

► An Interview with Neville Thiele

By Steve Mowry

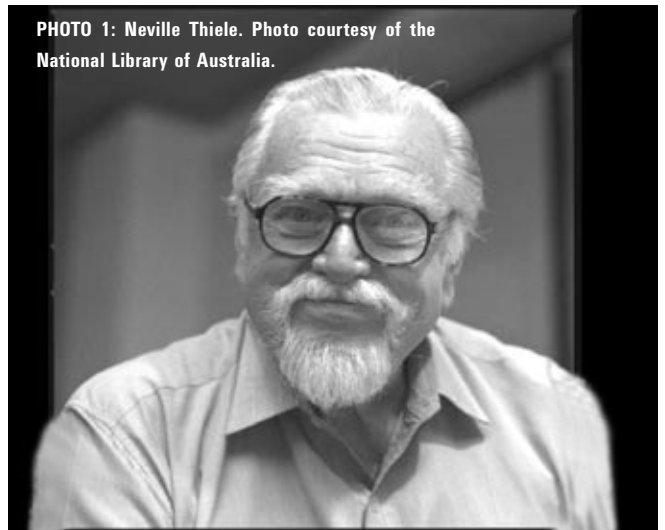
Albert Neville Thiele was born December 4, 1920, in Brisbane, Queensland, and educated at Milton State School, Brisbane Grammar School, and the Universities of Queensland and Sydney. After performing on Brisbane radio stations (as a boy soprano in the early '30s), and later as an actor, he became intensely interested in the reproduction and transmission of sound. After five years of war service in infantry and in the Australian corps of Electrical and Mechanical Engineers, he graduated with a Bachelor of Engineering (Mechanical and Electrical) in 1952.

Joining E.M.I. (Australia) Ltd. in 1952, he was employed as a design engineer on special projects, including telemetry. With the start of television in Australia, he spent six months of 1955 in the laboratories of EMI at Hayes, Middlesex, and associated companies in Scandinavia and the United States, and on return to Australia he led the design team that developed EMI's earliest Australian television receivers. Appointed Advanced Development Engineer in 1957, he was responsible for applying advanced technology in EMI Australia's radio and television receivers and electronic test equipment.

Joining the Australian Broadcasting Commission (subsequently Corporation) in 1962, he was engaged as Senior Engineer, Design and Development, in designing and assessing equipment and systems for sound and television broadcasting. After acting as Director of Engineering ACT, responsible for engineering of the ABC's radio and television studios in Canberra, he was in 1978 appointed Assistant Director Engineering NSW (TV), responsible for engineering of the ABC's Gore Hill television studios in Sydney.

In 1980 he was appointed Director, Engineering Development and New Systems Applications, where he was responsible for the ABC's engineering research and development until his retirement at the end of 1985. In 1991, he became Honorary Visiting Fellow in the University of New South Wales, and since 1994 Honorary Associate at the University of Sydney, where he teaches loudspeaker design in its Graduate Audio Program. He is currently a consulting engineer in the fields of Audio, Radio, Television,

PHOTO 1: Neville Thiele. Photo courtesy of the National Library of Australia.



and Electronic Filter Design.

He has published thirty-eight papers on electroacoustics, network theory, testing methods, and sound and vision broadcasting in *Electronic Engineering* (UK), *Proc IREE* (Aust) (later *JEEEA*), *JAES*, and has spoken at conventions of *IREE* (Aust), *AES*, *IEE*, and *IEEE*. Some of his papers, notably on loudspeakers, television testing, and coaxial cable equalization, have become accepted internationally as references on these topics, including origination of the Thiele-Small parameters for measuring and designing loudspeakers.

In 1968 and in 1992 he was awarded the Norman W.V. Hayes Medal of the Institution of Radio and Electronics Engineers Australia for best papers published during those years in the Institution's Proceedings, and in 1996 he received its Award of Honor. In 1976 he was invited by the Audio Engineering Society (AES) to lecture, with Dr. Richard H. Small, on loudspeaker design in a seminar at the University of Colorado, a convention of the Institute of Electrical and Electronics Engineers (IEEE) in Philadelphia and meetings of the AES throughout the United States. In 1994 he was awarded the Society's Silver Medal "for pioneering work in loudspeaker simulation."

The Institute of Electrical and Electronics Engineers named him co-recipient, with Dr. Richard H. Small, of its 2003 Masaru Ibuka Consumer Electronics Award “for major contributions to the synthesis and analysis of loudspeakers.”

He was awarded the Medal of the Order of Australia (OAM) in the 2003 Queen’s Birthday honors “for service to audio engineering, particularly in the field of loudspeaker design and the development of audio engineering standards.”

