Two musical theories of Sven E. Svensson reconsidered

'Tension of fifths' and 'intervallic pulse'

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The year 2019 marks not only the centenary of the *Swedish Journal of Musicology*, but also the hundred-and-twentieth anniversary of the birth of Sven Emanuel Svensson (1899–1960), who may without exaggeration be called one of Sweden's most remarkably original musical thinkers in the twentieth century. Svensson was indeed also one of the most frequent contributors to the journal in its earliest decades. This anniversary offers an opportunity to revisit two grand, albeit not unflawed, musical theories of Svensson: the conceptual notions of 'tension of fifths' and 'intervallic pulse'. These are little known among music theorists internationally today, partly due to Svensson's hesitance to publish on these matters. Although he corresponded widely in the German-speaking sphere, Svensson lectured mostly in Sweden, and published predominantly in Swedish, which has made his peculiarly original thinking inaccessible to most readers today.[1] The theories of tension of fifths and intervallic pulse may both be seen as distinct continuations of the Riemannian theory tradition, but they also have their idiosyncrasies, and anticipate many of the later universal claims made within music theory in the second half of the twentieth century.

Svensson was the only Swedish musicologist in the twentieth century to engage fully in the systematic search for what was sometimes then termed 'universal music theory' ('Universaltheorie der Musik'), at a time when this field saw its halcyon days in the wake of the work of Heinrich Schenker, the late works of Hugo Riemann, and others. The latter theories eventually spread also outside Austria and Germany, not least in the United States, where they helped shape modern academic music theory. In Sweden, Svensson is today mainly remembered (if at all) as a conductor and eccentric character in musical and academic life. In historical musicology he has garnered notoriety as a scholarly swindler, who analysed, edited, performed and conducted the music of purported late-eighteenth century composer Gustaf Fredrici, whose fraudulent identity and output were not openly challenged until after Svensson's death (see Lundberg, 2016). Svensson's writings on music theory have no such tendencies, revealing instead a rare clarity of argument

1 All quotations of Svensson's writings in English have been translated by the author, unless stated otherwise.

and penetrating reflection on all potential obscurities of the matters at hand. The only major study of Svensson as music theorist to date is an excellent bachelor's thesis by Eva Bohlin (now Svanholm Bohlin), outlining Svensson's theoretical tenets and pedagogical writings (Bohlin, 1967).

Uppsala University Library holds Svensson's personal archive, containing a considerable number of annotated scores, sketches, working papers, and annotations relating to diverse topics of music theory. The archive is organised according to topics as defined by Svensson himself (see the numbering system under References, below). In some instances, these sources allow one to get an intriguing view of the different experimental and speculative theories of music with which Svensson was preoccupied. In the future, the sources deserve fuller description and analysis in relation to many topics.[2] Many of the manuscripts contain annotations that may seem discontinuous at first, but which shed light on the background to ideas expressed briefly and in more condensed form in Svensson's publications. In the following we shall evaluate the merits, relevance, and future possibilities of two of his particular contributions to music theory.

Svensson as harmonic dualist, and the role of music theory in the discipline of musicology at Uppsala University before 1947

Scholarly discourse on music theory in the early twentieth century was characterised by the divide between the 'monistic' and the 'dualistic' schools of understanding tonal harmony. The former school held that the major triad as an acoustic phenomenon took ontological precedence, and that the minor triad could only be understood in the light of the major triad. The monistic position was typically explained in terms of the minor triad being derived from the major triad, as an 'alteration' or 'variation' of the only species of third (major) that existed in the harmonic series of overtones (as the fifth partial tone) in relation to a fundamental tone. Proponents of the dualistic view, on the other hand, held that the major and minor triads existed on equal terms; they presupposed and mirrored each other as polar opposites in one coherent system of harmony. This was surmised from the fact that an exact inversion downwards of each partial tone produces a minor triad at the subdominant position (see figure 1). Svensson was a firm advocate of the dualistic school, on the theoretical level, but he adopted a critical stance to the extended polarity theories of harmony suggested by Riemann and Siegfried Karg-Elert, among others, the latter arguing very aggressively for the ontological parity of minor and major triads (Karg-Elert, 1931).

2 Musicologist and university librarian Kia Hedell has been working on the archive and the author would like to express his gratitude for fruitful discussions concerning its contents and structure.

Sven E. Svensson (right), presumably teaching. Uppsala, 1939. Photographer: Gunnar Sundgren.[3]

The dualist claim is that while the major triad can be derived from the harmonic overtones (partials), upwards *c′ – c″ – g″ – c‴ – e‴ – g‴* rendering a C major triad, so the minor triad can be derived from a series of 'undertones', downwards *c′ – c – F – C – A♭ – F* rendering an f minor chord (see figure 1). From this presumption follows that the harmonic series has a cumulative bent sharpwards. This is because the fifth is the strongest partial of a separate pitch class (the octave being the same pitch class as the fundamental tone) and it will have as its first partial with a separate pitch class a fifth, and so on, theoretically *ad infinitum*. Likewise, it follows that – mirroring this series – the (non-perceptible) 'undertones' have a flatwards bent, rendering subdominants on subdominants, since that is the first pitch class other than the fundamental tone (Svensson, 1933, pp. 14–15).

