Guest Editorial

The G-Pole – An Adventure in Space[1]

Joachim Gerhard

When did you have your last enlightenment?
Maybe as a child. Many. Sugar is sweet, fire is hot. Then your first pill: bitter.
Did you even have Satori? An intense feeling that you can love EVERYTHING. Stones, flowers, every human being! I must admit it was not that intense but I was quite mesmerized when it struck me that there is something wrong with conventional dipoles.
It all started back in the same year as 9/11.
There was a Stereophile show in May in New York. I even had a room in the same Marriot hotel that fell to pieces some months later.
I walked into a room where a strongly beaming electrostatic speaker was playing. At first I was told to sit in the sweet spot to enjoy the soundstage but I did not get that far.

One meter into the room and I heard the sound loud and clear radiating from two points in space on the back wall totally detached from the physical speakers. By slowly walking around and finding that "virtual" spot where the reflected signals coincided I could even hear a "second" stereo image. Several months later I had nearly forgotten that event but memory came back even stronger when I visited the son of the late and great Harold Beveridge, Rick, in Sonoma County. In a major effort, Rick had put together everything he could find about the audio work of his father and had set up shop to produce improved versions of the vintage and legendary speakers. We talked about his father's philosophy and especially his thoughts about playing WITH the room and not AGAINST it. His solution was a line source with a lens. It had electrostatic elements, damped on the back and an acoustic lens in the front. Those speakers where set up on the side walls, radiating *towards* each other. They could throw an extremely wide and deep soundstage. When you walked between the speakers to the other side of the room you could hear the soundstage again. Left and right reversed!

Suddenly a lot of things fell into place. I made a small drawing for Rick (**figure 1**). Two strongly beaming electrostatics could be set up in such a way that you listen on the cancelation axis. One image is

[1] Editor's note: This Guest Editorial is based on Joachim Gerhard's presentation at the 2013 European Triode Festival, held in Berlin in October 2013. It is not a traditional technical article but documents his discovery trip of many years into sound reproduction and acoustics. I am grateful for his willingness to share this very personal adventure with us.

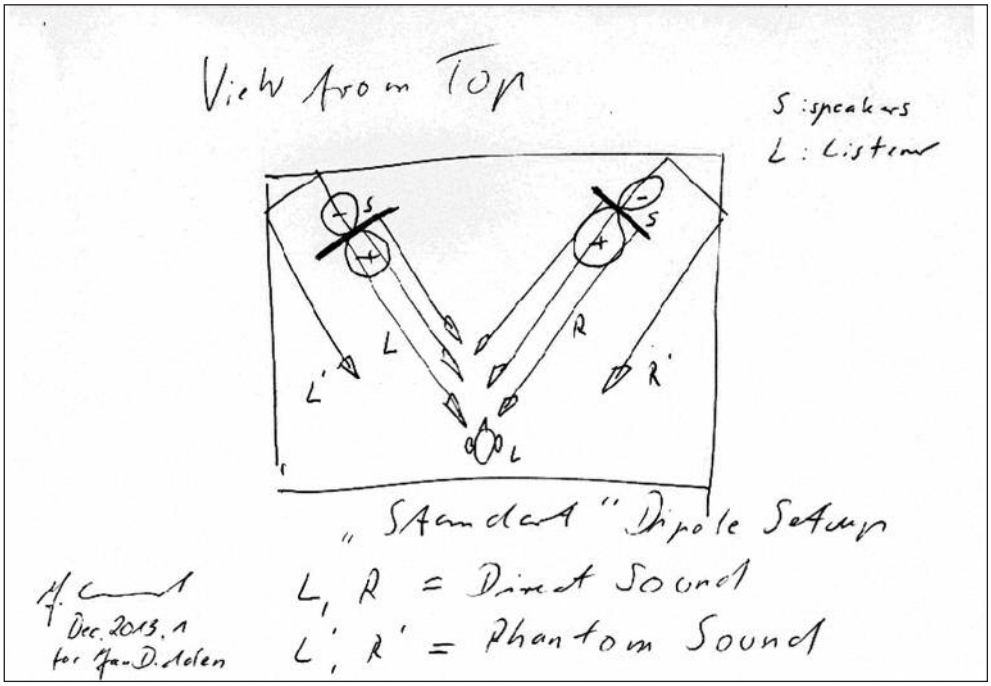

Figure 1 Standard stereo setup where L' and R´ create unwanted additional phantom image.

