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Robert Mayrhofer's Theory of Harmony

by

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ABSTRACT

This work examines the harmonic theory of the Austrian music theorist Robert Mayrhofer (1863-1935) as described in the author's first two treatises, *Psychologie des Klanges* and *Die organische Harmonielehre*. In presuming that musical listening involves the visual conceptualization of pitch as points in "tone space," Mayrhofer's harmonic theory builds upon the perception of the major third as an essential interval, the n-*Strecke*, to create a harmonic system consisting of distinct harmonic structures as expansions in tone space. These structures, which Mayrhofer calls cells, delineate various levels of expansion in tone space that allow him to characterize the boundaries of tonality. From these structural levels, Mayrhofer develops the concept of expanded tonality that in his view underlies most music composed since Bach and is especially helpful in describing the highly chromatic music of late tonality. Mayhofer thus develops a highly original and controversial theory of harmony from a single musical perception.

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Introduction

The highly chromatic music of the late 19th century presented a challenge to both of the two principal groups of harmonic theories existing in central Europe of the 19th century: scale-based theories and harmonic theories. Scale-based theories, which can trace their development to modal theory of earlier centuries view any harmonies as constructs rooted in one of the seven scale degrees of the diatonic. Any deviation from diatonic harmony is seen as an alteration of a corresponding diatonic chord, thus subsuming chromatic elements in the musical diatonic scale. Even the system of minor tonality was usually viewed as an altered form of major tonality.

In contrast, harmonic theories view harmonic species of major and minor triads as foundational entities and scales as being derived from them. Harmonic theories can be traced to the work of the French composer and theorist Jean-Philippe Rameau, who developed the concept of fundamental bass to describe the source of two principal harmonic species, triads and seventh chords, which could occur in any inversion. Rameau also formalized the terms dominant and subdominant, referring to harmonic species built a perfect fifth above and below a central tonic triad.

Harmonic dualist theories of the 19th century, as expressed in the work of Moritz Hauptmann, Artur von Oettingen, and Hugo Riemann, utilize several of Rameau's concepts to develop distinct systems of major and minor tonality. These systems employ triads consisting of root, major third, and perfect fifth, with the major and minor triads being projected in opposite directions as mirror-image duals from a common root, thus forming distinct and complementary systems of equivalent value as the basis of tonality. Using this dualism as his foundation, Hugo Riemann, among others, developed a system of functional harmony (*Funktionstheorie*) based on three primary (major or minor, depending on the tonality) triads (tonic, dominant, and subdominant) in which all other chords are seen as being related to these three functions.

Since the middle of the 19th century, both of these schools of thought began to encounter difficulties when confronted with music emanating from progressive composers. As well as introducing highly chromatic harmonic complexes and novel harmonic progressions, such music challenged the idea of well-defined major and minor tonality. The opening of Schoenberg's *Gurrelieder* illustrates both of these tendencies. As shown in Figure 1, the opening measures introduce a harmonic complex consisting of four pitch classes (C-Eß-G-Bß) which appears to function as a foundational "tonic" chord, although it is a more complex structure than a major or minor chord.

Figure 1 The opening of Schoenberg's *Gurrelieder* (1903) (mm.1–6)

Other passages of the opening illustrate a series of non-triadic harmonies that do not appear to be bound by a particular tonic centre and do not conform to many of the standard circle-of fifths progressions associated with diatonic music. Figure 2 provides an example of such a passage.

Figure 2 Schoenberg's *Gurrelieder* (1903) (mm.22–29)

The excerpt begins with emphasis of a Bß major chord, which may be considered to be embellished by such chord types as A-Cƒ-Eß-Gß (mm. 23–25). However, subsequent measures suggest other tonal centres, such as Gß (mm. 26–28). Although the excerpt resembles circle of fifth progressions that function as linked dominant- tonic progressions, the quality of the chords involved (eg. Dß-C-F-G in m. 26, Gß-Bß -Dß-Eß in m. 27 and m. 28) or frequent use of unexpected progressions involving tonally ambiguous chord types such as diminished 7^{th} chords undercuts a conventional sense of tonicization and presents a challenge to any theory that defines tonality in terms of a diatonic seven-note scale.

Difficulties with material that stretched the boundaries of tonality engaged many music theorists, including the Austrian music theorist and pedagogue Robert Mayrhofer. Mayrhofer was born in 1863 in Gmünden, Upper Austria and studied law and philosophy before becoming a private music educator in Brixen, South Tyrol, which now lies in Northern Italy (Riemann 1929, s.v "Mayrhofer, Robert"). He was an ardent supporter of the music of Richard Wagner and published several articles in the *Bayreuther Blätter*, a journal that enthusiastically promoted the Wagnerian *Weltanschauung* as well as his music. Although born in Austria, where scale-based theory maintained a particularly strong following in comparison to other German-speaking areas (Klumpenhouwer 2002, 456), Mayrhofer developed a highly original approach to music theory that sought to reform the errors of conventional music theory in general and scale-derived music theory in particular. He believed that the newer music, especially music by his favourite composer, Richard Wagner, clearly displayed the inadequacy of established music theories. As well as publishing *Von der Theorie des Schönen*, a short work on aesthetics, and several short articles advocating reform of music theory (1908b, 1911), Mayrhofer published three major music theoretic treatises: *Von der Psychologie des Klanges und die daraus hervogehende* *theroetisch-praktische Harmonielehre* in 1907 (henceforth *PdK*); *Die Organische Harmonielehre* in 1908 (henceforth *OH*); and *Der Kunstklang, 1.Band: Das Problem der Durdiatonik* in 1910 (henceforth *DKK*). All three describe a fundamentally similar harmonic system. In a nutshell, Mayrhofer argued that different pitches are conceived as points (*Tonpunkte*) existing in tonal space in the imagination of the listener, where these *Tonpunkte* are connected to each other via the concept of the *Strecke* (spans or distances).

Of all the possible *Strecken* available, the major third (which he calls the n-*Strecke*) possesses characteristics that allow it to form "cells", the basis of triadic harmony. N-*Strecken* project a symmetrical centre: for instance, the n-*Strecke*, C-E, is symmetrical (in fifth space, diatonic space and chromatic space) about D, which Mayrhofer calls the *Kernpunkt* (nuclear point) or *Zellkern* (cell centre or nucleus) of the n-*Strecke.* An n-*Strecke* may be supplemented by a *Durpunkt* ("major point") — the *Tonpunkt* G in the case of the n-*Strecke* C-E— to form a major triad or supplemented by a *Mollpunkt* ("minor point") — the *Tonpunkt* A in the case of the n-*Strecke* C-E— to create a minor triad. Conventional minor and major chords are both equally derived from the n-*Strecke*. Taken together, an n-*Strecke* and its *Dur*- and *Mollpunkte* form a symmetrical structure in fifths space around the *Kernpunkt*. The *Kernpunkt* D, for instance, generates the n-*Strecke* C-E along with its *Dur*- and *Mollpunkte* G and A, respectively, to form C-G-D-A-E.

Due to considerations of length, the thesis will examine only the first two Mayrhofer treatises (*PdK* and *OH*) in which he first formulates his harmonic system.[1] In Chapter 1, I shall

[1] The third treatise (*DKK*), which represents only the first volume in a never-completed trilogy, establishes a harmonic system that is fundamentally similar to that developed in the earlier two works. The fundamental difference between *DKK* and the earlier works lies in Mayrhofer's new rationale for constructing his harmonic system. In *DKK*, Mayrhofer denies the validity of justifying his system mainly from symmetrical principles as he attempts to do in the first two treatises and draws on biological terminology as well as the principal of tonal fusion (*Verschmelzung*) to a far greater extent. Mayrhofer viewed *DKK* as an improvement to the first two treatises, but was unable to complete the final two volumes he had envisaged.

provide background to Mayrhofer's tonal system by exploring the psychological assumptions and theories underlying his harmonic system as found in the first two of his treatises. Both treatises stem from the same conceptualization of a symmetrical projection of *Strecken* in tonal space (*Tonraum). OH* can be seen as the completion of a theoretical system begun in *PdK*, a completion which was motivated at least in part by critical reception of Mayrhofer (Wetzel 1908, 170). Chapters 2–4 cover the concepts of *Strecke* and the concept of cell, the basic unit of tonality derived from the *Strecke.* Chapters 5–6 explore ways in which cells can form higher-level constructs conceived as expansions from cells. Chapters 7–8 introduce Mayrhofer's usage of the term cadence and its application to the cell structures introduced in the preceding chapters as well as outlining Mayrhofer's conceptualization of major and minor tonality. Chapters 9–11 explore the outer limits of tonality with analytical examples from music of the 19th century. To conclude, Chapter 12 examines the reception of Mayrhofer's works during his lifetime.

Although Mayrhofer's influence on music theory disappeared altogether after his death, Mayrhofer nevertheless managed to construct a harmonic system derived from the concept of the the n-*Strecke,* thereby attracting the attention of several music theorists, including Hugo Riemann and Ernst Kurth, with its originality and logical consistency. The ability of Mayrhofer's system to provide a fresh approach to the analysis of complex chromatic music addressed a crucial need in music theory at the turn of the century, as existing theories struggled to come to terms with music that stretched the boundaries of tonality.

CHAPTER 1

Musical Perception and *Psychologie des Klanges*

In his first treatise, *Psychologie des Klanges* (*PdK*), Mayrhofer provides a theory of musical perception, a process he considers essential for any sound harmonic theory. Mayrhofer asserts that certain psychological laws[2] operate in the mind, which interprets a succession of individual tones (*Klänge*) as music (*PdK*, 7).[3] These laws of musical perception are not simply based on the actual sound produced, since the listener can recognize a combination of *Klänge* as music even when the frequency ratios of the musical intervals deviate from their pure forms, represented as whole-number ratios (7). For example, a listener recognizes pitches forming a perfect fifth as such if the interval is a tempered form of the ratio of 3:2. Based on this evidence, Mayrhofer argues the laws of musical perception differ from the laws of acoustics (7).

Furthermore, Mayrhofer claims that conventional musical theories of chord classification and harmonic progressions do not satisfactorily describe the essence of musical apprehension (*Auffassung*) (8). All previous music theories err in equating chord progression with musical apprehension, as a well-trained ear is capable of comprehending music without recourse to theoretical language. To Mayrhofer, a description of chord progression represents an activity carried out by the intellect after musical apprehension has already taken place (8).[4] He thus sees

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[2] As we shall see later, the psychological laws described by Mayrhofer refer to the perception of the relationship of tones as distances in tone-space.

[3] The German word *Klang* (plural=*Klänge*) may refer to an individual tone or may be used to refer to several such tones in combination and be translated as "sonority" or even "chord". For example, the word *Dreiklang* denotes a triad.

[4] Mayrhofer argues that musical apprehension occurs as a perceptual process that occurs almost unconsciously within the listener (*OH*, 4). As discussed later in this chapter, musical apprehension has two components: aesthetic (natural) apprehension and absolute (spatial) apprehension.

musical understanding in the realm of *Klangpsychologie,* the perception of acoustic sensations, a process which occurs before any conscious theorizing and classification ever takes place.[5]

Mayrhofer's usage of the term psychology reflects one of the most passionate debates among music theorists of the later 19th and early 20th century, especially in German-speaking lands, concerning the question of how exactly comprehension takes place. In his *Die Lehre von den Tonempfindungen* (1863), Hermann von Helmholtz provides a detailed study of acoustical and physiological descriptions of musical phenomena. Such interests coincided with the development of the new field of experimental psychology, which extensively explored the interrelationship between sense stimulation and perception. Other music theorists, including Moritz Hauptmann, Carl Stumpf, and Hugo Riemann, considered Helmholtz's account to be unsatisfactory in addressing the musical and "subjective" aspects of sound perception.

In a letter published in the *Allgemeine Musikalische Zeitung*, Hauptmann acknowledges Helmholtz's description of physiological processes in elucidating the nature of consonance (*Wohlklang*), but regards such elucidations as irrelevant in providing insights into the nature of musical understanding, a process that transcends the physiological response to sound (1863, 670). [6] To Hauptmann, any theory of music must be based on insights into musical understanding as an "internal, spiritual perception of tones" that combines and rationalizes the relationship between musical components (tones, chords, intervals etc.) to provide musical context rather than on merely providing the acoustic and physiological basis of these phenomena as foundational principles (671).

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[5] As discussed later, Mayrhofer believes that musical meaning develops at the level of perception, where the relationships between individual tones are perceived as distances in tone-space. Since not all acoustic signals result in the perception of distances between distinct individual sounds, the question of whether or not the acoustic signals will be interpreted as "making musical sense" is determined by whether the individual sounds correspond to certain "essential" intervals (see Chapter 2 and subsequent chapters for an account of Mayrhofer's concept of *Strecke*).

[6] Hauptmann writes" although a significant protion of Helmholtz's book contains an explanation of the tonal system of music……., I cannot find anything in all that which he presents as an outstanding physiologist which contains anything enlightening for tone comprehension (*Tonverständnis)*". (1863, 670)

The role of psychological processes involved the transformation of sensations to perceptions that shape musical comprehension became a widely-discussed issue among theorists of the late 19th century, who sought to address the issues not covered by Helmholtz. The differences between Stumpf and Riemann to Helmholtz as well as to each other concerning psychological ideas emerged clearly in their debate concerning the nature of consonance and dissonance. For Stumpf, the distinction between consonance and dissonance could be made by discovering laws of perception as essentially automatically-occurring consequences of sensations. Stumpf's theory of tonal fusion (*Tonverschmelzung*) suggests that perception of consonance and dissonance depends on the degree to which two tones are perceived as a single tone and not on the acoustic properties of the sound or their direct physiological consequences, which Helmholtz regarded as foundational to his theory (Green and Butler, 264).

Riemann also regarded psychological processes to play a role in musical perception. In contrast to Stumpf, Riemann believed *a priori* conceptions of major and minor triads to constitute the foundational consonant species of music. Riemann (1914) ultimately developed the concept of *Tonvorstellung* (tone representation), which attributed the ability to make distinctions between consonance and dissonance to a conscious and active mental process that compares a given musical sonority to the constituents of major/ minor triads as tonic, dominant, or subdominants of a particular key to establish its status as a consonant or dissonant species. In contrast to both Stumpf and Helmholtz, Riemann's concept of consonance depends on the musical context rather than isolated tonal phenomena.

Mayrhofer joins the debate concerning musical perception by offering his description of the processes that take place during the apprehension (*Auffassung*) of music. The matter is important to him, because he considers music theory to be equivalent to the "psychology of tonal comprehension and formation" (*PdK*, 14). In his view, stimulation of the sensory apparatus leads to sensations, which then allow connections between discrete musical content to be perceived according to inner psychological laws (12), a process carried out solely within imagination of the listener (rather than by a physiological response to the musical content).[7]

Mayrhofer regards the increase in musical awareness in the mind as a process of elaboration or "growth" from a single musical phenomenon, the *Naturklang* (sound of nature), which consists of a complex sonority comprised of a fundamental tone and its overtones, and therefore considers this inner "spiritual process" (*seelischer Vorgang*) to be an"organic process" (12). As we shall see later, this "organic process" involves the apprehension of the relationship of tones as successive expansions in a conceptual tone-space from the *Naturklang*. Since Mayrhofer believes that the inner psychological laws governing musical perception at the heart of this organic process exist solely within the imagination, he wishes to make the act of sensing/perceiving (*Empfinden*) of the listener the object of his studies (12).[8] To elucidate the act of *Empfinden*, Mayrhofer spefically aims to study the behaviour of the soul in the process of intonating (*Intonieren*) and absorbing (*Aufnehmen*) of tonal phenomena, which control the formation of intuitions (*Anschauungen*), and wishes to carry out "*klangpsychische Experimente*" ("tone-psychological experiments") to learn more about these inner psychological laws (12).[9]

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[7] The inner psychological laws described by Mayrhofer refer to the processes governing musical perception that Mayrhofer considers essential in determining musical comprehension. As discussed later in this chapter, tonal phenomena are apprehended in two different ways: as aesthetic (natural) apprehension and absolute (spatial) apprehension.

[8] At first glance, Mayrhofer's aim to study the process of *Empfinden* as the object of his studies echoes Helmholtz's *Lehre von den Tonempfindungen*, in which Helmholtz presents an elaborate examination of acoustic and physiological phenomena. However, Mayrhofer's treatises do not share this approach and emphasize the "subjective" aspects of psychological responses to music. Mayrhofer's use of *Empfinden* in this passage acknowledges that psychological musical processes arise from sensations but, ultimately, he aims to study musical perceptions through his *klangpsychische Experimente* rather than sensations *per se*.

[9] Although Mayrhofer states the aim to carry out *klangpsychische Experimente* as a principal aim of *PdK*, neither *PdK* nor *OH* contain any detailed descriptions of actual experiments but contain instead theoretical assertions based observations of musical introspection. For example, Mayrhofer critiques the chord classification system of existing harmonic theories, according to which the chords containing A2-C3-E3 and A2-E3-C4 are considered to be more

According to Mayrhofer, the transformation of stimulations of the senses to become "psychological acts" occurs through two kinds of activities (*Tätigkeiten*) (17–18).[10] The first of these activities, which is associated with aesthetic apprehension, grasps the many kinds of acoustic signals that may be part of the sensation as a whole. Although certain commonalities exist between individuals, the process includes emotional responses and therefore differs significantly among them (17). This activity makes loose connections between the various sounds that are heard, resulting in general and non-specific perceptions of the music heard, thereby allowing the listener to distinguish one kind of sound from another. For example, a major triad will be perceived as being different from a minor triad (17).

The second kind of psychological activity, which is associated with absolute apprehension, isolates specific sensations and discerns similarities between them (18).[11] This activity involves a breakdown (analysis) and synthesis of sensations, thus creating a concrete

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closely related to each other (as A minor triads in root position) than to C3-E3-A3, a first-inversion triad built on A (*PdK*, 49). On the basis of his theory of essential *Strecken*, which will be discussed in Chapter 2, Mayrhofer claims that C3-E3-A3 is actually more closely related to A2-C3-E3 than A2-E3-C4, as the "essential" major third found in the two former sonorities is identical (C3-E3), whereas the third sonority an inversion (E3-C4) of this interval. Mayrhofer claims that any listener will be able to perceive the major third as a characteristic and essential interval and uses claims such as this to substantiate his theory. The clearest example of a *klangpsychisches Experiment* can be found not in *OH* or *PdK*, but rather in Mayrhofer's article *Eine Frage an das Gehör* (1908b, 290–295). In this article, Mayrhofer attempts to convince the reader of the concept of expanded tonality, according to which tonality can be defined by collections of pitch-classes greater than the seven pitch-classes of a diatonic scale that form conventional major tonality. He presents the listener with a series of harmonic progressions lacking in the final chord and asks the reader to complete the progression with a chord that could serve as a suitable conclusion. He claims that each of these (cadential) progressions can be satisfactorily concluded by a harmonic sonority more complex than a major or minor triad that is usually employed to achieve tonal closure. Mayrhofer contends that trained listeners should be able to obtain the same "correct" answer and believes he is thus able to demonstrate the validity of his concept of expanded tonality (Mayrhofer's concept of expanded tonality will be discussed in Chapters 9–11).

[10] The concept of "act psychology" whereby mental states are described by studying psychological processes first appears in the writings of Franz Brentano, a pioneer in the field of psychology. The music-psychologist Carl Stumpf utilized Brentano's concept of "act psychology" in his own work *Tonpsychologie*, in which he identified several ways in which psychological acts influence the perception of tones (Kim 2003, 112), including the realization of phenomena and their relations, the putting together of phenomena to form complex wholes, formation of concept conception and judgment emotions, desire and will (Stumpf 1906, 4–5). Stumpf's concept of tonal fusion can be seen a manifestation of a psychological "function" which is equivalent with Brentano's concept of psychological acts (Kim 2003, 112).

[11] Mayrhofer does not provide a name for either the "Analytical Process" or the "Subjective Process" described above, but describes two activities (*Tätigkeiten)*, through which sensations are transformed into "psychological acts" leading to two kinds of apprehension (aesthetic and absolute apprehension) (*PdK*, 18).

intuition (*Anschauung*) of a particular musical phenomenon to form an “absolute” apprehension of music in the imagination of the listener (21–22). Together, these two activities lead to a transformation of physiological signals into psychological elements.

As a result of these two psychological activities, which occur simultaneously and underlie all musical perceptions, two kinds of *Auffassungen* (apprehensions) thus take place in the “soul” of the listener: aesthetic (natural) apprehension and absolute (spatial) apprehension.[12] The psychological acts involved in both kinds of musical apprehension constitute an organic, unified process, in which absolute apprehension is never in disagreement with the aesthetic apprehension, but rather complements aesthetic apprehension to form a unified musical comprehension (*OH*, 199). Thus, absolute apprehension constitutes a representation (*Vorstellung)* that corresponds to the perceptions received aesthetically.

Aesthetic apprehension, which Mayrhofer equates with “formal psychology” and describes as “naturalistic” in *OH*, maintains the subjective, emotional response of the listener to the overall impressions made by the sound. According to this type of apprehension, all subtle qualitative differences that exist in the initial sound continue to be understood as such (*PdK*, 24).

Absolute apprehension represents the second type of comprehension (19–23). According to Mayrhofer, relations between tones are *perceived* as distances, thus creating an expansion of tones in a conceptual tone space (20).[13] Although absolute apprehension describes a perceptual phenomenon, Mayrhofer considers the precise way in which these distance-perceptions can be

[12] *Auffassung* can refer to a particular opinion, view or interpretation of phenomena or to the processes (comprehension, conceptualization, understanding) of an object. In translating the word *Auffassung*, I will use the word “apprehension”. Elsewhere in the treatise, Mayrhofer uses the word *Begriff*, which can also be translated as “concept” to refer to an intellectual process of abstraction that is formed after psychological processes and intuitive perception has already taken place. When using the word *Auffassung*, Mayrhofer is clearly not describing such an abstract intellectual process, but refers to intuitive understanding related to perception. I therefore prefer to use the word apprehension for *Auffassung*, which does not explicitly suggest a process of abstract intellectualization as conceptualization or comprehension, and reserve comprehension and conceptualization for translating *Begriff.*

[13] Mayrhofer repeatedly stresses the role of intuition in his description of spatial *Vorstellungen*, which not only appear to be “understood” as distances between pitches, but to be *perceived* as such (*PdK*, 12, 20-22; *OH*, 201).

arranged (and described visually) by the listener within tone space (*Tonraum*) to be an intellectual abstraction.[14] Mayrhofer considers this absolute apprehension to be absolute because it ignores the specific aspects of form in which the musical content is presented and remains separate from the "subjective" elements that play a role in aesthetic apprehension (21). In *OH*, Mayrhofer replaces the term absolute apprehension with spatially intuitive apprehension (*raumanschauende Auffassung*) which deals with extensions in tone space (*tonräumliche Ausdehnungsanschauungen*) (*OH*, 36).[15]

In both *OH* and *PdK*, this kind of perception involves the recognition of sound categories as being equivalent. Individual pitches related by octave, for example, are considered to belong to the same category, as are different inversions of the same chord (*PdK,* 29; *OH,* 8).[16] Mayrhofer's notion of octave equivalence approximates a concept recognized by many theorists, including Mayrhofer's contemporaries Stumpf (*Erweiterungsgesetz*) (1898, 81) and Riemann (*Tonbegriff*) (1877, 10). Octave equivalence, an important category that forms as a result of spatial apprehension, leads Mayrhofer to propose that all pitches can be viewed as joining together in single points in space, or *Tonpunkte* (*OH,* 165), between which distances are perceived to exist.

Although this process creates the idea of distance between pitch-classes (*Tonpunkte*), Mayrhofer claims that the process is not one of intellectual abstraction but occurs as an intuition

[14] As discussed later in Chapter 2, Mayrhofer determines that a particular arrangement of pitch-classes (*Tonpunkte*) in tone-space (as a series of adjusted fifths) is particularly useful in mapping tone-space.

[15] Mayrhofer also uses the term "kunstmäßig" (artful) to describe spatial apprehension, which incorporates analytical elements such as the recognition of categories of pitches (*Tonpunkte*), as opposed to " natural" apprehension (*OH,* 201).

[16] Mayrhofer regards the analytical aspects of absolute apprehension, such as recognition of categories of *Tonpunkte* due to octave equivalence to occur at the level of perception and to be distinct from the intellectual processes that Mayrhofer claims occur after perception to form concepts (*Begriffe*) such as chords or scales.

(*Anschauung*) (*PdK*, 22). To Mayrhofer, the representations (*Vorstellungen*)[17] of *Tonpunkte* in tone space thus occur at the level of intuitive psychological processes, which are also at work in forming the aesthetic apprehension of sound.[18]Aesthetic apprehension and absolute apprehension are at work in the perception of every kind of musical sound: for example, two chords (C3–E3–G3) and (G3–C4–E4) will be perceived to be equivalent in the absolute sense, but will be perceived as different in the aesthetic sense (*OH*, 199).

All harmonic content can be seen as resulting from expansions in tone space as part of an "organic" process occurring solely in the imagination of the listener, which provides an internal

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[17] In *OH*, especially, Mayrhofer frequently uses the term *Vorstellung* to describe the spatial constructs which emerge in tonal space. The term *Vorstellung* can be very difficult to translate. In terms of German idealist philosophy (especially Kant), *Vorstellung* can refer to the mental states and thoughts that emerge as a product of mental activity of conceiving of an idea. In this sense, *Vorstellung* is most frequently translated as "representation", although words such as "conceptualization" would also convey this meaning. *Vorstellung* can also be translated in a more direct and visual sense (for example, the verb *vorstellen* can refer to an attempt to conceive a visualization of something else). In this sense, the word *Vorstellung* can be translated as "presentation" or even "image". Yet another translation of *Vorstellung* likens it with the German word *Phantasie*, and translates it as 'imagination". Such a translation sees *Vorstellungen* as a more creative activity than the rational or concrete visual processes suggested by the earlier translations.
I believe that Mayrhofer's use of the term is multi-faceted. Often, Mayrhofer presents the word *Vorstellung* in conjunction with very specific visual depictions of *Strecken* (spans) between pitch-classes (*Tonpunkte*). In this sense, the most concrete translation of *Vorstellung* as "image" seems appropriate. This word does the most justice to the automatic quality of *Vorstellungen* as emerging through unconscious psychological acts. However, Mayrhofer frequently describes his *Vorstellungen* as complements to the "aesthetic" apprehension which arises from the perception of sensations as a whole. In this sense, the spatial *Vorstellungen* can be seen as "representations" of the aesthetic impressions left by sensations. Depending on the context, I will translate *Vorstellung* in different ways throughout the text supplying the German original in brackets or simply write *Vorstellung* if a situation should arise in which translation of *Vorstellung* appears inadequate (Max 1958 s.v. *Vorstellung*).

[18] Mayrhofer's description of psychological processes that lead to musical understanding anticipates the writings of theorists such as Riemann and Ernst Kurth, who also turned to psychological explanations (explanations which ascribe musical meaning to mental processes rather than acoustic properties of sound or the immediate physiological response to the sound) of musical comprehension in the early 20th century. Interestingly, Mayrhofer's recognition of two types of musical apprehension closely resembles ideas presented by the Austrian comparative musicologist Richard Wallaschek ten years earlier (Wallaschek 1894). Like Mayrhofer, Wallaschek also distinguishes between two modes of musical perception: *Tonvorstellung* (tone representation) and *Musikvorstellung* (music representation). Tone representation describes the processing of individual musical elements such as pitch, intervals, or chords. *Musikvorstellung* describes higher-order musical structures such as phrases or rhythm. Wallaschek's concept of *Tonvorstellungen* closely resembles Mayrhofer's aesthetic apprehension, which considers the effect of individual pitches and chords as they are heard (Graziano 2004, 18). Although Mayrhofer's concept of spatial apprehension is not identical to Wallaschek's *Musikvorstellungen*, which perceives groups of sounds as whole *Gestalt* structures, both concepts (Mayrhofer's spatial apprehension and Wallaschek's *Musikvorstellungen*) describe a kind of musical perception that extracts musical meaning from the actual sound and thus represents an artful rather than a natural comprehension of music.

justification (*innerliche Begründung)* of such tone values (6). Mayrhofer believes that perception of *Tonpunkte* as expansions in tonal space originating from a single tone phenomenon, the *Naturklang* (sound of nature) can be likened to the growth of an organism (*OH*, 186). In *OH* in particular, Mayrhofer aims to describe the organic connections between a single sound and its furthest expansions in tonal space to the limits of tonality.

As absolute apprehension and aesthetic apprehension combine to define musical perception, musical meaning is not solely derived from an abstract spatial concept such as the distances between *Tonpunkte* but depends on the particular distribution of individual *Tonpunkte* relative to each other. To Mayrhofer, such a qualitative factor should be reflected in any theory of harmony, which should therefore not rely only on the classification of chord types based on intervals (*PdK*, 6). Chords that share a particular interval, such as, say, a minor 7th may have very different characteristics depending on the other notes present and the particular way in the intervals are distributed (*PdK*, 19). A major-minor seventh chord is very different from a "minor-minor seventh chord" and classification systems that regard them as similar simply because both contain a minor seventh are mistaken.[19] Rather than viewing chords as constituting formative units of harmony themselves, Mayrhofer seeks the formative units of harmonic meaning in the individual components that constitute chords, thus leading him to his core concept of *Strecken*, which considers the interrelationship of two *Tonpunkte*.

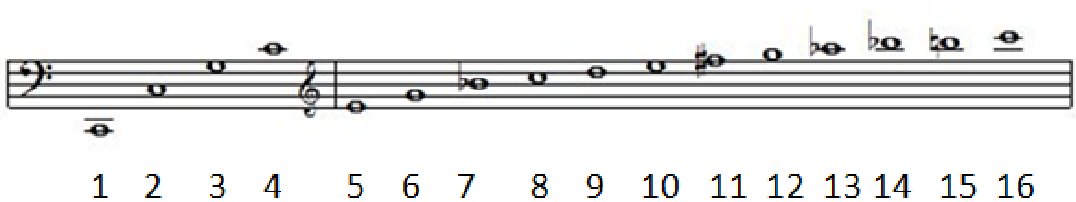
[19] For example, scale-based classification systems consider chords to be related to each other if built on the same scale degree, even if that scale degree has been raised or lowered. Mayrhofer himself comments that "conventional" harmonic theories erroneously regard harmonic entities such C-E-G-B, Cƒ-Eß-G-Bß, Cƒ-E-G-Bß, C-E-Gƒ-B, etc. to be related to each other in that they are all considered to be seventh chords derived from a common root, C (*PdK*, 139).

Chapter 2

The Concept of *Strecke*

Mayrhofer, like many theorists before and since, points out that even the simplest musical sound that can be represented by a single note contains more than one actual *Tonpunkt*, as suggested by the existence of the phenomenon of the harmonic series (overtones). A single tone denoted by its fundamental is actually a composite of tones with frequencies that are multiples of this fundamental tone. Figure 3 provides the first sixteen partials of harmonic series for C2.

Figure 3 Harmonic Series of C2



Mayrhofer's psychological process of breaking complex sounds into their constituents allows the spatial (absolute) apprehension to comprehend the single tone as a complex of partials (*PdK*, 28). He understands the overtone series as a spatial expansion of the single tone. Mayrhofer refers to overtones as *Automatik*, since overtones are necessarily present within a single tone (*OH*, 127). In Mayrhofer's view, music aims to reinforce the components of the *Automatik*, which, although only weakly present in a single tone, provide the source of all *Tonpunkte* Mayrhofer considers artistically useful (*OH*, 193).

To describe the spatial expansion, present in both a "single" tone and between *Tonpunkte*, Mayrhofer introduces the concept of *Strecke*. The term *Strecke* possesses several closely-related definitions in German. Its mathematical usage is the line between to two points in a Cartesian plane (Wahrig 2000, s.v. "*Strecke*"). *Strecke* can also refer to the particular path among a multitude of possible ways in which one can travel from one place to another, along the lines of the English word "route". The latter sense implies that the actual path taken from point A to point B can vary and that different routes can all be classified according to the outer limits which define them. Such a definition appropriately reflects Mayrhofer's use of *Tonpunkte* as representing pitch-classes, so that a *Strecke* may be understood as an unordered dyad. In this sense, {C, E} may represent C2–E2, E2–C3, C3–E2, and so on.[20]

Throughout his works, Mayrhofer prefers to use the term *Strecke* rather than the conventional concept of the intervals because the concept of *Strecke* subsumes the categories of octave equivalence and interval interversion, thereby more adequately describing the space perceived between the two *Tonpunkte.* Due to their position on the boundary of the *Strecke*, the two *Tonpunkte* involved in the *Strecke* act as *Randpunkte* ("border points" or "edge points") to the linear expansion that forms between them (*OH*,166). The *Randpunkte* of the *Strecke* may enclose other *Tonpunkte* found between them that are not present as actual sounds but are nevertheless understood to be contained within the *Strecke* (*PdK*, 39). This idea of enclosing *Tonpunkte* between the *Randpunkte* of the *Strecke* constitutes a central tenet of Mayrhofer's harmonic theory.

