
ONSET ASYNCHRONY IN WESTERN ART MUSIC: FINGERS, HAMMERS, AND MUSIC THEORY'S EARS

ASINCRONÍA DE ATAQUE EN LA MÚSICA ARTÍSTICA OCCIDENTAL: DEDOS, MACILLOS Y LOS OÍDOS DE LA TEORÍA MUSICAL

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ABSTRACT

Melodic onset asynchrony, whereby the upper or some component of a musical simultaneity may strike the ear ahead of other sounds, is a common feature in the performance of Western art music. It seems to be of high aesthetic value in the history of pianism, often harnessed to the seemingly contradictory “bass lead” that prevailed in the early 20th century, though in fact the two are far from exclusive. Departing from an application of Brent Yorgason’s taxonomy of “hand-breaking” (2009) to canonical, composed examples of onset asynchrony from Beethoven, Schumann, and Liszt, we examine timbral, organological, and

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aesthetic continuities that underly distinct practices of asynchrony. We consider the physical nature of such normally non-notated “microtiming”, ranging in performance from a few ms of melodic onset asynchrony to about 100ms, above which it is generally agreed that even the casual listener may perceive it. A piano-roll recording by Claude Debussy, of “The little shepherd”, illustrates the mix of melodic onset asynchrony, bass lead, and apparent simultaneity that may be applied in a single interpretation. We then discuss the concept of “audibility” and the question of to what extent, and in what ways, the combined transients of piano attacks may interact. We consider with reference to 20th-century Russian piano pedagogy why onset asynchrony seems to have been a little-documented, rather than an explicit playing technique, even though certain sources, such as a 1973 treatise by Nadezhda Golubovskaya, show it to be ubiquitous and well theorised. Finally, regarding the thinking that has predominated in musical performance studies in recent decades, with its emphasis on average practices and “ordinary” listeners, we suggest that a new emphasis will be fruitful, that is, research on what is particular about the embodied creativity of expert musicians.

Key words: melodic asynchrony; piano; performance studies.

RESUMEN

La asincronía melódica de ataque, por medio de la cual el elemento más agudo —o cualquier otro— de una simultaneidad musical es percibido por el oído como adelantado a los demás sonidos, es una característica habitual de la interpretación de la música artística occidental. Parece haber sido dotada de un alto valor artístico en la historia del pianismo. A menudo ha sido unida al aparentemente contradictorio «adelantamiento del bajo» que prevaleció a comienzos del siglo xx, aunque, en realidad, ninguno de estos fenómenos es excluyente. Tomando como punto de partida una aplicación de la taxonomía de la «separación de manos» de Brent Yorgason (2009) a ejemplos compositivos canónicos de asincronía de ataque en Beethoven, Schumann y Liszt, examinamos una serie de continuidades tímbricas, organológicas y estéticas que subyacen a distintas prácticas de asincronía. Tenemos en cuenta la naturaleza física de ese tipo de microagógica, normalmente no anotada, que varía en la interpretación desde unos pocos milisegundos (ms) de adelantamiento melódico hasta unos 100ms; existe un consenso de que, por encima de estos 100ms, incluso un oyente poco entrenado puede escucharla. Una grabación en cilindro del «The little shepherd» de Claude Debussy, interpretada por el propio compositor, ilustra la mezcla de asincronía melódica de ataque, adelantamiento del bajo y aparente simultaneidad que puede darse en una misma interpretación. Después pasamos a tratar el concepto de «audibilidad» y la cuestión del grado hasta el cual, y las formas en que, pueden interactuar los parciales combinados de los ataques del piano. En referencia a la pedagogía rusa del piano en el siglo xx, sopesamos por qué la asincronía de ataque parece haber sido una práctica instrumental poco documentada y tácita, aunque algunas fuentes, como un tratado de Nadezhda Golubovskaya de 1973, la muestra como extendida y bien teorizada. Finalmente, en relación al pensamiento que ha predominado en los estudios de la interpretación musical en las últimas décadas, con su énfasis en las prácticas generales y los oyentes «medios», sugerimos que un nuevo énfasis puede ser fructífero,

a saber, la investigación sobre lo que es particular de la creatividad corporeizada de los músicos de primera línea.

Palabras clave: asincronía melódica; piano; estudios de la interpretación.

Onset asynchrony, whereby some component of a musical simultaneity strikes the ear ahead of any others, is a common feature in the performance of Western art music¹. There is no statistical evidence to demonstrate that assertion, but every practitioner of “classical” music is, we submit, able to hear asynchrony, down to a level, as we shall see, of a few milliseconds’ separation, even if it is not, normally, a focus of aural attention. Already in the last century there were pioneering studies of this phenomenon², and more recently there has been something of a proliferation³, although we submit that the underlying reasons for, and potential drivers of, this area of musical research have not previously been presented in the way to which this article aspires. We shall also discuss the curious absence of discussion of this feature of musical performance from treatises on performance, particularly treatises on pianism, where asynchrony is under the direct control of a single player. With the notable exception of Nadezhda Golubovskaya’s pedalling treatise⁴, pianistic onset asynchrony may be regarded as pianism’s best kept secret. This article considers some of the historical origins of pervasive onset asynchrony, and the evidence for it as current practice. This includes some focus on piano playing, and the switch in musical taste from nineteenth-century “arpeggiation” or “chord spreading”, as well as “bass lead” or “melody lag”, to the supposedly precise vertical coordination of notated simultaneities that set in during the last century. Asynchrony is typical of different performance media from solo to ensemble to orchestral, as well as vocal. There has been

¹ Among various institutions at which earlier versions of this research were presented, particular thanks for inspiring discussions with expert colleagues are offered to The Royal Academy of Music (London), the Sibelius Academy (Finland), and the University of Rochester (Rochester, NY).

² For example, Rudolf Rasch, “Synchronization in performed ensemble music”, *Acustica* 43 (1979): 121-131; Jonathan Dunsby, *Performing Music: Shared Concerns* (Oxford: Clarendon Press, 1995); and Caroline Palmer, “Anatomy of a performance: Sources of musical expression”, *Music Perception* 13, no. 3 (1996): 433-453.

³ For example, Neal Peres da Costa, “Dislocation in piano playing: A neglected expressive technique”, *Early Music Performer* 10 (2002): 15-36; Brent Yorgason, “Expressive asynchrony and meter: A study of dispersal, downbeat space, and metric drift” (doctoral thesis, Indiana University, 2009); Alan Dodson, “Expressive asynchrony in a recording of Chopin’s Prelude No. 6 in B minor by Vladimir de Pachmann”, *Music Theory Spectrum* 33, no. 1 (2011): 59-64; Jennifer MacRitchie and Hubert Eiholzer, “Playing hands together: Exploring the use of asynchrony as an expressive device”, in *Proceedings of the Fourth International Symposium on Performance Science (ISPS 2013): Performing Together, 28-31 August 2013*, ed. Aaron Williamson and Werner Goebel (Brussels: Association Européenne des Conservatoires, 2013), 715-720; and Ana Llorens, “Recorded asynchronies, structural dialogues: Brahms’s *Adagio affettuoso*, Op. 99ii, in the hands of Casals and Horszowski”, *Music Performance Research* 8 (2017).

⁴ Nadezhda Golubovskaya, *Iskusstvo pedalizatsii* (Leningrad: Muzyka, 1973). A translation of this treatise into English, by Yannis Rammós, is forthcoming.

considerable debate about quantifying the levels of asynchrony that are pertinent to listening: thus, for example, asynchronies as miniscule as 10ms are believed to be perceptible to highly trained musicians, and those of greater than about 200ms perceptible to the average listener. The main aim of our exposition here, however, is not scientific debate, but dissemination of awareness of the issues involved in discussing onset asynchrony, and indeed of what this phenomenon actually sounds like, since many musicians may not be familiar with paying attention to it. Ultimately, “agency” may be the question that carries the greatest musicological significance:⁵ that is, what do performers believe they are doing, and why do they do it?