thrown against the front wall and one image is thrown against the sidewall, reaching the ears with considerable delay. Sitting in the middle you should hear a well-developed soundstage and the delayed sound from the side walls could enhance spaciousness without blurring the image. Rick got the essence immediately and told me that this is the first good idea how to drive a room since his father had passed. Yes, it's true, ask him. You can imagine how proud I was.

Back home I had another idea. The beaming positive side that reflects from the front wall could be thrown against a curved plate. That would also solve the beaming problem making it possible to hear with several people (**figure 2**). Now I was hooked and went into serious research.

I set up a wide band speaker on an open baffle and started to measure the first strong reflection. I even was granted a patent "Gekreutze Schallwand" (Crossed Sound Surface) where two baffles were arranged in such a way that the woofer section can be rotated horizontally against the midrange section. There is not enough space here to describe it in full. Read the patent if you wish. The beaming electrostatic experience has survived here in the form of a "Phantom Source", so this is the first patent I know of that claims that a stereo phantom source can be used to listen to high end audio. My curiosity did not stop there so I started to work with several baffles in the same room. I think I ended up with 6 baffles. I fed them the same mono signal and after some experimentation was able

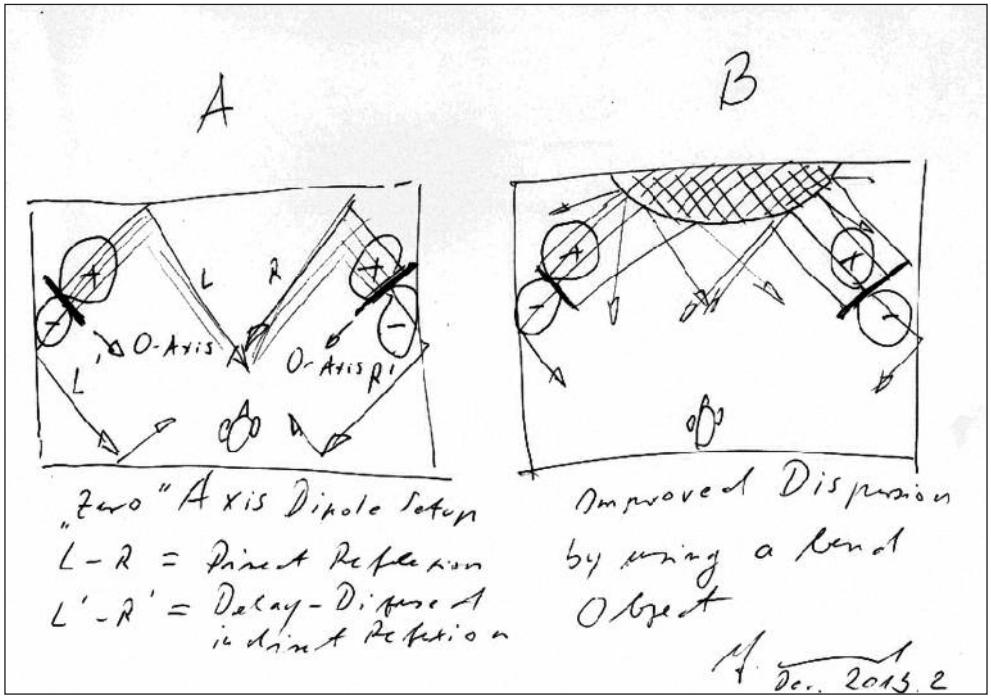

Figure 2 The drawing I made for Rick Beveridge (A) and the version to avoid beaming (B).

to throw something like a fake stereo signal. People where really surprised to hear a setup like that. I called the effect "Quellenseparation" that would translate into something like "Source Separation". I thought it would be great for artists that work with sound or such but ultimately it drove me nuts. Too much work for a single person. So for some time I stopped this work and constructed more or less conventional speakers, phono stages and such.

