

Fruits and Vegetables

By Alvin Lucier

In May of 1999 I happened to be in Prague for the first performance of *Diamonds*, a new work for three orchestras. Petr Kotik, who had commissioned the work for The Orchestra of the SEM Ensemble and the Janáček Philharmonic, had organized two orchestral concerts for the Prague Spring Festival. The first had the title Music in Space. Besides *Diamonds*, it included Earle Brown's *Modules I, II, III*; two Canzoni from the *Sacrae symphoniae* of Giovanni Gabrieli; and Stockhausen's *Gruppen*. While I was there I had lunch at the Maly [small] Buddha, a vegetarian restaurant near the Hradcany Castle, with pianist Joseph Kubera and singer Thomas Buckner. Joe was the solo pianist in *Gruppen* and Tom was soloist in Roscoe Mitchell's *Fallen Heroes*, a featured work on the second concert. The meal was memorable. Never had I tasted vegetarian food so fragrant and delicious. I highly recommend the Maly Buddha to all my friends. (Uvoz 46, Prague 1, Hradcany, Tel/Fax: 02-20513894.) Later that summer I started working on a commission from Tom Buckner for a new work for baritone voice. I immediately thought of writing a song cycle for voice and piano, a work that Tom and Joe could perform.

For several years I have been developing a method of composition in which voices and instruments sustain tones against pure-wave oscillators, creating audible beats that occur when two or more closely tuned sound waves coincide. I use electronically generated waves because their purity (no overtones) produces vivid beating against the richer, more complex instrumental sounds. I began experimenting with this phenomenon in the early '80s, when performers started asking me for works. I wanted to make music for conventional instruments with the same aesthetic that informed my earlier electronic pieces (which often explored brain waves, echoes, and room resonances). I have always been drawn to sound that does *work*, that causes something physical to happen.

There are two ways I go about this: 1) sustain one or more pure waves and ask the performer to microtune tones against them, causing beats at various speeds (the farther apart, the faster the beating; at unison no beating occurs); and 2) design oscillator-sweeps against which the players sustain fixed tones. Since the waves are in constant motion, the beating speeds continually change. In *Still and Moving Lines of Silence in Families of Hyperbolas* (1984), a series of eleven solos and a duet, players detune sustained pitches around one or more stationary waves. I didn't specify exact tunings—that would have been impossible for the players to execute;

instead I asked them to make equal steps in one direction or another against the pure waves. As long as the pitches move in the required direction without inadvertent backtracking, I am satisfied. Included were four solos for mallet instruments. Since their pitches are fixed, the player repeats the same tone, varying the tempi of the repetitions, causing overlap, truncations, and elongations of the fixed beating caused by the differences in pitch between the mallet instruments and the oscillators. In *Septet for Three Winds and Four Strings* (1985), however, the players tune precisely above and below a sustained oscillator tone, in terms of cents, with the help of electronic tuners. In *In Memoriam Jon Higgins* (1985) a clarinetist holds minute-long fixed tones straddled across a continually rising wave that sweeps up the entire clarinet range. In the more recent *Wind Shadows* (1994), a trombonist tunes one, two, and three cycles above and below two closely tuned sine waves that beat once every ten seconds.

Under certain circumstances, slowly beating pure waves may seem to spin across the room, moving from the higher source to the lower. This is vivid in *In Memoriam Jon Higgins*, when near-unisons are reached between the sustaining clarinet tones and the slowly ascending pure waves. Most of the time it is very difficult to perceive, especially when more than one or two instruments are sounding and the beating is rapid. In a controlled environment, however, the effect is vivid. In the sound installation *Seesaw* (1983), a pure-wave oscillator slowly sweeps around a fixed tone, causing beats to slow down and speed up. As it does so, the movement changes direction from one loudspeaker to the other as the sliding wave moves above and below the fixed one. In an installation at the Whitney Museum in New York, I treated the walls with Sonex, an acoustic-absorptive material, which virtually eliminated reflections. The spinning effect was extremely vivid.