Every time we listen to, say, a fine orchestra and massed choir with four soloists performing Beethoven’s Ninth Symphony, live, we are hearing many dozens of skilled musicians each exercising the finest shades of microtiming in many completely different ways, according to particular physical and perceptual constraints. We tend to assume that coincident sounds occur literally at the same time, but plenty of experimental and experiential evidence indicates that this is often not so. In particular, the projection of a cantabile melody in an upper, or inner, or bass part, perhaps most obviously in piano music and in the most expert of hands, is typically achieved by or anyway is demonstrably characterised by what is called here an onset asynchrony. Many agential terms have been applied to onset synchrony, all the way from the more generic ones such as “microtiming”, to subjective ones such as “melody lead” and even, for good historical reasons, “melodic rubato”. It may come as a surprise to nonpractitioners, and indeed some experienced, intuitive performers, to know that this microtimed onset synchrony is so demonstrably prevalent, and has been, since at least the earliest days of sound recording. Probably the difference between then and now is that what Robert Phillip calls the “dislocation of melody and accompaniment” was in the routinely perceptible range (more than, perhaps, 200ms, as mentioned above) but has nowadays become almost subliminal:

The dislocation of melody and accompaniment in tempo rubato [...] disturbs our expectation of regularity in the rhythmic progress of a melody and of synchrony between treble and bass. In modern performance, only the subtlest dislocation is allowed to disturb the clear placing of the beat (except in jazz playing, which has become the last refuge of old-fashioned melodic rubato).⁶

⁵ For an authoritative recent discussion of agency in research on Western art music, see Seth Monahan, “Action and agency revisited”, *Journal of Music Theory* 57, no. 2 (2013): 321-371.

⁶ Robert Philip, *Early Recording and Musical Style: Changing Tastes in Instrumental Performance, 1900-1950* (Cambridge: Cambridge University Press, 1992), 233-234.

+55 +30 +45 +30 +36 +39
 +53 +37 +33 +29 +43 +50
 +50 +31 +23 +51 +49 +42
 +40 +9 +38 +40 +41 +43

+74 +79 +47 +87 +13 +19 +37 +20 +2 +25
 +49 +2 +52 +56 +44 +21 +34 +32 +30 +47
 +13 +10 +42 +45 +21 +27 +37 +37 +40 +17
 +22 +15 +38 +54 +34 +18 +33 +41 +36 +30

-40 +18 +22 +23 +30 +14 +21 -3
 -11 +10 +35 +11 +16 -3 +18 +14
 -10 +21 +25 +30 +15 +14 +24 -3
 +8 +44 +20 +17 -23 +19 +15

- = lag
 + = lead

Figure 1. L. v. Beethoven: Klavierstück WoO 60, bars 18-29

Figure 1 is offered to forestall possible doubt, or at least curiosity, in the reader who may have been unaware, previously, of the prevalent onset asynchrony in contemporary performance practice. Eric Clarke discussed “expression” in performance, including a detailed comparative study of recorded performances of Beethoven’s piano piece, WoO 60⁷. Figure 1 reproduces Clarke’s analysis of onset asynchrony in the middle section of this short piece, in four separate recordings. It offers decisive evidence—though it is but a small part of Clarke’s data on the WoO 60 recordings—of the consistent “use” or at least occurrence of melodic lead, that is, onset asynchrony, by two different pianists, each performing the piece twice, and neither of whom had heard the other’s interpretation of WoO 60. We are not making any particular musical point with this example, but showing that its acoustic feature is a normal part of modern piano playing⁸. The reader will already notice how, within the range already mentioned—where perhaps 10ms is the minimal, expert perceptible asynchrony, and perhaps 200ms is the lower threshold of generally perceptible sonic non-simultaneity—the average values in figure 1 seem relatively large. They are clearly nowhere near generally perceptible, that is, nowhere near what Philip called “melodic rubato”. They are also strikingly consistent, and clearly significantly congruent between all four performances, although whether they are intuitive, or in some sense deliberate, is a different question.

We return later to this specific phenomenon of onset asynchrony in the production, consciously or otherwise, of piano tone. Meanwhile, we pose the following questions: (1) where did onset asynchrony come from historically, (2) how prevalent was it and how prevalent is it still, and (3) how might we theorise that it is effective, given that this is a *temporal* phenomenon on which it is believed that *sonic*, or tonal phenomena can depend? Microtiming has been a growing field of interest in about the last four decades. In the psychological literature it has often seemed to be studied as an empirical phenomenon, for which no musical explanation is offered. There is real value in the accrual of purely statistical information concerning the incidence and physical types of onset asynchrony. However, measurement of asynchrony perception thresholds has mostly been conducted using artificial signals, that is, using what Elizabeth Margulis calls “strange beeps” that, as she argues in general, fail to represent real-world musical perception⁹. However, even in the critical literature on recorded performance which is indeed about real-world perception, and even when there is some music-analytical substance on offer about the relationship between sound production and musical effect, the level of interpretation has mostly been rather basic. Recent, frequently cited studies by, for example, Dodson and MacRitchie¹⁰ may be typical examples in relying on only rudimentary concepts of musical structure.

⁷ Eric Clarke, “Expression in performance: Generativity, perception and semiosis”, in *The Practice of Performance*, ed. John Rink (Cambridge: Cambridge University Press, 1995), 21–54.

⁸ One of the pianists in Clark’s experiments was Jonathan Dunsby; the other pianist was Vovka Ashkenazy. Although this was not a literally blind experiment, neither of the pianists had been informed what the purpose was of these recordings, or indeed what kind of data was being recorded, on a Yamaha grand piano with what was then state-of-the-art keystroke-analytical technology. They were simply invited to play “normally”.

⁹ Elizabeth Hellmuth Margulis, *On Repeat: How Music Plays the Mind* (New York: Oxford University Press, 2014), 98.

¹⁰ See above, note 3.

I. UBIQUITOUS ASYNCHRONY

We turn to the historical and artistic threads that, as mentioned, can and should be drawn out from this contemporary phenomenon. The first thread is to recognise that this phenomenon of onset asynchrony is widespread across the families of instruments. Pioneering research in the 1990s by Bruno Repp was indeed mostly of piano music, but the proliferation of modern experimental study of sonic asynchrony has covered many different kinds of ensemble music. What Peter Keller in his recent essay on “Ensemble performance...” calls “vertical timing deviations” are, to put it informally, ubiquitous¹¹. As long ago as the late 1970s, Rudolf Rasch was publishing evidence on this regarding polyphonic and ensemble music, and Yorgason’s 2009 dissertation outlined how there remains much to be learned about the performance of vocal ensembles. Vocality has a tacit but fundamental importance in this discussion, not least thanks to the mimetic impulses that permeate, beyond doubt, all types of instrumental onset asynchrony as a melodic phenomenon. Unlike the instrumentalist, the singer cannot avoid direct confrontation with acoustic and aesthetic issues involving transient sounds, literally at every syllable. The uninitiated is prone to easily mistake a manual on opera singing, for instance, with a treatise on the phonetics of consonants. Instructively for our purposes, Gerald Neufeld translates the art of beautiful consonants into two parameters: their precise placement in the metric structure of the music, and their linkage with the ensuing vowel¹². A negotiation between metric and spectral domains will inevitably permeate this discussion.

Perhaps not surprisingly, then, the Revised *New Grove Dictionary* considers this feature, in the “Psychology of music” entry, under “Perception and cognition” (section II), and specifically in relation to “Timbre” (subsection 3), where it is discussed in the special category of “Contributions to perception” (subsubsection iv):

Timbre perception is at the heart of orchestration, a realm of musical practice that has received relatively little experimental study. The creation of new timbres through orchestration necessarily depends on the degree to which the constituent sound sources fuse or blend to create the newly emerged sound. Sandell (1995–6) has proposed three classes of perceptual goals in combining instruments: timbral heterogeneity, in which one seeks to keep the instruments perceptually distinct; timbral augmentation, in which a single instrument embellishes another one that perceptually dominates the combination; and timbral emergence, in which a new sound results that is identified as none of its constituents. Blend appears to depend on a number of acoustic factors such as *onset synchrony of the constituent sounds* and others that are more directly related to timbre, such as the

¹¹ Peter Keller, “Ensemble performance: Interpersonal alignment of music expression”, in *Expressiveness in Music Performance: Empirical Approaches Across Styles and Culture*, ed. Dorottya Fabian et al. (Oxford: Oxford University Press, 2014), 262.

¹² Gerald Neufeld, “Text declamation and consonants: Means to expressive choral singing”, in *The Phenomenon of Singing*, ed. Brian A. Roberts, vol. 1 (1997), 158.

similarity of the attacks, the difference in the spectral centroids and the overall centroid of the combination.¹³

While models predictive of blend are still inchoate, in cautiously extrapolating Rasch's laboratory conclusions we might expect that even imperceptible amounts of onset asynchrony between orchestral parts at widely different dynamic levels—say, around 50dB, or roughly the distance between *fortissimo* and *mezzo-piano*—may suffice to prevent their timbral fusion, and maintain polyphonic clarity. Transients of nonpercussive symphonic instruments typically have durations between 14ms and 85ms, with significant variety within this range¹⁴, so a salient degree of onset asynchrony is intrinsic to instrument combinations, and integral to the compositional negotiation of blending and polyphony. We shall return to issues of attack quality in relation to the piano, in particular.