My interest in open baffles came back when a friend of mine developed a new wide-band speaker. Actually he tried to combine the best of the old and the new and he succeeded big time after more than two years of experimentation. The most difficult part was to find a membrane that does not break up too much. Instead of following the usual way of using at least one coincident frequency where the membrane breaks up and start to work as a bending wave radiator, not much different from the Manger Transducer, that has simply a very low coincident frequency, he was searching for a membrane that is as stiff as possible, even at higher frequencies. He also wanted to avoid a whizzer cone because that is again a new coincident frequency higher up. His reasoning is that bending wave transducers can create a lot of harmonic distortion, especially second. That is always a sign of chaos and can lead to masking of information although it can be quite pleasing to the ear. The whizzer cone on many drivers also works in opposite phase to the cone. You can see that as a hole in the response around 10kHz in many drivers. Years later my friend was even able to make a version with a

whizzer cone that works admirably, but that is another story. You can find information about those drivers at www.enviee.de .

Back to business. I was convinced that this driver was really good and found that it sounded best on a simple open baffle. Try it yourself. Put a driver in a big baffle, say 0.2 x 1.2m and listen without crossover, just plain. Then put any volume behind it, it can even be a box from lead, and you hear a strange squeaky sound. That effect can be damped somewhat but the virgin magic is gone. So I put that driver in open baffles and added a horn ribbon tweeter over 8kHz and an active M-dipole below 80Hz. I documented much of that work on diyaudio.com under MPL (My Private Loudspeaker). It sounds swell and I got much recognition, also from Holger Barske and Michael Methe who visited me and described their experience on the web. (Holger Barske.de Michael Methe.de).

Well, that system is really big and ugly although I plan to make the baffles somewhat prettier. And it suffered first from the same effect I described earlier. When you walk between the dipole baffles to the back and turn around you can hear a second image approximately where you have being sitting before (**figure 3**).
For a while I kept it just as is but then something struck me on the www.linkwitzlab.com website. Actually Siegfried had called me and told me that he had found out that the latest incarnation of the