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[20] Mayrhofer does distinguish the n-*Strecke* (major third) from its inversion (minor sixth or ne-*Strecke*), but this distinction is aesthetic sense rather than structural. In terms of spatial *Auffassung*, the n-*Strecke* and the ne-*Strecke* are identical. As Mayrhofer develops his classification system of *Strecken* largelyon the basis of spatial apprehension, he frequently treats ne-*Strecken* as being identical to n-*Strecken* and makes no distinction between them.

In tone space, all combinations of *Tonpunkte* are understood as *Strecken*, which constitute the basic units of expansion. Such expansion results from the presence of multiple *Tonpunkte* irrespective of their musical presentation. Therefore, *Strecken* exist independently of any rhythmic elements, which Mayrhofer considers entirely insignificant with regard to his harmonic theory (*DKK*, 3).

In *PdK*, Mayrhofer examines the different kinds of *Strecken* that can be derived from the *Automatik* in an attempt to discern which *Strecken* should be considered most important or "essential." Examining the first sixteen partials in the harmonic theories, Mayrhofer isolates four relationships as special: the interval between the first and third partials (C2–G3) in Figure 3; the interval between the first and fifth partials (C2–E4); the interval between the first and ninth partials (C2–D5) and the interval between the first and 15th partials (C2–B5). Mayrhofer claims that these four partials have been shown by physiologists to enhance the sensual pleasure ("*sinnliche Wohligkeit*") of the fundamental to the greatest extent (*PdK*, 33).[21] Conversely, Mayrhofer considers the remaining partials— the seventh, 11th, 13th, and 15th — to form musically unusable relationships with the first partial (*PdK*, 35).[22] Of these four special intervals, the first two— the interval between the first and third partials (C2–G3) and the interval between the first and fifth partials (C2–E4), which also happen to coincide with the intervals of a major

[21] "Die Physiologen haben herausgefunden, daβ die sinnliche Wohligkeit des Haupttones oder Einzeltones, bzw. des gesamten Klingens im Naturakkord dann am gröβten ist, wenn bei der Tonerregung die….. den Nerv noch erzittern machenden Obertöne 1, 2, 3, 4 …. verhältnismäβig stark- jedenfalls stärker als noch weiter abseits gelegene Obertöne- in Mitschwingung kommen." (*PdK,* 33)
(Mayrhofer refers to the 3rd, 5th, 9th and 15th partials as *Obertöne* 1, 2, 3, and 4, respectively)

[22] The rationale for Mayrhofer's rejection of the 7th, 11th, and 13th partials involves concepts discussed later. Essentially, Mayrhofer claims that the value of these tones (*Tonwert*) as distant partials of the fundamental represent too great a deviation from Mayrhofer's preferred conceptualization of tonal space, in which he chooses to arrange *Tonpunkte* as a series of tempered (stylized) fifths (Qq) (*PdK*, 83) (Although Mayrhofer regards the major thirds as the essential *Strecke* rather than the perfect fifth, he considers this arrangement of *Tonpunkte* to have the greatest practical utility in describing tone-space). For example, the pitch-class approximated by the 7th partial (pitch class Fƒ) is too far removed from the pitch class Fƒ as defined by Mayrhofer's tone-space, according to which, the *Tonpunkt* corresponding to pitch class Fƒ is six Qq units away from pitch class C. Mayrhofer's conceptualization of tonal space will be discussed in Chapter 4.

triad, — exert the most prominent effect on the listener and deserve consideration as constituting some kind of essential musical relationship (*PdK*, 33).[23]

Mayrhofer argues that the major third, derived from the relationship between the first and fifth partials, far outclasses the importance of the perfect fifth as a foundational *Strecke.* Mayrhofer gives several reasons. In *PdK*, he distinguishes between the major third as a "more stimulating, characteristic, exciting, visible, more penetrating and more beautiful" interval as opposed to the "dull, feeble, hollow, though easily comprehensible impression of the so-called fifth" (34–35).[24] These factors allow the major third to be the most easily-grasped interval, making it by far the more "powerful element" of the two and the prototypical consonance (*Urkonsonanz*) (*PdK*, 38).

In *OH*, Mayrhofer points out that the perfect fifth does not constitute a genuine *Strecke.* Instead, the perfect fifth forms a "transitional *Strecke*" (*Übergangsstrecke*) because its associated partial cannot be considered completely independently of the fundamental. He has in mind here the music-psychologist Carl Stumpf's theory of tonal fusion (*Verschmelzungstheorie*), according to which, intervals may be graded according to their ability to fuse (*verschmelzen*) their constituent pitches into a single sound in the perception of the listener (*OH*, 171).[25] Pitches that form a perfect fifth fuse to a greater extent than pitches that form a major third (The octave and the prime have higher degrees of fusion than both the perfect fifth and the major third).

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[23] Mayrhofer does not consider the major second (which can be obtained from the fundamental and its 9th partial) or the minor second (which can be obtained from the fundamental and its 15th partial) to be as significant to the overall effect on the listener. Through his preference for the major third and major fifth (rather than the major and minor seconds) Mayrhofer ensures that his candidates for an essential musical relationship to correspond to the components of a major triad.

[24] "fadere, dürftige, hohle, wenngleich leichtfaβliche Eindruck der sogenannten Quint oder des ersten Obertones" (*PdK*, 35).

[25] See Stumpf's most well-known work *Tonpsychologie* for a description of tonal fusion (Stumpf 1883) and (Stumpf 1890). See Stumpf (1898) for a discussion of fusion and its relevance to consonance and dissonance.

Mayrhofer also points out that the perfect fifth is structurally less important than the major third because of its inability to define the boundaries of a key (as defined by the subdominant and dominant triads enclosing a central tonic triad) containing the seven notes of the diatonic scale (*OH*, 31). He considers the diatonic major key to be bounded by three major thirds (e.g. F-A, C-E, G-B), whereas the three perfect fifths (C-G, G-D, F-C) would not similarly define this species. The dyad C-G could belong to a eight keys: C major,C minor, G major, G minor, F major, F minor, G major, G minor, Bß (major), Aß (major). Major thirds on the other hand are less ambiguous tonally (*OH*, 31). The dyad F-A, for instance, belongs to six keys: F major, D minor, C major, Bß major, G (natural) minor, and A minor.

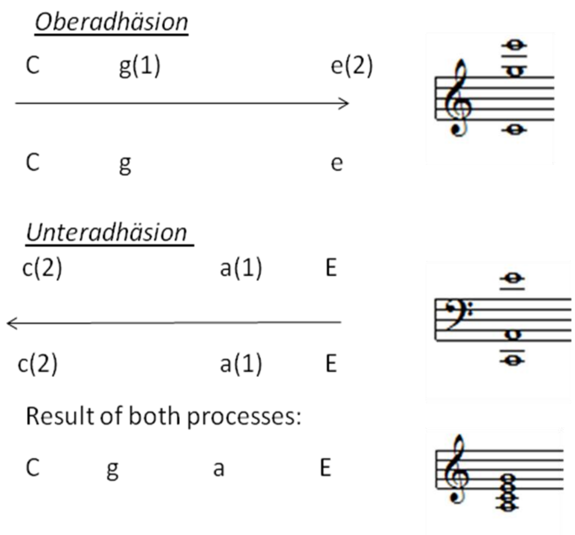
Mayrhofer also examines the relationship between a major key and its relative natural or pure minor key, which he considers to be the closest relationship possible between two different keys, as they share identical *Tonpunkte* (*OH*, 31).[26] He views the major third as the connective link that joins the two keys together and regards the major third as being particularly prominent when a major triad and its relative minor triad are sounded (*OH*, 7). In an attempt to convince the reader of the essential nature of the major third, Mayrhofer thus combines a number of disparate arguments, which may not seem especially conclusive individually. For example, Mayrhofer's perceptual (and subjective) arguments concerning the hollowness of the perfect fifth as opposed to the major third or the usage of Stumpf's theory of fusion to denounce the ability of the perfect fifth to function as an independent *Strecke*, are completely unrelated to abstract arguments in which the perfect fifth is (marginally) less effective in defining the spatial boundaries of a particular key. Nevertheless, Mayrhofer considers these arguments as a whole to constitute a compelling rationale for the primacy of the major third.

[26] In fact, Mayrhofer views the major key and its natural minor key to be so closely related that they in fact constitute one single key, with major and minor constituting aesthetic variants. Mayrhofer's description of major and minor will be discussed later in Chapter 7.

After having identified the major third as the fundamental entity that relates a major triad to its relative minor triad, Mayrhofer explains how these triads relate to the essential n-*Strecke*. For this purpose, he turns again to the harmonic series and describes how the series adds the *Tonpunkte* required for the formation of major and minor triads from a common n-*Strecke*. In *PdK*, Mayrhofer describes this process of *Strecken*-formation, which adds either of these *Tonpunkte* to the *n-Strecke* to create a total of three non-equivalent *Strecken*, as *Adhäsion* (38).

As shown in Figure 4, Mayrhofer considers two types of *Adhäsion* to be relevant to the formation of the major and minor triads: *Oberadhäsion* and *Unteradhäsion.* The top portion of Figure 4 depicts *Oberadhäsion* (upper adhesion). We have seen that an n-*Strecke* exists between two *Tonpunkte* which form the interval of a major third (e.g. C and E). The harmonic series of a given fundamental generates pitches that represent the two *Tonpunkte* required for such an n-*Strecke:* The second (non-octave) overtone (E6 in Figure 4) of a given fundamental (C4 in Figure 4) represents a *Tonpunkt* (E) that forms an n-*Strecke* with the *Tonpunkt* (C) represented by the fundamental (C4).

Figure 4: Mayrhofer's Concept of *Adhäsion*



As discussed earlier in this chapter, Mayrhofer believes that additional *Tonpunkte* can be conceived to exist in between the two *Randpunkte* (border points) of an n-*Strecke*. The two border points of a given n-*Strecke* may suggest the conceptual presence of additional *Tonpunkte* within the limits demarcated by the n-*Strecke*. With the aid of the harmonic series, Mayrhofer concludes that the first non-octave overtone (G5 for the C4 fundamental in Figure 4) exists conceptually between the fundamental (C4) and the second non-octave overtone (E6) in the relevant series and therefore between the two border points of the n-*Strecke* (36). The n-*Strecke* (C-E) thus receives the additional *Tonpunkt* G, which yields a total of three distinct *Strecken*: C-E (n-*Strecke*), C-G (*Quint-Quart*), G-E, which is equivalent in a spatial sense to E-G (an example of an *aza-Strecke*).[27] Mayrhofer refers to this union of unequal *Strecken* using the harmonic series as *Oberadhäsion*, a process which yields the three *Tonpunkte* that constitute the major triad.

[27] Chapter 3 explains Mayrhofer's system of nomenclature for *Strecken.*

In addition to *Oberadhäsion*, Mayrhofer describes a second type of *Adhäsion* known as *Unteradhäsion* (under-adhesion), which applies to the inversion of the n-*Strecke* (E-C), considered by Mayrhofer to be equivalent to the n-*Strecke* C-E according to absolute apprehension. To describe *Unteradhäsion*, Mayrhofer makes use of the "undertone" series, a series of tones completely symmetrical to the overtone series but generated in a downward direction.[28] Mayrhofer takes the upper boundary point of the n-*Strecke*, represented by E4 in Figure 4, as his fundamental to which he applies the undertone series, thereby generating C2 as the second (non-octave) undertone. In a manner similar to *Oberadhäsion*, Mayrhofer considers the first non-octave tone in the undertone A2 to be included within the limits demarcated by C2 and E4, thereby adding *Tonpunkt* A to the n-*Strecke*. This process constitutes *Unteradhäsion* and generates the *Strecken* E-C (= C-E, the n-*Strecke*), C-A (= A-C, the *aza-Strecke*) and E-A (*Quint-Quart*) from E.

Mayrhofer acknowledges that this series of undertones does not exist in reality and that A does not exist in the original C-*Klang* from which he derives the overtone series, but nevertheless claims that the listener has been able to grasp A as a *Tonpunkt* generated by *Unteradhäsion* (38–39). The undertone series can be conceived (*vorgestellt*) because of its symmetrical relationship to the overtone series, even if the actual sound of such *Tonpunkte* must be provided by a

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[28] The first notion of an undertone series was developed by Hermann Helmholtz, who used the term to describe the series of fundamentals to which a particular pitch may belong (1853). This series generates an inversion of the intervals found in the overtone series and was incorporated by von Oettingen in his concepts of tonicity and phonicity (1866). Helmholtz's undertones series corresponds directly to the intervallic series suggested by Mayrhofer's discussion of undertones.
Among the 19th century theorists who incorporated undertones into their works, only Hugo Riemann advocated their existence in reality. For a considerable period of time, Riemann sought to justify the existence of undertones and rationalized the inability for such a series to be audible through a process of interfering sound waves through which the undertones effectively cancel each other out, thereby preventing them from being detectable by ear (Riemann 1891, 78–80). He used the principle of undertones initially as an acoustic basis for his theory of harmonic dualism before increasingly relying on psychological explanations in his theories later in his career.

"different source" (39).[29] Thus, Mayrhofer does not see the non-existence of undertones as a threat to his ability to derive the *Tonpunkt* A and the minor triad through his process of *Adhäsion.*[30]

To Mayrhofer, the two *Tonpunkt*e that generate major and minor triad are included as values that lie within the n-*Strecke*. The addition of G to the n-*Strecke* forms a C-major triad. In this context, Mayrhofer calls G the *Durpunkt* (*OH,* 10). The addition of A to the *n-Strecke* forms an A minor triad. In this context, Mayrhofer calls A the *Mollpunkt* (10). Yet this is not simply a way for Mayrhofer to generate major and minor triads. Both triads are considered to be variants of the fundamental n-*Strecke* C-E. The *Durpunkt* and *Mollpunkt* are *Tonpunkte* within the outer boundaries defined by the n-*Strecke*. So, a C major triad and an A minor triad are different forms of the same n-*Strecke* and not two distinct formal structures. They have the same structural meaning.

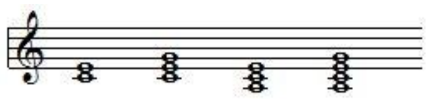
Moreover, the *Durpunkt* and *Mollpunkt* may in fact appear together in a musical structure as yet another form of the n-*Strecke*. Mayrhofer calls such a formation — the minor

[29] In *OH* and *PdK*, Mayrhofer frequently describes mental processes as occurring within the *Vorstellung*. This use of *Vorstellung* illustrates the difficulties involved in translation of this word. In this particular passage *Vorstellung* refers to the capability (mental faculty) to develop concepts, ideas or images from perceptions. It would be awkward to translate this use of *Vorstellung* as representation (e.g. describing a process to be occurring within the representation. The alternative English equivalent , "imagination", which could be used in a literal translation without creating the same awkwardness as representation, is misleading because it suggests a more random and open-ended process, which does not correspond to Mayrhofer's use of the word (or to most uses of the word *Vorstellung* in general). Therefore, I will either simply keep the word *Vorstellung* when referring to a process occurring in the mental faculty in which representations/ideas/ and images are formed in the mind or translate the passage less literally by rearranging the passage to employ a translation of the verb, *vorstellen*, rather than attempting to translate an event literally as occurring within the *Vorstellung*.

[30]The problem of deriving the minor triad from a fundamental tone, had occupied many theorists including Rameau, Helmholtz and Riemann, leading some theorists to claim that the minor mode is less "natural" than the major mode because the constituents of a minor triad cannot all be derived from the same fundamental. Mayrhofer's solution, in proposing two series of notes proceeding symmetrically in opposite directions closely resembles the solution eventually attained by Hugo Riemann, who ultimately denied the need to justify the minor chord through acoustic means but nevertheless utilized the series of partials generated in either direction in his defence of harmonic dualism (Riemann 1905). Instead of generating this series from a common fundamental tone, however, Mayrhofer uses the two *Tonpunkte* at the edge of the n-*Strecke* to generate his complementary series of *Tonpunkte*, which generate major and minor triads from their first two notes in the series which are not duplicates of the fundamental.

seventh chord or the chord of the added sixth in conventional harmonic theory— a *Durmollklang*. All of these structures appear in Figure 5.

Figure 5 "Aesthetic" variants generated from the C-E n-*Strecke*



All five intervals have the same structural meaning as different forms of the same essential n-*Strecke* (C-E), which is responsible for determining the characteristics of a sonority in an absolute (spatial) sense. They are considered equivalent with respect to spatial representation (*Vorstellung*), but not equivalent in an aesthetic sense, because each sonority possesses a distinct pitch-content (*PdK*, 73) and therefore generates a different "aesthetic" impression. Figure 5 provides the n-*Strecke* C-E itself, the major triad C-E-G and the minor triad A-C-E, as well as the *Durmollklang* (major-minor sonority) A-C-E-G that contains both *Durpunkt* and *Mollpunkt*. Since no difference exists in the spatial apprehension between any of these species, Mayrhofer claims that a suitably trained ear can recognize that a major triad suggests the presence of the corresponding minor triad and that the tonic always exists as a *Durmollklang,* the composite species of all four possible *Tonpunkte* in any construct containing the essential n-*Strecke* (*OH*, 36-37). He believes that the *Durmollklang* (e.g. A-C-E-G) is in fact harmonically equivalent to the major or minor triad. This is certainly a provocative idea: all other harmonic theorists regard a C major triad, an A minor triad, an A minor seventh chord, and the dyad C-E as quite distinct structures.

Although one may be tempted to use Mayrhofer's *Durmollklang* to explain additional sonorities that contain combinations of these four *Tonpunkte* (e.g. A-C-G, A-E-G, or A-C)

Mayrhofer makes it quite clear that only the four sonorities described in Figure 5 can be considered to constitute structural variants of n-*Strecke* C-E. Appealing to his principle of adhesion, Mayrhofer considers the *Durpunkt* (A) and the *Mollpunkt* (G) to be enclosed by the boundaries of C and E. Therefore, any collection taken from among the four *Tonpunkte* of the *Durmollklang* A-C-E-G that does not contain the outer boundaries of n-*Strecke* C-E cannot unambiguously represent this n-*Strecke*, as the absence of either of the two *Randpunkte* C and E obscures the outer boundaries of these structures built on the dyad C-E. Sonorities such as A-C-G, A-E-G, E-G, or A-C do not contain the n-*Strecke* C-E and cannot be considered to be structural variants thereof (*PdK*, 105).

To examine Mayrhofer's claim that the *Durpunkt* and *Mollpunkt* of a given n-*Strecke* are somehow present within the limits of the n-*Strecke*, we will need to examine Mayrhofer's unique description of tone space, which underlies his concept of a fundamental harmonic unit which he calls "cell". As we shall see in the next chapter, the idea of inversional symmetry lies at the heart of both Mayrhofer's harmonic structures and his conception of tone space. We will also examine Mayrhofer's claim that the harmonic meaning of *Durmollklang* (e.g. A-C-E-G) is identical to that of a major or minor triad and consider possible musical justifications for this idea.

CHAPTER 3

The Cell: A symmetrical Harmonic Foundation

The dually symmetrical derivation of major and minor triads from the essential n-*Strecke* forms the foundation for Mayrhofer's definition of the basic harmonic unit, the cell. The process of *Adhäsion,* which places both the *Durpunkt* and the *Mollpunkt* within the boundaries of the cell, also leads to a conceptualization of additional species of *Strecken*, such as the fifth (termed Qq for *Quintquart* or Fifth-Fourth in *PdK* and referred to as transitional *Strecke* in *OH*) and the major sixth/ minor third (both described as *aza-Strecke*).[31] Mayrhofer claims that spatial apprehension, after having grasped these other kinds of *Strecken*, is now a position to understand in a symmetrical manner the notes contained within the essential n-*Strecke*. As a consequence of such a "psychological act", spatial apprehension regards the *Tonpunkt* D as dividing the pure n-*Strecke* C-E into two equal halves.[32] Thus it constitutes a central *Tonpunkt,* which Mayrhofer calls *Kernpunkt* (central or nuclear point) (*PdK*, 42).[33]

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[31] Mayrhofer names *Strecken* other than the n-*Strecke* based on the interval that exists between them in the collection of the following *Tonpunkte*: A C D G A. He selects these *Tonpunkte* to create "easily-pronounced" names. Thus, the minor third (major sixth) is labeled as "aza", because the interval of a minor third is spanned by the pitches (A-C-A), with Mayrhofer replacing "C" with the letter z to produce"ze", which corresponds to the German pronunciation of the alphabetical letter C. Similarly, the perfect fifth is classified as "ada" (A-D-A), although it is then incorporated under the definition of Qq. The major second becomes known as "aga" (A-G-A). Mayrhofer only applies these names in a limited sense in *PdK* and refrains from using these descriptors in his later two treatises. In any case, only the Qq has any significance for Mayrhofer's spatial arrangements of tones in tonal space (*PdK*, 31).

[32] Mayrhofer regards the pure major third as the essential interval of perception. Therefore, his rationalization of the *Tonpunkt* D as the central *Tonpunkt* between C and E does not employ the concept of "whole tone space" (i.e. the whole-tone space suggested by equal temperament in which the ratio between two pitches separated by a whole-tone equals $\sqrt[6]{2}= 1.12246$). Instead, Mayrhofer takes his foundational n-*Strecke* as suggesting a conceptual whole tone interval in the imagination which uses a ratio between whole-tones that is equal to $\sqrt{(5/4)} = 1.11803$. As discussed later in this chapter and in Chapter 4, Mayrhofer employs a similar conceptual space when describing the position of D in fifth (fourth) space (*PdK*, 44–45).

[33] Although Mayrhofer's discussions of harmonic structures exclusively use D as the tonal centre, Mayrhofer does not suggest that this *Tonpunkt* constitutes the centre of ALL tonal music. As we shall see, Mayrhofer utilizes a complex system of nomenclature for *Tonpunkte* beyond the diatonic scale. As he introduces these terms gradually, Mayrhofer prefers to describe all of his structures from a single easily-named *Tonpunkt* such as D to illustrate the expansive nature of his harmonic system and to limit the (additional) confusion the reader may experience when encountering his new names for the other *Tonpunkte*.

Mayrhofer has two more arguments for positing D as the *Kernpunkt* of the n-*Strecke* C-E. Figure 6 provides the first of these arguments. The diagram aligns the overtone series of C2 and the undertone series from E6. The numbers below each series indicate the first appearance of partials in each series that do not constitute octave-replicates of the fundamental. All octave replicates (e.g.G4, a duplicate of G3) are omitted from this series. In comparing the two series, we see that both contain D as the fourth partial.[34]

Figure 6. The overtone series of C2 and the undertone series of E6

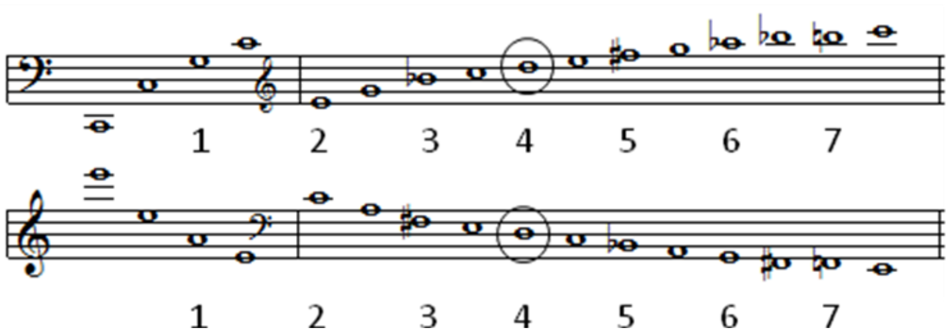


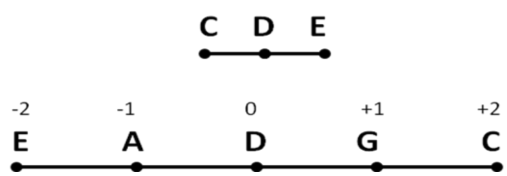
Figure 7 provides the context for Mayrhofer's final argument for D as the centre of the C-E n-*Strecke.* Mayrhofer claims that the intellect, after having grasped the *Strecke* of Qq, arranges the five *Tonpunkte* contained within the n-*Strecke* as a series of fourths (or, alternatively, fifths) — E,A,D,G,C— whose central element is the *Tonpunkt* D (*PdK*, 42). Mayrhofer finds the conceptualization of *Tonpunkte* given in Figure 7 as a series of Qq in tone space particularly useful and depicts all subsequent expansions in tone space in this manner throughout *PdK* and *OH*. By depicting tone space as a series of fourths (fifths), he categorically rejects the traditional

[34] Although D actually represents the fourth non-octave partial in either series, Mayrhofer labels D as the third distinctive partial ("*dritte eigenartige Oberton*"), as he considers the seventh partial in either series musically unusable (*PdK*, 41).

concept of arranging *Tonpunkte* in a scale of any kind, which he considers a particularly artificial construction (*OH*, 117).

Figure 7 provides Mayrhofer's spatial representation of the *Tonpunkte* around D. Mayrhofer labels the system's *Tonpunkte* by the number of Qq a given *Tonpunkt* lies above or below the *Kernpunkt* D. Positive integers indicate Qq above the *Kernpunkt*, negative integers indicate fourths below the *Kernpunkt.* [35]

Figure 7. The *Tonpunkte* of a d^2 cell as Qq-*Strecken*



Because D stands at the centre of the *Tonpunkte* contained within the boundaries of the n-*Strecke*, Mayrhofer regards n-*Strecken* as forming a "cell" around this midpoint. The outer *Randpunkte* defining the n-*Strecke* are the only *Tonpunkte* that must be realized to create the impression of a cell, although the cell centre itself, the *Durpunkt* and the *Mollpunkt* may be added to provide aesthetic variation. Thus, the *Tonpunkt* D becomes the *Kernpunkt* of a "D cell (*PdK*, 41) formed by the realization of *Tonpunkte* C and E. To Mayrhofer, symmetry constitutes the most essential characteristic of the representation of *Tonpunkte* in tone space (41). By positing D as the centre of a system of *Tonpunkte* that encompasses the musically-significant

[35] Although Mayrhofer consistently depicts *Tonpunkte* as a row of Qq units as shown in Figure 4, his identification of E as *Tonpunkt* -2 Qq and C as *Tonpunkt* +2 Qq from D is arbitrary. Mayrhofer notes that his assignment of positive and negative *Tonpunkte* deviates from such constructs as the well-known circle of fifths in which pitches ascend by perfect fifths in a clockwise direction (*OH*, 15).

species of a major triad and its relative minor triad (and, in fact, the entire collection of structures provided earlier in Figure 5), Mayrhofer attempts to preserve the symmetrical quality of these constructs.

In reviewing Mayrhofer's discussion of the *Kernpunkt* and its n-*Strecke,* we might argue that the fundamental organizing principle of the n-*Strecke* C-E is much better conceived as inversion-about-D rather than by way of the traditional interval of the major third.[36] Certainly, Mayrhofer's first argument for associating D with the *Strecke* of C-E relates strongly to the idea of inversion about D in chromatic space, when he points out that D bisects the span C-E into two tones. Furthermore, the structures shown in Figure 7, which depicts his third argument for associating D with the span C-E, translates this same idea into fifths space.

As the boundary *Tonpunkte* C and E each constitute elements from the central D according to the arrangement by fifth-fourths (Qq), Mayrhofer notes such a cell as d^2.[37] For this entire cell to be realized, no *Tonpunkte* except the outer boundary points C and E need be sounded. As discussed earlier, the presence of the *Durpunkt* and the *Mollpunkt* provide an aesthetic variation of the n-*Strecke*, which has cell-forming power (*zellbildende Kraft*) (*OH*, 22). For analytical purposes, Mayrhofer develops a short-hand notation of the different variants of a cell. Thus, the dyad C-E, a simple n-*Strecke* around D is represented as d . A vertical stroke to the right of the *Kernpunkt* indicates the presence of the *Durpunkt.* Accordingly, the triad C-E-G is represented as d |. A vertical stroke to the left of the *Kernpunkt* indicates the presence of the *Mollpunkt.* Hence, the triad A-C-E is represented as |d . The tetrachord A-C-E-G is represented

[36] Mayrhofer's German expression that describes a cell uses the word *um*, which may be translated either as "about" or as "around".
[37] Mayrhofer describes cells using lower-case letters with numerical superscripts throughout. I will use his approach in describing the content of cells in this work.

as | d |. If the *Kernpunkt* D is also included, its presence is represented by a dot under the *Kernpunkt.*

Mayrhofer`s interpretation of the harmonic content of any multiplicity of tones rests on identifying these combinations of *Tonpunkte* as cells. Figure 8 depicts the first two measures of No.10 of Schubert`s 12 *Valses Nobles*, D.969 as analyzed by means of Mayrhofer`s notation.

Figure 8: Mayrhofer analysis of mm. 1–2 of No.10 from Schubert's 12 Valses Nobles, D.969

The F major chords of the first measure contain the n-*Strecke* F-A to form a g^2 cell, notated g| in Mayrhofer's system. The right vertical stroke represents the presence of C, the *Durpunkt*. The second quarter, however, suggests the sonority D-F-A, a minor triad around the same n-*Strecke* F-A, and can be represented by |g. The left vertical stroke represents the presence of D, the *Mollpunkt*. The melodic C on the weak half of the second beat of the measure returns the harmony to F-A-C and g|. The second measure consists solely of C major triads, built on the *n-Strecke* around D, C-E, with its *Durpunkt*.

In Mayrhofer`s analyses, all *Tonpunkte* are equally important in forming a collection: he does not make any theoretical distinctions between " non-chord tones" and chord tones but considers the overall conglomerate of *Tonpunkte* that may be present in the *Vorstellung* of the listener created by simultaneously-presented *Tonpunkte*. It is also possible that *Strecken* may be formed from an immediate succession of *Tonpunkte* rather than from simultaneously-sounding *Tonpunkte*, which may often be the case in music consisting of only a single melodic line. As Mayrhofer does not incorporate any rhythmic criteria in his harmonic analyses, the length of the time span from which the members of a discrete collection of *Tonpunkte* may be drawn remains undefined and subject to variation. Most often, harmonic species that constitute chords are treated as the distinct collections of *Tonpunkte* that form cells in the *Vorstellung* of the listener.

Thus, Mayrhofer's analytical system classifies sonorities harmonically based on the criterion of the presence of n-*Strecken* between any set of two *Tonpunkte* that may be present in the mind of a listener at a given time rather than treating the entire sum of *Tonpunkte* species as a single chord (which may or may not contain pitches acting as non-chord tones) based on the demands of triadic conceptions (i.e. the identification of harmonic species obtained by stacking in thirds from a chord root typical of other harmonic theories). The composite nature of identification of harmonic elements creates for Mayrhofer additional descriptive power in dealing with harmonic entities that do not correspond to the species obtained by stacking thirds as described by conventional harmonic theories.

It is worthwhile reflecting for a moment on Mayrhofer's idea that the *Durmollklang* may act as a fundamental tonal sonority that is based on the n-*Strecke.* We are accustomed to the idea that only major and minor triads can serve this role, so it seems strange to us to come across the argument that these are only two possible variants drawn from a collection of four *Tonpunkte* that appears in other theories as a minor seventh chord or a major chord with an added sixth.

It may be helpful in this regard to think of the opening of Schoenberg's *Gurrelieder*. Figure 9 provides the first six measures. The music aims to represent a primitive or natural harmonic state, very much along the lines of the opening of Wagner's *Rheingold*. The opening measures contain four pitch-classes (C-Eß-G-Bß) repeated for an extended period of time. All four notes appear to be of equal importance: identification of any of these pitches as not belonging to the overall harmony seems inappropriate. The two options afforded by conventional harmonic analysis— as either an Eß major triad with an added sixth or as a C minor seventh chord in first inversion— seem faulty since one explanation subordinates C to Bß and the other explanation argues that C is the root of the structure. Mayrhofer's notion of n-*Strecke* allows us to understand the structure as an independent, stable formation, rather than as a sonority requiring a resolution. C-Eß-G-Bß exists as a legitimate aesthetic form of the n-cell around the *Tonpunkt* F in the presence of both *Durpunkt* and *Mollpunkt*, thus forming a sonority which Mayrhofer considers as "natural" as any other realization of a cell around the *Tonpunkt* F.

