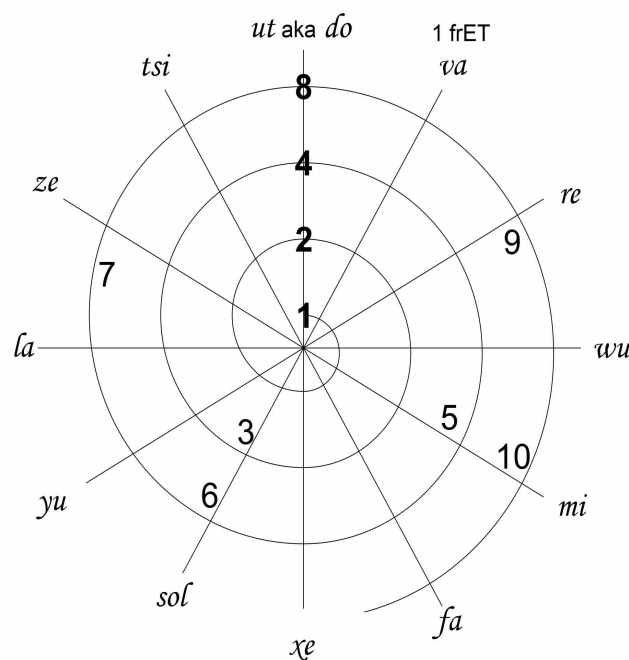


The Disharmony of Harmony

Bob Stuckey 2023

Harmony is a battle of shifting allegiances and jostling for position, typical of politics. The boss of a piece of music is called the *tonic* or *keynote*. The boss of a chord interval is called the *root*. Other notes can show support for a particular note by faking one if its harmonics, or disloyalty by forcing into a context where it becomes the fake harmonic of another note. The drama is demonstrated below in relation to *ut* aka *do* but could, of course, be transposed to any other focal point. In the centre of the diagram the harmonics are shown as a spiral, (one octave per circulation, up to the 10th harmonic (h10). They are shown aligned to the nearest note in the conventional tuning aka Equal Temperament as in guitar frets (frETs), piano and orchestral instruments. The diagram uses chromatic solfa (XroSol) leaving sharps and flats to the listener's judgement according to context.

The harmonics as approximated by Equal Temperament



7 frETs is 2 cents flat of h3 and h6
4 frETs is 14 cents sharp of h5 and h10
10 frETs is 31 cents sharp of 7
2 frETs is 4 cents sharp of h9

All of the harmonics faked in Equal Temperament (apart from the octaves 2, 4, 8 etc) are slightly out of tune but they fool most of the listeners and the context is almost as important as the tuning. **Sol** is 2 cents flat of h3 and h6, **Mi** is 14 cents sharp of h5 and h10, while re is 4 cents flat of h9.

The most out of tune **ze** which is which is about 31cents sharp of h7. And that's just the mathematics: in reality musical pitch can be affected by many factors.

A harmonic can mean many things. When a we hear a pitch played or sung it will normally be at the fundamental frequency aka the 1st harmonic (h1), along with all its multiples, 2nd harmonic (h1 x2), 3rd harmonic (h1 x 3), and so on to infinity, the strength of the various harmonics contributing

to the *timbre*, or recognisable tone colour. Many of harmonics may be beyond our hearing range, and getting denser as they get higher. While h1 and h2 are an octave apart h17 and h18 sound roughly a guitar fret apart. As the multiples are infinite every harmonic has its own harmonics - into infinity. Sometimes we can isolate them, as in the “harmonics” on a string or brass instrument, which will be heard along with the harmonics of that harmonic. They were all there in the fundamental but are now shifting attention away from the fundamental. A fake harmonic sung by a voice or played by an instrument is different in another way. A fake harmonic comes from another source will usually also highlight its own harmonics.

Here the various notes get a chance to state their viewpoints. Please exercise your sympathy and understanding if the language gets a bit bitchy.

ut – I rely on my bodyguard **sol** to keep me as top dog by reinforcing my 3rd harmonic. Without **sol** I can be easily subjugated into the role of 3rd harmonic of **fa**, or 5th harmonic of **yu**, or, the indignity, 7th harmonic of **re** or even 9th harmonic of **ze**. Don't desert me, **sol**.

va – Thankfully I have nothing in common with **ut** except our proximity and I don't get coerced into forming alliances with **ut** to support any other notes in the circle. I am always ready to act as 5th harmonic to **la** or, when the rare opportunity comes up 3^h to **xe**, 7^h to **wu**, even 9^h to **tsi**. On special occasions with the help of **yu** bolstering my 3rd harmonic and **fa** my 5th, I get to be a root of a major triad myself, a real challenge to **ut** especially if **ut** is tonic of a minor key while I boast a major chord and become honoured as a Neapolitan citizen.

re – I can act as h9 for **ut** especially if I am higher, and reciprocally **ut** can act as h7 for me if I am lower. If we are close we can sound discordant if heard low but higher up **ut** likes to use me to add a mellow flavour to its major and minor chords. I am nowhere near as discordant as **va**.

