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## The Gradient 1.3 Revisited

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The following article is being reprinted because of the ongoing interest of the ideas that the speaker embodies. The speaker itself is no longer available, but the later Gradient models, the Revolution and the Evidence , embody related ideas about controlling radiation pattern. ( My review of the latest version of the Revolution will be appearing in The Absolute Sound Issue 154 , June 2005.

My continuing experience with the Gradient 1.3s --I bought my review pair and still have it--has been one of my formative experiences in audio. Through these speakers, I learned a lot about the audible effects of early room reflections and of their absence. The 1.3s can , like almost all speakers, benefit from a little analogue or DSP correction of their intrinsic frequency response. But they need surprisingly little help with eliminating room effects.

If you make them anechoically flat, they sound neutral in-room too, with only a little touch-up of the bass needed as it always is. And even the bass is freer than usual of broad-band deviations. You can see the good behavior in the graph shown later. If you EQ out the boom at 50 Hz and pull down the 300 Hz region a little, something very like true neutrality emerges.

### **The basic ideas of the 1.3s are these:**

First, the speaker is designed geometrically to minimize the delayed floor-bounce effect. The bass is fired at the floor , so direct sound and floor bounce are combined. The midrange is produced by a directional dipole driver that points somewhat upward, so not much hits the floor. And the treble is produced by a line array that produces a horizontal beam. So ,altogether ,little comes off the floor.

The second idea is that the speaker has high directivity as well as quite uniform directivity. (Recall that directivity at a frequency is by definition the difference in dB between the total radiated power at the given frequency and the radiated power that would be produced by an omni directional

source with the same direct-arrival SPL at the frequency: Directional speakers have high directivity while an omni-radiator has 0dB directivity by definition. A speaker with constant directivity produces flat power response if its anechoic on-axis response is flat.

High directivity speakers put less sound into the room compared to the direct sound. Uniform directivity speakers have uncolored room sound. The Gradient 1.3 does both things. Read on for what this does for you.

-REG

May 2005



# The Gradient 1.3 Speakers

## An Exploration at the Frontiers of Acoustics

We all agree that the goal of the audio chain, from recording microphone all the way to your ears in your home listening room, is the reproduction of the original musical experience. Between the microphones and your speakers, the goal is precisely specified: a voltage should appear at your speaker terminals that is an exactly amplified copy of the voltages of the two channels of microphone output (or mixings, as the case may be). This may be hard in practice, but it is clear and precise in principle. But at the two ends, no such precise paradigms of perfection persist.

For all the attractiveness in theory of the Blumlein method, it is not so easy to implement in practice. For one thing, microphones do not "edit" the

literal sound the way the ear-brain does. And the theory of spaced microphone techniques---well, the theory shows it's a wonder they work at all, much less work as marvelously as they can work.

At the speaker end, things are even more confused--sound bouncing every which way around the room is supposed somehow to recreate the original, absolute sound? What are we supposed to expect out of this mish-mash, this process sans predictability, sans repeatability, sans consistency, apparently sans everything?

Let's think first about something simpler, though not so simple as it appears: getting the perceived tonal balance right; or at least predictable, from a single, mono source in an actual home listening room. In an anechoic chamber, or outdoors up in the air, all you need is flat on-axis response, and you yourself on axis. But in a room, aye, there's the rub. There are two ways to try, ways which can in fact be combined: (a) Try to make both the on-axis and the total power responses flat, so that the room sound has roughly the same correct balance as the direct sound and (b) try to make the speaker highly directional so that there is relatively little room sound to worry about.

Surely, you might say, this problem is so basic that all speaker designers get it solved immediately, before they go on to worry about High End exotica like soundstage shape, etc. Surely such a primitive, basic issue cannot fail to be treated and disposed of almost *ab initio*. But no. Virtually no speaker on the market delivers a flat response at the listening position.