From 1969 to 1974 he was involved in standards for broadcasting, as a member of five of the seven committees advising the Australian Broadcasting Control Board on standards for the introduction of Australia’s color television service and Chairman of the Working Party on the Standard Demodulator.

Neville Thiele has worked on international standards for sound and television broadcasting with the International Radio Consultative Committee (CCIR) of the International Telecommunications Union (ITU) in Geneva, where he represented Australia at four meetings in 1980, 1981, 1983, and 1985, and was an active member of CCIR Interim Working Parties on International Exchange of Sound Programmes, Subjective Testing of Television Picture Quality, and High Definition Television.

At the 1985 meeting, he was appointed Chairman of CCIR Sub Working Group CMTT-C-1 on Long Distance Transmission of Analogue Sound. He is currently an active member of the Australian National Study Group 6, on Sound and Television Broadcasting, of the ITU’s Radio Communications Bureau, which has succeeded the CCIR.

He has also been involved in standards for electroacoustics, nationally on committees of Standards Australia (SA), where he was Chairman of its Committee TE/8, Sound and Television Engineering and Recording and is at present a member of its committee IT 29, Information Technology, on digital compression of video and audio, and internationally in committees of the International Electrotechnical Commission (IEC) and of the Audio Engineering Society, concerned with Loudspeakers and Digital Audio.

Thiele is a Member of the Society of Motion Picture and Television Engineers and a Vice President of the Australian Sound Recordings Association. He is a Fellow of the Institution of Engineers Australia and of the Audio Engineering Society, of which he has been Vice President, International Region from 1991 to 1993 and from 2001 to the present. He was President of the Institution of Radio and Electronics Engineers Australia from 1986 to 1988.

His other interests are bushwalking, music, and theatre, and he recently narrated the soundtrack of Bruce Petty’s well-received film, “The Mad Century 1900-2000” for SBS Independent.

Steve Mowry: When I searched the Internet on “Neville Thiele” with Google and Yahoo, I got 10,700 and 10,900 hits, respectively. Did you ever think that you would become legendary within the audio industry?

Neville Thiele: No, I certainly never, even vaguely. People

are very kind to say so. The one thing I did hope was that the industry would pick up the Parameters after I had done them. It seemed to me, so obviously a way to specify a driver nicely. But there hadn’t been a glimmer of interest in the Parameters apart from my personal friends in the lab at EMI. EMI’s management had rejected the Parameters as being an academic exercise with no practical interest. I published my paper in August 1961, left EMI in December of 1961, and went to the Australian Broadcasting Corporation and focused much more on television from then on.

It wasn’t until Dick Small came to the University of Sydney in 1964 and expressed an interest in loudspeakers. One of the lecturers there, Bob Frater, told Dick that there had been quite an interesting paper published recently here and you, Dick Small, might want to read that paper.

So one night, after I had given a lecture as Chairman of the Sydney Division of the Institution of Radio and Electronics Engineers, up came two nice people, Dick Small and the lady later to become his wife, Jane. They introduced themselves and we started talking about loudspeakers.

Dick soon afterwards started a Ph.D. at University of Sydney and became friends with Ernest Benson¹. Then Dick wrote his series of publications, which you know about, for the *Journal* of the Audio Engineering Society, in 1972 and 1973, and had persuaded the *Journal* to reprint my 1961 paper in May and June of 1971. It was only then that people became interested in the Parameters. As far as I knew, Ray Newman and Don Keele at Electro-Voice were the first to use them. But a long time afterwards Laurie Fincham at KEF told me that he had obtained a copy of my Australian paper in 1964 but thought it too valuable to let anyone else know.

Even in the seventies it still seemed that the parameters would not become generally known as a useful device. It wasn’t until about 1980 that you could say just about everybody was using the parameters and realizing that they were a handy way to design loudspeakers. About my getting personal recognition, that has always been a surprise to me. I am just an engineer with a bit of an obsession with quality. That can be quite painful at times.

SM: What do you consider to be your greatest achievement in your career as an audio engineer?

NT: The Parameters, and through them my friendship with Ern Benson and Dick Small. It was more than just an engineering collaboration. We all became very good friends and so were our wives. I used to refer to us as the Sydney Loudspeaker Mafia.

I think I was the first person to describe all-pass crossovers. If you put complementary high-pass and low-pass odd order Butterworths together in a crossover, you got a flat response, but except for a first order crossover it can only be all pass. That was published in Australia in 1975. I described the second order Linkwitz-Riley crossover there too, but dismissed it as not very useful! But that was only published in Australia and all-pass crossovers only became well known generally when Peter Garde published his paper on them in the AES

Journal in 1980.