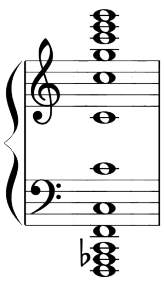

Figure 1. The harmonic dualism, mirrored from the note c′ (Svensson, 1933).

Otto Ortmann distinguishes four kinds of dualism (Ortmann, 1924, p. 372): (1) *theoretical dualism*, claiming that the undertone series is logical, or that it offers some type of positive musical understanding; (2) *physical dualism*, claiming empirical evidence of the undertone

3 Upplandsmuseet. Image accessed via *DigitaltMuseum* <https://digitaltmuseum.se/011013983098/musikforskaren-sven-e-svensson-och-annan-man-vid-musiknoter-uppsala-193>. Licence: CC BY-NC-ND 4.0.

series; (3) *aural* or *psychological dualism*, claiming that the human senses and faculties perceive the undertone series *as if* it existed; and (4) *historical dualism*, claiming that music theorists have operated with, or hinted at, dualistic notions. Svensson is a strong dualist only in the first of these senses, and to a lesser extent in the fourth.

One of the first proponents of harmonic dualism was Moritz Hauptmann (1853), but the idea had been developed further by Riemann (1905) and (with acoustic underpinning) by Arthur Joachim von Oettingen (1866; 1913; 1917) as well as (in an empirical direction) by Hermann von Helmholtz (1863). It was the merits of the form of dualism codified in Riemann's works that Svensson took as his point of departure. In his *Harmonilära* of 1933, co-authored with Carl-Allan Moberg, Svensson elucidates extensively the arguments for his position, in what he calls a 'modified dualism' (*modifierad dualism*), attempting to demonstrate its value also for the practical study of harmony (1933, pp. 13–17). He holds that while the major triad exists 'in nature', i.e. in the harmonic series, the minor triad does not, but, for him, that in no way undermines the mirroring structure as harmonically understood (this is theoretical dualism, as described above). The argument here is one from culture rather than from nature – everybody would agree, Svensson holds, that inversions of fugue subjects or any other thematic material 'exist', both as theoretical possibilities and in actual repertoire. Everyone must then, according to Svensson, also agree that they are perceived as in some way 'mirroring' their original form, and nothing else. He seems to take it that the descending minor 'undertones' exist on the same terms (Svensson, annotations, M 13).

Moberg's role in the 1933 *Harmonilära* was to provide historical examples for the harmonic understanding borne out (the book was published as a commemoration of the two-hundred-and-fiftieth anniversary of Jean-Philippe Rameau's birth, and Moberg and Svensson try to identify dualism with the French *basse fondamentale* tradition). We will leave these historical-cum-genetic arguments out from the present study, interesting though they are for the understanding of musicological currents of the day.

Since 1927, Moberg had taught musicology at Uppsala based on a curriculum outlined by Tobias Norlind written for the Faculty of Arts at the University of Lund and ratified there in 1915 (Bohlin, 1980; 2019, p. 59). In Lund, Uppsala, and Stockholm, the scholarly discipline was called 'History of music with music theory' (*Musikhistoria med musikteori*), and in Lund the theory part was examined not by Norlind, but by music theory teacher and University music director Alfred Berg. It seems that it was this twofold scholarly conception ('history *with* theory') that urged Moberg (himself emerging as an international authority in historical musicology) to elevate music theory to a serious study far beyond the status of a mere auxiliary discipline to historical studies, and to encourage Svensson to pursue such work. The task of defining music theory in Uppsala was then

allocated to Svensson, Moberg's junior by only three years. This probing and competitive phase of nascent modern musicology in Sweden, which ultimately led to a consolidation of the Uppsala department, with Moberg as professor in 1947, may explain Svensson's frenzied dynamism and drive up to that point, exemplified below by two of his original theories.[4]

The theory of tension of fifths (*Kvintspänning*)

During the 1940s Svensson was much occupied with a theory he called 'tension of fifths' (*kvintspänning*). The term itself – in its German form *Quintspannung* – had then been used intermittently in music analysis, denoting merely that leaps of a fifth produced what many perceived as a 'kinetic' energy, notably in opening phrases (see for example Rudolf Steglich, 1928, p. 613; 1952, pp. 56–65). Svensson's claim was a far-reaching and systematic application of this basic notion of tension based on fifth leaps. *Kvintspänning* (abbreviated 'ks' in Svensson, and also here in the following) is taken to increase with each degree a note is separated from another by cumulative fifths, counting the steps in the circle of fifths with arabic numbers sharpwards and with roman numerals in the flatwards direction. This means that an upward leap of a fifth has a ks of 1, a step from prime to second in a scale has a ks of 2, and so on. A downwards leap of a fifth has ks I (one flat from 0), while the minor seventh has ks II (two flats from 0), the minor third ks III (three flats from 0), etcetera.

Counting from the unison and the octave (which are regarded as one and the same pitch class with the ks of 0), the following ks tension values apply to a major scale:

	c – d – e – f – g – a – b – c
ks	0 – 2 – 4 – I – 1 – 3 – 5 – 0

The system is obvious when seen from the circle of fifths. It takes two fifth leaps (and two sharps) to get to *d* from the fundamental note of *c*, which gives ks = 2. It takes four stacked fifth leaps (and four sharps) to get to *e* from the fundamental note of *c*, and so on. It takes one fifth leap downwards (and one flat) to reach *f*, which gives a tension of one fifth in the opposite direction (ks = I). The ks of an entire phrase or section can be calculated by adding the ks values to a sum total, counting downward and upward fifth tensions separately.