For a start, the vast majority of speakers have a rather severe suckout in the midbass or lower midrange (usually around 250 Hz) from the floor cancelation: The direct sound and the reflection from the floor are  $180^\circ$  out-of-phase at some frequencies and cancel, in good part---though not entirely, because the floor reflection is typically a bit weaker than the direct sound. This cancelation occurs at many frequencies but the lowest frequency at which it happens usually has the biggest suckout because the floor is an almost perfect reflector at low frequencies, even if it is carpeted. High frequencies may be soaked up by the carpet, but carpet won't do anything to the (approximately) 4-foot waves of 250 Hz. Even ignoring the wall reflections for the moment, you can take it for granted that floor reflections are playing merry hell with the integrity and in particular the frequency response of what you hear.

Ah, but you say, almost everything we hear has a floor reflection; we're used to it. True, but the real, original floor reflections are already recorded. Moreover, the floor reflections from a cello, say, on stage for you listening in the audience are entirely different from the floor reflections from your speakers eight feet away in your listening room. Speakers with strong floor reflections will always be offering aural clues that you are hearing speakers, not hearing the original music. Those floor reflections are always going to be saying to your brain, subconsciously or consciously, "Speaker, speaker," or "Source eight feet away." The original recorded acoustics--hardly.<sup>1</sup>

What about the wall reflections? Those are bad, too, but if you have a largish room you can delay them--speakers far from walls, yourself close to speakers. And the precedence effect will minimize the damage they do. And then you can point the speakers at the listening position, or, better yet, cross their axes a bit in front of the listening position, minimizing what hits the walls (for speakers that are somewhat directional, anyway). But floor reflections remain fast and deadly.

How bad is the combined effect of all these reflections? There is some good, if somewhat anecdotal, evidence that the reflection problem is the main failing of speakers as they are used in rooms. Jim Thiel, a man much given to modesty, once said to me that, on-axis and anechoically, his speakers produced an acoustic signal that resembled the input so much it was "scary." Other designers have told me the same thing--if a speaker is on-axis flat, its sound, picked up anechoically by a high quality mike, is remarkably close to its electrical input. How can this be? What about resonances, phase shifts, distortions, etc.? Such experiences seem to suggest that in today's better speakers they don't amount to much compared to room effects, or should I say, room-related defects.

This is particularly interesting relative to distortion: Speakers at low volume typically have really low distortion. As volume increases, up goes distortion, but up too go the masking thresholds. Speaker distortion remains masked by the distortion content of the music, and of your hearing mechanism, at least for good speakers. I don't want to dismiss utterly all other problems, but the room interaction seems to be the fundamental problem.

There is almost nothing new under the sun, and serious speaker designers have been thinking about these problems for a long time. Keith Johnson's design for one of the larger Precise models included compensation for the first floor reflection. Earlier, Peter Snell's Type A and Type 1 both addressed floor reflection questions by putting the woofer, and in the Type 1, the

tweeter, too, on the floor. More recently, the Snell Type B, designed by Kevin Voecks, put the (forward-firing) woofer close to the floor and made the midrange have limited vertical dispersion to deal with the same problem. And, over the years, a long succession of planar radiators have minimized vertical dispersion and thus reduced the floor reflection problem.

The Gradient 1.3 designers, Jorma Salmi and Anders Weckstrom, have attacked the floor reflection problem, and room interaction in general, flat out. Their position paper (AES preprint No. 1871) describes their anechoic experiments, which yielded the same conclusion that Thiel and others had reached independently: Speakers can sound nearly perfect, anechoically. They go on to identify the floor reflections as the worst source of degradation. And, in the 1.3, they set out to solve the problem.

It is relatively easy to make a speaker that has very narrow dispersion in the vertical direction in the higher frequencies, and will thus have not much energy hitting the floor and bouncing off to cause trouble. But how to deal with the lower frequencies, which almost inevitably have wide dispersion because of their long wavelengths? The Gradient, like the Snell Type A model, takes this bull by the horns: The woofer fires at the floor, downward, at very close range (about 1 "). So for the frequencies over which it operates, up to 250 Hz, the reflection and the direct sound are virtually perfectly in phase. (One inch out of the four or more feet of wavelength, corresponding to 250 Hz or lower, amounts in effect to no phase difference). Or, thought of another way, all, or virtually all, of the woofer sound is reflection; there is effectively no direct sound to cancel with. The bass thus produced has 3 dB directivity (half-space radiation). So in addition to no reflection-cancellation problems, it also has the advantage of putting less energy into irrelevant room modes. (Dipoles, at 4.8 dB directivity are even better, but they don't deal as well with the floor cancellation question.)

