

# Could the endless progressions in James Tenney's music be viewed as sonic koans?

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## ABSTRACT

In Zen practice, a koan is an enigmatic spiritual question that doesn't suppose a rational answer. *Koan* is also the name of a solo violin piece composed by James Tenney in 1971 that presents an endless melodic progression. *Koan* is actually derived from the electronic piece *For Ann (rising)* composed two years prior. This paper focuses on both pieces. It examines how this American composer drew his inspiration from both a Buddhist philosophical idea and from Shepard and Risset's investigations in the field of auditory computer-generated illusions.

## 1. INTRODUCTION

### 1.1 What is a koan?

A koan (correctly written *kōan*) is a Buddhist term that refers to enigmatic spiritual formulas in Zen practice. It takes on the shape of a story, dialogue, statement or question aiming to test a student's progress in Zen practice [1]. Because it is paradoxical and strange in character, a koan doesn't call upon ordinary logic. Though appearing intrinsically incomprehensible, it is actually an invitation to meditation.

Koans are generally known as psychological tools that convey a philosophical message about the meaning of enlightenment. Some of the most prominent examples are questions such as 'Does a dog have Buddha nature?' and 'What is the sound of one hand clapping?' [1]

In 1971, James Tenney (1934-2006) composed *Koan*, a piece for solo violin. How does this singular piece drawing inspiration from the Buddhist idea? Does its richness also reside in the processes stimulated by contemplation of a paradox more than in the potential answer as in the case of a koan question?

### 1.2 James Tenney

I'm interested in a form that as soon as you've heard a couple of minutes of it, you get a pretty good idea of what you're going to hear later. So you can sit back and relax and get inside the sound. [2]

Throughout his life, James Tenney developed a scientific approach through his musical pieces that systematically tend to explore cognition and perception phenomena.

na.<sup>1</sup> Like John Chowning or Jean-Claude Risset, Tenney freely navigated between art and science, "applying his engineering acuity and musical vision to some of philosophical insights he gained from his close association with Cage (and Varèse)" [5].

In viewing music as an object of perception, rather than a dramatic or narrative form, Tenney sought to reveal the richness of perceptual processes. He built sound patterns that epitomized his vision of music, avoiding drama and promoting simplicity and clarity instead. For example, he developed the concept of ergodic structure in which "any given temporal 'slice' is equally likely to have the same parametric or morphological statistical characteristics as any other slice" [6]. Consequently, he often laid out all the elements of a piece clearly at the start, allowing the listener to contemplate the primary material and the way it is treated.

In a sense, many of the pieces are monothematic in that they systematically and exhaustively explore the ramifications of a particular sonic idea, using the various musical parameters to directly re-enforce the perception of that idea. [6]

Within the ideas that pervade and unite Tenney's work, koan is of importance. In this paper, we will solely focus on Tenney's tendency to explore endless progressions that, through their strange and paradoxical appearance, represent a particular type of sonic koan. Our main goal is to describe some of Tenney's pieces in order to understand how the koan, as a Buddhist idea, might be explored musically. We will begin with recalling the importance of Roger Shepard and Jean-Claude Risset's researches on computer-generated illusions during their stay at Bell Laboratories in the 1960's. We will show the impact of their investigations upon the genesis of *For Ann (rising)*, which Tenney composed in 1969. This disconcerting and minimalist piece, often considered as an archetype of his aesthetic, is an endless uprising sound pattern. We will then see how this effect, which was developed in a technological context, was transposed into one of his instrumental pieces entitled... *Koan*.

<sup>1</sup>For a brief and synthetic overview of James Tenney's work, refer to [3] or [4].