Against sweeping waves, one has three options as to tone placement: 1) starting a tone simultaneously with the oscillator tone against which it is to beat, in which case the beating starts at zero and speeds up as the wave moves away from it; 2) anticipating the tone's arrival and then stopping at the unison, so that the beating will start fast and slow down to zero; or 3) straddling the tone, so that the beating starts fast, slows down to zero at unison, then speeds up again as it passes to the "other side" of the fixed tone. In each case the speed of the beating depends on the frequencies of the pitches and how far apart they are at any given moment. At each higher octave the frequencies double, as do the beating speeds. For solo works, I often simply notate the performers' pitches simultaneously with the pure-wave tones, allowing the performer the leeway to anticipate or delay her pitches. In *Music for Piano with Slow Sweep, Pure Wave Oscillators*

(1992) I notate two pitches per pure-wave semitone because the pure-tone sweeps are so slow—18 and 22 seconds between semitones—and the decay time of the piano is so short (see fig. 1).

In *Crossings* (1982), for small orchestra, the instruments invariably straddle a slowly ascending wave. The players watch a television monitor upon which are displayed the frequencies of the wave as it rises from the lowest double bass note to the highest reaches of the piccolo range. In *Six Geometries* (1992), for small chorus, these gestures are used to produce a more varied four-voice counterpoint (see fig. 2).

I have discovered that three intervals produce vivid beating patterns: the near-unison (most vivid), and, because of the strong second and third partials, the near-octave (less vivid), and the near-perfect twelfth below (least vivid). Having three pitch choices, one can lead voices in contrary motion, defeating the inexorable chromatic motion demanded by ascending and descending sweeps. For example, starting with two waves moving away from unison in opposite directions, one can simply track the sweeps' pitches stepwise from semitone to semitone, stepping and skipping up or down from the lower to the upper sweep, or through octave displacement produce Webernesque melodic lines consisting of leaps of sevenths and ninths. Furthermore, when two waves reach an octave or a perfect fifth, a single instrumental tone—the near-unison with the lower tone of an octave and the near-twelfth below the fifth of the perfect fifth—will create double beating. I look for this opportunity to use single tones as a way to relieve the constancy of two-part writing (see fig. 1).

For works using fixed oscillator pitches, I record them at home with digital oscillators onto DAT tape or compact disc. For those that require sweeps, I describe the precise motions of the waves—in cycles per second and in seconds in time—then send the information to sound engineer Bob Bielecki, who has made a computer program that executes the shapes on DAT tape. I send dubs on compact disc to my publisher, Material Press in Kiel, along with the written score.

For this new work I decided to use sweeping oscillators because of the fixed pitches of the piano and to ensure that the beating would be as vivid as possible. In an earlier work for Buckner, *Music for Baritone with Slow Sweep, Pure Wave Oscillators* (1993), I freely “drew” rising and falling shapes against which Tom would sustain wordless long tones. I used two lines only; Tom would move from one to another. In *Still Lives* (1995), a suite of eight piano pieces I wrote for Kubera, I simply drew objects I saw around my house, including a lampshade, a bread knife, and a hammock in the backyard. I sketched those items and freely outlined them on staff paper. I didn't try to draw them to scale. The shapes and their musical manifestations are more impressionistic than accurate. I drew a few shapes,

Figure 1: *Music for Piano with Slow Sweep, Pure Wave Oscillators*, excerpt.

The musical score consists of three systems of staves. The first system includes two oscillator staves, labeled 'Osc.1' and 'Osc.2', and a piano staff. The piano staff is marked with a piano dynamic (*p*). The second system continues the piano part. The third system includes the piano staff and the instruction 'pedal down throughout ...' centered below the staff. The piano part features a slow sweep of notes across the system, with some notes marked with accidentals (sharps and flats). The oscillator parts consist of single notes that sweep across the staves.

