

**BOUNDARIES OF PERCEPTION AND THE
ENDLESS STRUGGLE FOR UNITY IN THE MUSIC
OF KARLHEINZ STOCKHAUSEN**

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Every aspect in the world can be seen as a point on some continuum, which means: as a gradation of at least two extremes. A human being can be seen as a certain point or band on a continuum between purely material beings on one side and pure spirit on the other. Every tone, every sound in Stockhausen's music is meant to be a crossing point of several continua (Coenen, 1994, p. 208).

This essay reviews and reinterprets the seminal—and controversial—1957 article by Karlheinz Stockhausen entitled “...How Time Passes.” By considering the wider implications of Stockhausen’s deceptively technical essay, I will trace Stockhausen’s entire compositional approach to two central ideas: unity, and the continuum. In “...How Time Passes,” these two metaphors are expressed as a scientific theory for uniting the timescales of pitch and timbre with that of rhythm, applied in practical terms to the works *Gruppen*, *Zeitmasze*, and *Klavierstück XI*. I will argue that despite Stockhausen’s obvious mastery of many scientific topics, his early applications of scientific ideas often fail to establish the kind of perceptual unity that he appears to be searching for. Noting Stockhausen’s later avoidance of new technologies for connecting timescales, I will conclude that the metaphorical quest for unity is perhaps more important to Stockhausen than the proper application of scientific ideas.

Using the pitch-rhythm continuum as a central example, my critique will focus on the limitations of human perception with regard to structural unity in musical composition. First, I will consider the pitch-rhythm continuum from a historical perspective. Next, I will examine two specific compositional examples: Stockhausen’s chromatic scale of durations (as presented in “...How time passes”), and Henry Cowell’s application of tonal ideas to rhythm (as presented in “New Musical Resources”). Taking inspiration from Curtis Roads’ “Microsound” (2001), I will examine the distinctive behaviors and identities of musical elements at different timescales. Next, I will consider the relationship between perceptual continuums and compositional unity from a more general, phenomenological perspective, relating it to Stockhausen’s compositions *Hymnen* and *Kontakte*. In this analysis, I will compare the strictness of formally imposed compositional structures to the organic, malleable nature of human perception. Finally, I will ponder

Stockhausen's belief in the evolution of human perception and its relation to a "proper" understanding of his work.

A BRIEF HISTORY OF THE PITCH-RHYTHM CONTINUUM

[S]ince these modern means have become available, to change the time of perception continuously, from one range to another, from a rhythm into a pitch, or a tone or noise into a formal structure, the composer can now work within a unified time domain. And that completely changes the traditional concept of how to compose and think music, because previously they were all in separate boxes: harmony and melody in one box, rhythm and metre in another, then periods, phrasing, larger formal entities in another (Stockhausen and Maconie, 1989, p. 95).

The awareness of a connection between pitch and rhythm has a long history--a history that, as might be evident in the above statement, Stockhausen does not credit or dwell upon. It is often noted that Henry Cowell's discussion of the topic in his book "New Musical Resources" predates Stockhausen's essay by nearly 30 years (Koenigsberg 1991, Roads 2001), long before the existence of the "modern means" Stockhausen refers to. David Lewin traces the connection back even further to works by pre-20th century composers such as Brahms, citing Moritz Hauptmann's 1853 book "Die Natur der Harmonik und Metrik": "...Moritz Hauptmann introduced to Western music theory the idea that the philosophical principles underlying metric structure are the same as those underlying the harmonic structure of tonality" (Lewin 1981, p. 261).

As Cowell argued, "There is, of course, nothing radical in what is thus far suggested. It is only the interpretation that is new" (Cowell 1930, p. 51). Following this statement, several examples of the pitch-rhythm continuum can be discerned in daily life. Consider the sound of a creaking door. When moving slowly, a rusty hinge will generate a succession of discrete sounds. When moving quickly, it will be perceived as a continuous pitch. Most children have undoubtedly explored this effect. Even the human body, through its various expulsions of air, can easily

demonstrate this continuum. So it could be said that the continuum between pitch and rhythm is something we understand to some degree on a fundamental, instinctual level.

THE CHROMATIC SCALE OF DURATIONS

So what is new about Stockhausen's approach in "...How Time Passes"? Rather than see the pitch-rhythm continuum as a means for general creative expression, as Cowell did, Stockhausen wished to unify them. To achieve this unity, Stockhausen proposed a scale of durations whose proportions would form a one-to-one relationship with the fundamental frequencies of their associated pitches. He considered using a scale based on harmonic proportions, but ruled it out for two reasons. First, he reasoned that the use of harmonic pitch relationships (and harmonic rhythm relationships expressed as polyrhythm) would be stylistically inappropriate within the confines of serial composition. Second, he figured that in an equally dispersed serial ordering of harmonic durations, the longer durations would overshadow the short. Instead, Stockhausen resolved to create a chromatic scale of durations, corresponding to the equal-tempered chromatic scale of pitches.

