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**Applying microtonality to pop songwriting**

*A study of microtones in pop music*

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**A thesis submitted to the University of Huddersfield in partial fulfilment of the requirements for  
the degree of Master of Arts**

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## Abstract

*While temperament and expanded tunings have not been widely adopted by pop and rock musicians historically speaking, there has recently been an increased interest in microtones from modern artists and in online discussion. For this project I compose and create a portfolio of music exploring the use of microtones as a songwriter. By pairing microtonality with pop/rock/electronica music I aim to improve and explore the balance between innovation and accessibility within my own music. The accompanying text outlines current issues and limitations of solely using equal temperament in songwriting while also highlighting notable examples of microtonal techniques in relevant music across numerous styles. Additionally, the text analyses each song created for this project and discusses the various microtonal techniques used therein.*

## Introduction

*“Music has always been something of an enigma from the aesthetic point of view.” (Steiner, 1906)*

In this project I planned to explore the use of microtonality/xenharmonics in my own, lyrically driven pop, rock and electronica music. Alternative/expanded tuning systems and microtones are rarely used by modern songwriters and instead are usually associated with experimental composers or traditional world musicians. I have built and expanded upon modern examples of non-abrasive or subtle uses of microtonality and by doing so I hope to ascertain the extent to which xenharmonic music can be made accessible to me as a pop songwriter. I did this by composing and creating an album of songs built upon various microtonal systems and methods. The aim will be to create an album grounded in microtonality while still maintaining the generally non-abrasive, singer-songwriter aesthetic that my music usually has. Through this I will draw conclusions as to how far songwriting can make microtonality “accessible” or “beautiful” and which methods of composition are most effective.

For the purposes of this project, I will be incorporating and contrasting various elements and definitions of “pop” music. For example, whereas David Frith has described “pop” as music “designed to appeal to everyone” (Frith, 2001, p. 95) I am more interested, as a practitioner, in using pop music as a tool for personal expression. Frith also refers to the importance of sentimentality and performing “from the heart” (ibid, p. 103) in pop music. Since the goal of this project is to apply microtonal techniques to my own songwriting practice, the styles of music will include art pop, alternative rock and lo-fi electronica among others. Both art pop and alternative rock have been described using their relationships to the mainstream and commercialism. Alternative rock musicians often paradoxically reject commercialism through a return to basic production, lack of polish and lyrical irony (Shepard & Horn, 2012, p. 21-23) while still achieving widespread success. Art pop artists on the other hand, regularly explore and embrace the very nature of pop and songwriting as a commercial artform (Frith, 1989). Much of the music that inspires me as a songwriter adopts one of these two contrasting approaches to songwriting in a commercial context. Lo-fi electronica is an umbrella term for varying styles of electronic music. Typically relaxing, slow and incorporating elements of ambient and glitch music (Johnson, 2018, p. 163). The music of these styles often offer a subtle and effective use of microtones while still maintaining mass appeal.

As a songwriter I believe that pop/rock/electronica music is surprisingly well suited for integrating microtones and in this project I have explored the idea of microtones as not necessarily dissonant

while simultaneously innovating and expanding my scope as a songwriter. While microtones are far from uncommon in western music as passing notes for example, the vast majority of modern songs are composed and based around equal temperament. I want to take steps towards a musical climate in which xenharmonic melodies and harmonies are not considered exotic or hard to get into. By accustomising western ears to a fuller range of the frequency spectrum, I believe that alternative tuning systems could be as common as equal temperament. Furthermore, I believe that songwriting is an ideal medium through which to integrate microtonality.

For this project I have defined microtones/xenharmonics as any frequency that does not apply to twelve tone equal temperament. This can include more familiar techniques, for example glissandos, detuning/pitch shifting and any equally tempered scale where  $A \neq 440\text{hz}$ . Similarly this definition will also include alternative tuning systems or non equal temperaments, for example just intonation, meantone temperament and pythagorean tuning. Lastly it includes expanded or polychromatic tuning systems that feature more than twelve notes per octave and intervals smaller than a half step. For example 24 edo (equal division of the octave), 31 edo and 72 edo.

After outlining my methodology, the following thesis will ~~will~~ first discuss reasons for expanding past equal tempered composition, then outline the various cultural and musical problems the dominance of equal temperament has had on traditional music and cultural diversity. After this I will present relevant examples of microtones in pop music that I have drawn on in this project. I will end with a track by track discussion on the album I have made. I will also be reviewing relevant literature throughout the thesis.

I am using a mixed methodology to explore what the useful or interesting ways to apply microtonality to pop music are. This is a qualitative, practice as research project in the form of a 10 track album and accompanying write up. It is a project which explores microtonality and how it can enrich my own practice of songwriting in a pop music context. Nelson (2013) refers to "Liquid knowledge" (Nelson, 2013, p. 48) meaning that which comes from experience, in this sense I hope to gain an experiential insight into microtonal practice and create an album I'm happy with creatively. I have put emphasis on the specific process of the research (Creswell, 2007 p. 37) as the project is neither empirical nor positivistic but rather creative and interpretivistic. The accompanying write up will discuss and analyse the music I have composed in relation to other relative texts and music. I will focus on the process of creation as well as the resulting product (Stévanec & Lacasse, 2018, p. 19).

### **Equal temperament and learned behaviour**

Much of the writing on microtones has been in regards to either experimental or traditional music. An exception to this and an important text to my project has been Adam Hart's "Microtonal Tunings in Electronic Dance Music: A Survey of Precedent and Potential." (2016) In it he puts forward that microtonality in EDM can "sound deceptively diatonic" (Hart, 2016, p. 253) as (unlike with experimental composers) the timbral and sonic context has a more mainstream appeal, "It is the maintaining of stylistically familiar ground that clearly sets these artists apart from contemporary microtonal composers." (ibid, p. 251). The timbres produced by electronica artists are constantly evolving, it is a mainstream pop genre where listeners expect to hear new sounds so its application to the accustoming of microtones is valuable, "Microtonality affords an endless spectrum of consonance and dissonance, being limitless in possibility. Many of the microtonal EDM tracks sound

very consonant—a casual listener could be expected to hear nothing unusual in Ganymede by Sevish, for example.” (ibid, p. 253). The piece of music he references, Sevish’s “Ganymede” (2010) was composed in a 22 note octave but the stylistic familiarity of the music makes the “out of tune” notes seem almost unnoticeable.

The concept that microtones, in the correct context are not abrasive is an important part of my project. I want to contest the argument put forward by Werntz (2001) which advocates to forego traditional intervallic hierarchies and “start from scratch” when composing with microtones (Werntz, 2001, p. 185). She states that “With the creation of a new intervallic vocabulary such as the seventy-two note chromatic, such freedom from presumptions is crucial.” (ibid). A noteworthy advocate for xenharmonics and the accessible use of microtones, Dolores Catherino uses this exact tuning system (which in fact could be described as ideal for introducing audiences to microtones as it contains within it all the 12 notes of the equal temperament chromatic system) and yet I would not describe her music as “free from presumptions” and it does not sound atonal. Similarly Wertz’s rejection of diatonic uses of microtones ignores the many world musics that use them and sound perfectly inoffensive to western ears.

Catherino, who utilises a range of modern MIDI controllers and expanded temperaments (72 edo, 106 edo) to create completely unique and yet seemingly consonant ambient soundscapes. Catherino defines xenharmonics as:

“a philosophy which regards the infinite pitch scale division methods applied to the pitch continuum as equally valuable. Also, it expresses an aesthetic of freedom and openness toward any and all methods of pitch scale division and the exploration of their melodic, harmonic, rhythmic, timbral, etc. implications in new musical compositions.” (Catherino, 2018)

This idea of opening up composition to encompass the whole frequency spectrum as opposed to one, strictly unchanging temperament seems like an obvious standard as it gives composers the greatest possible amount of options and control over pitch. Historically however, western music demanded the necessity of an intervallic and frequently tempered standard. Equal temperament has many benefits concerning key modulations, notation and convenience (Erich, 2015, p. 160) and has been a valuable tool in the development of modern music. Nevertheless, equal temperament is a compromise (Duffin, 2008), a system where every interval is equally “wrong” in order to account for a natural harmonic series which does not match up with western music theory’s circle of fifths. Its flaws are clearly apparent and plentiful (Mathieu, 1997, p. 165-169). It features no harmonically pure or “perfect” intervals, it leaves little room for expressive leading notes in virtuosic performers (Duffin, 2008), it has no intervals smaller than a half step and it ignores countless tuning systems and scales from non-western traditions. And yet the unspoken assumption amongst many modern musicians who are aware of other temperaments seems to be that equal temperament is the best choice of compromise when compared to alternative tuning systems. While there were scientific and practical reasons behind the widespread adoption of equal temperament, one only needs to read Werckmeister’s: *Musicalische Paradoxal-Discourse* (1707) which demonstrates how dated the concluded standardisation of equal temperament is with its metaphorical comparisons between harmonic consonance and biblical imagery. This rhetoric is increasingly irrelevant in a secular, multi-cultural and modern day musical landscape. Nevertheless, equal temperaments dominance has continued for over a century with little deviation:

“any deviations from the chosen system, especially during the educational period of any aspiring musician, are considered to be erroneous and even in some cases, like during competitions, auditions, final examinations etc., punishable. In other words, the process of indoctrinating the right intonation is in fact a forceful enculturation methodic.” (Yanakiev, 2018)

In this sense, equal temperament as a sentiment is a true example of Hume’s “Standard of Taste” (1757), a guitar played “out of tune” in the context of western music is considered “bad” or “wrong” music (Frith, 2004, p. 20) as it does not conform to the standard of equal temperament. Interestingly, if a guitarist were to play the same chords for every song on an album, this would likely be considered repetitive or formulaic (ibid). The same, however, does not typically apply to an album’s tuning system. Following on from Hume’s theory, in my project I wish to “acquiesce in [my] own sentiment” (Hume, 1757,) by exploring the tones that I used to automatically reject (due to my western trained ear) and essentially personalise my own frequential pallet. This can also be compared to Kant’s “Critique of Judgement” (1790) where he argues that beauty is not an inherent property of objects and as a result cannot be based on concepts but rather the pleasure that they elicit (Kant, 1790). Frith (2007) sums this up more musically by writing that “Successful pop music is music which defines its own aesthetic standard.” (Frith, 2007, p. 261)

I want to create music that merges together and bridges the gaps between different styles and approaches to music. Microtonal music is generally associated with two types of music which I will draw from and apply to a pop songwriting context: experimental classical and traditional world music. Where experimentalism is concerned, composers often express boredom towards equal temperament and view microtones as a liberation to the musical homogeneity of equal temperament (Catherino, 2016). Composers usually want to feel that their pieces are completely unique, an individualistic expression of themselves and yet so many composers, regardless of how experimental they consider themselves, write music in the same tuning system as their most conservative counterparts. For example Schoenberg’s serialist music, while successfully breaking away from standard tonality, still features the same twelve notes that would appear on a Cliff Richard album. If, as mentioned before, the standard practice was to approach frequencies with equal value, if composers were to pick and choose their own tuning systems (or select one of the many already in existence) then the opportunities for experimenting are infinite. The intervals for every piece could differ drastically and be as consonant or dissonant as the composer chooses. As Kyle Gann puts it “one of the thrills of composing microtonally is the ability to write logical chord progressions and feel virtually certain that no one has ever heard them before.” (Gann, 2008). It is this customisable practice of composing harmony that draws me and many others to microtones. So by applying this harmonically free system to the accessibility of pop music, I hope to both illustrate the potential for microtonality to be conventionally beautiful or “pop” sounding and that microtones are not necessarily disagreeable to western ears while also expanding the scope of creative songwriting. Microtones are a “natural progression” for western music (Mansell, 2009) and I believe that their application to pop music is inevitable.

