Early Modern Music Cognition: The Case of W. C. Printz

Caleb Mutch

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Abstract

Although W. C. Printz has not figured prominently in the history of music theory, this article argues that he deserves a place of great importance in the pre-history of music cognition. Drawing upon the broadest reading of Printz's oeuvre to date among Anglophone scholars, the article demonstrates that he was attuned to how sounding musical phenomena in the domains of rhythm and pitch can differ from how they "appear" or are "understood." It concludes by considering Printz's overlooked, late-career *summa*, in which he adapts Descartes's *Compendium musicæ* to craft an account of musical perception.

Wolfgang Caspar Printz (1641–1717) has not cut a wide figure in the history of music theory. He spent much of his career on the eastern fringe of the Holy Roman Empire, in Sorau (modern-day Żary, Poland), and although his contemporaries and successors cited him with respect, little of his wide-ranging music theorizing made a significant impression. Nor has his oeuvre attracted much attention in recent decades, as his best-known work, *Phrynis Mitilenæus* (1696), bristles with abstruse novelistic details and in-jokes, and his other publications are lost or languish in near-complete obscurity. Yet there is one context in which his name is often invoked: discussions of historical theories of rhythm, and particularly of its cognition.[1] William Caplin, for instance, writes that one of Printz's formulations "implies that accent resides in our personal cognition of an event rather than in the event itself" (2002, 662). By examining previously overlooked works by Printz this article argues that he in fact makes explicit claims about music cognition, that he does so concerning harmonic phenomena as well as rhythmic ones, and that his late writings react to Descartes's *Compendium musicæ* to theorize a yet stronger account of music perception.

This article proceeds in three parts. The first reexamines Printz's innovative concept of internal duration, in which certain notes appear to be longer or shorter than they truly are, in light of a broader reading of his music-theoretical corpus. The second part explicates his doctrine of cadences, where he classifies progressions based on where they are understood to resolve, even when they actually resolve elsewhere. The article's third part turns to Printz's late-career addressing of the relation between the intellect and the senses when perceiving music and shows that it is provoked by his in-depth engagement with Descartes's *Compendium*.

1. Internal Duration

Inasmuch as Printz is known today, it is due to his innovative concept of "internal duration" (*quantitas temporalis intrinseca*).[2] Printz evidently introduces this idea in an attempt to

[1] See Houle 1987, 80–81; Hasty 1997, 105; Caplin 2002, 662; Mirka 2009, 43; London 2012, 174; and Petersen 2013, 196–97.

[2] One counter-example to the claim that Printz is known for internal duration is Petersen 2013, 196–97, which presents a withering summary ("problematic . . . incomprehensible, even arbitrary") of Printz's rhythmic theory—as presented in the third book of *Phrynis Mitilenæus*. Petersen is evidently unaware of Printz's concept of

theorize the phenomenon we call metrical accentuation, and its music-perceptual ramifications have attracted attention. Indeed, it is this very concept that Caplin interpreted as implicitly cognitive in the passage quoted above. The modern reception of "internal duration" relies on Printz's *Phrynis Mitilenæus* (1696), but Printz originally devised the idea decades earlier. That 1696 publication was actually an expanded second edition of a work first published twenty years earlier as *Phrynis* (1676–77), and the meat of Printz's treatment of internal duration occurs in the treatise's first book, which the 1696 publication copies practically verbatim from the first edition.[3] Furthermore, Printz first introduced the concept even earlier, in his Latin-language *Compendium musicæ* (1668).[4] (See Example 1 for an overview of Printz's treatises that are cited in this article.)

Year	Treatise	Description
1666	*Kurtzer Bericht Wie man einen jungen Knaben . . .*	Printz's earliest publication, on rudiments of theory
1668	*Compendium musicæ in quo breviter . . .*	Contains earliest discussion of internal duration, in Latin
1676–77	*Phrynis, oder Satyrischer Componist*	His famous theoretical work, discusses internal duration
1687–89	*Exercitationes musicae theoretico-practicae curiosae*	Nine-part treatise investigating the concords
1689	*Compendium musicæ signatoriæ & modulatoriæ vocalis*	Last original theoretical work published, on rudiments of theory
1690	*Historische Beschreibung der edelen Sing- und Kling-Kunst*	Oldest significant German-language history of music
1696	*Phrynis Mitilenæus, oder Satyrischer Componist*	Reprint of *Phrynis*, with added second and third parts

Example 1. Works by Printz cited in this article

Nonetheless, since the reception of Printz's concept is based on *Phrynis Mitilenæus*, let us begin by examining how he defines it in that treatise:

> Further, number has a peculiar power and virtue which cause notes with similar durational length (*der Zeit nach* / *gleich-langen*) to appear to be longer or shorter. This should be especially noted as much because of the text as because of consonance and dissonance. The variable length of notes with similar durational length is called *Quantitas Temporalis Intrinseca* (inner temporal quantity) (Printz 1696, 18).[5]

internal duration—presented in *Phrynis*'s first book—a concept which makes perfectly comprehensible those details which bedeviled Petersen. My thanks to one of my anonymous reviewers for bringing this source to my attention.

[3] Since the modern reception of Printz's thought is based on the second edition and it is more readily available, I cite that, despite its chronological posterity.

[4] A detailed examination of the concept's non-cognitive aspects, and how they differ between the *Compendium* and *Phrynis*, is provided in Mutch 2024.

[5] "Ferner ist zu wissen / dass die Zahl eine sonderbare Krafft und Tugend habe / welche verursacht / dass unter etlichen / der Zeit nach / gleich-langen Noten oder Klängen / etliche länger / etliche kürzer zu seyn scheinen:

How is number related to notes seeming longer or shorter? Printz explains that in duple contexts, for instance, "all notes numbered with an odd number (like 1, 3, 5, 7, etc.) are [internally] long; contrarily, those numbered with an even number (like 2, 4, 6, 8, etc.) are [internally] short (Printz 1696, 19).[6] How, then, does one determine how to number notes? While there are some complications,[7] the overall impression Printz gives in *Phrynis Mitilenæus* is that odd numbers should align with what we would call the metrical hierarchy, which he (in typical baroque-era fashion) conceives of in terms of the *tactus*: "Every semibreve or entire *tactus* also should be long according to [its] internal duration, because it is numbered with an odd number, *viz*. 1" (1696, 20).[8] Printz'z earlier *Compendium musicæ* offers a fuller picture, as it details how internal duration relates to the *tactus*'s division into thesis and arsis. Having explained that odd-numbered notes are internally long and even-numbered ones are internally short, Printz clarifies that "this is not the case if the first number in the arsis is even, for then, since it is odd with regard to the arsis, it is lengthened" (1668, VII, §4).[9] In the composite picture that results Printz ensures that the onset of the *tactus* (which coincides with the onset of the thesis) is always internally long, and that the onset of its constituent arsis is internally long, too. The words "metrical accentuation" are not articulated, but Printz certainly seems to be attempting to characterize how events that coincide with the metrical structure of *tactus*, thesis, and arsis differ from those that do not.

Let us now turn to the concept's perceptual ramifications. As was mentioned in the introduction, William Caplin views it as implicitly cognitive: "Printz's mention of an 'apparent' difference in length between the notes implies that accent resides in our personal cognition of an event rather than in the event itself" (Caplin 2002, 662). The first sentence of Printz's definition would seem to support this, as it states that notes of similar length "appear to be" (*zu*

Welches sonderlich wohl zu mercken / so wohl wegen des Textes / als auch wegen der *Consonantien* und *Dissonantien.* Diese unterschiedliche Länge etlicher / der Zeit oder Wahrung nach / gleichlange Noten / wird genennet *Quantitas Temporalis Intrinseca,* die innerliche Zeit-Länge"; trans. adapted from Houle 1987, 80–81. All translations hereafter are mine unless otherwise noted.