## 2. ENDLESS PROGRESSIONS

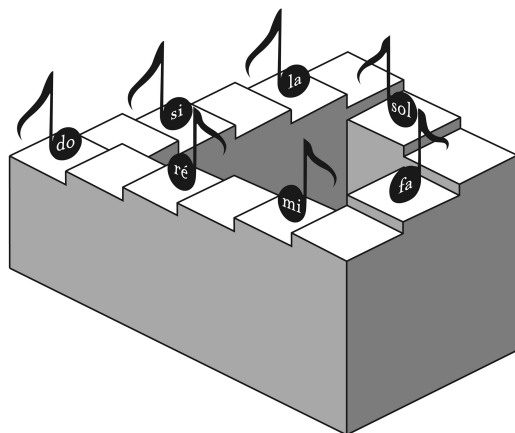
### 2.1 Definition

Giving the sensation that a sound parameter is subject to a never-ending process emphasizes its potentially infinite aspect and generally heightens musical tension. For example, compositional tricks allow composers to produce rhythmic patterns that appear to accelerate or decelerate endlessly [7]. However, this type of “endless *trompe-l’oreille*” is most often explored melodically. For centuries composers have used the perceptual and musical aspects of pitch circularity to produce such endless progressions [8].

In his remarkable and iconoclast essay on Gödel, Escher and Bach, Hofstadter underlines the magical power of the strange loops that occur when, “by moving upwards (or downwards) through the levels of some hierarchical system, we unexpectedly find ourselves right back where we started” [9]. To obtain such a loop you must play parallel scales in several different octave ranges and independently control the weight of each voice. The bottom octave is brought in as the top octave fades out. Thus, when the span of one octave above would have been reached you have in fact returned to the starting pitch.

These strange loops produce astonishing endlessly rising or falling melodic progressions. “Implicit in the concept of strange loops is the concept of infinity, since what else is a loop but a way of representing an endless process in a finite way” [9]? In the 1960’s, thanks to the *Music-N* family of computer music programs developed within Bell laboratories, Roger Shepard and Jean-Claude Risset achieved spectacular endless progressions based upon strange loops.

### 2.2 Shepard and Risset’s endless illusions



**Figure 1.** Penrose’s stairs with the seven diatonic pitches. © F.-X. Féron & K. Brunel-Lafargue [7].

Roger Shepard is a renowned experimental psychologist who manages to create a sonorous equivalent of the Penrose’s stairs (Figure 1). Designed by Lionel Penrose and his son Roger in 1958 [10], it is a two-dimensional depiction of a staircase in which the stairs make four 90° turns

and form a continuous strange loop such that one could climb them forever and never get any higher (and conversely).

Shepard synthesized twelve harmonic tones, each of them constructed with ten spectral components in octave relation. In such stimulus, tone chroma is perfectly clear (the twelve sounds reflect the twelve chromatic pitches) but tone height is ambiguous [11]. Thanks to the spectral envelope shaped like a bell, the twelve tones form a chromatic scale that seems to rise endlessly in pitch when they are repeated (the thirteenth half tone fits the first one).

In 1968, working on the music for the theatre piece *Little Boy* by Pierre Halet, Risset wished to create a version of the scale where the tones glide continuously to illustrate the fall of the atomic bomb – called Little Boy – on Hiroshima. The computer-generated single sound gliding down endlessly was created [12].

### 2.3 Impact on Tenney’s music

Shepard and Risset’s illusions produce astonishing effects that still stimulate the imagination of many composers. Yet, Tenney was obviously the first one who wished to create a similar effect in a different manner.

Tenney is known as one of the first composers to successfully make use of digital synthesis techniques developed by Max Mathews at Bell Labs where he worked during the years 1961-1964. At the time, he was close to Roger Shepard from whom he borrowed different ideas such as multi-dimensional scaling (MDS) “which allows a set of complex multi-variable *differences* between even unrelated objects or concepts to be viewed in a simpler space” [5]. Tenney was also interested in endless illusions, a phenomenon he explored in 1969 in *For Ann (rising)*.