My project is built upon the assertion that microtonal discrimination is learned (Bailes, Dean and Broughton, 2015). There are multiple academic sources that back this up, Yanakiev, for example also asserts that “any division of the scale is learned” (Yanakiev, 2018) and goes onto show “that our physical sensors are capable of recognizing very subtle differences in pitch. The current musical practice, however, does not employ this capability to the full extend.” (ibid). In fact many academic

journals that do show some kind of inherent pitch tendency show that equal temperament is inadequate for representing it. Howard (2007) conducted an experiment measuring to what extent unaccompanied a cappella barbershop singers will stay “in tune” and found that, “pitch drift is potentially a necessary part of staying in-tune.” (Howard, 2007). So if consonance and dissonance are essentially learned qualities, this only gives further justification to use microtones as a way of exploring new and personalised tuning systems, “In a fundamental sense, the phenomenon of consonance does not exist a priori.” (Bucht & Houvinen, 2004, p. 9)

A potential byproduct of creating an album of microtonal music that I feel happy with as a songwriter is that by exposing my ears (which have been trained to equal temperament) to microtones they may be desensitised to the extent that the “out of tuneness” becomes unnoticeable. In Jacob Collier’s song “Hideaway” (2016), for example, A=432 Hz at the beginning and slowly tunes up to 440 Hz as the song progresses, giving a strong sense of journey and arrival. This effect, however, is subtle and likely not something a non-musician would pick up on. Jacob Collier has thus created a song built on a microtonal concept without any sense of abrasiveness. His use of passing microtonal intervals when constructing melody is also an example of a musician desensitising listeners to microtones through subtlety. “We are largely unaware of the gross pitch deviations that are the norm in musical performance.” (Siegel & Siegel, 1977, p. 406) An overlooked positive of western “trained ears” is that they will automatically hear a slightly flattened 5<sup>th</sup> as an in tune one due to our learned “categorical perceptions” of pitch (ibid). “the ear usually hears what it wants to hear, even if that does not correspond to the acoustically given interval” (ibid). This is one of the most overlooked tendencies when discussing the accessibility of microtones. While adopting these techniques I will also draw inspiration from more overtly microtonal sources like King Gizzard and the Lizard Wizard’s *Microtonal Flying Banana* (2017) album where every song was composed in a 24-note per octave tuning. Here the microtonality is more apparent but it is made less jarring by drawing heavily from traditional Middle Eastern music and applying these new tunings to the more familiar instrumentation of psychedelic rock, “sounds themselves are dependent on the context and can be altered by it” (Platz & Wharton, 1995, p. 23). The interpreted meaning of a sound is not purely based on its frequency but on its timbre as well. This conclusion can be used to criticise the ecological validity of many psychoacoustic experiments as they use pure tones to determine our perceptions of pitch. This ignores the importance of timbre (ibid).

### **Appropriation and Traditional music**

In the case of traditional and indigenous musics, microtones represent, to many western composers at least, a sort of isolated evolution from the globally dominant European canon and brings to light the more socio-political problems of equal temperament’s monopoly on tuning. In the post-imperial world, few cultures are left who have maintained their alternative tuning systems, traditional celtic and English music for example has suffered from what could be called musical gentrification. The 1909 Vaughan Williams recording of the traditional English song “Fare Ye Well, Lovely Nancy” (1909) sung by George Lovett is performed without accompaniment and thus is tuned to no specific key and features plenty of subtle and obvious microtonal intervallic movements. However, when comparing the recording to Vaughan Williams’ transcription of the piece, it is clear that he “fixed” the out-of-tuneness of the original recording and produced a melody in equal temperament. Given his reputation, along with Cecil Sharp who “transcribed” traditional folk music, these writings became the standard for performers and are still referenced to this day. Modern western tuning misses the

complexities of the oral traditions of English folk music. Now it is accepted that musicians who perform “traditional” music of the British Isles tune to equal temperament. For example Julie Fowlis’ “An Roghain Dain Do Eimhir XXII” (2014) The Unthanks’ “Felton Lonnin” (2007) Daoiri Farrell’s “The Creggan White Hare” (2013) are all tuned to equal temperament. It should be noted that folk music as a genre is an ever evolving form that does not need to be pure or authentic (Harker, 1985). However in a genre that often puts so much importance on culture and tradition, this obvious compromise is something few British folk musicians alleviate.

Ian Brennan 2016 describes equal temperament as an example of “xenophobia of sound” (Brennan, 2016,) in which only certain sounds are “legal”. This can be interpreted both musically and culturally. Since the progressive rock movement of the late sixties, despite the fact that western pop musicians have explored new compositional techniques, timbres and harmonies, microtonality has rarely been employed as more than colouration or embellishment (e.g. glissandos, quarter notes). While African and Asian influences are key to the development of modern pop and rock music, for example slave music’s influence on blues or the pentatonic basis of the blues scale (Sloboda, 1999, p.25), the tuning has undoubtedly remained Eurocentric. This may be due to musical Orientalism (Said, 1978) as all traditional influence had to pass through the filter of equal temperament (Halewood, 2015, p. 17). An example of this would be during the Conference of Arabic Music in 1932 where Cairo’s ministry of education attempted to “modernise” the music of Egypt by adjusting it to fit with the European standard. Essentially westernising Egypt’s musical traditions (Lueg, 2010). Longhurst, (2007) Compares the western rules of pop music to the rationalisation of production in a capitalist society. He refers to the elimination of microtones in modern pop music and equipment (e.g. synths) as an example of globalisation as it makes truly non-western music impossible (Longhurst, 2007, p. 12). Here traditions have become trivialised by only popularising them if they are sufficiently westernised and tuned “correctly”.

The misrepresentation and appropriation of “tradition” can be found in many world music pop acts, for example Sacred Spirit’s “Ly-O-Lay Ale Loya” (1994) or Deep Forest’s “Sweet Lullaby” (1992) where not only were the sampled vocalists not credited, their given country of origin was incorrect (Feld, 2000, p. 154-159) (Buljo 2007). While collaborative projects between western “pop” musicians and “world” musicians such as Paul Simon’s *Graceland* (1986) or Afro Celt Sound System’s *Anatomic* (2005) should be commended for expanding the timbral and cultural scope of pop songwriting, even these projects are continuously dominated by western tuning as the non-western acts are almost always the ones compromising in regards to tuning. It seems peculiar and contradictory that the often erroneous search for authenticity in these world fusion artists is manifest in taking traditional instruments and re-tuning them to be equally tempered, essentially “fixing” them by imposing the homogeneity of the western scale. There are ethical parallels to be drawn between this and the European imposition of religion, culture and government on indigenous peoples that has occurred throughout the last few centuries. Where world fusion has been quick to adapt traditional instrumentation and vocal styles, the tuning systems of foreign cultures has been almost completely ignored in the west and instruments have been customised to play in equal temperament. Whereas this is not an inherent loss in itself, and could even be seen as a positive part of musical diversification, the problem is that in many cases the original tunings of these instruments are lost. The West African balafon or kora for example are centuries older than equal temperament and therefore have their own tunings, however many balafons and koras that are sold today are equally tempered for the ease of playing with other instruments. Even more extreme than this are The



Native American Flute or the Andean Quena where the original tunings are completely unknown as all modern iterations are tuned to the European scale. This compromise is also apparent in musical education systems where equal temperament often dominates even when dealing with music outside of European traditions (Yang et al, 2015). This exemplifies “globalization’s uneven naturalization” (Feld, 2000, p. 165) as instead of a true multi-cultural musical environment, we have a heavily biased and Eurocentric one. It is both historically inaccurate and philosophically questionable that these traditions be represented solely through a western standard.

More relevant to my own work is the simple loss of compositional opportunity and potential that comes with ignoring these tunings. As important as Claude Debussy’s “Estampes” (1903) (influenced by Indonesian Gamelan music) was as far as drawing from traditional musics, his piano remained in the same tuning. I want to build more on this idea by exploring traditional tuning systems, composer John Eaton stated in an interview that, “All the music of the world, except for a very brief period in Western music, has involved intervals which are not part of the white and black keys of the piano keyboard. There’s a whole reservoir of microtonal melody to discover and seize upon” (Keislar et al, 1991, p. 207). Musically this is what interests me. Far from abandoning equal temperament, I intend to fill the gap that exists between microtones and pop songwriting. I want to move toward a more open form of composing that balances and represents tunings from multiple cultures and traditions where the only bias is that of mine as a composer. My hope is that as more people create harmonically fluid music, personal preferences will become more apparent and as a result songwriters can become more unique from one another

### **Examples of microtones and pop music**

Modern pop songwriters draw from a wide variety of genres, instrumentation and cultural movements, yet the vast majority of modern songs (with exceptions) are built upon the compositional assumption of equal temperament. In a musical climate where the some accuse songwriting to be formulaic or homogenised (Percino, Klimek and Thurner, 2014), it seems to me that one way to explore the possibilities that pop music affords is through the new melodic and harmonic potential offered by microtonality. The criticisms that pop music is overly accessible or that it too often “sounds the same” (Serrà et al, 2012), (Frith, 2004) ignore that the most successful, impactful and respected pop artists have consistently been those who innovate and push creative boundaries while also appealing to a mass audience (Ashwood & Kukstis, 2005), in a sense, pioneering artistically without becoming inaccessible. Experimentation is as important in pop music as any other art form or genre (Frith, 2007, p. 252), the songs can cover a wide range of emotions and generally, pop/rock music has demonstrated a widespread mainstream interest in musical experimentation (Martin, 2002, p. 181).

