Egbert de Boer 80

Over the past 25-years, Egbert de Boer became particularly well-known and respected because of his contributions in the field of cochlear mechanics. But today I want to stress briefly that this was definitely not the only field in hearing in which he has been active. His doctoral dissertation in 1956[1] immediately received considerable interest, probably particularly so because at the time there was quite a difference between the interpretation of pitch perception by medical hearing specialists (ENT groups) and by auditory biophysicists, such as JF Schouten, who became my thesis supervisor.

Egbert investigated the pitch of 5-tone complexes, in which the distance between the components was fixed at (e.g.) a 200 Hz, and shifted the frequency positions of the tones. He found that a perceived pitch shift that followed the frequency shift linearly: the so-called first effect. Moreover he observed the second effect, which implies that the pitch is greater than would be expected on the basis of an average harmonic shift. For instance, for the harmonic components at 600, 800, 1000, 1200, and 1400 Hz, which produce a pitch similar to that of a 200-Hz tone (mid=frequency divided by 5, its harmonic number), a shift Δf in frequency does not generate a pitch corresponding to Δf/5, the dotted line in his Fig.5.2.2,

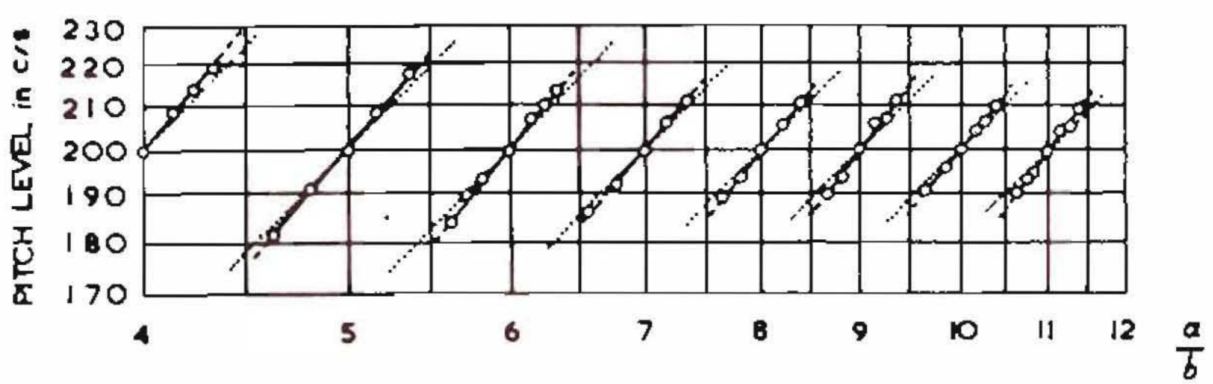

Fig. 5.2.2 Pitch versus centre frequency (b = 200). Each point mean of 5 judgements.

but steeper. In other words, the first effect shows that the pitch is not fixed by the difference frequency of 200 Hz, but it shifts in the direction of the average frequency (the dotted lines), and the second effect denotes the fact that all observations are located on even steeper lines.

Generation and perception of the difference tone was the popular explanation at the time, and Egbert de Boer had developed a crucial experiment that invalidated this theory. In the Netherlands he found some support from Schouten, and in 1962, 5 years after the establishment of the Institute for Perception Research in Eindhoven, Schouten, Ritsma and Cardozo[2] published similar results obtained in an experiment that employed three components.

These crucial results have not been published by Egbert at other places than his thesis, but that has not withheld pitch researchers from all over the world to acquire the information, and cite the thesis extensively.

A second theme in his work addresses the mechanism that underlies auditory frequency analysis. Here his studies also started with psychophysical experiments and theoretical analysis, as in studies involving the critical band[3]. But, given the developments during the 1960s, the tie to frequency selectivity observed in auditory nerve fibers started to demand his interest[4].

Besides getting actively involved in the demanding electrophysiological measurements in single auditory nerve fibers he developed the theoretical method and concept of reverse correlation between neural spikes and the driving stimulus. This method is based on the sound idea that the spikes were a causal response to the preceding stimulus. Revcor[5,6,7] proved to be an excellent analysis tools, even though it is virtually insensitive to nonlinear properties of the system.

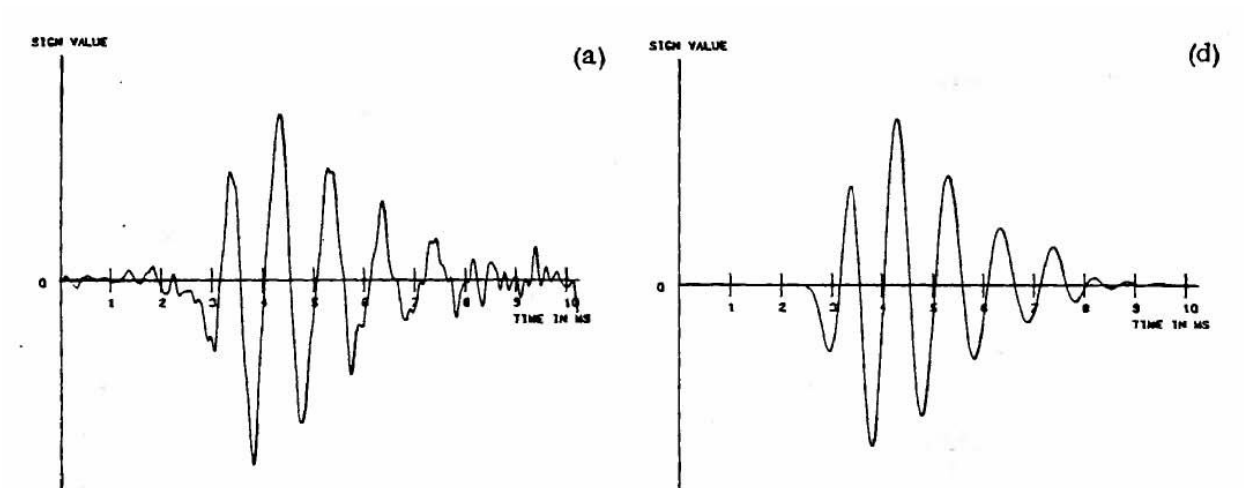

Figure 2: From Fig 6 deBoer & deJongh 1978[6]: measured (a) and smoothed (d) revcor at 1 kHz.