## 3. FOR ANN (RISING) (1969)

### 3.1 Genesis

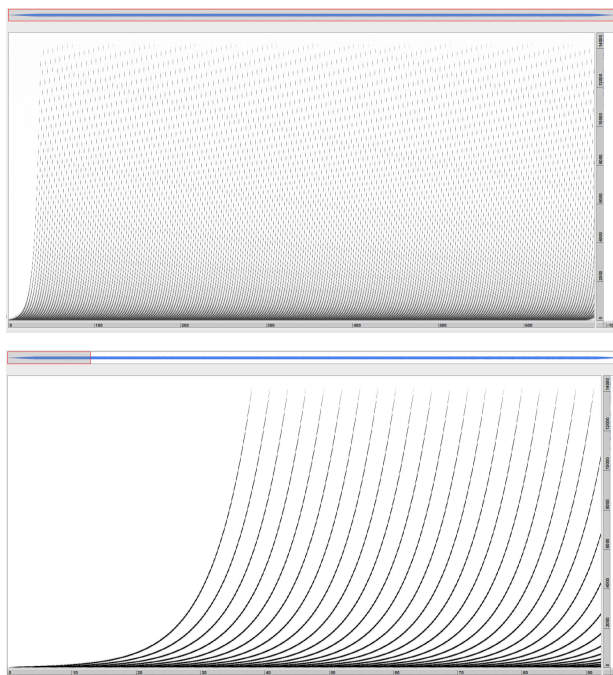
*For Ann (rising)* is an electronic piece originally recorded on magnetic tape in which the resulting global sound seems to continuously rise along an eternal spiral. The effect in this typical ergodic piece is very close to the infinite scale and the infinite glissando that Shepard and Risset generated via computer. *For Ann (Rising)* – which was elaborated in December 1969 – went through several versions but the main idea remained the same: tones superimposed upon themselves to create an endless rising progression.

In the first attempt, Tenney recorded himself on the piano playing a descending chromatic scale with the tonal pedal down: by playing it backwards, he obtained a rising chromatic scale with erased attacks but result was not what he wished: “That was a mess and it was noisy, and it wasn’t smooth enough” [2]. The second attempt was using a Lafayette oscillator but the setting needed to be switched in order to work on different frequency areas. So, Tenney had “to record the glissando in two segments and then splice them together and try to make something that was smooth” [2]. Though he was satisfied with the

glissando thus obtained, when it was superimposed upon itself there was “turmoil going on in the mid-region, in the middle frequency area” [2]. He then asked Risset to generate a single slow glissando via computer, which he superimposed with tape techniques. Due to a tiny imprecision, “the harmonic character of the set of pitches was slightly different at the end than it was at the beginning” [2]. He finally asked Tom Erbe to generate the piece in a single process according to his specifications. Later, Erbe produced the piece digitally using Barry Vercoe’s CSound composition and synthesis language. Our analysis is based on this ultimate version featured on the CD *Selected works: 1961-1969* [13].

### 3.2 Analysis

The material and process Tenney used in *For Ann (Rising)* are quite minimalist since the piece is simply the superimposition of a unique glissando upon itself for approximately twelve minutes. Erbe gives some technical details [14] that we can partially verify using spectrographic representations (Figure 2).



**Figure 2.** *For Ann (rising)*, spectrogram [0 – 14 000 Hz] of the entire piece (top image) and the first 90 seconds (lower image). FFT analyses were done with Audiosculpt software (Hanning window type, 4096 samples). If we had chosen a logarithmic frequency scale, we would have seen a succession of straight lines instead of the curved lines above.

According to Erbe, the piece consists of 240 sine wave sweeps, each of which lasts 33.6 seconds long and rises 8 octaves (4.2 seconds per octave)<sup>2</sup>. Thanks to a fade in / fade out, respectively at the beginning and at the end of each glissando, they enter and leave imperceptibly. Each sweep has a trapezoidal amplitude envelope which rises from 0.0 to 1.0 gain in the first two octaves, stays at 1.0

for the 4 mid octaves, and drops from 1.0 to 0.0 for the top two octaves of each sweep. A new sweep starts every 2.8 seconds. This timing was chosen in sort that each new glissando form a minor sixth from the next.

*For Ann (rising)* is a breathtaking piece that challenges auditory perception. “The listener’s attention is constantly shifting, both between various bands of the spectrum and the various levels of his own perception” [6]. Tenney does not concern himself with releasing tension (an important characteristic in Western music) but in *For Ann (rising)*, the tension grows more and more obvious as a result of the endlessly rising progression.