Bill Martin’s “Avant Rock: Experimental music from the Beatles to Bjork” (2002) provides a detailed history of innovation and experimentation in rock music. He also discusses the necessity for rock music to be forward thinking in order to stay relevant (Martin 2002, p. 109-110) Similarly other key pieces of literature that discuss aesthetics and pop music is Simon Frith’s “Performing Rites: On the Value of Popular Music” (1996), Peter Wicke’s “Rock Music: Culture, aesthetics and sociology” (1990), Von Appen’s “On the aesthetics of popular music” (2007) and Bruce Baugh’s “Prolegomena to Any Aesthetics of Rock Music” (1993). These texts highlight the significance and value of pop/rock

music both culturally and aesthetically.

Pop can acclimatize mainstream audiences to otherwise challenging musical concepts. D'Angelo's *Voodoo* album (2000) for example featured grooves that were built upon drummer Questlove's use of micro-rhythmic swing. Many non-musicians may not notice the subtle complexities of these rhythms but would instead just enjoy the "wonky" beat. On top of this, pop music can also achieve the opposite goal of making boring or formulaic concepts interesting and new. Laurie Anderson's *Big Science* (1982) achieved success not through packaging complicated ideas in an accessible way but rather by filtering mainstream concepts through an avant garde lense, thereby she "makes cliches strange" (Walker, 1987, p. 137). Laurie Anderson is also an advocate for microtones in pop music. Her influence within the industry has led to equipment manufacturers providing alternative tuning capabilities on certain synthesizers (Jones, 1992, p. 82). With this in mind, the recent release and success of the Seaboard MIDI controller which offers access to live performance of quarter tones further demonstrates an interest in microtones in comparison to previous microtonal MIDI controllers most likely due to its familiar layout and accessible price.

Recently there have been noteworthy examples of microtones in pop, with his interview video discussing microtonal theory receiving over one million views and generating a lot of discussion online (Lee, 2017), the recent popularity of Jazz/Pop musician Jacob Collier illustrates a current interest in xenharmonics. Similarly, the recent success of psychedelic rock troupe King Gizzard and the Lizard Wizard's *Flying Microtonal Banana* (2017) album has already paved the way for multiple other bands of the same style to venture into microtonal experimentation. For example Us3's *Voyage* (2018), Ilevens' *Transmitter* (2017) and The Mercury Tree + Cryptic Ruse's *Cryptic Tree* (2018) are all heavy rock albums that are rooted in microtonal composition. Metal is another popular genre that has a growing interest in complexity, innovation and even microtones; Last Sacrament's *Enantiodromia* (2013) is performed in 16 edo and the unfamiliar intervals sound at home in the aggressive context of the music.

Microtones are commonly advocated in experimental classical circles (Fox, 2003, p. 124) (Bousted, 2003, p. 54) but have also been heavily used recently by some veteran pop songwriters. Paul Simon's *Stranger To Stranger* (2016) album for example made use of Harry Partch's custom made microtonal instrument collection. Partch, who pioneered microtonal songwriting (Gilmore, 2003), often worked in a 43 note octave which was adopted by Simon and demonstrates a strong sense of exploratory and artistic growth when compared to his earlier work. In addition to this, the longstanding alternative rock group They Might Be Giants released two songs recently, "Dog" (2018) and "Flo Wheeler" (2018) which both heavily feature microtonal keyboard parts. As the band has always been eclectic as far as style and timbre, these new notes simply sound like another step in musical exploration for the band.

There are also many examples of microtonal pop music that may not have been intentionally "microtonal" but rather out of tune for effect. Nine Inch Nails "Hurt" (1994), Sonic Youth's "Cinderella's Big Score" (1990) and Kikuyama's "The Shanty Village" (2014) all feature detuned guitar sounds. These songs have taken sounds that most guitarists are trained to avoid from their first lesson and used them to expand their sonic and expressive pallet. This technique can also be seen in many modern hip hop beats; Saba's "Heaven all around me" (2018) and Stephen James Taylor's "Hip Hop Village" (2014) are built around detuned synths and samples. Perhaps due to the large influence hip hop has on the modern mainstream music scene, this microtonal detuning has become

widespread in numerous new music genres such as lo-fi jazzhop and vaporwave (both subsets of lo-fi electronica). Joey Pecoraro's "Tired Boy" (2016), Peatu's "It's Still Raining (I Don't Mind)" (2018) and BATBXY's "All I Have" (2016) are all recent examples of this. Also building music around detuned synths is the recent progressive electro jazz duo Sungazer's "DRUNK" (2018). The microtones in these developing modern electronica genres may also have taken from the subtle detuning and pitch shifting common in IDM and ambient music. Boards of Canada's *Music Has The Right To Children* (1998), Aphex Twin's *Selected Ambient Works Volume II* (1994), Fennesz's *Endless Summer* (2001),  $\mu$ -Ziq's *Lunatic Harness* (1997), Minamo's *Shining* (2005) and Freescha's *What's Come Inside of You* (2003) are all influential electronica albums and yet their use of microtones is not often addressed despite the fact that they are very prominent throughout all of the examples.

Other pop artists are more overt and experimental with their use of microtones but can nevertheless, still remain accessible or beautiful. H. Wakabayashi's "Iceface Tuned Piano (Microtonal Lucid Fairytale)" (2014) uses the "Iceface" tuning that he developed himself. It incorporates quarter tones into a twelve note octave by sharpening the black keys on his keyboard by 50 cents, thus creating extra "ice" notes. The effect is dreamlike and nostalgic. The notes are noticeably "out of tune" while also never quite sounding chromatic. This tuning is not entirely dissimilar from Stephen James Taylor's "Quantum 7" (2015), which is performed on a 31 note-per-octave guitar. While the new notes may sound strange when isolated, their use within the context of the piece as passing notes between an otherwise equally tempered piece adds a bizarre uniqueness and interesting flavor. Even more far reaching than these examples are The Forever Bad Blues Band's *Just Stompin'* (1993) and Syzygys' *Complete Studio Recordings* (2003). These are bands that have founded themselves around microtonal concepts and tunings. Also in this vein, there is a small but growing microtonal EDM community online. City of the Asleep's *Transcendissonance* (2011), ZIA's *Drum 'n' Space* (2011), YMP's "Imperialism Impossible" (2017) and Brendan Byrnes *Micropangaea* (2012) are all pieces of work where the context of drum n' bass and EDM is used to explore the possibilities of expanded tuning systems

There are some criticisms of microtonality in pop music. Hawkins (2011) criticises Britney Spears' use of microtones in her song "Toxic" (2003) as being an example of orientalism (Hawkins, 2011, p. 69). While this may be true it should be noted that for the most part, the examples I have provided are generally well received and tactful in their use of traditional music. Tesla Manaf's *It's All Yours* (2014) for example fuses traditional Gamelan music with his own style of jazz guitar. To me the album sounds forward thinking, collaborative and far from commercially exoticist. Another relevant piece of work in this regard is Ghazal's *The Rain* (2003) which merges Indian classical music and traditional Persian music.

For this project I felt it was important to take from modern and experimental classical examples as well as traditional musics. I have chosen the following examples as, to me, they demonstrate beauty, relaxation, euphoria etc. in contrast to the challenging reactions more commonly associated with experimental classical music. Terry Riley's *Aleph* (2012), La Monte Young's *The Second Dream of The High Tension Line Stepdown Transformer from the Four Dreams of China* (1991), Arnold Dreyblatt's *The Adding Machine* (2002) and Town and Country's *5* (2003). These pieces are mostly minimal and often use long held drone chords. This demonstrates a useful way of introducing listeners to unfamiliar intervals as it can give them time to become used to the new note combinations.

The two seemingly juxtaposing goals of accessible vs cutting edge are in fact representative of the average listeners needs, "Listening habits are strongly influenced by two opposing aspects, the desire for variety and the demand for uniformity in music." (Percino, Klimek, Thurner, 2014) similarly, "the demand for repetition of pleasant stimuli, and the opposing desire for variety, for change, for a new stimulus." (Schoenberg, 1978, p. 48). I have attempted to achieve the correct balance between these two approaches in a manner resembling a musical adaptation of Brewster's (1991) Optimal Distinctiveness model. This model has been applied to musical listening habits before (Cohrdes & Kopiez, 2014) (Peoples, 2017). Originally applied to human social behaviour it states that humans seek both conformity and individuality thereby aiming for an "optimal" state of distinctiveness that reaps the benefits of both (ibid). This is what I hope to achieve musically. An optimal point between innovation and traditional appeal.

I acknowledge the risk that an over-simplification of microtones could be detrimental to their long term acceptance. However the songwriting medium within a pop context is not necessarily simple and even those within the contemporary classical field acknowledge the benefits of microtones in pop music. When being interviewed on microtones, composer Easley Blackwood stated that, "the most advantageous use for new tunings now would be popular music. You would get a lot of people hearing them on television or the radio. I can imagine some cute jingles in fifteen equal." (Keislar et al, 1991, p. 207). The truth is that people take pop music very seriously, people describe their deepest emotions in relation to songs, a popular youtube video by "School of Life" explains, "[pop] is more deeply loved, more trusted, and a more constant companion in our joys and sorrows than any other art form." (2016).

Many consider Hemholtz the founding father of temperament and tuning and in his influential "On the Sensations of Tone" he argues that the laws of harmony are not unalterable but has at least something to do with aesthetics principles "which have already changed, and will still further change, with the progressive development of humanity" (Hemholtz, 1863, p. 358) My project is not a crusade against equal temperament. Equal temperament has served its role in the development of modern music (Lobel, 2011) and almost all of the most loved music in the west is listened to in equal temperament. This project is about expansion "The real justification for these temperaments lies in the search...for the expansion of harmonic/melodic resources for both tonality and atonality" (Fuller, 1991, p. 231). Composers are only utilising a tiny fraction of the frequential continuum and it seems apparent that microtones need not be solely abrasive or exotic. In regards to tuning "need there be just one solution?" (Wood, 1986, p. 328)

## **Discussion**

The following section is a track by track analysis of the album I have created for this project.