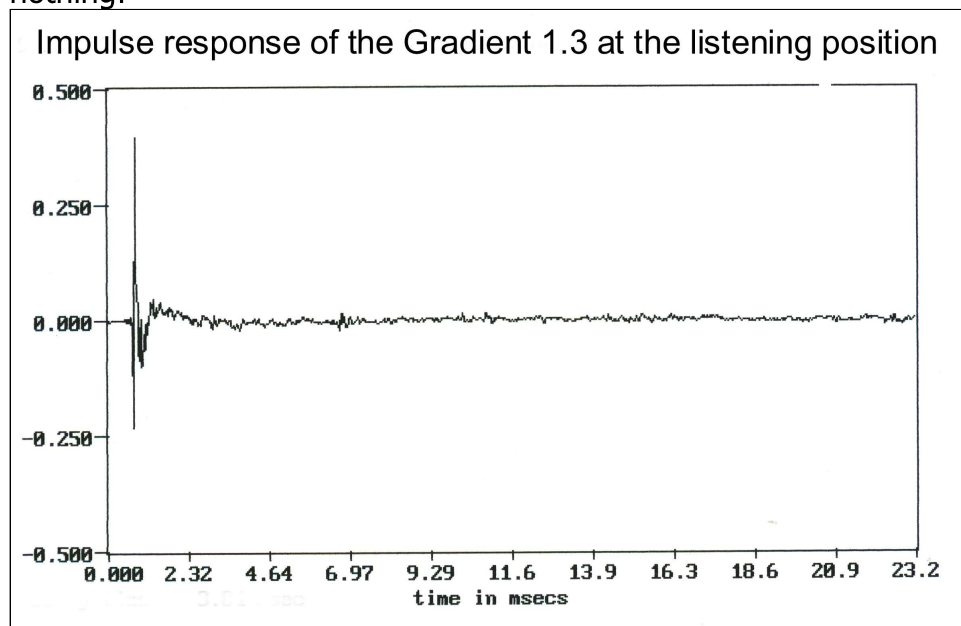
The midrange of the Gradient (250 Hz to 1500 Hz, as it happens) is handled by a dynamic (cone) driver operated as a dipole. The dipole is passively equalized (rolled off in the highs) so that it has flat response in spite of the increasing dipole cancellation at lower frequencies. (Otherwise the upper ranges would be more prominent than the lower, partially canceled ranges; since at 250 Hz, the wavelength is four feet, there is indeed serious cancellation happening by 250 Hz.)

The tweeter unit is compound, made of four tweeters in a vertical array. These all operate from 1500 Hz and a little up from there. With increasing frequency, various ones of the four are EQed in such a way that the unit as

a whole maintains flat response and constant, or essentially constant, directivity.

The tweeter unit has strongly limited vertical dispersion. The dipole midrange has the usual dipole "figure eight" pattern at its lower frequencies but becomes more directional near the top of its range. The dipole unit is tilted upwards somewhat to aim its edge-on null at the floor at an angle. This angle is chosen to reduce floor reflection while still keeping the listening position with the essentially flat part of the dipole units radiation pattern.

The reflection suppression really does work. Look at the picture of the impulse response here and compare it to the impulse response graphs in the articles on DSP room correction. The (uncorrected) Gradient has direct arrival and then--more or less nothing!