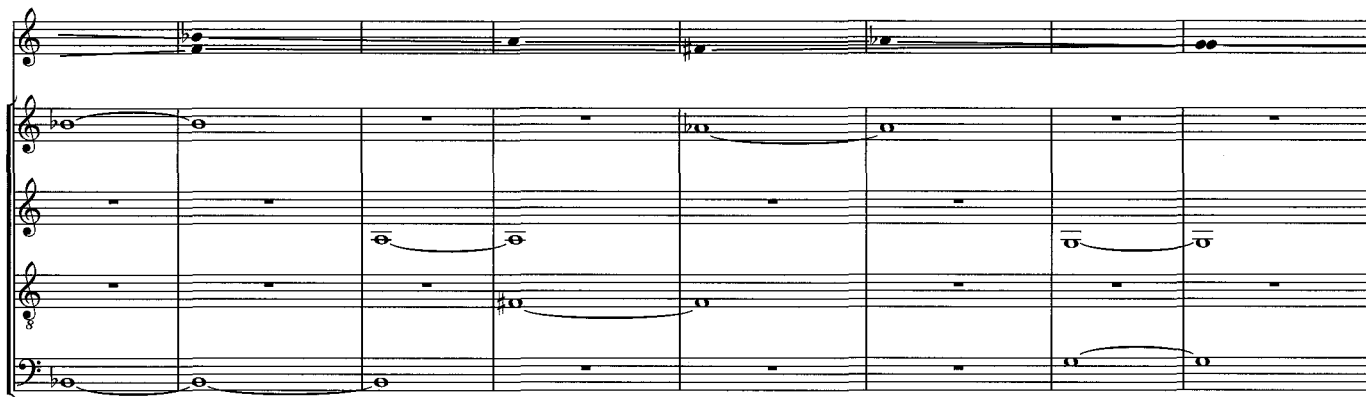
Figure 2: *Small Fish Logo*, from *Six Geometries*.

The musical score is presented in two systems. The first system includes a tempo marking of $\text{♩} = 60$ and a 4/4 time signature. The instruments are labeled on the left as Osc. 1,2, Soprano, Alto, Tenor, and Bass. The Osc. 1,2 part begins with a tremolo of two notes. The vocal parts (Soprano, Alto, Tenor, Bass) enter with sustained notes, some featuring long horizontal lines above the staff to indicate breath marks. The second system continues the vocal lines and includes a new instrumental line at the top, which appears to be a continuation of the Osc. 1,2 part. The notation uses various note values, including quarter and eighth notes, and rests.

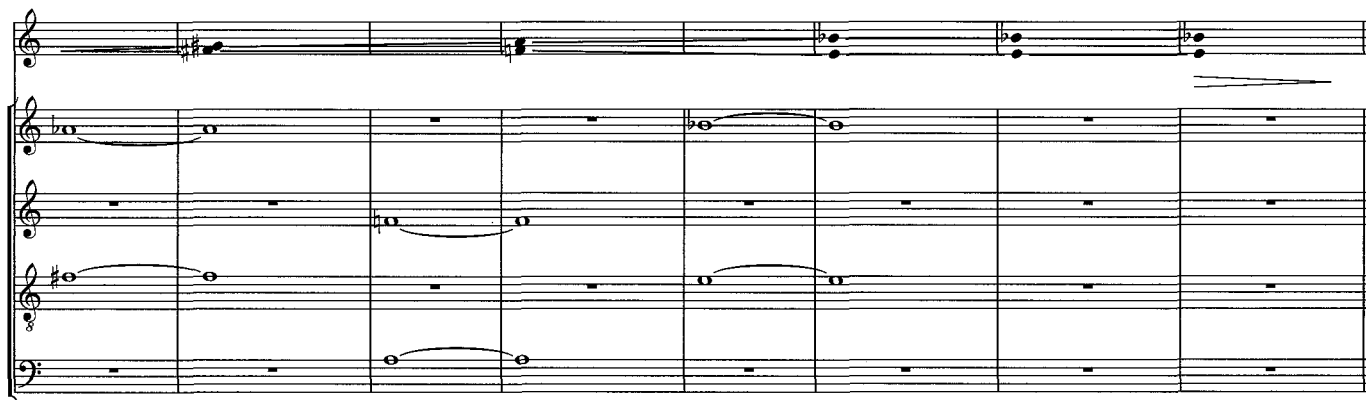
Figure 2 (cont.)

The image displays two systems of musical notation, each consisting of five staves. The top system includes a vocal line and four piano accompaniment staves. The vocal line features a melodic phrase with a trill-like figure. The piano accompaniment consists of a right-hand part with sustained notes and a left-hand part with a bass line. The bottom system follows a similar structure, with a vocal line and four piano accompaniment staves. The notation includes various musical symbols such as notes, rests, and slurs, indicating a complex musical piece.