The idea of the tension of fifths was logical, granted two premises: (1) that what many German music theorists already had called *Quintspannung* indeed was something really

4 In addition to these theories, several others are to be found in the writings comprised in Svensson's archive in Uppsala University Library.

experienced by listeners, that is, that a fifth leap constituted on some experienced level a move in the sharpwards direction; and (2) that premise 1 was cumulative, so that in the tone series *c – g – d* the energy, or tension, was added cumulatively for the whole series, step by step. To this, one may add the premise of harmonic dualism in Svensson's modified form – the sum is the same in intensity sharpwards 1–10 and flatwards I–X. Rather than subtracting the flatwards movement from the sharpwards, they have the same intensity of progression, but in different directions from the dualistic starting point ks 0.

Svensson purports that if the tension of fifths exists (in the experience of music), it may be calculated on three different levels:

1. Between successive notes (regardless of outer context);
2. Within a melodic phrase or section, counted from a tonal centre (such as in the scale above);
3. Between successive chords (where the ks is a sum of all separate parts considered separately).

In method 2 (as illustrated above), ks is calculated by adding up the ks of all sharpwards motion (1–10) and all flatwards motion (I–X). In polyphony, however, the flatwards motion is subtracted from the sharpwards motion. Svensson's explanation for this relates to the concept of melodic inversion – in melodic terms, an inverted fugue entry (ks 0 – 1 turned into ks 0 – I, for example) does not *negate* the tension, but retains the same. In a polyphonic situation, consisting of a compound of melodies, on the other hand, the tension is perceived as harmony, not as melodic lines, for which reason it ought to be balanced on the dualist centre of ks 0 (unison and octave).

At first scrutiny, the assumption that a monophonic leap of c – g – e is to be experienced, interpreted or understood as ♮(C major) – ♯(G major) – ♯♯♯♯(E major), rather than ♮(C) – ♯(G major) – ♯(e minor), seems to be a serious flaw in the theory of tension of fifths. The third note being heard, interpreted or understood as an e minor sonority, would be a much closer step from G major than E major. Is there not a risk of unduly conflating melody and harmony, that is, of disregarding the different possible chord functions of each note? This reservation, which Svensson readily admits, is, however, much less devastating to the assumption of cumulative tension of fifths than it may at first seem. The important matter, according to Svensson, is that the tension of fifth ratio follows proportionally both in the major and minor genera, as long as it is interpreted as harmonic situations, the mirror theory meaning that +1♯ is added and I (-1)♭ is subtracted.

In polyphonic tension of fifths analysis, Svensson demonstrates his perception of the mathematical beauty of his dualist symmetry. In the progression of a C major chord to a D major chord, for example, one can calculate the ks in several different directions. Given the stepwards consecutive upwards motion (allowing for otherwise prohibited voice-leading) we get a ks of 6:

g – a (ks 2)

e – f# (ks 2)

c – d (ks 2)

sum: 2 + 2 + 2 = ks 6

Svensson argues for the explanatory power of his theory by illustrating how the same progression with leaps downward would give the same tension of fifths in dualist balance:

g – f# (ks 5)

e – d (ks II)

c – a (ks 3)

sum: 5 + 3 – II = ks 6

A distinguishing feature of Svensson's argumentation is that these theories aim at theoretical and logical elucidation, not at ontological identification of physical properties. He bases the tension of fifths on what he takes to be a psychological consensus in current German music theory (that sharpwards motion carries tension, and subdominant motion releases tension) and constructs a melodic theory that could stand logically. But he does not attempt to claim a universal theory from this alone, nor does he argue from history by claiming, for example (like Schenker), that all tonal works are deeply rooted in such experience. It is central to Svensson that the fifth could even be chosen arbitrarily (even though for him it carried special significance due to his argument from the harmonic series as described above). This leaves his method open, he claims, even to those who (unlike himself) do not accept the Pythagorean generation of the scale from fifths. The critical implication he seems to attempt to counteract, or neutralise, by such concessions is probably the fact that the fifth carries less, not more, tension, than all other intervals, bar the unison and octave which are regarded as devoid of tension (ks 0).

Behind Svensson's elegant solutions, carrying considerable explanatory power, lies a tenet that was most likely harder to swallow for most contemporary analysts of tonal music: Svensson's sternly held Pythagoreanism, in the form of a strong belief in tonal generation by fifths (see more below).

In Svensson's theory, tension of fifths is ultimately made one of the key properties of a melodic unity (the other three being contour, ambitus, and rhythm; see M 39, p. 1). If we apply his theory to the opening phrases of the theme of the second movement of Beethoven's Piano Sonata no. 32, op. 111 (figure 2), we get the following results (repeated notes and octaves count as identical pitch class).