(In this measurement, the speaker was equipped, as the designers suggested, with a small piece of foam, mounted cross-ways below the tweeter array. This eliminates a reflection of the treble off the mid-driver and improves both measured and audible performance. (graph and indented material added 2005)

Admittedly, the result is a highly unusual looking speaker. The bass unit resembles a large oval hat box sitting on three small wheels. Atop the hatbox is an exposed woofer-size driver supported by a metal frame which extends upwards to support the tweeter array-shades of Star Wars' robots. (The woofer enclosure is vented, with vent and woofer pointing at the floor). More to the point, one might wonder how such disparate radiation patterns could be made to sound integrated. The acoustic logic goes as

follows (according to the designers, and I find their analysis convincing both theoretically and audibly):

At 250 Hz, the standing wave modes of usual rooms are at very closely spaced frequencies and many different directions, so in effect, one is dealing with a diffuse sound-field as far as "room sound" is concerned. So the fact that the floor-firing woofer and the dipole midrange interact differently with standing wave modes is not too troublesome. There is a certain compromise in changing from the 3 dB directivity of the floor-firing woofer to the 4.8 dB directivity of the dipole midrange: It is impossible to make both on-axis and "power" response flat in this transition. But for a listening room of reasonably standardized size, one can choose a relationship between driver levels that will give a smooth-sounding transition.



As to the dipole midrange to tweeter transition, again a slight compromise is involved, since the tweeters fire forward only. The choice is to make the forward radiation of the tweeters equal to that of (the forward half of) the dipole, i.e., to give the tweeter unit directivity approximately 3 to 4.8 dB. Between 6 and 8 dB for the tweeter unit, depending on frequency, is attained in practice. For smoothness of power response, on-axis response is allowed a small rise above the 1500 Hz crossover.

If it seems that the word "compromise" has popped up a few times here, keep in mind that the average box speaker is compromised far more. Indeed, for most box speakers, the word "disaster" would be more appropriate as far as smoothness of power response is concerned. According to the manufacturer's data, the Gradient 1.3 has very smooth power response and, by the usual standards of speakers, commendably flat axial response, too. (The bass is "anechoic" down in level, since it automatically is reinforced by the floor; this assumed, the response becomes flat to around 50 Hz.)

What does all this add up to in listening terms? The most striking aspect of the Gradients is their ability to act acoustically as if the room around them was simply not there. Measurably, but most especially audibly, the listening room's own acoustics are almost completely differentiated against. One feels as if the speakers were being heard in a nearly anechoic environment.

Reaction to this is likely to vary from one person to another. Some of the people who wandered through described the sound as "nonresonant" and "small," though "clear." Well, clear the Gradients certainly are, in terms of midrange detail, for instance. But it is true that records and CDs are typically recorded/monitored with different speakers in mind, speakers that in general excite the room much more. And without this room excitation effect, many recordings do sound dry.

Moreover, the peculiarities and inconsistencies of the microphone techniques commonly used are distinctly, even cruelly revealed, even in audiophile classics. The Mercurys generally sound like one, two, three microphones. Many of the classic RCAs slam the first violins solidly into the left channel, the celli into the right. And typical multi-mike (non-classic!) recordings stand revealed as having the incomprehensible imaging that one might expect.

What works well here is one-point microphoning: the Sheffield *Firebird*, the Unicorn Fenby-conducted Delius. (Issue 64, p. 142), the awesome Varese-Sarabande Christmas record *Do You Hear What I Hear* [VCDM 1000.70]. These produce the orderly, focused sound that one-point (Blumlein) microphone technique promises in theory.<sup>2</sup>

I found this aspect of the Gradients' performance, this revelation of the intrinsic acoustics of the recordings and their environments, to be fascinating to the point of hypnosis. The Gradients are not free of problems (to be discussed momentarily). But they stand as a landmark of how a controlled radiation pattern can nullify the erratic influences of the listening room and reproduce the truth of what is recorded.

It is interesting to compare the Gradients in this regard to the more familiar types of speakers offering minimized room interaction, in particular, to dipole planar radiators. A dipole planar has limited vertical and horizontal dispersion by nature. As such, its forward radiation offers much the same general advantages as the Gradients. But without careful positioning (angling of the speaker) and back wall damping, the back radiation of dipole speakers reflects to the listening position quite soon after the first-arrival, direct sound. This produces what I personally regard as an artificial, though often pleasing, kind of image enlargement and spaciousness.