N.B. in the final sentence I translate "der Zeit oder Wahrung nach / gleichlange Noten" simply as "notes with similar durational length," a contraction of the more literal "notes with similar length according to the time or duration." While the *Leo* German-English dictionary (dict.leo.org) lists "observing" as a possible translation for *Wahrung*, suggesting that "notes with similar durational or observed length" would be a good translation, the Grimm brothers' *Deutsches Wörterbuch* provides no corresponding definition. Its fourth definition, however, is "bestand, dauer" (continuance, duration), suggesting that Printz is simply employing *Wahrung* as an explanatory synonym for *Zeit*.

[6] ". . . so seyn alle Noten / so mit einer ungeraden Zahl / als 1, 3, 5, 6, &c. gezehlet werden / lang; Hergegen / die mit einer geraden Zahl / als 2, 4, 6, 8 &c. gezehlet werden / kurtz."

[7] I elaborate on those complications in Mutch 2024. In short, whereas in *Phrynis* Printz largely proceeds by aligning odd-numbered notes with what we would call the metric hierarchy, in his earlier *Compendium* Printz adopts a much more idiosyncratic approach based on a general principle with subsequent modifications.

[8] ". . . eine jede Semibrevis oder gantzer Tact / auch der innerlichen Quantität nach lang sey / weil sie mit einer ungeraden Zahl / nemlich 1. gezehlet wird . . ."

[9] "Excipe tamen, si numerus primus in reductu par est: tunc enim, cum sit impar ratione reductûs, producit [recte: producitur]." As a careful reading of the *Compendium musicæ*'s fourth chapter reveals, Printz uses the term *pulsus* ("striking") for the tactus's thesis, and *reductus* ("drawing-back") for its arsis. I have not encountered this idiosyncratic usage elsewhere.

seyn scheinen) longer or shorter.[10] And this conception of a discrepancy between appearance and sounding reality goes back practically to the start of Printz's career: in his 1668 *Compendium* he defines *quantitas intrinseca* as a duration which is *apparens* (1668, VII, §1). This term literally means "being visible to," and in music-theoretical texts "perceptible" would normally be a fine rendering. In the context of the *Compendium*, however, "apparent" or "seeming" fits better. That is because Printz sets up an opposition between external and internal duration: he defines external duration as "the true (*vera*) length of a measure, of notes, and of rests," whereas internal duration is only apparent (*apparens*) (1668, II, §3).[11] In other words, a note can have one true duration and at the same time a different, merely apparent duration.[12]

It should be noted, however, that Printz is curiously reticent to identify the agent who perceives internal duration. As *Phrynis Mitilenæus* presents it, internal durations are characteristics of sounds. They are "apparent," and it surely the sense of hearing to which they appear, but in *Phrynis Mitilenæus* and the *Compendium musicæ* Printz never states that the listener's cognition is the agent imposing longer and shorter internal temporal quantities on stimuli of equal chronological duration.[13] To frame sounding duration (what Printz calls "external duration" in his *Compendium musicæ*) vs. internal duration as a matter of stimuli vs. a listener's cognition of them would certainly have been simpler, or at least it seems so from today's perspective. Printz, however, attributes to the notes themselves both the sounding (external) duration and accentual (internal) duration, even when they conflict. Nonetheless, despite Printz's coyness about the agent to whom these apparent differences appear, it is evident that he is concerned with addressing the discrepancy between how metrically emphasized notes actually *sound* and how they *appear*.

2. Cadential Seats

Printz's interest in addressing how music is understood also expressed itself in the domain of pitch, most prominently in *Phrynis*'s doctrine of the cadence (*clausula formalis*). In that treatise Printz expounds a highly structured and baroquely verbose set of cadence types (see Example 2 for a transcription of Printz's table of cadence types, the details of which we may elide here[14]),

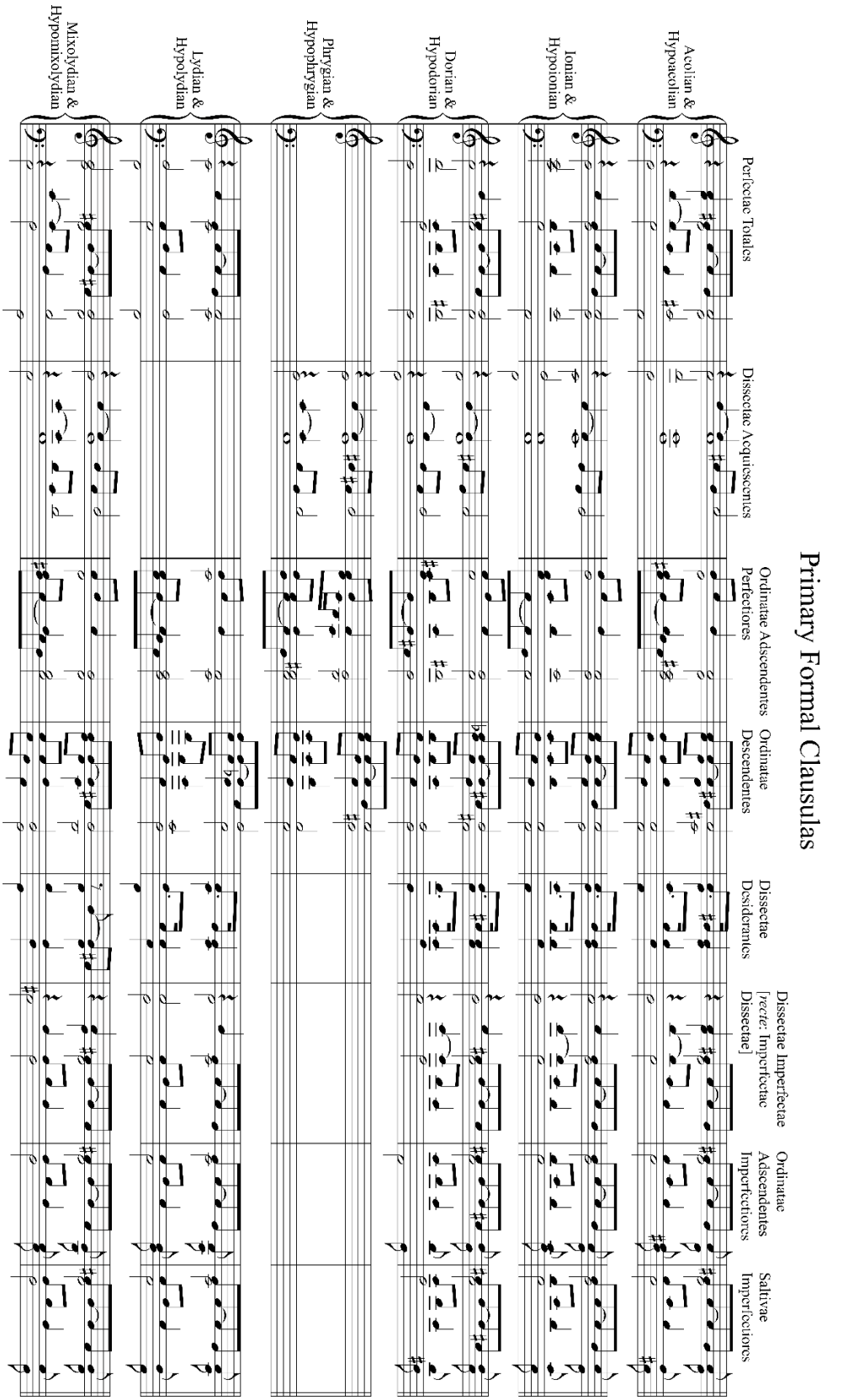
[10] Caplin's quotation of the word "apparent" comes from Houle's translation of Printz's definition of internal duration, a translation which Caplin quoted shortly before the quotation. At the start of the definition's final sentence Houle renders the words "Diese unterschiedliche Länge" as "The apparent different lengths" (1987, 81), interpolating the word "apparent."

[11] Elsewhere in the *Compendium* Printz describes a relationship that is "apparently" (*apparenter*) fixed but in reality (*re verâ*) unfixed (1668, III, §2), thereby supporting the interpretation that the internal and external durations' *apparens* and *vera* constitute a contrasting pair.

[12] This distinction makes Printz's theory substantially different from Descartes's account of the realization of metrical structure, since Descartes holds that notes actually are played or sung more loudly at the beginning of each measure (Descartes 1908, 94; 1961, 14). For more on Descartes's ideas on rhythm and meter see Raz and Cohen's joint contribution to this issue.