### *You're Welcome Here*

Track 1 is a minimal electronica piece based on the Hexany tuning system developed by Erv Wilson. The Hexany system is a "Combination Product Set", a system that is designed to imply no tonic (Grady, 1991).

I chose the piece to open the album as I feel that it is the most balanced between accessibility and innovation. By this I mean that although the microtones are very much noticeable from the beginning and perhaps even off-putting initially, they do not sound abrasive to me. I feel that the new notes add interest to an otherwise harmonically conventional piece were the notes tuned to their nearest equally tempered counterpart. For example the chord change in the second bar sounds like a standard resolution of tension when the interval is in fact less than a half step. The frequency barely changes and yet the musical effect of tension and release is still very apparent, perhaps as if the first note is so close to resolution that the listener interprets it to be there up until it does resolve. Kraig Grady's experimental ambient piece "Beyond The Windows Perhaps Among The Podcorn" (2006) also demonstrates this idea with its slow moving harmonic textures. The piece often lacks a tonal centre and instead presents the listener with unfamiliar note combinations to explore.

Instead of utilising a typical verse/chorus song structure used in many of the preceding tracks, this one uses a terminally climactic form where instead of a repeating chorus throughout the song, the chorus part comes only at the end in the form of a rising climax (Osborn, 2013 p. 23-47). To compliment this, the last section of the piece has a reverb effect on the master bus, slowly rising in wetness. This is in stark contrast to the rest of the piece which is almost completely dry. The aim here was to familiarise, or at least present the listener with the "new" frequencies of the tuning system, first with clarity and distinctness, then in the final section as more of a miscellany or cluster of tones. I feel that this production choice reflects well against the awkward optimism of the first sections' lyrics and the disturbed euphoria of the final section. Similarly, it is interesting to note that the microtones seem least noticeable at the end of the piece, even though this section arguably features the most challenging and large note combinations. A possible area of future research could be on the effects spatial FX such as reverb or delay has on perceived consonance and dissonance.

Ideally a Starr Labs Microzone U648 (a hardware MIDI controller by Erv Wilson designed for playing microtones) would have been used for this piece as it would allow for more diversity in timbre. Instead the main composing tool for this song was the Wilsonic app controlled using an Ipad as this was a cheaper option. The app features a large collection of Erv Wilson's tuning systems but more usefully allows the player to experiment and perform live using the alternative keyboard layouts that he invented. New tuning systems bring with them new possibilities for altering the standard 12 note keyboard design and I found that the geometric layout of his Hexany system and its variations offer more intuitive interface for playing microtones than the standard 12 note piano keyboard (Narushima, 2017, p. 65).

Stylistically the song was inspired by various IDM and experimental electronica artists, especially those made popular by warp records. The use of "out of tune" sine waves was taken from Boards of Canada's "Sixtyniner" (1995). This technique of applying lo-fi and glitchy effects over layered synths and electronic percussion is often complimented by detuned melodies and chord structures in IDM.  $\mu$ -Ziq's "Brace Yourself Jason" (2003) and Four Tet's "Spirit Fingers" (2003) are further examples of this style of subtle microtonal experimentation in electronica.

Although it is a tuning more often associated with experimental compositions it is surprisingly flexible and well suited to pop music. With the exception of percussion and vocals the track is made entirely with sine waves. This timbre, in combination with the relaxing tone of the piece seems to be an ideal setting for easing listeners into the unfamiliarity of the microtones.

### *Cicadian Scales*

Track 2 is a prog/electronica piece that merges two famous experimental, American piano piece tunings: La Monte Young's *The Well-Tempered Piano* and Terry Riley's *The Harp of New Albion*.

I was interested to hear how these tunings would sound on instruments other than piano so I used .SCL files to edit the tuning of software instruments and control them using a standard keyboard MIDI controller. Similarly a retuned guitar MIDI controller is used for the middle instrumental section. The bass part was performed on a fretless bass and played to match both tuning systems of the song.

I was interested in the idea of merging existing alternative tuning systems together (Dean, 2009, p. 95). I chose these two pieces as while they both sound fairly accessible to me harmonically speaking (they are not atonal or serialist), they each have a remarkably distinct sound which is at least in part due to the tuning systems that they were developed around. Authenticity and personal expression are often highly valued in songwriting and in the cases of these two pieces the composers have innovated by personalising the very pitches that they use. They have not just organised a set of existing notes but have instead created their own unique combinations. It is this customisable and innovative approach to tuning that is the focus of much of the literature describing "The Well-Tempered Piano" (Gann, 1993), (Service, 2013), (Masters, 2018) and is something that makes microtones look very appealing to me from a song writing perspective. The potential to build upon, merge and create new tuning systems is seemingly endless.

La Monte Young's tuning is strikingly easy to compose with as it "resembles a pentatonic or 5-note scale...but with a couple different tuning options for each note." (Arnold, 2018) Also by this logic I found that it was very rewarding to write a song with as it had the "no wrong notes" benefits of a pentatonic scale only with more options. *The Harp of New Albion's* custom just intonation tuning is much closer to equal temperament than *The Well-Tempered Piano* tuning.

A common trope in progressive and art pop music is experimentation within the confines of the "pop song". The repeated "David was close" sections of this song serve as the chorus, although most of the lyrics are not repeated. Similarly, there are familiar "pop" instruments (e.g. bass guitar, electric piano) but they are mixed in with obscure percussive samples and atypical synthesized sounds. All of these irregularities within familiar contexts help to blend the microtones more seamlessly into the music

The song also draws from David First's "When Blue Skies Divide" especially in the synth/guitar solo section in the middle. I found that (as with *The Well-Tempered Piano*) fast clusters of notes in a lead part sound more acceptable as I am already used to microtones in guitar solos, for example Jimi Hendrix's "Star Spangled Banner" (1999). Similarly David First's music features a lot of microtonal concepts (synth glissandos, heavy vibrato, long drones) but is first and foremost an experimental pop album. The microtones do not define the music, which I tried to mimic in my music.

### *Bye Plato!*

Track 3 is a world fusion/jam track which I composed by improvising using microtonal techniques on selected instruments.

The practice of rock music is often done through jamming where performers improvise around a theme or groove. I noticed that as microtones were initially unfamiliar to me, ~~that~~ most of the songs that I wrote had been meticulous and precise. Similarly as many instruments require new techniques in order to perform microtones, it is often easier to make microtonal music electronically through sequencing. With the exception of the electronic drum part, I performed all of the parts for this song live.

The fretless bassline uses intervals smaller than a semitone in the vein of Nancy Sinatra's "These Boots Are Made for Walkin'" (1966) where the first and final note of a phrase are "in tune" and the microtones in between are filling in the space between them. The electronic piano line was performed on a seaboard MIDI controller and also uses this technique. For both the bass and the keyboard I was very liberal with intonation, thus giving the parts a wonky and hectic feel that I think matches the mood of the song. For the string solos, I wanted to replicate the music of jazz guitarist David Fiuczynski who performs upbeat jam tracks on fretless and re-fretted guitars. For example "Fung Wah Express" (2008). I performed these on a Moroccan sintir as the lack of frets made it easy to express microtones when soloing. In all of the solo parts I attempted to mimic the gamak technique used in traditional carnatic music. These are microtonal passing notes and embellishments that play a role in defining the expressive characteristics of a certain raga. Aruna Sairam's "Raga Thodi: Padam Poosadaramu" (2011) is a vocal example of this technique. There is often a fluidity between the notes of the ragas melody, this is the gamak ornamentation.

The song also includes a lot of cowbells and kalimbas in different (and sometimes seemingly arbitrary) tunings. Although initially dissonant, I found that when placed within the context of a fast paced jam song, they became texturally ambient. This was in an attempt to mimic the percussion parts in Terje Isungset's *Ice Concerts* (2008) which uses a selection of tuned and untuned percussion in combination with traditional scandinavian techniques. The song also includes a Senegalese Tama and an Australian didgeridoo which both further add microtones to the mix. Although the song has a strong and at times inconsistent use of microtones, they are always close enough to frequential familiarity that an equally tempered harmony is often assumed even though it is not there. "The ear usually hears what it wants to hear" (Winckel, 1967, p. 129) and I feel that this song demonstrates well how the human ear can "correct" dissonance in the right context.

When creating this track I wanted to demonstrate that a unique and appealing part of pop songwriting is how diverse and eclectic it can be. While this is not always the case, very often pop artists will borrow from a wide range of different styles (Lamb, 2018). This has made it much easier to experiment with instrumentation and structure on songs like this one. Most of the instruments in this song are not "typical" nor is the structure in standard song form, but rather through composed and largely improvised. It is common, in pop music, to break convention as genre fluidity is built into the culture around it (Shuker, 2016, p. 113). I found that this general acceptance of musical diversity is another reason that pop songs are well suited for experimentation with microtones as the timbre of this song (while not conventional) is perfectly acceptable.

### *A Taste of Human Flesh*

Track 4 is an a cappella pop song in 96 edo (equal division of the octave).

The potential of accessibility through expanded tuning systems (any octave with more than twelve notes) can easily be demonstrated by the collaborative *Next Xen* (2016) album which includes mostly expanded tunings matched with upbeat electronica arrangements. Similarly the ambient music of Dolores Catherino which is often performed on expanded MIDI controllers (and features tunings as large as 106 edo) is both relaxing and harmonically interesting, for example “Temporal Parallax” (2014).

Microtones in pop vocals are fairly common as they are with all vocal music. The human voice both spoken and sung is full of microtonal inflections. Sinéad O'Connor’s “Nothing Compares 2U” (1990) and The Cranberries “Zombie” (1994) are some more obvious examples of this. The human ear is “generous” in regards to intonation especially with singers (Seashore, 1967, p. 269) and will often tolerate more pitch deviation in vocals than other sounds. As I and most others lack the ability to accurately sing sixteenth-tones I processed many of the parts in Celemony’s melodyne software to ensure that the song remained in 96 edo. The most noticeable thing I found with this song is that as the distances between the shortest intervals is so small, the tuning system begins to resemble the continuum of the frequency spectrum instead of individual set notes. I found the effect of this was that it was one of my favourite tuning systems I used for this project. I believe the reason is to do with control. I could essentially compose using the familiarity of equal temperament as a starting point and then proceed to “colour” the harmonies with a precision and diversity that is not often found in songwriting. I could be incredibly accurate at how flat or sharp I wanted each note to be and so few combinations would sound off so long as I used the equal temperament frequencies as a point of reference.