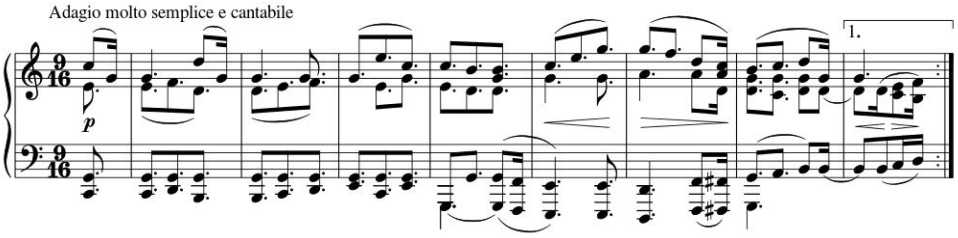

Figure 2. Beethoven, Piano Sonata, no. 32, op. 111, beginning of second movement.

A calculation of tension of fifths, bar for bar, gives the following result for the top part ('pl.' indicating a note that is prolonged by repercussion or by slur).

upbeat	bar 1	bar 2	bar 3	bar 4	bar 5	bar 6	bar 7	bar 8
0+1 (pl.)	+2+1	(pl.)	+4+0 (pl.)	+5	+0+4+1 (pl.)	-I+2+0	+5+0+2+1	(pl.)

This renders a sum of ks 28 / I (+28 in sharpwards direction, negative –I in flatwards direction). The only note 'pulling back' into subdominant tension in this part is thus I (*f*) in bar 6.

If one considers the three lower parts, in the table given in rows from top to bottom as represented in the score (where '/' signifies the change of stem grouping in bars 6–7), the following tension results:

upbeat	bar 1	bar 2	bar 3	bar 4	bar 5	bar 6	bar 7	bar 8
+4 (pl.) +1 (pl.) 0 (pl.)	-I+2 (pl.) (pl.) +2+5 (pl.)	+4-I (pl.) 0+2	+4+1 (pl.) +4+0+4	+4+2 (pl.) -I +1-I	+1 (pl.) +4 (pl.) +4 (pl.)	+3/(pl.) / +2 (pl.) +2-I+6 /	+1+2 (pl.) +0+2 (pl.) +1+3+5 (pl)	+4-I +0+5 +0+2

Next uppermost part = ks 32 / III
Next lowermost part = ks 14 / I
Lowest part = ks 41 / II

The sum of all four parts: ks 28 / I + ks 32 / III + ks 14 /I + ks 41 / II renders a sum of <u>ks 115 / VII</u>

Ultimately, VII is seen as the flatwards mirror image of 115, and may thus be subtracted: 115 – VII = <u>ks 108.</u>

What, then, is the point of such analysis? From this test of the analytical approach, one may deduce that what may be seen as a rather balanced and kinetically 'resting' passage (broadly, the harmonic functions are T – DD7 – D) gives a very high sum in the dominant sharpwards direction (the *f* in the final bar of the example – a minor seventh in the dominant chord – with its ks I does not manage to retain the balance). This is, in fact, true of most such passages perceived as being in stable tonic regions. Only very strong subdominant sections can decrease the tension of fifths sums in entire passages of polyphonic music. Interestingly, also dissonant sections with suspensions, passing notes, and appoggiaturas tend to generate higher subdominant (I–X) values. Svensson seems aware of this and states that 'one should therefore not be surprised to find the sums of harmonic tensions of fifths smaller in passages with dissonances dissolved stepwise than in those built entirely on consonances. In the harmonic styles of our present time, with unresolved dissonances, the sums of tensions of fifths are of course increased quite considerably' (M 39, p. 11).[5]

From where, then, did Svensson acquire the idea to calculate the 'tension' of a pitch in relation to others? If he remained skeptical to von Oettingen's and von Helmholtz's calculations on dualism, he seems to have been very interested in their reasoning on the calculation of harmonic proximity. If we consider figure 1 above, we can see that the harmonic overtone series produces one chord, and the 'mirrored' downwards series produces another – in Riemannian terms, they stand in a tonic-minor subdominant relationship. In relation to this, von Oettingen, in his *Harmoniesystem in dualer Entwickelung*, had surmised that the relationship between the minor and major triad in fact hinged upon their common fifth, which he called *Phonika* (in reference to Riemann's term *Tonika*). Considering the triads *c'* – *e'* – *g'* and *c'* – *e♭'* – *g'*, respectively, the pitch *g'''* is the third overtone of *g'*, the fourth overtone of *e♭'* and the fifth overtone of *c'*. This is mathematically and acoustically very convincing, and it is rooted in the assertion that it is not just fundamental notes that give rise to harmonics, but that also fundamental notes proper can be interpreted *as if they were harmonics*, so that one imagines or experiences them as such; on this latter point theorists differ, depending on whether they argue from psychoacoustics, or from 'cultural' factors, as Svensson and others do. Before von Oettingen, Hauptmann had argued for the derivation of the minor triad from the fifth relationship (Hauptmann, 1853, pp. 32–35). For him this was a matter of 'having' and 'being had', so that the mind may derive both natural partials (the c *has* a fifth [g] in a c major triad), but that pitches may also be defined from the harmonics (the c *is* a fifth in a minor triad

5 'Man bör därför icke förvåna sig över att de harmoniska kvintspänningssummorna blir lägre i en sats med stegvis upplösta dissonanser än i en sats helt uppbyggd på konsonanser. I vår tids harmoniska stilarter med dess oupplösta dissonanser ökas självfallet kvintspänningssummorna högst väsentligt.'

[f minor]).[6] For a dualist, an attractive quality of this theory is, of course, that the triad contains both genera of thirds, the three notes arising from one major and one minor third interval.