Figure 9. The opening of Schoenberg's *Gurrelieder* (mm.1–6)

Along somewhat different lines, we might also consider Gottschalk's "Pensive", whose opening is excerpted in Figure 10. Examining the first phrase in mm. 1–8, we see that the n-cell around G generally appears in measures 1, 4, 5, and 8 accompanied by both its *Durpunkt* (C) and its *Mollpunkt* (D). The asterisks shown in Figure 10 indicate each instance in which the *Durmollklang* D-F-A-C occurs in the excerpt. This *Durmollklang* sonority has a very different meaning aesthetically and stylistically than the similar structure in the example taken from Schoenberg, but, like the *Gurrelieder* opening, also suggests a style of musical thinking about fundamental structure very much in keeping with Mayrhofer's notion of the n-*Strecke.*

<u>Figure 10. Gottschalk's "Pensive", mm. 1-14</u>

CHAPTER 4

The ino-Cell: First Expansion from the n-Cell in Tone Space

The basic cell, (also termed *Glattzelle* [smooth cell] in *PdK* or n-*Zelle* in *OH*) provides the foundation of further expansion. As in his elucidation of the n-cell, Mayrhofer continues to describe these expansions using the visual depiction of *Tonpunkte* as a series of Qq (fourths or fifths) in both directions from the centre. This unit of Qq (fifth-fourth) does not correspond exactly to the ratio of 4:3 (3:2) of pure intervals (*PdK*, 45). According to Mayrhofer, the Qq interval is slightly smaller than a perfect fifth and larger than a perfect fourth, and thus represents a *quasi-Einheit* (pseudo-unit).[38] Therefore, the depiction of expansions by fourths from the cell nucleus acts as a stylized (*stilisierte*) version of tone space expansions, which are developed in spatial apprehension as a psychological act (45).

Rather than constituting a product of intuitive perception, the visualization provides an "intellectual but nevertheless useful representation"[39] of tone-space expansions and suggests a way in which musical understanding can incorporate tuning systems containing intervals that

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[38] As Mayrhofer's principal aim is to study music perception rather than the acoustic properties of music, Mayrhofer does not provide any mathematical derivation of his Qq unit. However, he does state that the major third is perceived in tone space according to the "natural" interval and can thus be assumed to correspond to 5/4 found in just intonation (*PdK*, 54). From this information, it can be assumed that the Qq *Strecke* must correspond to a value such that every pair of *Tonpunkte* in tonal space which will be perceived as an n-*Strecke* must be related by a factor of 5/4, the size of the "pure" interval. For example, if the *Strecke* between *Tonpunkte* E and C is conceptualized as a series of ascending fourths in the series E-A-D-G-C, then the ratio of the frequencies of C:E found in this series will be 2*2*4/5= 16/5. As C and E are separated by four equivalent Qq units, a single Qq unit will correspond to the fourth root of 16/5= $\sqrt[4]{(16/5)}$ = 1.33748. This value not only exceeds the pure interval of a perfect fourth (4/3= 1.3333) suggested by acoustics, but also the fourth found in equal temperament ($\sqrt[12]{32}$ = 1.33484) as Mayrhofer claims. The fifth of Mayrhofer's Qq unit can be calculated in a similar fashion. The frequencies of E to C in a series of ascending fifths (C-G-D-A-E) will be related by a factor of 2*2*5/4= 5. Mayrhofer's fifth as a Qq unit will be $\sqrt[4]{5}$= 1.49535, a value which is smaller than the perfect fifth postulated by acoustics (3/2= 1.5) as well as the fifth found in equal temperament ($\sqrt[12]{128}$= 1.49831).

[39] In the introduction of *PdK*, Mayrhofer emphasizes that he aims to correct the errors of previous music theories by formulating a theory based on musical perception. He regards all previous theories, including both scale-based and harmonic theories (e.g. Riemann) as being intellectual abstractions that occur "after" the critical process of music perception. Throughout *PdK*, Mayrhofer remains highly prejudiced against any sort of "intellectual" music theory.

deviate from the whole-number ratios of pure intervals into a musically-significant *Vorstellung* (*OH*, 30). Theoretically, Mayrhofer's conceptualization of tone space allows enharmonic reinterpretation of *Tonpunkte*, as the "meaning" of particular *Tonpunkte*, is determined in the first instance by psychological factors and musical context (*PdK*, 115).

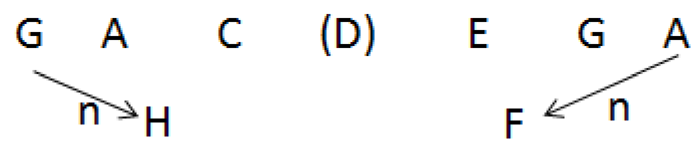
Although Mayrhofer continues to present the *Tonpunkte* of such expansions in tone space as a series of Qq from the centre, he insists that it is the n-*Strecke* that forms the foundation of the cell, and not the Qq-*Strecke*. The n-*Strecke* constitutes the starting point for derivation of all other *Tonpunkte* and further expansions beyond the cell. *Tonpunkte* are pitch classes and hence many different possible ways exist in which the intellect could arrange them. For example, the *Mollpunkt* A, can be regarded as a fourth above E, the "upper" boundary of the n-cell around D (*PdK*, 53). As the musical apprehension (*Auffassung*) comprehends the n-*Strecke* of the major third intuitively without difficulty, the imagination *(Phantasie)* will have no difficulty conceiving of a further n-*Strecke* projecting itself from A by a major third in the direction of the boundary, *Tonpunkt* E (53). This action results not only in the creation of an additional *Tonpunkt* F, but also in a new type of *Strecke*, the *Leittonstrecke* (leading-tone or minor second *Strecke*) between E and F. This process of creating *Strecken* is known as o-*Adjektion* in *PdK* (o-*Anwerfung* in OH). The prefix o represents the *Tonpunkt* F as the upper leading tone (*Oberleitton*) of E. A similar process, *i-Adjektion* in *PdK* (*i-Anwerfung* in *OH*) [40], adds the *Tonpunkt* H (the German name for B) to G, creating the lower leading tone of C.[41] Figure 11 displays the generation of these

[40] Mayrhofer does not provide a reason for labelling this kind of *Adjektion* as *i-Adjektion* instead of providing a complementary form to the *o-Adjektion* by employing the German letter "u" to represent the German word for lower leading tone (*Unterleitton*). Mayrhofer writes: "Die Reststrecke, welche bei Anwerfung des n= G H an G C erübrigt – verläuft,........ ...von unten nach aufwärts. Wir nennen diese von unten herauf laufende oder steigende Reststrecke allgemein "i" (*PdK*, 56). ("the remaining span, which results from adjection of the n-span G-B onto G C......... proceeds upwards from below. We will denote this remaining span, which ascends from below, as "i".)

[41] The German pitch class H corresponds to B in English. Also, the German pitch class B corresponds to Bß in English nomenclature. Mayrhofer makes use not only of German nomenclature, but also invents his own system of nomenclature for all *Tonpunkte.* To maintain consistency, I will label all *Tonpunkte* as Mayrhofer presents them in

Tonpunkte through i-*Adjektion* and o-*Adjektion* onto a d^2 cell (*PdK*, 53). Both H and F constitute the fourth and final "musically useable" 15^{th} partial in the C- overtone (E- undertone) series given earlier in Figure 6.

Figure 11. i-*Adjektionen* and o-*Adjektionen* to d^2 cell



The addition of the *Tonpunkte* H and F through adjection not only adds to *Tonpunkte* three Qq units removed from the central D in the stylized Qq *Tonraum* diagram, but also creates an entirely new *Strecke*, H-F, which Mayrhofer calls the ino-*Strecke*. This *Strecke* contains the interval traditionally described as a tritone, diminished fifth, or augmented fourth. In contrast to traditional interval theories, Mayrhofer insists that this species not be considered a derivative of a major triad or perfect interval as implied by its classification in conventional theory as a diminished or augmented form of a perfect interval, but rather as an independent *Strecke* with its own characteristics (*OH*, 23).

Mayrhofer claims that the ino-*Strecke*, because it contains two *Tonpunkte* related to the boundaries of the n-cell, is perceived by the listener as containing the resolution to the outer boundaries of the n-cell (C and E) (17). This resolution exists in the mind of the listener to such an extent that an actual resolution to the n-*Strecke* need not actually occur for the ino-*Strecke* to be unambiguously linked to its resolution (17). Therefore, Mayrhofer considers the ino-*Strecke*

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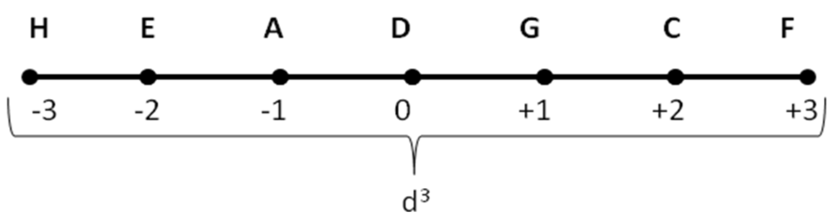
his treatises, including the German names H and B for the pc B and Bß. A full list of Mayrhofer's nomenclature and its English equivalent is provided in Chapter 5.

H-F to have cell-creating capabilities to the same extent as the n-cell (d^2) to which it is related to by leading-tone *Strecke* (*PdK*, 59–60). Figure 12 provides Mayrhofer's visualization in Qq tonal space of the ino-cell that receives the label d^3 due to the distance in fourths (fifths) which its outer boundaries H and F are removed from its central *Tonpunkt*, D. Mayrhofer refers to d^3 as a so-called ino-cell, and often describes the ino-cell in general as an *armierte* (sheathed) cell or *Vollzelle* (complete cell) to distinguish it from the *Glattzelle* (*n-Zelle*), d^2, discussed earlier.

Figure 12. The d^3 ino-cell



This ino-cell (d^3) thus produces the seven notes of the C major diatony and completes the closest "consonance sphere" (consonance region), a term which Mayrhofer uses to describe the *Tonpunkte* encompassed by different levels of expansion from a central *Kernpunkt* (*PdK*, 40). As is the case of the n-cell, the ino-cell can be accompanied by its *Durpunkt* G and *Mollpunkt* A (*PdK*, 61–62). With the ino-cell, such additions not only add aesthetic variety, but also complete additional neighbouring cells adjacent to the actual ino-cell, which are nevertheless understood to be contained within the boundaries of the original *ino-Strecke*. Figure 13 catalogs several possible aesthetic variants of a d^3 ino cell. (More types are possible than presented in Figure 13). For example, addition of the *Durpunkt*, G, to H-F creates the cell a^2 (G-H), a structure Mayrhofer calls mino (n-cell added around *Mollpunkt*), so that the *Tonpunkte* G-H-F are called"mino D, which he represents in his cell notation as d^3a^2 (61–63). Since the *Tonpunkte* G and H, which signify the presence of an n-cell around A (a^2), within the boundaries of the ino-cell d^3, Mayrhofer typically places brackets around such *Seitenzellen* (secondary cells or neighbouring cells) or omits them entirely in his analyses. The Figure provides Mayrhofer symbolic shorthand notation for ino cell variants.

Figure 13 Ino-cell variants around d^3

Tonpunkte	**Cells present**	**Symbolic notation**
H D F	d^3	d̰
G H D F	$(a^2)d^3$	\d̰
H D F A	$d^3(g)^2$	d̰/
G H F A	$(a)^2d^3(g)^2$	\ḋ̰/
G H D F A	$(a)^2d^3(g)^2$	\d̰/
G H D F A C	$(a)^2d^3(g)^2$	\d̰/
H C E F *	$d^{3,2}$	d̰ (?)
E G H D F A	$(a)^2d^3(g)^2$	\d̰/

(* Mayrhofer does not introduce a distinct symbol for this collection of *Tonpunkte*, and only discusses this species using the numerical cell description provided in the middle column)

As shown in Figure 13, Mayrhofer uses the "tilde" (~) underneath the intended *Kernpunkt* to indicate the presence of an ino-cell and to distinguish the ino-cell from the n-cell. The slash placed to the left of the tilde indicates the formation of an n-cell around the *Mollpunkt* of the ino cell. The second row in the figure contains (a^2) d^3 for an ino-cell around D. A slash placed to the right of the tilde indicates the formation of an n-cell around the *Durpunkt* of the ino-cell. The third row in the figure contains d^3 (g^2) for an ino-cell around D. Mayrhofer`s notational system for ino-cells varies in the two treatises, but in *OH*, Mayrhofer does make the distinction between ino-cells that are accompanied by their *Kernpunkt* and those that are not (*OH*, 26) by placing a dot above the letter name of those ino-cells in which the *Kernpunkt* is not sounded. The fifth row in the figure is an instance.[42] Mayrhofer does not consistently employ symbolic notation for every type of ino-cell variant that may arise: for example, an *ino-Strecke* with its n-cell resolution (e.g. H C E F in Figure 13) never appears with its symbolic notation but can be described in the cell superscript notation as containing both kinds of cells (e.g. $d^{3,2}$ in Figure 13).[43]

As the ino-cell encompasses the seven *Tonpunkte* that construct the diatonic scale, entire pieces of music written in a single major key can be described by using only n-cells and ino-cells. Figure 14 describes the harmonic content of Schubert's *Valse noble* No.10, D. 969 in F major in terms of Mayrhofer's n-cells and ino-cells. All harmonic structures contained in this excerpt can be described using n-cells except for the g^3 ino-cells in measures 7, 10 and 15. Not all beats of all measures contain harmonic species that conform to Mayrhofer's species: for example, the first beat of measure three contains the *Tonpunkte* G and B, which do not constitute either an n-cell or an-ino cell. However, Mayrhofer claims that a succession of *Tonpunkte* can be retained in the mind of the listener beyond *Tonpunkte* that are sounded simultaneously, so that the remainder of the measure projects a c^2 cell, in which the *Kernpunkt* C itself appears on beat 3

[42] Mayrhofer only uses this dot notation in *OH* (26) and does not make this distinction in *PdK*. In general, considerable variation exists in his symbolic notation across all three of his treatises, especially with regard to the more complex species consisting of multiple cells.

[43] Although Mayrhofer provides examples of a detailed symbolic notation in *OH* (150–151), these symbols often obscure rather than clarify his descriptions of more complex structures by overwhelming the reader with still more hitherto unfamiliar symbols. Mayrhofer's own explanations of theoretical constructs (e.g. cell levels) tend to focus on the *Randpunkte* of cell structures, which often makes symbolic rendering superfluous rather than helpful.

of the measure. Measure 7 contains a g^3 ino cell with n-cells realized around both the *Mollpunkt* D and the *Durpunkt* C through the use of D in the melody.[44]

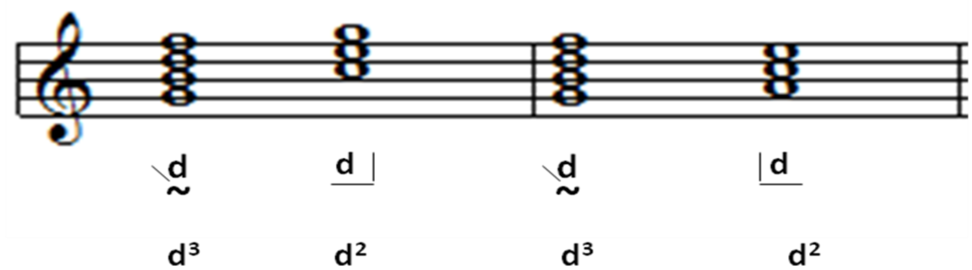
Figure 14. Mayrhofer Analysis of Valse noble No.10 (D.969)

Mayrhofer's concept of the ino-*Strecke* attempts to address certain perceived shortcomings of traditional music theory. Mayrhofer incorporates the frequently-observed tendency of the interval of a tritone to resolve to inward (or outward) in opposite directions, but unlike previous theorists, he attributes this tendency to the mental representation of the *Leittonstrecke* in the imagination created by the tritone rather than the tendency of a leading-tone to resolve (*OH*, 16–17). This *Leittonstrecke* always exists in pairs as a symmetrical phenomenon occurring between the n-cell and ino-cell boundaries of a particular cell centre. Rather than the interval of the seventh requiring downward resolution, it is the presence of the ino-*Strecke* that governs the resolution of dominant seventh or diminished seventh chords (*PdK*, 61–62). As

[44] In order to avoid the ambiguity involved in grouping successive *Tonpunkte* into collections from which *Strecken* are to be derived, Mayrhofer generally prefers to apply his analytical method to musical works in which most, if not all, *Tonpunkte* have a distinct harmonic function as part of block chords and avoids works that appear to have been conceived "melodically".

shown below in Figure 15, resolution from the ino-cell d^3 can proceed either to the minor triad A-C-E or the major triad C-E-G, both of which form cells around d^2. Both progressions provide an equally acceptable inward resolution of the *ino-Strecke* H-F to C-E. Thus, Mayrhofer considers the so-called deceptive cadence structurally equivalent to the authentic cadence, irrespective of statistic differences of their appearances.

Figure 15. Resolution of the ino-Cell



CHAPTER 5

Further Expansion, Cell Multiplicities, and *Kernstrecken*

The seven *Tonpunkte* included within the boundaries the ino-cell constitute the farthest possible expansion of points that can be understood to be part of a single cell around the *Tonpunkt* D (*PdK*, 57). In Mayrhofer's view, further expansions beyond +/-3 Qq from the centre of the ino-cell cannot evoke a similar expansion as part of the original cell around D, because they do not form "musically useful" values in the harmonic series of the fundamental at the heart of this particular cell (*PdK*, 83). Take, for example, the two *Tonpunkte* representing an expansion of +/-4 Qq from D, which Mayrhofer labels as "M" (Fƒ) and "B" (Bß). Bearing in mind enharmonic equivalence, we can interpret a simultaneous appearance of M-B either as Gß-Bß or Fƒ-Aƒ. But we cannot relate either *Strecke* unambiguously to the *Kernpunkt* D in the same manner we can relate the *Tonpunkte* of the ino-cell to D. Therefore, the *Strecke* B♭-Fƒ does not constitute a musically useful entity in Mayrhofer's eyes (*PdK*, 33). M-B could, of course, be interpreted as a genuine n-*Strecke,* but it would then form an n-cell not around D but around Gƒ or Aß.

In describing *Tonpunkte* beyond the boundaries of the ino-cell, Mayrhofer again appeals to the principle of the *Adjektion (Anwerfung)* employed in his derivation of the ino cell. Further *Tonpunkte* (representing pitches considered to be beyond a particular diatonic tonality in the narrowest sense) can be understood through *Adjektion*, thus resulting in the addition of *Tonpunkte* which represent a distance greater than +/-3 Qq from the cell centre. For example, an *Adjektion* of an n-*Strecke* onto D in the direction of *Tonpunkt* A yields the *Tonpunkt* B, while a projection of n-*Strecke* in the direction of G from D yields the *Tonpunkt* M, thus yielding the *Tonpunkte* +/-4 Qq from the centre D.[45] Similarly, Mayrhofer derives Cƒ (Di) through an *i-Adjektion* between A and D and the *Tonpunkt* representing Eß (Do) through an o-*Adjektion* between G and D, which represent the *Tonpunkte* +/-5 Qq from the tonal centre (*PdK*, 76–77). Figure 16 provides a list of Mayrhofer's names of *Tonpunkte* and their pitch class equivalents as described in the graphic supplement of *PdK*. Figure 17 depicts the expansions of these *Tonpunkte* from the central *Tonpunkt* D and the numerical values associated with each of these *Tonpunkte* as a convenient reference for navigating Mayrhofer's tone space.

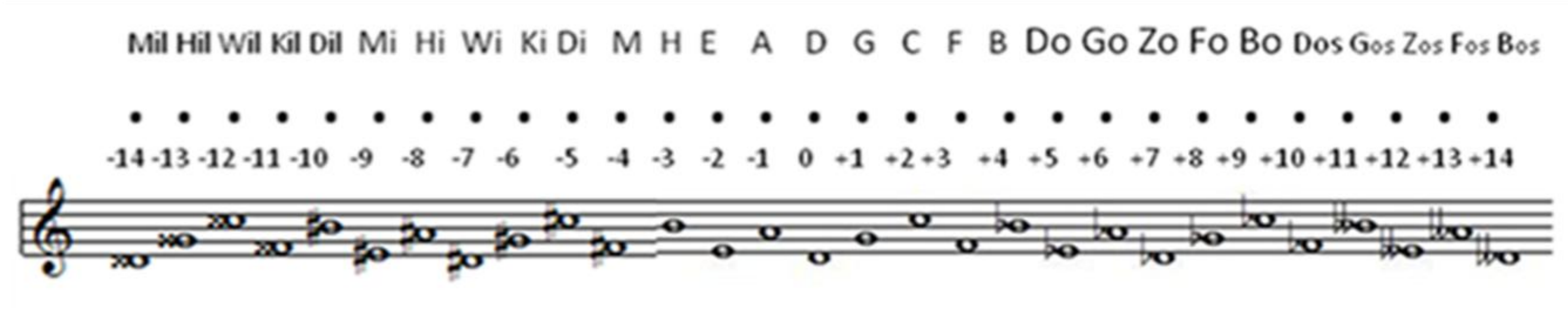
Mayrhofer analyzes the *Tonpunkte* found beyond the limits of an ino-cell as components of other cells. Complex collections containing pitch-classes outside of diatony thus represent the presence of multiple cells according to the ino- or n-*Strecken* expansions which they form. (Additional *Tonpunkte* that do not form ino- or n-*Strecken* function as *Dur*- or *Mollpunkte* for these cells.) Such simultaneously-existing cells are conceived as *Multiklänge* (multiple sonorities). (Sonorities that contain more than one cell but in which both can be found within the limits of the same outer boundaries, such as d^3g^2, are not considered *Multiklänge*).

[45] By selecting the letter M for the pitch class Fƒ, Mayrhofer attempts to dispel notions that this *Tonpunkt* is somehow derived from F. Further *Tonpunkte* beyond M and B are labelled by Mayrhofer according to their derivation through either i-*Adjektion* or o-*Adjektion*. Mayrhofer labels the pitch class Eß as Do since this *Tonpunkt* is obtained through o-*Adjektion* from G in the direction of *Tonpunkt* D and conceived as the upper leading tone (*Oberleitton*) of D. Similarly, Mayrhofer labels the *Tonpunkt* representing pitch class Cƒ as Di, as this *Tonpunkt* represents the lower leading tone of D as the result of i-*Adjektion* from A in the direction of D. Mayrhofer extends this procedure to remote *Tonpunkte* which contain additional letters (e.g. Fos, Bos, Dil, Hil) which signify that they are products of two *Adjektionen.* I will be using Mayrhofer's names for all *Tonpunkte*, but will use the standard English names of pitch-classes when specifically referring to them rather than to *Tonpunkte*.

Figure 16. Pitch classes and their equivalent *Tonpunkt* names used by Mayrhofer

Pitch Class	**Mayrhofer's *Tonpunkt* Syllable**	**Pitch Class**	**Mayrhofer's *Tonpunkt* Syllable**
D	D	A	A
G	G	E	E
C	C	B	H
F	F	Fƒ	M
Bß	B	Cƒ	Di
Eß	Do	Gƒ	Ki
Aß	Go	Dƒ	Wi
Dß	Zo (Co in *OH*)	Aƒ	Hi
Gß	Fo	Eƒ	Mi
Cß	Bo	Bƒ	Dil
Fß	Dos	F©	Kil
Bå	Gos	C©	Wil
Eå	Zos (Coo in *OH*)	G©	Hil
Aå	Fos	D©	Mil
Då	Bos		

Figure 17 Expansion of *Tonpunkte* from *Kernpunkt* D in Mayrhofer's Tone Space



Let us examine Mayrhofer's analytical process rationalizing *Multiklänge*. Consider the first sonority in Figure 18. The collection contains the pitch-classes D, Dƒ, E, Fƒ, and A. Mayrhofer begins his analysis by scanning the collection for the presence of n-*Strecken* (which involve *Tonpunkte* separated by 4 Qq) and ino-*Strecken* (which involve *Tonpunkte* separated by 6 Qq), both of which have cell-forming capabilities and will determine the *Kernpunkte* of individual cells. All other (enharmonically non-equivalent) intervals and their corresponding *Strecken* are completely irrelevant to the process of n- and ino- cell formation.

<u>Figure 18 Analysis of four examples of *Multiklänge*</u>

To facilitate our understanding, let us assign numerical values to each *Tonpunkt* found in Mayrhofer's tone space. The outer boundaries of of any n-cell constitute *Tonpunkte* that are 4 Qq apart from each other in tonal space. A major third exists between D and Fƒ (*Tonpunkte* D and M), thereby creating an n-cell around E, which we notate as e^2. By setting *Tonpunkt* D as 0 as in the depiction of Mayrhofer's tone space given in Figure 17, the boundaries D and M of the first chord of Figure 18 may be assigned *Tonpunkte* values of 0 Qq and -4 Qq, respectively.

After having identified the essential *Strecken*, our next step is to determine how the remaining *Tonpunkte* can function as aesthetic components of the identified n-*Strecken* and ino-*Strecken.* The other components of the collection falling within the boundaries of this n-cell can then be analyzed as aesthetic components. For example, in the first collection, E, which has a *Tonpunkt* value of -2 Qq, can be rationalized as the actually-sounding *Kernpunkt* of the cell created from *Tonpunkte* D and M, while A (-1 Qq) forms the *Durpunkt*. The four *Tonpunkte* D, E, M, and A can therefore all be rationalized as components of this particular manifestation of an e^2 cell, whose boundary points D and M are sufficient (and necessary) for its realization. The pitch class Dƒ (-7 Qq), however, cannot be analyzed as a component of e^2, but does play a role in the other cell present in this collection.

In addition to the e^2 cell described above, a second cell exists as part of this collection. We can rationalize the augmented fourth A-Dƒ (A-Wi) as the ino-*Strecke* Wi-A, whose *Kernpunkt* is Fƒ (M). The cell notation for the ino-*Strecke* Wi-A is m^3. Ino-cells contain boundaries that are 6 Qq apart in Mayrhofer's tone space. The outer boundaries (Wi and A) of the m^3 cell have *Tonpunkt* values of -7 Qq and -1 Qq, respectively. The collection thus contains two cell-creating *Strecken*: the n-*Strecke,* D-M, labelled e^2, and the ino-*Strecke*, Wi-A, labelled m^3.

As in the case of the analysis of the n-cell, the additional components of the collection are analyzed as aesthetic components if contained within the boundaries of the cell. Although neither a *Durpunkt* nor a *Mollpunkt*, the *Tonpunkt* E (-2 Qq) can be conceived as a constituent of the m^2 (E [-2 Qq] -Ki [-6 Qq]) cell enclosed by m^3.[46] And we have seen that the *Tonpunkt* E is the *Kernpunkt* of the n-*Strecke* e^2. So is the *Tonpunkt* M (-4 Qq), which appears as an acutally-sounding *Kernpunkt* for m^3 as well as a member of the n-*Strecke* e^2. *Tonpunkt* D (0 Qq) cannot be rationalized as a component of m^3 and therefore plays no role in defining this cell. As in the case of the n-cell, only the outer boundary points (Wi and A)

[46] As discussed in Chapter 4, Mayrhofer considers the *ino-Strecke* to suggest its resolution to an *n-Strecke* in the imagination of the listener.

are relevant in describing the spatial contents of the ino-cell (m^3). The entire *Multiklang* found in Figure 18 can thus be summarized as m^3e^2 and represents an expansion enclosed by the *Tonpunkte* Wi, M, A, and D (-7 Qq,-4 Qq,-2 Qq, and 0 Qq), a total of eight *Tonpunkte.*[47]

As discussed above, only the boundary points (*Randpunkte*) of the individual cells are required for the representation of a cell to appear in Mayrhofer's tone space. Omission of the *Tonpunkt* E from the collection, as shown in the second sonority depicted in Figure 18, does not alter the realization of the m^3e^2 cell depicted in the first sonority of the figure.

Frequently, *Multiklänge* appear in which a single *Tonpunkt* acts as a *Randpunkt* for more than one individual cell. Let us consider the third sonority described in Figure 18. This structure contains the same *Tonpunkte* as the second sonority, but adds the *Tonpunkt* H (B). H forms an n-*Strecke* with *Tonpunkt* Wi (Dƒ) and thereby creates an n-cell (di^2) around the midpoint, Di (Cƒ), in which the *Randpunkte* Wi and H have *Tonpunkt* values of -7 Qq and -3 Qq, respectively. Overall, this sonority thus contains three cell-forming *Strecken*: an n-*Strecke* between D (0) and M (-4); an n-*Strecke* between Wi (-7) and H (-3); and an ino-*Strecke* between Wi (-7 Qq) and A (-1 Qq). This *Multiklang* therefore contains three cells: m^3, di^2, and e^2. The fact that the *Tonpunkt* M forms the *Durpunkt* to the cell about Di does not affect the spatial apprehension of M as a component of the e^2 cell.

A quick glance at the tone-space diagram reveals that the *Randpunkte* of di^2 fall within the limits prescribed by m^3. Di^2 thus acts as a *Seitenzelle* (neighbour cell) within the ino-cell m^3. As we discussed in Chapter 4, Mayrhofer surrounds such *Seitenzellen* contained within the

[47] Although the order in which the components of a *Multiklänge* are listed is not entirely consistent, Mayrhofer usually arranges them in one of two ways (which at times conflict with each other). According to the first method, Mayrhofer lists them in the according to the arrangement of Qq of his tone-space. Therefore, a *Multiklang* containing the *Kernpunkte* A and G will be listed as a^3g^3 and not as g^3a^3. The other convention employed by Mayrhofer, is indubitably influenced by the practice of forming triads by stacking thirds on top of a chord root and scale-based theory: Mayrhofer usually represents a *Multiklang* consisting of cells around *Tonpunkte* C and E as c^3e^3 rather than e^3c^3.

boundaries of an ino-cell with brackets in his analyses. Accordingly, the third sonority of Figure 18 is analyzed as the *Multiklang* m^3 (di^2) e^2.

Another factor to consider in the application of Mayrhofer's analytical method is the possibility of enharmonic reinterpretation of individual *Tonpunkte* or *Strecken.*[48] The ino-*Strecke* often appears in chords that facilitate modulation between distantly-related keys and thus frequently become open to enharmonic reinterpretation. The interval of a tritone between two pitch-classes suggests the possibility of one of two possible ino-*Strecken* existing between them. For example, the sonority introduced in Figure 18 containing *Tonpunkte* D, Ki,M, and A (D, Dƒ, Fƒ, and A) could be reinterpreted as D, Do, M, and A (D, Eß, M and A) . As shown in Figure 18, this would result in the realization of a different *Multiklang*: c^3e^2.

Mayrhofer considers enharmonic reinterpretation to be a potential factor in determining n-*Strecken*. For example, two *Tonpunkte* that form a diminished fourth may theoretically form an n-*Strecke*. Such situations involving enharmonic reinterpretation of the *Tonpunkte* involved in the creation of n-cells or ino-cells cannot be analyzed without reference to the greater musical context and will be discussed further in Chapter 11.

Multiklänge appear frequently in both the common practice era and beyond and constitute some of the most important harmonic entitities of the chromatic vocabulary. Figure 19 shows three examples of *Multiklänge*: an augmented triad, a fully diminished 7th chord and an augmented sixth chord.

[48] See Mayrhofer's analysis of the second movement from Beethoven's op.27.2 piano sonata (*OH*, 156-160) or Bach's C Major Prelude from the Well-Tempered Clavier (*OH*, 238-245).

Figure 19. Examples of some important *Multiklänge*

The first chord in Figure 19 contains the *Tonpunkte* D, M (Fƒ), and Hi (Aƒ). *Tonpunkt* M forms the boundary of two distinct n-cells, the upper *Randpunkt* of a cell around E (D-M), as well as the lower boundary of a cell around Ki (Gƒ). The augmented triad utilizes the minimum number of *Tonpunkte* (three) that can combine to form a *Multiklang*.