[13] Granted, in his *Compendium* Printz does mention the need for an attentive listener at the start of the treatise, declaring that "the subject in which the aim of music [i.e. pleasing harmony] is introduced is the listener, and not a stiff and stoic one, but one who is attentive and loves music" (Subjectum in quod finis Musicæ introducitur, est auditor, isque non rigorosus & stoicus, sed attentus & Musicam amans) (1668, I, §3).

[14] For a detailed examination of Printz's cadential doctrine, see Mutch 2015, 154–204.



Example 2. Printz, *Phrynis Mitilenaeus* I.8

before he introduces what he calls the "seat" of a cadence.[15] He identifies two types of seats: the "expressed seat" (*Sedes expressa*) and the "understood seat" (*Sedes subintellecta*). Printz puts the concept of the cadential seat to work in several contexts, of which we will focus on three: cadences vis-à-vis the twelve modes, rising-fifth cadences, and what we now refer to as deceptive cadences.

As is the case with most other German theorists of his day, Printz held to the century-old teaching that there are twelve modes, despite the gradual coalescence of musical practice into two keys, major and minor.[16] He also continued the even older tradition of evaluating how cadences can support or undermine the mode in question. In this practice, which extends back at least to Pietro Aron in the 1520s, one considers whether the note held by the most important voice (in earlier times the tenor, later the discant) at the cadence's conclusion matches the mode's characteristic notes. As for what notes are characteristic, seventeenth-century German theorists largely followed Zarlino, who taught that they are the bounding notes of the modal octave, the note which divides the octave into its fourth and fifth, and the note which divides the fifth into its major and minor thirds (1558, IV.18, p. 320). Johann Lippius used his concept of the harmonic triad to simplify this: a primary (*primaria*) cadence is made on the modal triad's lowest note, a secondary (*secundaria*) on its fifth, and a tertiary (*tertia* or *tertiaria*) on its third (1610, sig. D3^{v}). Printz adopted this scheme, along with Conrad Matthaei's binary of "proper" (*propria*) for modally supportive cadences and "foreign" (*peregrina*) for those which lead away from the mode (Matthaei 1652, I, §5, 7).

By contrast, there is no evident precedent for Printz's concept of the *sedes*. Printz labels all the cadences shown in Example 2 as primary cadences (*clausulae formales primariae*), suggesting that all of them should be associated with the modal triad's lowest note. Yet as Lori Burns has observed, Printz's primary cadences "do not necessarily resolve to the tonic, as in the I – V progression, and there are even some primary cadences in which the tonic triad is not present . . . In considering these cadential progressions to be primary, Printz departs significantly from earlier definitions of primary cadences" (1995, 202). Indeed, Printz's concept of the *sedes* proves to be central to Printz's innovative sense of what makes a cadence "proper."

In his initial discussion of the proper cadence, Printz defines it as "that which has its seat or place (*Sitz oder Stelle*) on one part of the harmonic triad of its mode" (1696, 28).[17] The terms *Sitz* and *Stelle* go unremarked upon throughout his definitions of the three types of proper cadences and the foreign cadence. It is not until several paragraphs later that Printz clarifies that

> In order to understand this correctly one must know that the seat (*Sitz*) of the cadence is the *sonus fundamentalis* (the fundamental sound), which is required to make the cadence complete and perfect. This *sonus*, or sound, is either expressed (*ausdrücklich gesetzt*) or is understood. If it is the former, it is called a *sedes expressa* (an expressed seat); if it is the latter, it is called a *sedes subintellecta* (an implied or understood seat) (1696, 28).[18]

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[15] Johann Andreas Herbst uses the term "sedes" when discussing cadences, but applies no adjectives to it: "Es ist der jenige Clavis oder MusicSchlüssel / inn welchem die Cadenz formirt und gemachet wird" (1643, 50).

[16] On this gradual evolution, with particular attention paid to modes 3 and 4, see Powers 1998, 322-33.

[17] "Propria ist / die ihren Sitz oder Stelle hat in einem Theil Triadis Harmonicae ihres Modi."

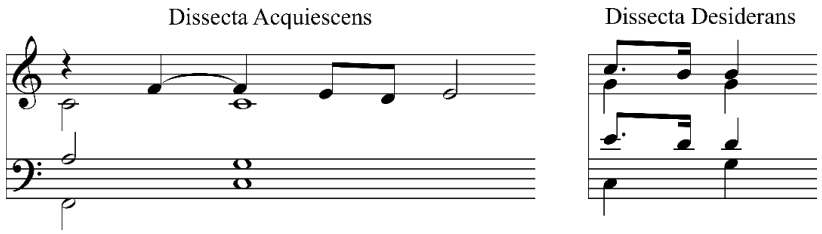
[18] "Umb dieses recht zu verstehen / ist zu wissen / daß der Sitz Clausulae Formalis sey Sonus fundamentalis, (der Grund-Klang) welcher erfordert wird / die Clausulam Formalem gantz und vollkommen zu machen. Dieser Sonus oder Klang wird entweder ausdrücklich gesetzt / oder verstehet

Any doubt that the "fundamental sound" is the modal triad's lowest note (*i.e.*, the modal final) is dispelled by Printz's later description of those cadences which have a *sedes expressa*: ". . . in these the seat is easily recognized because it is the final sound in the lowest voice, in that it is required to make the cadence entire and full" (1696, 29).[19] And indeed, in Example 2 all progressions which end with the modal final in the bass belong to cadence types Printz classifies as *sedes expressa*.

Thus, in place of the traditional, mechanical definition of the primary cadence, where the cadence's final chord has the modal final in the discant voice, Printz has proposed a new one based on what is understood (*subintellecta*). Now a primary cadence is said to happen whenever the final chord of the cadence's complete and perfect form *should* have the modal final in the lowest voice, *even if that does not actually occur*. In other words, for the first time Printz is able to articulate that modal identity (or perhaps pitch centricity, in modern terms) is able to be reinforced even by progressions that resolve away from that pitch center—even by devices like the half and deceptive cadence.

Printz's concept of the *sedes* also illuminates his two types of rising-fifth cadences (Example 3). In keeping with his complex terminological scheme, Printz embeds many conceptual details in his names: namely, the "perfect, cut-off, resting" (*perfecta dissecta acquiescens*) and "perfect, cut-off, desiring" (*perfecta dissecta desiderans*) cadences. Since Zarlino's day most theorists had based the terms "perfect" and "imperfect cadence" upon the quality of consonance found between the two primary voices at the end of the progression. By contrast, Printz shifts the emphasis from concrete description of intervals to the cadence's quality of restfulness or closure:

> "Perfect" is that which leads the melody or concord to rest, so that a perfect end of a perfect melody or harmony can therewith be made. . . . An "imperfect" cadence is that which does incline to rest, but all the same does not lead the harmony to rest, so that a perfect conclusion of a perfect melody and concord could be made with such [a cadence], but the melody . . . indicates that it should be sung further (1696, 26–7).[20]



Example 3. Printz's Rising-Fifth Cadences

sich. Ist jenes / so heisset er Sedes expressa, (ein ausdrücklicher Sitz;) Ist dieses / so heisset er sedes subintellecta, (ein verdeckter Sitz)."

[19] ". . . in diesen wird der Sitz leicht erkennet / weil er der letzte Klang in der Grund-Stimme ist / als der da erfordert wird / die Clausulam Formalem gantz und völlig zu machen."

[20] "Perfecta ist / welche die Melodey oder Zusammenstimmung zur Ruhe führet / also daß damit ein vollkommenes Ende einer vollkommenen Melodey oder Harmonie kan gemacht werden. . . . Clausula Formalis Imperfecta ist / welche sich zwar zur Ruhe neiget / aber doch die Harmonie nicht zur Ruhe führet / daß mit einer solchen ein vollkommenes Final einer vollkommenen Melodey und Zusammenstimmung könte gemacht werden / sondern die Melodey . . . daß weiter fortgesungen werden solle / andeutet."

