sic and the instrument.

The Stick's range covers both bass *and* melody. Emmett Chapman takes full advantage of its range and tuning with a two-hand-ed independence and interdependence.

Mr. Carlberg's dismissal of this landmark recording as "interesting" and "somewhere between jazz and bluegrass" demonstrates the fact that he didn't listen to the record. *(I can assure you that unlike many reviewers, Robert does, in fact, listen to records all the way through —Ed.)* The only song with even the slightest reference to bluegrass is the first one, "Back Yard." If he had listened further, Mr. Carlberg would have discovered a world of sounds and styles that is rare in these days of carbon copy musics. The songs on *Parallel Galaxy* range from a heavy and extremely emotional Stick/drums performance of "My Favorite Things" to a beautiful solo of John McLaughlin's "A Lotus on Irish Streams." Mr. Chapman's technique on "his own" Stick is *unmatched* and the performances on *Parallel Galaxy* are mind-boggling—often sounding like two or three musicians playing at once.

Emmett Chapman's *Parallel Galaxy* is a beautiful album, full of innovative sounds and techniques, and rather than being "heavily guided by the capabilities of The Stick itself" Mr. Chapman pushes his instrument into areas here no one else has yet to venture.

Barry F. Chabala
New Jersey

Barry—I think, as do you, that Emmett's playing is truly exceptional. I also think David Torn is a great guitarist, and Robert and I butted heads over that one too. But people hear what they hear; as someone who has listened to Parallel Galaxy *a lot, I don't think his comment about "somewhere between jazz and bluegrass" is off the wall. Emmett's music defines a very broad sweep, and the space between bluegrass and jazz is very large indeed. The intricate picking does recall a lot of bluegrass technique, and the improvisation recalls jazz. Let's just agree that for whatever reason, different people perceive different music differently. I'm glad you have written in to express your opinion.*

Having said that, I'd like to add that I have yet to hear a recording that truly captures the magic Emmett generates live, and I feel that those who have seen him live will derive the most enjoyment from his albums. If any readers get a chance to see Emmett in person, go for it—his act is all the more amazing by virtue of him relying solely on his musicianship and consummate technique to attract, hold, and ultimately mesmerize an audience's attention.

Poor Man's Split Defended

(In the Nov. '87 issue, we published a letter from an irate reader who blasted a program submitted by Les Penner, and said that the software EM *publishes is "worthless." The reader didn't sign his or her name, which was probably a good idea considering that the reader hadn't applied the program properly, as explained by Les in his thoughtful response. Here is one reader's opinion on the letter from the "mystery upset reader.")*

I hope this will be only one of many letters you get in support of Les Penner's "Poor Man's Split" program published in the Aug. issue. I found the program extremely useful since it provided all the necessary subroutines to access the MPU-401. It saved me quite a few painful hours trying to translate the C examples from the Voyetra 4001 manual into Turbo Basic. I can understand the mystery reader's frustration with a program that does not work. (I used a separate controller and sound generator so I did not have the echo problem described.) However, I *strongly* disagree with the notion that the program was useless. It is unrealistic to expect that a fully functional application would be presented in such a context. The author clearly stated the limitations of the program, and stressed the applicability of the subroutines for use in other programs. This is exactly what I needed, and I hope similar articles on the IBM PC/MPU-401 combination will be included in future issues. Please pass on my positive comments to Mr. Penner, and thanks for printing the only music magazine that I never throw away.

David Trubitt
Sylvan Systems
California

Thanks, Wendy

After the enthusiastic article Walter Daniel authored, "Alternate Scales on the Commodore 64: A Tuning Demonstration Program" (Oct. '87), a fine, imaginative idea, and the many flattering comments he makes about my tuning ideas, I am really embarrassed to have to write this letter. But just because "facts is facts," and for those readers who may attempt to hear the two fortuitous accidents of scale building I discovered, Alpha and Beta, it should be pointed out that the tuning tables listed in the article are in error.

Due to the colloquial nature of my interview with Freff (Nov. '86 EM), the 78.0 cent scale of Alpha may have looked like the number was a rounded-off value to the nearest cent. What was really rounded-off was the term "minor third" (as the interval being split). This is a *nominal* minor third I was using, and did not mean to equate it to an exact 6/5 minor third, as is interpreted for me in the article. I said 78.0 cents (in my mind) and it was written 78, no decimal, and that happens to be the correct value to use for Alpha, i.e., a division of the octave into 15.385 equal steps. Beta is 63.8 cents/step, or 18.809 equal steps per octave (oh, alright, Gamma happens to be 35.1 cents/step = 34.188 steps/octave). The value of 78.91 used in the article does split the perfect 6/5 just minor third into four equal parts, but only by ruining the major third and

perfect fifth. Alpha is *not just intonation*, only a surprisingly close approximation, with the added bonus of equal-sized steps. Unknown to me at the time is the close match to the 8/7 so-called "super second," which means that Alpha is in fact preferable to Beta for excellent versions of the dominant harmony (in third inversion) of 4:5:6:7, using the wonderful harmonies of 7/4.

Although an approximation, the 78.0 cent scale has very small errors, and thus leads to the very slow beats of "mistuning" by a max. of 2 to 4 cents, which, as Daniel aptly notices, "gives . . . a chorusing sound I rather like." Yup—perfection down to the 10th decimal is unnecessary, and systems like those now coming on-line with an accuracy of only about 1½ cents are musically fine. Our ears rather like the small rounding-off that this may result in, and mathematically it's certainly convenient to remain within this approximately 16-bit arithmetic.