Because the Gradients' dipole midrange is angled about 30° upward in the listener's direction, its backwave is aimed downward by the same amount. Thus the backwave's reflection does not bounce directly off the back wall at



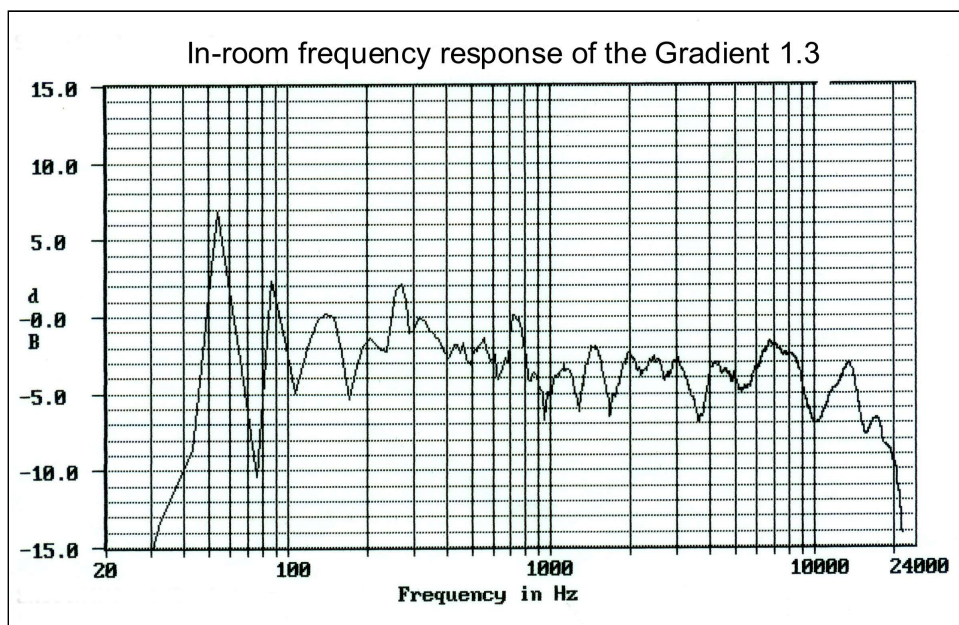
the listener. Rather, it can reach the listener only after a series of oblique reflections. The backwave becomes, in effect, part of the diffuse sound-field. And, as indicated, the tilt of the dipole midrange together with the floor-firing woofer minimize irrelevant floor reflections even more than dipoles do.

Presumably for these reasons, the Gradients sound even more "anechoic" than dipoles. In this regard, of ignoring the room around them, the Gradients stand in the top echelon of speakers in my experience.

How do the Gradients sound otherwise? From the bottom up: As might be expected from a relatively small box woofer, bottom bass is missing. But bass in the main orchestral range (say 50 Hz and up) is excellent. Indeed, one of the strong points of the Gradients outside the radiation pattern business is the delineation of bass. Tuba parts become instrumental lines, not vague rumblings. Double basses change bows and articulate notes. On the (fabulous) Telarc/Previn/Vienna recording of the *Alpine Symphony*, the full glory of Strauss's bass scoring is revealed not just with weight but with *d\_tail* and delineation, too. I couldn't help wondering why there aren't more speakers with floor-firing woofers since they, work so well here.

The midbass and lower midrange of the Gradients is rather full by prevailing standards, presumably because the usual cancelations from floor reflections are not happening. Relatively speaking, the midrange driver then seems down a bit in level. While the transition from woofer to midrange is smooth and integrated, the overall orchestral balance is directed more at midbass instruments less at midrange ones. The midrange itself, however, is extremely smooth and neutral, and, of course, totally free of box colorations. In fact, the midrange is very low in coloration altogether, and at the same time is superbly detailed. Woodwinds, for instance, are essentially spot-on in tonal character, as are well-recorded strings.

Here is the in-room response of the Gradient. Perhaps it looks a bit irregular--until you first note the quite expanded vertical scale and then compare it to , say, speakers A and B in "Digital Room and Speaker Correction: The Big Picture" ( on this site ) .