The second element of the cadences' names, "cut-off" (*dissecta*), indicates that they are an abbreviated modification of the default, "complete" (*totalis*) cadence type (see the leftmost column of Example 2). Printz never provides a definition of what makes a cadence "complete," but his examples suggest that (in anachronistic terms) it is a resolution from a dominant-functioning chord to a tonic-functioning one. The cut-off cadence, by contrast, stops on the dominant-functioning chord. Thus, Printz writes that the perfect, cut-off (*perfecta dissecta*) cadence occurs when the bass falls a fourth or rises a fifth, "so that the falling fifth or rising fourth [which would follow in a perfect, complete cadence] appears to have been, as it were, cut off from it" (1696, 27).[21] The third element of the cadences' names, desiring vs. resting, explains itself: the former desires the cut-off chord, whereas Printz explicitly says that the latter does not long for that absent chord (1696, 27).

The concepts embedded in these cadences' names raise questions about how they are perceived. To start, in what sense can a cadence be both *perfecta* and *dissecta*? That is, what does it mean for a cadence come to rest while simultaneously appearing to be an aborted version of a complete cadence? It is clear that for Printz the quality of restfulness takes priority over the cadences' mechanics. Consider the desiring cadence: it ends with a fifth between the tenor and bass, so earlier theorists from Zarlino to Matthaei would have considered it imperfect, and it yearns for its absent chord. Yet Printz judges that it sufficiently leads "the melody or concord to rest," so he deems it instead to be perfect. An analogy to today's concept of the half cadence suggests itself: while one usually understands it as an aborted full cadence, which is interrupted before reaching stronger closure on a withheld tonic, the half cadence also ends phrases, thus attaining a degree of rest.[22] This analogy works well for the "perfect, cut-off, desiring" cadence, since it by definition includes a sense of yearning for the cut-off chord, but it is less true of the "perfect, cut-off, resting" cadence, of which Printz explicitly says that it does not long for that absent chord.

The concepts of *sedes subintellecta* and *expressa* clarify why this is so. As one would expect, Printz labels the desiring cadence as being *sedes subintellecta*, since the yearned-for sound that "is required to make the cadence complete and perfect" (that is, the tonic-functioning chord which would follow the final dominant) is only understood, not expressed. The resting cadence, on the other hand, is labeled *sedes expressa*, meaning that it does come to rest on the cadence's fundamental sound.[23] As a result, the cadential seat is not the cadence's expected final element (the omitted descending fifth), but rather the last sounding element: what would have been the dominant of a complete (*totalis*) cadence. In modern terms this yields a plagal cadence, coming to rest on the tonic. Printz, by contrast, views it as an aborted authentic cadence, one that paradoxically is made "complete and perfect" by arriving on the cadential seat at the moment of interruption. Thus, through the combination of his terminological choices and his concepts of

[21] ". . . also daß gleichsam die absteigende Quint oder auffsteigende Quart darvon abgeschnitten zu seyn scheinet."

[22] Of course modern half cadences are understood to arrive normally on a strong beat; thus, the aborted full cadential progression also undergoes a rhythmic alteration. Printz does not address the metrical and rhythmic implications of cut-off cadences.

[23] Note that this sound is not necessarily the modal final, since in secondary, tertiary, and foreign cadences the cadential seat is different from the mode's final.

sedes expressa and *subintellecta*, Printz carefully characterizes the perceptual experience of the desiring and resting cadences, which are formally similar but experientially different.

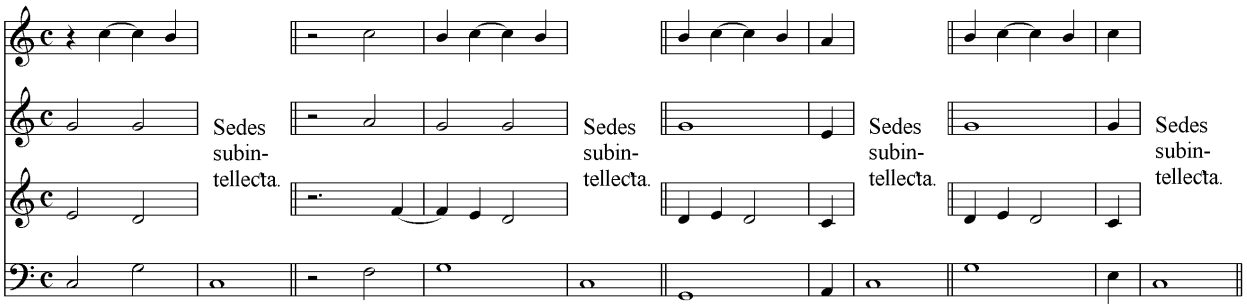
The cognitive potency of the *sedes* emerges most clearly in Printz's discussion of what we would call deceptive cadences. Techniques for altering a cadence's normal resolution had been discussed since Zarlino. For instance, in the generation before Printz, Conrad Matthaei provided examples of what he called the "hidden cadence" (*clausula occulta*), including a progression where a G major chord moves to an A minor triad. Matthaei's description is limited to a concise account of chord progression, writing that these cadences "lead their ultimate sonority elsewhere" (1652, 8).[24] Printz, by contrast, introduces an unprecedentedly cognitive interpretation of incomplete cadences.

When Printz first introduces the concept of the *sedes subintellecta*, he provides an illustration of four such cadences (Example 4). The four types (which he calls *perfecta dissecta desiderans*, *imperfecta dissecta*, *ordinata adscendens*, and *saltiva imperfectior*) are all notated in the Ionian mode, and after each cadence Printz supplies the "understood" *sedes*, which in each case is a C. In the first two cases, including the previously discussed "perfect, cut-off, desiring" cadence, the harmonies progress to a G major chord and then halt; Printz's "subintellecta" notation indicates that C in the bass is not actually sounded, and its attendant major harmony has been omitted.

The situation becomes more complex with the last two progressions. With respect to the third, the "imperfect complete conjunct ascending less-perfect" (*imperfecta totalis ordinate adscendens imperfectior*) cadence, Printz writes that it has an understood seat

> because the last sound of the desired falling fifth or rising fourth, in place of which the rising second is set, is an understood seat. [This is] because it would make a perfect (*vollkomme*) cadence if it were employed instead of the last sound of said [rising] second (1696, 29).[25]

That is, at the very moment that the G major resolves to A minor, Printz avers that something different is understood: the progression's proper resting place, the bass's C. (The situation is



Example 4. Printz's Examples of *Sedes subintellecta*

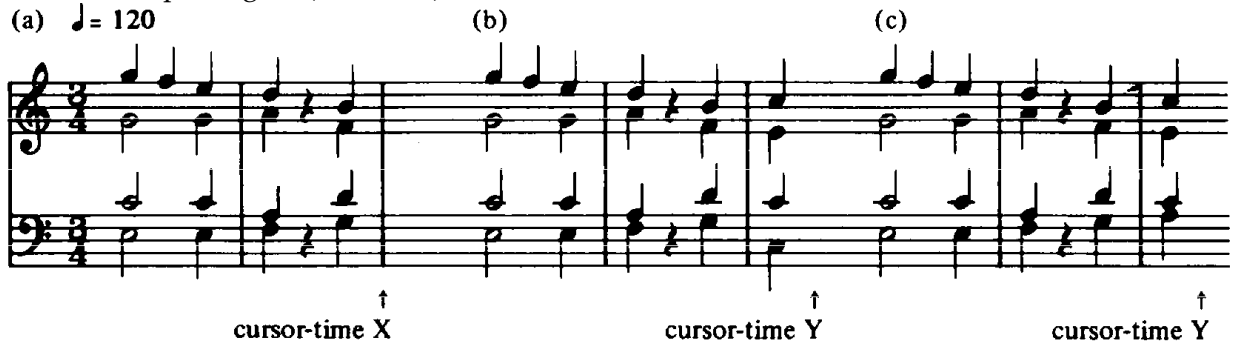
[24] ". . . ihre Ultimam anders wohin führen . . ."