The second chord contains the *Tonpunkte* Zo (Cƒ) E, G, and B (Bß). Like the first chord, an augmented triad, the second chord, a fully diminished seventh chord, is formed by two cells: Zo and G form an ino-cell e^3 around E. E and B form an ino-cell around G. So, two *Tonpunkte*—E and G— have two functions: first as *Kernpunkte*; and, second, as *Randpunkte* of another cell. E is a boundary point for g^3 while G acts as a boundary point for e^3.

The third chord of Figure 19, an augmented sixth chord, is a more complicated form of *Multiklang*. Its four *Tonpunkte* Go (Aß), C, D and M (Fƒ) form four distinct cells: two n-cells and two ino-cells. D and Go combine to form an f^3 ino-cell and M and C form an ino-cell around A (a^3). Each of these *Tonpunkte* also takes part in the formation of two n-cells: D-M (e^2) and Go-C (b^2).

To interpret such a cell conglomeration, Mayrhofer turns to the tone space diagram shown in Figure 17 and the concept of *Seitenzellen* (neighbouring cells) of ino-cells. The b^2 cell (Go-C) contains one *Randpunkt* (Go) that coincides with a *Randpunkt* of the f^3 ino-cell (D-Go) and another *Randpunkt* (C) that is contained within the boundaries of the f^3 cell as a *Mollpunkt*. The b^2 cell is thus enclosed by the *Randpunkte* of the f^3 ino-cell, thereby forming a neighbouring cell (*Seitenzelle*) (b^2) to f^3 around the *Durpunkt* (B). Similarly, e^2 (D-M), which shares a boundary point (M) with the ino a^3 (M-C) while providing the *Durpunkt* (D) to a^3, forms a *Seitenzelle* around the *Mollpunkt* (E) of a^3. In the situation described above, the ino-cell structures, which enclose a greater number of *Tonpunkte* than n-cells, thus determine the "true" *Kernpunkte* involved in the *Multiklang.*

By employing the concept of *Multiklänge*, Mayrhofer is able to classify several complex sonorities that present difficulties to other harmonic theories. The only sonorities that remain elusive to Mayrhofer are what he calls *Partialklänge*, which do not contain any ino- or n-*Strecken*. The sonority, C-F-G, is just one example. Mayrhofer explicitly states that any such chord species, which does not contain an n-*Strecke* or an ino-*Strecke* does not constitute a *Klang* at all (*PdK*, 105). According to Mayrhofer, such sonorities occur relatively rarely, but are used for great effect by composers such as of Wagner (*PdK*, 142).[49] Figure 20 depicts three sonorities which Mayrhofer considers to be without cell content: E-G, A-C-G, and F-C-G.

<u>Figure 20 Examples of *Partialklänge*</u>

Mayrhofer's rejection of these species as *Klänge* stems from the lack certain qualities that the n-*Strecke* and the ino-*Strecke* both possess. The boundary points of both the n-*Strecke* and

[49] Such *Partialklänge* occur less rarely in music of the latter 19^{th} century than Mayrhofer claims. Furthermore, as Mayrhofer's analytical approach typically analyses the sum of all *Tonpunkte* present at any one time for the presence of *n-Strecken* and ino-*Strecken* without discriminating between chord tones and non-chord tones, gestures such as "4-3" suspensions technically do not contain n *Strecken* or ino-*Strecken* and are indistinguishable from *Partialklänge.* In a sense, Mayrhofer's analytical method treats all notes that cannot be rationalized as components of n-cells or ino-cells (or their *Durpunkte* and *Mollpunkte*) as "non-chord tones".

the ino-*Strecke* both form multiple elements of symmetry. As discussed in Chapter 2, the *Tonpunkte* C and E project D as a midpoint in several different conceptions of tone space, including Mayrhofer`s Qq space. To Mayrhofer, this element of inversional symmetry is a vital component in the determination of a central *Tonpunkt* as *Kernpunkt* between two *Tonpunkte* and the *Strecke* that they form. Without such symmetry, a *Kernpunkt* cannot be formed. This consideration immediately excludes the dyad E-G presented in Figure 20 from any consideration as containing cell-forming *Strecken.*

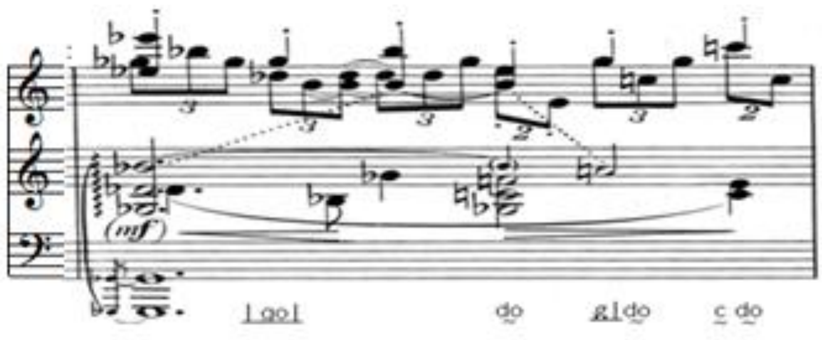
What about the other two sonorities? At first glance, the *Tonpunkte* contained in A-C-G appear to possess an element of symmetry: A and G are equidistant from the *Tonpunkt* D (which does not exist in this *Klang*, but could still be suggested as the centre according to Mayrhofer's theory) in Mayrhofer's tone space and certainly could imply D as *Kernpunkt* based on symmetry alone. The sonority A-C-G, however, fails to comply with another of Mayrhofer's criteria, which stipulates that the outer boundaries of the applicable *Strecke* (in this case, A and G) must enclose all existing *Tonpunkte* in Mayrhofer's Qq tone-space conceptualization. Mayrhofer's n-*Strecke* fulfills this criterion and can incorporate additional *Tonpunkte* to form major and minor triads, but the existence of *Tonpunkt* C (+2 Qq in Mayrhofer's tone space) in A-C-G violates this stipulation, because it exists outside the boundaries suggested by A (-1 Qq) and G (+1 Qq).

What about the last of the three sonorities being considered, F-C-G? The *Tonpunkt* C fulfills the criterion of acting as a symmetrical centre between F and G in Mayrhofer's tone-space. Also, the outer boundaries F and G enclose the other *Tonpunkt* (C) of this sonority. Nevertheless, Mayrhofer rejects this sonority as a cell-containing *Klang*. The reason for this rejection stems from his fundamental tenet that the only the interval of the major third (and the ino-*Strecke* as its derivative) can be *perceived* as a fundamental *Strecke* capable of forming "cells". F-C-G, which contains fifths (and seconds, depending on one's arrangement of the *Tonpunkte*) but not major thirds cannot be rationalized as a *Klang*. F-C-G constitutes an ambiguous sonority: its *Tonpunkte* could be fragments of more than a single n-cell or ino-cell in Mayrhofer's Qq space. F-C-G could theoretically represent the *Tonpunkte* -1 Qq, 0 Qq, and +1 Qq of a c^2 cell, but could also form the *Tonpunkte* -2 Qq, -1 Qq, and 0 Qq of an f^2 cell (other possibilities also exist). Ultimately, Mayrhofer's entire system rests on his assertion of a psychological aspect— the classification of the major third as an essential interval capable of forming cells— of musical perception.

Armed with the concept of *Multiklänge* and a thorough understanding of the *Tonpunkte* enclosed by n-cells and ino-cells discussed in Chapters 3 and 4, we can apply Mayrhofer's method to Schoenberg's *Gurrelieder* and the complex structures identified in the introduction. Figure 21 depicts measure 27 (the key signature contains three "flats") of the opening of Schoenberg's *Gurrelieder* along with an interpretation of the harmonic content using Mayrhofer's cell structures.[50]

[50] Although Mayrhofer does present further symbols which expand on the shorthand symbols for n and ino-cells to describe particular kinds of *Multiklänge*, Mayrhofer often refrains from using these symbols in his explanations in the texts and prefers to describe complex entities using the letter name+ numerical superscripts (e.g. a^3 or c^2) to describe the content of his cell species. For complex analyses such as those involving *Multiklänge* as in Figure 13, I will also use this superscript method and not introduce the shorthand symbols.

Figure 21. Measure 27 of Schoenberg's *Gurrelieder* analyzed using Mayrhofer's method of analysis



The first beat (first three quarter note values) of m. 27 projects a *Durmollklang* that forms the cell go^2 (Aß). The second beat of m. 27 contains the *Tonpunkte* C, F, B (Bß), and Do (E^{ß}) in addition to the stationary Fo (Gß) in the lowest voice. In this complex of *Tonpunkte*, C, Do (Eß) and Fo (Gß) form a do^3 ino-cell in which the centre, Do, can be heard along with the outer boundary points that delineate the cell. The *Tonpunkt* F does not form any n-cell or ino-cell with any other *Tonpunkte* heard at this point, but can be rationalized as a *Tonpunkt* that would constitute resolution of the *Leittonstrecke* Fo (Gß)-F as part of the resolution of the do^3 ino-cell and is thus contained in within the conceptualization of this ino-cell (do^3). Thus, the entire structure representing found on the fourth quarter note of the measure can be described as a variant of a do^3 ino-cell.

On the fifth quarter-note, the *Tonpunkte* A, F, C, and Do (Eß) appear over the stationary Fo (Gß), which represent the n-cell g^2 and the ino-cell do^3, thereby constituting a *Multiklang*. The *Tonpunkte* present on the sixth and final quarter note of the measure include *Tonpunkte* A, C, Do, and Fo and thus contains two separate ino-cells, c^3 and do^3. Mayrhofer's theory permits enharmonic reinterpretation of the ino-*Strecke* (tritone), thereby adding a further element of adaptability to his analytical method. In this case, the ino-*Strecke* A-Do could be reinterpreted as an ino-*Strecke* between Wi (Dƒ) and A which forms an ino-cell around M (Fƒ), while we could interpret ino-*Strecke* C-Fo as the ino-*Strecke* M-C. This forms an ino-cell around A as a^3.[51] In any case, Mayrhofer's identification of harmonic contents in terms of n-*Strecken* and ino-*Strecken* of such complex structures as found in m. 27 suggests an alternative mode of interpretation to chord classification by stacking thirds above a fixed root, which encounters considerable difficulty with such highly chromatic structures.[52]

The *Multiklänge* that contain cell nuclei separated by the distance of an n-*Strecke* represent a special case of cell multiplicity. Such cells contain a *Kernstrecke* (nuclear *Strecke* between two *Kernpunkte* as found in *Multiklänge*) which itself possesses cell-forming power, and forms higher-order cells defined by the midpoint between the two centres (*OH*, 188). The *Kernstrecke* between nuclei attains its ability to form cells because the cells that constitute the boundaries of the *Kernstrecke* are "psychologically equivalent values" due to their symmetrical position relative to the centre of this entity (*PdK*, 67). Thus, a realization of the *Multiklang* c^2e^2, through the *Tonpunkte* B (Bß)-D-M (Fƒ) forms a higher-order structure around D because these two cells are an equal distance removed from this *Tonpunkt.* The outer boundary *Tonpunkte* B and M also reflect this symmetry, as they are an equal distance of four Qq removed from D. *Multiklänge* such as c^2e^2 thus contain one further *Tonpunkt* (+/-4 Qq) in both directions from the

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[51] The complex criteria employed by Mayrhofer in selecting between these alternative interpretations of ino-*Strecken* involve the musical context on a much larger scale and will be explored in more detail in Chapter 10. From this short excerpt, it is impossible to unambiguously determine beyond doubt which interpretation applies here according to Mayrhofer's criteria.

[52] Mayrhofer views the traditional means of building a chord by identifying the lowest pitch-class and adding thirds on top of this root to complete triads, seventh chords, etc. as a highly artificial consequence of scale-based theory. His approach of identifying the major third as being constitutive of both major and minor triads bears more resemblance to Riemann's function theory, which acknowledges the possibility of the highest pitch-class constituting the root of a chord. Riemann's designation of chord roots in two parallel triads (e.g. C major/ a minor) identifies the two boundaries of Mayrhofer's n-*Strecke* as chord roots. Mayrhofer specifically discusses harmonic dualism and Riemann's theory in particular in relation to his own in *OH* in a separate section (142–150).

central *Kernpunkt* (e.g. D for c^2e^2) than would be found within the boundaries of an ino-cell (+/-3 Qq) with this *Kernpunkt* (D) and contain a total of nine *Tonpunkte.* We shall see in Chapter 6 chapters that this *Multiklang* constitutes the third level of *Tonpunkt* expansion from a *Kernpunkt* after the n-cell and the ino-cell.

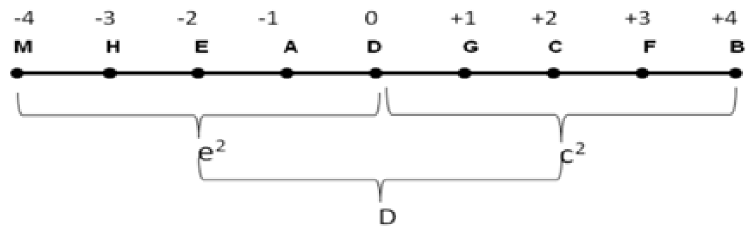
CHAPTER 6

Higher Level Organization: The N-Cell and the INO-Cell

The *Tonpunkte* enclosed by a *Kernstrecke* spanning a major third form the third type of cell, the N-cell, a structure which Mayrhofer also describes as *Hochzelle* ("higher-order cell"). The upper case N distinguishes this structure from the n-cell based on a single n-*Strecke*. Figure 22 provides a diagram of the N-cell about D. We see that the n-cell about D (note the lower case n) forms the middle of the span from M (Fƒ) on the left to B (Bß) on the right. But the diagram does not parse out an n-cell about D. Instead, it indicates with brackets two other n-cells– an n-cell around E on the left and an n-cell about C on the right– conjoined at D in the centre.

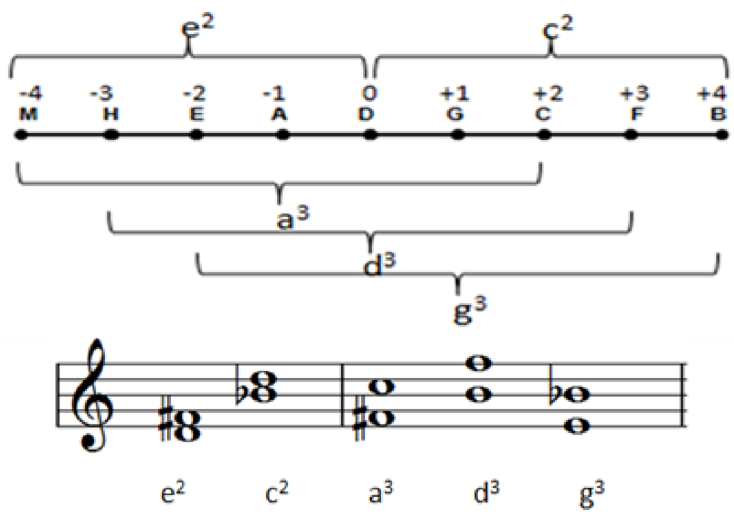
The diagram brackets together the *Kernpunkte* of the n-cells about E and C to form a higher order n-*Strecke*, whose elements are the n-cells c^2 and e^2 rather than *Tonpunkte* (C-E). The *Tonpunkte* enclosed by the outer boundary points (for example, c^2e^2 about a *Kernpunkt* D contains the *Tonpunkte* B and M as the outermost *Tonpunkte*) are all understood to be part of the *Hochzelle*; therefore, the D-*Hochzelle* contains all of the points enclosed by M and B. As is the case with the cells discussed in earlier chapters, the two *Strecken* that form the *Hochzelle* may be accompanied by their respective *Durpunkte* and/or *Mollpunkte*, which can all be located in between the *Tonpunkte* constituting the boundaries in Mayrhofer's *Tonraum* diagram.

Figure 22. The N-Cell (*Hochzelle*) around D



As in the case of n-cells and ino-cells, the inner *Tonpunkte* and the *Kernpunkt* do not have to actually sound in order for the centre of the *Hochzelle* to be understood as present as long as the outer boundaries are clearly defined through *Strecken*. Since the N-cell includes nine *Tonpunkte* and the realization of the outer boundaries requires a minimum of only four *Tonpunkte* (two *Strecken*, e.g. c^2e^2), a *Hochzelle* contains several *Tonpunkte* within its boundaries which do not necessarily have to be realized for a *Hochzelle* to be understood. Mayrhofer refers to the additional cells that are implied within the boundaries of the *Hochzelle* as *Füllzellen* (filler cells) which reinforce the image of such cells "aesthetically" but are not absolutely required for the cell to be understood in the spatial or "absolute" sense (*PdK*, 67–68). For example, the cells a^2 (*Tonpunkte* G-H) and g^2 (*Tonpunkte* F-A) would be considered *Füllzellen* within the D *Hochzelle* bounded by c^2e^2. The *Hochzelle* thus contains all of the points +/-4 Qq from the cell centre. Furthermore, as shown in Figure 23, the outer boundaries of a *Hochzelle* coincide with those of three adjacent ino-cells $a^3d^3g^3$ spatially. Thus, the *Hochzelle* around D could be realized by either the presence of c^2 and e^2 or the presence of the three ino-cells around A, D and G.[53]

Figure 23 Realizations of the boundaries of a *Hochzelle* (N-cell) around *Tonpunkt* D

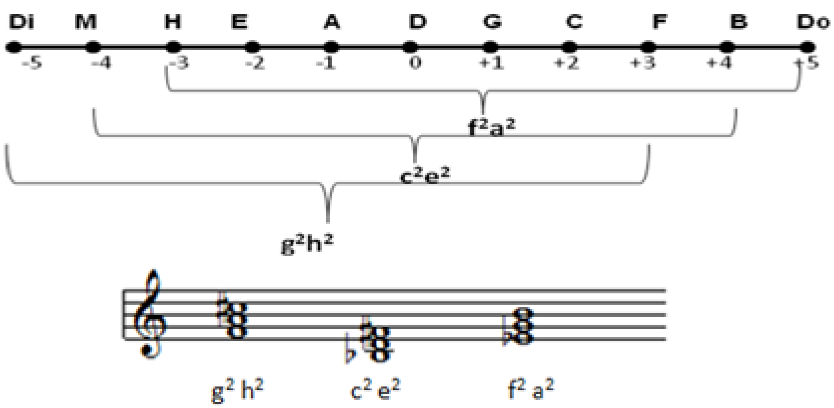


We can see from Figures 22 and 23 that the *Hochzelle* represents a symmetrical expansion outward from the cell nucleus to include all *Tonpunkte* within a distance of +/-4 Qq from the cell centre, D. To describe the expansion to +/-5 Qq (eleven *Tonpunkte*) Mayrhofer employs the concept of the INO-cell, a higher-level expansion of the ino-cell. Mayrhofer uses upper case to distinguish the INO-cell, a relation among n-*Strecken*, from the ino-cell, a relation among *Tonpunkte* (*OH*, 79). Figure 24 shows an example of an INO-cell around D and the *Tonpunkte* that form the boundaries of the associated lower level cells. To construct Figure 24, the tone space of Figures 22 and 23 has been extended one Qq in each direction to produce Di (Cƒ) on the left and Do (Eß) on the right. The INO-cell around D includes three overlapping

[53] According to Mayrhofer, even the two ino-cells a^3 and g^3 would suffice for an image of a D *Hochzelle* to be formed in terms of spatial apprehension. The *Tonpunkte* B-D-M are equivalent in terms of spatial apprehension to B-C-E-M (*OH*, 112).

Hochzelle elements as bracketed in the figure c^2e^2 as a *Hochzelle* about D, g^2h^2 as a *Hochzelle* about A, and f^2a^2 as a *Hochzelle* about G. The outermost *Tonpunkte* Di (Cƒ) and Do (Eß) form part of the boundaries of the *Hochzellen* around +/-1 (G and A). Underneath the tone space, the figure provides the three cell structures in musical notation.

Figure 24. The INO-Cell around D in Mayrhofer's tone space



Mayrhofer derives the label for each INO-cell from the particular rearrangement of the six cells that constitute the INO-cell. If we rearrange the four *Tonpunkte* that represent the outward limits as h^2 c^2 e^2 f^2 (with a^2, g^2 and the implied d^2 cells acting as *Füllzellen*) we derive a higher order ino-*Strecke* around D (H-F) creating an ino-*Kernstrecke* accompanied by the *Kernstrecke* around D (C-E). The INO-cell, which consists of six n-*Strecken*, evokes the central cell, d^2 in the imagination. Now the recursive structuring between the INO-cell and the ino-cell becomes clearer. The structuring of the ino-cell involves the *Tonpunkte* H-E-A-(D)-G-C-F. The structuring of the INO-cell involves the n-*Strecken* h^2 e^2 a^2 $(d)^2$ g^2 c^2 f^2 .

As shown in Figure 25, the INO-cell can also be parsed into a series of simple ino-cells rather than simple n-cells. The diagram brackets five overlapping ino-cells— e^3 a^3 (d^3) g^3c^3— in which the *Tonpunkte* of the central d^3 are implied by the outer ino-cells and are not absolutely required to be present for the INO-cell itself to be understood (*OH*, 75).

Figure 25. Realizations of the INO-cell about D through ino-cells

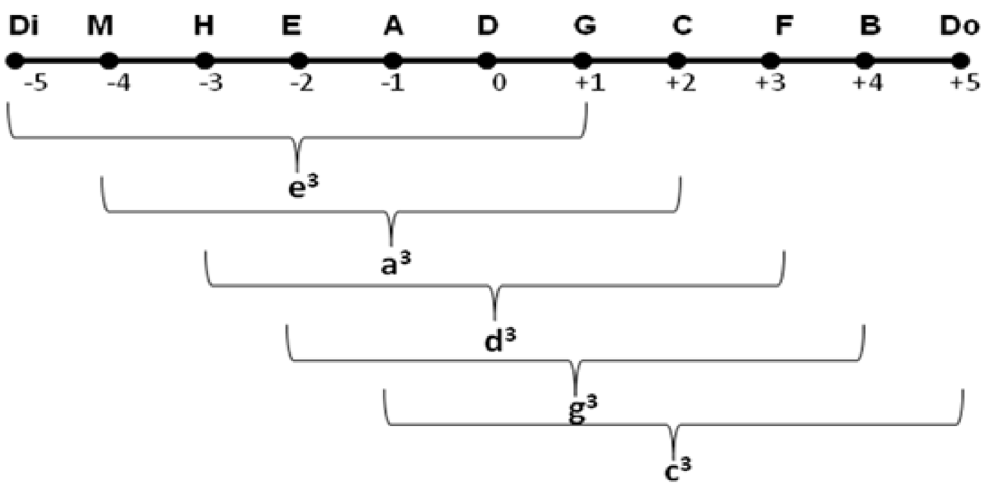
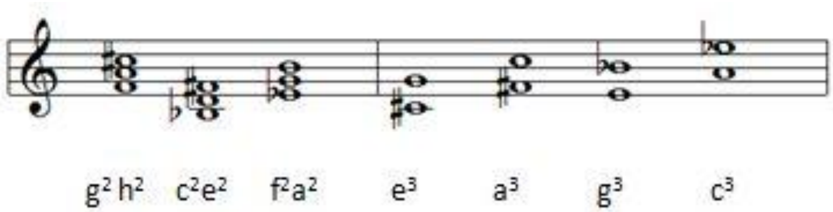


Figure 26 provides both realizations of the INO-cell about D. The left side of the figure lists the three structures that emerge from realizing the INO-cell as three N-cells. On the right, the figure lists the four structures that emerge from realizing the INO-Cell as four ino-*Strecken.*

Figure 26 Two Realizations of the D INO-Cell



A careful study of the figure shows that these two series of cells, both of which are sufficient to create an image of an INO-cell according to the spatial apprehension of the listener, do not contain all of the eleven *Tonpunkte* of the INO-cell. The first arrangement (using n-cells) does not include realization of the *Tonpunkte* C and E, whereas the second arrangement (using ino-cells) lacks *Tonpunkte* H and F. Nevertheless, Mayrhofer claims that as both of these arrangements contain real cells (either in the form of an ino-cell or an n-cell) constructed with outer boundary points required for an INO-cell (Di and Do), they are sufficient for the spatial apprehension to incorporate any missing *Tonpunkte* within the symmetrical expansion of an INO-cell around D.

Mayrhofer thus conceives the INO-cell according to the same principles that governed the n-cells and the ino-cells: all of these constructs (n-cell, ino-cell, N-cell, INO-cell) include the *Tonpunkte* encompassed by outer boundaries of the constructs as visualized in terms of Qq *Strecken* between them. The symmetrical arrangement of these outer cells then suggests a central *Tonpunkt* regardless of whether this *Tonpunkt* is realized as an actual sound. The remaining *Tonpunkte* understood to be present in between the outer boundary *Tonpunkte* contribute as *Durpunkte* or *Mollpunkte* to the cells suggested by the construct to provide the aesthetic quality of these cells and are thus not absolutely essential in making the construct intelligible as a representation in tone space.

CHAPTER 7

Cadences and Major-Minor Aesthetics

In discussing the four successive levels of cell structure and the *Strecken* required in order for these entities to be formed as a spatial representation in the listener, Mayrhofer is not concerned with any sort of functional harmonic progression. Rather, he is interested in demarcating different levels of tonality that he believes characterize music (Wetzel 1908b, 140–142). In order to look more closely at Mayrhofer's view of the interrelationship between these different levels of tonality, we will now turn to Mayrhofer's concept of cadence.

Although Mayrhofer's incorporates the traditional concept of cadence, his use of the term ultimately represents much more than a series of harmonic progressions. Other harmonic theories, including such influential late 19th century *Harmonielehre* texts by Richter (Richter 1901, 32) and Louis & Thuille (Louis & Thuille 1920, 81–82) regard cadences as the endings of musical phrases, which bring a degree of closure by reinforcing a particular key through prescribed harmonic progressions.[54] Function theory, advanced by theorists such as Hugo Riemann, conceives of cadential progressions as composed of the three primary triads while allowing for substitution of these triads through secondary triads in certain ways using concepts such as *Parallelklänge* and *Leittonwechselklänge*) (1893). The primary triads include the subdominant and dominant triads, which are built on chord roots either a fifth below or above a central tonic triad.

Mayrhofer agrees that the harmonic progressions defined by theorists such as Riemann through subdominant, dominant and tonic chords constitute a key-defining cadence and he uses

[54] See Louis & Thuille (1920). The German word for cadence by Louis and Thuille, who published the first edition of their influential treatise in 1907, is *Schluß* (close) (Louis & Thuille 1920, 12).

the same terms to describe a cadential progression very much along these lines (*OH*, 97). In place of Function labels, however, Mayrhofer employs the n-*Strecken* associated with the three major thirds F-A (g^2), G-H (a^2) and C-E (d^2). Let us recall that in Mayrhofer's view, the addition of the relevant *Durpunkte* or *Mollpunkte* constitutes aesthetic enhancements to n-*Strecken* that bring about C major or A minor from the n-*Strecke* C-E (*OH*, 75). In C Major/ A Minor, Mayrhofer therefore describes the cadence as a collection of three n-*Strecken*: G-H C-E F-A (a^2 d^2 g^2).

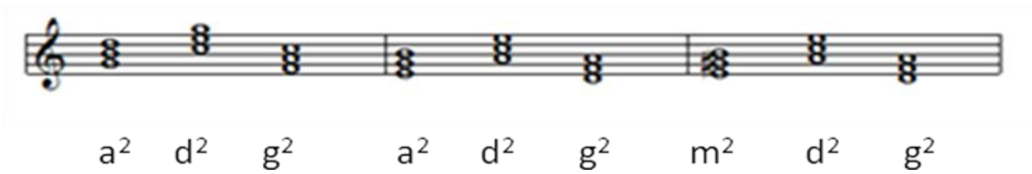
Mayrhofer has another way of describing the cadence. He notes that the two n-*Strecken* a^2 and g^2 include the outer limits of the relevant ino-cell (e.g. H-F [d^3]). He therefore equates the *Tonpunkte* that comprise a^2 and g^2 (viz. F-A, G-H) with the *Tonpunkt*-content of the ino-cell d^3 (in accompaniment with *Durpunkt* and *Mollpunkt*). A movement from any cell containing the *ino-Strecke* H-F resolving to C-E , with G and A as aesthetic supplements, can then also be seen as a cadential progression from an ino-cell inward to its core n-cell (d^3 to d^2), thereby linking the first two levels of cell structure (*OH*, 179). In some ways, this two-term definition of a cadence resembles the views of many scale-based music theories, in which tonal progressions are seen as movements between a tonic pole and a dominant pole. Mayrhofer's first description of the cadence interacts much more strongly with the harmonic tradition that considers the tonic as mediating an opposition between the subdominant and dominant. So in a sense, Mayrhofer's theory of cadences represents a way of seeing the bipolar cadential theory of scale-based approaches and the meditational cadential theory of harmonic approaches as two sides of the same coin.

Common to both of his approaches to cadences is the principle of symmetry. In the three-term cadential model (dominant, tonic, and subdominant), Mayrhofer describes cadential resolutions as the inward movement of two outer n cells (a^2 and g^2) to their centre (d^2) according to Qq *Strecken*, and depicts cadences as three adjacent n cells (e.g.: a^2:d^2:g^2). In his two-term cadential model (movement from ino-cell to n-cell), a cadential progression moves inward from *Tonpunkte* that lie +/-3 Qq from the *Kernpunkt* (H-F) to the *Tonpunkte* that lie +/-2 Qq from the *Kernpunkt* (C-E). In a sense, the central n-cell becomes a centre of gravity (*Gravitationszentrum)* and the dominant and subdominant, which include the outer points of the ino-cell, function as immediate extensions from this centre (*PdK*, 67).

This process also applies equally to cadences of major and minor keys: the same cells that form the basis of a cadence in C major do so in A minor as well. Mayrhofer claims that the entire *Durmollklang* exists as an representation (*Vorstellung*) in the soul of the listener upon hearing the tonic of any cadential resolution regardless of whether a minor or a major chord is actually heard (*OH*, 36–37). According to these considerations, the most commonly employed minor cadence, which utilizes a major chord on the root of the dominant, does not satisfactorily establish a key. The *Strecke* thus produced by the major dominant cannot serve as an n-*Strecke* that marks the position of the dominant chord relative to the other two *Strecken* with which it is to form a cadence. The n-*Strecke* E-Ki (E-Gƒ) constitutes an m^2 cell which cannot occupy the position of the dominant relative to d^2 (C-E) and g^2 (F-A) because the three cells used to construct the cadence do not constitute a symmetrical expansion from the centre (*PdK*, 72).[55] Figure 27 depicts three cadences: the major cadence, the pure minor cadence and the mixed minor cadence of which Mayrhofer disapproves.

[55] Mayrhofer reserves a particularly scathing expression for this type of "minor" cadence and labels it as a `*Mollkadenzdrache*`` (minor-cadence dragon!)

Figure 27. Major, minor, and mixed minor cadences

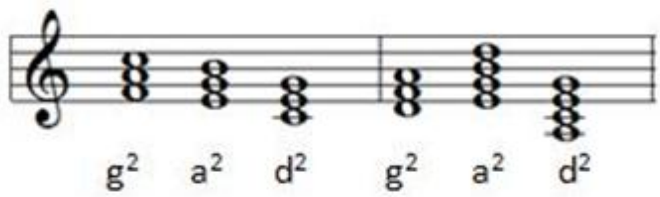


major cadence **minor cadence** **mixed cadence**

Mayrhofer’s critique of the mixed minor cadence will strike those schooled in scale-based harmonic theory, whose idea of the normative minor is the harmonic minor, as strange. Yet it engages strongly with the views of the German harmonic tradition, which conceives of four (not two) tonal systems: pure major, pure minor, mixed minor (minor with a major dominant) and mixed major (major with a minor subdominant). Riemann, the dominant figure in the German harmonic tradition, considered the mixed minor progression as an artificiality derived from the pure or natural minor cadence (1906, 16–18). The mixed major tonality, described by Moritz Hauptmann, among others, which contains a minor subdominant, major tonic and major subdominant similarly fails to satisfy Mayrhofer’s criteria of symmetry (1853, § 43).

Although Mayrhofer rejects the both the mixed major and the mixed minor forms of cadences described above, his view that major and minor triads around a n-*Strecke* constitute aesthetic variants of the same spatial expansion permits progressions that do not constitute cadential progressions in either scale-based or harmonic theories (*PdK*, 73). Figure 28 provides examples of such additional permitted cadential progression.