wu – I have always had a troubled relationship with **ut**, not close enough to be discordant but no feeling of loyalty. I am always ready to act as h6 for **yu** which forces **ut** to act as h5 (ha ha!). I can also fake h7 for **fa**, which casts **ut** as h6. Poor **ut**.

mi – My first allegiance is of course with **ut** for whom I am happy to act as h5 but I am not inflexible in my loyalty and can play h9 for **re** forcing **ut** into the role of h7. I also can serve as bodyguard (h3 or 6) to **la** forcing **ut** into the dubious role as minor 3rd. Generally, I am much less trouble than **wu** which is why I often get included in the final chord of minor pieces, as Picardie 3rd. All those **wu** tantrums are over, folks. Sit back and enjoy my good vibrations.

fa – I subjugate **ut** to be my bodyguard h3 whenever possible, or, as a further indignity, I act as h3 to **ze** forcing **ut** into an h9 role. How are the mighty fallen. Sometimes I even get to take control of the whole tune, as *Unforgettable* and Lennon's *Happy Xmas*.

xe – Somehow I've got a bad name as the *Devil's Interval*. Well, I suppose if you hear me and **ut** together in the bass we sound like bitter rivals, neither of us having bodyguards and leaving our own harmonics to assert their particular loyalty. But in the treble we make a flexible pair, serving as h5 and h7 to **re** or swapping roles for **yu**. Such a swap bears the grand name *tritone substitution*. I am quite happy in these roles though I can't speak for **ut**. who is probably a bit niffed in either role.

How come the Devil's Interval got lodged between two Perfect neighbours, so-called, **fa** a Perfect 4th above **ut**, and **sol** a Perfect 5th, with devilish me lodged in between. Lately that's been to my advantage. I even get the honour of being listed in the music theory books now as part of a scale, the Blues Scale. Get me. The Afro-Americans, emerging from slavery and dumped on the open

market, found if they moved their melodies from my devilishness to either of my “perfect neighbours” it was an expression of anguish followed by calm. Glad to be of use.

sol – I am of course devoted to **ut** and happy to give my support as h3 whether acting a bodyguard, if **ut** would wish to be the root of a chord, or even aspire to be the tonic of a piece. That's good for me as I then am given the rather flattering name “the dominant”. But my loyalty is not total. I can be persuaded to act as h9 to the dreaded **fa**, when **ut** gets subjugated into an h3 role. I can even form an alliance with **wu** acting as h5, but for this **wu** needs to be quite low to get its harmonics well heard. If **la** is around I am always happy to act as h7.

yu – I am a serious threat **ut** adding a touch of gravity to any scenario. I undermine **ut** forcing it to be my h5. And adding a touch of grandeur if **ut** has assembled a minor scale: after all those miserable minor chords I get to stick out as the major chord of importance, an uplift as well as a threat. If **ze** gets uppity and wants to play root I am more than happy to act as h7 forcing **ut** to act as h9. Composers often use me as the last threat to **ut** before our “leader” grabs the last chord as victorious tonic. I can also cause trouble for **ut** by helping **la** to take over as the tonic. If you want to be a tonic you’ve got to get your 3h emphasised which in **la**’s case is **mi**. I can fake h5 for **mi** and a stringer **mi** is all good for **la**. You might call me double trouble.

la – I have a vague relationship with **ut**, not discordant but unable to offer particular support. My loyalties are with **re** whose h3 I can complement, forcing **ut** into an h7 role. I can also act as h5 to **fa** putting **ut** into a h3 role. As one of seven notes, **la, tsi, ut, re, mi, fa, sol**, I stand a pretty good chance of being tonic though **ut** most times gets the upper hand.

ze – Like **re** I have a mixed relationship with **ut**. Firstly I can offer to reinforce **ut**’s h7, helping **ut** to be the root of a chord. I can also help **ut** to be the tonic in the blues tradition where I have the honour of being a “blue note” and even get listed in the “Blues Scale”. I can also offer my humble support in many other music traditions but in European Classical I am the last thing **ut** wants to hear as my presence immediately downgrades it to the role of dominant (h3) of **fa**. Funny, because **ut** has got me as one of its harmonics but doesn’t want me to be highlighted which would cause loss of status, from ruling tonic to the subservient dominant.

tsi – You might expect me to be in as much conflict with **ut** as **va**, its neighbour on the other side. Yes, we can fight and make just as discordant a noise when sounding together, however I have something else going for me: I can act as h5 to **ut**’s trusted dominant **sol** and so I feature in the Dominant Chord **sol tsi re**, where we line up as h4, h5, h6 sometimes with the next in line **fa** as h7.

Long may the rivalries continue.

The political theme was borrowed from the theories of Ernst Terhardt who sometimes used the term **candidates** for the competing possible pitches or roots.

Comments and corrections welcome
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