II. NOTATION/PERFORMANCE

Care must be taken to distinguish between onset asynchrony, or vertical timing deviation, that is at a rarely perceptible microlevel, of, say, 100ms or less, with deviation that is sufficiently conspicuous, and perhaps we might sometimes call it notationally noncompliant, as to be called a kind of rubato. All the way from medieval hockets to Beethoven's sometimes spectacularly syncopated ideas, compliant—that is, notated, or specified asynchrony—has been a consistent compositional resource. In jazz, of course, and many other kinds of popular music, deliberate, perceptible syncopation has been the essence of performing style, developments of which came to be called “swing,” and indeed an aspect of the more modern concept “groove”. The first author to draw a link between the artful application of onset asynchrony and the limits of perception was Sigismond Thalberg. In his introduction to his piano arrangement of Rossini's aria “Perché mi guardi e piangi” he writes: “In a slow melody of long notes, it produces a good effect, especially on the first beat of each measure or at the beginning of each phrase, to take the melody after the bass, but only inasmuch as the delay is almost imperceptible”¹⁵. One must agree with Neal Peres da Costa, who cites this passage¹⁶, that the way this practice actually

¹³ Our emphasis. Among the fourteen authors of *New Grove's* “Psychology” entry, the “Timbre” section is attributed to Stephen McAdams. It is not clear why McAdams regards features such as similarity of attacks “more directly” related to timbre than is onset asynchrony, although that supposition is far from counterintuitive. See *Grove Music Online*, ed. Deane Root, accessed September 13, 2021, <http://www.oxfordmusiconline.com>.

¹⁴ See Kai Siedenburg, “Specifying the perceptual relevance of onset transients for musical instrument identification”, *Journal of the Acoustical Society of America* 45, no. 1078 (2019): 1078-1087; and David Luce and Melville Clark, Jr., “Duration of attack transients of nonpercussive orchestral instruments”, *Journal of the Audio Engineering Society* 13, no. 3 (1965): 194-199.

¹⁵ S. Thalberg, introduction to “Perché mi guardi e piangi, duetto da ‘Zelmira’”, no. 6 in *L'art du chant appliqué au piano*, Op. 70 (Mainz: Schott, n.d.), 2.

¹⁶ See also Peres da Costa, “Dislocation in piano playing...”, 19. The translation of Thalberg's passage provided here is ours.

sounded cannot be determined. Nonetheless, Thalberg's recommendation ought to be recognised as a harbinger of the general tendency, through the nineteenth and twentieth centuries, towards notationally noncompliant asynchronies.

III. PERFORMANCE PRACTICE

The history of asynchrony includes a third, and perhaps more specific feature, which is the tradition of arpeggiation, whereby chords are rolled or spread as a matter of course. This feature raises another factor, in that there is a presumption that some of the origins of spreading chords lay in the physical nature of the ubiquitous lute, which was, as it were, the piano of the Renaissance period, meaning that for several centuries in the development of Western art music most chords in secular music were typically spread upwards, rather than being simultaneous, this being in the very nature of lute playing. Spread chords were an organological fact. Yet the story was reinforced in the Baroque period through the development of keyboard instruments, basically the harpsichord, which as far as we know—and there is plenty of evidence for this—retained the now elective feature of upwards arpeggiation in performance. Here another empirical, organological characteristic came into play, for whereas the lute is a spectacularly dynamically sensitive instrument where voicings can depend on gradated amplitude and tone as much as on temporal placement, the harpsichord has uniform, fixed amplitude and tone, with a tendency for lower tones to mask higher ones, so it was taken for granted that temporal placement was necessary in order to bring all textures to life sonically, and perhaps especially non-contrapuntal textures.

IV. PIANO-PLAYING

It is perhaps those two styles of interpretation, on lute and harpsichord—a culture of non-simultaneity lasting some four centuries, and thus evidently a momentous aspect of music's evolution—that spilled over into nineteenth-century pianism, and this is the fourth thread in our account. We know two central features of that pianism, features that were in an intriguing tension. On the one hand, non-simultaneity of various kinds was endemic throughout the Romantic period; yet on the other hand, interestingly, there are strong indications of a tendency to resist that overwhelming practice. This is documented for example by Clive Brown, who cites Carl Czerny complaining in 1839 about “most players” becoming “quite unable to strike full chords or even double notes firmly and at once”¹⁷. As late as the early twentieth century in Paris there were two distinct practices, neither of them exclusively applied; on the one side expressive, elective arpeggiation, but

¹⁷ Clive Brown, *Classical and Romantic Performing Practice 1750-1900* (Oxford: Oxford University Press, 1999), 612-613.

on the other side its opposite, perceptible simultaneity, even within such a generally unified musical aesthetic. Later, we shall observe that in practice in a recording by Claude Debussy.

V. BASS-LEAD

Whether allied to the custom of elective arpeggiation or not, bass lead is the fifth thread that we have to try to trace back into the history of sonority. It is, of course, arpeggiation of a kind, and on the face of it one assumes that it was adopted for reasons of sonic clarity. The audio-recording expert Philip, writing in 1992, embraced all overt asynchrony of melody in the category of *tempo rubato*. There was certainly a historical case for doing so, as Richard Hudson's brilliant historiography confirmed¹⁸. Whether we turn to the practice of nineteenth-century Italian aria singers with their bold rubatos backed by a steady orchestral accompaniment, or reports of Mozart's and Chopin's rhythmically steady left hands at the piano to support a metrically dissonant upper line, evidence of the tolerance of rubato suggests that the phenomenon of bass lead—or indeed perceptible lag—as an expressive device seems to present itself as a rhythmic rather than sonic feature, although its sonic aspect is the most relevant to this inquiry. Yorgason has suggested in an unpublished paper that “handbreaking”, to use his term, and which he found to be still endemic in early twentieth-century recordings, served a number of musical purposes, of which he can identify at least six (table 1). Significantly, in Yorgason's opinion these purposes—as codified in general, and not merely regarding Brahms—rather than being overtly rhythmic or metric, are sonic, structural, or affective.

Table 1. Expressive functions of handbreaking, from Brent Yorgason, “The functions of expressive asynchrony...”, table 2. Emphasis added¹⁹

Expressive functions of hand-breaking
<ul style="list-style-type: none"> • To delay a melodic note in order to accentuate it. • To strengthen the “singing quality” of a melodic line. • <i>To mark thematic returns.</i> • <i>To accentuate structural downbeats.</i> • To communicate yearning or striving sentiments. • <i>To resolve individual voice leading strands</i> or to draw attention to an inner voice.

¹⁸ Richard Hudson, *Stolen Time: The History of Tempo Rubato* (Oxford: Clarendon Press, 1994).

¹⁹ In table 1 we have emphasised the three purposes that are most clearly of structural significance.

VI. NOTATION

There can of course be a fine line between performance and compositional practice. In figure 2 we see an extract that underlines Dana Gooley's memorable diagnosis: "Liszt's notation practices are revealing: there is an almost ridiculous density of notated information on dynamics, accentuation, articulation, tempo, and character"²⁰. In this extract from Liszt's Transcendental Etude no. 12, there are in close proximity a spread chord, fastidiously notated left-hand leads (bar 10), and presumably, possibly, simultaneities (bar 11). Those are tiny details²¹, yet that does not mean they are trivial. Figure 3 provides us with powerful compositional evidence of that. In Beethoven's piano sonata no. 16, melodic onset asynchrony in the primary compositional idea of the opening is notated precisely, and we can only conclude that the contrast between asynchrony and simultaneity is clearly fundamental to Beethoven's compositional narrative; yet we can only speculate whether in Beethoven's ear the notated simultaneities in bars 10-11, and from bar 24, would have been subject, in actual performance, to melodic lead, a subliminal rather than notated onset asynchrony. Perhaps less dialogically than in the Beethoven, contemplate also the case of some of the middle movement of Schumann's *Fantasie*, Op. 17, as shown in figure 4, an enforced asynchrony—in other words, there is no way to play this and similar passages in the movement that fails to implement Schumann's notated microtiming, where the left-hand melody is distinguished aurally by anticipation of the beats. By subjugating handbreaking to a synthesis of tonal design and virtuosity, it is easy to see, in retrospect, that such passages ultimately served to defamiliarise the practice, as if to remove the vestiges of *Empfindsamkeit* banality it carried from older arpeggiation formulas, and to incorporate it within an emergent aesthetic of heightened precision, interpretive, sonic, and psychomotor²².

