

A Glorious Time: AR's Edgar Villchur and Roy Allison

Editor's Note: In 1954, a New York writer and teacher reinvented the world of audio with the modest-looking Acoustic Research AR-1 loudspeaker. A small fraction of the size of the behemoths that were then de rigeur for the reproduction of bass frequencies, Edgar Villchur's loudspeaker went as low with less distortion. Perhaps more importantly, the AR-1 pioneered both the science of speaker design and the idea that a low-frequency drive-unit could not be successfully engineered without the properties of the enclosure being taken into account.

To celebrate the fiftieth anniversary of Villchur's revolutionary idea and his founding (with the late Henry Kloss) of the Acoustic Research company, I asked David Lander to interview not only Villchur but also Roy Allison. Allison played a major role in the company's fortunes for several years before leaving in 1972, but more importantly, extended Villchur's idea of system engineering to one where a complete loudspeaker should not be designed without taking the properties of the listening room into account.—**John Atkinson**

Edgar Villchur: Thinking Inside the Box

Edgar Villchur's acoustic-suspension loudspeaker was an idea as big as its cabinet was small.

By the time he entered the City College of New York in 1933, Villchur knew he wanted to be an inventor. He was attracted to engineering, but a passion for painting and theatrical set design led him to major in art, and he earned a master's degree in that field. Not long afterward, World War II began, and he was drafted. Villchur spent five years in the army, about half of it in the Pacific. He worked in electronics and rose from private to captain.

After the war, Villchur opened a radio shop on West Fourth Street, in Manhattan's Greenwich Village, and built custom hi-fi sets and made repairs. He also spent considerable time in the New York Public Library reading on his own, and took courses in engineering and math. He also worked as a teacher, creating and presiding over a novel course at New York University called "Reproduction of Sound."

But Villchur longed to live in the country, and decided that becoming a writer would allow him to do so. His first editorial client was *Audio Engineering* magazine; when he submitted an article, editor C.J. McProud asked for a series. *Saturday Review* also agreed to regularly publish his work. In 1952, Villchur and his wife, Rosemary, moved to Woodstock, New York, which had long been a haven for creative people. They still live in that Catskill Mountains town.

Villchur, whose friends call him Eddie, is now a youthful 87. *Stereophile* readers tend to know him for having developed the acoustic-suspension woofer and dome tweeter, and as a founder of Acoustic Research. Some also remember his many magazine articles and his two authoritative books on high fidelity. [*His 1965 book, Reproduction of Sound in High-Fidelity & Stereo Phonographs, is available as a Dover reprint.—Ed.*]

Others recognize a separate set of achievements. After selling AR in 1967, Villchur founded and funded a nonprofit laboratory, the Foundation for Hearing Aid Research, and went on to develop a prototype device whose basic design is used widely in today's hearing aids. He also wrote some two dozen papers relating to audiology and, in 2000, published a book on the subject, *Acoustics for Audiologists*.

David Lander: You've said you turned your attention to loudspeakers because, back in the early 1950s, they were the weak link in the hi-fi component chain.

Edgar Villchur: In those days you could buy an amplifier for home use with 0.5% distortion or less, even at the frequency extremes and at full rated power. Loudspeakers showed distortion levels in the low bass of 20 to 100 times that amount. The problem was the mechanical suspension that held the cone in place. When the cone moved a large distance, the suspension would stretch. It wouldn't allow the cone to travel the full distance in response to low-frequency waveform peaks. I thought, *Well, what we need is a linear restoring force, one that doesn't bind, one that allows the cone to move a large distance and brings it back elastically.*

That's when the light went on. This linear spring had been there all the time. The cushion of air in the cabinet was exactly the kind of spring I wanted.

Lander: So you decided to reduce the springiness of the mechanical structure and replace it with air.

Villchur: By reducing the stiffness of the mechanical cone suspensions and then reducing the size of the air cushion—which is to say, reducing the size of the cabinet. The latter is something you have to do; it won't work otherwise. You end up with a linear restoring force, radically reduced low-frequency distortion, and—as an extra dividend, not a primary dividend—a small cabinet.