There is a boom at 50 Hz, easily EQed out, and some extra energy at 200-300 Hz, as noted in the original review (which was done by listening only !--this measurement was done much later. ) But the overall balance octave-by-octave is very good, with no broad-band dips or the like. ( graph and indented material added 2005)

The one truly troublesome aspect of the Gradients, their Achilles' heel, as it were, is their treble. [ See the "Further Thought" that follows this article---this problem essentially resolved itself.] The treble has constant, or essentially constant, directivity. Now it is the prevailing, conventional wisdom that speakers that are on-axis flat and have constant directivity (i.e., flat power response, too) will sound too bright with most material. And in the Gradients the treble is even a bit elevated relative to the midrange on-axis, as well as having essentially constant directivity. Of course, such conventional wisdom is self-fulfilling prophecy: If recordings were balanced with constant-directivity, flat-on-axis speakers, they would be balanced correctly for them! But, self-fulfilling or not, I'm afraid the conventional wisdom is true. The Gradients do tend to sound bright with most source material. (Actually, the extreme top sounds rolled-off. Cymbal crashes and the like are rather airless. I am talking here about the lower and mid-treble.)

On top of this, the treble drivers of the Gradients don't seem to me to be "state-of-the-art," if you'll pardon the hackneyed phrase. As noted, they sound airless at the very top and somewhat colored in their lower regions, and not as clean and articulate as the finest tweeters available. For all that, however, I would estimate that by far the main source of the problem with the treble is simply quantity. Most speakers roll down the total high-frequency forward radiation very severely in the top octave, however flat

on-axis they may be. The Gradients do not. You hear what you'd expect to under these circumstances. Don't even think about using these with a rising-top moving coil cartridge. And be prepared to hear all the digital grain there is to hear. Interestingly, though, the tonal balance tends to be more compatible with contemporary orchestral CD recording than with any but the more subdued recordings of the analogue era. (Apparently, the relentless flatness of the digital top end has led generally to a more tonally distant balance on CDs, if not always to a purist mike technique as such, and seldom to a truly sufficiently distant mike placement.)

The Gradients bring to mind some important general points about home listening versus concert listening. It is a familiar consideration in concert hall design that listeners like to hear strong side wall reflections. These reflections give "intimacy," as the resulting sense of being immersed in sound is usually called. Now, in a recording, these side wall reflections should be part of the recorded ambience. But the Gradients bring to one's attention most emphatically that the side wall reflections are seldom recorded strongly enough to be satisfying. Recording engineers, whether by conscious decision or subconscious habit, are apparently relying on the home listening room's acoustics to generate intimacy. No wonder that so many audiophiles have taken to pointing their speakers straight ahead from one end of a long narrow room and listening from the far end.

I have discussed before the lack of standardization for bass balance and, to an extent, treble balance in the relationship between recording and playback. The Gradients point up the fact that there is need for standards of reflective behavior, too. The only theoretically sensible standard is minimization of early reflections. But if this reasonable standard is to be used in practice, then recordings need to be made at a sufficient distance to have relatively strong, correctly timed wall reflections. The old way, which is still too often with us, of making recordings from far too close for natural listening and hoping that listening room wall reflections would fill in-that way can never work consistently and predictably. Not to mention that the wall reflections of a home listening room are totally inappropriate in timing and angles to large-scaled music.

In any case, the Gradients reveal spatial detail as it is actually recorded very well. Real width and depth is well reproduced indeed. There is almost nothing added, and recorded spatial errors are again ruthlessly revealed. But on properly recorded material, remarkable things can happen. The Gradients can float a realistic dimensional center image in a way few other

speakers can. The Gradients themselves can simply vanish as apparent sources; the usual subliminal hints that you are hearing sound from speakers, the little reflections that tell you there are two speakers out there, not one clarinet player--all those distractions are gone. This can be an almost hypnotic experience. The Gradients make most other speakers sound like speakers in their spatial performance.

Though the Gradients do tend to exhibit emphatically the defects of recordings, I want to emphasize that on suitable material they can sound amazingly realistic. Choral music can sound superb, e.g., the Proprius *Cantate Domino* which is given great word clarity and delineation of individual voices (it is December as I write this). So can chamber music, such as the wonderful Paula<sup>3</sup> Zemlinsky and Brahms clarinet trio recording. Kavi Alexander's violin classic (Bach, Kreisler, and Ysaye played by Delmoni) sounds ultra-realistic, even in CD version.