Figure 2 (cont.)



The first system of the musical score consists of five staves. The top staff is a single treble clef staff with a key signature of one flat (B-flat) and a common time signature. It contains a sequence of notes: a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, then a quarter note chord of B-flat and F, and finally a half note chord of B-flat and F. The second staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The third staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The fourth staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The fifth staff is a bass clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F.



The second system of the musical score consists of five staves. The top staff is a single treble clef staff with a key signature of one flat (B-flat) and a common time signature. It contains a sequence of notes: a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, then a quarter note chord of B-flat and F, and finally a half note chord of B-flat and F. The second staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The third staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The fourth staff is a treble clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F. The fifth staff is a bass clef staff with a key signature of one flat, containing a whole note chord of B-flat and F, followed by a half note chord of B-flat and F, and then a whole note chord of B-flat and F.

including a fern growing outside a window in my living room, with three oscillators. This enabled me to generate three- and four-note chords.

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As a remembrance of that exquisite meal we had in Prague, and as a gesture to the passionate vegetarianism of Tom and Joe, I decided to use as my shapes a collection of fruits and vegetables. In the early sixties in Venice, while on a Fulbright Scholarship to Italy, I had encountered the works of Renaissance painter Carlo Crivelli (b. Milan 1527) and had been entranced by the beauty and richness of the fruits and vegetables that often framed his paintings. I was reminded, too, of Italian painter Giuseppe Arcimboldo's *Vegetable Garden* (c. 1590), in which a bowl of vegetables, when viewed upside down, becomes a face with a hat. I am aware of the ridicule I may encounter for using *Fruits and Vegetables* as a title, but I have decided to use it nonetheless.

First, I traced each vegetable and measured it lengthwise and vertically, getting a rough idea of its size. For each inch along its length I apportioned four measures of $4/4$ time. For example, the red pepper, lying on its side, measured five inches, producing a 20-measure piece. At a tempo of a quarter note equals 52", I got a 1'36" song. I generally (though not always) used the height of each vegetable as a rough guide to the range of the sweeps. The pepper was about three inches at its widest; I started with a three-octave spread. It had a bulge along its length, so I drew two horizontal ridges, outlining that bulge, at not quite equidistant intervals: two minor sixths, a fifth apart. Thus there are four oscillator tones: two for the outline of the shape—F 87.3 cycles per second on the bottom and F 349 cps on top—and two for the ridges: D 146.8 cps and A 220. The outside tones sweep inward at slightly different speeds, the inner ones at about half those speeds, for over a minute, then abruptly curve into a perfect fourth at the end of the piece. In general, if an object showed no horizontal lines or striations, I simply drew an outline of the shape. If it had lines, I used that number of oscillator tones. For example, the celery stalk had twelve horizontal lines along its length; correspondingly, I used twelve oscillators.

For each song I made a chart of the oscillator sweeps in terms of frequency and timing. Below is the chart for the first song, *Red Pepper*. Letters in parentheses indicate the stereo placement of the oscillators: Right, Right Center, Left Center, and Left. Fade-ins of four beats are included within the sweeping waves (4.6"); fade-outs are longer, eight beats (9.2"), to allow time for the piano tone(s) to decay (see fig. 3). No dynamics are given; rather, they are chosen by the performers to produce the most effective beating.

Red Pepper

Osc. 1 (R) F 349 cps: 65.8" (including 4.6" fade-in) down to D 293.7; 9.2" down to C 261.6; 10.4" down to A 220; 9.2" fade-out to 0. Total time: 94.6"

Osc. 2 (RC) A 220 cps: 65.8" (including 4.6" fade-in) down to G 196; 9.2" down to F 184.9; 6.9" down to D# 155.5; 3.5" up to E 164.8; 9.2" fade-out to 0. Total time: 94.6"

Osc. 3 (LC) D 146.8 cps: 65.8" (including 4.6" fade-in) up to E 164.8; 13.8" up to G# 207.6; 4.6" up to B \flat 233; 2.3" down to A 220; 9.2" fade-out. Total time: 95.7"

Osc. 4 (L) F 87.3 cps: 65.8" (including 4.6" fade-in) up to A 110; 13.8" up to C# 138.6; 4.6" up to D# 155.5; 2.3" up to E 164.8; 9.2" fade-out to 0. Total time: 95.7"

See fig. 3 for the notated version of *Red Pepper*. Diagonal lines indicate sweeps. Black note heads indicate chromatic pitches.