Lander: You built the very first acoustic-suspension loudspeaker system soon after moving to Woodstock. How long did it take?

Villchur: It was a matter of a couple of weeks before I had a working model. I miscalculated the size of the cabinet in the first prototype. It was too small; the bass dropped off at much too high a frequency. Otherwise, it worked the way it should have. I was encouraged by that, and once I had the data, I could calculate exactly the size of the cabinet needed. So the second prototype worked like a charm.

Lander: What did you use for the acoustic-suspension woofer itself?

Villchur: A cannibalized Western Electric 12". I cut away the entire rim suspension and replaced it with mattress ticking. Then I cut away part of the spider. The whole thing had a very floppy mounting. I left just enough stiffness in the suspension to center the voice-coil.

Lander: What did you do once you realized what you'd wrought?

Villchur: My measurements showed that my little prototype had better bass and less distortion than anything on the market, yet it was one quarter the size. I thought, *This has got to be the future of loudspeakers*. But the last thing in the world I wanted to do was get into business. For me to be a corporate president is anathema. So, I thought, I'd sell it to a loudspeaker manufacturer. I made up my mind to ask \$10,000 and, if they offered me \$5000, to take it. I called somebody I knew at Altec and told him what I had, and he said, "You know, Ed, we have a pretty good staff of engineers here. If there were something around such as you describe, I think they would have found it."

Lander: You've also said that a friend of yours approached Rudy Bozak, and he turned it down.

Villchur: My friend asked why, and Bozak said, "Because what you describe is impossible."

Lander: Enter Henry Kloss, who was in the army, stationed in New Jersey, taking your NYU class.

Villchur: I had hinted to my class what I was doing, and Henry started acting like a terrier. He wanted to know about it. At first I said, "Look, this has got to be done by a major speaker manufacturer," but when I saw what the manufacturers' attitude was, I said, "Well, okay, let's talk about it." So one night in the spring of 1954, after class, we got into my 1938 Buick and went to Woodstock. I explained it to him in the car on the way, which was no problem because Henry worked from fundamental principles of physics. We must have got in sometime after 11. He heard it, and right then and there suggested we use his loft in Cambridge [Massachusetts], where he was building cabinets for Baruch-Lang speakers, to make it.

Lander: You agreed and, in effect, the two of you started AR on the spot.

Villchur: Yes. On the basis of my working speaker, with my patent application already in Washington, we started AR. I wanted to pick a manufacturer we could rely on for the woofer and tell him how to make the new-type suspension, but Henry said, "No, I'll do the whole thing." He educated himself to make a woofer from scratch.

Lander: The AR-1 was a two-way system. Where did the other driver come from?

Villchur: It was made by Western Electric, their 755A, and later by Altec.

Lander: You've given Henry credit for 75% of the production design on the AR-1.

Villchur: The production design. That's accurate.

Lander: You unveiled the AR-1 to the public at the New York Audio Fair in the fall of 1954. As it happened, an article by you describing it had just come out in *Audio* magazine, which was the name *Audio Engineering* had adopted a few months earlier.

Villchur: By that time, we had three or four made. At the show, some people were bowled over. Other people were skeptical. One guy who was an engineer said, "It violated every principle I learned about speakers, and then I went home and read your article." And he put his finger to his head as though it were a pistol and said, "Of course."

Lander: When did you begin delivering the AR-1?

Villchur: March '55. We started to ship 15 or 20 a month. Maybe fewer in the very beginning. In 1955, we shipped 455 speakers. I remember that number because it happens to be an IF frequency from my old shop days. About half were AR-1s and half were 1Ws.

Lander: The AR-1W was a woofer-only unit. Arthur Janszen used to demonstrate his electrostatic tweeter in combination with it.

Villchur: Henry knew him, and we went to his house, and Arthur compared the AR with a giant, four-woofer Bozak. His decision was just as quick as Henry's. It was an obvious decision. How many people were going to buy this giant thing when they could buy his tweeter with an AR?