Figure 28 Additional Cadential Progressions permitted by Mayrhofer



Both of these progressions contain the identical cell content (g^2:a^2:d^2) as the conventional cadential formulae indicated in Figure 27 but also possess *Tonpunkte* that create aesthetic variants of these cells to create progressions not accepted as cadences according to other harmonic theories. In the first progression, the essential *Tonpunkte* G and H are accompanied by the *Tonpunkt* E to create an E minor triad that functions as the dominant of C major. In the second progression, an E minor 7th chord built around the G-H n-*Strecke* resolves to an A minor 7th built around the n-*Strecke* C-E rather than a major or minor triad.

Clearly, Mayrhofer considers a progression containing a mixture of major triads, minor triads, and minor 7th chords to constitute a progression fundamentally identical to one containing only major or minor triads. As a result, major and minor triads are not the constitutive components of distinct polar tonalities in the same sense as described by harmonic dualists, but are aesthetic variants that can intermingle in every conceivable combination at any time.[56]

Although minor and major triads do not form two distinct and opposite key systems that together comprise tonality as described by harmonic dualists such as Riemann, Mayrhofer does offer an explanation for the different aesthetic qualities of "major-ness" (*Durität*) and "minor-ness" (*Mollität*) (*OH*, 132). He considers any addition of a *Tonpunkt* to an n-*Strecke* that is

[56] The music theorists Hermann Erpf (1927, 11) and Daniel Harrison (1994, 19) have acknowledged Mayrhofers' contribution in developing this principle of *Dur-Moll-Durchdringung* (major-minor permeation) as an apt characterization of later 19th century music.

contained within the overtone series (*Automatik*) of the lowest note of that n-*Strecke* (e.g. C in C-E) to possess major quality (169). The addition of G to the n-*Strecke* C-E constitutes its *Durpunkt* and has major quality. Similarly, Mayrhofer considers the addition of a *Tonpunkt* that does not appear in the overtone series to add a minor quality to the resulting entity. Therefore, addition of the *Tonpunkt* A, which does not appear in the overtone series of C, to C-E, results in the addition of the *Mollpunkt* to C-E and increased minor-ness. The addition of both A and G to C-E creates a sonority that has a degree of major-ness as well as a degree of minor-ness. To Mayrhofer, major and minor represent two different principles: major constitutes the quality of presence (sounding of *Tonpunkte* present in the overtones series increases the major-ness of a given fundamental), while minor represents the idea of absence (*Nichtvorhandensein*) (169–170).

Mayrhofer expands the concept of major-ness and minor-ness beyond the level of the chord to the various cellular levels. Consider the ino-cell d^3 (*Tonpunkte* H E A D G C F), which contains a *Kernpunkt* D and an n-*Strecke* built on *Tonpunkt* C, which acts as the fundamental tone (*Grundton*) of the associated overtone series with this cell. Mayrhofer contends that the tonic and dominant *Strecken* C-E and G-H(B) provide a quality of majorness to the entity, whereas the subdominant n-*Strecke* F-A has a minor quality with respect to the *Kernpunkt* D (and the fundamental *Tonpunkt* C). Mayrhofer applies major and minor to all levels of cells and develops a procedure for determining whether the addition of a given *Tonpunkt* as an aesthetic variant increases the degree of either major-ness or minor-ness present, a procedure that employs the principle of *Adjektion* (*Anwerfung*) described in Chapters 4 and 5.

Let us recall that Mayrhofer considers two different types of *Adjektionen* to be responsible for adding the *Tonpunkte* required for the expansion of an n-cell to an ino-cell. For example, i-*Adjektion* adds the *Tonpunkt* H to the *Durpunkt* (G) of initial n-*Strecke* C-E. O-

Adjektion adds the *Tonpunkt* F as a projection to the *Mollpunkt* (A) of the cell. In combination, these adjections realize the seven *Tonpunkte* of the d^3 ino cell.

From these observations, Mayrhofer generalizes that any *Tonpunkt* expansion that results from i-*Adjektion* increases the degree of major-ness of the sum of any construct present, while the addition of any *Tonpunkte* obtained through o-*Adjektion* increases the overall minor-ness (133–134). Therefore, the addition of *Tonpunkte* H(B), M (Fƒ),Di (Cƒ), and so on, to an n-*Strecke* C-E (this process could occur through realizations of *Strecken* such as G-H, D-M, A-Di) increases the major-ness present with regard to the original d^2 cell. Similarly, realization of *Tonpunkte* F, B (Bß), Do (Eß), and so on) to a central C-E *Strecke* increases the minor-ness (and results in an expansion to cells F-A, B-D, Do-G, and so on).[57]

According to Mayrhofer's conception of Qq tone space (Figure 17), major and minor qualities can be associated with expansion of *Tonpunkte* in two different directions. I-*Adjektionen* result in the realization of *Tonpunkte* in the "negative" direction to increase the degree of major-ness, whereas o-*Adjektionen* result in the realization of *Tonpunkte* in the positive direction to increase the degree of minor-ness. In a way, major and minor can still be viewed as opposites: not in the sense of constituting exclusive *Tongeschlechter* (tonalities), but rather as projections in opposite directions in tonal space (134). Through his concept of major and minor, Mayrhofer deviates from the concepts developed by Riemann and other harmonic dualists. Instead of than eliminating dualism altogether, however, he transforms the opposition of major and minor into an aesthetic principle.

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57 The exact degree of the major and minor quality depends on the precise *Tonpunkte* present. If the cell A-Di(C) is realized with respect to C-E as the central d^2 cell, the *Tonpunkt* A will increase the minor quality (as *Mollpunkt*) while Di simultaneously increases the major quality of the cell. Mayrhofer considers the intricate interplay between the many different degrees of major-ness and minor-ness possible to be the source of much aesthetic fullfillment (*OH*, 135).

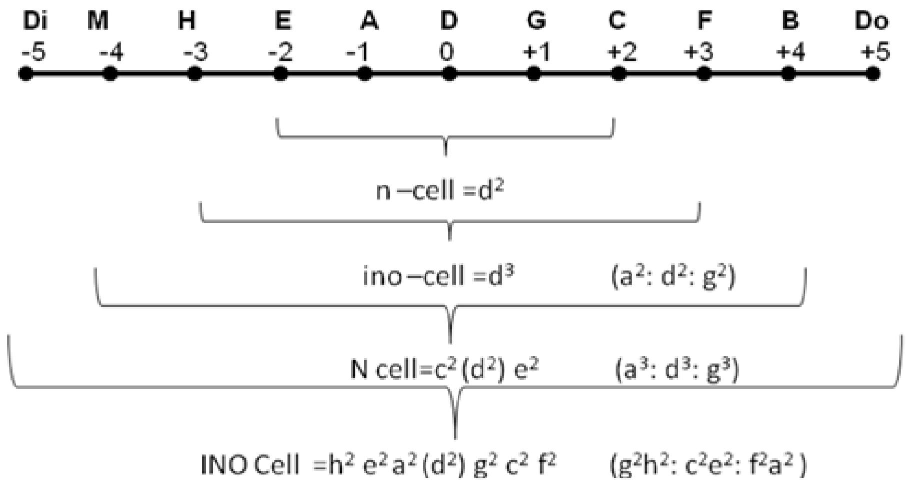
CHAPTER 8

Higher Level Cadences

Mayrhofer's theory of cadences as the resolution of an ino-cell to its relevant n-cell still shares many similarities with the concept of cadence to the harmonic entities described by theorists such as Riemann (and Rameau). Mayrhofer, however, also claims such a cadential relationship in higher levels of tonality, a fact which he claims had been previously overlooked by established music theory (*OH*, 43–44). As described above, Mayrhofer's definition of cadence describes a relationship of expansion-contraction between the contents of the ino-cell (*Tonpunkte* +/-3 Qq from the cell centre) and the contents of the n-cell (all *Tonpunkte* +/-2 Qq from the cell centre). Mayrhofer claims that similar cadential relationships exist between all sets of adjacent cell structures that he describes. Thus, a cadential relationship exists not only between n-cells (+/-2 Qq) and ino-cells (+/-3 Qq), but also between ino-cells (+/-3 Qq) and N-cells (+/-4 Qq), as well as between N-cells (+/-4 Qq) and INO-cells (+/-5 Qq) (*OH*, 44–45).

Figure 29 shows the four nested levels in Mayrhofer's tone space listing the contents of each of these four cells in two different ways. The first method describes the content as a collection of n-cells (or a single ino-cell in the case of d^3) The second method, (shown in brackets on the right hand side of the figure) reveals that the ino-cell, the N-cell (*Hochzelle*), and the INO-cell can each be realized as three cell structures that lie next to each other in Mayrhofer's tone space diagram (for example, the three cells a^3:d^3:g^3, which realize an N-cell about D, constitute three neighbouring ino-cells).

Figure 29 The Four Nested Levels of Cells as Cadential Relationships



According to Mayrhofer, each of the three sets of cell groups shown in brackets in the figure constitutes a cadential relationship. The most elementary cadence occurs at the level of the ino-cell and involves resolution of the two outer cells (a^2 and g^2 when the *Kernpunkt* is D), Together, they determine the contents of an ino-cell (d^3), for the central n-cell (d^2). Mayrhofer describes this cadence, which equals the traditional cadence accepted by music theory, as the small cadence (n:n:n) (*OH*, 57). The second cadence, known as the ino-cadence (ino:ino:ino) (63), involves the movement of a^3 and g^3 to a central ino cell, d^3. Finally, the *große Kadenz* (Great Cadence [N:N:N]) involves the resolution of two N-cells (g^2h^2 and f^2a^2) to a central N cell (c^2e^2) (63). In each of the three cadential levels (except the resolution to an n-cell, which cannot resolve any further) the goal of resolution at the centre in itself constitutes the next lowest cadential level, thereby linking between all of the levels of cells.

Mayrhofer's cadential resolutions describe a general contraction from the outer boundaries of a cadential level to its innermost cells rather than specific harmonic progressions.

The only requirement for a cadential progression is that realization of outermost cell structures precedes the realization of the innermost cell. Figure 30 gives several examples of cadential resolutions in the form of hypothetical harmonic progressions. Figure 30(a)–(c) shows three of the possible ways the most elementary form of cadence can be realized. Resolution can occur from an ino-cell to its n-cell components (d^3:d^2 in Figure 30[a]) or through inward movement of the *Seitenzellen* to a central cell (g^2 and a^2 to d^2 in Figure 30[b]). Mayrhofer does not specify any particular progressions through which this must occur. Hence, the rather unusual progression in Figure 30(c) (a^2:g^2:d^2) could be categorized as a cadential "progression" in the same sense as those shown in Figure 30(a) and 30(b) as well as the aesthetic variants of these three cells discussed in the previous chapter.[58]

Figure 30(d) shows a possible realization of an ino-cadence about D (a^3 and g^3 to d^3). The *Tonpunkte* constituting the ino-*Strecken* a^3 (*Tonpunkte* M and C, beat 2) and g^3 (*Tonpunkte* E and B, beat 3) both resolve to the *Tonpunkte* of their constitutive n-cells. The ino-*Strecke* M-C eventually resolves to *Tonpunkte* G (beat 3) and B (beat 4), while the ino-*Strecke* E-B of beat 3 resolves directly to F-A on beat 4. This realization represents the most direct form of a cadential "progression" of an ino-cadence about *Tonpunkt* D, as all three required components are realized in succession. Mayrhofer's higher cadential levels are less likely to occur as successive chords and may instead unfold over a greater time interval than indicated by this example.

[58] Other than the example of a cadential progression from an augmented sixth chord, which will be described in the next section, Mayrhofer does not provide concrete examples of cadential progressions, but does mention that the most convincing progressions employ good voice-leading practices of individual parts (*OH*, 77).

Figure 30. Examples of possible progressions for three cadential levels

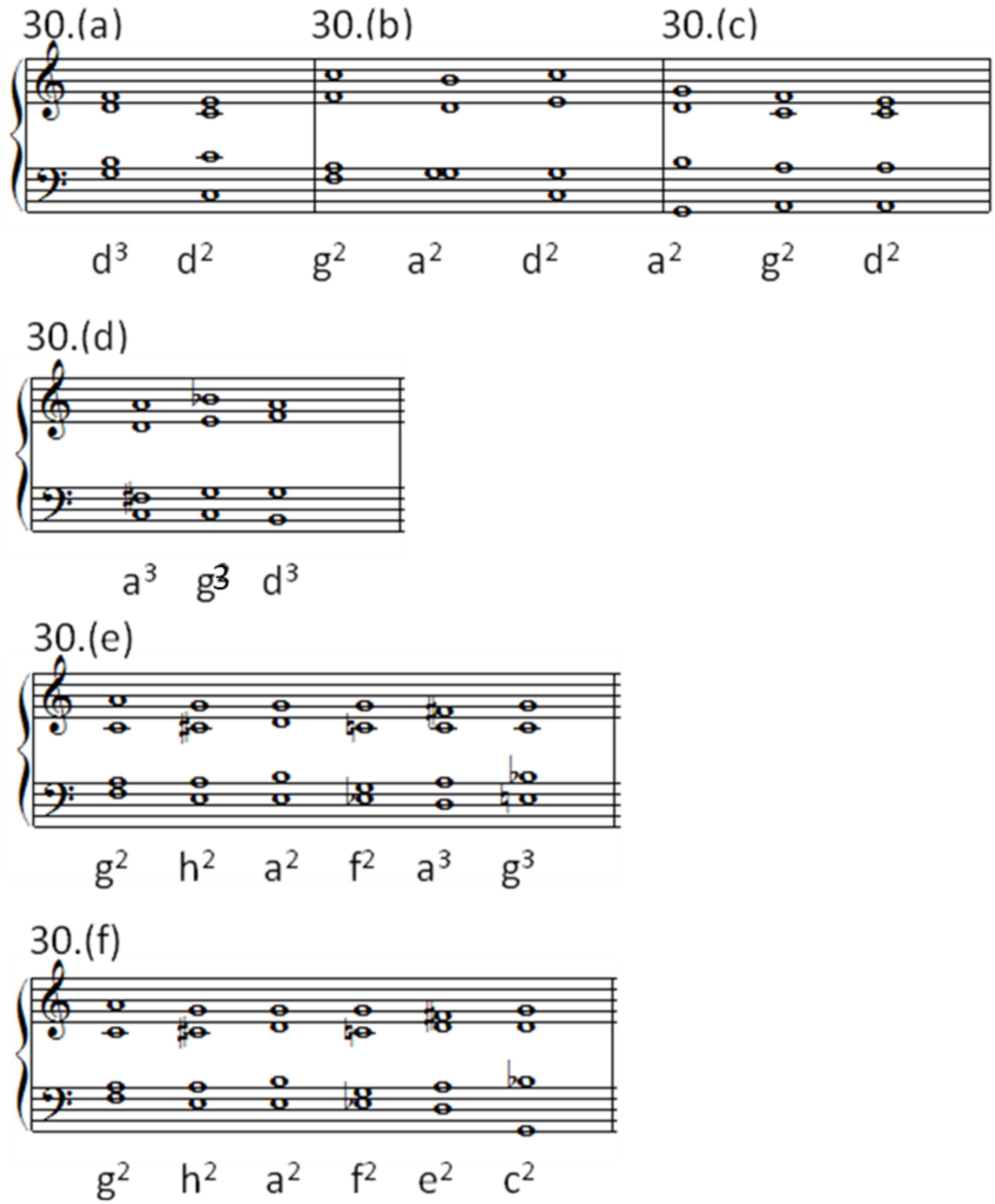


Figure 30(e) depicts the third cadential level, the *große Kadenz* around D. In this example, the four outer boundary n-cells appear in succession as g^2 (F-A), h^2 (A-Di), a^2 (G-H), and f^2 (Do-G) prior to reaching a^3 and g^3 on beats 5 and 6. This progression represents an inward movement of the outer boundary points (Di and Do) by a value of one Qq to M and B. Direct resolution to an augmented triad c^2e^2 (B-D-M) is as valid as the resolution presented in Figure 30(e), but is comparatively rare in music, although c^2e^2 can also be realized as successive chords as shown in Figure 30(f).

Although the structures presented in Figure 30 could conceivably function as cadential progressions of the respective cadential levels around *Tonpunkt* D, one should point out that Mayrhofer himself often uses the term cadence loosely to describe the *Tonpunkte* that comprise the different cellular levels rather than specific progressions (57). Thus, the examples shown in Figure 30 should be interpreted as possible candidates among a vast multitude of progressions rather than normative cadential formulae.

The cadences described above represent only one aspect of the close interrelationship between the various cell levels. Mayrhofer also discusses a process of *Vorstellungen* in the mind of the listener that connects the INO-cell, the highest structural level discussed so far, to all three subordinate cell levels. Mayrhofer attempts to demonstrate that each of the *Strecken* comprising the lower cell levels that are encompassed by an INO-cell about D (i.e. the n-cell d^2, the ino-cell d^3 and the N-cell c^2e^2) arises as a representation (*Vorstellung*) when the six n-*Strecken* of an INO cell are realized and then retained in the imagination. As a result of these *Vorstellungen*, these lower level species can be considered to be present within the INO-cell (*OH*, 58–60).

The INO-cell around D realizes the following *Strecken* in the imagination of the listener: g^2, h^2, c^2, e^2, f^2, and a^2. According to the spatial Qq given earlier, the two cells a^2 and g^2

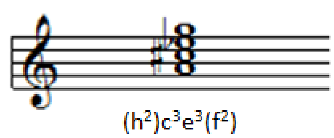
represent values of +1 Qq and -1 Qq, respectively, from the centre D. This collection of cells realizes an ino-cell, d^3 which contains the ino-*Strecke*, H-F. As we saw in Chapter 4, the ino-*Strecke* contains within it the representation *(Vorstellung)* of its resolution. Therefore, the mere presence of a^2 and g^2 evokes the central cell d^2 (*OH*, 58) The presence of a^2 and g^2 in the original INO-cell thus contains both the actual *Tonpunkte* involved in d^3 as well as a suggestion of the *Tonpunkte* of d^2 (C and E).

Mayrhofer proceeds to demonstrate that the d^2 and d^3 cells, in combination with the six *Strecken* of the INO cell about D, produce the *Strecken* required to generate the cell level not realized in cadential form : the N-cell as a^3:d^3:g^3. Mayrhofer has already claimed d^3 as another way of describing the content of a^2 g^2. Since Mayrhofer believes that d^3 automatically contains its resolution to d^2, d^2 in turn plays a role in further mental representations. The imagined d^2 (0) cell now combines with the already-existing c^2 (+2) cell to evoke a g^3 (+1) cell as a centre between them in a similar process through which actually-sounding a^2 and g^2 resulted in the realization of d^3 Figure 29 provides an overview of *Tonpunkte* and their relationship to various cell levels. Similarly, e^2 and d^2 combine to suggest a^3 as a centre, thereby completing the conceptualization of the three ino-cells a^3:d^3:g^3 required to depict the N cell c^2e^2 in its cadential form (*OH*, 58–59). Mayrhofer believes that such spatial representations (*Vorstellungen)* reveal the inner organic link among all four levels of cells: the representation of a common centre exists in all four levels, with the strength of the representation of the central cell becoming more "delicate and indistinct" (*zart und duftig*) in the higher cell levels (36).

The linkage of the spatial *Vorstellungen* among all four cell levels has implications for tonality and cadential progressions. Cadential progressions from extended structures such as INO-cells need not necessarily proceed stepwise through all cadential levels stepwise to be comprehensible (60). A resolution of the INO-cell level to its N-cell level could theoretically constitute a complete cadential resolution, since the N-cell contains the representation of the central n-cell within it (60). Thus, an entire cell level other than the n-cell could conceivably function as tonic (60). The senses may prefer a cadential resolution to the innermost level (n-cell), but the spatial *Vorstellung* considers such a higher level cadential resolution satisfactory. Accordingly, the resolution of a cadence therefore need not constitute a single chord, but could, for example, be comprised of a seven *Tonpunkt* ino-cell (42–43).

As an example of the practical implications of cadential levels, Mayrhofer considers the phenomenon of augmented sixth chords. He uses the example of A-Cƒ-Eß-G, provided in Figure 31 (*OH*, 110–112).

Figure 31. Augmented Sixth Chord



This structure consists of the cells (h^2), realized as A-Cƒ; c^3, realized as A-Eß; e^3, realized as Cƒ-G; and (f^2), realized as Eß-G. The structure represents the outermost points of an INO-cell around D. According to the conventional resolution, this chord could resolve to the *Tonpunkte* A-D-M, thus undergoing a resolution to e^2. Mayrhofer points out that resolution to c^2 (*Tonpunkte* B-D-G) represents an equally valid resolution. Neither progression, however, resolves both ino-cells present, which can be carried out by movement of the augmented sixth chord to the augmented triad containing *Tonpunkte* B-D-M, c^2e^2, — the only resolution in Mayrhofer's sense of the word. Further resolution at the level of the ino-cadence could be carried out from the *Multiklang* containing *Tonpunkte* B-C-E-M (a^3g^3), which possesses the same outer boundaries as B-D-M and is conceptually equivalent to the resolution B-D-M, to G-H, F-A (a^2g^2), which in turn resolves to d^2 at the level of the smallest cadence (*OH*, 112). Figure 32 provides the entire cycle of resolutions from the augmented chord representing an INO-cell to the final resolution to a simple n-cell around D. The original augmented sixth chord, shown on the far left, represents the level of the INO-cell. The second structure from the left, an N-cell, is equivalent to the middle structure (a^3g^3) from which further resolution can proceed to the fourth species from the left (ino-cell a^2g^2).

Figure 32. Resolution of an Augmented Sixth Chord through three Cadential Levels

As illustrated in the discussion of the augmented sixth chord in Figure 31, the resolution thus does not refer to an absolute stability of a species, but to its relative stability in comparison to its unresolved state. The augmented triad— traditionally considered a highly dissonant altered form of the major triad — can function as a cadential resolution in the same sense as a major or minor triad. Mayrhofer's definition of cadences does not rest on the identification of specific qualities possessed by particular acoustic phenomena and thus has little in common with theorists such as Helmholtz, whose musical definitions are generally derived from acoustic observations.

Mayrhofer thus expands the traditional scope of the cadence and fuses the term to his conception of music as a series of *Strecken*-expansions in his tone space. This definition of cadence is not equivalent to a specific description of the resolution of tritones to major thirds, but a fundamental process of symmetrical *Tonraum* expansion and contraction.

Interestingly, Mayrhofer makes the principle of the cadence his model for the relationship between consonance and dissonance (*OH*, 167–168). To Mayrhofer, consonance and dissonance are not defined by particular harmonic species and any specific acoustic properties which these might possess, but exist as contrasts between greater or lesser degrees of tension. Such a relationship can best be found in the resolution of cadences (180–181). The resolution of subdominant/ dominant to a central tonic not only describes a cadential progression found on multiple levels, but also mirrors the relationship of tension and repose that characterizes the interaction between consonance and dissonance.

CHAPTER 9

The Determination of Expanded Tonality: *Setzung* and *Basis*

After having examined Mayrhofer's four levels of cells (n-cell, ino-cell, N-cell and INO-cell) and their relatedness through cadences, we are now able to discuss his concept of "expanded" tonality, a key goal of his endeavours. Mayrhofer's demonstration of the interconnectivity between the four cell levels around the central conception of a key centre forms the basis of his argument that a single key is comprised of more than the 7 notes of a major key. He believes that music that contains modulations (even for extended periods of time so that these modulations cannot be considered temporary tonicizations of related key areas) to closely-related keys can be heard as belonging to a single tonal centre throughout. An ino-cell containing seven diatonic *Tonpunkte* may be sufficient to delineate the boundaries of strictly diatonic works such as the *Valse Noble* No.10 by Schubert examined earlier in Figure 12, but is clearly insufficient for defining the boundaries of key of more complex music in Mayrhofer's sense of expanded tonality. In fact, Mayrhofer claims that the vast majority of musical compositions since the days of Bach are conceived with such an expanded view of tonality in mind (*OH*, 63).

To further explore Mayrhofer's notions of tonality, let us first examine the opening eight measures of Schumann's well-known *Träumerei*, the seventh piece from his *Kinderszenen*, op. 15. Figure 33 provides the score along with a description of the cell content in a purely spatial sense, that is, without aesthetic additions such as *Durpunkte* and *Mollpunkte*.

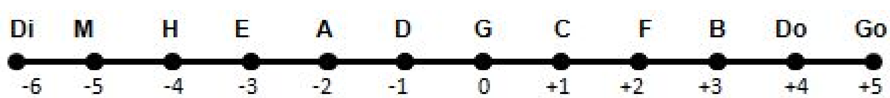
Figure 33 Realization of “Cells” in Schumann’s *Träumerei*, mm. 1–8

The first four measures of the piece stay completely within the confines of the seven *Tonpunkte* of an ino-cell around G. To Mayrhofer, passing notes, such as the E in the first measure, result in the realization of distinct cells (for instance, d^2 in m. 1 or in m. 2, beat 3). The *Tonpunkte* on the second and third beats of m. 3 (C,E,B,G and D) contain three cells: a central ino-cell, g^3, along with two n-cells, d^2 and c^2, which is suggested by the succession of *Tonpunkte* B to D in the right hand on beat 3. These *Tonpunkte* thereby generate $(d^2)\ g^3\ (c^2)$: an ino-cell around g^3 with *Seitenzellen* around both its *Durpunkt* and *Mollpunkt*. *Tonpunkt* A does not figure into the construction of this ino-cell.

Although the first four measures do not describe more than the seven *Tonpunkte* that constitute an ino-cell (realization of the neighbouring cells around D, G and C with G as centre), mm. 5–8 involve an expansion to *Tonpunkte* beyond these limits. The pitches A and Cƒ on the second beat in the left hand of m. 6 create an n-cell around *Tonpunkt* H, h^2. In fact, Cƒ, if considered to be retained by the *Vorstellung* beyond its actual sounding, forms part of an e^3 cell that occupies the remainder of m. 6. Schumann introduces a b^2 (bß^2) cell along with its *Mollpunkt*, F, on the second beat of m. 7. The boundaries of the b^2 cell include the *Tonpunkte* Go (Aß) and C.

By relating the *Tonpunkte* to the Qq diagram presented in Figure 17, one can see that Schumann has already incorporated a span greater than even the eleven *Tonpunkte* encompassed by the INO cell in these two measures alone. Figure 34 provides an illustration of the *Tonpunkt* expansion of the first eight measures of Schumann's *Träumerei* as seen from *Kernpunkt* (cell centre) G. According to Figure 34, the *Tonpunkt* Di (Cƒ) in m. 6 represents a value of -6 Qq, whereas *Tonpunkt* Go of m. 7 has a value of +5 Qq. The diminished seventh chord, which creates the *Multiklang* a^3c^3, further reinforces the expansion in tone space beyond the limits of strictly diatonic F major (cell formation around *Kernpunkt* G) suggested by the first four measures.

Figure 34. Expansion around G in Mayrhofer's Tone Space



Despite these expansions beyond the limits of F major tonality, the eight-measure excerpt can still be related to a single centre throughout without recourse to concepts like "tonicization" and "applied dominants" to account for the chromatic elements. All structures in the music are creatures of a tonal expansion around a single tonal centre, which appears to be G. Mayrhofer claims that the development of music over a period of centuries to routinely incorporate *Tonpunkte* that exist well beyond the boundaries of a diatonic major key has heightened the ability of the listener to retain *Vorstellungen* of a tonal centre over longer stretches of time while simultaneously extending the boundaries of tonality (Mayrhofer 1908b, 191–192). Mayrhofer's version of expanded tonality thus contrasts with other approaches, including Riemann's function theory, which attempts to relate all tonal phenomena to the three "pillars" of harmony of tonic, dominant and subdominant (Mickelsen 1977, 4), or, the theory of modal mixture, which regards all chromatic structures as modified diatonic scale degree harmonies. In the analysis of *Träumerei*, even the INO-cell level does not contain the full range of *Tonpunkte*. If passages as brief as the first eight measures of *Träumerei* should be understood according a concept of expanded tonality, then further concepts to rationalize such additional *Tonpunkte* are required.

To introduce his discussion of expanded tonality, Mayrhofer introduces the concept of *Basis*. *Basis* refers to the central cell that functions as the tonic of an extended passage (*PdK*, 70). In the world of expanded tonality, in which more than the seven *Tonpunkte* of the ino-cell are realized, the *Basis* corresponds to the central ino-cell. For example, if the d^3 ino-cell is to act as *Basis*, the passage must realize at the very least the *Hochzelle* c^2e^2 (*PdK*, 70; *OH*, 207–208). Schubert's *Valse Noble* No. 10 from Figure 12, which contains only the seven *Tonpunkte* that comprise the cells $d^2g^2c^2$ (g^3), possesses *G-Basis*, but in this purely diatonic piece, the *Basis* would be g^2. The analysis in Figure 11 provides an example. Any *Klang* that realizes the *Basis* of a particular series of cells by depicting its centre symmetrically is described by Mayrhofer as a *Cent-Klang* in *PdK* (71). So, a *Klang* that realizes the N-cell c^2e^2 would constitute a *Cent-Klang* in a passage containing the relevant nine *Tonpunkte* for *D-Basis* that consists of the cell d^3 because it clarifies the position of D as the centre of an extended structure in which the *Basis* can function as tonic through realization of its outer boundary points. For Schubert's *Valse Noble* No. 10, d^2c^2 functions as an effective *Cent-Klang*.

From the concepts of *Cent-Klang* and *Basis*, Mayrhofer introduces the concept of *Setzung* (setting). *Setzung* is the particular *Tonpunkte* that bring the first realization of *Basis* (through a *Cent-Klang*) in a given piece (70). Although some works of Western music, especially those written prior to 1600, do not require anything beyond the ino-cell for such a *Setzung* to occur (such as Schubert's *Valse Noble* No.10), a *Klang* such as the ino-cell will fail to provide a sufficient *Setzung* for the majority of music written since Bach because these works contain *Tonpunkte* that transcend the boundaries of an ino-cell (*OH*, 101). As we saw in the analysis of Schumann's *Träumerei*, much common practice music demands more expansive *Setzungen* in order to describe the boundaries of their tonality (98).

PdK and *OH* provide somewhat different regulations about the capacity of sonorities to constitute *Setzungen*. In *PdK*, a symmetrical realization of the limits of an N cell suffices to provide a *Setzung* and establish a *Basis*. Thus, e^2c^2 (B-D-Fƒ), which contain outer boundary *Tonpunkte* B and M at a distance of +/-4 Qq from the cell centre D, or h^2f^2 (A-Cƒ- Eß-G), which contain outer boundary *Tonpunkte* Di (Cƒ) and Do (Eß) at a distance of +/-5 Qq from the cell centre D, constitute D-*Setzung* (*PdK*, 76–79). Species such as $a^3c^2e^2$ (C-D-Fƒ−Bß) or $c^2e^2g^3$(D-E- Fƒ−Bß) described earlier in connection with Figure 23, in which the ino-cells around A and G are *Füllzellen* between the outer limits of c^2 and e^2 and therefore do not alter the overall symmetry of the outer boundaries provided by c^2 and e^2, also constitute D-*Setzung*. However, sonorities that contain such *Tonpunkte* as Ki (Gƒ), D, B (Bß) and M (Fƒ) to form $h^3c^2e^2$ would not clearly define a central cell in the sense of Figure 23 and could not function as D-*Setzungen* the way $a^3c^2e^2$ or $c^2e^2g^3$ can (93).

In *OH*, however, Mayrhofer reserves the term *Setzung* for the realization of an INO-cell (e.g. $g^2h^2c^2e^2f^2a^2$ or F-A-Cƒ−Bß-D-Fƒ−Eß−G−B for D-*Setzung*) rather than an N-cell.[59] To Mayrhofer, *Setzung* provides a sense of stability and clarification of the position of the *Basis* as the centre in the context of expanded tonality than is attained specifically through the enclosure of eleven distinct *Tonpunkte* in Mayrhofer's tone space through realization of the INO-cell (216-217).[60] Only an expansion to the level of the INO-cell (with its 11 *Tonpunkte)* truly establishes a *Basis* built upon a given cell centre. As is the case in *PdK*, *Setzungen* constitute species containing multiple cells which may exist in the form of individual ino-cells or n-cells. As we see in Figure 35, D-*Setzung* can occur through depiction of its ino cells $e^3a^3d^3g^3c^3$ or its n-cells $h^2e^2a^2d^2g^2c^2f^2$ (*OH*, 152–153). The open noteheads in the figure indicate the *Tonpunkte* required for the relevant cells to be realized. The closed noteheads provide the aesthetic qualities of these cells. As revealed by Mayrhofer's analyses of examples from the literature (*OH*, 238–245), the realization of the D-*Setzung* is more flexible than the figure indicates: these cells do not have to

[59] The *Basis* depicted by such a *Setzung* would contain the *Tonpunkte* of an N-cell, in this case c^2e^2.