²⁰ Dana Gooley, *The Virtuoso Liszt*, in *New Perspectives in Music History and Criticism*, Series Number 13 (Cambridge: Cambridge University Press, 2004), 37.

²¹ As a matter of interest, even such a fastidious artist as Daniil Trifonov does not seem to follow them all precisely (Deutsche Grammophon recording, released October 2016). For further inquiry into this repertoire, see Brent Yorgason, "Mandatory mannerisms: The evolution of notated expressive asynchrony in Liszt's Transcendental Etudes", *Journal of the American Liszt Society* 69 (2018): 5-27.

²² In a recent experiment, microtiming asynchronies between -80ms and +80ms were related to an increase in the listeners' mental effort indexed, as typically done in cognitive-load research, by eye pupil measurements (pupillometry). It should be noted that the experiment involved solely jazz. See Jo Fougner Skaansar, Bruno Laeng, and Anne Danielsen, "Microtiming and mental effort: Onset asynchronies in musical rhythm modulate pupil size", *Music Perception* 37, no. 2 (2019): 111-133. This may evidence the aesthetic of heightened precision.



Figure 2. F. Liszt: *Chasse-Neige*, Transcendental Etude no. 12, bars 8-11

Allegro vivace

The musical score is for the first movement of Beethoven's Sonata Op. 31 no. 1, measures 1-33. It is in 2/4 time and D major. The tempo is marked 'Allegro vivace'. The score is written for piano and includes various dynamics such as *p* (piano), *f* (forte), and *cresc.* (crescendo). There are also articulations like accents and slurs. Fingerings are indicated with numbers 1-5. Breath marks are shown with a stylized 'v' symbol. Measure numbers 5, 10, 15, 20, 25, and 30 are circled. The score shows a complex interplay between the piano and the right hand, with frequent changes in texture and dynamics.

Figure 3. L. v. Beethoven: Sonata Op. 31 no.1, i, bars 1-33

The image displays a musical score for R. Schumann's *Fantasia Op. 17, ii*, bars 54-77. The score is written for piano and voice. The piano part is in G major and 4/4 time. The vocal line is in G major and 4/4 time. The score includes dynamic markings such as *p*, *sf*, *mp*, and *mf*. The piano part features a complex rhythmic pattern with many sixteenth and thirty-second notes. The vocal line includes a trill and a fermata. The score is presented in five systems, each with a piano and a vocal staff.

Figure 4. R. Schumann: *Fantasia* Op. 17, ii, bars 54-77

The musical score is arranged in two systems. The first system contains five staves: four for the orchestra (Violins I, Violins II, Violas, and Cellos/Double Basses) and one for the piano. The second system contains three staves: two for the piano (Right and Left Hand) and one for the orchestra (Violins I). The score is in G major and 3/4 time. It features a crescendo leading to a fortissimo (ff) section, followed by a piano (p) section marked 'dolce'. Blue wavy lines highlight specific passages in the piano part, particularly in the right hand.

Figure 5. Ludwig van Beethoven, Piano concerto no. 4, i, bars 249-257

In this account so far, we have aimed to distinguish compositional from interpretive matters, but the following is an example where they have to be considered together. Stephen Lubin's recording of Beethoven's Piano Concerto no. 4, with the Academy of Ancient Music conducted by Christopher Hogwood, begins with a feature that has intrigued pianists for decades, in a sense, even centuries—is the opening chord meant to be struck, in Beethoven's student Czerny's words, firmly and at once (if quietly, marked *piano* and *dolce*), or might Beethoven have intended, or at least permitted, the chord to be, literally, audibly, spread? Lubin performs it spread²³. Beethoven's own, compositional dialogue between simultaneity and spread chords reaches a climax at the recapitulation (see figure 5), where he unpicks his opening chordal invention, and Lubin wisely does not spread his *fortissimo* and *sforzato* chord announcing the reprise. He does, however, spread some of the ensuing chords, as marked in figure 5. Purists might argue that, at both the opening and the point of reprise, Lubin is contradicting Beethoven's compositional logic, in that such distribution of spread and non-spread chords in performance can seem whimsical, and of course such spontaneity may be exactly what Lubin meant to capture; whereas Beethoven himself figures the answering phrase differently in the reprise than the block chords in the exposition (compare figure 6 with the bars 5-7 in figure 5, i.e., the corresponding passage from the exposition). This example underlines the point that there is a fine line between what a performer is historically *entitled* to do and what the performer perhaps *should* do in light of the kind of internal compositional evidence prized by music theorists.



Figure 6. Ludwig van Beethoven, piano concerto no. 4, bars 1-4

To return now to the historical argument, that all suggests a plausible hypothesis, that there is a connection between bass lead and melodic, microtimed onset asynchrony. Both bass lead and melodic onset asynchrony were essentially aimed at, or embodiments of, an ideal of sonic clarity. Philip is doubtless correct to state that by the late twentieth century musical taste had changed, thus over the

²³ Issued by Decca, 2006. The reader with access to Spotify may wish to stream <https://open.spotify.com/track/5sWpOnmQrs1dJWdkEsdA5i?si=064c2bd64ea64c78>.

course of the six or seven decades during which audio recording technology had become a significant feature of musical life:

The dislocation of melody and accompaniment in tempo rubato [...] disturbs our expectation of regularity in the rhythmic progress of a melody and of synchrony between treble and bass. In modern performance, only the subtlest dislocation is allowed to disturb the clear placing of the beat (except in jazz playing, which has become the last refuge of oldfashioned melodic rubato).²⁴

However, Philip's position can also be taken as emblematic of what modern researchers nevertheless rather misguidedly seem to think about ensemble, or coordination, in Western art music performance. That is not entirely misleading, but it all depends on what we regard as perceptible. What Philip says, as quoted earlier, is true for the average or normal listener perhaps, but crucially it is probably not true for the skilled listener or indeed, when it comes to piano playing, for skilled tone production, whether consciously or otherwise. In these latter contexts and agencies, minuscule asynchronies are in play, and there is no doubt that, potentially, we can hear them and use them. Let us take a moment to rehearse the argument so far. Melodic, microtimed onset asynchrony is not only an archeological feature from the history of music, but both a tradition of piano tone production, and, we would argue, also the current, sonic ideal of a much modern Western art music in the hands of skilled performers, all the way from soloists to large ensembles. This feature is what we saw demonstrated so vividly by Clarke in the Beethoven's WoO 60 example. It appears, on abundant evidence, in media and genres of all kinds.

VII. THE SCIENCE

Perhaps the exact physical nature of such onset asynchrony does not need to be a central concern, though the acoustic questions it raises suggest that precise measurements can be vital. It is nearly half a century since Rasch's pioneering measurement of onset asynchrony in ensemble music, and some two decades since Palmer's much-cited research generalizing what she calls "melody lead" in piano playing as in the order of 20 to 50ms.²⁵ That could come as a surprising figure, especially if it were typical, if it were somewhere near the centre and peak of performance practice's bell curve, rather than being an outlier. In a table by Yorgason (table 1) we have highlighted three items to assist the reader in appreciating the minuscule properties of sound being discussed here²⁶. 10ms has been claimed to be the lowest threshold perceptible to what are superior practising musicians, that is, people at peak professional performance. There is always likely to be doubt about that threshold.

²⁴ See above, note 6.

²⁵ Palmer, "Anatomy of a performance", 441; Palmer cites several items from her previous research in this connection.

²⁶ Yorgason, "Expressive asynchrony and meter...", 395.