Lander: At that point, Henry Kloss was in charge of the AR factory. What did the two partners he had brought in to help capitalize the company do? Were Tony Hofmann and Malcolm Low active? And what were you doing?

Villchur: Tony, a distinguished physicist, was keeping the books, and he did a beautiful analysis of the relation between speaker elements. Malcolm wasn't really active at first. I started paying a lot of attention to writing articles and talking to people who would write articles. At the 1955 Audio Fair, we had about six magazines on display, each with a whole article on the AR speaker.

Lander: After about a year and a half, Kloss, Low, and Hofmann sold their AR shares to you. Was there friction?

Villchur: There was friction. Henry really needed to have his own company; you can't have two presidents. Part of the agreement was that, whatever company they formed—which was, of course, KLH—they could take a license from us that would allow them to produce acoustic-suspension speakers. I took over production at that point. Henry left an AR-2 that wasn't ready, and a lot of work still had to be done. Then we hired somebody for production who could have been a good slave overseer for the Egyptian Pharaohs. That's when I called in people I knew.

Lander: Right. You enlisted Abe Hoffman, a CPA, for the position of vice-president and treasurer. He became AR's president after you sold the company to Teledyne in 1967, and he later teamed up with your former plant manager, Roy Allison, to form Allison Acoustics. Harry Rubinstein, a music teacher who had studied mechanical engineering and had managed a small factory during World War II, came in to run the

plant. You also brought in a sales manager and a materials manager. These were people you knew and could trust. They freed you to spend your time doing what you did best.

Villchur: Exactly. I did the technical correspondence at that time, and I did all the advertising with an old friend, Seymour Einwohner, who was in an art class at City College with me. I would send him the ad copy and photographs if I had any or an indication of what I wanted drawn, and he would send me back layouts. I believe these ads gave AR a distinctive image.

Lander: Some years after the acoustic-suspension woofer, you designed the first dome tweeter. You've said it was initially intended for the AR-1, because the driver made for you wasn't up to the quality of the woofer, and because you were relying on a competing company for it. How long did that project take, and why did you decide on a dome configuration?

Villchur: Building the woofer prototype was a matter of a couple of weeks, but this took a year and a half. Of course, I had other things to do. As for the dome, it wasn't so much the shape of the diaphragm as the fact that the diaphragm can be made very small while the speaker still carries adequate power. This is accomplished by putting the voice-coil at the large diameter of the diaphragm rather than at the small diameter. A small radiator provides the best dispersion and power response, along with extended, smooth high-frequency response. A different shape could be used for the diaphragm, but it would have a greater tendency to break up. The AR-3 was the first speaker to use the dome tweeter, which wasn't imitated in other speaker systems for about 10 years.

image: <http://cdn.stereophile.com/images/archivesart/105vil2.jpg>

Lander: In 1956, you were awarded a patent for the acoustic-suspension speaker. You wrote the description yourself rather than relying on a patent attorney. Why?

Villchur: The estimate the patent attorney gave me was too high. I said, "How about if I just come talk to you and you tell me what I need to do to write my own? How much would you charge for that?" He said, "\$30 an hour," and I said, "I'll take one."

Lander: But a 1962 court ruling found your patent invalid because of one that Harry Olson and John Preston, an RCA colleague, had gotten in 1949. How did that come about?

Villchur: We filed a suit against Electro-Voice for patent infringement. We already had licensees, KLH and Heathkit, that were paying us royalties. Rather than pay, Electro-Voice offered us an exchange deal for a useless patent of theirs. So we had to sue.

Lander: Do you think using an attorney at the time you applied for your patent would have prevented the ruling against you?

Villchur: Yes. He would have had a thorough patent search made. If I had been aware of the Olson patent beforehand, it would have been easy to protect my patent, which was quite different. But sufficient protection wasn't written in because I hadn't had an adequate patent search made. Again, a matter of money.

Lander: What did the Olson patent actually describe?