The concepts of 'Phonika' and 'Tonika' as two different ways of understanding what one hears ('tonic' relating to common fundamentals, 'phonic' relating to common partials) is at least partly a prerequisite for the 'tension of fifths' theory, since the stepwise descent (flatwards) by fifths can be seen as phonic relationships that could be read from the other direction (sharpwards) as tonic relationships. In itself, this is made possible by the circle of fifths alone, and is thus compatible with many monist theories. But placing the fifth as the pitch that *generates* phonic series seems to give the minor triad (and the subdominant) an equality in relation to the major triad (and the dominant). The theory was also attractive in relation to Pythagorean theory, to which Svensson held firmly, as we have seen. He links the derivation of just tuning and pure consonances (and indeed all intervals) from stacked fifths to the overtone tension inherent in a fifth.

Svensson was consistent in the dualist position that the third of a minor triad ought to be counted from the fifth downwards, not from the root. This follows logically from the 'mirror theory' where the note *c* renders an upward major triad (C major) and a downward minor triad (f minor), as in figure 1. In the theory of tension of fifths, this is combined with Svensson's Pythagoreanism, since he truly believed that intervals were most readily understood phenomenologically as fifths, rather than as a scale. (See figure 3. The scale reads from left to right, with sharpwards direction above *c*, flatwards direction below.)

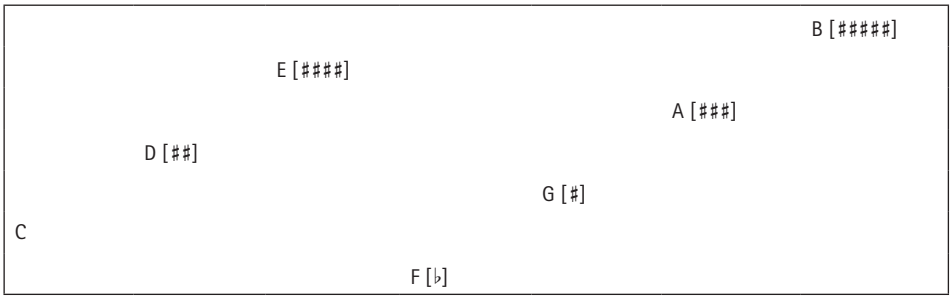

Figure 3. Scale as conceived by Pythagorean generation by fifths (Svensson, M 39).

Svensson's work may not have had a large impact on coeval music theory, but it was considerably significant for the consolidation of the Department of Musicology in Uppsala (at the time the only one of its kind in Sweden, and thus to a large extent defining the discipline on a national level) by proposing that advanced music theory could be

6 For a review of different types of minor triad derivation from harmonic partials, see Jorgenson, 1963.

a powerful tool also in historical musicology. Uppsala musicologist Ingmar Bengtsson honed and modified the tension of fifths theory in his licentiate thesis in 1945, covering melodic studies in J.S. Bach's cantatas; from Svensson's excerpts in Uppsala University Library it is clear that he and Bengtsson worked closely together on this topic. Also in his 1955 doctoral thesis on the instrumental music of Johan Helmich Roman, Bengtsson refers to the concept of *kvintspänning*, albeit less markedly. Svensson and Bengtsson made the word a lexical reality in Swedish, and thereby also a concept that advanced music students had to learn and be able to explain. Svensson wrote an entry on *kvintspänning* in the music encyclopedia *Bonniers illustrerade musiklexikon* (1946), and Bengtsson later authored one in the second edition of *Sohlmans musiklexikon* (1979). As an addition to Svensson's absolute tension of fifths (counting from the keynote) and summative tension of fifths (of an entire passage, as seen in the Beethoven application above), Bengtsson introduces a 'relative tension of fifths', counting also from the relative minor keys of a major key.

The main argument against the notion of calculating sums of cumulative 'tension' between linear progressions is, one must say, that the dualist notion of two directions (+1 sharpwards and –I flatwards, respectively) is indeed superfluous for understanding pitch perception in many cases, since the circle of fifths alone suffices to explain how pitch and interval can be perceived and understood musically in two directions. This has also been the focus of much scholarship in recent decades, and Carol Krumhansl's influential work has shown that the distance of two notes in the circle of fifths seems to have greater importance for interval perception in major contexts, while the distance of notes in the chroma circle (a chromatically linear octave circle) have greater importance in minor contexts (Krumhansl, 1990, pp. 131–133). It is interesting to note that tension between linear (by chroma) and Pythagorean (by fifths) understanding of scales and intervals still lingers in the empirical studies of music psychology.

Related to theories of tension is Svensson's 'table of intensity' of different triadic progressions (M 19), which purports to classify, and, even more importantly, grade progressions of different types, starting from the simple progressions where one note is substituted, going on to the most complex, and in Svensson's view 'intense' progressions. This table was constructed later, around 1950, while Svensson was working on an article on 'intensity of dissonance' (*dissonansintensitet*; Svensson, 1951). It is, in some ways, a logical consequence of his earlier tension of fifths theories, but it also foreshadows many tenets of later so-called Neo-Riemannian theory, in that it assumes no 'conventional progressions' but operates by single note substitutions in triads, and double substitution operations. This preoccupation with 'intensity of dissonance' also linked the 'tension of fifths' theory with another peculiar theory of Svensson's: the theory of 'intervallic pulse'.