For example, there is the question of agency and awareness, so that when Rasch reported that a violin was leading a string trio by an average of 4 to 8ms²⁷, he was not in the business of deciding whether this was an expressive feature or, rather, perhaps an error, and whether it represented any kind of communal intention. In any case, the gap between active or conscious hearing, and the work of the autonomic nervous system, seems to be of breathtaking magnitude: as is mentioned in *Performing Music*²⁸, John Sloboda, in his groundbreaking study from 1986, *The Musical Mind*²⁹, seemed generally unimpressed by onset asynchrony perception in a musical context, given that the human auditory system is so acutely sensitive. It seems likely that a human behaviour such as music-making, presumably evolved over millions of years, will exploit the full physiological potential of our species; and, for instance, regarding the binaural hearing that enables us to know from which direction a sound is coming, it is known that we detect the gap, or time difference between sounds striking each of our auditory receptors down to about 0.0007 of a second, that is, about 700 millionths of a second. One of the remarkable features of binaural hearing is that the gap can be less than the actual wavelength of the perceived sound itself. Moving up the scale, Yorgason records a finding that even an asynchrony as large as 70ms may not be perceived if there are three or more tones, rather than two, which again makes intuitive sense in that we know how the combination of three transients is exponentially complex compared with two; such a threshold as about 70ms may indeed be something of a gateway through which skilled musicians alone can pass, upwards, as it were, to finer discriminations, because of their ability to filter musical meaning more efficiently than average listeners; and at a third level, as it were downwards, we see Rasch's original finding that clearly audible, intentional asynchrony is, he claimed, always going to be above the 100ms threshold³⁰.

²⁷ Rasch, "Synchronization in performed...", 100.

²⁸ Dunsby, *Performing Music*..., 72.

²⁹ John Sloboda, *The Musical Mind* (Oxford: Oxford University Press, 1986); see, for example, 156.

³⁰ The reader curious to experience 100ms actively is invited to listen to the first five pips of the Greenwich Time Signal, freely available on the internet, each of which lasts 100ms. Note that the sixth, time-marker pip is 500ms. There are many internet sites at which the reader may take microtiming discrimination tests and experience their audio reality, for example www.AudioCheck.net. The human auditory system is highly variable at an individual level, hence the concept familiar to trained studio engineers of the exceptional, so-called "golden ear" that has acute hearing properties (a term used also in clinical audiology to refer to the hearing of individuals whose auditory system resists the normal aging process). It gives pause for thought that the sixth Greenwich Time Signal pip, at 500ms, is fifty times the length of the 10ms time interval, between two sounds, that is said to provide expert musicians with a clear awareness of which sound comes first. 10ms is the order of time interval which, we suspect—though in principle it can never be proved scientifically—represents one ideal of sonic beauty in Western art music, sound endowed with special musical meaning, for the acculturated listener. The ability of the human mind to measure time is generally underestimated. Brian Capleton expects his students of piano tuning to hone a level of "metronomic" competence that enables them to count silently with a maximum error of one second per minute. He recommends practising with the word "Mis-sis-sip-pi" as a handy segmentation of 1sec into four 250ms subdivisions. Unsurprisingly, a sensorimotor modality reinforces the "golden ear", at least in this instance. See his *Theory and Practice of Piano Tuning: A Manual on the Art, Techniques and Theory* (Malvern: Amarilli, 2014), 348.

It would be a mistake to slip into regarding different kinds of microtimed onset asynchrony as mutually exclusive aspects of interpretation. They are, of course, literally mutually exclusive at the same musical moment—physically you cannot have bass and melody leading in the same simultaneity. You can combine onset asynchrony with dynamic differentiation, and that after all is the obvious way to articulate so-called “contrapuntal” texture, one musical line, or part, striking the ear first while another is, say, louder, so that each line has a simultaneous, distinct identity by essentially imperceptible means. Yet the point here is that, in the reality of actual performance, different kinds of asynchrony will indeed occur in the same music, if not literally at the same time: to illustrate again from piano playing, typically a modern pianist, playing some thundering Liszt for instance, will use almost imperceptible bass lead in places to produce a notably powerful sound, but almost imperceptible melody lead in other places to clarify the upper line in other places³¹.

VIII. A CASE STUDY, AND EXPLORING THE PIANO

We illustrate this polysemic phenomenon by means of a concrete example, that of Debussy performing his own composition, “The little shepherd”, from the *Children’s Corner Suite* of 1908³². There are certain provisos about this mechanical recording using the Welte-Mignon system. The reliability of this kind of capture, reproduced on a different instrument than the instrument on which Debussy himself recorded, has been discussed expertly by a number of Debussy scholars: what is reliably authentic in what we are hearing is the relativities in Debussy’s playing, not its absolute qualities³³. There is no doubt that Debussy is spreading some chords in this performance that are not notated in the score, and it certainly does not meet the “modern expectation” as Philip put it of “playing chords together”. Figure 7 shows two kinds of annotation: the bold, black, diagonal

³¹ Werner Goebel and Richard Parncutt, in “Perception of onset asynchronies: Acoustic piano versus synthesized complex versus pure tones”, in *Society for Perception and Music Cognition*, March 2001, argued that experimental research had cast doubt on the “frequently encountered tacit assumption in the music (and especially piano) performance literature” that the first onset, when by less than about 30ms, “is perceived as more salient”, although they also observed that “the detection of asynchrony is more difficult in real instrument sounds than in steady-state or artificial stimuli”. It would be one thing to show that a phenomenon is not detectable and thus, plausibly, to deny its salience; it is quite another to demonstrate its variable detectability and to then, questionably, deny its salience.

³² The first commercial release of a modern performance of Debussy’s original piano rolls was issued in August 2010 on the Pierian Recording Society label, PIR0001, entitled “Claude Debussy: The composer as pianist”. The reader with access to Spotify may wish to stream Debussy’s performance of “The little shepherd” (cf. figure 7) at <https://open.spotify.com/track/6awQpqyJRQ0yUVACIyydWk?si=29c7e3c65cb24689>.

³³ The most recent discussions of Debussy’s recording of fourteen pieces seem to be in Tihomir Popovic and Olivier Senn, *Claude Debussy’s Aufnahmen eigener Klavierwerke* (Stuttgart: Steiner, 2020). Probably the first modern musicological discussion was by Roy Howat, “Debussy and Welte”, *The Pianola Journal* 7 (1994): 318; see also Howat’s chapter “Debussy’s piano music: Sources and performance”, in *Debussy Studies*, ed. Richard Langham Smith (Cambridge: Cambridge University Press, 1997), 78-107.

lines are instances of marked onset melodic asynchrony, and the bold, black, spread notation shows some of Debussy's most obvious spreads. What may interest us even more than that stylistic feature is the extraordinary precision of Debussy's playing. Despite the mythology of Debussy being a failed pianist, we know, if only from John Clevenger's research, that during his three years in piano class at the Paris Conservatoire, Debussy's repertoire consisted of major works from the tradition of virtuosic masterpieces, and he received top grades from his professors³⁴. The Welte-Mignon roll of his third prelude from Book 1, "La cathédrale engloutie", to mention one case, is a remarkably faithful recreation of a finely differentiated score—it would for instance certainly stand the test of modern international piano competitions where accuracy and fidelity are premium requirements. In his "The little shepherd" we hear not only a sprinkling of spread chords, but also simultaneities that are, perceptibly, precise, such as at bars 24-25 (marked in figure 7 in a bold, black box), the tonal turning point of the composition where the harmony has arrived at scale degree #4, a tritone from the tonic to which it will return directly at the closing reprise. To our ears, those four chords are played with perceptibly equal simultaneity, with an upward spread of only a few milliseconds, and a clear balance through amplitude that picks out the top voice and then the answering inner parts: as one listens to the excerpt more and more the degree of precision here is at an ultra-professional level; note that Welte-Mignon piano rolls cannot be edited regarding relative dynamics—in that sense, this is exactly what Debussy played on 1 November 1913, in Paris. Figure 8 offers a Sonic Visualiser representation of three of those chords (first chord omitted for bleed reasons—it is not cleanly pedalled, which may well have been deliberate on Debussy's part) that shows the vertical alignments, although admittedly here not down to a few milliseconds.

³⁴ John Clevenger, "Debussy's conservatoire training", in *Debussy and His World*, ed. Jane Fulcher (Princeton: Princeton University Press, 2001), 299-361.

Très modéré

p
très doux et délicatement expressif

mf *p*

Plus mouvementé

p *poco*

Au Mouvt **Cédez -** **Au Mouvt**

pp *ppp*

Cédez -

piú p

Au Mouvt

ppp *pp*

in poco piú forte

A musical score for the song 'The Rose Tree'. The score is written for voice and piano. The voice part is on a single staff with a treble clef and a key signature of one sharp (F#). The piano accompaniment is on two staves, with the right hand in treble clef and the left hand in bass clef. The key signature for the piano is also one sharp. The tempo is marked 'Andante'. The score consists of two systems. The first system has a vocal line starting with a half note G4, followed by a quarter note A4, and then a half note B4. The piano accompaniment starts with a half note G3 in the right hand and a half note E2 in the left hand. The second system continues the vocal line with a half note C5, followed by a quarter note D5, and then a half note E5. The piano accompaniment continues with a half note F#4 in the right hand and a half note F#2 in the left hand. The score ends with a double bar line.