Villchur: The central feature was a compliant-mechanical-rim suspension design. There was no general claim for a system that had a speaker mechanism with a free-air resonance frequency substantially below its



optimum operating resonance, and which therefore required a small enclosure. That's what an acoustic-suspension system is, but the judge, who was totally nontechnical, ruled against us. I guess I feel vindicated by the fact that the Smithsonian Institution, in its exhibition on the history of technology, shows two speakers: a bass-reflex unit and the AR-3.

Lander: When asked why you chose not to appeal the ruling, you've cited the example of Edwin Armstrong, who invented the superheterodyne circuit and FM radio.

Villchur: He spent his life in litigation. I figured, "Why waste my time? I have better things to do."

Lander: One of them was promoting AR, and one way you did that was with live-vs-recorded music demonstrations. Audiences at those events got to compare a live string quartet with recordings of the same musicians playing the same pieces.

Villchur: We did them all over the place. We did one at Carnegie Recital Hall. The *Washington Post* gave us half a page when we rented a hall and did it there. We got tremendous publicity. Then we opened up the Music Room in Grand Central.

Lander: That was an offshoot of a display established by Milton Sleeper, a founder of *High Fidelity*. It was in New York City's Grand Central Terminal, where the traffic is unbelievable and a lot of people have nothing to do while waiting for trains.

Villchur: We bought it from him and revamped it so that it looked entirely different and, most important, sounded good. One year we counted a hundred thousand visitors.

Lander: You also maintained a similar facility in Cambridge, Massachusetts. And you had a demo room at the 1963 World's Fair, in New York. AR speakers were never sold in those places, but they must have done a lot for sales.

Villchur: *Stereo Review* used to do an annual survey [of market share by component category]. In the late '50s, we became number one in speakers, and our share increased and increased.

Lander: In 1966, the year before you sold the company, *Stereo Review* put AR's share at just over 32% of the speaker market.

Villchur: And number two would have been 10 or 12%.

Lander: Along with innovative speakers, which you backed with blue-chip warranty service, the textbook-quality ads you wrote, and ingenious promotion, your unique style of running a company had to be a factor in your success. For one thing, you gave your employees substantial benefits. Tell us about that.

Villchur: We had medical insurance for everybody, unheard of in the late '50s, especially for a company our size. And we had profit sharing, which is meaningful only when wages are up to scale or better. We had twice-yearly meetings at which I'd announce what the profit sharing was. The highest figure was 21% of earnings for half a year. That was for the ordinary joe; foremen and top management got more. While it's what I believed in, it really is very good business, because the employees know that the better the quality of their work, the more their bonuses will be. We also made it clear to them that when something comes back because it fails, it takes far more out of the profit-sharing kitty than it ever contributed. Profit sharing stimulated efficient but careful work.

Lander: Tell us about the genesis of the legendary AR turntable, which Roy told me was your baby.

Villchur: I wanted to make a complete system, and I thought the next thing should be a turntable, because our forte was mechanical rather than electronic. I hired a consultant for the job, but about a year and a half and maybe \$25,000 later, what he had was useless. So I had to do it, and I did almost all of it in my lab in

Woodstock in the late '50s and early '60s, just after the AR-3. We thought we could bring it out at \$58, but that was an error. Not too long afterward, we had to raise it to \$78—complete, with everything but a cartridge. By that time, we had a reputation. When we announced we were bringing out a turntable, we had orders for thousands.

When I brought the prototype in from Woodstock, Abe said to me, "How many of these are we going to sell?" And I said, "How should I know?" He said, "Well, you have to make an estimate, because I have to know what to invest in tooling." So I said, "Okay. I'll be optimistic. I believe in this thing. It's a superior device. We're going to sell 50,000 of them before we're through." About 10 years after that—I was long gone from AR, and I was talking to Roy—I asked, "How's the turntable doing?" He said, "It's doing okay. We'll sell maybe 50,000 this year."

Lander: However long gone you may be from AR, you maintain strong views about hi-fi. In fact, you initially balked at doing this interview because you feel that many aspects of high-end audio, such as expensive cables and equipment break-in, are meaningless.