The theory of intervallic pulse (*Klangrytm*)

For a long time, melody, harmony, and rhythm were understood as separate fundamental entities in music primers, although speculative music theory had long tried to bridge the three with some fundamental theory that were to guide *all* elements of music. The motivation behind the search for theories that could unify such diverse phenomena as intervals and rhythmic metres made its presence known also in the twentieth century. Svensson's contribution to this enterprise is what he termed *klangrytm*, here translated 'intervallic pulse', while Svensson sometimes used the English term 'sound rhythm' (the literal meaning of *klangrytm* connotes 'rhythm of resonance' as much as it does 'rhythm of sound'). For many scholars it seemed logical to attempt to find such a synthesis, given the tradition of describing both the elements of intervals and of metre in the form of fractions (3:2 signifying both 3/2 time and the interval of the fifth). But the driving force that made Svensson go further than anyone else (indeed, too far, most theorists would probably say), appears to be a dictum from Hauptmann:

> [...] in all aspects of its [i.e. that of music] harmonic-melodic, as also its metric-rhythmic existence, there will always be only o n e law for its correct and intelligible organisation that one can refer to. (Hauptmann, 1853, p. 6)[7]

While Hauptmann claimed that the rules ultimately must transcend (and thus exist beyond) all practices of music, Svensson takes the role of experimentalist, intending to put the idea of intervallic pulse to the test *within* musical practices and perception.

The 1951 edition of *Svensk tidskrift för musikforskning* comprised an article by Svensson on what he calls the relative intensity of dissonances: 'Till frågan om intervallernas dissonansintensitet' (Svensson, 1951). Here his theory of *klangrytm*, intervallic pulse, is outlined in relation to the levels of friction of all consonances and all dissonances. His notion is that the fractions for complex (and dissonant) intervals are complex, just as the intervals that have been deemed as consonances can be expressed as simple fractions. From here, Svensson goes on to empirical matters of psycho-acoustics: if the intervals resound in the lowest register of human perception, the pulsation of the numerator and denominator are easily perceptible, as regular beats. In the case of a perfect fifth (fraction 3:2), the three beats against two will result in a rhythm, not just a pitch (this can be observed in 16-foot organ pipes, for example). The octave will result in a different pulsation (fraction 1:2), two beats against one; the perfect fourth (fraction 3:4) in three beats against four; while the intervals with ratio of more complex fractions will pulsate

7 '[...] in allen Momenten seines [i.e. that of music] harmonisch-melodischen, wie auch seines metrisch-rhythmischen Daseins wird immer nur das e i n e Gesetz für die richtige, die verständliche Bildung nachzuweisen sein'. (Translation by the present author.) William Caplin (1984) has demonstrated how the strive for a synthesis of rhythm and harmony was important for Hauptmann's peculiar theory of harmonic suspension.

more intensely and irregularly. The latter would need many units of resounding together, before being in phase on the same beat again. Svensson calls rhythm on the level normally associated with metre and pulse 'macro-rhythm' and the rapid pulsation of separate pitches and combined intervals 'micro-rhythm'. In an English summary, Svensson explains it thus:

> As there is no doubt that consonant quality and dissonant intensity are independent of the existence of harmonic partials, I have tried to find a method of examining the intervals by enlarging the rhythmic skeleton which is formed by the coincidental pulses of two (or more) simultaneously sounding tones on a different pitch. (Svensson, 1951, p. 126)

Empirically, the premise of the theory of interval pulsation is straightforward, and it is used practically, for example, when tuning instruments (as one gets closer to a unison or octave from a second or seventh, the pulsation goes from complex rapid beats to slower, even fluctuations, until the beats stop and become one stable sound). But what are its consequences theoretically, and, as Svensson asked in the 1951 article, does the intervallic pulse analysis have any bearing on how consonances and dissonances are in fact perceived and experienced? In fact, he poses a whole battery of questions in relation to this. Each intervallic pulse rhythm occurs in what he calls a 'sound bar' (*klangtakt*) but which is better termed 'intervallic pulse bar', giving us the reference point for example of two beats against three (perfect fifth):

X						X					
X				X				X			

Figure 4. Perfect fifth, 2 : 3 (Svensson, M 103).

This could then be reduced further. If the beats are produced with the same sound, a monophonic rhythm of stressed crotchet – two quavers – unstressed crotchet results:

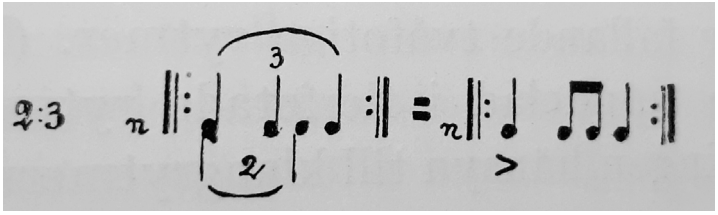

Figure 5. Intervallic pulse of perfect fifth, 2 : 3 (Svensson, 1951).