*For Ann (rising)* is a type of sonic koan as the endlessly rising global sound is perceived by the listener as a paradox to be untangled. In Zen practice, reminds Polansky, a koan takes the shape of a question whose answer is less important than the processes stimulated by the contemplation of the apparent paradox [6]. Listening to this piece produces a similar effect: we often try to follow an isolated glissando but fail because of the continual overlapping. We can wonder, like Philip Corner [15], how many voices can be heard at any time and how many voices there are. Thanks to spectral analysis, we see that at any given point after the extinction of the first glissando, there are systematically around 13 simultaneous glissandi. The listener is invited to travel inside this complex spectrum, focusing on different frequency ranges, skipping from one glissando to another, and discovering that it is impossible to detect their extinction.

### 3.3 Instrumental orchestration

In 1971 Tenney undertook an orchestration entitled *For 12 Strings (rising)* and scored for 2 double basses, 3 cellos, 3 violas and 4 violins. This piece represents not only an instrumental rendering of an electroacoustic source, but also an explicit orchestration of an evolving spectrum. According to Wannamaker, it is an early example of spectral music.

In this work each instrument executes an ostinato consisting of an upwards glissade, but the instrumental parts are carefully dovetailed in both pitch and dynamic to give the impression of a collection of overlapping tones smoothly rising more than five octaves from F1 to A6 and separated by intervals of a tempered minor sixth. The audible effect of the piece cannot be reliably assessed, since it has never been performed. [16]

*For Ann (rising)* also served later as a model in ‘Array (a’rising)’, the second movement of *Glissade* (1982) for viola, cello, double bass and tape. However, our main focus is on *Koan* (1971), a solo piece for violin in which Tenney carries out another very interesting instrumental variant of the Shepard-tone phenomenon.

<sup>2</sup>Spectral analysis of the recording shows that the glissando actually rises from around 25 Hz to 14 300 Hz over 37,8 seconds (and not 33,6): which is the equivalent of a 9-octave sweep.

## 4. KOAN (1971)

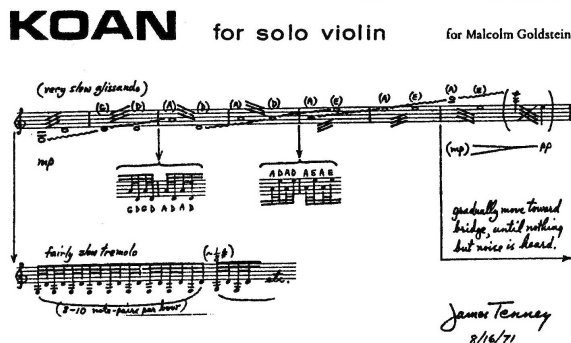
### 4.1 The postal pieces

Between 1965 and 1971, Tenney composed a series of ten *Postal Pieces* (also referred to as *Postcard pieces* or *Scorecards*) dedicated to his friends. Most of them were written in 1971, which is the year they were actually printed. The *Postal Pieces* share a phenomenological orientation with the use of simple gradual formal processes. They all involve a very high degree of predictability and the original idea determines systematically the micro and macro form [4]. The audience is invited to focus on the process and to enter into the sound in order to note unsuspected details and meditate on the overall forms<sup>3</sup>.

The *postal pieces* deal with fundamental ideas such as intonation, swell and meditative perceptual states. Tenney himself and others sometimes seem to refer to all of them as musical koans, although only one is thus called [6]. *Koan* for solo violin was written August 16<sup>th</sup> 1971 and dedicated to the violinist and composer Malcom Goldstein, one of the co-founders, in 1963, with Tenney and Corner, of the new-music group Tone Roads Chamber Ensemble.