[60] Mayrhofer's rationale as to why realization of an INO-cell alone constitutes *Setzung* and confers a sense of tonal stability draws upon the concept of the Law of *Präsenz*, which will be further discussed in Chapter 10. According to the Law of *Präsenz*, a maximum of twelve different *Tonpunkte* can be comprehended as distinct *Tonpunkte* at the same time. In *OH*, Mayrhofer considers a *Basis* to be ill-defined until the boundaries of tone space are realized as n-*Strecken* or ino-*Strecken* that precisely determine their position in tone-space.through sounding of its outer boundaries. The *Tonpunkte* +/-5 Qq from a tonal centre (and an additional *Tonpunkt* which marks the 12th *Tonpunkt* is discussed in Chapter 10) constitute enharmonically-variable *Tonpunkte* which Mayrhofer calls *Breitstellen* (see Chapter 11). Until such *Breitstellen* (Aß/Gƒ, Eß/Dƒ, Dß/Cƒ for *D-Basis*) are defined through realization of an INO-cell, the overall tonal centre remains unclear. For example, the realization of the N-cell c^2e^2 for a tonal centre D establishes the *Tonpunkte* B (Bß) and M (Fƒ) as the furthest expansion from the centre (+/-4 Qq). But such a realization does not tell us whether the next expansion of *Tonpunkte* in the Qq diagram to +/-5 Qq, employing Cƒ and Eß will be understood as *Tonpunkte* Di and Do (which would unambiguously establish D as tonal centre of eleven *Tonpunkte*) or whether the *Tonpunkte* will be understood in a different sense, for example, as *Tonpunkt* Zo (Dß) and/or *Tonpunkt* Wi (Dƒ). Realization of either of the latter *Tonpunkte* would undermine D as the *Basis*. Only the realization of an INO-cell, which incorporates these *Tonpunkte* into *Strecken* within cells that define a *Basis* of an expanded tonality clarifies the "correct" *Tonpunkt* value of these *Breitstellen*, thereby establishing a tonal centre (*OH*, 216-217). *D-Setzung*, through the realization of the INO-cell $g^2h^2c^2e^2f^2a^2$, realizes *Tonpunkte* Di (Cƒ) and Do (Eß) and thereby establishes these *Tonpunkte* as the outer boundaries of D-*Basis* rather than alternative *Tonpunkte*, such as Zo (Dß) and Wi (Dƒ). Mayrhofer considers such a realization of an INO-cell that establishes D as the centre to provide a sense of clarification of the value of *Tonpunkte* in his tone space and therefore a stabilizing and tonality-defining entity.

occur in the precise order indicated: they can appear either simultaneously or in succession and are not bound by specific temporal constraints.

Figure 35 Examples of D-*Setzungen*. (Adapted from *OH*, 152–153)

Although Figure 35 represents Mayrhofer's definition of *Setzung* in *OH,* his own musical analyses containing *Setzungen* do not follow such a rigid framework. Realization of the cells containing the outer boundaries of the INO-cell is required for a *Setzung* in accompaniment of a sufficient number rather than all of the inner *Füllzellen* to satisfy the demands of the senses for a *Setzung*. The spatial *Vorstellung* will be able to fill in the necessary *Füllzellen* to complete the INO-cell in the mind (*OH*, 59).[61] Spatial apprehension of *Tonpunkte* thus plays a crucial role in any practical realization of *Setzung*, through which the INO-cell attains practical analytical value by anchoring in the mind of the listener a tonal structure around a particular cell centre.

[61] Mayrhofer does not specify a minimum number of *Füllzellen* required for a *Setzung* to be understood. He devotes a significant amount of space in his analyses to explain why he considers a particular series of cells to constitute a *Setzung*. For example, in his analysis of Bach's C Major Prelude from the *Well-Tempered Clavier*, he considers the realization of the cells e^3g^3, g^2, and d^3f^3 (mm. 12–14) to be indicative of *G-Setzung* (INO around G with a^3f^3 as the boundaries of the INO-cell $a^3d^3g^3c^3f^3$) despite the fact that c^3 is not realized. (Technically, a^3 does not appear here either: Mayrhofer evidently considers the ino-cell e^3 to contain the cell a^3 within it, thereby exceeding the boundary points of the INO-cell by one *Tonpunkt*, according to the the principle of *Randschwellung* (*Randschwellung* will be discussed in Chapter 9) (*OH*, 239-241).

CHAPTER 10

Expanded Tonality and the Law of *Präsenz*

In describing the limits of expanded tonality, Mayrhofer turns to the following question: how many *Tonpunkte* can be understood as distinct entities simultaneously by the listener? To answer the question, he introduces the notion of *Präsenz* (presence) (*PdK*, 87; *OH*, 91). In *PdK*, the *Präsenz* refers to the region of tone space occupied by all of the *Tonpunkte* that comprise the series of adjacent cells delineated by the INO-cell. The *Präsenz* contains a series of seven n-cells (including the silent cell at the centre) and eleven *Tonpunkte* that reach outer boundaries of +/-5 Qq from the *Kernpunkt* (*PdK*, 87). In *OH*, Mayrhofer expands the scope of the *Präsenz* to include a 12th *Tonpunkt*, thereby producing the *Tonpunkte* required to form the equal-tempered chromatic scale (91). (We will examine Mayrhofer's process for determining the 12th *Tonpunkt* later in the chapter). The *Präsenz* represents the maximum number of *Tonpunkte* that can be understood by the listener as distinct entities at any given time under enharmonic equivalence.

As in the case of all previous constructs, Mayrhofer visualizes the *Tonpunkte* that constitute the *Präsenz* in his tonal space. Figure 36 adapts of Mayrhofer's depiction of four different *Präsenzen* according to their *Tonpunkt* content. (*OH,* 105). The extension of *Tonpunkte* +/- 14 Qq from D appears at the top of the diagram along with their Mayrhoferian syllabic name. Underneath the series of *Tonpunkte* expanded around D, the figure provides four instances of *Präsenzen*: Wi to B (Dƒ to Bß); Ki to Do (Gƒ to Eß) ; Di to Go (Cƒ−Aß); and M to Zo (Fƒ to Dß). Under the relevant *Tonpunkte*, the figure provides, in the first set of parentheses, two options for the boundary cells of each *Präsenz*. For example, the third *Präsenz* on the list, Di to

Go, could be articulated either by the cells h^2f^2 —as realizations of *Strecken* A-Di (Cƒ) and D-Go (Aß)— or the cells e^2b^2 — as realizations of the *Strecken* Di-G and Go-C.

Figure 36. Examples of *Präsenzen* and their relationship to D-*Basis*. (adapted from *OH*,105)

Wi . . . . B

(Boundary cells of this Präsenz di^2g^3 or m^3c^2) (-2 Pz. for D-Basis)

Ki . . . . Do

(Boundary cells of this Präsenz : m^2c^3 or h^3f^2) (-1 Pz. for D-Basis)

Di . . . . Go

(Boundary cells of this Präsenz h^2f^3 or e^3b^2) (+1 Pz. for D-Basis)

M . . . . Zo

(Boundary cells of this Präsenz e^2b^3 or a^3do^2) (+2 Pz. for D-Basis)

Mayrhofer's identifies these collections of cells as determining the *Präsenz* by way of what he calls the Law of *Präsenz* (*OH*, 92). The law states that the greatest possible number of cells can belong to the same *Präsenz* is seven, which means that the distance that exists between the cell centres of a *Präsenz* cannot exceed 6 Qq, the number of Qq *Strecken* in an ino-cell (H-E-A-D-G-C-F) of seven *Tonpunkte*. Another condition of the Law stipulates that these seven cells may never comprise a total greater than 12 *Tonpunkte*. As only seven cells can be incorporated within a *Präsenz*, the Qq distance between the outermost cells of a *Präsenz* cannot exceed the Qq distance between the centres of an ino-*Kernstrecke* (e.g. H and F).

In the second set of parentheses, the figure provides the relationship given *Präsenz* relative to a central D-*Basis*. Since the *Präsenz* contains an even number of 12 *Tonpunkte*, no single *Tonpunkt* among the twelve can by itself constitute as a central *Tonpunkt*. For example, the "midpoint" of a *Präsenz* bounded by Ki (Gƒ) and Do (Eß), in which these two boundary points are -6 Qq and +5 Qq removed from D, respectively, falls in between D (0) and *Tonpunkt* A (-1 Qq). Similarly, the midpoint of a *Präsenz* bounded by Di (Cƒ, -5 Qq) and Go (Aß, +6 Qq) will fall between D and G (+1 Qq). Therefore the two *Präsenzen* (Ki to Do and Di to Go) are described as -1 and +1 *Präsenzen* (abbreviated as Pz.) with respect to D-*Basis*.

The following procedure can be used to calculate the position of the Pz. relative to 0:

1. Add the Qq values of the two outer boundaries relative to a given *Tonpunkt*. (e.g., for the *Präsenz* bounded by Wi and B, this would be (-7) + (+4) = -3 relative to D as 0)
2. Divide the sum by 2. If the value is positive, add 0.5 to obtain the Pz. position relative to the centre. If the value is negative, subtract 0.5 to obtain the Pz. value. (e.g. for Wi-B *Präsenz*: -3/2= -0.5. (-0.5) – 0.5 = -1 Pz.)

We are now in a position to discuss how Mayrhofer expands the eleven *Tonpunkte* of the INO-cell to generate the twelve distinct *Tonpunkte* of the *Präsenz*. To explain the additional *Tonpunkt*, Mayrhofer introduces the concept of *Randschwellung* (edge swelling), through which a cell at the outer border of an INO-cell expands from an n-cell to an ino-cell (*OH*, 117). For example, the INO-cell marked by the outer boundaries h^2f^2 —containing the n-*Strecken* A-Di

(Cƒ) and Do (Eß)-G— obtains its twelfth *Tonpunkt* through *Randschwellung* in two ways: either by expanding to h^2f^3, so that the *Strecken* A-Di and D-Go (Aß) form a +1 *Präsenz* with respect to D-*Basis*, or by expanding to h^3f^2, so that the *Strecken* Ki (Gƒ) -D and Do-G form a -1 Pz with respect to D-*Basis* (118).

We can also now further pursue the logic of Mayrhofer's Law of *Präsenz.* At first glance, the law, which limits the expanse of a *Präsenz* to cell centres separated by six Qq seems arbitrary*:* why, for example, can a -1 Pz. with respect to D-*Basis* be formed through the *Multiklang* h^3f^2, whose cell centres are separated by six Qq, but not by the *Multiklang* m^2f^2, whose cell centres are separated by seven Qq? After all, as we can see in Figure 36, both realizations encompass exactly the same twelve *Tonpunkte* and have identical outer borders: the *Tonpunkte* Ki (Gƒ) and Do (Eß).

In answer, Mayrhofer explains that m^2f^2 contains an actual realization of the *Strecke* E-Ki, which is implied but not realized as a silent cell in h^3f^2. Thus, the *Multiklang* m^2f^2 contains simultaneous realization of E-Ki and Do-G (*OH*, 154). Returning to the locus of Qq-related pitches at the top of Figure 30, we can see that the two parts of *Tonpunkte* of m^2f^2 have values of (-2 Qq, -6 Qq) and (+5 Qq, +1 Qq), respectively. (The analogous values for two pairs of *Tonpunkte* represented by h^3f^2 are (-6 Qq, 0 Qq) and (+5 Qq, +1 Qq), respectively.)

Mayrhofer contends that the realization of m^2f^2 results in an enharmonic reinterpretation of the m^2 cell (E-Ki [Gƒ]) because of the Law of *Präsenz*. In terms of *Tonraum* distance, the *Tonpunkte* E- Ki (-6 Qq,-2 Qq) are closer to Do-G (+5 Qq,+1 Qq), the contents of the f^2 cell, if reinterpreted enharmonically as *Tonpunkte* Dos (Fß) and Go (Aß) with values of +10 Qq and +6 Qq, respectively. Mayrhofer contends that such an enharmonic reinterpretation does indeed take place to form the *Multiklang* f^2fo^2 ($f^2gß^2$), which leads to the actualization of a *Präsenz* in an entirely different region of tone space. The *Multiklang* f²fo² encloses only ten *Tonpunkte* and therefore does not by itself define an entire *Präsenz*. Theoretically, this *Multiklang* could occupy several different *Präsenzen* around numerous possible centres (B, Do, Go, etc.). For example, with respect to Do (Eß) as 0, the outer boundaries G (-4 Qq) and Dos (+5 Qq) could belong to a +2 *Pz.* bounded by G and Zos (Eå), which have values of -4 Qq and +7 Qq, respectively.[62] Alternatively, these *Tonpunkte* could belong to a *Präsenz* defined by D and Gos (Bå), which have values of -5 Qq and +6 Qq relative to Do, as +1 Pz.

Accordingly, the Law of *Präsenz* forms the foundation of his enharmonic theory, which aims to correct what he sees as the errors in conventional theory. [63] Mayrhofer's discussion of augmented sixth chords illustrates his unwillingness to be confined by established procedures of notating and rationalizing the structure and resolution of such chords. Mayrhofer contends that other music theories frequently rationalize the spelling of chords based on the voice-leading tendencies of particular intervals (*OH*, 111–112). According to this view, the resolution of enharmonically equivalent harmonies Eß-G-Bß-Dß and Eß-G-Bß-Cƒ determines the notation as either dominant 7th chord or augmented sixth chord.

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[62] Calculation of Pz.offset to Do= 0 as determined by formula described earlier. G (-4 Qq) + Zos (+7 Qq)= +3. +3/2= 1.5. 1.5+ 0.5= 2= +2 Pz. Alternatively, if the boundaries of the *Präsenz* are D (-5 Qq) and Gos (+6 Qq): (-5) + (+6)= +1. 1/2 = 0.5. 0.5 + 0.5=1 = +1 Pz. Several other possibilities, including Pz. with different centres are theoretically possible.

[63] With his denunciation of conventional theory, Mayrhofer mainly targets any harmonic theory that attempts to explain chromatic *Tonpunkte* as arising from alterations of diatonic triads or alterations of scale-degrees of the diatonic scale *per se*. Such explanations of chromatic species circulated widely in many 19th century *Harmonielehre* texts, including the *Harmonielehre* by Louis & Thuille (Louis & Thuille, 1920), who are mentioned by Mayrhofer, along with Richter and Riemann, as representative advocates of the "errors" of conventional theory. For example, Louis and Thuille explain that the interval of the augmented sixth in augmented sixth chords arises from the "raised fourth scale degree" (Fƒ) and the "minor" third of the subdominant triad in minor keys (224–225). Explanation of chromatic species as arising from altered pitches also appear in functional harmonic theory of Hugo Riemann, who views dissonances such as the augmented triad, as arising from raised or lowered intervals with respect to a major or minor triad (Riemann 1893). Although much of Mayrhofer's polemic is directed against music theory based on a diatonic scale, a construction which Mayrhofer considers highlyartificial (*PdK*, 176), Mayhofer's opposition to conventional theory is also directed against all harmonic theories that explain chromatic species as altered diatonic chords. Mayrhofer's unique system of nomenclature in deriving *Tonpunkte* as leading tones created by major third projections onto existing *Tonpunkte* constitutes a direct attempt to correct such errors.

Mayrhofer disagrees, pointing out that it is nevertheless possible (and not at all unprecedented) for the harmony Eß-G-Bß-Cƒ to resolve to a sonority containing C, such as Eß-Aß-C, or for the harmony Eß-G-Bß-Dß to resolve to D-Fƒ-A (*PdK*, 131–132). Figure 37 summarizes Mayrhofer's findings concerning this sonority. The Table catalogs the two resolutions of Eß-G-Bß-Dß and Eß-G-Bß-Cƒ and provides the relevant cell analysis of each structure and the corresponding Qq values from D, along with the number of *Tonpunkte* and cell each resolution encloses.

To obtain the numerical information presented in Figure 37, the *Tonpunkt* D was given the value of 0 and the value of each individual *Tonpunkt* relative to D obtained through subtraction using Mayrhofer`s Qq tone space from Figure 17. The n-*Strecken* and ino-*Strecken* content determines which *Tonpunkte* were to be associated as pairs. For example, the harmony Eß-G-Bß-Dß contains a b^3 cell through *Tonpunkte* G and Zo (Dß), which have values of +1 Qq and +7 Qq, respectively. Inclusive counting of the extreme *Tonpunkt* values yields the number of *Tonpunkte* enclosed by the progression catalogued in the fifth column (e.g. +1 Qq to + 7 Qq in the first row results in a total of seven *Tonpunkte*). Finally, inclusive counting of cell centres of the sonorities involved as found in Mayrhofer`s tone space yields the number of cells enclosed (e.g. f^2, b^3 and e^2 in the second row enclose a total of seven cells from *Tonpunkte* E-A-D-G-C-F and B).

Figure 37 Resolutions of the Augmented Sixth/ Dominant Seventh and the Law of *Präsenz*

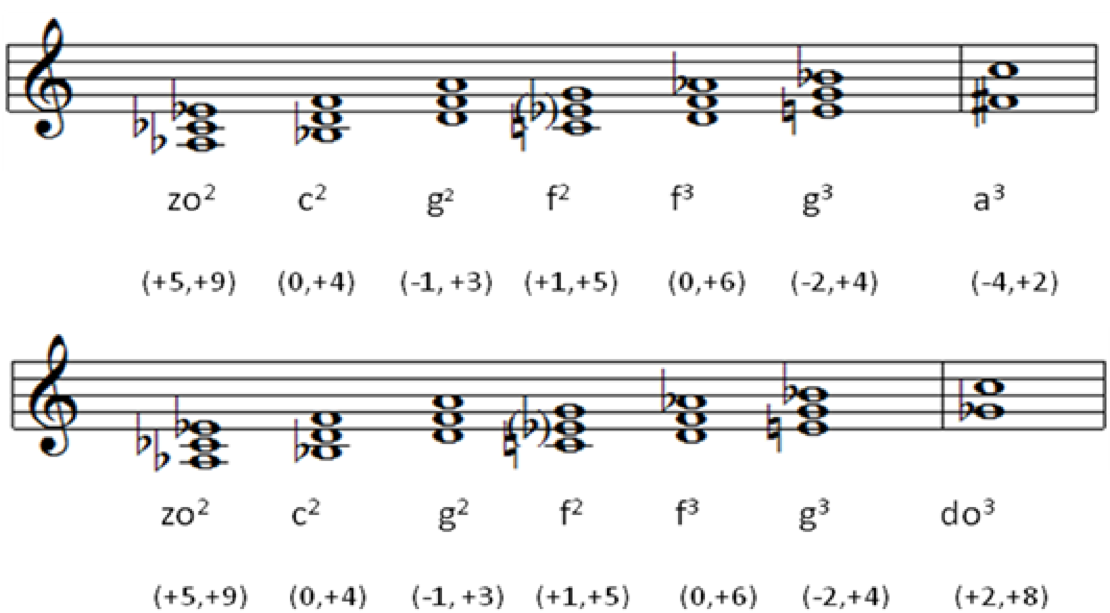
Harmonic Progression	***Tonpunkte***	**Cells**	**Qq Values of cells (relative to D= 0)**	**# of *Tonpunkte* enclosed**	**#of cells enclosed**	**Compatibility with Law of *Präsenz***
Eß-G-Bß- Dß to Aß-C-Eß	Do G B Zo Go C Do	f^2b^3 b^2	(+1,+5) (+1,+7) (+2,+6)	7	2	Yes
Eß-G-Bß– Dß to D-Fƒ-A	Do G B Zo D M A	f^2b^3 e^2	(+1,+5) (+1,+7) (0, –4)	12	7	Yes
Eß-G-Bß- Cƒ to Aß-C-Eß	Do G B Di Go C Do	e^3f^2 b^2	(–5,+1) (+1,+5) (+2,+6)	12	7	Yes
Eß-G-Bß- Cƒ to D-Fƒ-A	Do G B Di D M A	e^3f^2 e^2	(–5,+1) (+1,+5) (0,–4)	11	6	Yes

Mayrhofer bases his explanation on his Law of *Präsenz*. Resolution can occur to a sonority containing either C (the goal of resolution of the minor seventh Eß-Dß) or D (the goal of the resolution of the augmented sixth Eß–Cƒ) regardless of whether the original sonority is spelled as a dominant 7th (Eß-G-Bß-Cƒ) or as augmented sixth (Eß-G-Bß-Dß), because none of these resolutions crosses the outer boundaries of 12 *Tonpunkte* and seven cells (6 Qq *Strecken*) required to constitute acceptable interpretations. Therefore, all of the above progressions constitute acceptable "resolutions" of this harmonic species and reveal that the "correct" spelling of the augmented sixth/dominant 7th species cannot simply be determined from its resolution.

The musical context of the chords in an extended passage, which will provide other *Tonpunkte* and thereby help clarify the boundaries of the *Präsenz* of the passage, may render some of the possibilities to be less valid than the others. For example, if the progression Eß-G-Bß-Dß to D-Fƒ–A is preceded by a passage containing the realizations of such cells as h^2

through *Tonpunkte* A- Di (Cƒ) and other cells on the "negative" side of D, then Eß-G-Bß-Dß will likely be heard as Eß-G-Bß-Cƒ and will need to be spelled as such in order to satisfy the requirements of the Law of *Präsenz*. Figure 38 describes a more subtle way through which the Law of *Präsenz* shapes enharmonic interpretation. The figure provides two harmonic progressions identical in every way except for the labelling of the final sonority as either Fƒ-C or as Gß−C. The figure provides the cell content realized by each of these sonorities as well as the *Tonpunkt* value of the outer boundaries of the cells with reference to an arbitrary *Tonpunkt* (D) as the offset value at 0.

<u>Figure 38 Enharmonic Reinterpretation and the Law of *Präsenz*</u>



At first glance, both progressions appear to be acceptable to according to the Law of *Präsenz*. After all, the Law of *Präsenz* states that a maximum of twelve *Tonpunkte* can simultaneously be understood as distinct *Tonpunkt* entities. A musical work may certainly change from one *Präsenz* region to another and even change its central *Basis* completely (as we shall see in the next chapter), as long as such changes in tonality are not attempted through successive chords, because they will not be psychologically understood as such according to the Law of *Präsenz*. The progressions in Figure 38 do not indicate any direct succession of harmonies in which the cell boundaries imply the realization of a greater number of *Tonpunkte* than 12. The cell g^3 (E-B [Bß]) can progress to either an a^3 cell (M [Fƒ]-C) or do^3 ($Eß^3$) cell directly. The first progression (g^3-a^3) encompasses nine *Tonpunkte* (-4 Qq to +4 Qq); while the second progression (g^3-do^3) encompasses eleven *Tonpunkte*.

Mayrhofer, however, insists that the wider musical context exerts its influence in this example. Although the last two sonorities of both progressions are by themselves acceptable as written, only the second of the two progressions depicted above stays within a single *Präsenz* throughout. The first progression contains a *Tonpunkt*, Bo (Cß), with a value of +9 Qq that cannot simultaneously exist in the same *Präsenz* as the *Tonpunkt* M (-4 Qq) because a total of 14 *Tonpunkte* (9 cells) are enclosed by these outer boundaries. To realize these *Tonpunkte* as they are written, a change in *Präsenz*. (for example, from a *Präsenz* with boundaries of [-2 Qq,+9 Qq] to one bounded by [-4 Qq,+7 Qq]) must occur when the last harmony of the progression, the *Tonpunkte* M (Fƒ)-C is realized as written. A change in *Präsenz* thus would cancel out the outlying *Tonpunkte* (+8 Qq, and +9 Qq), and replace them with -3 Qq and -4 Qq, respectively. In contrast, the second progression of Figure 38 encompasses a total of 12 *Tonpunkte* (from -2 Qq to +9 Qq) that can easily be incorporated under a single *Präsenz*.[64]

Although Mayrhofer does not reject the first interpretation as impossible, he undoubtedly prefers the second progression as the more likely psychological interpretation because of its

[64] Several possibilities for Pz. values exist for the boundaries of -2, +9. These outer boundaries (*Tonpunkte* Bo [Cß] and E) could occupy a +2 Pz. around C, a +1 Pz. around F, -1 Pz. around B (Bß), -2 Pz. around Do (Eß).

realization of successive cells occupying a single *Präsenz* region. In determining the correct enharmonic spelling of a sonority open to enharmonic reinterpretation such as the tritone (*ino-Strecke*), the *Beharrungstendenz* of a *Präsenz* (the tendency of a *Präsenz* to remain stationary) plays a significant role (*PdK*, 133–134). According to this principle, the second progression is clearly to be preferred in depicting the *Strecken* through which this passage is more likely to be understood.[65]

Evidently, Mayrhofer has devised a method for determining the correct spelling of enharmonically variable harmonies. The principle of *Beharrungstendenz* of the *Präsenz* allows him to place such sonorities within a wider musical context than other theorists, who typically determine the correct enharmonic spelling from voice-leading progressions of individual voices or from the harmonic content of the chords that immediately precede or follow the enharmonically-variable sonority in question. In combination with Mayrhofer's interpretation of the resolution of augmented sixth chords discussed in Figure 36, Mayrhofer's theory places the enharmonic species in question within a much wider temporal context that allows him interpretive access to a greater breadth of harmonic progressions than such theories that base their enharmonic interpretations on localized voice-leading convetions. (We shall explore the interpretative power of Mayrhofer's enharmonic theory again in the next chapter).

Although his system originates from a conception of a pure major third n-*Strecke*, Mayrhofer's theory accepts any enharmonic respelling of a sonority as long as it does not contradict the Law of *Präsenz*. Mayrhofer's concern with enharmonicism is that the notation used to write down a particular *Tonpunkt* should reflect the psychological value that the actual

[65] It would be theoretically possible to affect a change of *Präsenz* in the negative direction if more *Strecken* were realized in the negative region of tone space afterwards. For example, if the cells such as d^2, a^2, and e^2 were realized repeatedly after the last sonority of Figure 38, a change in *Präsenz* that replaces *Tonpunkt* Zo with *Tonpunkt* values in the negative direction will take place. The sonorities of Figure 38, however, do not suggest a definitive enough movement to bring about such a change.

sound possesses in the mind. He thus reprimands composers who write progressions such as D-Gƒ-B to D-F-Aß: in Mayrhofer`s system, the former structure is h^3, and the latter structure is f^3. The two cells enclose 13 *Tonpunkte*, thereby transgressing the Law of *Präsenz* although only seven cells (six Qq *Strecken*) are realized by this progression, and will therefore not be perceived by the listener as written (*OH*, 87).

To close, let us return to our discussion of Schumann's *Träumerei* given in Figure 33. The opening eight measures contain a total of twelve distinct *Tonpunkte*, with furthest expansions in tone space being represented by the e^3 cell (accompanied by *Seitenzelle* h^2) realized through *Tonpunkte* A-Di(Cƒ) -E-G in m. 6 and the b^2 cell (*Tonpunkte* F- Go (Aß) - C). The outermost *Tonpunkte* Di and Go correspond respectively to -5 Qq and +6 Qq with respect to D in tonal space or -6 Qq and +5 Qq with respect to G in tonal space. As D and G appear to be the most likely candidates for the position of *Kernpunkt* around which a *Basis* could be formed, this passage likely represents one of two possible *Präsenzen*: the +1 *Präsenz* around the *Tonpunkt* D as *Basis*, and the -1 *Präsenz* around the *Tonpunkt* G as *Basis.*[66]

To determine which of these two possibilities applies, Mayrhofer's analytical method typically examines the symmetrical arrangement of all of the cells in the passage under review. The ino-cells e^3 and c^3 in mm. 6-7 would fit the requirements as outer cells of an INO-cell with the centre D (see Figure 35 for examples of possible D-*Setzungen*). In fact, mm. 6-7 contain realizations of cells around all *Tonpunkte* that exist in between E and C in tonal space: g^2 d^2 and a^3, thus making a *Setzung* between e^3 and c^3 more plausible.[67]According to this interpretation, D

[66] The *Präsenz* with respect to D can be calculated according to the formula given earlier in the chapter using the outer boundary values (-5 Qq ,+6 Qq). (-5) + (+6)= 1. 1/ 2 = 0.5. 0.5 + 0.5= 1 = +1 Pz. Similarly, for G *Basis* (-6,+5): (-6) + (+5) = -1. -1/2 = -0.5. -0.5- 0.5= -1= -1 Pz.

[67] Admittedly, the cell b^2 is also realized in m. 7. An alternative interpretation could be argued by maintaining that an *ino-Strecke* between Aß and D is formed in the mind of the listener, thus creating the cell f^3 which forms the outer boundaries of an INO cell (f^3-a^3) around G and therefore constitutes G-*Setzung.* However, such an

can be considered the *Basis*. Mayrhofer would thus interpret this passage in C major (*D-Basis*) and not F major (*G-Basis*)![68]

interpretation undermines the prominence of the h^2e^3 *Multiklang* of m. 6. Also, this interpretation does not contain as satisfactory of a realization of *Füllzellen* as the interpretation offered above, in which e^3 and c^3 also appear as the outer boundaries of an INO-cell in the temporal sense (i.e. as a harmonic progression).

[68] Mayrhofer completes a similar analysis of Bach's Prelude in C major of the *WellTempered Clavier* and concludes that this piece has *G-Basis* rather than the *D-Basis* associated with C major. The prominence of the C-major triad at the beginning and end of the piece can be explained as a not uncommon method of concluding a piece with the realization of a *Seitenzelle* (*OH*, 238–245).

CHAPTER 11

The *Tonal*: The Limits of Expanded Tonality

Although the concept of *Präsenz* limits of the number of *Tonpunkte* that can be perceived as distinct *Tonpunkte* at any given instant, the actual limit of tonality incorporates additional *Tonpunkte* which can still be comprehended as belonging to a tonal centre. To describe this final extension of tonality, Mayrhofer introduces the term *Tonal.*[69]

The *Tonal* is the collection of *Tonpunkte* obtainable through the processes of i-*Adjektion* (*Anwerfung*) and o-*Adjektion* (*Anwerfung)* to all of the seven *Tonpunkte* of the ino-cell, from which the diatonic scale can be formed (*PdK*, 97–98). The *Tonal* does not refer to a cell structure in the same sense as an N-cell or INO-cell but represents the theoretical limit of the number of *Tonpunkte* that can still be identified as being associated with a given *Basis* (98). As we recall, *Adjektion* (*Anwerfung*) is the process that produces additional *Tonpunkte* through projection of an *n-Strecke* to components of an n-cell. I-*Adjektion* occurs from the "upward" n-*Strecken* projection from a given *Tonpunkt*. We recall that i-*Adjektion* to G yields the *Tonpunkt* H, thereby assisting in the expansion of the d^2 cell to the ino-cell d^3. O-*Adjektion* projects an n-*Strecke* downward from a given *Tonpunkt*. So, applying o-*Adjektion* to A yields the *Tonpunkt* F, which, when combined with i-*Adjektion*, provides the *Tonpunkte* required for the d^2 cell to expand to its ino-cell d^3.

[69] Although the *Tonal* constitutes the maximum number of *Tonpunkte* (15) that can be rationalized as belonging to a single tonality according to Mayrhofer's concept of expanded tonality, Mayrhofer briefly discusses a further level beyond the *Tonal* in *PdK.* Mayrhofer identifies a further structure known as *Makro*, which consists of two *Tonale* whose centres are separated by a *Kernstrecke* of a major third. For example, a D-*Makro* contains all *Tonpunkte* described by the *Tonpunkte* found in *C-Tonal* and *E-Tonal.* Since *Makros* contain a large number of *Tonpunkte*, Mayrhofer finds it difficult to ascribe structural significance to *Makros* and does not further develop this concept in *OH*.

Such *Adjektionen* can theoretically be carried out not only in the restricted sense that allows an n-cell to expand to an ino-cell, but from all seven of the *Tonpunkte* of an ino-cell, the largest collection of *Tonpunkte* belonging to a single cell, in both directions. Figure 39 provides all of these *Tonpunkte* generated by the two processes applied to the D ino-cell. The figure contains 15 distinct *Tonpunkte*, which constitute the material in D *Tonal*. The *Tonal* can also be expressed in terms of the *Präsenzen* it contains. A given *Tonal* of 15 *Tonpunkte*, can form four distinct *Präsenzen*, which can be described as -2 Qq, -1 Qq, +1 Qq, and +2 Qq from the centre. The four *Präsenzen* examined in connection with Figure 36 in Chapter 10 in fact describe the four *Präsenzen* that constitute D *Tonal*.