Stockhausen's proposal is a simple one, but the implementation is much more complex, leading Stockhausen to devote more than half of "...How Time Passes" to the practical considerations involved in writing music with such a system. In addition to providing charts and graphs for calculating note durations according to the logarithmic relationship of the 12th root of 2, he mused over possible ways to notate these durations and how a conductor (or conductors) might conduct them. Many of these practical methods are applied to Stockhausen's *Gruppen* for three orchestras. While *Gruppen* certainly succeeds in achieving a formal, structural unity of pitch and duration, my critique will focus on the implications of such a unity at the level of perception.

A CRITIQUE OF THE CHROMATIC SCALE OF DURATIONS

In the 1950s, a few serial composers tried to invent a system of composition that could uniformly apply to any time scale. Their aim was for a kind of ideal logical coherence. This did not take into account the nonlinearities of musical perception... A main lesson of Stockhausen's 1957 essay "How time passes" is precisely how awkward it can be to apply a proportional series developed for one time scale (e.g., pitch periods) to another time scale (e.g., note durations)... Sound phenomena on one time scale may travel by transposition to another time scale, but the voyage is not linear. In other words, the perceptual properties of a given time scale are not necessarily invariant across dilations and contractions... This inconsistency, of course, does not prevent us from applying such transpositions. It merely means that we must recognize that each time scale abides by its own rules. A perfect hierarchy is a weak model for composition (Roads, 2001, p. 331).

The continuum between pitch and rhythm would perhaps be described more objectively as the continuum between pitch and *pulse*. When we speak of rhythm, we speak of a generalized notion of discrete events perceivable in time. In relation to our perception of pitch, this "rhythm" is manifest as a series of continuous, periodic repetitions. Any complex rhythm on the macro scale (consisting of more than a simple pulse) would be better equated with timbre on the micro scale, although any timbre with a definite pitch must also be periodic.

The number of sequential repetitions necessary to generate a sensation of pitch is subject to some variation among scholars, but is generally agreed to be within the range of 3-15, depending on the frequency range. Without such a series of repetitions, a single period (or "phase," in Stockhausen's terms) would be perceived in the timescale of rhythm as a non-pitched click. While we may be able to perceive minute differences in timbre between different clicks (Roads 2001), we cannot associate a click of a given duration with its respective pitch unless it is repeated. Stockhausen's scale of durations essentially represents a scale of pitches reduced to clicks. While we may certainly note a connection between Stockhausen's pitches and their associated durations on a formal level, we are simply unable to perceive the connection. It would be interesting to consider what Stockhausen might have created had he not been prevented by

serial practices from utilizing repetition in the timescale of rhythm. However, any notion of unity must still take into account the fact that perceptual elements (sonic or otherwise) behave in fundamentally different ways at different timescales.

Let us take a moment to further consider the connection between timbre and rhythm. Complex timbres cannot be reduced to rhythms in the audible range, because they are not composed of combinations of discrete impulses. When a complex timbre is slowed down, depending on its spectral content, it will contain a mixture of audible and inaudible, periodic and aperiodic fluctuations. These elements resist unification, because they behave differently at different timescales. What gives complex timbres their perceptual identity is precisely their behavior in the timescale of timbre. These timbres contain plenty of information that can be used creatively to generate sound or control parameters on other timescales, but the notion that these timescales can be unified is a mystical, unattainable dream.

EXPANDING THE CRITIQUE: PROPORTIONAL RELATIONS

While not claiming the goal of unity, Henry Cowell advocated a similar, albeit much simpler method of connecting timescales by directly applying tonal ideas to rhythm (an idea that Stockhausen avoids because of its contradiction with serial practices). In one example, Cowell outlined the process of mapping the frequency relationships of a major triad onto three rhythmic streams (by simply overlaying meters of $2/4$, $3/4$, and $5/4$). In doing this, he believed it was possible to express the idea of a major triad in the realm of rhythm. However, the identity of a major triad as such is unique to the timescale of pitch. When it crosses over into the realm of rhythm, it maintains a connection as far as proportions are concerned, but it can no longer be viewed or perceived as a major triad. While we can certainly make connections between the two timescales, we cannot *unify* them. Timescales behave differently, and that's what makes them, and the fuzzy boundaries between them, so interesting to explore.

Let us consider the example of an equal-tempered perfect fifth, as expressed by Stockhausen's chromatic scale of durations. An equal-tempered fifth is perceived as being approximately the same as a just-tuned fifth, even though the just fifth expresses a perfect 3:2 harmonic relationship, while the equal-tempered fifth does not. Because they operate in the timescale of pitch, they are perceived as the same gestalt. However, an equal-tempered fifth expressed as two tempos in the timescale of rhythm would not yield the same perception of a 3:2 relationship, because the change of timescale would slow down phasing relationships between them to a point where the ratio would be perceived as constantly fluctuating.