Villchur: The concluding paragraph of a talk I once gave at an Acoustical Society meeting sums that up. I'll read you part of it: "Scientific method allows investigators to form hypotheses in any way they please: out of a cold assembly of facts, intuition, or a drunken stupor....Once a hypothesis is proposed, however, it must be demonstrated rigorously. The audio discipline needs to be brought back to the world of reason."

Lander: Is there room in that world for subjectivity?

Villchur: Objective measurements in audio are primary, but they're useless unless they've been subjectively validated as predictors of musical accuracy. The validation method we used at Acoustic Research was the live-vs-recorded, or simulated live-vs-recorded, comparison. The standard I use today is set by our Woodstock chamber music concerts.

A Glorious Time: AR's Edgar Villchur and Roy Allison Allison

Roy Allison: Bending Boundary Effects

Before other people paid attention to the phenomenon, Roy Allison noticed that loudspeaker measurements taken in conventional home living rooms typically revealed a dip in power response in the 100–300Hz range. That was in the late 1960s, when Allison was VP for engineering and manufacturing at Acoustic Research. In 1972, after designing or supervising the design of nine models at AR, he left to begin an investigation of real-room speaker behavior. Next he teamed up with former AR president Abe Hoffman and two other colleagues from that company, Sumner Bennett and Frank Callahan, who had worked in sales and quality control, respectively. The quartet founded Allison Acoustics to build loudspeakers expressly designed to perform optimally where speakers were generally placed: in the home. The first of them, the Allison Model One, appeared exactly 30 years ago, at the end of 1974. Though the firm curtailed operations about 10 years ago, versions of three original Allison designs are now available from a reincarnated Allison Acoustics, which was later re-formed under new ownership.

image: <http://cdn.stereophile.com/images/archivesart/105allison.jpg>

David Lander: The US Navy provided your first formal training in electronics. You enlisted at age 17, during World War II.

Roy Allison: Yes. They were recruiting electronics technician trainees and giving something called the Eddy test—there was a Captain Eddy in the Navy—to weed out the people who might not be suitable. One of my friends from high school suggested we both go take it because we were both technically inclined. Ironically, he failed and I passed, so I spent just about a year in very intense



training in electronics, with emphasis on radar maintenance. Then they sent me to Hawaii as an instructor. After a little more than two years of active duty, I re-upped in the reserves for six years, and they sent me home. I refused a significant advancement in rank, which I would have gotten if I were willing to ship out for the first atom-bomb tests in the Pacific.

Lander: Enlisting in the reserves led to your being called up again during the Korean conflict. What was your assignment then?

Allison: I was still an instructor, but in Rhode Island, on a submarine that never left the area. That lasted eight months, then my enlistment was up. I was offered officer training but refused.

Lander: After your first period of active duty, you studied engineering at the University of Connecticut. When did you get your degree?

Allison: I never got a degree. I got married—in May 1948, two days after my 21st birthday—and my wife, Nancy, gave birth to our son about 13 months later. I left UConn a year short of a BSEE degree to support them, but I never stopped studying. I soon qualified for membership in the IEEE and then the Audio Engineering Society. The AES eventually granted me a fellowship for original contributions in audio.

Lander: Your first job after that was with a magazine, *Radio Communications*, a trade publication that covered mobile and point-to-point radio. How did that come about?

Allison: On a break from school, I brought my car into Great Barrington [in western Massachusetts], where we were living with Nancy's folks, to have the oil changed. I wandered into a drug store on Main Street and saw these two fellows sitting at the counter having coffee. It was Milton Sleeper and Charles Fowler, and I overheard them talking about needing a draftsman to draw circuit diagrams. I had taken drafting, so I offered my services. That was in 1949. *Radio Communications* barely eked out a living for them. Once in a while, we would run an audio article, and that's when the magazine would make money.

Lander: So Sleeper and Fowler, who at the time were co-owners of *Radio Communications*, started a new magazine called *High Fidelity*. And you, having edged into editing and writing, became one of its—and the hi-fi industry's—first reviewers (footnote 1). Tell us about that.