[25] "Sedem subintellectam haben . . . Ordinatæ Adscendentes Imperfectiores: Denn der letzte Sonus der desiderirten absteigenden Qvint oder auffsteigenden Qvart, an deren statt die auffsteigende Secunda gesetzt ist / ist Sedes subintellecta; Weil er die Clausulam Formalem vollkommen machte / wenn er an statt des letzten Soni der besagten Secundæ gesetzt würde."

analogous in the fourth progression, but with a resolution to an unexpected inversion instead of an unexpected harmony.)

It is striking how compatible Printz's conceptualization of this progression is with modern thinking. Consider David Lewin's discussion of perceiving a deceptive cadence (parenthesized letters refer to his Figure 1, reproduced below as Example 5):

> In order for [the *subintellecta* resolution in progression] (b) to be "denied" by [the *expressa* resolution in] (c) at time Y, (b) must be at hand at that time, in a phenomenological location different from that of (c). One must not think of (b) as "disappearing" and of (c) as "replacing" it (1986, 334).



Example 5. Lewin 1986, Figure 1

For Printz, too, it is decidedly the case that an unexpressed *sedes* does not "disappear," nor is it rendered inaccessible by being "replaced": instead, it is understood. Both seats exist (in one sense or another) simultaneously, although Printz never specifies the different "phenomenological locations" where each is at hand. Indeed, just like we saw with his discussion of internal duration, Printz is reticent to name the listener's cognitive agency in the perception of cadences, even while making innovative observations about discrepancies between what is expressed and what is understood.[26] The cut-off cadences' falling fifth "appears" to have been cut off, but Printz does not acknowledge the listeners to whom this appears. And in the case of the *sedes subintellecta* the cadential seat is "understood," even when not actually present, but Printz never indicates that this sophisticated interpretive act takes place in the intellects of listeners. Yet in both cases, even though Printz consistently opts for passive-voice constructions that leave the agent unspecified, these actions of appearing and understanding only make sense in reference to a perceiving listener's senses and intellect.

Printz's concept of the "understood" seat also prefigures Rameau's notion of the fundamental bass;[27] indeed, Rameau's term *sous-entendu* (which he uses for non-sounding fundamental bass notes that—according to his theory—are elided in the musical surface) is a

[26] In the later books of the treatise, found only in the second edition (*Phrynis Mitilenæus*) Printz is occasionally explicit about the listener, as when he notes that excessively large sectional numbers [i.e. irregular-length phrases] "cannot be grasped by the listener's understanding" ("von dem Verstande des Auditoris nicht apprehendiret werden kan" [1696, vol. 3, 99]). Yet observations such as this are isolated in *Phrynis Mitilenæus*, and Printz does not develop them into any noteworthy account of perceptual activity in that treatise.

[27] For more on the cognitive implications of Rameau's concept, see Cohen 2001, 69-92.

literal translation of the Latin *subaudita*, a synonym of *subintellecta*.[28] Since late Antiquity both terms were used in a variety of disciplines to refer to things that are implied, that is, things that are understood by the intellect, despite not actually being present. For instance, discussions of grammar stretching from Augustine through Printz's contemporaries referred to logically supplied words and constructions as being *subintellecta* or *subaudita*, and similar usages occur in legal theory, theology, logic, and more.[29] With rare exceptions, though, these terms apply to things that are logically required and are merely non-expressed, as is the case with Rameau's *sous-entendu* fundamental bass.[30] Printz's discussion of the deceptive and evaded cadences makes a more intriguing claim. By stating that a sounded (*expressa*) pitch happens "in place of" (*anstatt*) a non-expressed, understood (*subintellecta*) one, Printz is suggesting that listeners can listen to a cadence resolve to one note at the same time that they cognize a mental representation of that cadence resolving to a different, conflicting note. Yet for all the cognitive underpinnings of Printz's discussions of internal duration and cadences, he only began to address directly the relationship between the intellect and senses in perceiving music when he came under the influence of a certain René Descartes, a development to which we now turn.

3 The Principles of Cognition

In a neat act of coming full circle, in his last music theory treatise Printz revisited and reworked the subject matter of his first: the rudiments required for singers. The earlier, descriptively titled work, *Kurtzer Bericht wie man einen jungen Knaben auf das leichteste nach ietziger Manier könne singen lehren*, was published in 1666; to my knowledge it has not been previously studied and is not mentioned in *Oxford Music Online* or *Musik in Geschichte und Gegenwart*. Printz starts the little treatise, a mere thirty-two pages in length, with three pages introducing its subject matter and the topics to be discussed. Thereafter he turns to his task, introducing the basics of musical notation and vocal figures, and concludes with a brief appendix on lute playing. The *Compendium musicæ signatoriæ & modulatoriæ vocalis* of 1689, which appears to be Printz's final music-theoretical work,[31] similarly addresses musical notation and vocal figures. Yet his lead-in to this material is starkly different: after a one-sentence definition of musical notation (*musica signatoria*) Printz puts forth eleven axioms (*Axiomata*),

[28] While the Latin participle *subintellectus* can also mean "understood incompletely," Printz's glossing of the term with the German word *verdeckter* ("concealed" or "occluded") clarifies that he means a seat that is not audibly expressed, rather than one that is only partially comprehended.

[29] Augustine, *City of God*, XV.7; Krämer 1689, 49. W. Keith Percival further elucidates the grammatical background of the terms (1976, 238–253).

[30] A potential exception may be found in a commentary on the book of Job by Pope Gregory the Great, where he provides a Christological reading of a verse from Job (*Libri moralium*, XXXIII.17). It is worth noting, though, the Gregory uses an indicative form of the verb, "you understand" (*subaudis*), rather than the participle *subaudita*, which later became conventional for implied though absent things.

[31] The second, expanded edition of *Phrynis* was published seven years later, but it is a stretch to consider this a separate work. The latter portions of Printz's nine-part *Exercitationes musicae theoretico-practicae curiosae* were also published in 1689, so may technically have been published after the 1689 *Compendium*, but they are a continuation of a work which started to be published in 1687, so the *Compendium musicæ signatoriæ* is reasonably considered a later publication. And finally, Printz's *Historische Beschreibung der edelen Sing- und Kling-Kunst* was published a year later, in 1690, but is a work of music history, rather than theory.

which he describes as notation's "most important principles of cognizing" (*ihre vornehmste Principia Cognoscendi*) (1689b, 7).

These eleven principles are not axioms in any traditional sense. For instance, Printz's third, "Everything superfluous is to be disallowed," is more an imperative than a self-evident postulate of a typical axiomatic system (1689b, 8).[32] Furthermore, Printz does not build upon these "axioms" to make larger arguments, nor does he ever refer back to them in the rest of the treatise. Printz's alternate description of these eleven, as "principles of cognizing," offers better insight into their purpose. Rather than constituting an incompetent attempt to put on Euclidean airs, they indicate an effort to set out the optimal relation between the senses and their objects. In particular, Printz proposes restrictions on how music is notated in ways that implicitly ensure that the senses can perceive the resulting notation straightforwardly. Consider the first of the eleven principles: "Everything that can cause a misapprehension (*Irrthum*) should be eliminated" (Printz 1689b, 7–8).[33] A perceiving agent is not explicitly invoked, but by labeling the axioms as principles of cognizing, Printz makes clear that this restriction aims to ensure optimal cognition of musical notation on the part of the perceiver.

These "principles of cognizing" borrow much of their methodology from the Preliminaries (*Praenotanda*) of Descartes's *Compendium musicæ*. There Descartes sets out the conditions under which the senses can most easily or agreeably perceive their objects.[34] For instance, his third principle begins: "The object must be such that it does not fall on the sense in too complicated or confused a fashion" (Descartes 1961, 12). Descartes explicitly links the senses' capacities to his restrictions on their object, whereas Printz leaves that connection implicit in his *Compendium musicæ signatoriæ*. Other than that, their respective lists of preliminary principles share much in spirit.