The pop music world is often criticised for its widespread use of autotune (Kramer, 2014) due to its lack of authenticity. I would argue, however, that the loss is less to do with authenticity and more to do with homogeneity. The human voice is full of microtonal inflections and equal tempered autotune removes these. The good thing about pitch correction in the example of this song is that you can not only retain (or add) the subtleties of human singing but also customise and edit it to a level of precision that would be impossible to reproduce live. With this in mind, I edited the notes only subtly from the original recordings. This, in combination with a wide use of the stereo field and reverb, allowed for the piece to sound much more like a live a-cappella performance than it otherwise may have. In the same way that modern production allows for precise and intricate control of a songs spatial, rhythmic and timbral attributes, so can it be used to refine a pieces frequential and harmonic content.

Reflecting the lack of precision in the melody and harmony is the ambiguity of the lyrics. These lyrical techniques are very common in the songwriting practice where the words and the music are often inseparable when analysed (Negus & Astor, 2015, p. 226-244). Throughout this album I enjoyed experimenting with lyrical authenticity, or lack thereof in some cases. I found that presenting a disturbing or dark concept with amiable or “sincere” language (as with this song) is not so dissimilar to making a chord of microtones seem to resemble a major triad by choosing similar pitches. I believe that the obscurity of the new microtonal pitches can compliment ambiguous and ironic lyrics.



### *Linh and Lan*

Track 5 is an upbeat pop song that merges the Ling Lun tuning system with microtonal performance instruments.

Most of the synths in this song were performed in the tuning system accredited to Ling Lun of Chinese legend (Yang & An, 2005). This tuning is so close in sound to equal temperament that it is almost unnoticeable. I chose this in an aim to have the same effect as songs such as Good Charlotte's "Hold On" (2002) and The Jimi Hendrix Experience's "Purple Haze" (1967) where the tuning is microtonal in a relative sense, meaning that although the intervals are equally tempered, A is not equal to 440 hz. It seems to me that it is solely due to convenience that many songwriters only choose between 12 potential tonic frequencies instead of choosing any frequency and tune the instruments accordingly. This way of thinking further allows for songwriters to customise their music by using more personalised tuning systems. The only clear difference between Ling Lun and equal temperament is that in the key of C the subdominant is flattened in relation to equal temperament. This had a subtle but interesting effect as the song keeps returning to an Fmaj7 chord. Throughout the track a modulating drone is performed on a Seaboard (an expressive MIDI controller capable of detuning and playing quarter tones) moving between a G and a quarter tone below.

The song also includes performances on the Chinese erhu and the Vietnamese đàn bầu. Traditionally the microtonal aspects of these instruments typically manifest as performance embellishments which I attempted to mimic in a pop setting. Pham Duc Thanh's "Patched Dress" (2005) and Yu Hong Mei's "Ballad of North Henan Province" (2006) demonstrate this continuous and fluctuating approach to melody. The performance inaccuracies and pitch fluidity of these instruments contrast with the heavily quantised processed electronic parts. Similarly the bass part is performed on a fretless bass which emphasises slides between notes and features intentional inaccuracies in pitch in relation to the rest of the piece where the root note is often "out of tune"

While many of the other tracks presented here would likely lean towards the "art pop" label due to their experimentations and irregularities both lyrically and musically, I feel that this song is possibly the most "mainstream" or "modern pop" sounding due to the arrangement, instrumentation and lyrical content. As a result of this, I attempted to put extra effort into the production of this piece. Much time was spent on the kick and snare drum (created using an Elektron Machinedrum) in order to achieve the "punchiness" heard in modern dance songs. Similarly the more peculiar parts of the instrumentation (e.g. đàn bầu, erhu and beatboxing) required heavy processing before they could begin to fit with the synth driven, mainstream sound of the piece.

Continuing in this fashion, the song also has the most standard song structure. Intro, verse, bridge, chorus, verse, bridge, chorus, instrumental, chorus. The chord structure only deviates during the bridge and the arrangement is almost constant throughout. However, my hope is that instead of coming across over-simplistic or uninspired, the simplicity of the piece reflects the sincerity and warm-heartedness of the lyrics. Although the song form can be very limiting, people continue to engage deeply with it (de Clercq, 2017). A complicated structure would have felt out of place and obscured the message.

This song is likely the least abrasive within the project. I wanted to demonstrate how a shifted and slightly uncommon temperament in combination with small microtonal embellishments of an

otherwise mainstream written pop song could add interest and individuality while maintaining mass appeal.

### *Desperate Attempt*

Track 6 is a love ballad composed using Just Intonation

Some practitioners seek out microtones not necessarily for expansive reasons but to instead to be more “perfect” with their harmonies. Equal temperament has no perfectly tuned intervals as every pitch is shifted slightly. Tolgahan Çoğulu’s *Microtonal* (2018), Süleyman Hakan Görener’s “Hüseyini II” (2018) and Jacob Collier’s arrangement for “In The Bleak Midwinter” (2016) are all pieces in which the artist has used microtones in order to achieve more natural and accurate intervals than equal temperament offers.

This song uses the Logic X “hermode” MIDI tuning feature that allows for perfect intervals to be performed live via MIDI. Just intonation is a popular alternative temperament as it has more perfect intervals than equal temperament, however it also usually only accommodates certain key signatures and any chromaticisms can sound very out of tune. The “hermode” feature alleviates this by tuning the 3rds and 5ths live as the piece goes on, therein making the intervals perfect based on the context of the chord. The effect is sonically satisfying and may be largely unnoticeable to some, but it is something I think many songwriters would be interested in, especially as this method removes the modulation problem of acoustic instruments tuned to just intonation. In the past this technique would have been difficult to create (for example, if the pitch shifting was performed live) however, now, algorithms and post production has made the execution of microtonal ideas like this much easier (Darreg, 1978, p.37).

In the same vein as track 5, this piece is one of the more mainstream sounding ones. The structure forgoes a verse/chorus pattern and instead is built upon a repeated harmonic pattern and a lyrical theme which are varied throughout the song. This structure, along with the sparse arrangement add to the supposed familiarity of the intonation. Just intervals are not unheard of in pop music, Red Hot Chili Peppers’s “Scar Tissue” uses a just tuned guitar. As the average listener will not notice this technique, I wanted the song to appear familiar as well in order to compliment this.

### *Her Garden*

Track 7 is a folk/electronica song that was written as a performance piece for the Seaboard MIDI controller.

The original motivation for this whole project was while I was analysing the harmonies in the Boards of Canada piece “In the Annexe” (2002). I soon realised that the inexplicable complexity of the harmonic textures was due to microtones. Boards of Canada often detune or modulate the pitch of their pieces with microtones. The effect is perhaps not obvious but is a vital part of their aesthetic of nostalgia and decay. Other examples of electronic pieces that use this technique are Oval’s “Do While” (1995) and Ann Annie’s “Moons Apart” (2017).

I felt that this technique would be effective with lyrics. An infamous example of microtones in pop/rock music is in Radiohead’s “How to Disappear Completely” (2002). Jonny Greenwood’s strings

and ondes martenot arrangement incorporate chords where every part is slowly moving in and out of tune. Against the sadness of the lyrics, this technique is very emotionally effective. Another songwriting example of this in and out of tune technique is in Florist's "Rings Grow" (2016) where the synth part begins to slowly modulate around the key centre as the song develops.

To create this effect I performed all of the songs layered synth parts on a seaboard and emphasized slow movement of the individual chord notes as I did so. As every note is individually controllable the resulting harmonic texture was very rich. By layering these parts I was able to achieve the subtle frequential movement that I was after. Also as a songwriter I felt that the immediate and seemingly natural way that I can create microtones with the seaboard was very appealing as it resulted in every bar in the song being subtly unique while still retaining the same general harmonic movement. To further develop this idea of slow movement around the target note, I performed the minimal violin part with slow glissandos and lax intonation. Harmonic repetitiveness is a staple of pop songs (Moore, 2016, p. 78) and although it is not an inherently negative quality, I believe that this method of applying microtones can easily be applied in songwriting as an experimental tool. It allows for vast and unique harmonic diversity without losing the repetitive or catchy tropes associated with the genre.

### *Hey Takahe*

Track 8 is an indie rock/chiptune song that merges equal temperament with various microtonal techniques

Most songwriters have been trained to compose in equal temperament. I was curious to see how microtonal parts could be added to a song written in the standard twelve note octave (as opposed to the other songs on the album that, while they may feature equally tempered parts, are built upon microtonal ideas). The basis of the song is a very simple chiptune chords structure. I used the ipad app "microSketch" to add a 31 note per octave synth part underneath this and another app "d401" provided a detuned synth part for the chorus and bridge. The fast chiptune lead part in the bridge was created using "Beepola" software which is a front end for music based around the Spectrum line of computer consoles. The sonic limitations of the early sound chips on these machines meant that there were often problems with intonation, for example the title music for the game *Fairlight* (1985) has a microtonal melody part.

For the vocals, ukuleles, gameboy, otamatone, slide guitar and fretless bass parts I focused on the idea of frequency as a continuum. My Bloody Valentine's "Only Shallow" (1991), Mac DeMarco's "Honey Moon" (2018) and Neon Indian's "Deadbeat Summer" (2009) are all indie rock songs that inspired this idea. They all seem to put as much attention on the slides and portamentos between the notes as they do the destinations. As glissandos are commonplace in equally tempered music, the music does not sound out of tune at all and gives the song a pleasing sense of tension and release. For the slide guitar solo, I was inspired by hard rock guitarist Bumblefoot's "Little Brother Is Watching" (2015) and Guthrie Govan's guitar work on progressive rock trio The Aristocrats' "Erotic Cakes" (2012). Both of these guitar solos are performed on fretless guitars and demonstrate a very fun and accessible use of microtones. In addition to this, The Derek Trucks Band's "Sahib Teri Bandi - Maki Madni" (2006) which uses a slide guitar and a drone to mimic Indian classical music and bring out microtones in a contemporary rock band setting. I felt that the

improvisatory nature of Indian ragas are interestingly compatible with jam rock music and wanted to explore that in this song.