### 4.2 Score analysis

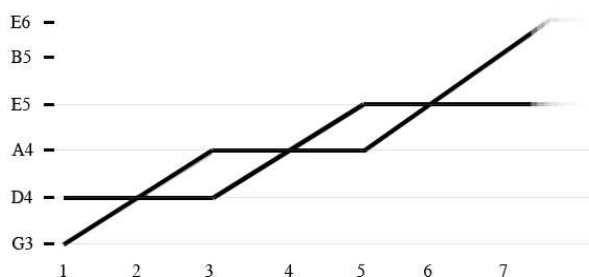
It is easy to memorize *Koan's* score (Figure 3) but the piece requires new efforts from the interpret, as well as the listener, who cannot relate it to any previous musical experiences.



**Figure 3.** James Tenney, *Koan* (1971) for violin. © Sonic Art Editions. Used by permission of Smith Publications, USA.

The primary material in *Koan* is a double-stop tremolo that rises very slowly. Only one note of the tremolo is perpetually rising thanks to a very slow glissando while the other is maintained. At the beginning (bar 1), the tremolo is a perfect fifth G3-D4 played on G and D open strings. The low note (on G string) then gradually shifts until it reaches D4 and consequently forms a unison tremolo (bar 2). Ascension carries on until a new perfect fifth A4-D4 that is once again played on G and D strings, and then on A and D strings (bar 3). The same process can be reiterated on this new couple of strings, passing

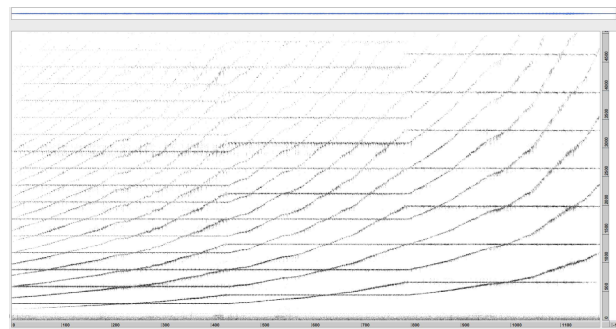
from A4 unison (bar 4) until it reaches again the perfect fifth A4-E5 (bar 5). After switching strings, in order to play it on A and E strings, the interpret repeats the same process one last time, leading to B5-E5 perfect fifth (bar 7). To give the illusion of a perpetually rising motion, Tenney pursues the ascension (until the octave E6-E5) but combines it with a general fade out and timbre transition: while decreasing intensity, interpret has to “gradually move toward bridge, until nothing but noise is heard”. The score can be summed up with the following simple chart (Figure 4).



**Figure 4.** Schematic representation of *Koan* (1971) for violin. Bar numbers are indicated at the bottom. The four horizontal light grey lines indicate pitches of the violin's open strings.

### 4.3 Auditory impression

As the composition process offers no mystery as to how it will unfold, the ear is directed towards the constituent sounds themselves. Behind its simplicity, *Koan* is the gateway to an oneiric sonorous world full of unnoted and ambiguous things that happen along the way such as beats, combination tones, stream segregation...



**Figure 5.** *Koan*, spectrogram [0 – 5 000 Hz] of Marc Sabat's recording [17]. This FFT analysis was done with Audiosculpt software (Hanning window type, 8192 samples).

Firstly, despite being in presence of a sequence of successive tones, continuous and smooth sounds sometimes emerge, acting as pedal points. There are reinforced spectral components shared by the two tones constituting the tremolo. For example, at the beginning (tremolo G3-D4), the pitch D5 forms a halo of sound: this continuous halo is the result of the regular succession of G3 third harmonic and D4 second harmonic. The harmonics intersect at different moments (Figure 5) and invariably produce either complex beats, which continuously change the inside of the sound.

<sup>3</sup>Such compositional preoccupations are shared by another singular composer: Giacinto Scelsi who is, by the way, also considered as a pioneer of spectral music.

Secondly, do the static and moving notes in the tremolo integrate into one or two streams? Bregman has underlined the impact of tempo and frequency differences in stream segregation [17]. In *Koan*, the “fairly slow” tempo is not well defined in terms of beats per minute but Tenney indicated that the violinist had to play 8 or 10 note-pairs per bow. Listening to Sabat’s recording, we can clearly hear the alternation of the two tones: at the beginning, there is according to me only one stream, but I gradually experience two streams of sound, following the slow and gradual shifting of the moving note. When the interval approaches the tone, I once again experience one stream: the tremolo becomes a trill.