Incidentally, the realism in all cases is aided by the dynamic ease. Neither solo sopranos nor loud clarinet notes, nor orchestra at full volume, nor chorus plus organ yield any sign of stress. (At 86 dB/2.83V/1 m, the Gradients are intermediate in sensitivity, but they will absorb lots of power without problems.) At their best, the Gradients can altogether sound remarkably like the live experience, and in particular can transport one into the original acoustics of the recording to an extent that is startling compared to almost all other speakers.

The key ingredients for the Gradients to sound their best seem to be good (read distant, in general) microphone technique and warm acoustics. But, as noted, many orchestral recordings decompose into incoherent, bright, grainy mish-mashes--which is exactly what many of them are, I think.

Again with good recordings" the Gradients offer remarkable levels of information about what is going on musically in complex textures. I am almost reluctant to mention this, because so much sonically abusive equipment has been supposedly justified via the "separation of lines" idea. But in the case of the Gradients, one does indeed hear lines clearly, even when the treble is EQed not just to the usual levels but even far below that (EO courtesy of the Cello Palette preamplifier, review forthcoming). If I needed to transcribe a complex work into score from listening alone,<sup>4</sup> the Gradients would be my speaker of choice. They quite often don't sound beautiful, or even particularly "musical" in the usual audiophile sense of the word (i.e., smooth, sweet, recessed), but with some caveats about treble

grain, I would guess that they sound a lot like what was happening at the location of the microphones---a location, as like as not, where the music itself sounds raucous, edgy, and aggressive. In any case, the Gradients will give you a good idea indeed of what the musicians were up to.

The last of such philosophical questions summarizes the others. The Gradients remind one to ask the question: How has the audio industry come to expect that, using microphone placements not even close to a natural listening position--too close-up, elevated, picking up practically none of the indispensable sidewall reflections--using those microphone positions, how have they come to expect anything like the absolute sound on playback?

In this sense, of reminding me so strongly of the intrinsic errors of most recordings, I found the Gradients more than a little disturbing. On the other hand, with recordings that suited the Gradients' presentation, its emphasis on direct-from-the-speaker sound, the Gradients provide reassurance that replication of the live experience is possible. On occasion, they really can sound surprisingly close to reality.

The Gradients are a speaker built to a theory. Within that theory, they are a remarkable success. This is a design with real thought behind it about fundamental acoustical matters. (Space restrictions prevent detailed discussion of it here, but, among other things, the Gradient designers developed a new, psychoacoustically-motivated idea of how to measure frequency response in rooms, and tried to make their speakers flat according to this criterion.) Regardless of the vagaries of recording as it is practiced commercially and the compatibility of those practices with the theory of the Gradients, the achievement in acoustic design here commands respect.

I believe strongly that the only hope of really approximating the live experience lies in an almost complete discrimination against the acoustics of the home listening room, along the general lines of the Gradients and other controlled-radiation speakers. The sooner that recordings are made to sound like music when heard on such speakers, the sooner we shall have recordings that have a predictable sound at all. And predictable results on playback are necessary for recording accuracy to be a concept with meaning, much less a concept that can be realized.

There is a potential crisis here that passed almost unnoticed in the days when speakers were almost all wildly inaccurate. The crisis is simply that recording engineers can deal effectively with the refined aspects of sound

only if they can know how the recordings will be played back. Until we have speakers that sound the same in different rooms, no one can know what a given recording will sound like in any kind of detail. Recording, and the reviewing of recording, become a matter of shooting at moving targets.

The Gradients must be heard by anyone interested in speaker design, or audio in general. Whether you will want to own them will be a complex decision. But I can almost guarantee that they will rearrange your ideas about what recordings really sound like, and what most speakers are doing to that reality.

**REG**

**TAS issue 77 February/March 1992**

<sup>1</sup> This has all been covered before in my article "Directional Hearing: How to Listen to Stereo," Issue 64, pp. 40-56. ( Also reprinted on this site )There I was concentrating on stereo imaging, for which the floor reflection is not as bad as wall reflections because it is "in fine" with the speaker laterally. But tonally it remains disastrous, particularly disastrous.