Cartesian-inspired principles of cognizing are not such a natural fit for teaching the basics of musical notation, though, so it is perhaps unsurprising that Printz did little to integrate his "axioms" with the subsequent music-theoretical content. The situation was quite different in a more learned context, however, such as Printz's *Exercitationes musicae theoretico-practicae curiosae*, a work published in nine parts from 1687–89. The first of these nine parts functions as an introduction, while each of the remaining parts is dedicated to one of the consonances, from the unison through the octave. He considers each interval from a variety of perspectives, including their roles in earlier music theory, their tuning, and contrapuntal uses. The introductory first part, however, sets forth a series of fourteen axioms, which Printz again describes as principles of cognizing. And whereas his axioms in the *Compendium musicæ signatoriæ* were somewhat constrained by the rudimentary subject matter, here Printz has no such limitations. Instead, he proceeds to engage in depth with the Preliminaries from Descartes's *Compendium musicæ*.

This introductory part of the *Exercitationes* never mentions Descartes or his *Compendium*, which helps explain why previous research on Printz has overlooked his dependence on

[32] "Alles überflüssige ist zu verwerffen." This is likely an adaptation of an idiom, as expressions involving *überflussige* and *verwerfen* become common in German in the generations after Printz. Prior to him, though, I have only found one case (*Der Teutsche Advokat* 1678, 222).

[33] "Alles / was einen Irrthum verursachen kan / soll abgeschaffet werden."

[34] For much more on Descartes's Preliminaries, see David E. Cohen's contribution in this issue.

Descartes's Preliminaries.[35] (Indeed, far from acknowledging his source, Printz instead claims that "these principles of understanding or axioms are known to every reasonable person by nature" [Printz 1689a, 10].[36]) Yet over the course of the *Exercitationes*' introduction, Printz addresses all eight of Descartes's Preliminaries, doing so in different ways. First, Printz places them into a more sensible order. Descartes's first, third, seventh, and eighth preliminaries offer general principles of what makes object pleasing to the senses, while the second, fourth, fifth, and six concern the specific numerical relationships that are ideal. Printz covers the first group in his series of axioms (further reordering them so that the Descartes's seventh axiom comes second), and saves the remaining four number-related preliminaries for consideration in his series of thirty-five theorems, which are generally more verbose and speculative.

As regards his treatment of the individual preliminaries, Printz translates some almost word for word from Descartes's Latin into German, save for minor emendations. See, for instance, Example 6, which compares Descartes's seventh preliminary with Printz's third axiom.[37] Printz makes two small interventions (underlined in Example 6). In the first, where Descartes talks of senses "being carried to [their] objects" (a curious formulation, presumably implying that the perceiver's attention does the carrying), Printz instead says that the senses "alight on (*fallen auff*) their objects." And in the second, Printz expands Descartes's "perceived" to "perceived and heard" (*perciperet und vernommen wird*).

Printz also supplements Descartes's preliminaries with many new axioms. For instance, his first axiom is "Because the intrinsic aim of figural music is a lovely harmony, therefore everything which can do away with or prevent such loveliness is objectionable. Conversely, everything which in fact engenders and advances such loveliness is to be accepted."[38] This axiom sets forth the aim of music, just as the very first sentence of Descartes's *Compendium musicæ* does, and then restricts the object of study, just as Printz does in the *Compendium musicæ signatoriæ's* first axiom. Printz's eighth through tenth axioms furnish more noteworthy examples of newly added content. The preceding two axioms, the sixth and seventh, expand upon Descartes's eighth Preliminary, which is that "variety is in all things most pleasing."[39] To this idea Printz adds:

8. Nature always seeks perfection and delights therein.
9. Nature loves to proceed incrementally and by step.

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[35] To the best of my knowledge Printz's detailed engagement with Descartes's *Compendium* has never before been observed, though Harald Heckmann has noted that in 1690 Printz mentions Descartes's *Compendium musicæ* (first published in 1650, though completed in 1618) in his *Historische Beschreibung* (Heckmann 1953, 126, referencing Printz 1690, 144). Heckmann has also identified a much earlier passage, in *Phrynis*, where Printz invokes the notions of clarity and distinctness (ibid., referencing Printz 1677, sig. D4r), though Printz could well have heard of this Cartesian hallmark without having yet read any of Descartes's works.

[36] ". . . diese Principia cognoscendi oder Axiomata einem ieden Verständigen von Natur bekandt seyn . . ."

[37] Descartes 1908, 92; trans. adapted from Descartes 1961, 13; Printz 1689a, 9. Curiously, this is the only of Printz's axioms which is omitted in an anonymous eighteenth-century lexicon's quotation of the *Principia cognoscendi*, which is not attributed to Printz (*Kurzgefaßtes musicalisches Lexicon* 1737, s.v. Transitus).

[38] "Weil Musicae Figuralis Finis internus eine liebliche Harmonia ist / so ist alles / was solche Lieblichkeit auffheben / oder verhindern kan / verwerfflich: Hergegen ist alles anzunehmen / was solche Lieblichkeit reverà verursachet / und befördert" (ibid., 8).

[39] "Denique notandum est varietatem omnibus in rebus esse gratissimam" (Descartes, *Musicæ compendium*, 7; trans. Robert, 13).

10. Therefore every change which is too large and sudden is aggravating (1689b, 9).[40] These three axioms work together to add more specificity to Descartes's claim that variety is pleasing. Printz holds that not every kind of change, and by implication not every kind of variety, is pleasing; only properly modulated change is delightful.

When it comes to Descartes's number-related preliminaries Printz differentiates himself even more. Over the course of his lengthy second and third theorems Printz engages with the content of Descartes's remaining four preliminaries, but formulates them differently. Descartes portrays sensory pleasure as depending on proportional relationships, and holds up the arithmetic proportion (n : n+m : n+2m) as necessary for easy perception (1908, 91–92; 1961, 11–13). Yet this postulate offers nothing more than a simple dismissal of any set of ratios failing to

Descartes's Latin	Descartes trans.	Printz trans.	Printz's German
Inter obiecta sensûs,	Among the objects of the sense	Among the objects of the sense	Unter denen Objectis der Sinne
illud non animo gratissimum est,	the most agreeable to the soul/mind is not the one	the most agreeable to the mind is not the one	ist nicht das jenige dem Gemüthe am angenehmsten /
quod facillime sensu percipitur,	which is perceived very easily by the sense	which is perceived and heard very easily by the sense	welches von dem sensu, oder Sinn sehr leicht /
neque etiam quod difficillime;	nor also the one which [is perceived] with great difficulty,	nor also the one which [is perceived] with great difficulty,	auch nicht dasjenige / welches sehr schwerlich /
sed quod non tam facile,	but the one which [is perceived] not so easily	but the one which [is perceived] not so easily	sondern dasjenige / welches nicht so leicht /
vt naturale desiderium,	that it does not entirely fulfill the natural desire	that it does not entirely fulfill the natural desire	daß es die natürliche Begierde / mit welcher die Sinne
quo sensus feruntur in obiecta,	with which the senses are carried to the objects,	with which the senses alight on their objects,	auff ihre Objecta fallen gantz nicht erfülle /
plane non impleat, neque etiam tam difficulter,	nor also with such difficulty	nor also with such difficulty	noch auch so beschwerlich /
vt sensum fatiget.	that it fatigues the sense.	that it fatigues the sense.	daß es den Sinn ermüde / perciperet / und vernommen wird.

Example 6. Comparison of Descartes's seventh preliminary and Printz's third axiom

[40] "Das VIII. Axioma: Die Natur strebet allezeit nach der Vollkommenheit / und delectiret sich darinnen. Das IX. Axioma: Die Natur hat Beliebung successivè, und per Gradûs fortzugehen. Das X. Axioma: Daher ist alle gar zu grosse und gehlinge Veränderung verdrießlich."

constitute an arithmetic proportion. Furthermore, the results of evaluating consonances by that proportion are a ludicrously poor match for actual musical practice: the dissonant trichord formed by the ratios 7:4:1, for instance, would be deemed acceptable, while the minor triad (15:12:10) would not. Printz, by contrast, never mentions the arithmetic proportion. Instead, he evidently views Descartes's fourth preliminary ("An object is perceived more easily by the senses when the difference of the parts is smaller") as more fruitful, since he proposes comparing the relative simplicity of a pair of intervals according to the terms of their corresponding ratios (Printz 1689b, 11). This is a substantial improvement over Descartes's approach, as it provides a spectrum of greater to lesser ease of perception, rather than a simple binary of arithmetic proportion (and thus purportedly simple to cognize) vs. not.