SM: How long have you been in the industry?

NT: I have been in the broadcasting industry for seventy years. At the age of 12, my brother and I were boy sopranos singing on Brisbane radio. That motivated both of us to a passion for broadcasting. Actually my brother, who passed away ten years ago, became one of Australia's best-known actors.

SM: How did you begin your engineering career?

NT: I graduated from the University of Sydney in May 1952 and started work at EMI Australia in their Special Products lab. I thought that this was really good luck and that I would be working on recording. It wasn't; it was weaponry. We had a contract for telemetry for Australia's rocket range at Woomera. The little rockets went up for two minutes and came down in two minutes. They had sensors for pitch and yaw and other flight data and we measured their speed and range by Doppler. A signal was sent up from the ground at 108MHz, frequency doubled in the rocket to 216MHz, modulated with the data, and sent back to the ground. This was cutting edge electronics. Its pulse signals needed an understanding of transient response and my University course had not covered the Laplace transform. So I had to learn it to handle the rocketry.

SM: Shame on you, ha ha.

NT: During this time EMI had two positions to fill and they asked me if I would like to be a loudspeaker or a television engineer. I told them I would prefer loudspeakers. They replied that they would like me to do television and by the way, if I did, there was a six months secondment to the EMI lab in London. So I became a television engineer.

I was responsible for making EMI's first Australian television receiver that had a 17" tube—quite big for that time.

SM: Was it round?

NT: Oh no, that was the earlier 12".

SM: Was your 1961 paper on the parameters your first?

NT: My first paper was published January–February 1956 on active filters in the English journal, *Electronic Engineering*. I did the work on this in 1953. When I first submitted the paper in 1954, I received a letter that seemed to indicate that the paper had been rejected. In 1955 I was sent to England by EMI to study television receiver design. While I was there, I visited EMI's Abbey Road studios and also decided to look up the editor of the *Electronic Engineering* journal. He remembered me and wondered why I had not returned the paper. Checking again, they found the reviewer had been pretty scathing but thought that it could be worthwhile after a lot of re-writing.

So I rewrote the paper while I was in England, a kind

lady in the EMI lab in London typed it for me, and it was published in two parts in January and February 1956 as "The Design of Filters Using only RC Sections and Gain Stages." It was one of the earliest papers on active filters and I was rather proud of it, but in the end it was overshadowed by Sallen and Key's much more practical configuration.

SM: Could you describe your course within the Graduate School of the University of Sydney?

NT: It is a 26-hour course, which is not as long as I would like to cover the whole subject. It counts for credit towards a Masters by examination. We cover fundamentals of drivers, acoustical/electrical equivalents, the loudspeaker as a high-pass filter, the parameters and how to measure them, box design, crossovers, cables (!), the relationship of the loudspeaker with the room, and subjective listening tests.

SM: How do you envision the role of the AES with regards to the audio industry in the future? With the Internet providing an alternative platform to the *Journal* of the Audio Engineering Society, has the AES considered the possibility of potential loss of technical contributors such as new and/or independent audio engineers publishing technical papers on their own websites?

NT: I prefer to get my information from a more reliable source. I find the Internet helpful, but so much nonsense is published there. The AES offers its *Journal* to members online for a reduced membership fee as an alternative to the printed version. The source of AES papers generally is presentations at conventions. But more recently the *Journal* has added tutorial papers of wider general interest.

SM: What do you consider to be the most important characteristics of a loudspeaker system?

NT: Flatness of response, low distortion, and, through my conversations with BBC Research, balance. If they cannot reproduce the bottom end they don't try to reproduce the very top end. *The Radio Designer's Handbook* stated 50 years ago that the product of the top and bottom cutoff frequencies should be 500,000; for example, 50Hz and 10,000Hz or 25Hz and 20,000Hz.

SM: What impact do you think the migration of the loudspeaker industry to the People's Republic of China will have on the future of loudspeaker technology?

NT: Some of their products are good and some not so good; however, they appear to be improving. I have a friend who purchases loudspeakers from China and modifies them. The enclosures are beautifully made.

SM: I think they need you and me to help them along. Could you describe your innovative crossover filter design, the Neville Thiele Method?

NT: I prefer to describe them as notched crossovers. They have a notch symmetrically in the high-pass and the low-pass responses, to achieve a very steep rolloff rate immediately outside the passband. Beyond the notch, the response rises again, but remains respectably low. They are especially useful when the amplitude, or more treacherously the phase, response of one or both drivers is poor outside their useful band.

SM: How many patents do you hold and which one do you consider to be the most significant?