<sup>2</sup>Do You Hear What I Hear is not really Blumlein stereo. It is done with two Calrec mikes, one for orchestra, one for chorus, set as angled hypercardioids. But the result still has the essential coherence of one-point miking, for each of the groups separately at best.

<sup>3</sup> Karin Jurgensen of Paula told me at some point that she felt she was on the track of how to eliminate the generally cold, hard character of CD sound. This recording indicates that she was, indeed.

<sup>4</sup> Mozart, Glazunov and others of musical genius could do this after a single (live) listen. The almost supernatural abilities of such people should be kept in mind when the temptation arises to indulge in cocktail-party criticism of the great musicians' works.

Manufacturer: Gradient, Finland. Distributor: Quad USA, 111 South Drive, Barrington, Illinois 60010. (708) 526-1646. Source: Manufacturer Loan. Serial Number: N/A. Price: \$2500 per pair. Warranty: Five years parts and labor.

***Manufacturer's Response:***

It is encouraging to find that there still are reviewers who deeply involve themselves in the given subject matter. REG's findings covering the sound reproduction chain, from recording location to the listener's room, are of the real in-depth grist.

We agree with the opinion that the weakest link in many cases is the recording occasion. With accurate reproducers like the Quad ESL -63, mediocre recordings sound bad, proper ones excellent. We feel that the tendency in recording technique is toward simpler miking and thus better sounding recordings containing the original acoustics.

The design goal for the Gradient 1.3 was to design a speaker which would replicate the original soundstage to the listening room, with minimum coloration. Hearing the subtle acoustic differences of the great symphony halls, not one's living room, is what high fidelity is all about. Unfortunately the acoustics of the listening room of the final user is not under the speaker designer's control. If a "good" speaker sounds bad in one's living room, the blame is usually put on disastrous acoustics. We have tried to combine the design ways (a) and (b) described by REG in the beginning of this review: reasonably flat on-axis, off-axis and power response combined with higher than normal directivity. Thus the room acoustics will not contribute to the recordings and the reproduction of music will sound similar in different rooms.

The proper treble level is a complicated matter. In our seven years experience with this design, this is the first instance where a reviewer has raised this point. Subjective taste and equipment (especially vinyl) related factors must be considered. One way to reduce treble level is to cross the speaker axis in front of the listener, thereby also increasing the listening area.

We also agree with the conclusions of the review. The only way to improve the listening accuracy at home, is to eliminate the room induced colorations. That is why we at Gradient continue working on controlled directivity design in loudspeakers.

**Jorma Salmi**, Director Gradient Ltd., Jarvanpaa, Finland

## **FURTHER THOUGHTS**

### **THE Gradient 1.3 Speakers**



The essence of TAS reviewing is time. Not for us the audio cowboy's thirty-second listen, with one thing "blowing away" another immediately. Long term listening can reveal failings and virtues, too, that are hidden in the quick listen. Well, I certainly listened for a long time to the Gradient 1.3s before writing my review in Issue 77. But I found their sonic performance so intriguing that I continued listening after I had completed the review -- that's something that seldom occurs. And, as it happened, the speakers changed somewhat, and for the better. What changed was that a persistent, almost pervasive graininess in the treble, that one perceived as exaggerated treble, went away almost entirely.

One wonders how this could have happened. Driver break-in is one possibility. But my guess is capacitor "forming." Capacitors do change their behavior as they are used and there are, I would suppose, quite a number of caps in the complex treble crossover of the Gradient, which has four tweeters per channel, each tweeter with its own roll-off rate. In any case, for whatever reason, the grain diminished.

The Gradient 1.3s were an intriguing and impressive design as I reviewed them. With the grain in their treble virtually gone, they are now even more attractive listening than before. The scrutiny they apply to records is still revealing of recording defects; but now, even more than before, they can sound truly exceptional on well recorded material. Try to audition a pair that has been broken-in long term. You'll find it a sonically revealing experience, even more than I indicated the first time around

**REG**

**(TAS issue 80 June 1992 )**

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