An equal-tempered fifth can be expressed in the timescale of rhythm as two overlapping tempos of 60 beats per minute and 89.9 beats per minute. At certain points, the approximated 3:2 relationship would be quite easy to identify, at others, it would be drastically out of phase, and thus, we would stop perceiving the relationship as being close to a "fifth." This relationship would be even harder to perceive if it were not expressed as two continuous pulses, but as a complex collection of individual durations, as Stockhausen has done in *Gruppen*. Each one of Stockhausen's "groups" essentially represents a tiny snapshot of a waveform, which is not enough to generate an association with the timescale of pitch or tone. Each group may be more rightly viewed as a tiny burst of noise – in the timescale of pitch, a click.

Far from accomplishing the goal of perceptual unity, we might say that an equal-tempered duration scale has about as much to do with equal-tempered pitches as a cake cut into 12 logarithmically proportioned slices. Staying in the musical realm, we could just as easily "unify" the chromatic duration scale with a scale of loudness, which is also expressed logarithmically in decibels. What we're really talking about is simply the division of an entity into 12 logarithmically proportioned parts. This idea has very little to do with pitch per se, but instead relates to the concept of proportions in a general sense.

IMPOSED CONNECTIONS vs PERCEIVED CONNECTIONS

Things look like one another from one end of the universe to the other, without it being possible to say which is reality and which is mere appearance. All forms of comparison are legitimate (Leonardi and Kohl 1998, p. 65).

A simple crossfade between two sounds with characteristics in common (as all sounds can be said to have, to a certain extent) will cause the listener to establish a meaningful continuum of perception between the two. Stockhausen makes extensive use of this technique in *Hymnen*, a nearly two-hour long masterpiece of electronic music, composed in 1967 at the beginning of the composer's "intuitive" period.

In *Hymnen*, Stockhausen utilizes a mixture of scientific and intuitive methods to create a dizzyingly complex, multi-layered tapestry of profound perceptual links between musical elements. These elements are derived almost entirely from recordings of national anthems, with the addition of various field recordings and electronic sounds. By now, Stockhausen has been expanding on the ideas presented in "...How time passes" for more than 10 years, but the strict compositional techniques for unifying timescales in *Gruppen* and *Klavierstück XI* have loosened in favor of a more organic approach.

This approach is perhaps best demonstrated in the famous passage where a continuous rattling sound slows down to reveal itself as the sound of a cheering crowd, then slowly transforms (through a simple crossfade) into the sound of quacking ducks. The first stage of this transformation can be said demonstrate the 'objective' continuum of timescale, as the sped up sound of the crowd cheering transitions into a range that allows the listener to identify it as such. The second stage achieves the same level of continuity through 'subjective' or artificial means. As Stockhausen explained:

What I use is the mutation process of nature; that's what music is all about. It's an intermodulation so that one being can become another. I'm not interested in collage, I'm interested in revealing how, at a special moment, a human sound is that of a duck and a duck's sound is the silver sound of shaking metal fragments.

All these sounds are interrelated very subtly just by the manner in which you listen to them and in the way that they're exposed in time and space; the basic material is all the same. Many of the fairy tales are about this: the straw that the miller's daughter has to weave into gold in Rumpelstiltskin, for example. This has been in my works from the beginning: transubstantiation. Like the mystical moments in religion when the water is transformed into wine. And that's the theme of *Hymnen* (Stockhausen and Cott 1973, p. 150).

With his mention of collage, Stockhausen seems to be asserting the superiority of his compositional methods over those of musique concrète, as if the connections he created are real because of his intention to make them so. But he contradicts himself almost immediately by admitting that the sounds are related "by the manner in which you listen to them." And what is collage if not a fundamental attempt to establish (or at least encourage) perceptual connections between adjacent and overlapping elements?

Stockhausen's landmark work *Kontakte* provides another perfect example of the discrepancy between imposed and perceivable connections between musical elements. In his many discussions of the significance of the pitch-rhythm continuum, Stockhausen often references the pivotal moment in *Kontakte* when pitch slows down to become rhythm. He goes to great lengths to describe the complex technical process of generating this sound with pulse generators, filters, and tape (Stockhausen 1962). Yet he admits the limitations of what can be perceived:

What is interesting about this moment is that if I were to play little bits of the passage one after another, like notes on the piano, nobody would be able to hear the transition that takes place from one field of time perception to another. The fact that I make the transition continuously makes us conscious of it, and this effort of consciousness changes our whole attitude towards our acoustic environment (Stockhausen and Maconie 1989, p. 96).