Allison: *Radio Communications* ceased publication, and I joined *High Fidelity*. Fowler had done subjective testing for the magazine, but I wasn't satisfied with that. We started building and reviewing kits, which were big then, and measuring them. I gradually built up test equipment for making some basic measurements. We didn't really test speakers because they were unknown territory at the time.

Lander: What equipment did you own back then?

Allison: The woofers of choice then were Bozaks. I had four in this huge enclosure stuffed with fiberglass. It was 10' long and nearly spanned my living room. It had to be big because these were not acoustic-suspension woofers; put four Bozaks in a small enclosure and you almost had tweeters. On each end of this box was a Janszen four-panel electrostatic tweeter.

Lander: And the associated equipment?

Allison: At that time it would have been an UltraLinear amplifier from Dyna; UltraLinear was a circuit design. I think the preamp was a Heathkit. And a Minter turntable—string drive. The string was slightly elastic. Wow and flutter were actually very good because the turntable weighed about 25 lbs. I was probably using a Fairchild arm and a Fairchild cartridge.

Lander: In 1959, you moved to the manufacturing sector as assistant to the president of Acoustic Research, Edgar Villchur, and for a time supervised customer service. Tell us about that assignment.

Allison: We had an extremely liberal policy. Even after the warranty period, it was almost impossible to pay for a repair unless there was blatant abuse, and even then we very often fixed the speaker at no charge. Some customers actually sent gifts—a crate of oranges, for example, from people down here [in Florida, where Allison and his wife now live]. We got that more than once. Customers then were mostly professionals—doctors, lawyers—anywhere from age 30 on up. College kids were brought into the fold with the AR-4 in the early '60s, and with the less expensive speakers that followed.

Lander: In 1967, when building conglomerates was the rage, Teledyne added AR to its portfolio of companies. Ed Villchur left at that point, but you got a five-year contract and, along with other senior managers, stayed on.

Allison: To Eddie's credit, he insisted on very generous contracts for all of us.

Lander: You've said he would spend about three days each week in Cambridge, Massachusetts, where the company was located, but his home was in Woodstock, New York, a haven for artists. Does that hint at his management style?

Allison: Almost every day that he was in Cambridge, after the workday was over, we went into Eddie's office and had a conference, which consisted mainly of eating macadamia nuts and drinking Johnnie Walker scotch.

Lander: Red or Black label? [*laughter*]

Allison: Black. There was a liquor locker with all kinds of alcoholic beverages available for the senior executives, including fine wines like Chteau Lafite. We all had company cars—Chevrolets. We didn't even have to buy gasoline; we had a caretaker who checked the cars and filled them with gas.

Lander: A manager could justify all that by saying it kept you at work longer.

Allison: Actually, some useful discussions occurred over the little jiggers of Johnnie Walker Black.

Lander: I'm sure the corporate overseers from Teledyne employed different management techniques. How did they behave?

Allison: We had a relatively uneventful five years under Teledyne, but they bedeviled Abe Hoffman, who had been financial vice president and became president after Eddie left. They insisted on very detailed financial reports, which of course we provided. They insisted on profit plans, which Abe said was like telling fortunes. We did electronics—first an amplifier and then a receiver—and several more speaker models. All the speakers, with the exception of the AR-5, were phenomenally successful.

Lander: The legendary AR turntable remained in the line, of course.

Allison: The turntable provided a big profit. I don't know how many hundreds of thousands sold. That was Eddie's concept. What I did was help in production engineering.

Lander: In 1966, *Stereo Review's* annual market survey indicated that AR had just under a third of the speaker market locked up. What happened between 1967 and 1972, when you left?

Allison: In those five years we doubled sales and doubled profits, but our market share was dropping because the market was expanding. It was sort of like a pyramid, with very low-end stuff building out at the base, but it was building upward, too. Medium and high-end stuff was where the profit could be achieved; a lot of low-end people were flashes in the pan and went out of business after a while. But at the end of five years, Teledyne decided they wanted to exploit that lower end more than we were doing, and they didn't

renew Abe's contract. They brought in a president who was very personable but who was totally unfamiliar with the quality speaker market.