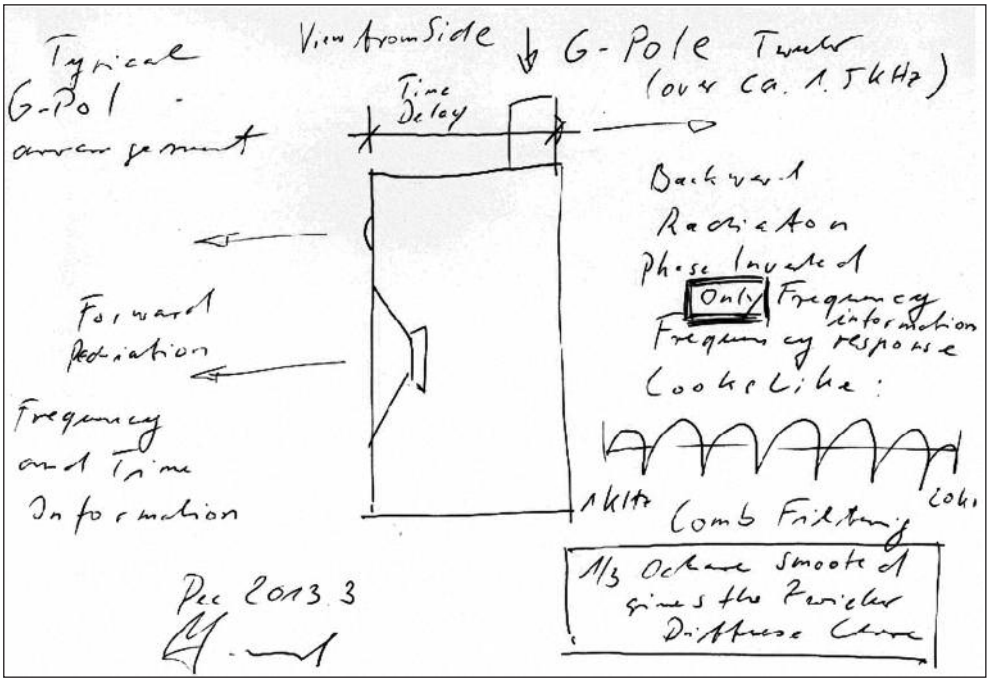

Figure 3 Typical 'G-pole' implementation.

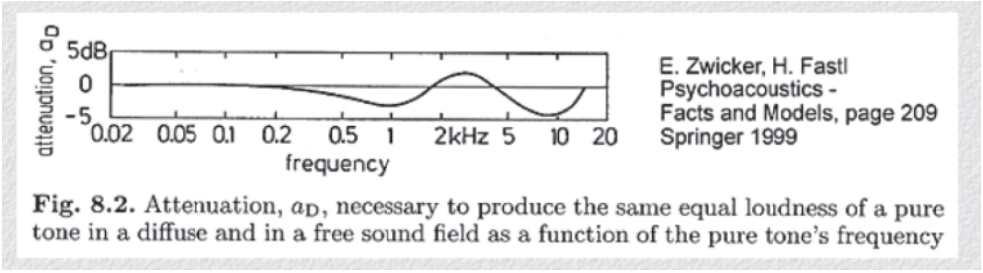

Fig. 8.2. Attenuation, a_D, necessary to produce the same equal loudness of a pure tone in a diffuse and in a free sound field as a function of the pure tone's frequency

Figure 4

Orion sounds much better when he shapes the frontal response in a certain way so going away somewhat from a totally flat on axis response. Shortly after a tread appeared on diyaudio.com called "Flat is not correct". Looking at his website I found an interesting graph from Professor Zwicker (**figure 4**). It showed that the sensitivity of the human ear is different for direct and diffuse sound. I knew that to a certain degree at least since the late 80-ies. The Audio Physic Avanti that came out in 1989 had a set of resistors where you could tune the response to "Near field" or "Diffuse field". The diffuse field setting had more treble off axis for use in bigger, absorbing rooms. The idea came from using Stax headphones that also had a diffuse and free field setting but for other reasons. Must have being based on Zwickers research too but at that time I did not understand the full consequences. I thought long and hard about the Linkwitz solution to shape the response on axis. Actually I think he tries to shape the response because in a typical equi-distant triangle you hear the speaker not from straight ahead but some angle, say 35°, from the side.

Anyway, I concluded that this is not the solution I am searching for out of the simple notion that we need a norm that everybody agrees on. Imagine the control room of a typical recording studio. Usually the studio is well damped with a short and even reverberation time. The monitor speakers are usually setup to be flat at the control seat, sometimes with a "house curve" that tames the treble a bit. If the artist or the producer finds the sound unsatisfactory they will use equalization until the result is to their liking. Say, it is a Classical or Jazz production with unamplified natural instruments in a decent room they COULD put in the Linkwitz equalization, if they wish. Reproduced over the new Orion we would end up with "double equalization" if you understand what I mean.

Of course Siegfried is too wise to reshape the response in any drastic way and he has put in many hours of listening to arrive at a good compromise that works well on most of the material. Maybe I am simply "too German" to do it that way.

You will now ask when lightning struck me. Actually at exactly the point in time back then when I had finished the described thinking process. What would happen when I shaped the response flat on axis AND diffuse field equalized to the back of the dipole ? Bingo. Then lightning struck again. This time much harder because all kinds of memories came back from my earlier work and the meeting

with Rick. What would happen if I destroy the impulse response to the back of my dipoles by using an additional tweeter out of phase with time delay and make sure that the diffuse frequency response is shaped after Zwicker?