<u>Figure 39. The *Tonpunkte* of D *Tonal*</u>

Tonpunkt	**i-*Adjektion***	**Qq from D**	**o-*Adjektion***	**Qq from D**
H	Wi (Dƒ)	-7	**	
E	Ki (Gƒ)	-6	**	
A	Di (Cƒ)	-5	F*	+3
D	M (Fƒ)	-4	B (Bß)	+4
G	H (B)*	-3	Do (Eß)	+5
C	**		Go (Aß)	+6
F	**		Zo (Dß)	+7

* *Adjektionen* that expand the d^2 cell to the d^3 but do not generate additional *Tonpunkte* with respect to the seven *Tonpunkte* of d^3.
**No *Adjektionen* occur in the direction specified from these *Tonpunkte*, as such *Tonpunkte* already exist as part of the original d^2 cell structure without *Adjektion* .

Mayrhofer calls the six outer *Tonpunkte* on both side of the *Tonal* (Wi Ki and Di in the i-*Adjektion* column and Do, Go, and Zo in the o-*Adjektion* column) *Breitstellen* (wide-locations or wide-spots) (*OH*, 100). Each of the *Tonpunkte* of a *Breitstelle* closely resembles the value (*Wert*) of another *Tonpunkt,* an enharmonic equivalent. So,Wi (Dƒ) and Do (Eß) have the same value. Yet no *Strecke* can be conceived between them (95). Therefore, *Breitstellen* easily become subject to enharmonic reinterpretation. The *Tonal* can thus be seen as constituting the region of a *Präsenz* with the addition of three further *Tonpunkte* to the *Breitstellen*. The *Tonal* thereby completes the concept of expanded tonality, as no further *Tonpunkte* can be conceived as being generated through *Adjektionen* from the constituents of the ino-cell, which constitutes the *Basis* of the expanded tonality.[70]

Mayrhofer designs his concept of expanded tonality to accommodate the music of Richard Wagner. We shall examine the Pilgrims' Chorus from Act Three of Wagner's *Tannhäuser* according to Mayrhofer's concept of expanded tonality. Figure 40 provides mm. 1–24 of Franz Liszt's piano transcription of the Pilgrims' Chorus from Wagner's 1845 (Dresden) version of *Tannhäuser.* The excerpt can be divided into two sections: the first section (mm. 1–16) is the generally diatonic refrain of the Pilgrim's chorus. The second section (mm. 17–24) constitutes the beginning of the middle passage of the Pilgrims chorus, which passes through several different keys. The asterisks in the figure indicate the presence of *Partialklänge* that cannot be analyzed as cells. The cells enclosed by parentheses indicate neighbouring cells (*Seitenzellen*) of an ino-cell.

[70] In *PdK*, Mayrhofer discusses a further structural level beyond that of the *Tonal*. The *Makro* refers to structures formed by multiple groups of *Tonale* through *Kernstrecken* formation between them.Due to the large numbers of *Tonpunkte* involved when examining groups of *Tonale*, Mayrhofer finds the movements between *Tonale* quite limited and abandons a discussion of the *Makro* altogether in *OH* and *DKK* (*PdK,* 165-167).

Figure 40. Mayrhofer Analysis of Pilgrims Chorus from Wagner's *Tannhäuser* (mm. 1-24)

We can appeal to the concept of *Präsenz* to describe the difference between these two sections. Figures 41(a) and 41(b), corresponding to the two sections, help to visualize the concept of *Präsenz* more clearly. The figures apply a simplified version of Mayrhofer's method of illustrating cell centres and *Präsenzen* of a piece.[71] Mayrhofer`s tone space, expanded to +/- 14 Qq from D, an arbitrary but convenient offset value, along with Mayrhofer's syllable labels for each *Tonpunkt* and the corresponding pitch class of these syllables underneath, is arranged horizontally across the top of both figures. Each section's harmonies and relevant measure numbers are arranged vertically in both figures. For each harmony, the figures provide the relevant cell centres, shown as asterisks, and the cell's outer *Tonpunkt* boundaries. Accordingly, in Figure 41(a), the first harmony in measure 1, m^2— an n-cell around M (in particular, an E major triad) — appears as an asterisk in the M column. The outer boundaries of m^2 are shown by the vertical bars at Ki (Gƒ) and E. Structures with more than one asterisk are *Multiklänge* containing more than one cell centre.

The first section is a very stable clustering of cells within a small region of Mayrhofer`s tone space. Nearly half of the cells realized in this particular section form around the *Tonpunkt* M (Fƒ) (–4 Qq). The first two measures introduce both the major variant with *Durpunkt* H (B) and minor variant with *Mollpunkt* Di (Cƒ) of the E-Ki (Gƒ) n-*Strecke* that constitutes the m^2 cell. Measure 2 introduces the h^2 cell, which also appears in both the minor (with *Mollpunkt* M [Fƒ] and major (with *Durpunkt* E) variants. The first four measures thus feature a back-and-forth interchange between *Tonpunkte* both at the level of individual cells (between *Durpunkt* and *Mollpunkt*) and between separate cells (m^2 and h^2).

Figure 41(a) Wagner's Pilgrims Chorus (mm.1–16) in Mayrhofer's Tone Space

[71] In his own visual representations of the overall cell content of a particular work, Mayrhofer introduces new symbols to describe the aesthetic variants of cells, to mark the presence of such species as INO-cells, *Setzungen*, N-cells, etc.

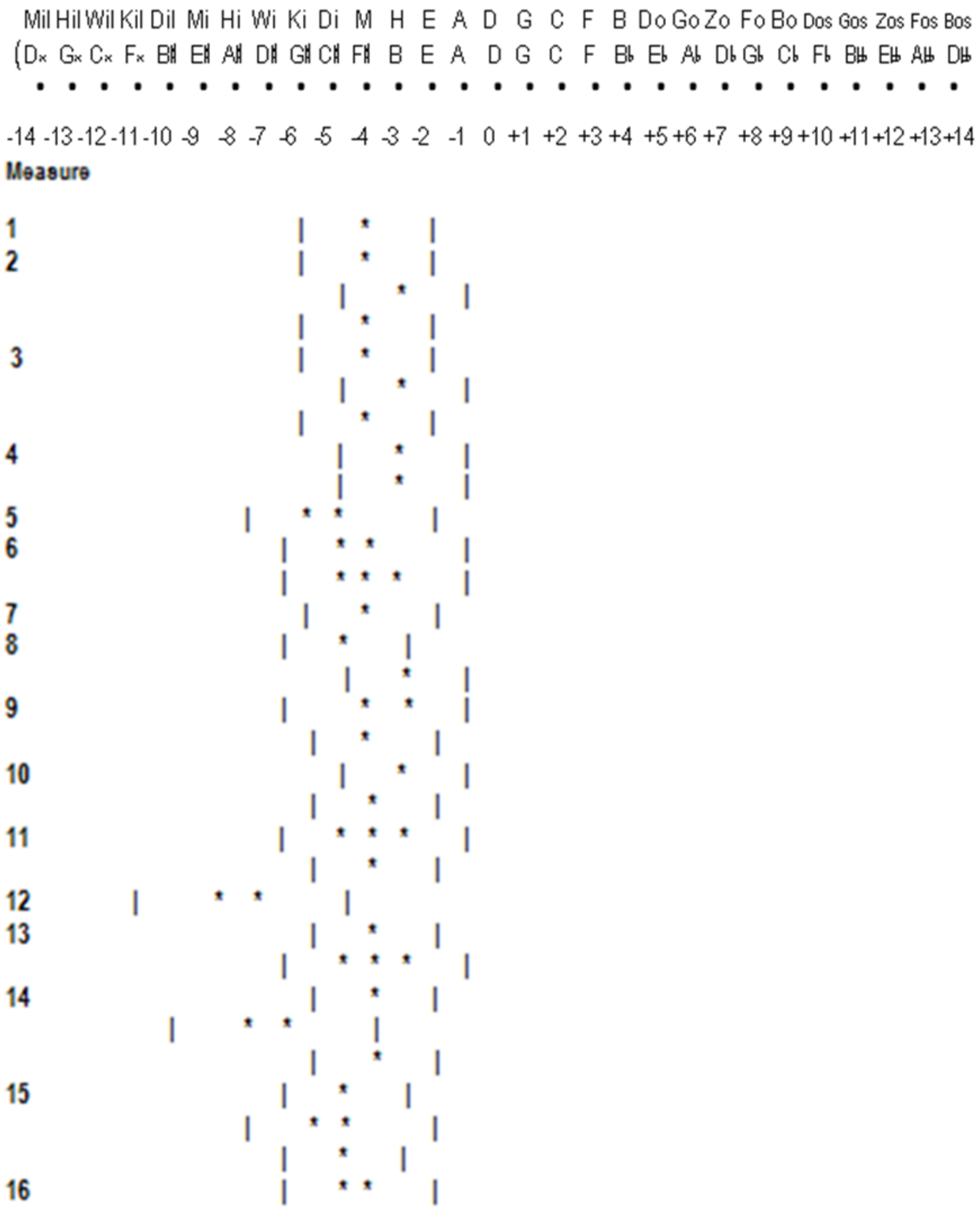
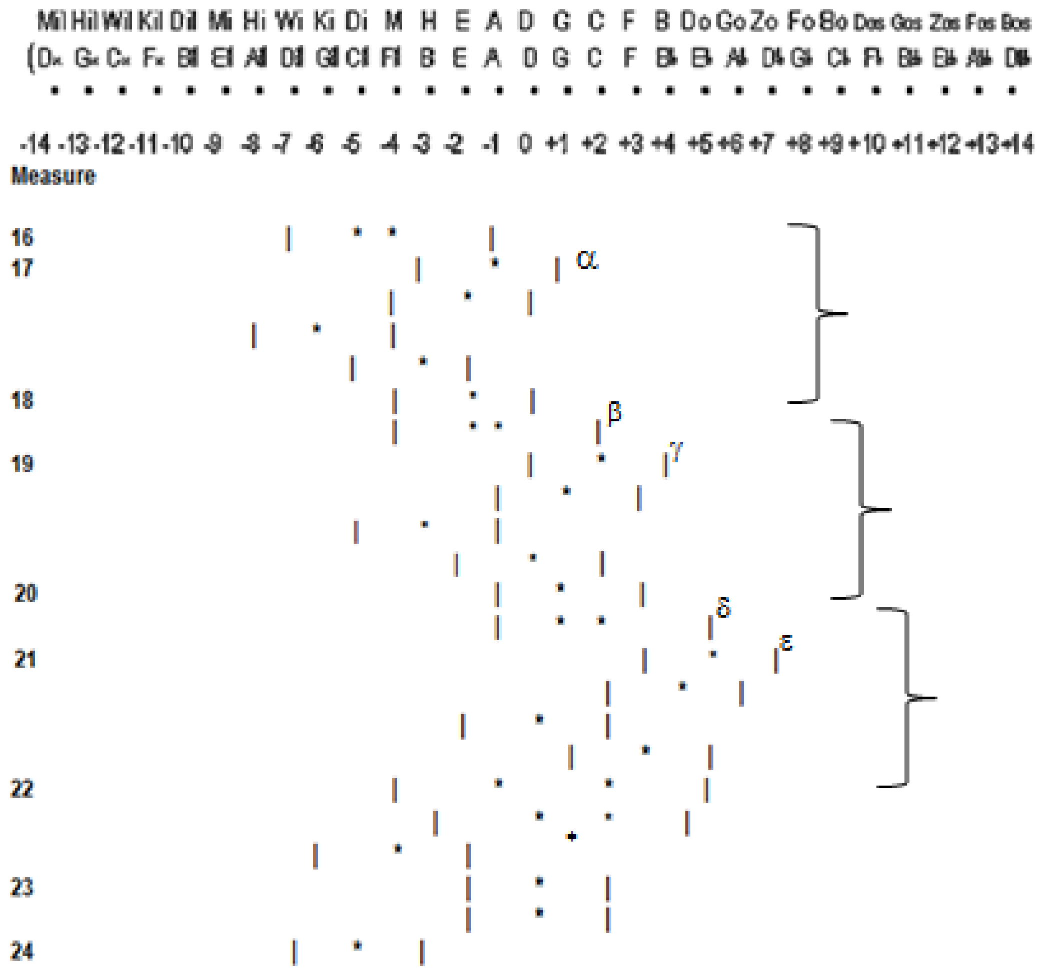


Figure 41(b) Wagner's Pilgrims Chorus (mm.16–24) in Mayrhofer's Tone Space



Measure 5 introduces the first ino-cell, di^{3} (cƒ^{3}) cell, which appears along with the *Seitenzelle* ki^{2} (gƒ^{2}). The first evidence of a cadential progression in Mayrhofer's sense occurs in mm. 6–7: the ino-cell m^{3} (fƒ^{3}) , accompanied by its *Seitenzellen* h^{2} (b^{2}) and di^{2}, proceeds to its constitutive m^{2} cell at the beginning of measure 7. If the entire excerpt contained only the seven diatonic *Tonpunkte*, such a progression would be sufficient in determining the *Basis* as *M-Basis*. The presence of chromatic *Tonpunkte*, first appearing in measure 5, negates this possibility.

The subsequent measures show a similar pattern to the opening six measures, as both the both the major and minor variants of n-cells appear. The cell h^2 appears as the major variant, A-Di (Cƒ)-E, in m. 9 and the minor variant, M (Fƒ)-A-Di, in m. 10. Di^2 appears in both guises [H-Wi-M and Ki-H-Wi] in m. 8. Ino-cells also appear with *Seitenzellen* being realized: In m. 11, the cells h^2 and di^2 accompany the ino-cell m^3, thus realizing *Seitenzellen* around both the *Durpunkt* and the *Mollpunkt* of the m^3 ino-cell.

In addition to the suggestion of E major tonality, the prominent appearance of cells either forming around *Tonpunkt* M or around the *Tonpunkte* directly adjacent to M suggest *Tonpunkt* M as a strong central *Tonpunkt* around which one can expect a *Setzung* to occur that establishes M-*Basis*. Mayrhofer requires that a *Setzung* realizes cells that enclose the eleven *Tonpunkte* of an INO-cell in *OH* (and at the very least, the nine *Tonpunkte* of an N-cell in *PdK*) to truly define a *Basis* in the sense of expanded tonality. As described in Chapter 9, a *Setzung* defines the outer boundaries (*Breitstellen*) of a given area in tone-space, such that *Basis* can be clearly defined and perceived as constituting such a centre. The first eleven measures, however, only enclose the eight *Tonpunkte* from Hi (Aƒ) to A and cannot define a *Basis* of any kind.

The *Setzung* that finally establishes the *Basis* occurs in m. 12 through the realization of the cell hi^3 through the ino-*Strecke* Kil (F©)-Di (Cƒ) and its *Seitenzelle* mi^2 ($eƒ^2$). As indicated by the vertical bars in Figure 41, Kil realizes a *Tonpunkt* that is -11 Qq removed from D, thus combining with *Tonpunkt* A (-1 Qq) from m. 11 to enclose the boundaries of an INO-cell. Measures 11 and 12 realize the following cells: mi^2, hi^3, di^2, m^3, and h^2. Hi^3 and m^3 form the edge of this INO-cell, which has the *Tonpunkt* Ki at the centre. According to Mayrhofer's process, the centre of this INO-cell does not imply M-*Basis* at all, but rather *Basis* around the *Tonpunk*t Ki (-6 Qq), which will be perceived to form the centre of all of the *Tonpunkt* realized up to this point.

The identification of *Tonpunkt* Ki as the *Basis* of the first sixteen measures through Ki-*Setzung* in mm. 11-12 may appear to contradict the strong suggestion of E major (M-*Basis*) of the passage. We must keep in mind, however, that Mayrhofer's Ki-*Basis* defines an expanded tonality and does not correspond merely to Gƒ major or Eƒ minor, which enclose a much smaller region of tone space. Furthermore, the section as a whole contains realizes the *Füllzellen* between the outermost cells hi^3 and m^3 to reinforce the suggestion of Ki-*Basis*: wi^3 (dƒ^3) is realized in m. 14 through *Tonpunkte* M (Fƒ) and Dil (Bƒ); ki^2 itself appears in m. 15 through M-Hi (Aƒ); and cells such as m^3, di^3, and h^2 occur frequently throughout the excerpt. The overall pattern of *Füllzellen* supports the idea that the Ki-*Setzung* of mm.11–12 leads to the establishment of Ki-*Basis.*

As the opening section identifies a total of eleven *Tonpunkte* rather than the twelve required to realize a *Präsenz*, no *Präsenz* can be unambiguously determined here. With the realization of the outermost *Tonpunkte*, Kil (-11 Qq) and A (-1 Qq), two *Präsenzen* around Ki could theoretically exist: the inclusion of the *Tonpunkt* Wil (C©) would create a *Präsenz* bounded by *Tonpunkt* values of -12 Qq and -1 Qq constitung the -1 Pz with respect to Ki. The inclusion of D (0) would create a *Präsenz* bounded by *Tonpunkt* values of -11 Qq and 0 Qq constituting the +1 Pz with respect to Ki.[72] As neither of these *Tonpunkte* appears in this section, the *Präsenz* remains undefined until the second section of the piece. (As observed in retrospect from the cell movement to the right side of tonal space starting in m.17, the latter *Präsenz* more accurately

[72] These Pz values can be calculated using the formula described in Chapter 10:
Präsenz enclosed by Wil (-12 Qq) and A (-1 Qq). Wil and A have values of (-6 Qq) and (+5 Qq) with respect to Ki.
Calculation of *Präsenz* value: (-6)+ (+5)= -1. -1/2 = -0.5. -0.5 -0.5= -1= -1 Pz.
Präsenz enclosed by Kil (-11 Qq) and D (0 Qq). Kil and D have values of (-5 Qq) and (+6 Qq) with respect to Ki.
Calculation of *Präsenz* value: (-5) + (+6)= +1. 1/ 2= 0.5. 0.5 +0.5= 1= +1 Pz.

reflects the excerpt). Despite the absence of a definitive *Präsenz,* the Ki-*Setzung* allows the listener to nevertheless perceive this section as a well-defined expansion from the *Kernpunkt* Ki according to Mayrhofer. Other than the *Partialklänge* arising from suspensions in measures 4 and 15, this section presents no further challenges to Mayrhofer's analytical technology.

The character of the music changes very abruptly at m. 16. In comparing the two figures, we can see that Figure 41(b) contains structures whose boundary pitch-classes are farther apart than the structures in Figure 41(a) and that the structures in Figure 41 (b) generally move horizontally along the tone space to a greater extent than do the structures in Figure 41(a). Beginning on the last beat of m. 16, Wagner introduces a two-measure passage, which he then repeats twice (mm. 18–20 and mm. 20–22), transposing up a minor third at each repetition. In the language of traditional theory, these changes could be described as arrivals at dominant seventh chords in the keys of E, G, and Bß, before the music reaches a diminished seventh chord Dƒ-Fƒ-A-C in m. 22.

In Mayrhofer's terminology, the sequence encompasses a total of six adjacent cells when arranged in Qq tone space. For example, the first appearance of the sequence results in the realization of cells stretching from *Tonpunkt* Ki to *Tonpunkt* A (ki^{2}di^2 m^3 h^2 e^2 a^2), thereby enclosing ten *Tonpunkte.* This sequence, which nearly contains the *Tonpunkte* required to constitute a *Präsenz* in itself, brings about several changes in *Präsenz* as well as changes in Tonal. Unlike the first section, in which a single *Basis* emerged from an expansion of around a central *Tonpunkt* through a *Setzung*, the transitory nature of the different *Präsenzen* reached in this section does not allow for such clear demarcations of a *Basis* through *Setzung*.

The sequence results in significant alterations of position within Mayrhofer's tone space. Figure 41(b) indicates each of the three statements with braces. In Mayrhofer's terms, the realization of a^2 at the beginning of m. 17, indicated by α in the figure, precipitates a change of *Präsenz*, since the outermost *Tonpunkt* (G) cannot coexist as a separate *Tonpunkt* in the mind of the listener at the same time as *Tonpunkt* Kil (F©). The appearance of G (+1 Qq) thus cancels out the the recollection of Kil (-11 Qq) in the memory of the listener, resulting in a shift of *Präsenz* in the positive direction by one *Tonpunkt.* The new *Präsenz* now encompasses the 12 *Tonpunkte* bounded by G (+1 Qq) and the *Tonpunkt* Dil (Bƒ), (-10 Qq), thus resulting in realization of the +2 Pz of Ki-*Basis.*

The change of *Präsenz* brought about in m. 17 represents only the first of several such shifts precipitated by the three statements of the sequence in mm. 16–22. Arrival at a^3 (e^2) cell (M-C) in m. 18, indicated by β in the figure, introduces the *Tonpunkt* C (+2 Qq) and a further change of *Präsenz.* The *Präsenz* now encloses the *Tonpunkte* Mi (Eƒ) and C. According to Mayrhofer's definition of *Tonal*, the resulting *Präsenz* (-9 Qq to +2 Qq) can no longer be defined by Ki-*Basis* and therefore represents a change of *Tonal*. To determine the *Basis* that constitutes the centre of the new *Tonal*, Mayrhofer considers the cells that bring about particular the shift of *Präsenz* (*PdK*, 150–152).

In the limited examples of shifts in *Tonal* which he discusses, Mayrhofer attempts to derive the new *Basis* from the *Adjektion* process (projection of a new *n-Strecke* onto a *Kernpunkt* among the seven *Tonpunkte* of the existing *Präsenz)* which brings about the addition of a foreign *Tonpunkt* as part of a new n-*Strecke* to create a shift in *Präsenz* (151).[73] In this passage, the realization of the a^3 cell creates a *Vorstellung* of *Kernpunkt* A in the mind of the listener. The new *Tonpunkt* C, however, does not appear to arise from an *Adjektion*, but simply emerges as a component of an *ino-Strecke*, M-C (+2 Qq), in which the new *Tonpunkt* C appears to cancel out

[73] The *Präsenz* shift occurring in measure 19 of this exerpt provides an example of such an *Adjektion* resulting in a a change of Tonal and will be discussed in the next paragraph.

the Dil *Tonpunkt* present in the memory of the listener through the previously-existing *Präsenz* (-10 Qq to +1 Qq).[74]

The resulting *Präsenz* (Mi to C) has boundary values of -9 Qq and +2 Qq, suggesting the seven cell *Kernpunkte*: Wi (Dƒ), Ki (Gƒ), Di (Cƒ), M (Fƒ), H (B), E, and A. We recall that according to the Law of *Präsenz* described in Chapter 10, a *Präsenz* cannot encompass more than seven *Kernpunkte.* Due to its central position of the series of seven *Kernpunkte,* M will be perceived as the new *Basis,* as an inner revaluation of the *Basis* ("innere Umwertung der Basis") occurs in the imagination of the listener (*PdK*, 149). The resulting *Präsenz* enclosed by *Tonpunkte* with the values -9 Qq and +2 Qq as the outer boundaries will be the +1 Pz. of M.[75] Mayrhofer reserves a particular term, *Gleitung* (slippage), for any realization of cells that leads to a change in *Tonal* such as the one described above.

The two next statements of the sequence bring about similar changes of *Präsenz* in the positive direction of tone space. Realization of the cell c^2 at the beginning of m. 19 introduces the *Tonpunkt* B (Bß) indicated by γ in Figure 41 (b), brings about another change in the prevailing *Präsenz* by two *Tonpunkte* on the right side of tone space. The boundaries of this new *Präsenz* are the *Tonpunkte* Wi (-7 Qq) and B (-4 Qq).

As in the previous paragraph, this change in *Präsenz* can not be incorporated by the existing *Basis*, (M), and again results in a *Gleitung*. To determine the new *Tonal*, let us examine

[74] Based on the *Beharrungstendenz* of *Präsenz* discussed in the previous chapter, one could argue that the listener will *still* perceive the C *Tonpunkt* indicated in the score as Dil (Bƒ) here. Such an interpretation, however, becomes less plausible when considering the larger musical context and the gradual motion in the positive direction of tone space brought about by the three statements of Wagner`s sequence in subsequent measures. Maintaining M-Dil (-10 Qq,-4 Qq) and the *Präsenz* defined by the boundaries (-10 Qq, -1 Qq) through enharmonic reinterpretation of C to Dil would mean either an even more drastic *Präsenz* shift to include the *Tonpunkte* B (Bß) and D (0 Qq,+4 Qq) or an enharmonic reinterpretation of this *Strecke* as Hi (Aƒ) and Wil (C©) (-12 Qq,-8 Qq). In either case, the existing *Präsenz* can not be maintained and a change in *Präsenz* must be acknowledged at some point.

[75] Calculation of *Präsenz* with respect to M: *Tonpunkte* Mi and C are -5 Qq and +6 Qq away from M. (-5)+ (+6)= +1. 1/ 2= 0.5. 0.5+ 0.5= 1= +1 Pz.

how this new *Tonpunkt* arises as a product of *Adjektion*. The new *Tonpunkt*, B (Bß), appears as a component of a c^2 cell, which is directly preceded by an (e^2) a^3 cell. The generation of the new *Tonpunkt* occurs through an o-*Adjektion* between D and A analogous to the *Adjektion* described in chapter 4: in traversing the fourth between D and A, the imagination conceives the *Tonpunkt* B as an *Adjektion* of an n-*Strecke* onto D, creating the perception of a shift of the overall tonal centre. The c^2 cell can thus be seen as arising from e^2a^3, which must be considered as constituting the central cell from which the new *Tonpunkt* B and therefore the new *Präsenz* arises (151), thereby forming the *Basis* of the newly-emerging *Tonal*.

To answer the question as to which *Tonpunkt* should now be considered the *Kernpunkt* of the new *Basis*, we will examine the construct (e^2a^3) from which the new *Tonpunkt* arises in more detail. The e^2a^3 structure consists of the ino-cell a^3 and its *Seitenzelle,* e^2. The e^2 *Seitenzelle* is enclosed by the outer boundaries of a^3 and therefore secondary in nature, thus making A (-1 Qq) the true centre of the structure and also the centre of the new *Tonal.* The *Präsenz* (-7 Qq,+4 Qq) for this new A-*Basis* will be -1 Pz.

With the realization of new *Tonpunkte* on the left side of tone space outside the existing *Präsenz*, the music travels to two further *Präsenzen.* The *Tonpunkte* Do (Eß) in (m. 20) and, finally, Zo (Dß), in m. 21 bring this music further away from the original *Ki-Tonal*. The addition of these new *Tonpunkte* is indicated by the symbols δ and ε in Figure 41 (b), respectively. The first change of *Präsenz* from Ki (G) to Do (E) (-6 Qq, +5 Qq) could still be interpreted as the +1 Pz of A-*Tonal*; however, the introduction of Zo (+7 Qq) in m. 21 leads to yet another change of *Tonal* and the *Präsenz* boundaries of -4 Qq and +7 Qq. In a process analogous to the *Adjektion* described in the paragraph above, this new *Tonpunkt* arises from an o-*Adjektion* from *Tonpunkt* F in the direction of *Tonpunkt* C in the immediately preceding chord in m. 20 to produce the n-

Strecke Zo (Dß)-F and the cell do^2. The new *Tonpunkt* Zo thus arises from the c^3 cell, so that its *Kernpunkt* becomes the centre of the new *Tonal*, C. The *Präsenz* (-4 Qq,+7 Qq) encompassed by this *C-Basis* is -1 Pz.[76]

Returning to the score in Figure 40, we see that the end of the third statement of the sequence in mm. 21–22 is isolated by a box. On the third beat of m. 21, the harmony C-E-G appears, in which the E descends to Wi (Dƒ) as an anticipation. According to Mayrhofer, who rejects the concept of non-harmonic tones, we should certainly consider the *Strecken* created between the *Tonpunkte* at all times. By replacing Wi with its enharmonic equivalent, Do (Eß), we can hear an f^2 *Strecke* between G and Do. Since m. 21 begins with the *Tonpunkt* Zo (Dß), respelling seems entirely appropriate. Moreover, respelling Wi as Do reveals the parallelism between the third statement of the sequence and the previous two statements. Nevertheless, Wagner respells Eß as Dƒ throughout m. 22 and thereby suggests a return to the left or "sharp" side of tone space.

How does Mayrhofer approach such an enharmonic ambiguity? To begin with, Mayrhofer rejects the idea that two *Tonpunkte* that constitute enharmonic equivalencies can exist simultaneously. He claims that such *Tonpunkte* are too close to each such that a *Strecke* can be formed between them (*OH*, 88–89). We will therefore focus on analyzing the pitch-class in question either as Do (Eß) or Wi (Dƒ) and determine the advantages and drawbacks to each analysis.

As mentioned previously, reinterpretation of Wi to Do seems appropriate for several reasons. Respelling of Wi to Do accurately reflects the perception of an n-*Strecke* existing between this *Tonpunkt* and G; a perception which would not be captured by leaving the *Tonpunkt*

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[76] Calculation of C-*Basis* value using the formula described in Chapter 10: The outer boundary points, M and Zo form Tonpunkt values that are -6 Qq and +5 Qq apart from C(+2). (-6)+(+5)= -1. -1/2= -0.5. -0.5-0.5= -1= -1 Pz.

as Wi. Mayrhofer's theory suggests a further reason for replacing Wi with Do. According to the Law of *Präsenz*, maintaining the spelling as Wi changes the existing *Präsenz* (which includes the Tonpunkt Do and not Wi) to incorporate Wi at the end of m. 21. Such a respelling of Dƒ appears unjustified in Mayrhoferian terms because it contradicts his principle of *Beharrungstendenz* of the *Präsenz* described in Chapter 10. According to Mayrhofer, changes in *Präsenz* occur as a result of the realization of n-*Strecken* and/or ino-*Strecken* that incorporate new *Tonpunkte*. Respelling Do as Wi (and therefore perceiving this *Tonpunkt* as Wi) denies rather than affirms the existence of an n-*Strecke* at this point (unless G were to be enharmonically reinterpreted as well) and therefore could not bring about a change of *Präsenz*. For these reasons, an enharmonic reinterpretation of Wi to Do in m. 21 appears much more convincing if observed through Mayrhofer's eyes.

The replacement of Wi with Do, however, encounters problems in m. 22. In order to stay within the *Präsenz* established at the beginning of m. 21 (bounded by M [-4 Qq] and Zo [-7 Qq]), the Dƒ of the first chord, Dƒ-Fƒ-A-C must be reinterpreted as Eß. Such reinterpretation realizes the ino-cell c^3 between A and Do, thus creating the *Multiklang* c^3a^3. The original interpretation of this chord as written contains the cells m^3a^3 and presents a challenge to the Law of *Präsenz,* because a total of eight cells (from f^2 to m^3) and 13 *Tonpunkte* would be enclosed by the immediate succession of the former cell by the latter. The spatial *Vorstellung* cannot comprehend such a progression as written and thereby necessitates enharmonic reinterpretation of Wi to Do to realize the *Multiklang* c^3a^3.

Such an interpretation, however, creates difficulties in interpreting the second sonority found in this measure. This sonority contains the pitch classes B, Dƒ, F and A, which Wagner treats as an augmented sixth chord through the outward resolution of Dƒ and F to (E). The chord contains the *Tonpunkte* F and H, which combine to form a d^3 ino cell. F forms a g^2 cell with the *Tonpunkt* A. Also, the *Tonpunkt* A will form an ino-cell with either Dƒ (m^3) or Eß (c^3).[77] To accurately reflect the major third that will be perceived between *Tonpunkt* H (B) and Dƒ / Eß, this *Tonpunkt* must be understood as *Tonpunkt* Wi. This interpretation in turn conflicts with the analysis described above, which rejects the immediate succession of Eß with Dƒ as a violation of the Law of *Präsenz.* As Mayrhofer rules out any suggestion that the two enharmonic equivalents can be understood as distinct *Tonpunkte*, our analysis appears to fall short of being able to analyze all of the *Streckenvorstellungen* found in mm. 21–22: interpreting the pitch-class in question exclusively an Wi or Do cannot make sense of all of the *Strecken* and neither interpretation can in itself explain the shift in *Präsenz* reflected in Wagner's score by the sudden movement to the left side of tone space.