Very common in alternative rock music is a quiet/loud structure (Shepard & Horn, 2012, p. 21-23) which this song uses. The initial verse section establishes the equal tempered “points of reference” in a clear and intimate context which is then followed by a sudden change in the next sections both dynamically and harmonically as the arrangement fills up and the microtones are emphasised.

Like track 5, I feel that this song provides a strong example of how microtonal techniques can add character and personality to a stylistic song. Composer Ben Johnston often creates completely new tuning systems for every piece he composes, this use of microtones has been described as adding “emotional flavour” and uniqueness to his music (Sabat, 2015).

### *Sad and Alone*

Track 9 is a lofi blues/folk song that uses instruments in “out of tune” equal temperaments.

Microtonal inflections were common in the vocals and guitar playing of early blues pioneers. Robert Johnson’s “Drunken Hearted Man” (1937) and Muddy Waters’ “Feel Like Going Home” (1964) both demonstrate an intuitive use of microtonal embellishments (Monzo, 1998) (Curry, 2017). In trying to mimic this, I recorded multiple vocal takes and experimented as far as I could with flattening and sharpening certain notes in the melody. I compared and chose the takes that where I felt that the microtones complimented the bittersweet nature of the song without sounding too rough. While my voice may lack the soulful control that Robert Johnson had of his vocals, I found that the results of experimenting with vocal intonation was not as distracting as I thought they would be. The melodies fit with the style and may be something that other songwriters would be interested in.

The instrumental parts of the song (guitar, ukulele and piano) were all performed on noticeably “out of tune” instruments. This was inspired by Daniel Johnston’s “True Love Will Find You in the End” (1990). This recording is lo-fi, the vocals are wavering and the guitar is obviously out of tune. The reaction to this however (from me and many others) is deeply emotional. If the recording had been more professional, the vocals stronger or if guitar was in tune, it would not have the same heartbreaking warmth and innocence of the original. The lyrics that I wrote for this song were uncharacteristically personal and would have felt out of place to me in an overproduced recording. The out of tune instruments are meant to reflect the visceral and reflective mood of the piece. In addition to this, the out of tune piano creates a honky tonk sound that is suitable for the style of the piece.

The vocals, ukulele and guitar parts were all recorded with a cheap Gatt Audio tom drum microphone and the piano was recorded with the inbuilt microphone on my old macbook. This was an intentional choice so as to replicate the vintage and DIY style of the music that inspired this piece. To further increase this effect, a heavy bandpass filter EQ was applied to the master track. By only allowing a small range of mid frequencies to be heard in the final mix, the music again mimics antiquated or subpar speaker systems associated with the example artists. The lack of polish also adds to the perceived authenticity of the recording. This is a common way for some artists to avoid making overly manufactured music. Authenticity can be one of the main appeals and aesthetics of

songwriting (Till, 2016) and in the case of this song, the microtonal subtleties bring out a more authentic sound due to their imperfections.

### *Untitled*

Track 10 is a short ambient jazz song that merges a 24 note per octave piano and a 48 note per octave synth.

The performance style of this piece was inspired by composer Ivan Wyschnegradsky (Ader, 2009), Charles Ives' "3 Quarter-Tone Pieces" (1924) and H. Wakabayashi's "Microtonal chord progressions in 24 EDO" (2017) all of which made quarter tone music by tuning two pianos 50 cents (half a semitone) apart to create a 24 note octave.

I would argue that the quarter tone is the most foreign interval to the average trained listener as a quarter tone is further away from an equally tempered note than any other interval. For example a slightly flattened G over a C will likely have the effect of a perfect fifth to the average listener as it is so close to the interval that they are familiar with. However if the G was flattened by a quarter tone, listeners' ears would not know whether it is meant to be a perfect fifth or a diminished one as the distance is halfway. My way around this compositionally was to generally stay on one of the two keyboards per bar. As the performance is intentionally very slow, the extra time and space allows the listener to continually readjust to the repeatedly shifting tuning (Bowan, 2012, p. 226). Furthermore when the two keyboards are played together for melodic reasons the quarter tones would almost only be used as passing notes to add tension and movement. The end result is that ~~despite~~ the music sounds very relaxing to me despite the heavy use of quarter tones.

The introduction of a synth tuned to 48 notes per octave at the end of the piece is understandably less abrasive than the 24 note per octave piano part as it begins to bridge the distances between the quarter tones by filling in the gaps with notes that are more similar to equal temperament.

Aesthetically, this song was inspired lo-fi electronica musicians who often use effects and techniques to create a feeling of nostalgia (Harper, 2014, p. 323). For example, the reverse piano, synthesized drones and even the detuned effect of the microtones themselves are all common in this style. I feel that the resulting aesthetic context compliments the nostalgic and sentimental lyrics as well as the "broken" effect of the microtones.

My main inspiration to use quarter tones in an ambient jazz piano piece was the music of H. Wakabayashi. The unresolved nature of the quarter tones is complemented by the slow and relaxed tempo of the music. The lack of clear resolution in long ambient spaces are also apparent in the piano pieces *Revelations* (2007) by Michael Harrison and *Hyperchromatica* (2018) by Kyle Gann.

### **Conclusion**

"The arena of musical scales and tuning has certainly not been a quiet place to be for the past three hundred years. But it might just as well have been if we judge by the results" (Carlos, 1987, p.29). The area of microtonality and xenharmonics is an one where the theory seems to outweigh the practice. As a songwriter I am always looking to learn new techniques and innovate as a composer and I have attempted to explore microtones creatively in my own practice of pop songwriting. This

project has been an attempt to take a step in expanding the realm of pop and rock songs away from the “universality” of equal temperament (Pohlit, 2017).

I have applied and built on previous microtonal methods and techniques of other composers, pop/rock/electronica musicians and traditional musics to the process of making this album in an attempt to achieve an “optimal distinctiveness” (Brewer, 1991) of taste. The result is an album that is not overly abrasive but instead clearly “pop” sounding. The hooks are as catchy, the melodies as “in tune” and the harmonies as rich as they would be in a 12 tone equal temperament song. At the same time, the new frequencies and intervals have added something new and interesting to the genres and styles of the various songs. While creating the album, it did not take long before unfamiliar (and initially dissonant sounding) pitches began to sound interesting, beautiful, melancholy etc. The aesthetic possibilities of microtones grew on me exponentially as the process went on.

I hope that by analysing practical, cultural and creative reasons for this that I have succeeded in demonstrating the expansive possibilities of microtones as an accessible technique. My hope is that more songwriters continue to explore xenharmonics in their own creative styles and that the resulting new music continues to inspire innovation and experimentation in the world of pop music, “musical accessibility, whereas it might have certain parameters, is not static and changes as society changes and music itself changes” (Eisentraut, 2013, p. 83) I have however, only scratched the surface of vast potential that microtones in pop songs have to offer.

## Bibliography

Ader, L. (2009). MICROTONAL STORM AND STRESS: GEORGY RIMSKY-KORSAKOV AND QUARTER-TONE MUSIC IN 1920S SOVIET RUSSIA. *Tempo*, 63(250), pp.27-44.

Arnolds, C. (2018). *The Great Piano Mystery*. [video] Available at: <https://www.youtube.com/watch?v=luzZCWA-HIY>

Ashwood, D. and Kukstis, C. (2005). *On a Philosophy of Pop Music*. [online] Thecrimson.com. Available at: <https://www.thecrimson.com/article/2005/4/15/on-a-philosophy-of-pop-music/>

Bailes F, Dean RT, Broughton MC (2015). *How Different Are Our Perceptions of EqualTempered and Microtonal Intervals? A Behavioural and EEG Survey*. PLoS ONE 10(8): e0135082. doi:10.1371/journal.pone.0135082

Baugh, B. (1993). Prolegomena to Any Aesthetics of Rock Music. *The Journal of Aesthetics and Art Criticism*, 51(1), p.23.

Bousted, D. (2003) An empirical study of quarter-tone intonation, *Contemporary Music Review*, 22:1-2, 53-85, DOI: 10.1080/0749446032000134742

Bowan, K. (2012). Living between Worlds Ancient and Modern: The Musical Collaboration of Kathleen Schlesinger and Elsie Hamilton. *Journal of the Royal Musical Association*, 137(2), pp.197-242.

Brennan, I. (2016). *How music dies (or lives): Field Recording and the Battle for Democracy in the Arts*. Allworth Press.

Brewer, M. (1991). The Social Self: On Being the Same and Different at the Same Time. *Personality and Social Psychology Bulletin*, 17(5), pp.475-482.

Bucht, S, Houvinen, E. (2004). Perceived consonance of harmonic intervals in 19-tone equal temperament. In: R. Parncutt, A. Kessler & F. Zimmer (Eds.) *Proceedings of the Conference on Interdisciplinary Musicology (CIM04) Graz/Austria, 15-18 April, 2004*

Buljo, A. (2007). *Millionkrav til Virgin Records*. [online] NRK. Available at: <https://www.nrk.no/sapmi/millionkrav-til-virgin-records-1.4364954>

Carlos, W. (1987). Tuning: At the Crossroads. *Computer Music Journal*, 11(1), p.29.