I cannot describe my feeling but I felt that I had given birth to a baby: the G-Pole was born.

First I modified my big MPL baffles. I fitted a second ribbon horn in the treble and experimented with polarity, crossover and level. The Zwicker curve shows the biggest differences in the upper midrange and treble so I thought that adding the tweeter is enough. Also due to the Haas effect and steepening of the first transient in the ear, destroying the treble impulse response should be enough to avoid a second image from the back. Usually I am very measurement and simulation oriented but this time I just listened. Delaying the tweeter by some 20cm, inverting the polarity, giving it the same crossover as the front one and lowering the volume by a 3,9Ohm series resistor gave the desired result. Walking back and forth between the baffles, the sound from the back had approximately the same tonality but the second "phantom" image was gone.

I sat down and listened and was quite struck by the difference it made. Imaging and three-dimensionality was better and there was a sense of "air" I only know from the concert hall.
I was pretty satisfied. Since then I have demonstrated the effect to a lot to professionals and amateurs alike and 95% liked it a lot. Some of the population did not react to any significant degree but that where those kind of people like the mother of my son who love music but do not care much if it comes from a High End system or You Tube on a Mac Book. Lucky people. Saves lots of money and trouble.
The MPL is big and ugly (that must not be but I am simply too busy to build better looking baffles, the shoemaker always wears the worst shoes, you know) and I build it for myself. So I did not measure much but tuned it by ear to my taste and purpose.

When I design for other people I try to be more objective so I set up a plan how a G-Pole could be build that is smaller, cost efficient and well documented. It all ended up as the MiniMPL on diyaudio.com. I have shown some pictures and measurements there but did not publish the circuit diagram or any deeper instructions about its inner workings. This Guest Editorial gives me the opportunity and I am grateful for it.

Another chance came at the 2010 European Triode Festival in France. I had promised a lecture about the G-Pole principle. It was called "The G-Pole, a new radiation pattern".
When I got the program I was in shock! Nine AM on Saturday morning!
That is absolutely the wrong time for me. I work a lot at night because I do business with Japan and the USA and the time delay allows me to communicate with both countries at approximately the same time and Friday night is the only time in the week I take a rest, listen to my system or watch films until the morning. So that schedule hit me like a hammer.

Anyway, I thought let's give it a try. There will be only a few people anyway. Coming into the lecture room after at least *some* hours of sleep in the morning I got another shock. The room was packed! Fortunately I had put most of the slides on a USB stick and Martina Schoener and one of the French organizers (sorry I forgot the name, but you know who you are) did a wonderful job of helping me to find the correct pictures in the correct order. It was like telepathy but somehow I managed to struggle through the program. It was not my best lecture by a far margin and I witnessed a lot of skeptical faces so sorry boys and dolls. Next time I will make it more digestible.

What was positive was that a lot of people where now curious enough to listen to our system. Martina and I had set up the MiniMPL plus an active M-Dipole sub with a Garrard record player in a rather big room, even very close to the back wall where we put them on the first day after a long and dangerous car ride (it was quite foggy, windy and dark on the arrival day). We were simply too exhausted to tune the system in any way so this was a real acid test. Would the system sound good without the usual set up tricks and hours of tuning? It did, just fine. Once more the G-Pole principle had proven to be superbly tolerant to room acoustics and setup. A lot of people could not believe what that small tweeter hanging in the back on a spring could do and poor Holger Barske had to explain the principle to no one less than Frank Blöhbaum who asked his typical painful questions. Thanks Holger, you saved me once more. I was wasted and went to bed.

Very late on Saturday night I woke up and went back to the listening room. I had to throw some small stones against the windows to draw attention but was eventually let in. To my surprise there was a peaceful crowd around Martina and Holger listening for the 20st time to Paul Kuhn on Image records. The sound did not bother them at all after at least a 10 hour marathon and I thought "these G-Poles must be musical"….

Erratum:
The references in the text to the figures are not always correct, however the captions with each figure are.