Lander: Did they offer to renew your contract?

Allison: Yes, but not on the same terms. They were going to take away some of my salary and my responsibility for manufacturing. I decided to leave.

Lander: Had you and Abe discussed forming your own company, Allison Acoustics?

Allison: No. He was going to retire. I took time off, but I didn't just put my feet up; I decided to find out what was going on with loudspeakers and room interaction. I'd had a hint of it while doing some papers at AR. There was an unexplained phenomenon—nobody could tell me why it happened: a suckout in the middle bass range in almost every loudspeaker, almost every room transmission curve that we measured. That got my curiosity aroused. I wanted to find out what was causing it.

Lander: The same speakers measured flat in an anechoic environment, did they not?

Allison: Yes. It was the goal at the time, but when you put them in real rooms, they were not flat at the low end.

Lander: How did you begin your investigation?

Allison: I bought Brüel & Kjaer test equipment, which cost the earth, and I set about measuring loudspeakers under varying conditions and doing research to see if there had been any literature about this. It turns out there had been. I came across Waterhouse and Cook's original papers. They were scientists at the National Bureau of Standards, and they had done a lot of experiments in a huge reverberant chamber. They varied the distance of a small test loudspeaker to walls in that chamber and recorded the reverberant energy. They didn't extend their work to the use of loudspeakers in homes, but they did quantify the effect of reflections from room boundaries and developed some very elegant formulas for predicting that effect.

Lander: Were other people concerned with room reflections at that time?

Allison: Not that I know of. Everybody knew about standing waves, which tended to muddy the water and make these other effects very difficult to see. I did a great deal of empirical testing of my own and racked my brain, trying to figure out how to avoid this problem—and it was indeed a problem. Reflections from room surfaces can increase or decrease the power output of a woofer. Reflected energy increases the instantaneous density of the air in front of the woofer at very low frequencies. This provides an improved impedance match, and the efficiency of the woofer is thereby increased, along with the woofer's power output. At some higher frequency that depends on the distance or distances from the room surface or surfaces, the reflected energy goes out of phase with the woofer cone motion. That decreases the instantaneous density, and the woofer efficiency decreases. That's what causes the dip.

Now if the woofer is fairly close to one room surface and distant from others, in most home listening systems, power output in the range between 100 and 300Hz will drop about 1dB below what it would be without the nearby reflecting surface. At very low frequencies, there would be a 3dB increase in power output. That means, given maximum increase and maximum decrease, there's a total variation of 4dB. With the woofer equidistant from two intersecting surfaces, the dip is 3dB; factor in the maximum rise, in this case 6dB, and you have a 9dB variation. If it's equidistant from three surfaces that intersect at right angles, the dip would be a devastating 11dB and the maximum rise 9dB—a 20dB change over the bottom octaves. If the woofer is not on the line of symmetry, which is to say the same distance from all three surfaces, the dip is less severe but can still be significant. In home listening situations, I've found this reflected impedance typically causes variations from 5 to 12dB. If a tuner or receiver exhibited variations like this, it would be rejected out of hand.

Lander: You hold a patent relating to this boundary-effects phenomenon. What does it cover?

Allison: The design of cabinets that get the woofer very close to one or more adjacent room surfaces. That changes the frequency range of the dip, because the closer the woofer is to a surface or to the point where surfaces intersect, the higher in frequency the dip occurs. In the case of a three-way system, it's possible to position the woofer so the dip is above its operating range, and to place the midrange driver far enough away from an intersection for the dip to occur below its range. In effect, that eliminates the problem. This approach really isn't feasible with two-way systems, because the woofer has to handle frequencies high enough to put the destructive reflections within its range. But you can build a cabinet that has the woofer very close to one surface—the best place is on top—and then position that cabinet so distances to the other nearby room surfaces are staggered. Doing that creates mild dips that are spaced along the frequency axis. They aren't able to add in the nonlinear manner that they would if the distances between the woofer and all adjacent room surfaces were equal.