It is worth noting the superficial resemblance between Printz's ranking of intervals according to their ratios and the so-called coincidence theory of consonance. That theory, which became common earlier in the seventeenth century, attributes an interval's degree of consonance to how frequently the pulses of its two sounds align; rendered mathematically, the smaller the product formed by the multiplication of a ratio's terms, the greater the degree of consonance imputed to the corresponding interval.[41] (For instance, 20 is the product of the 5:4 major third, whereas 5,184 is the product of the 81:64 ditone, so the former is more consonant.) Printz, by contrast, ranks intervals not by their terms' products, but by their sums, which have no relation to sound propagation. (As he says, 4 is the sum of the triple ratio, whereas 5 is the sum of the sesquialtera, so the former is easier to understand [Printz 1689b, 11].) This reveals that in Printz's view our cognition of an interval is ultimately based, Pythagoreanesquely, on the abstract ratio of numbers to which it corresponds, rather than on the acoustic properties of the sounding phenomena we perceive.

Printz also differs from Descartes in how he uses the content of the Preliminaries. As mentioned, Printz's decision to call the Principles of Cognizing "axioms" in his *Compendium musicæ signatoriæ* is questionable, since he never makes further use of them after their introduction. In the *Exercitationes*, by contrast, the term *axiom* is a better fit, since Printz makes frequent reference back to them in the immediately ensuing thirty-five theorems.[42] The first three of these address Descartes's number-based preliminaries, as we have seen, and theorems four through seven characterize the effects of the consonances on the hearing (*das Gehör*). Thereafter, however, Printz's ambitions expand considerably, as he makes an attempt to found the principles of voice leading and composition on the preceding axioms and theorems. In doing so, Printz covers the content of the first five of Descartes's rules of composition from late in his *Compendium* (Descartes 1908, 132–34; 1961, 46–8), but adds to them substantially. Consider Printz's eleventh theorem, which has no parallel in the *Compendium*:

[41] For more on the history of the coincidence theory, which stretches back to Antiquity, see Barbieri 2001, 205–20.

[42] Another example of Printz's dependence on Descartes can be seen in his use of the axioms. In the course of the *Exercitationes* he only explicitly refers back to his axioms when reworking Descartes's discussion of the perfect fifth; and that discussion by Descartes is one of the few times when Descartes explicitly invokes one of his preliminaries (Printz 1687b, 28; cf. Descartes 1908, 105; 1961, 23).

> One should not use perfect consonances alone, but also should mingle them with imperfect ones. For because [“] the perfect concords please the sense [“] (according to the fourth and fifth theorems), but [“] as soon as the sense is pleased it desires variety [“] (as the sixth axiom confirms), so it is certainly necessary that imperfect consonances be mingled among the perfect ones, in order that such desire be quenched and not accrue revulsion and displeasure from the excessively great and perpetual pleasure (Printz 1689a, 15).[43]

Other theorems address more sophisticated issues, like ending pieces with consonances, avoiding successive perfect consonances, and preferring stepwise motion in the highest voice and leaps in the lowest (Printz 1689a, 13–19). Throughout, nearly every theorem cites at least one of the preceding axioms or theorems in support of the proposed principle.

It can hardly be a coincidence that in the *Exercitationes* Printz both engaged in detail with Descartes’s psychologically-motivated account of music (see Cohen’s, and Raz and Cohen’s, contributions to this issue) and also addressed the role of cognition in musical experience with more explicitness and depth than he had before. For instance, we have seen that in *Phrynis* and his *Compendium* Printz never identifies the agent to whom internal duration appears nor the one who performs the act of understanding in his “understood seats” (*sedes subintellectae*); in the second axiom of the *Exercitationes*, by contrast, he states that “Each object of the sense thus easily perceived and heard *by the sense* and recognized *by the understanding by means of the sense* is pleasurable to it,” an expanded reworking of Descartes’s first preliminary in which I have italicized Printz’s newly added references to the cognitive process.[44] Notably, Printz’s articulation of a distinction between the perception work done by the senses (*Sinn*) and the cognitive work done by the understanding (*Verstand*) is a departure not just from his earlier work, but from Descartes’s *Compendium* as well. As Raz and Cohen demonstrate in their joint contribution to this issue, Descartes is concerned with attributing acts that we today would see as cognitive to the ear and the imagination, not to the mind/understanding.[45]

Later in the *Exercitationes* Printz is even more explicit. When asserting that the octave is the most perfect consonance after the unison, he offers three supporting statements, the most interesting of which is the second: “Because the other term [of the ratio] is half the size of the first, the difference is 1, whereby the human understanding (*der Menschliche Verstand*) does not particularly have to work to apprehend (*kommen in cognitionem*) the terms, but rather discerns

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[43] “Die Concordantias Perfectas soll man nicht allein gebrauchen / sondern auch die Imperfecten mit untermengen. Denn weil die Perfecten Concordantien nach dem 4. und 5. Theor. den Sinn vergnügen: der Sinn aber / so bald er vergnüget / der Veränderung begierig ist / besage des 6. Axiomatis: als ist freylich nothwendig / daß unter die perfecten Concordantien Imperfecte gemenget werden / damit solche Begierde gestillet werde / und nicht aus der allzugrossen und immerwährenden Vergnügung ein Eckel / und Verdruß erwachse.”

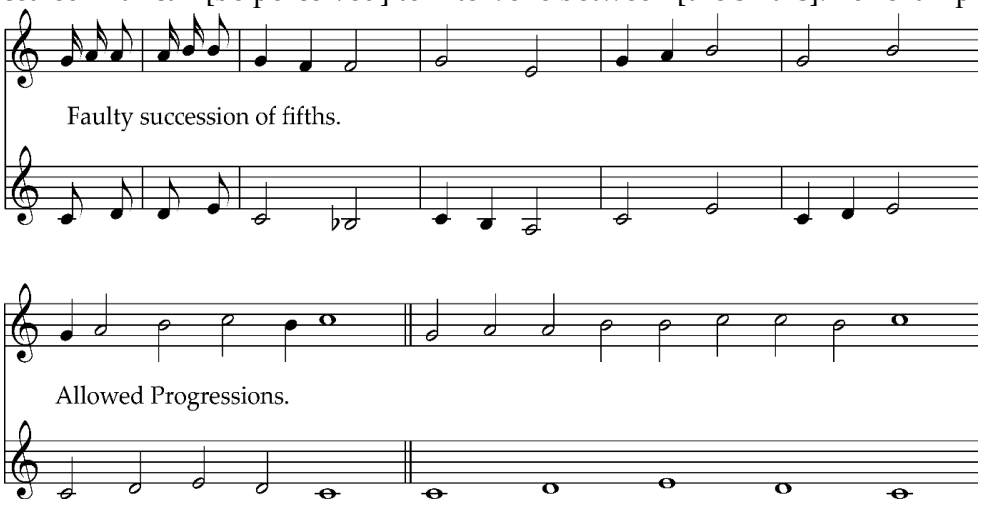
[44] “Ein ieglicher Gegenwurff des Sinnes (objectum sensus) so von dem Sinn leichtlich percipiret / und vernommen / und von dem Verstande vermittelst des Sinnes erkennet wird / ist demselben angenehm” (Printz 1689a, 8–9). Descartes’s corresponding preliminary simply reads: “All senses are capable of receiving pleasure” (Sensus omnes alicuius delectationis sunt capaces) (Descartes 1908, 91; Descartes 1961, 11). This is not an isolated case of Printz differentiating understanding and the senses, as he does so again in his eleventh axiom (1689a, 9).

[45] Descartes’s seventh preliminary (translated in Example 6) is the sole place in the *Compendium* where he uses the term *animus* as a clear indicator of the mind or the soul, as Cohen observes in his contribution to this issue. Given the development that Printz formulates between the mind/intellect and the senses, it is no surprise that he translates the ambiguous *animus* as “mind,” not “soul.”