Thirdly, is the tremolo constituted by the repetition of an ascendant or descendant interval? Each note-pair generates a clear pulsation. At different moments, pair-notes form ascendant or descendant intervals that lead to confusion with the invariably uprising global progression. In the first part (bar 1-2), the beat is on the rising note. Consequently, the interval is first ascendant (bar 1), then descendant (bar 2) since the moving note has risen above the static note. In the second part (bars 3-4), the beat is meant to be on the static note (A4). Consequently, the interval is first descendant (bar 3), then ascendant (bar 4). The process is similar in third and fourth parts.

Contrary to *For Ann (Rising)* and auditory illusions that Shepard and Risset generated via computer, there is, here, no strange loop but only a tremolo blended with a static note played on an open string and a slow rising note. The composer aims to suggest an endless uprising melodic progression using two interlacing voices. It tends to remind us of the double ostinato on the left hand in Ligeti’s *Passacaglia ungherese* (1978) for harpsichord. In both cases, infinity is just suggested by “slowing down” the melodic progression thanks to compositional tricks.

Finally, *Koan* is also challenging in terms of performance: because of the incessant repetition of a tremolo during an extended period, it is physically difficult to continue playing without tensing up. In zen practice, a Koan is used as a personal training device between the master and his students. In Tenney’s eponymous piece, this training dimension is present but, as Polansky wonders, who is the teacher and who is the student [6]?

## 5. CONCLUSION

James Tenney was not interested in musical emotion or dialectical forms but in acoustic phenomenology. Through his music, he sought to achieve a basic level of perception unencumbered by taste, judgment or emotive associations related to a more traditional aesthetic. An entire piece is often just driven by one foreseeable process that often reveals an isolated psychoacoustic phenomenon such as endless progression in pitch, an effect he explored for the first time in *For Ann (rising)* (1969).

Drawing his inspiration from Shepard and Risset’s computer-generated illusions, Tenney constructed a strange uprising progression by superposing one single glissando upon itself. The formal structure is not predefined but is the result of the compositional process. The composer began exploring endless progression in pitch as a phenomenon in an instrumental context in 1971, not

only in *For 12 strings (rising)* but also in *Koan* for solo violin, before declining it in later pieces such as *Glissade* (1982), *Two Koans and a Canon* (1982) and *Koan* (1984) for string quartet. Like koans in Zen-practice, endless progressions invite the listener into a state of meditation and self-questioning. How can a sound pattern rise (or fall) endlessly in pitch? Is it a normal or paradoxical effect? Which musical processes allow for the production of such auditory effects?

Endless progressions are not the only musical processes that might be considered as sonic koans. This idea became of importance in Tenney’s aesthetic at the end of 1960s. According to the composer himself, *For Ann (rising)* represents an authentic watershed: “Everything before that I think of as a kind of different world. Everything after that is where I still am now”, he confided to Donnacha Dennehy in 2006 [2]. Thus, this minimalist piece might never have existed had Tenney not worked in the field of computer music at Bell Labs in contact with Shepard and Risset. Their common interest in phenomena such as endless progression, as shown in *For Ann (rising)* and other instrumental pieces discussed above, is an engaging example of digital echos.

*For Ann (rising)*, *Postal pieces* and other works composed from the late 1960s, tend to explore a single process and the performer is required to enter into it “at a microscopic level and meticulously articulate its fine details” [3]. These pieces often appear as sonic meditations, bringing the listener to a direct confrontation with sound itself and making him aware of specificities of auditory perception.

Tenney likes to set a process in motion and let its aural manifestations be a kind of meditative fabric, as in the music of Pauline Oliveros, LaMonte Young and others. His processes/Questions are often rather complex in their formulation – usually outgrowths of the tireless investigation of deeper, perhaps “simpler” musical and perceptual problems. [6]

## Acknowledgments

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