There are thirteen songs in all. In several of them, I felt that the shapes were too simple or redundant in relationship to the others, so, for example, I drew *Two Lemons* and *Three Figs*, and for the *Granny Smith Apple* cut it in two and laid the two halves end to end. Within each half was embedded the heart of the apple, which produced a form within a form (see fig. 4).

Another way of lessening the chromaticism generated by the oscillator sweeps, in addition to writing near-octaves and -twelfths, is to sustain pitches through two or three sliding oscillator semitones. If a pitch holds through a series of two, a whole-tone scale is suggested; or if, as in *Two Lemons*, the voice and piano parts hold through three adjacent tones, melodies in minor thirds are generated (see fig. 5).

At certain places in the piece, I had to accept consonances or chords that seemed out of place, that seemed to come from music of another time period. The first-inversion D-minor chord at the very beginning of *Red Pepper*, and a series of ascending and descending diminished sevenths in *Celery* are two examples. For the latter I divided the twelve parallel lines extending the length of the stalk into two six-note chords, running them in contrary motion against each other. The singer and pianist simply outline the notes of the chords. In both cases, the familiar sound images are heard against continually detuning waves, providing a microtonal background. I had originally hoped that this polytuning would provide a context for these and other more familiar sound images, creating an excuse or rationale for their use. I now realize that this doesn't happen and that context is a cop-out. So I simply accept them for what they are: lovely sounds with associations.

Figure 3: *Red Pepper*, from *Fruits and Vegetables*.

The musical score for "Red Pepper" from "Fruits and Vegetables" is presented in a multi-staff format. The score includes parts for Oscs. 1,2; Oscs. 3,4; Baritone; and Piano. The tempo is marked as ♩ = 52. The score is divided into two systems. The first system covers measures 1 through 10, and the second system covers measures 11 through 20. The Baritone part features a melodic line with a circled 5 above the fifth measure and a circled 10 above the tenth measure. The Piano part includes a complex accompaniment with a circled 15 above the fifteenth measure and a circled 20 above the twentieth measure. The score is written in a key signature of one flat and a 4/4 time signature.

Figure 4: *Granny Smith Apple*, from *Fruits and Vegetables*.

The musical score is arranged in a system with five staves. The top four staves are labeled Osc. 1, Osc. 2, Osc. 3, and Osc. 4. Each oscillator staff begins with a tempo marking of $\text{♩} = 56$. Osc. 1 features a melodic line with a circled '5' above the fifth measure and a circled '10' above the tenth measure. Osc. 2, 3, and 4 provide harmonic accompaniment. The fifth staff is labeled Baritone and also starts with $\text{♩} = 56$, containing a single melodic line. The bottom two staves are grouped under a brace labeled Piano, with a tempo marking of $\text{♩} = 56$, and contain a piano accompaniment with chords and bass lines.

Figure 4 (cont.)

Figure 4 (cont.) is a musical score consisting of five systems of staves. The first system contains four staves, each with a circled measure number: 15, 20, and 25. The second system contains one staff with a circled measure number 20. The third system contains two staves, each with a circled measure number 20. The score is written in a key signature of one sharp (F#) and a common time signature (C). The notation includes various rhythmic values, accidentals, and dynamic markings.

Figure 5: *Two Lemons*, from *Fruits and Vegetables*.

The musical score is divided into three systems, each with a tempo marking of $\text{♩} = 63$.
The first system consists of four staves labeled Osc.1, Osc.2, Osc.3, and Osc.4. Osc.1 and Osc.2 play a melodic line with a circled '5' above the fifth measure and a circled '10' above the tenth measure. Osc.3 and Osc.4 play a lower melodic line.
The second system is a single staff labeled Baritone, playing a sparse, rhythmic accompaniment.
The third system is a single staff labeled Piano, playing a sparse, rhythmic accompaniment.