Figure 7. Claude Debussy, “The little shepherd”, from the *Children’s Corner Suite*

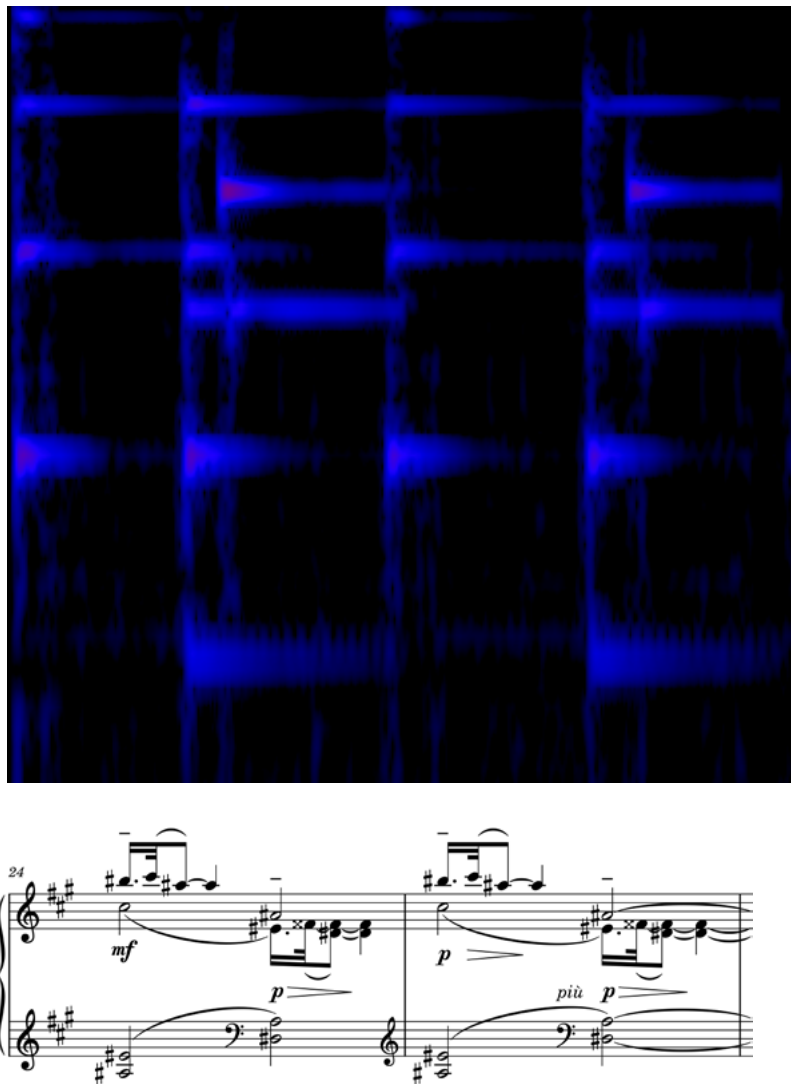


Figure 8. Claude Debussy, “The little shepherd”, bars 24-25, spectrogram; Claude Debussy, piano

There is much debate among acousticians and piano technicians about exactly what can be measured in piano sound. The question is not only “epistemic”, in a way, but also “deontic”: what exactly *should* be measured, for the sake of an aesthetic argument? Debussy’s scrupulous handling of both audible and

inaudible asynchrony are signs of a musical agency that has totally mastered the gaps between the natural, the psychoacoustic, and the notational in the phenomenon of tone production. To attempt a “grammatological” critique of the predominant asynchrony discourse, it is an artifact of Western art-music notation, and the noncompliance of asynchrony with it, that renders asynchrony “inaudible”; whereas an artistically pertinent litmus test of “audibility” would rather assess the listener’s discrimination of unmistakably different timbral qualities, as a result of such asynchrony. This, we suggest is what “music theory’s ears” could be. No one describes, say, a piano scale as “inaudibly” out of tune on the grounds of an average listener, and likely the average pianist, being unable to individually hear the upper partials of its tones, much though it is in those partials that the psychoacoustic secret of equal temperament lies. One might even want to suggest, metaphorically, that micro-asynchrony is not so much “inaudible” as simply “invisible”.

No aspect of piano playing exemplifies these “gaps” better than the transient noise of the piano tone. If it has become commonplace, perhaps, to criticise music theory for traditionally excluding “noise” from the privileged category of “musical” or harmonic sound³⁵, then the study of asynchrony might serve as a genuine remedial step. The pianist who perceives the transient as an instantaneous event, presumably one that is fastened to a unique point on the metric grid of the score, with or without rubato, is prone to a number of fallacies. In comparison with the ultra-short duration of hammer–string contact, measured by J. J. Burred at 2ms, the duration of the entire transient is even less instantaneous³⁶. Figure 9, borrowed from Burred, offers a simple diagram to remind the reader of some of the rich haptic variability accompanying the sonic event of a piano keystroke. It illustrates, for instance, that the noisy impact of the key against the keybed might occur more than 10ms before, or after, the string excitation, depending on the velocity of the attack. By that time, the impact of the fingertips on the keys, often around 20ms before the keybed impact, will also have been inherited by the transient—as recognized by Rimsky-Korsakov and N.A. Dyakonov already in 1952³⁷—at least with a so-called “struck touch” initiated at a distance from the keys³⁸. Complicating matters further, and beyond the purview of “touch” in the strict sense, lower piano pitches have inherently longer transients and attain their peak volume later than higher pitches. The registrally extreme passages of, say, the *Arietta* in Beethoven’s last piano sonata are a case in point. Taking the numbers in Jürgen

³⁵ For a recent, pioneering example of the aesthetic assimilation of supposedly extra-musical sonic phenomena, see Richard Beaudoin, “Gould’s creaking chair, Schoenberg’s metric clarity”, *Music Theory Online* 27, no. 1 (2021).

³⁶ Juan José Burred, *The Acoustics of the Piano* (Madrid: Conservatorio Profesional Arturo Soria, 2009), 14.

³⁷ Nikolai Rimsky-Korsakov and N. A. Dyakonov, *Muzykal’nye instrumenty* (Moscow: GIMP, 1952). More recent scholars have also conceded that this component of the transient is in principle audible, if only among “trained musicians”; see, for example, Werner Goebel, Roberto Bresin, and Alexander Galembo, “Once again: The perception of piano touch and tone. Can touch audibly change piano sound independently of intensity?”, in *Proceedings of the International Symposium on Musical Acoustics* (Taipei, 2004), 332-335.

³⁸ The most detailed measurement and analysis of the piano transient available, to the best of our knowledge, has been contributed by A. Askenfelt in “Observations on the transient components of the piano tone”, *Speech Research Summary Report* 34, no. 4 (1993): 15-22. The 20ms mark that we cite for the duration of the key-drop is indicative and taken from his figure 3.

Meyer's manual as a rough guide, the transients of the ostinato bass may well be 15-20ms longer than those of the estranged figurations five octaves higher³⁹.

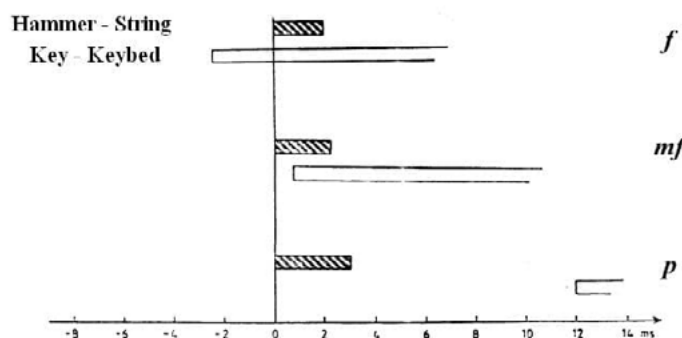


Figure 9. Juan José Burred, “The acoustics of the piano”, trans. David Ripplinger (Madrid: Conservatorio Profesional “Arturo Soria”, 2004), 8, figure 3.5

Four observations are worth making at this point: first, the time scale of these transient phenomena is clearly commensurate with the millisecond-level “onset asynchronies” of modern pianism; second, their relative intensities and relative timing are, for the most part, subject to the pianist’s agency, and amenable to skillful manipulation, belonging to the individualising artistic qualities broadly termed “touch”; third, the nature of these transient phenomena complicates the measurement of “onset” asynchrony, if less so the assessment of its presence and qualities.