The next step is to outline the rule of all such rhythmic pulsation at all different intervals:

> The briefer the intervallic pulse bar – i.e. the more intervallic pulse bars that fit into a given time frame – the stronger the value of consonance in that interval. At the unison the number of intervallic pulse bars coincide with the Hz. frequency. [...] The longer the intervallic pulse bar, the more dissonant the interval. (Svensson, Om svävningar, M 103)[8]

The phenomenon that Svensson calls *klangrytm* had been hinted at in earlier music theory, but never covered so systematically and logically as by Svensson. As with the case of tension of fifths, many would say he takes its implied logic too far. But, seemingly independently of Svensson's ideas from the 1930s and 40s, American composer and critic Henry Cowell had feigned at similar deliberations in his *New musical resources* (1930), which was later to become very influential on Anglo-American modernist composition. Svensson was on the whole unfamiliar with Anglo-American authors; in his 1933 *Harmonilära* he quotes and scrutinises an impressive amount of literature in German, but seems unaware for example of Ortmann's resolute refutation of dualism in *Musical Quarterly* (Ortmann, 1924). Similarly, Cowell and other Anglophone authors are suspiciously absent. Had they not been, Svensson would have found in their writings ideas rather similar to his own, but approached via a completely different line of thought:

> It will also be seen that the ratio from C to any other tone of the scale will be found, in time, by using quarter-notes to express the numerical. Thus, the ratio between C and C sharp is 14 : 15. If fourteen quarter-notes are placed over against fifteen seven-thirtieths notes, the ratio will be correctly expressed. (Cowell, 1930, p. 100)

Cowell does not persevere with the consequences of what he calls an 'almost insurmountable complexity of this procedure' (1930, p. 104), and his expressed hope of some day being able to recreate it on a piano roll demonstrates that he envisages this on what Svensson would call the macro-level (as structure), not on the micro-level (as sound). Thus, Cowell's calculations, which most likely precede the earliest ones by Svensson, point more towards the type of music later created by Conlon Nancarrow, than towards the music theory of intervallic pulse (the latter creating audible intervals [micro-rhytm] rather than musical structures of audible rhythm).

One of Svensson's final questions regarding his proposed theory of intervallic pulse is the most far-reaching for musical analysis and aesthetics, namely:

8 'Ju kortare klangtakten är d.v.s. ju flera klangtakter som ryms inom ett avgränsat tidsavsnitt, desto starkare är samklangens konsonansvärde. Vid enklang sammanfaller antalet klangtakter med Hertztalet [...] Ju längre klangtakten är, desto mera dissonant är samklangen.'

> [...] if our tendency to resolve an augmented interval by increase and a diminished one by contraction has its roots in the physical constitution of the interval. Alternatively, this tendency could have its roots in the harmonic function of the interval or simply be an entirely historical convention. (Svensson, 1951, p. 120)[9]

Of course this inquiry cannot really be answered, since the categories of 'historical', 'functional', and 'physical' cannot be measured against each other, nor would it be possible to separate any physical factors from the historical practice of composition. But this speculation illustrates how fundamental matters are raised by the concept of intervallic pulse, and how keen Svensson generally was to relate his highly abstract theories to musical practice; he spent most of his day, one must remember, conducting and teaching elementary harmony and counterpoint.

Svensson's legacy of searching for coherent systems of empirical and logical understanding of pitch and rhythm as one and the same thing was kept alive by Ingmar Bengtsson. When Bengtsson succeeded Carl-Allan Moberg as professor of musicology in Uppsala in 1961, the year after Svensson's death, he had already, for several years, attempted to test the intervallic pulse theory with the tape technology of the department. He did so both by analysis (by slowing the tape down through several stages of modified copying so that the pulse of the beats could indeed be perceived by the human ear), and by synthesis (by trying to create pitches and intervals by manually adding the beats on the tapes, then speeding the process by copying).[10] Svensson's positivist legacy was, thus, certainly important for Bengtsson's more famous later large project on rhythm research, first with tapes and mechanical devices, later with computer technology.

Six years after Svensson had published his theories on intervallic pulse and microrhythm, the third volume of Karlheinz Stockhausen's journal *Die Reihe* covered similar matters, as applied to serial music. The connection was noted by Bengtsson the year after (unpublished manuscript in Svensson's archive, February 1958), crediting Svensson with the concept and the construction of a system for treating the phenomenon. Again, just as in the case of Cowell, it seems that there had been no contact between Svensson and the authors in *Die Reihe*. It is hoped that Svensson's theories are henceforth brought more firmly into the general historiography and discourse on advanced music theory around the middle of the twentieth century.

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9 '[...] om vår tendens att upplösa ett överstigande intervall genom vidgning och ett förminskat genom sammandragning har sin grund i intervallets fysikaliska gestalt. Alternativt skulle denna tendens kunna ligga i intervallets harmoniska funktion eller helt enkelt i en historiskt betingad konvention'.

10 The plans for these experiments and preliminary outcomes are mentioned by Bengtsson already in writings from 1958, addressed to Svensson and Moberg (M 104).

In his theory of intervallic pulse, Svensson took a conception from speculative theory of late Antiquity and the Middle Ages, and gave it as much empirical rigour as was possible in the wake of the recent work by physicists like von Helmholtz and von Oettingen. This is in itself no small feat, but today we may add that the attempts to prove the theory synthetically (as sketched by Bengtsson's tape-recorder experiments) turn the once startling theory into an uncontroversial discovery. The effect of intervallic pulse is readily observable by the ear and has been reproduced synthetically, for example by using a click sound and a snare drum in a 'two over three' pattern, sped up, rendering a perfect fifth. This application of the concept has been used by, among others, multimedia artist Loudon Stearns at Berklee College of Music.[11] This was technologically unthinkable for Svensson and Bengtsson, who would surely have been amazed and gratified to hear such psychoacoustic proof of their intervallic pulse theory. No less daunting is the fact that Loudon Stearns most likely is unaware that an eccentric music theorist in Uppsala, far from public attention, constructed the notational recipe for this connection between rhythm and interval pitches seventy years earlier, using only pencil and paper.