Catherino, D. (2018). *Polychromatic Music*. [online] NewMusicBox. Available at: <https://nmbx.newmusicusa.org/polychromatic-music/>

Catherino, D. (2016). *Polychromatic music | Dolores Catherino | TEDxSacramento*. [video] Available at: <https://www.youtube.com/watch?v=EfJbS5jPIOk>

- Cohrdes, C. and Kopiez, R. (2014). Optimal distinctiveness and adolescent music appreciation: Development of music- and image-related typicality scales. *Psychology of Music*, 43(4), pp.578-595.
- Creswell, J. (2007). *Qualitative inquiry and research design*. 2nd ed. Thousand Oaks: Sage.
- CURRY, B. (2017). Two Approaches to Tonal Space in the Music of Muddy Waters. *Music Analysis*, 36(1), pp.37-58.
- Darreg, I. (1978). [A Xenharmonist's Message to the Computer Musicians]. *Computer Music Journal*, 2(2), p.2.
- de Clercq, T. (2017). Embracing Ambiguity in the Analysis of Form in Pop/Rock Music, 1982–1991. *Music Theory Online*, 23(3).
- Dean, R. (2009). Widening Unequal Tempered Microtonal Pitch Space for Metaphoric and Cognitive Purposes with New Prime Number Scales. *Leonardo*, 42(1), pp.94-95.
- Duffin, R. (2008). *How equal temperament ruined harmony*. New York: W.W. Norton.
- Eisentraut, J. (2013). *The accessibility of music*. New York: Cambridge University Press.
- Erllich, P. (2006). A middle path between just intonation and the equal temperaments, part 1. *Xenharmonikôn*, 18, 159-199.
- Feld, S. (2000). A Sweet Lullaby for World Music. *Public Culture*, 12(1), pp.145-171.
- Fox, C. (2003) Hybrid temperaments and structural harmony: a personal history, *Contemporary Music Review*, 22:1-2, 123-139, DOI: 10.1080/0749446032000134779
- Frith, S. (1996) *Performing Rites: On the Value of Popular Music*. Harvard University Press
- Frith, S. (2004). What is Bad Music? In: *Bad Music : The Music We Love to Hate*, edited by Christopher J. Washburne, and Maiken Derno, Routledge, 2004.
- Frith, S. (2007). *Taking Popular Music Seriously*. Ashgate.
- Frith, S., Horne, H. (2016). *Art Into Pop*. Routledge.
- Frith, S., Straw, W. and Street, J. (2001). *The Cambridge Companion to pop and rock*. Cambridge: Cambridge University Press, p.95.
- Fuller, R. (1991). A Study of Microtonal Equal Temperaments. *Journal of Music Theory*, 35(1/2), p.211.
- Gann, K. (1993). La Monte Young's The Well-Tuned Piano. *Perspectives of New Music*, 31(1), p.134.
- Gann, K. (2008). *A Chord Sequence You've Never Heard*. [online] PostClassic. Available at: [https://www.artsjournal.com/postclassic/2008/08/ive\\_said\\_it\\_before.html](https://www.artsjournal.com/postclassic/2008/08/ive_said_it_before.html) [Accessed 7 Jan. 2019].
- Gilmore, B. (2003) The climate since Harry Partch, *Contemporary Music Review*, 22:1-2, 15-33, DOI: 10.1080/0749446032000134724



- Grady, K. (1991) *Ervin Wilson's Hexany*. <http://anaphoria.com/grady1-1.pdf>
- Guion Peoples, D. (2017). Nothing Compares to You: Prince and the Theory of Optimal Distinctiveness. *Journal of African American Studies*, 21(3), pp.443-460.
- Halewood, M. (2015). On equal temperament: Tuning, modernity and compromise. *History of the Human Sciences*, 28(3), pp.3-21.
- Harker, D. (1985). *Fakesong*. Milton Keynes: Open University Press.
- Harper, A. (2014). *Lo-Fi Aesthetics in Popular Music Discourse*. University of Oxford.
- Hart, A. (2016). Microtonal Tunings in Electronic Dance Music: A Survey of Precedent and Potential. *Contemporary Music Review*, 35(2), pp.242-262.
- Hawkins, S. (2011). *Pop Music and Easy Listening*. Routledge.
- Hemholtz, H. (1863). *On the Sensations of Tone as a Physiological Basis for the Theory of Music*.
- Howard, D. M. (2007). *Intonation Drift in A Capella Soprano, Alto, Tenor, Bass Quartet Singing With Key Modulation*, *Journal of Voice*, Volume 21, Issue 3, Pages 300-315, ISSN 0892-1997
- Hume, D. (1757). Of the standard of taste. In: *English Essays: Sidney to Macaulay*. Vol. XXVII. The Harvard Classics. New York: P.F. Collier & Son, 1909–14; Bartleby.com, 2001
- Johnson, T. (2018). Analyzing Genre in Post-Millennial Popular Music. *CUNY Academic Works*. pp.163
- Jones, S. (1992). *Rock Formation: Music, Technology, and Mass Communication*. Newbury Park, Calif.: Sage.
- Kant, E. (1790). *Critique of Judgement*. (W. H. Pluhar, Trans). Indianapolis
- Keislar, D., Blackwood, E., Eaton, J., Harrison, L., Johnston, B., Mandelbaum, J. and Schottstaedt, W. (1991). Six American Composers on Nonstandard Tunings. *Perspectives of New Music*, 29(1), p.176.
- Kramer, K. (2014). *The T-Pain Effect: How Auto-Tune Ruined Music... And Saved Hip-Hop*. [online] Complex. Available at: <https://www.complex.com/music/2014/04/the-t-pain-effect-how-auto-tune-ruined-music-and-save-d-hip-hop>.
- Lamb, B. (2018). *What Is Pop Music?*. [online] Liveabout. Available at: <https://www.liveabout.com/what-is-pop-music-3246980>
- Lee, J. (2017). *Interview: Jacob Collier (Part 1)*. [video] Available at: <https://www.youtube.com/watch?v=DnBr070vcNE>
- Lobel, L. (2011). *In Defense of Equal Temperament - Part I*. [online] My.ptg.org. Available at: <http://my.ptg.org/blogs/larry-lobel/2011/08/24/in-defense-of-equal-temperament-part-i>
- Lueg, M. (2010). *Modernisation & Westernisation of Music in Egypt*. [online] Available at: <http://arabicmusicband.com/articles/modernisation-and-westernisation-of-music-in-egypt>

- Longhurst, B. (2007) *Popular Music and Society*. Polity Press
- Mansell, J. G. (2009). *Music and the Borders of Rationality: Discourses of Place in the Work of John Foulds*, in Grace Brockington, ed., *Internationalism and the Arts in Britain and Europe at the Fin de Siècle*. (Oxford: Peter Lang, 2009), 49-78.
- Martin, B. (2002). *Avant Rock: Experimental music from the Beatles to Bjork*. Carus Publishing Company.
- Masters, M. (2018). *La Monte Young: The Well-Tuned Piano Album Review* | Pitchfork. [online] Pitchfork.com. Available at: <https://pitchfork.com/reviews/albums/la-monte-young-the-well-tuned-piano-81-x-25-61750-111859-pm-nyc/>.
- Mathieu, W. A. (1997). *Harmonic Experience: Tonal Harmony from Its Natural Origins to Its Modern Expression*. 2nd ed. Inner Traditions.
- Monzo, J. (1998). *A Microtonal Analysis of Robert Johnson's "Drunken Hearted Man"*. [online] Tonalsoft.com. Available at: <http://tonalsoft.com/monzo/rjohnson/drunken.aspx>
- Narushima, T. (2017). *Microtonality and the tuning systems of Erv Wilson*. Routledge.
- Negus, K. and Astor, P. (2015). Songwriters and song lyrics: architecture, ambiguity and repetition. *Popular Music*, 34(2), pp.226-244.
- Nelson, R. (2013). *Practice as Research in the Arts: Principles, Protocols, Pedagogies, Resistances*. Palgrave Macmillan.
- Osborn, B. (2013). Subverting the Verse–Chorus Paradigm: Terminally Climactic Forms in Recent Rock Music. *Music Theory Spectrum*, 35(1), pp.23-47.
- Platz, R. and Wharton, F. (1995). More Than Just Notes: Psychoacoustics and Composition. *Leonardo Music Journal*, 5, p.23.
- Percino G, Klimek P, Thurner S (2014) *Instrumentational Complexity of Music Genres and Why Simplicity Sells*. PLoS ONE 9(12): e115255. doi:10.1371/journal.pone.0115255
- Pohlit, S. (2017). EPISTEMOLOGY OF TONE: AN OBITUARY FOR JULIEN JALÂL ED-DINE WEISS. *Tempo*, 71(281), pp.71-79.
- Sabat, M. (2015). PANTONALITY GENERALISED: BEN JOHNSTON'S ARTISTIC RESEARCHES IN EXTENDED JUST INTONATION. *Tempo*, 69(272), pp.24-37.
- Said, E. (1978). *Orientalism*. Pantheon Books
- Schoenberg, A. (1978). *Theory of Harmony*. California Press
- School of Life. *POP CULTURE: Pop and Philosophy*. (2016). [video] Available at: <https://www.youtube.com/watch?v=9yypg71Aixwc&t=>
- Serrà, J., Corral, Á., Boguñá, M., Haro, M. and Arcos, J. (2012). *Measuring the Evolution of Contemporary Western Popular Music*. *Scientific Reports*, 2(1).

- Service, T. (2013). *A guide to La Monte Young's music*. [online] the Guardian. Available at: <https://www.theguardian.com/music/musicblog/2013/mar/25/contemporary-music-guide-la-monte-young>
- Shepherd, J. and Horn, D. (2012). *Continuum Encyclopedia of Popular Music of the World Volume 8*. London: Bloomsbury Publishing, pp.21-23
- Shuker, R. (2016). *Understanding Popular Music Culture*. Milton: Taylor & Francis.
- Siegel, J. and Siegel, W. (1977). Categorical perception of tonal intervals: Musicians can't tell sharp from flat. *Perception & Psychophysics*, 21(5), pp.399-407.
- Sloboda, John. 1999. *The Musical Mind. The Cognitive Psychology of Music*. Second Edition. Oxford. ISBN 978-0-19-852128-0
- Steiner, R. (1906). *The Inner Nature of Music and the Experience of Tone*.
- Stévançe, S. and Lacasse, S. (2017). *Research-creation in music and the Arts*. 1st ed. Routledge.
- Thompson, R. (2016). Singer-songwriter authenticity, the unconscious and emotions (feat. Adele's 'Someone Like You'). In: K. Williams and J. Williams, ed., *The Cambridge Companion to the Singer-Songwriter*. Cambridge: Cambridge University Press, pp.291-304
- von Appen, R. (2007) *On the aesthetics of popular music*. Music Therapy Today (Online 1st April) Vol.VIII (1) 5-25.
- Walker, J. (1987). *Cross-overs: Art into Pop, Pop into Art*. London u.a.: Methuen.
- Werckmeister, A. (1707). *Musicalische Paradoxal-Discourse*. Quedlinburg: T.P. Calvisius.
- Werntz, J. (2001). Adding Pitches: Some New Thoughts, Ten Years after Perspectives of New Music's "Forum: Microtonality Today". *Perspectives of New Music*, 39(2), 159-210. Retrieved from <http://www.jstor.org/stable/833567>
- Wicke, P. (1990). *Rock Music: Culture, aesthetics and sociology*. Cambridge University Press.
- WINCKEL, F. and Binkley, T. (1967). *[Phänomene des musikalischen Hörens.] Music, sound and sensation. A modern exposition ... Translated ... by Thomas Binkley*. New York: Dover Publications.
- Wood, J. (1986). Microtonality: Aesthetics and Practicality. *The Musical Times*, 127(1719), p.328.
- Yang, L. An, D. *Handbook of Chinese Mythology*. Santa Barbara, California: ABC CLIO, 2005, p. 73
- Yang, Y., Welch, G., Sundberg, J. and Himonides, E. (2015). Tuning Features of Chinese Folk Song Singing: A Case Study of Hua'er Music. *Journal of Voice*, 29(4), pp.426-432.
- Yankiev, Ivan K. 2018. The Categorical Perception of the Music Scale: A Challenge Before the Microtonal Music. *Accelerando Belgrade Journal of Music and Dance* 3:3