So, the correct table for Alpha ought to be:

Note	Cents
0	0.0
1	78.0
2	156.0
3	234.0
4	312.0
5	390.0
6	468.0
7	546.0
8	624.0
9	702.0
10	780.0
11	858.0
12	936.0
13	1014.0
14	1092.0
15	1170.0
16	1248.0

Note that this table uses the standard convention of counting the steps above the reference note (= 0), and is *one less* than the table on page 41 of Daniel's article. I also have not included the ratios here, but if anyone wants them, they are easily gotten from:

R = exp(**C***ln(2)/1200)

where **C** is the cent value, and **R** is the equivalent ratio.

In the above table the value for the perfect fifth lies nine steps above the tonic note, and is nearly perfect (0.045 cents sharp!). The major third is at five steps up, and is a respectable 3.68 cents too large. The minor third is at four steps, and is a symmetrical 3.64 cents too small. The inverted 7/4 seventh lies at three steps down, and this is only 2.34 cents small. If you play a dominant seventh on note 5, say, that will require the four notes:

2 + 5 + 10 + 14

with an amazingly agreeable result, as you ought verify for yourself. With the slightest interesting timbres having tiny vibratos and subtle ditherings as most digital gear includes anyway, the chord is rich and just-sounding, the small beatings being slow and "chorusy," if audible at all in such rich harmonies. All this in a scale with only 3.385 steps more per octave than good ol' "12 times the square root of 2" equal temperament! (You do have to work out external ways to get the 2/1's of octaves, however—no free lunches here.)

Given equipment that can quickly retune from moment to moment, you ought also explore the *Harmonic Scale*. Here is the full table of that:

HARMONIC SCALE ON C TABLE

Note	Ratio	Cents
Cnat	1/1	0.000
Db	17/16	104.955
Dnat	9/8	203.910
D#Eb	19/16	297.513
Enat	5/4	386.314
Fnat	21/16	470.781
F#	11/8	551.318
Gnat	3/2	701.955
Ab	13/8	840.528
Anat	27/16	905.865
Bb	7/4	968.826
Bnat	15/8	1088.269

This is an awfully good scale for those of you who, like me, find the "classic" form of just intonation rather a bit bland, and want both the purity and lack of rough intervals (*surds*, they're called) of just, but with more exotic harmonies and wonderous new chords, some very thick and "tall." Another variation combines both the *Harmonic Scale* and the *Classical Just*, in a truly *"Super Just"* set of 12 pitches (use 6/5 = 315.641 cents on note D#/Eb, 4/3 = 498.045 on note F, and 5/3 = 884.349 on note A; *the rest stet*).

This is a rather difficult topic to get into in so little space. But fortunately, there really aren't an infinite number of variations which are also:

1. Audibly quite different from one another
2. Great sounding, or nicely exotic
3. Fit practical bounds of hand, instrument and brain
4. Whatever else I've forgotten . . .

It's all rather like an analogy in the timbre world to finding great sounds on any powerful synth: these are usually little islands floating in a large sea of (infinite?—hah!) "possibilities," most of which are musically useless, even if impressive on a manufacturer's literature sheets!

Since I try to make my living as a composer, not a teacher or musical theoretician, I am not the person to be writing about this, anyway. Like all of you, I'm just out here "trucking along" and have no real care about the path it may take me along, just as long as my curiosities are satisfied, and the *evidence-of-passage* (read: compositions) are of sufficiently high quality (read: the best I could do at the time). For me the rest is vanity. And you know what? I suspect that that's also how it was for Bach, for Mozart, for Stravinsky, for them all. . . . Music ultimately isn't a lot of facts and rules, these come later. Initially it's the music, *just the music*. It stands and falls not on the scales and tuning used, nor the timbres contrived and orchestration these may permit. Rather it stands on the mini & masterpieces that may result and make use of these tools, but go beyond them to the human ear and heart. If it moves the hearer, that justifies the means, however difficult, time-consuming, clever, or even facile these may be. (Omigod—a speech! Cue the organ music. . . .)

All this said, there *is* a fairly long article of some of my own personal observations about the tuning and timbre arena in the *Computer Music Journal* that came out late this past spring: Volume 11, No. 1, pages 29 through 43. Despite some ridiculous reductions of the original art work (bring a loupe) there may be a few useful thoughts buried therein, if you're interested. Meanwhile, hey, this "brief letter" with the tables has cost me five hours worth of composing time, so I must take my leave and get on with it! For the intent, ideas, and good stimulus, Walter Daniel, thanks for your article. And I'm certainly sorry to have to pick these nits over a welcomed, useful piece.

By the way, if you can get one to try, the Kurzweil 150 with Ralph Muha's latest software revision 1.6 has a lot of my tuning tables in it already, and a real convenient retuning algorithm to make them practical (lowest 12 MIDI notes, fairly useless things in themselves, retune the 150's table for that key). You can store the changes in a sequencer, even add them *after the playing is done*, and get auto retuning within the 144 resulting notes! Plus Hal Chamberlin's new *Sound Modeling Program* lets you build complex additive voices. Not perfection, for sure, but a fine tool for these jobs. And there's always the *MuLogix Slave 32*, a very modest investment, if you can find one. Happy woodshedding!

Wendy Carlos
New York

Additions and Corrections

The program "Groovestore" (Feb. '87 **EM**) has worked perfectly for some readers but not for others. Thomas Beutel, the program's author, tracked down the problem and writes:

"Please make the following corrections to lines 4010 and 4020:

```
4010 dim buf(265): bufadr# = varptr(buf(0)):
     midbuf# = 3518
4020 poke midbuf#, bufadr#: poke 3522,530
```

"As stated in the article, these lines modify