The fourth, and most important, observation is directly linked to Russian traditions of piano playing, with their widely documented and evidenced emphasis on tone quality. For the pianist, the transient is an aesthetic double sword. It is an indispensable psychoacoustic signature, thanks to which it is identified as a “piano tone”. It serves an expressive and articulatory function analogous to that of linguistic consonants, and in that connection we might also mention a particular hedonistic potential of the transient, which is exploited in some repertoires and particularly attractive to a small group of historic pianists⁴⁰. Yet the transient is also a source of inherently offensive percussiveness. The historical and contemporary literature of piano pedagogy proposes an array of means, effective and ineffective, of “masking the attack”—from the proverbial supple wrists, to various notions of arm weight, or ways of approaching and activating the keybed. Without claims to a complex psychoacoustic theory of frequency or temporal masking (although future research could consider that direction), we propose

³⁹ Jürgen Meyer, *Acoustics and the Performance of Music: Manual for Acousticians* (Braunschweig: Springer, 2009), 105.

⁴⁰ Gould, Gulda, Pogorelich and others might be identified as pianists with a less inhibited approach to the piano transient. A study of their uses of onset asynchrony could be illuminating.

to use “masking” in this context as an experiential phenomenon. Comparing Lev Oborin’s two generic types of touch, *sostenuto* (“in”) and *leggero* (“out”), Boris Berman writes: “both of these ways of playing [...] share a common goal: *to mask the most treacherous, dangerously telling moment*—that of the actual attack, when the hammer hits the string”⁴¹. It is easy to imagine, in a schematic scenario of two simultaneous notes, how a degree of microasynchrony not exceeding the span of the first transient will dissipate the percussive energy of the aggregate, and distribute it along a longer duration, without an appreciable increase in the *number* of perceived attacks—that is to say, without “handbreaking” or arpeggiating. This might explain, in part, why this practice is not applicable, at least not to the same masking effect, on earlier instruments such as the harpsichord, where the transient is shorter.

It is also safe to predict that the impulse of the second percussive event on piano, as a spike of energy, will be partly inherited via the bridge and soundboard by partials of the first tone, provoking a brief “swell.” Readers who have performed the proverbial exercise of knocking on the wooden structure of a piano with its sustain pedal depressed will recognise both the mechanism and timbral effect. The potential of post-attack “swells”, which are the exclusive privilege of voice, wind, and string instruments, and can only be imitated on most keyboard instruments, was recognised early on by the clavicinists. Da Costa observantly recalls a passage from François Couperin’s *L’Art de toucher le clavecin* (1717), in which the type of Baroque ornamental dislocation shown in figure 10, known as *suspension*, effectively a written-out bass lead, is assigned precisely this spectral and mimetic function: “In such cases where stringed instruments would increase their volume of sound, the suspension (slight retardation) of the sounds on the harpsichord seems (by a contrary effect) to produce on the ear the result expected and desired”⁴².

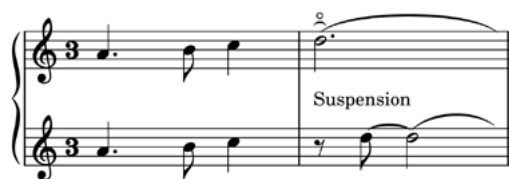


Figure 10. François Couperin, *L’art de toucher le clavecin* (1716); 1933 edition (Leipzig: Breitkopf and Härtel), 14

A piano tone consists of a cascade of partials which, unlike pure harmonics, beat and fluctuate in rich ways. Piano partials do not simply interfere in sonorous air, as they would if their sources were physically disconnected. They rather travel within, and emanate from, a single resonant system of strings, bridge, soundboard, and other materials. The amplitude curves of partials in the musically

⁴¹ Boris Berman, *From the Pianist’s Bench* (New Haven: Yale University Press, 2000), 5.

⁴² The excerpt is quoted as it appears in the 1933 trilingual edition of Couperin’s treatise: *L’art de toucher le clavecin* = *Die Kunst das Clavecin zu spielen* = *The art of playing the harpsichord* (Leipzig: Breitopf & Härtel).

rudimentary context of a tuning session, for example, are often classifiable according to a qualitative taxonomy of a dozen “generic decay patterns”, which facilitate the tuner’s empirical work and help appreciate a piano’s “vibrato”. Yet beyond that limited context, the behavior of partials in actual music is a result of intractable, nonlinear interactions through the soundboard and bridge, which are impossible to generalize about. Capleton has found strong evidence to the effect that even the partials of a single piano trichord in isolation exhibit mathematically chaotic behaviour⁴³.

In these circumstances, even the 2ms encounter between hammer and string must also be understood as an eventful duration, through complex mechanisms whose consequences propagate to the timbre of the decaying aftersound. Citing G. Weinrich’s landmark research on the behavior of two- and three-string piano unison, Capleton explains that inevitable grooves and microscopic irregularities of the hammer surface typically cause asynchronies in the order of 2-3ms between the unison strings, which translate into faster-decaying partials in its spectrum. In fact, it takes a deliberately ultra-fine “*mistuning*”, in a numeric sense, between the strings involved to eradicate this undesirable effect, without a perceptible change of pitch. Considering that all piano strings, not only those of string unisons, are coupled via the bridge, one is tempted to conjuncture that onset asynchrony may provide an artistic means of shaping the aftersound of the instrument’s sonority—shaping the vibrato of its “vowel”, as it were. Preliminary measurements and Fourier analyses carried out as part of our research to test this hypothesis were intriguing, but require further work.

IX. HISTORY: THE RUSSIAN SCHOOL

The sixth thread mentioned above, the “modern” practice of melodic onset asynchrony, concerns what the Russians call “sum”, that is, musical simultaneity, which nevertheless allows for microtimed tone production through asynchrony, and in some senses this is really the goal of what we aim to air in this research. If elective chord arpeggiation was a remnant of lute and harpsichord playing technique on modern pianism, then microtimed asynchrony represents, finally, a reconciliation of the history of asynchrony, in its pursuit of sonic purity, with the psychomotor and organological characteristics of modern pianism⁴⁴. Knowing about this has the potential to transform the hearing of a professional musician who may not previously have been aware of it explicitly. This kind of melodic heightening through microtiming is what might be called the holy grail of modern piano tone—and of many early twentieth-century recorded pianists too. Particularly in what is often called the Russian School, the projection of melody, at least in the aesthetic sphere of pre-modern piano music—whether it be a Beethoven bagatelle, a Chopin Nocturne, or a Scriabin

⁴³ Capleton, *Theory and Practice of Piano Tuning*..., 571.

⁴⁴ In the absence of exceptionally expert pianistic control, or deliberate effort to the contrary, the act of “bringing out” a melodic voice is typically coincident with an occurrence of melody lead. That said, we do not subscribe to the conclusions of Werner Goebel et. al. about the limited role and scope of the pianist’s agency in this chain of events. See his “Melody lead in piano performance: Expressive device or artifact?”, *Journal of the Acoustical Society of America* 3, no. 2 (2001): 563-572.

Etude⁴⁵—this melodic projection, this soaring upper voice, is the piano’s equivalent of the exquisite beauty of a vocal aria or a violin concerto slow movement. The reader may hear melodic onset synchrony in almost any medium⁴⁶. At least one intriguing puzzle does remain, however. If asynchrony is such a pervasive technique in the modern pianism that has been our subtext in most of this discussion, might it not be expected to have been described, indeed explored, in for example the many treatises that emerged in the last century from the Russian School? Anecdotally, we can report from conversations with practitioners that perhaps melodic asynchrony has been regarded by some, and still is, as a kind of trade secret, while on the other hand we have also found it to be regarded as a statement of the obvious⁴⁷.

The anticipated Russian, as we recently found, is Golubovskaya, who first exposed the “open secret”, as she describes it, of pianistic micro-asynchrony in two deceptively inconspicuous paragraphs of her pedaling treatise. In the midst of a chapter on Chopin, she writes:

Who has not been annoyed by the dilettantish manner of playing all melodic notes noticeably after the bass? And yet, its entirely legitimate roots, like many techniques of the self-taught, lie in an instinctive fear of increasing the dryness of the instrument as a result of the exact coincidence of two attacks. Although not a word on the subject can be found anywhere, combinations of two or more pitches are rarely ever played together. A perfectly exact coincidence of hammer blows (which are intrinsic to the onset of piano tone) sounds harsh and is therefore suitable for specialized characterizations and coloristic intentions. Softness in chordal sonorities results from an utterly unnoticeable but inevitably non-simultaneous attack of their notes. This technique does not sound like an arpeggiation and is not registered by hearing.