Figure 5 (cont.)

Figure 5 (cont.) displays a musical score consisting of six staves. The first four staves are grouped together, with measure numbers 15 and 20 indicated above the top staff. The fifth and sixth staves are positioned below the first group. The notation includes various note values, accidentals, and rests across the staves.

The first staff (top) contains measures 15 and 20, marked with circled numbers. It features a series of notes with accidentals (flats and sharps) and rests. The second staff continues the melodic line with similar note values and accidentals. The third staff shows a more complex rhythmic pattern with eighth and sixteenth notes. The fourth staff provides a harmonic accompaniment with chords and single notes. The fifth staff (bottom) contains a single note with a fermata in each measure. The sixth staff (bottom) contains a series of chords and single notes.

I have made a few works using limited feedback in place of pure waves. In *Music for Gamelan Instruments, Microphones, Amplifiers and Loudspeakers* (1994), microphones are inserted into bowl-shaped *bonangs*, producing sustained tones determined by the size and shape of the bonang and the acoustics of the room. Three *gender* players repeat a series of tones nearly in tune with the bonangs. In *Small Waves* (1997), six glass vessels, some partially filled with water, produce pure tones against which a string quartet, piano, and trombone play long tones. From time to time, water is poured from one vessel to another, raising and lowering the pitches. And in a sound installation titled *Empty Vessels* (1998), microphones are inserted into the mouths of eight vases and melon jars, creating strands of soft feedback that flow out into the room. The movement of visitors disturbs the feedback strands, causing bumps of sound and slight changes in pitch. Occasionally a vase will stop sounding completely. In *Music for Gamelan* the pitches of the resonating bonangs are indeterminate; the *gender* players search for them as part of the process of the performance. In *Small Waves* the pitches of the feedback strands are determined by the size of each vessel as well as the microphones inside. In *Empty Vessels* the chord produced by the eight sounding vessels was chosen by ear and remains the same from installation to installation.

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I have made several works for instruments without oscillators, in which stringed instruments do the sweeping. In *Navigations for Strings* (1992), for string quartet, I direct the players to strive for impossibly minute micro-tunings, with the understanding that they are impossible to hear and execute. I wanted the quartet to have a guide in compressing a minor-third interval to unison over a fifteen-minute performance. In *Serenade for Oboe and Strings* (1993), as the four strings sweep from a major 2nd out to a major 3rd and back, an oboist plays all 55 of the permutations of the five tones within a major third, creating beating of various speeds as it catches the strings' tones at different points along rising and falling sweeps. In these two works the beating is vivid enough for discriminating listeners. In *Fideliotrio* (1993), for viola, cello, and piano, the strings sweep in opposite directions away from, and back to, a repeated A-220 cps in the piano. The first minute or so sounds like an out-of-tune piano, with the viola and cello acting as fourth and fifth strings in addition to the three piano strings. The results are not as vivid as the two previously mentioned works, but retain a musical presence nonetheless.

In *Diamonds* the string sections of three orchestras draw differing diamond shapes, each one at a slightly different speed from the others, caus-

ing the shapes to phase out from each other. I had hoped that the sustained wind, brass, and percussion (slow-rolling glockenspiels) would beat not only against the sweeps within their own orchestral group, but with the other two as well. In the Spanish Hall of the Hradcany Castle this wasn't noticeable; the orchestras were positioned far too far apart for true physical interaction to take place. I was also disappointed that beating in the upper ranges of the orchestra wasn't as vivid as in the lower; in fact, sometimes you couldn't hear beating at all, although the work did succeed on a musical level. A few months later, however, a curious thing happened. I was playing a CD of the performance in my spouse's Subaru. The loudspeakers were positioned on the lower part of the front and back doors. Much to my surprise, I heard remarkable beating in the higher registers! A plausible reason is that the smaller loudspeakers don't project the low frequencies with as much energy as live performance or a bigger sound system, thereby allowing the highs to be more present. The small car space, too, might act as a high-pass filter.