(*erkennet*) them most easily after [those] of the unison" (Printz 1687a, 20).[46] Printz's association of consonance with the corresponding ratio's simplicity is a standard Pythagorean move, but explicitly justifying this on the basis of human intellective capacity and the work it does to come into cognition of ratios is a striking departure (and advance) from traditional music-theoretical discourse, one that Printz owes to Descartes.[47]

For a final example, let us consider Printz's discussion of parallel fifths in the section of the *Exercitationes* dedicated to that interval. He justifies the usual prohibition by appealing to now familiar ideas: "Because the fifth is the most agreeable concord, the human mind (*das Gemüth des Menschen*) is most delighted and pleased by it. But the greatest delight and pleasure that can arise from consonances is perceived in it, so one's attention (*Attention*) must be renewed with another consonance and be stimulated again" (Printz 1687b, 37).[48] Nor does Printz think that the error of consecutive fifths can easily be corrected with an anticipation or passing note:

> This error cannot be made right through an inserted fourth or sixth, even if a syncopation were to be involved. For since the intervening fourth or sixth (disregarding the syncopation) is short with respect to its internal quantity (*Quantitate intrinsecâ*), it is not particularly apprehended by the hearing (*Gehör*) and is thus almost as if it had never been added. One the other hand, the sixth is permissible in slow notes when the lower voice ascends by step, since it is somewhat more apprehended by the hearing, and [thus] no concealed fifth can [be perceived] to intervene between [the sixths]. For example:



(Printz 1687b, 38–9).[49]

[46] "Weil der andere Terminus noch eins so klein ist / als der erste / so ist die Differentia 1. wodurch der Menschliche Verstand sich nicht sonderlich bemühen darf / in cognitionem terminorum [sic] zu kommen / sondern dieselben nach des Unisoni am leichtesten erkennet."

[47] For more on this departure from Pythagorean tradition that Printz takes up from Descartes, see Cohen's contribution to this issue.

[48] "Denn weil die Quinta die allerangenehmste Concordantz ist / so wird das Gemüth des Menschen dadurch am allermeisten belustiget und vergnüget. Indem es aber die höchste Lust / und Vergnügung / so aus denen Concordantiis entstehen kan / empfunden / so muß dessen Attention mit einer andern Concordantia renoviret / und wieder aufgemuntert werden."

[49] "Dieser Fehler kan nicht gut gemacht werden durch die darzwischen gesetzte Quartam oder Sextam, es wäre dann / daß eine Syncopatio dazu käme. Denn weil die darzwischen kommende Quarta oder Sexta ausser der

Here Printz suggests that the same contrapuntal technique is effective in one context and ineffective in another, invoking both his concept of internal duration and the listener's act of apperception. By default, when a potential remediation of parallel fifths is even-numbered (that is, has a short internal duration, falling on a weak beat of the metrical hierarchy), it does not attract the listener's hearing sufficiently to distract from the parallel fifths. When the note values are longer, however, the situation resembles the arsis-related exception to even numbers being short that Printz proposed in his *Compendium musicæ*: when the first note in the arsis is even-numbered, it is considered as odd within the context of the arsis. In that light, it therefore also has a long internal duration—and thus a similarly great perceptual salience—as the odd-numbered note before it.[50] Printz's innovative concept of internal duration is consequently able to explain a complicated component of compositional practice, and his adoption of explicit acknowledgements of the listener's acts of cognition situate the concept of internal duration on a firmer epistemological foundation.

Conclusion

W. C. Printz did not significantly influence the course of music-theoretical history, nor is he noteworthy because he managed to come up with the "right answers" generations early. Rather, he is worth studying because he brought his incisive and creative mind to bear on still-timely questions about how listeners hear and understand music. For instance, in the domain of rhythm Printz addressed the question of what characterizes notes that occur at metrically significant moments (such as the start of the *tactus* or its arsis). Are these internally long notes actually perceived to be longer or louder by listeners? Similar questions still motivate music psychologists, such as Bruno Repp, who has developed an experiment to test his hypothesis that "metrical accents might confer illusory phenomenal accents on notes with which they coincide" (Repp 2010, 1402). That is, his hypothesis "predicts that metrically accented tones might be perceived as being louder, and perhaps also as being longer, than are metrically unaccented tones" (ibid., 1400). Repp tested listeners' ability to determine correctly which note in a strongly metrical series was made slightly louder or longer than the rest, on the presumption that listeners would err more frequently on strong beats if they actually perceived those beats as being louder or longer. The resulting experiment data suggest that metrically accented notes do not actually appear louder or longer (ibid., 1402). It is hardly startling that Printz's 350-year-old attempt to theorize metrical perception is not confirmed by experimental testing; what is startling is the compatibility of his theory with a modern hypothesis that was deemed to merit such testing.

Syncopation Quantitate intrinsecâ kurtz ist / so wird sie von dem Gehör nicht sonderlich apprehendiret / und ist also fast eben so viel / als wenn sie gar nicht gesetzt wäre. Wiewohl die Sexta in langsamern Noten / wenn die untere Stimme ordentlich auffsteiget / passiret: Angesehen sie von dem Gehör etwas mehr apprehendiret wird / und keine verdeckte Quinta darzwischen kommen kan. Ex. gr. [example] Vitiosa Quintarum Consecutio. {example] Liciti Progressus."

[50] Printz does not explain why this exception only applies when the lower voice ascends by step. His fifteenth theorem, which states that oblique motion is the easiest to perceive, would have helped him in that direction, as would his nineteenth, privileging stepwise motion, but neither would be able to justify convincingly the specifics of this particular exception.

Likewise in the domain of pitch. Here Printz addressed the question of how deceptive, evaded, and half cadences relate perceptually to perfect authentic ones. Given Printz's theory that the tonic is the "understood" resolution of deceptive, evaded, and half cadences, do listeners experience a sense of surprise when there is a mismatch between the resolution they understand and the resolution that is "expressed"? Along these lines, Roni Granot and Neta Maimon recently developed experiments to study (among other things) listeners' sensitivity to various types of harmonic cadences based on the listeners' demographics (2023, 307–11). All participants heard five different cadential progressions, including a perfect authentic cadence, a deceptive cadence, and a half cadence; after each progression

> listeners were asked to rate on a 7-point Likert scale how much they felt that the sequence was closed/complete (1 = "I feel the sequence is closed and needs no continuation" to 7 = "The sequence is open and strongly requires continuation"), and how much they felt the ending of the sequence was surprising (1 = "not surprising" 7 = "surprising") (ibid., 308).

This procedure allowed Granot and Maimon to test several of their hypotheses, including that listeners who are enculturated to music composed in the Arabian modal (*maqam*) system would be surprised by deceptive and half cadences to a similar degree as would listeners primarily exposed to Western music, but the latter group would perceive more of a need for continuation than would the former (ibid., 298).[51] The results of the experiment supported these hypotheses (ibid., 310–11). And at the same time they lend credence to the contention at the core of Printz's concept of the *sedes subintellecta*: namely, that listeners (and apparently even listeners with less exposure to Western music) understand the tonic to be the goal of cadential progressions, and they consequently experience surprise when confronted by a mismatch between the cadence's expressed resolution and the understood tonic.

Although Printz's innovative ideas about how music is understood have been obscured by his antiquated and often cumbersome terminology, working through that vocabulary to the insights thereby expressed could help us to approach musical situations with fresh ears. For instance, his concept of internal duration offers a fruitful framework for analyzing dance rhythms when combined with the traditional doctrine of poetic feet,[52] and his colossal theory of cadences prods listeners to be aware of differences between often-conflated cadences, attending to their rich perceptual implications. Considering that his most intellectually ambitious work, the *Exercitationes*, has scarcely been scratched by scholars, it is tantalizing to ponder what other riches await future research in the writings of W. C. Printz, a leading light in the pre-history of music cognition.

[51] Granot and Maimon report that "Our main analysis [of the different cadence types] used the ratings of the PAC as a baseline" (2023, 308), a procedure that Printz would presumably have deemed expressly appropriate.

[52] For an example, see Hudson 2019, 128–54.

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