The order of attacks in succession varies. Most often the melodic note anticipates the sonority and is then followed by the bass and remaining harmonic notes. This does not only soften the percussiveness but also prolongs the initial—and for the pianist so crucial—phase of sound production. No matter how infinitesimal the time interval, which makes it impossible to notice the absence of the proverbial “*zusammen*”, it substantially influences the color and, therefore, the characterization of the sonority. To a considerable extent the distinctive “sound” of different pianists is explicable in terms of this parameter and the countless multitude of ways to put it into use.

⁴⁵ The authors are aware that this article is categorically white-framed, and we have not sought, to use Blake Stimson’s term (*Nonsite*, February 2021), to “deneocolonise” it, as the “Western art music” in our title clearly indicates.

⁴⁶ That cautionary “almost” defers to, for example, some media where different research results might be expected, for instance certain kinds of electro-acoustic music; possibly also in styles such as American minimalism where the interplay of synchronised and non-synchronised sounds may be hard-wired into the composition, and perhaps leave little room for interpretation.

⁴⁷ It more or less fails to appear in Western treatises, such as, for one well-known example where it might have been expected, Jean Fassin’s *Lettre à un jeune pianiste* (Paris: Fayard, 2000). An exception is Fanny Waterman, *On Piano Teaching and Performing* (London: Faber Music, 1983), whose own teacher Cyril Smith trained in the Moscow Conservatoire. The topic is also discussed in Dunsby’s *Performing Music*...

In songful music, not a single pair of melody and bass notes will be merged by a skillful and sensitive pianist. Unlike the naive method of taking the melodic note noticeably after the bass in pursuit of softness, the melodic note is rather struck slightly before the bass—but ever so slightly.⁴⁸

Many threads unweaved earlier in our argument figure condensed in this pioneering statement by the historic Leningrad-based artist-pedagogue. Hypothesised mechanisms of melody lead, described earlier in intuitive terms as a “masking” or diffusion of transient noises, are perceived by Golubovskaya, also, as the primary motivation for the practice. The roots of asynchrony are recognized as historical as well as aesthetic: the pursuit of a high sonic standard, granted that it is a historically and organologically shifting one, is understood to have provided the impetus for old and new practices of asynchrony, which trace a continuity. But one must now overcome, she suggests, the reflexive recourse to conspicuous bass asynchrony, which falls far too short and, naively oblivious to the modern instrument’s workings, serves only to weaken two harsh attacks, instead of enriching their spectra with an alchemist’s precision.

Her insights on the role of agency in this account are worth noting: in comparison with most Western scholarship, the discussion is no longer existential. Golubovskaya not only takes the immense timbral salience of the practice for granted, but actually recognizes in it the potential of a “countless multitude” of colors to the initiated pianist. Her matter-of-fact statement can only inspire awe, when the colours on this “palette” can be no more than 3-5ms apart. Yet it is in line with Golubovskaya’s uncanny micro-rhythmic refinement, evidenced in records of her pedagogy, and certainly honed through her championing, as a recording artist, of the clavecinists—conjurers, such as F. Couperin, of timbral ornaments and mimetic illusions—on both piano and harpsichord. In her pedagogy, “rhythm emerges as a main thread traversing the entire range of problems, from intonation, to articulation, phrasing, and highly technical problems”⁴⁹. What type of problem is the pianistic mastery of onset asynchrony, after all, if not a fundamentally rhythmic one? The second intriguing insight on agency in Golubovskaya’s account is her recognition, in the practice of asynchrony, of “the source of different pianists’ distinctive ‘sound’”. One would be justified to read this statement as a thinly veiled truism about the individuating nature of “touch” in a generic sense. Yet her groundbreaking views on asynchrony occupy a meager 2% of a treatise dedicated to piano pedalling, an aspect of pianism widely considered characteristic and individualizing in its own right, so her choice cannot have been arbitrary.

In fact, the asynchrony described in this passage is not ornamental but ubiquitous: not a single pair of *cantabile* melody and bass, she repeats, will be played synchronously. This is to say, asynchrony gives melody a *voice*. In a number of passages in her pedalling treatise she stresses the importance of

⁴⁸ Golubovskaya, *Iskusstvo pedalizacii...*, 77.

⁴⁹ The assessment is cited from Semyon Denisov’s recent dissertation on Golubovskaya, which reconstructs a compendium of her pedagogic philosophy through archival research. See “Shkola N. I. Golubovskoj – V. V. Nil’sena v kontekste otechestvennogo fortepiannogo iskusstva XX veka” (doctoral thesis, A. Vaganova Ballet Academy, St. Petersburg, 2021), 71.

maintaining the timbral consistency of the melody tones, even in the face of sudden dynamic or textural changes, as if to reconstruct the art of Russian cantors or *bel canto* singers. One example is bar 40 of the first movement of Beethoven's *Tempest* (Op. 31, no. 2), with which the music arrives at V/V⁵⁰. Granted that these insights are drawn from discussions of pedaling, there is no reason why onset asynchrony would not serve the same “intonational” function, in the sense of Boleslav Yavorsky's “theory of musical speech”—essentially a theory of musical tension—which evidently permeates her musicianship.

X. BY WAY OF CONCLUSION

Each of the examples in our account has also been in some degree a music-analytical act of the performer. Each is the physical embodiment of the performers' musical concept. Obviously, knowing in general where the melody is, if it is music that has a melody, and endowing that feature with maximum expressivity, is hardly a sophisticated act of interpretive creativity. That is why we have not taken up the reader's time with extensive examples from some contemporary musical life⁵¹ of the simplest, though miraculous cases, of swooning to Yuja Wang's *cantabile*, gorging on Yo Yo Ma's ensemble projection, or marveling at the sonic clarity of the Concertgebouw Orchestra, or of one of the Boulez recordings of *Répons*. It seems that the connections between the open secret of sonic temporality and issues of structural clarity and understanding remain relatively unresearched. This is not a problem, but an opportunity, opened up by technology; for now that, since relatively recently, we can actually measure the properties of musical sound with the kind of accuracy that the human auditory system has been using since time immemorial, we can begin to evaluate what we think we are hearing; and we believe this is a tremendous resource for music theory, because theorists can ask why musicians are embodying not the obvious features so beloved of traditional “performance and analysis” studies, but the most subtle kinds of articulation and expressivity that may well be those crucially determining our basic aesthetic responses. We mentioned above a study by Llorens of a “historic” recording of the slow movement of Brahms's F major cello sonata by Pablo Casals, no less, and Mieczysław Horszowski⁵². According to her measurements, onset asynchrony characterises more than half of the movement. She considers that the players here are using this device deliberately, for expressive means which serve structural ends. The device is said to serve as a marker of structural boundaries, and it also creates “a sort of high-order rhythm that shapes the Adagio affettuoso in unique way”⁵³. It is such harnessing of technology with theory that can take us forward. Relatively few practitioners of Western art music have attended to this apparently crucial aspect of the embodiment of musical conceptions in musical sound: it seems that a key feature of interpretive creativity is underresearched, both empirically and aesthetically. The campaign in recent years, by for instance Nicholas Cook rather conspicuously, to persuade music theorists to

⁵⁰ Nadezhda Golubovskaya, *Op. 63*.

⁵¹ See note 46 above.

⁵² Llorens, “Recorded asynchronies...”, 5.

⁵³ *Ibid.*, 22.

study the actions and intentions of musical performance, rather than fixing solely on the evidence of musical scores⁵⁴, is a healthy one, but we must do more than quantify what seems to happen in musical performance through the ears of the average listener. Rather, we seek to know what is *particular* about the *creativity* of *expert* musicians; and that may represent a rather different research agenda than the one that has dominated musical performance studies in recent years.

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⁵⁴ See, for example, his widely cited early article "Between process and product: Music and/as performance", *Music Theory Online* 7, no. 2 (1987). Cook's thinking was developed more recently in *Beyond the Score: Music as Performance* (Oxford: Oxford University Press, 2013); and *Music as Creative Practice* (New York: Oxford University Press, 2018; *Studies in Musical Performance as Creative Practice*, 5).

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