NT: The attitude in Australia was that patents were not worth chasing. So I only got one when I was at EMI, on how to improve the focus of television picture tubes. When I was with ABC I got a couple of patents but they didn't come to anything. And then of course there is the NTM crossover for WHISE Precision Audio.

SM: I have read several of your papers; however, unfortunately I have not read all 78. Are there one or more papers that stand out in your mind as landmark piece(s)?

NT: With regards to loudspeakers, the parameters in "Loudspeakers in Vented Boxes," its successor, "Loudspeaker Enclosures and Equalizers," "Optimum Passive Dividing Networks" (which described the Zobel network for equalizing the driver's impedance), "The Notched Crossover," "The Air-Cored Auto-Transformer," and two papers on passive crossovers that take into account the impedance and the transfer function of the driver. There is another small, but I believe important, paper on "The Recovery of Amplifiers after Overload."

Half my publications are on television, largely in the Proceedings of the IREE Australia, on linear phase IF amplifiers for TV receivers, on phase equalization, on the equalization of coaxial cable. I was quite proud of one on pulse and bar testing of television equipment that included an atlas of pulse and bar waveforms for various kinds of response errors. One on aperture equalization won a prize in 1968. [For a listing of A.N. Thiele's published papers, go to www.audioXpress.com. —Eds.]

SM: Do you have any advice for new and aspiring engineers within the loudspeaker industry?

NT: Always keep your integrity, but don't be surprised if you get clobbered for it.

SM: What is your favorite loudspeaker system?

NT: I have heard beautiful demonstrations at B&W and Meridian.

SM: What about the Quad?

NT: We did a series of subjective tests at the ABC in 1966 where the Quad came out beautifully, except it did not have

the bottom end. Greg Cambrell made a large electrostatic loudspeaker at Monarch University in Melbourne and demonstrated its response to a square wave input. It is almost impossible for a loudspeaker to reproduce a square wave but Greg's electrostatic produced the nearest that I have ever seen.

Way back in 1946 I bought an Altec Lansing 604-B (for someone else) and thought it was marvelous. Then there were the RCA LC1As that the ABC used as studio monitors, with 15" drivers in 16ft³ boxes. They were wonderfully honest.

SM: The loudspeaker industry seems to have lagged behind other segments of the consumer electronics industry in technological advances. What do you think are the reasons for this?

NT: The loudspeaker is by now a pretty mature technology. A lot of work has already been done. Most of the work today is fine-tuning; however, I think it has a way to go yet.

SM: Other than yourself, whom do you consider to be currently conducting important research into improving sound reproduction?

NT: This must be a very selective estimate but I would say Bob Stuart, Peter Craven, and Rhonda Wilson at Meridian on loudspeakers and lossless digital coding. Then there is Graham Huon in Australia who believes that surround sound is the wrong way to go. He has been working on the perception of depth, as distinct from stereo's equidistant panorama of sound and has done several excellent papers on it.

SM: What do you see as the trends in loudspeaker design and development in the next ten years?

NT: Active loudspeakers with equalization, lower crossover frequencies, and more nearly omnidirectional radiation. They may not be trends but seem to me a better way of doing things. When people ask me what has happened that's new in loudspeakers since 1960, the main things that I think of are iron-neodymium-boron magnets and Linkwitz-Riley crossovers.

SM: Will the moving coil transducer ever become obsolete?

NT: I just cannot tell, but I think it has at least a few more years to go.

SM: Do you know when the moving coil transducer was invented? I thought it was 1944.

NT: My recollection is Rice and Kellogg in 1925, but the Germans point to Werner von Siemens in 1891 and Riegger at the Siemens lab in 1924.

SM: Will the digital transducer ever become a reality?

NT: It is possible. But years ago, I learned an important truth. If you want to know whether something can be done, ask an older engineer. If he says yes, believe him. If he says no, don't believe him.

SM: Are you familiar with the research and development work of my colleague Dr. Wolfgang Klippel?

NT: Wolfgang is on the AES Standards Committee, AES SC-04-03, on Loudspeakers, and his thinking is the clearest of its present members. I admire enormously his work on loudspeaker nonlinearity and recently enjoyed a memorable visit with him and Uta in Dresden, Germany.

Interviewer's note: Having met Mr. Thiele for the first time, I found him to be an amazing man and an inspiration. I have done my best to convey the accomplishments of Mr. Thiele and present an unrehearsed discussion; however, to best describe Mr. Thiele in three words is no easy task. But perhaps they would be **competence**, **attitude**, and **kindness**, all at the highest standards.

REFERENCE

1. Benson, J. Ernest, *The Theory and Design of Loudspeaker Enclosures* (available from Old Colony Sound Lab, PO Box 876, Peterborough, NH 03458, 888-924-9465, custserv@audioXpress.com).