## Discography

- Afro Celt Sound System (2005) *Anatomic*. Real World Records - CDRW133
- Ann Annie (2017) *Moons Apart*. <https://www.youtube.com/watch?v=sYoInWBzoYA>
- Aphex Twin (1994) *Selected Ambient Works Volume II*. Warp Records - WARPCD21
- The Aristocrats (2012) *Boing, We'll Do It Live*. BOING! Music LLC. – BM 00003
- Arnold Dreyblatt & The Orchestra Of Excited Strings (2002) *The Adding Machine*. Cantaloupe Music – CA21006
- Aruna Sairam (2011) *South India: Aruna Sairam (Padam, le chant de Tanjore)*. Ocora Radio-France
- BATBXY (2018) *All I Have*. <https://soundcloud.com/batbxy/all-i-have>
- Boards Of Canada (1995) *Twoism*. Warp Records - WARPCD70
- Boards Of Canada (1998) *Music Has The Right To Children*. Warp Records - warplp55
- Boards Of Canada (2002) *Geogaddi*. Warp Records -warpcd101
- Brendan Byrnes (2012) *Micropangaea*. Spectropol Records – SpecT 14
- Britney Spears (2003) *In The Zone*. Jive – 82876576442
- Bumblefoot (2015) *Little Brother Is Watching*. EMP Label Group - BBF08
- Charles Ives (1924) *3 Quarter-Tone Pieces*. Performed by Paratore brothers (2003)  
<https://www.youtube.com/watch?v=EXJPnUZhETg>
- City of the Asleep (2011) *Transcendissonance*.  
<https://cityoftheasleep.bandcamp.com/album/transcendissonance>
- The Cranberries (1994) *No Need To Argue*. Island Records - 74321 23344 2
- D'Angelo (2000) *Voodoo*. EMI – 5233732
- Daniel Johnston(1990) *1990*. Shimmy Disc Europe - SDE 9015/CD
- Daoiri Farrell (2013) *Creggan White Hare*. [https://www.youtube.com/watch?v=UPl\\_tHNjS78](https://www.youtube.com/watch?v=UPl_tHNjS78)
- David First (2002) *Universary*. Analysand – A-KCS 9128
- David Fiuczynski (2008) *KiF Express*. Fuzelicious Morsels – FUZE8908-2
- Debussy *Estampes* (1903). Gordon Fergus-Thompson (1989) *Complete Piano Music*. Brilliant Classics – 94415
- Deep Forest (1992) *Deep Forest*. Dance Pool - DAN 471976 3
- The Derek Trucks Band (2006)*Songlines*. Columbia – 82796 92844 2

- Dolores Catherino (2014) *Temporal Parallax*.  
<https://dolorescatherino.bandcamp.com/track/temporal-parallax>
- Fennesz (2001) *Endless Summer*. Mego - MEGO 035
- Florist (2016) *The Birds Outside Sang*. Double Double Whammy - DDW033
- Four Tet (2003) *Rounds*. Domino - WIGLP126
- Freescha (2003) *What's Come Inside Of You*. Attacknine – ATTCD003
- George Lovett (1907) *Fare Ye Well, Lovely Nancy*.  
<https://sounds.bl.uk/World-and-traditional-music/Ethnographic-wax-cylinders/025M-C0037X1557XX-0100V0>
- Ghazal (2003) *The Rain*. ECM Records – ECM 1840
- Good Charlotte (2002) *The Young And The Hopeless*. Epic - 509488 9
- H. Wakabayashi's (2014) *Iceface Tuned Piano (Microtonal Lucid Fairytale)*.  
<https://www.youtube.com/watch?v=vvDdMkyf6f8>
- H. Wakabayashi (2017) *Microtonal chord progressions in 24 EDO*.  
<https://www.youtube.com/watch?v=F75TzUy5OoU>
- Ilevens (2017) *Transmitter*. Records DK - 749368
- Jacob Collier (2016) *In My Room*. Qwest Records – 234286
- Jacob Collier (2016) *In the Bleak Midwinter*. <https://www.youtube.com/watch?v=mPZn4x3uOac>
- Jimi Hendrix (1999) *Live At Woodstock*. MCA Records - MCD 11987
- The Jimi Hendrix Experience (1967) *Are You Experienced*. Track Record - 612 001
- Joey Pecoraro (2016) *Tired Boy*. <https://soundcloud.com/joeypecoraro/tired-boy>
- Julie Fowlis (2014) *Gach Sgeul - Every Story*. Machair Records - MACH003
- Kikiyama (2014) *Yumenikki Sound Tracks Yu Me No O to 2*. Glaive Music
- King Gizzard And The Lizard Wizard (2017) *Flying Microtonal Banana*. Heavenly Recordings - HVNLP36CD
- Kraig Grady (2006) *Beyond The Windows Perhaps Among The Podcorn*. Transparency – 0234
- Kyle Gann (2018) *Hyperchromatica*. Other Minds – OM 1025-2
- La Monte Young (1991) *The Second Dream Of The High-Tension Line Stepdown Transformer From The Four Dreams Of China*. Gramavision - GRV 74672

La Monte Young (1987) *The Well-Tuned Piano 81 X 25* 6:17:50 - 11:18:59 PM NYC. Gramavision - 18-8701-2

La Monte Young & The Forever Bad Blues Band (1993) *Just Stompin' (Live At The Kitchen)*. Gramavision - R2 79487

Last Sacrament (2013) *Enantiodromia*. Cult Underground - CU001

Laurie Anderson (1982) *Big Science*. Warner Bros. Records - K 57002

Mac Demarco (2018) *Honey Moon*. Light In The Attic – LITA 45-038

The Mercury Tree + Cryptic Ruse (2018) *Cryptic Tree*.  
<https://themercurytree.bandcamp.com/album/cryptic-tree>

Michael Harrison (2007) *Revelation*. Cantaloupe Music – CA21043

Minamo (2005) *Shining*. 12k – 12k1031

Muddy Waters (1964) *Folk Singer*. Chess - LP-1483

My Bloody Valentine (1991) *Loveless*. Creation Records - crecd 060

Nancy Sinatra (1966) *Boots*. Reprise Records - R 6202

Neon Indian (2009) *Psychic Chasms*. Lefse Records - LEFSE001

Nine Inch Nails (1994) *The Downward Spiral*. Island Records - ILPSD 8012

Oval (1995) *94diskont*. Mille Plateaux - MP CD 13

Paul Simon (1986) *Graceland*. Warner Bros. Records - WX 52 C

Paul Simon (2016) *Stranger To Stranger*. Concord Records – 0888072397804

Peatu (2018) *It's Still Raining (I Don't Mind)*.  
<https://soundcloud.com/peatu/its-still-raining-i-dont-minds>

Pensoft (1985) *Fairlight*. <https://www.youtube.com/watch?v=hjgWaBOUAKU>

Pham Duc Thanh (2002) *Vietnamese Traditional Dan Bau*. Oliver Sudden Productions Inc. – K10-19CD

Rachel Unthank & The Winterset (2007) *The Bairns*. Rabble Rouser Music - 50999 504 3802 0

Radiohead (2000) *Kid A*. Parlophone - CDKIDA 1

Red Hot Chilli Peppers (1999) *Californication*. Warner Bros. 9 47386-2

Robert Johnson (1937) *Drunk Hearted Man*. The Complete Recordings (1990). CBS - 467246 2

Saba (2018) *Care For Me*. Saba Pivot LLC

Sacred Spirit (1994) *Chants And Dances Of The Native Americans*. Virgin - CDVX 2753

Sevish (2010) *Golden Hours*. Split Notes – SPNT001

Sinéad O'Connor (1990) *I Do Not Want What I Haven't Got*. Ensign - CCD

Sonic Youth (1990) *Goo*. DGC - GFLD 19297

Stephen James Taylor (2014) *Embrace It All*. Electric Mermaid

Stephen James Taylor (2015) *Quantum 7*. <https://www.youtube.com/watch?v=IWEFhUU5RC0>

Süleyman Hakan Görener (2018) *Hüseyini II*. <https://www.youtube.com/watch?v=32190wKYkO4>

Sungazer (2018) *DRUNK*. <https://www.youtube.com/watch?v=1FGPw-pkXyE>

Syzygys (2003) *The Complete Studio Recordings*. Tzadik – TZ 7240

Terje Isungset (2008) *Ice Concerts*. All Ice Records – All Ice 0804

Terry Riley (2012) *Aleph*. Tzadik – TZ 8167

Terry Riley (1986) *The Harp Of New Albion*. Celestial Harmonies - CEL 018/19

Tesla Manaf & Mahagotra Ganesha (2014) *It's All Yours*. Demajors – DIMI 356

They Might Be Giants (2018) *The Escape Team*. Idlewild Recordings – IDLE145

They Might Be Giants (2018) *My Murdered Remains*. Idlewild Recordings

Tolgahan Çoğulu (2018) *Microtonal*. AHENK MÜZİK YAPIM

Town And Country (2003) 5. THRILL128 - US

USSSY (2018) *Voyage*. Koolarrow Records

μ-Ziq (1997) *Lunatic Harness*. Planet Mu - CDPU5

Various Artists (2016) *Next Xen*. SPNT011

YMP (2017) *Imperialism Impossible*. <https://www.youtube.com/watch?v=nzhTR3SBtGI>

Yu Hong Mei (2006) *Erhu Chant*. Channel Of China – CCS SA 80206

ZIA (2011) *Drum 'n' Space*. <https://ziaspace.bandcamp.com/album/drum-n-space>