As stated earlier in this essay, such a continuum can be demonstrated just as easily with the human body. The alien timbre that Stockhausen has painstakingly created to demonstrate the effect is beautiful and intriguing, but there is nothing new or profound in the transition itself. Yet Stockhausen is suggesting that any complex alterations of this process would completely obscure

our ability to perceive it. And if this is the only moment in *Kontakte* when the continuum can be directly perceived, what should we make of the rest of the piece? Perhaps it is the ability of the work to generate multiple interpretations, to give the audience a new and profound experience with each listening, that gives life to *Kontakte*.

THE EVOLUTION OF PERCEPTION

Stockhausen believes in the ability to change perception... This is based on the assumption that music influences people, not only psychologically, but also physically (Coenen 1994, p. 207).

The continuum between pitch and rhythm resides on a crucial border of temporal continuity in perception (Roads 2001). It is on this border that the illusion of continuity breaks down to reveal discrete events. This recognition of continuity and discontinuity, of connections between timescales, represents a new way of perceiving, but not necessarily a change in the physical faculties that allow us to perceive. We can expand our ability to interpret what we hear, but while we occupy physical bodies, we will always be to some extent limited by the interface of our sensory organs. To propose that we will ever be able to hear the structural inner-workings of a symphony in one second (Stockhausen and Maconie 1989, p. 47) is to simply deny the physical limitations of our ears. The fact is, our aural faculties have not evolved in the Darwinian sense since the concept of music first came into existence, and they are not likely to evolve until this kind of hearing becomes essential to our survival. As Curtis Roads notes, “Human sensory organs set strict limits on our ability to perceive the discontinuity beneath the apparently hard surface of all phenomena” (2001, p. 330).

We might imagine humanity “evolving” to a point where we could choose to see blue when we see red, or choose to hear the sound of a bird when we hear the sound of a lion roaring. If we were to achieve such a state, would we be enlightened, or would we simply lose the ability to function in the physical world? In a piece like *Gruppen*, with its strict method of equating pitch

proportions to durations, Stockhausen may indeed be trying to make us hear birds when we hear lions. Although the various “inserts” and subjective changes made to the resulting “groups” may indicate that even Stockhausen realized to some degree the perceptual limits of formally imposed systems. Cage’s model of hearing sounds “for what they are” is somewhat less totalitarian. Rather than imposing a set of supposedly time-unified structural relationships on the listener (which we must perceive if we are to properly understand the work), Cage encourages us to ignore the intentions of the composer and experience the work for what it is, not what it is supposed to be. In either case, the listener will interpret the work for him or herself, and there is only so much a composer can (and arguably should) do to influence them.

FINAL CONSIDERATIONS: AN ASSESSMENT OF STOCKHAUSEN’S QUEST FOR UNITY

His approach is similar to that of the Renaissance scholars, who sought to understand and to domesticate the chains that connect earth to heaven--the microcosm to the macrocosm--in an effort of mystical introspection doubled by a rigorous pursuit of knowledge and the things of the world (Leonardi and Kohl 1998, p. 64).

Why did Stockhausen avoid new developments in technology such as granular synthesis, which to this day provide the most advanced means of connecting timescales? It may be the case that despite his obvious technical mastery of many scientific topics, Stockhausen was less concerned with the proper scientific application of his theories than he was with applying a general philosophical approach to music and sound. Where scientific theories suited his ideas, he would incorporate them. Where scientific theories did not reinforce, or in some cases, even contradicted his ideas, he either avoided them or adapted them in a pseudo-scientific manner to suit his needs. Stockhausen’s eventual reduction of focus on technology, and his turn to the more general, less scientific “formula” as the method of achieving unity, would seem to reinforce this idea.

Had Stockhausen accomplished his goal of total unity, he would have had nothing left to compose, and there would be nothing left for us to interpret. Paradoxically, it is this very struggle to combine all elements of the universe into a single continuum that led to such a diverse and imaginative outpouring of sonic configurations. Perhaps, then, we should not base our judgments of a composer's work on the successful execution of formal goals, removed from the realm of perception. Instead, we might take Stockhausen's suggestion and leave this determination up to the listener:

The temporal process by which a sound is transformed into a rhythm can, without doubt, take a musical form. The aesthetic judgment of the listener can determine if the result of this process is successful, if it is significantly congruent with the total work, and if it has been accomplished with originality and imagination (Stockhausen 1962, p. 47).

In closing, I will provide a quote from Jocelyn Goodwyn's preface to Henry Cowell's *New Musical Resources*, which could just as easily preface "...How Time Passes":

"Some parts of the book are naïve and shallow, but those of us who know Henry Cowell will forgive this as the natural consequence of an imagination that ranged far beyond its actual knowledge."

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