During this period, when I began as a graduate student at IPO in Eindhoven, I learned to know him through the vivid meetings that were organized by the Foundation for Biophysics.

After a number of years it became clear that successful auditory electrophysiology required more effort than Egbert was allotted by the UVA. That initiated the transition to the third main theme: cochlear mechanics. The topic is not entirely unrelated to the other themes, but it is recognized as a different specialization, with a very clear theoretical accent. In that period he started to cooperate quite extensively with mathematicians from Delft University[8] and later on we also cooperated in a common project. It also was the period where his writing became more prominent: both didactically, e.g., in his series of three papers about Auditory Physics in Physics Reports[9,10,11], and also in term of productivity following the demands of the university establishment. One of the experimenters with whom he has been cooperating extensively over the past decades, Fred Nuttall, will tell you more about this line of research.

Over the period that I have known Egbert as a fellow scientist I have benefitted considerably from his knowledge and collegial contact, with many open discussions about converging ideas as well as scientific differences of opinion. And we still agree on a great many points, and at the same time disagree on certain others. Those thrills, ladies and gentlemen, are essential for the advancement of science.
Diek Duifhuis

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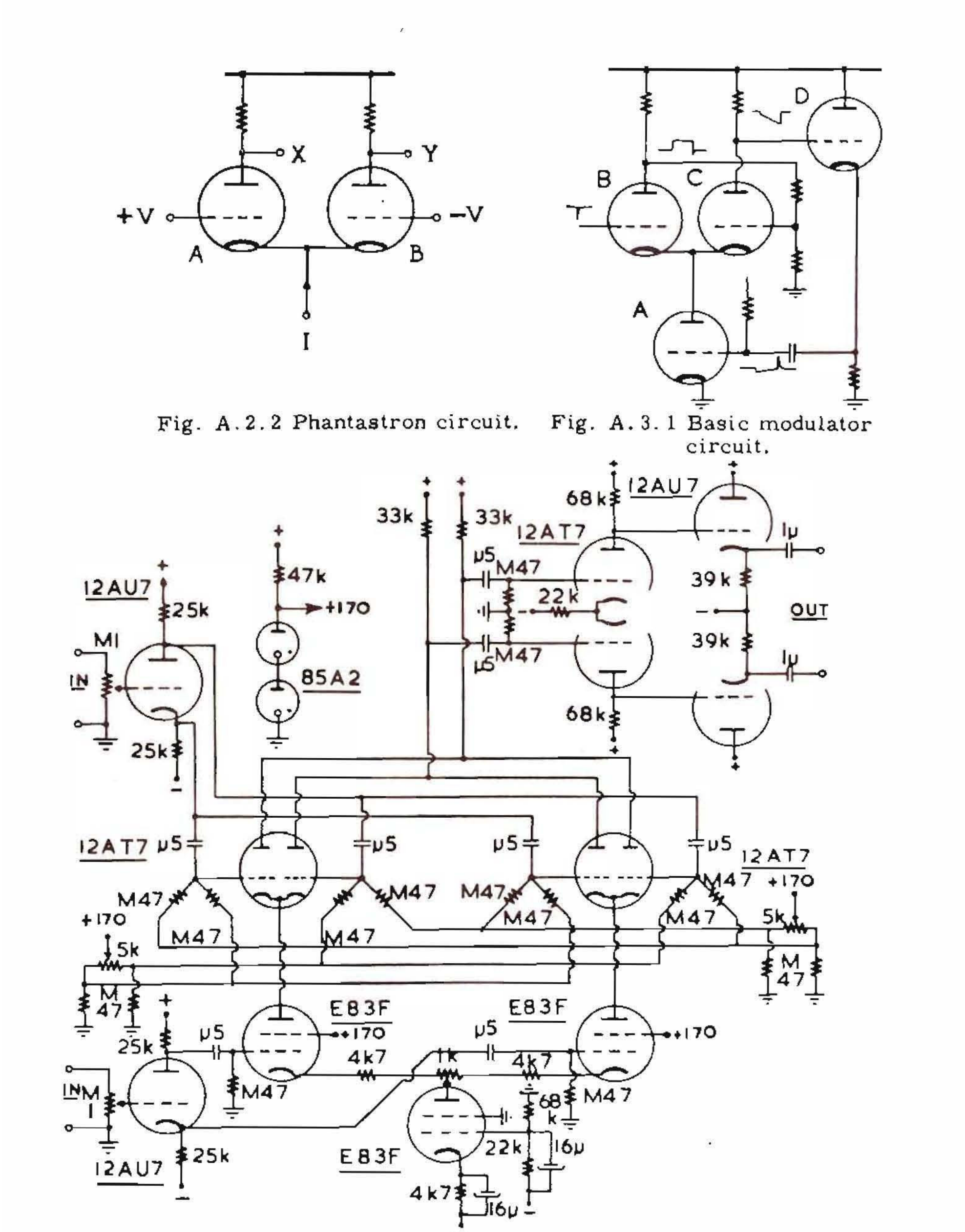

Figure A1: Just one example picture from the appendix of his thesis: the diagram indicating how he built part of his stimulus generator

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