But Mayrhofer, in fact, possesses one further tool with which he tackles the problem of enharmonic reinterpretation. To deal with the dilemma introduced in passages such as these, Mayrhofer advocates the concept of *Scheinmoll (Moll-Schein)* or apparent minor and *Scheindur (Dur-Schein)* (apparent major) (*OH*, 155). This concept refers to sonorities that appear to posses the acoustic cell content necessary to form either major or minor triads, but which in fact cannot function as such due to their musical context (*OH*, 109). Thus, an interpretation of the pitch classes G, C, and Dƒ as C-Wi-G (instead of C-Do-G= f^2) constitutes an example of *Scheinmoll*, in which the these *Tonpunkte* only appear to have the cell content necessary for a minor triad, but in which the psychological value of Dƒ as *Tonpunkt* Wi prevents such a sonority from being realized. This concept offers a possible rationale for the apparent C minor chord that appears in

[77] As discussed in Chapter 10, neither spelling of the augmented sixth chord resulting in the resolution to the octave in itself contradicts the Law of *Präsenz.* This also holds true in this particular instance, in which spelling of the Dƒ as Eß (+5 Qq) results in the enclosure of twelve *Tonpunkte* and seven cells in combination with the resolution to E-Ki-H (m^2 cell with -2 Qq,-6 Qq as the outer *Tonpunkt* values).

m. 21 and supports an interpretation of the enharmonic *Tonpunkt* as Dƒ throughout, although all of the other problems related to the Law of *Präsenz* in moving abruptly from the right side of tone space to the left side of tone space.

Similarly, the Dƒ of the second senority of m. 22 can be rationalized as *Tonpunkt* Do (Eß) by adapting the principle of *Scheindur.* Although no major triad (or enharmonic respelling thereof) exists in this augmented sixth chord, *Scheindur* can be applied at the very least to the dyad B- Dƒ to create the apparent n-*Strecke* H-Do.[78] Through this apparent n-*Strecke*, the perception of a major third can be acknowledged while maintaining an interpretation of *Tonpunkt* Do throughout the entire questionable passage found in mm. 21-22. This explanation, however, falls short once again in explaining how the music appears to move to the left side of tonal space.

Mayrhofer thus has considerable difficulty with such enharmonic reinterpretations that appear as movements between distant keys in the written notation and needs to envoke a principle (*Scheindur* and *Scheinmoll*) that is not solely based on musical perception (in contrast to his description of n-*Strecken* and ino-*Strecken*) to justify his interpretation. Ultimately, interpretations of the pitch-class in question as both Eß and Dƒ play a part in influencing how the the passage in question is written. Overall, the interpretation of the Dƒ as *Tonpunkt* Do provides a better psychological account of a Mayrhoferian interpretation of this pitch-class and provides a link with the Eß present in the chords that precede it. To truly reflect the perception of the Dƒ as *Tonpunkt* Do, the entire passage in question should maintain the Eß to preserve

[78] This sonority constitutes an augmented sixth chord (with the *Tonpunkt* A) but as Mayrhofer' analysis encourages a separate appraisal of all individual *Strecken* regardless of the other *Tonpunkte* present, the three *Tonpunkte* discussed above can be seen as an example of *Scheindur*. Although the entire progression from the end of m. 21 can be seen as the culminating in an augmented sixth chord that resolves to an E major triad at the end of m. 22, Mayrhofer does not make any distinctions between chord tones and non-chord tones and typically employs a chord-to chord analysis as described here.

the position on the right (flat) side of tone space.[79] Thus, the augmented sixth chord in m. 22 would be respelled as Gå-Bå-Då -Eß resolving to an Fß triad.

CHAPTER 12

Conclusion: The Reception of Mayrhofer's Harmonic Theory

[79] Mayrhofer does provide examples of instances in Wagner's music in similar situations involving changes of *Tona*l and *Präsenz*, in which he considers enharmonic respelling necessary to more accurately reflect musical perception (*PdK*, 137-138).

As we have seen, Mayrhofer's system of harmony rests on a single concept: the function of the major third (n-*Strecke*) as a foundational interval defining the centre of expansion in tone space at multiple levels of organization. At the heart of his system lies the idea that a linear expansion exists between any two different pitch-classes (*Tonpunkte*) in tone space, which Mayrhofer describes in a series of tempered perfect fifths or tempered perfect fourths known as Qq units. Mayrhofer contends that the two pitch-classes that comprise the major third possess the power to form a cell, a symmetrical entity in which the midpoint between the two boundaries of the *n-Strecke* forms the centre. The n-*Strecke* forms the foundation of both major and minor triads, which constitute inversionally-related entities sharing a common major third. The two *Tonpunkte* forming the outer boundaries (*Randpunkte*) of the cell can be sounded with any combination of *Tonpunkte* found within their limits as defined by Mayrhofer's tone space.

From Mayrhofer's concept of the cell arises his visual representation of music as a series of symmetrical expansions in tone space. Different levels of tonal organization (n-cell, ino-cell, N-cell, INO-cell) emerge from further symmetrical Qq expansions from the tonal centre. The first level of expansion, the n-cell, contains boundary *Tonpunkte* +/-2 Qq from the overall centre. The ino-cell is defined by boundary *Tonpunkte* +/-3 Qq from the centre. Further levels of expansion in tone space, including the N-cell (+/- 4Qq) and INO-cell (+/-5 Qq) create combinations of multiple cells.

Mayrhofer introduces the term *Präsenz* to describe the tone space area occupied by the largest number of distinct *Tonpunkte* (12) he thinks are simultaneously conceivable and the concept of *Tonal*, containing 15 *Tonpunkte*. In his view, the latter concept defines the number of *Tonpunkte* that can in some sense be considered to belong to a single tonality. Armed with these concepts, Mayrhofer's "iron-clad" (*eiserne*) logic (Mey 1911, 247) derives a uniform analytical system from the n-*Strecke*, in which cells and combinations of cells describes not only individual harmonies but the boundaries of more extended structures in tone space.

Although this system employs concepts such as *Strecken* within the theoretical of realm of tone space, Mayrhofer is careful to emphasize that his system, unlike all previous tonal theories, arises as a concrete product rooted in musical perception as opposed to intellectualization that is abstracted from perception (*PdK*, 8). His interest in further developing an understanding of musical perception coincides with a general turn towards psychology in music theory. Theorists such as Riemann, Kurth, and Stumpf, among others, had explored such questions in their work. Mayrhofer's concept of the n-*Strecke* presupposes musical comprehension by the interval of a major third in the first instance and more indirectly by way of the tritone. Mayrhofer's identification of the major third as THE principal essential interval and rejection of music theory based on scales in itself constitutes a radical departure from both scale-based and harmonic theories.

Mayrhofer extends his theory of music perception to his theory of expanded tonality, arguing that expanded tonality emerges as a necessary development of music to include a high degree of chromaticism in the 19th century. This acclimatization to chromatic music, which has stretched the boundaries of tone space, results in listeners who are able to retain a concept of a particular *Hauptklang* over a longer stretch of time even in the intermittent presence of distant harmonies (Mayrhofer 1908b, 292). According to this concept of expanded tonality, a triad built on the tonic no longer provides a sufficient determination of key. Rather than a major triad or minor triad, the *Tonpunkte* that comprise an entire major diatonic scale now serve as a tonic (*Basis*).

Mayrhofer regards his system as a necessary organic development built on the perception of the major third and serves to correct previous music theories in general and scale-based theory in particular. In 1911, Mayrhofer presented a "program for revisions to harmonic theory" at the I. Austrian Music-pedagogic Congress in Vienna (1911, 147–151). While acknowledging that the seven distinct *Tonpunkte* of the diatonic scale constitute a level of tonality, he vigorously opposes the idea that chromatic notes can be explained simply as altered forms of these diatonic scale steps. To him, this idea represents a contradiction: the diatonic scale accounts for seven *Tonpunkte* and cannot therefore under any circumstances suitably describe *Tonpunkte* outside of its realm (150–151). In short, chromatic *Tonpunkte* are in no way structurally subordinated to the diatonic *Tonpunkte* as derivatives (148). He contends that our current system of notation requires revision because it is heavily weighted to diatonicism and is thus inadequate in describing chromaticism (Mayrhofer 1908b, 292; Wetzel 1909, 631).

The radical nature of Mayrhofer's ideas and his vigorous presentation of them earned him a significant degree of notoriety during the time period of his publications. As well as exploring the psychological aspects of music that captured the interest of many music theorists, Mayrhofer's ideas appeared to present an alternative interpretation of the highly chromatic and often tonally ambiguous music of the latter 19th and early 20th centuries. Many of the leading contemporary music theorists, including Hugo Riemann, Heinrich Schenker[80], Arnold Schoenberg[81], and Ernst Kurth[82] were aware of Mayrhofer's work.[83] While Schoenberg

[80] The Austrian music theorist, composer, and pedagogue Heinrich Schenker (1868–1935) developed a theoretical system that would become the most widely-used analytical approach to tonal music in North America. Essentially, Schenker contends that tonal works of music can be seen as an "unfolding" of a fundamental tonic triad in which the melody descends through the diatonic scale to end on the fundamental scale-degree 1.

[81] Arnold Schoenberg (1874–1951) was one of the most significant composers of the 20th century and also published influential books on composition and a theory of harmony. He is best known for transcending the boundaries of tonality and playing a seminal role in the development of atonal music. His twelve-tone serial technique influenced the development of serialized music of many composers such as Anton Webern and Alban Berg.

considered Mayrhofer's works to be worth reading[84], Riemann and Kurth were dismissive. Yet, Mayrhofer's works also received extensive and generally favourable reviews from two other authors, the German composer-theorist Hermann Wetzel and the German musicologist Kurt Mey, an ardent Wagnerian.

Hermann Wetzel (1879–1973), who published reviews concerning Mayrhofer's first two treatises, composed over three hundred songs, as well as chamber music, choral works, and works for piano. He also published several music-theoretical works, including an analysis of Beethoven's op.110 piano sonatas (1909), a treatise concerning the psychology of rhythm, and a brief article on major and minor tonality (Riemann 1929. s.v. "Wetzel, Justus Hermann"). In his reviews concerning Mayrhofer, which were published in the two periodicals *Zeitschrift für Ästhetik und allgemeine Kunstwissenschaft* and *Die Musik*, Wetzel provides an extensive description of the major aspects of Mayrhofer's works. He discusses Mayrhofer's core concepts such as essential *Strecken*, *Adjektion*, the tonal levels (which he calls *Tonkreise*), major and minor tonality, consonance / dissonance, and Mayrhofer's relationship to other theorists.

Although Kurt Mey (1864-1912) provides reviews of Mayrhofer's writings that are far less comprehensive than Wetzel's reviews, he joins Wetzel in admiring Mayrhofer's theoretical system. Kurt Mey was a frequent contributor to the Wagnerian periodical *Bayreuther Blätter*. He

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[82] Ernst Kurth (1886–1946), a Swiss musicologist of Austrian birth, wrote several important books concerning music theory, including studies of Romantic harmony, the composer Anton Bruckner, as well as a treatise exploring the fundamentals of counterpoint. He developed the concept of "psychic energy" as a central principle to describe both melodic and harmonic components of music and incorporated many psychological aspects as well as philosophical thought into his work (von Fischer 2007, s.v. "Kurth, Ernst").

[83] Whereas Riemann, Kurth, and Schoenberg mention Mayrhofer in their writings, Schenker does not mention Mayrhofer in his works, but does refer to him in one of his letters. In a letter to the editor of Universal, J.Hertzka from 1911, Schenker requests the addressee to support his own theoretical writings to the extent which he supported those of Schoenberg and Mayrhofer (Schenker 1911).

[84] Schoenberg was known to possess a copy of Mayrhofer's third treatise, *Der Kunstklang*, in which he underlined and annotated several passages. He refers to Mayrhofer briefly in his theory of harmony, expressing the idea that he would have studied Mayrhofer more closely if he were able to express himself less ponderously (Schoenberg 1922, 1983, 409). In a private letter to the Austrian musicologist Josef Rufer, Schoenberg provides a list of thirteen major music theoretical works he considers worth further study and includes Robert Mayrhofer's *Der Kunstklang* in this list (Schoenberg 1938).

wrote two major treatises: *Der Meistergesang in Geschichte und Kunst* (1892) and *Die Musik als tönende Weltidee: Die metaphysischen Urgesetze der Melodik*, which both explore aspects of Richard Wagner's music (Riemann 1929, s.v. "Mey, Kurt").

Both Wetzel and Mey share an admiration for the logical consistency of Mayrhofer's system (Wetzel 1908, 146-47; Mey 1911, 247-248). Wetzel, in particular, finds many aspects of Mayrhofer's work to confirm his own views. He condemns the reduction of chromatic pitch-classes to diatonic scale-degrees (147). Furthermore, Wetzel appears particularly impressed with Mayrhofer's analytical system and finds Mayrhofer's discussion of incorrect enharmonic spellings in the literature using the Law of *Präsenz* to be convincing (1909, 631). Despite Mey considering *PdK* a most "strange" (*merkwürdiges*) book, Mey also admires the "firm consistency" and the strict logic as well as the strong mental elasticity (*Elastizität*) of Mayrhofer's system (1911, 247).[85] He believes that philosophers in particular will find much to admire in Mayrhofer's work (1908, 241).

Wetzel's approval of Mayrhofer stems to a large extent from his enthusiasm about the possibility that Mayrhofer's system represents an improved system of musical analysis particularly well suited to composers such as Wagner. Although he does not provide any proof, Wetzel claims that Mayrhofer's system is much more adept in analyzing such works as Wagner's Tristan Prelude (serving as the *locus classicus* of chromatic music) than any existing musical theory, including Riemann's *Funktionstheorie* (1908, 141). At the same time, however, Wetzel

[85] Depending on the context, *merkwürdig* may also be translated as "remarkable" rather than "strange". In the context used by Mey, strange appears to be more appropriate in describing Mey's bewilderment after reviewing a work by Mayrhofer for the first time. Mey begins his critique of *PdK* as follows: "Ein merkwürdiges Buch, in welchem man nur durch langwierige Studien eindringen kann und über welches sich nicht leicht ein Urteil bilden lässt." (A strange book, which one can penetrate only through lengthy studies and about which one cannot easily form a judgment) (1908, 240).

remains critical of the weaker aspects of Mayrhofer's treatise, especially Mayrhofer's presentation style.

In attempting to make Mayrhofer's ideas more accessible compared to their description in Mayrhofer's own work, Wetzel occasionally ventures beyond providing a précis of Mayrhofer's work and amplifies a number of elements in Mayrhofer's theories. For instance, Wetzel states that Mayrhofer treats all non-chord tones —passing notes, suspensions, neighbour tones, etc. — harmonically (1908b, 82). Mayrhofer does not express this explicitly, but it is clear through his treatment of such entities in his musical analyses. Occasionally, Wetzel misrepresents Mayrhofer's ideas: For example, Wetzel considers Mayrhofer an advocate of equal temperament (1909, 632), whereas the tuning system that emerges from Mayrhofer's writings is more complex than equal temperament, despite Mayrhofer's tolerance of deviations from the pure intervals. Wetzel's often succeeds in expressing Mayrhofer's thoughts more clearly than the author himself, but also misrepresents some of the less salient features of Mayrhofer's system as a result.

Mey admires Mayrhofer for a different reason. Although he too is impressed by Mayrhofer's logical consistency, Mey's most enthusiastic response to Mayrhofer appears in his discussion concerning the psychological premise of Mayrhofer's work. In his review of *PdK*, Mey directly quotes Mayrhofer's declaration that music does not correspond to acoustical phenomena, but is created within the musical participant (1908, 240).[86] Mey's approval of

[86] Mey cites the following passage from *PdK* (*PdK*, 7): "Daraus geht mit Sicherheit hervor, daß Musik erst in unserem Innern wird und äußeres Klingen nur Anlaß hierzu ist; ferner daß in uns seelische Kräfte nach bestimmten Gesetzen walten müssen, welche im besondern Fall entscheiden, ob die äußere Erscheinung derart ist, daß sie als musikalische Gestaltung hingenommen warden kann, Gesetze, welche auch Ursache sind, daß der Musiker ein Klingen immer in der Weise veranlaßt, daß es Musik wird."
("From this, one can gather with certainty that music is created only in our inner being and that external sound is only the agent that leads to this; also, it is clear that psychic powers operate under particular laws within us, which determine in particular cases, whether the external phenomenon is of a quality such that it will be accepted as a

Mayrhofer likely stems from his own conviction that music constitutes far more than mere acoustic signals and in fact functions as a carrier of ideas and concepts. Evidently, an acoustic theory of music would not allow Mey's own attempts at describing the metaphysical goals of melody, a goal of one of his two main works, much scope. Mey's initial approval of Mayrhofer can be understood through his position as an advocate of the Wagnerian *Gesamtkunstwerk*, in which music unites with other art forms and thereby ventures far beyond the idea that music consists only of acoustic phenomena.

Unlike Mayrhofer himself, Mey and Wetzel, especially, provide a comparative critique of Mayrhofer's positions with respect to other music theorists. To begin, Wetzel contends that Mayrhofer "is a dualist, like Zarlino, Tartini, Rameau, Hauptmann, von Oettingen, and Riemann before him".[87] Mey also describes Mayrhofer as a harmonic dualist who agrees with Riemann at one instance and contradicts him in other aspects (1908, 240).

Wetzel, too, thinks that Mayrhofer's theory closely relates Riemann's work, but points out several important differences (1908b, 86–87). He observes that, like Riemann, Mayrhofer appeals to the overtone series and the undertone series. He correctly points out that Mayrhofer's two series are both generated by n-*Strecke* as the generator of both series, while Riemann builds his two series on a common fundamental tone (1908, 142–143). He recognizes that Mayrhofer's use of symmetry extends Riemann's, and applies to all sound phenomena in tone space, rather than just the construction of major and minor triads. Furthermore, Wetzel observes that Mayrhofer's view of major and minor dispenses with the idea that these two tonalities represent

musical creation; such laws alsoenable the musican to bring forth sound that will always be created in a way that it becomes music").

[87] In describing theorists such as Zarlino and Rameau as dualists, Wetzel clearly adopts a Riemannian interpretation of the antecedents of 19th century harmonic dualist theory. Although elements of the theories of Zarlino and Rameau contain theoretical ideas later incorporated by Riemann, not all theorists agree that these two theorists can be classified as dualists and accuse Riemann of misreading their works (Dahlhaus 1975, 286–290) .

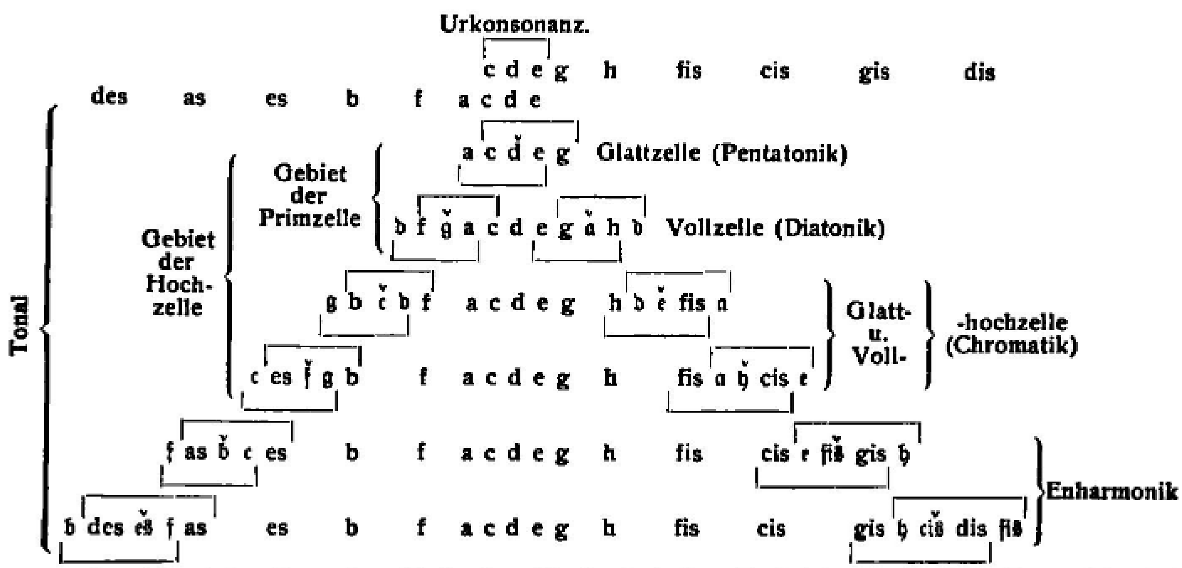
two distinct systems of tonality (1908, 146). Wetzel thus recognizes the differences of in the dualistic aspects between Riemann and Mayrhofer but nevertheless sees dualism as being at the heart of Mayrhofer's system (1908b, 82).

All reviewers of Mayrhofer, including Mey and Wetzel, who value the theoretical concepts of Mayrhofer's system, unanimously condemn two important aspects of Mayrhofer's writing: the impenetrability of his terminology as well as the lack of discipline and coherence in developing his ideas. In his article "*Die Phrasierung im Lichte einer Lehre von Tonvorstellungen*", Hugo Riemann characterizes Mayrhofer's writing as "quite unenjoyable" (*wenig geniessbar*) (1919, 29), while remaining largely silent about Mayrhofer's system itself. Mey considers Mayrhofer's writing style a significant barrier to translation and further circulation of the work, as he finds many of Mayrhofer's terms (for example, *dmino* for an ino-*Strecke* in which the *Seitenzellen* around both the *Durpunkt* and *Mollpunkt* are realized) unintuitive (1908, 241). Like Wetzel, Mey complains that *PdK* is long on structural "facts", but short on musical examples and analysis, which could clarify the book's ideas (1911, 248).

Wetzel's critique of Mayrhofer's writing style goes even further than Mey or Riemann. Wetzel expresses Mayrhofer's inadequacy in relating his thoughts and terminology to the ideas of other theorists, accusing Mayrhofer of superficiality when he deals with aspects such as the mathematical data for the acoustic implications of his tuning system (1909, 632). Indeed, Wetzel attempts to clarify Mayrhofer's theory in his review articles by substituting his own terminology.

As shown in Figure 42, Wetzel introduces his own visualization of Mayrhofer's tonal levels, which he calls *Tonkreise* (tone circles or regions) (1908, 143). In the diagram, Wetzel relates Mayrhofer's cells to the conventional tonal collections, including pentatonic, diatonic, chromatic, and enharmonic *Tonkreise.* For the purpose of clarity, Wetzel's terminology differs slightly from Mayrhofer's own definitions (and from the terms used in earlier discussions in this work). Since words such as *Pentatonik* and *Chromatik* are often used in conjunction with scales, Wetzel's usage of such terms is inappropriate for the works of Mayrhofer, but does communicate the number and intervallic characteristics of the *Tonpunkte* involved Mayrhofer's levels more directly than Mayrhofer's own terminology. As seen in the figure, Wetzel's *Primzelle* encompasses Mayrhofer's n-cell and ino-cell. Wetzel relates Mayrhofer's cells to the *Tonpunkte* found in pentatonic and diatonic collections, respectively. The N-cell and INO-cell represent a spatial expansion at the level of chromatic tonality (*Hochzelle*). Finally, the expansion to the level of *Tonal* encompasses additional "enharmonic *Tonpunkte*".

Figure 42: Wetzel's Presentation of Mayrhoferian Cells as *Tonkreise* (Wetzel 1908, 143)



* Wetzel uses German names for *Tonpunkte.* (H=B, fis=Fƒ, cis=Cƒ, gis= Gƒ, dis=Dƒ, b= Bß, es= Eß, as= Aß, des= Dß).

In his review of *OH*, Wetzel contends that he has "never seen as great a discrepancy between the clearly discerned foundational thoughts of a theory and their scattered, unrefined presentation... never (has he seen) such a lack of self-discipline in the author in controlling his language- and technical thought-apparatus *(sprach- und gedankentechnischen Apparat*), in a case where such a rich and original mind desperately needed such devices”.[88] Mayrhofer’s difficulty in conveying his thoughts in a more accessible manner may well account for Mayrhofer’s neglect in subsequent years by a musical public that found his stylistic deficiencies to be too great a barrier to overcome.

In addition to the universal objection of Mayrhofer’s writing style, Mayrhofer’s ideas themselves did not escape criticism from other music theorists. On two occasions, Riemann briefly mentions Mayrhofer (1919; 1908) and he includes an entry on Mayrhofer in his *Musik-Lexikon*. Riemann appreciates that Mayrhofer’s argument in *PdK* that musical perceptions cannot be reduced to acoustic phenomena, an idea which corresponds to Riemann’s own conception of *Tonvorstellungen* (1919, 29). Riemann regarded music perception to occur through *Tonvorstellungen* (tone images) and contends that all tones are seen as components of major and minor triads (and seventh chords derived from them) (1914) and agrees with Mayrhofer’s intention to describe the psychological factors involved. He claims, however, that Mayrhofer did not go far enough and did not suggest anywhere that *Tonvorstellungen* precede the realization of musical sound in reality (29), a concept which Riemann employed to account for the ability of the listener to form a conception of musical sound without being dependent on its realization (1914, 3).

Riemann also rejects Mayrhofer’s incorporation of the major third as a fundamental interval within a dualistic framework. While acknowledging that Mayrhofer’s system resembles

[88] Wetzel writes: “ Nie habe ich einen solchen Zwiespalt zwischen den klar erschauten Grundgedanken eines Autors und ihrer wirren, ungehobelten Ein- und Umkleidung bemerkt, nie einen solchen Mangel an Selbstzucht zur Beherrschung des sprach- und gedankentechnischen Apparates, wo doch ein reicher und origineller Geist ein solches Handwerkszeug dringend brauchte.” (1909, 632)

Moritz Hauptmann's[89], Riemann thinks Mayrhofer's theory fails on historical grounds. He contends that sophisticated forms of music existed long before the major third was even recognized as a consonant interval. To Riemann, Mayrhofer's attempt to build an entire system on the n-*Strecke* thus represents an artificial construct that does not agree with the pre-eminence of the perfect fifth and the triad as the fundamental *Tonvorstellung per se* which Riemann believes is revealed by the historical development of music from ancient times (1908; 1929).

The most probing and least sympathetic response to Mayrhofer's ideas, however, does not emerge from Riemann's pen, but from Ernst Kurth (1917). In his work on counterpoint, Kurth opposes several aspects of Mayrhofer's system, including what he considers a problematic usage of the overtone series to obtain the *Tonpunkte* involved in musical listening. But the main thrust of his critique is aimed at Mayrhofer's spatial conceptualization of tone space (93).

As discussed earlier, Mayrhofer contends that any combination of *Tonpunkte,* including the foundational essential intervals such as the n-*Strecke* and the ino-*Strecke*, results in a spatial projection of a distance between them. Kurth acknowledges that spatial perception plays a role in music, but argues that it takes place between tones generated through melody rather than within a given harmonic entity as Mayrhofer (and other theorists who view melody as being derived from harmony) claims. Kurth also claims that Mayrhofer's spatial interpretation of music is by no means foundational, but largely emerges from representing the musical sounds as a visual abstraction (94). To Kurth, Mayrhofer's attempt to "derive the movement of music from the

[89] Riemann considered Moritz Hauptmann to be his forerunner in developing harmonic dualism. Hauptmann's major work, *Die Natur der Harmonik und Metrik* (1853) describes a process through which triads containing major thirds and perfect fifths develop from a single tone and how these triads, which can be generated in opposing directions to generate either major triads or minor triads that can then further be propagated to complete diatonic tonality. As a result of this process, Hauptmann typically depicts the realms of tonality as a series of (either major or minor) thirds. For example, C major tonality can be described by the sequence: F-a-C-e-G-h-D, which contains three major triads built on subdominant (F), tonic (C) and dominant (G). Riemann considered Mayrhofer's system to be related to Hauptmann's "chains of thirds" (Riemann 1929 s.v. "Mayrhofer, Robert").

chord itself" represents a bizarre deviation from perception generated through melodic movement (93).

Kurth contends that this erroneous view of spatial perception leads Mayrhofer to further errors. Mayrhofer's theory contends that each distinct pitch-class comprises a *Tonpunkt* in tone space and that a distance is perceived to exist between any two *Tonpunkte* (94). Kurth claims that Mayrhofer's concept of spatial apprehension, in which two pitches separated by an octave do not generate a distance between them, does not represent the actual spatial perception that arises from melodic movement. He claims that Mayrhofer has intertwined his spatial apprehension with the concept of Stumpf's tonal fusion which describes the degree to which dyads appear to the listener as a single entity (94). So, the ability to distinguish between the two border points of an n-*Strecke* has little to do with spatial perception. Therefore, Mayrhofer's concept of tonal expansion is actually nothing more than an evaluation of the degree of fusion between the *Tonpunkte* (94–95).

Kurth's and Mayrhofer's views are irreconcilable: Kurth can never accept that the intervals C-E and E-C should somehow create an identical spatial perception and considers such an idea to contradict musical experience in which the obvious difference in perception of the C-E interval as opposed to E-C becomes clear (95). Kurth claims that perception of melodic motives and figuration pattern exposes the artificiality of Mayrhofer's concept of spatial perception, as the intervals involved in approaching any given note inevitably shape its perception in space. Ultimately, Kurth's reasons for rejecting Mayrhofer are shaped from his unwillingness to accept Mayrhofer's essentially harmonic conception of music.

At the conclusion of the section on Mayrhofer's spatial perception, he condemns Mayrhofer's theory in no uncertain terms. He compares the experience of reading Mayrhofer's writing with listening to a blind individual discussing colour (96). According to Kurth, Mayrhofer's *Kunstklang* has nothing to do with art but represents a discussion of an artificial and theoretical *Klang* (96). Kurth thus claims that Mayrhofer fails to provide a genuinely psychological theory of music and has instead created the most abstract speculative theory of all.

Mayrhofer's advocates, Mey and Wetzel, recognize some of the shortcomings of Mayrhofer's theory, but contend that his treatises are worthy objects of study, even if an entire book may be required to explain his ideas (Mey 1908, 241). The biggest obstacle to Mayrhofer's ideas remains his writing style and his technological apparatus itself: once Mayrhofer's ideas have been expressed more clearly and his terminology adjusted and standardized, Mayrhofer's treatises, including his third treatise, *Der Kunstklang (DKK)*, can be examined more thoroughly. Many possible projects concerning this long-neglected music theorist would then become possible. The development of Mayrhofer's thought, which undergoes significant changes from the time of his early treatises to *DKK*, can be traced and evaluated in the light of its context. Topics such as the relationship of Mayrhofer to German idealist philosophy or to the work of other music theorists, including harmonic dualists as well as theorists discussing issues of psychology and perception, also emerge. Furthermore, Mayrhofer's publication concerning aesthetics and its relationship to his harmonic theories could be evaluated, or his conception of symmetry and inversion compared to that of other theorists.

In addition to the possibilities described above, the analytical application of Mayrhofer's system to music constitutes perhaps the most interesting future endeavour concerning Mayrhofer. Wetzel himself suggests that the true merit of Mayrhofer's system will be determined in the application of his system to musical practice (1908, 146–147). Such an analytical evaluation that can be carried out by applying Mayrhofer's method to the music of Mayrhofer's contemporaries will then lead to a clearer answer to the question of whether Mayrhofer's analytical system can be considered a plausible alternative approach or whether it crumbles due to its distortions of musical perception. In addition to evaluating the music of late Romanticism for which Mayrhofer designed his system, Mayrhofer analysis of early atonal music by composers such as Schoenberg or Webern may prove highly stimulating and potentially insightful regarding both the validity of Mayrhofer's theory and the concept of tone space in general.

Although even his advocate, Kurt Mey, admits that Mayrhofer's system represents a rather eccentric approach, he nevertheless considers Mayrhofer to have made a valuable contribution to music theory. In determining Mayrhofer's position with regard to other music theorists, Mey writes:

> We contend that every one of these systems has its justification and will be true in its own way. Each system views music in a unique way and seeks to penetrate the essence of music from a different angle. One approach may be more philosophical in nature, another more physical, while a third approach appears physio-psychological, etc. Each contributes to a growth of knowledge in its own way, perhaps not always equally, as one may be more valuable than another in a certain respect. In our opinion, Mayrhofer's theory, as difficult as it may be to access, possesses the power to be not only compelling, but conclusive (1909, 240–241).

In acknowledging the distinct possibility that future readers may not view Mayrhofer's theory as providing a conclusive answer to the analysis of late tonal music, let us hope that the first three sentences of Mey's attitude to music theory may not be forgotten entirely by anyone interested in the unique body of work left behind by Mayrhofer.

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