Conclusions

Svensson's main argument in harmonic and melodic analysis was that a syntactic system of music theory need not be rooted in, or founded on, empirical grounds. From this position, he criticised von Oettingen and Riemann for having sometimes made too-far-reaching claims concerning the nature of their theoretical tenets. He held, however, that the dualistic view offers so much understanding of harmonic theory that it is useful as a purely theoretical and pedagogical system in its own right, and that it is, therefore, much more 'open to analytical understanding' than the monist position. In these respects Svensson takes a position similar to that of Elizabeth Godley, who held that 'it is *profitable* to invert the scale of C major [referring to mirror inversion, like that in figure 1, above]. The Tonic Minor Triad, a chord that has never been satisfactorily located or explained, *is seen to be* contained by notes nos. 8, 6 and 4 of the mirrored image of the scale' (Godley, 1952, p. 285; italics by the present author). Svensson seems, moreover, to have developed this position before he knew about Stumpf's and Ortmann's arguments against the 'hard' dualist position and the theory of undertone series.

Svensson is perhaps best termed a musicological *inventor*, rather than innovator. He searched for breakthroughs in his field of music theory, and did so together with a few colleagues, who were invited to test, criticise, and find weaknesses in his theories. What

11 A spectrogram and audio file by Stearns has been published on Vimeo. Loudon Stearns, [2011]. 3 over 2 polyrhythm becomes a perfect fifth interval. [video online] Available at: <https://vimeo.com/32408748> [Accessed 20 November 2019].

motivated him, it seems, was at least partly the pressing concern to establish music theory as an independent discipline in Swedish musicology (where almost all other scholars worked on historical topics and problems), and partly the vision of a coherent whole, a 'standard model' or *Universaltheorie der Musik* explaining all facets of music theory and analysis with fundamental principles that underpinned everything that could be gleaned from history, aesthetics, psycho-acoustics, and perception psychology. In a way quite peculiar to him, he was deeply ridden by inner musical problems and their solutions, a condition perhaps best illustrated by his crassly realistic view of the practical applications of his theories:

> […] it has even been the case that theorists themselves have not dared apply their theories in their practical manuals (for example Hauptmann). When I in the following again address the matter, covered by older theorists, on classification of the intervals (and, I hope furthermore also the polyphonic chords) for a reconsideration, I am not naïve enough to imagine that my studies will soon result in a practically useful harmonic system, much less that the hypotheses upon which I arrive will immediately be applicable to any extant system. I will be content if it will act as an eye-opener to those who teach the subject.[12] (Svensson, 1951, p. 87)

Given the fact that Svensson never published his most developed versions of the two theories covered here (they are found only in the manuscripts quoted above) and thus never had them submitted to review or evaluation by international authorities in the field of music theory, the theories nevertheless have played a much more important role for Swedish musicology than is widely understood. It is hoped that by revisiting them more than half a century after their conception, the present study may open up the analytical concepts of 'tension of fifths' and 'intervallic pulse' to further scrutiny by music theorists worldwide, a scrutiny that they surely deserve.

12 '[…] ja, det har t.o.m. förekommit, att teoretiker själva inte ha vågat söka tillämpa sina egna teorier i sina praktiska läroböcker (t.ex. Hauptmann). – När jag här nedan tar upp en av den hos äldre teoretiker ofta behandlade frågan om en gruppering av intervallerna (och som jag hoppas senare även de flertoniga ackorden) till ny omprövning, är jag inte nog naiv att föreställa mig, att min undersökning inom kort skall leda till ett praktiskt användbart harmonisystem, allraminst som de hypoteser jag därvid kommer fram till inte omedelbart låta sig tillämpas på något nu använt system. Jag får vara nöjd, om den kommer att ge dem som nu undervisa i ämnet en tankeställare.'

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Abstract

Sven E. Svensson (1899–1960) was a highly original music theorist in the first half of the twentieth century, at the time when musicology was being consolidated as a modern academic discipline in Sweden at Uppsala University. This study revisits two of Svensson's so-called universal theories of tonal music: 'tension of fifths' and 'intervallic pulse'. The former is rooted in the Riemannian notion of harmonic dualism and purports that linear melodic progression can be understood (and perceived) as a balance between cumulative kinetic tension in sharpwards and flatwards directions. The latter theory tries to ascertain empirically that rhythmic pulse and interval distance are indeed of one and the same substance, by explaining fractions of intervals as connected to the pulse beats of the concomitant numbers against each other on a microlevel of rhythm. While some of Svensson's premises and argumentation may certainly be criticised, other aspects of his visionary reasoning could offer serious elucidation to modern theories of tonal music. In some respects, Svensson's calculations and speculative hypotheses may in fact today be proven right in a way that was not possible within his own lifetime, due to a lack of technology.

Keywords
Sven E. Svensson; music theory; Swedish musicology; Hugo Riemann; dualism; Universaltheorie; tension of fifths; intervallic pulse.

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