Lander: You then applied all this to speakers meant for very specific room placement. The first, the floorstanding Allison Model One, which had a pair of 10" woofers in each cabinet, and the Model Two, a smaller version that used 8" woofers, were both designed to be backed up to walls away from corners. The floorstanding Model Three needs corner placement to compensate for the dip. Model Four was a bookshelf unit, and there were other models as well. You also designed the midranges and tweeters that your speakers used.

Allison: Developing midrange and tweeter systems that were high enough in quality to complement the woofer we anticipated making was much more difficult. I worked out a configuration that I thought would produce extremely wide dispersion, which I deemed essential. I always wanted maximum dispersion of energy at all frequencies, and preferably the same *amount* of energy at all frequencies, and I set about to get it. That resulted in what was then a unique design for a tweeter-and-midrange configuration: what is essentially half a pulsating sphere. When you make it flexible—from paper—and clamp the outer edge to the mounting plate, then drive it at the midway point, the surface of this driver is going to be forced to change its radius of curvature so that there's a relatively large component of motion at right angles to the voice-coil as well as in line with the voice-coil motion.

Lander: And this gave you the dispersion you were after. Do you still favor paper cones?

Allison: Yes, I do. Not for a woofer, where the material doesn't matter very much as long as it works like a piston. At the other end of the spectrum, I don't want it to work like a piston, because even a small tweeter, if it's big enough to produce any reasonable amount of energy, is going to become directional at very high frequencies. So I have to use a very flexible material, and paper has a nice ratio of stiffness to sound-energy absorption when it flexes. With the right configuration and density and stiffness, paper can behave in a unique way. It's aided in my design by the material used to clamp the outer edge to the mounting plate—a very thin layer of foam, which is pretty effective in absorbing any energy that wants to reflect back from the edge and cause nonuniform response.

Lander: You began corresponding with the speaker expert Dick Small when he was working on his PhD thesis in Australia, and maintained that relationship. In fact, you played the first pair of production Model Ones for him. Tell us that story.

Allison: He and his colleague Neville Thiele were making a speaking tour of the United States and had dinner with Nancy and me and our children. So after dinner we sat them down and played some music for them on Model Ones. Their response was very polite but unenthusiastic. It turned out that they were used to hearing speakers, characteristic of the Commonwealth, that had very precise, pinpoint imaging. The imaging of Model Ones was satisfactory to almost everyone who heard them, but not to people as enthusiastic as they were about the concept.

I had emphasized dispersion in order to re-create as best I could the performance-hall ambience. I don't want to put up with a sweet spot, and I'd rather have less dramatically precise imaging but a close simulation of what you hear in a concert hall in terms of envelopment. For that, you need reverberant energy broadcast at very wide angles from the loudspeakers, so the bulk of the energy has a chance to do multiple reflections before it reaches your ear. I think pinpoint imaging has to do with synthetically generated music, not acoustic

music—except perhaps for a solo instrument or a solo voice, where you might want fairly sharp localization. For envelopment, you need widespread energy generation.

Lander: That could explain why your Allison Acoustics speakers met with what you admit was a mixed response. You've also speculated that their appearance, which I've always liked, put some people off.

Allison: They looked unusual. People didn't expect speakers to look like that, and unconventional things can create suspicion.

Lander: Nevertheless, your volume did become substantial—and that was a time when new speaker companies kept popping up like weeds. At one point, though, sales began to drop off.

Allison: Sales picked up gradually, but we weren't growing as fast as I thought we should have to become really viable in the long run. Our overseas sales, mostly in France and Italy, accounted for a little more than half our total. Then we had a recession, and it really hurt Europe badly. That's when our slide downhill started.

Lander: It's easy to be nostalgic about the past, but music seems to have meant much more to people back in your AR years and in the early years of Allison Acoustics.

Allison: Actually, it was a glorious time.

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