In the introduction to this series I included a quotation from Lord Rayleigh which set forth the philosophy of his Theory of Sound. I didn't do this just to add class, but to illustrate several points which Rayleigh put forth very succinctly.

First of all, any person involved in audio, in my opinion, must recognize that the perception of sound is a personal experience. We have no window through which we can observe this experience in any one else, except our commonly shared impressions. However, as Rayleigh said, we should not automatically assume that the only way we can investigate acoustics is by listening. Because if you identify the physical principles involved in sound you can use those togain a better understanding of this experience as it may relate to yourself and others.

Those who have been exposed to what is loosly called the Philosophy of Science will recognize the tightnope I'm walking here. I in no way want to become engaged in a lively debate on philosophy, yet I need to describe the rationale for what appears to be a successful approach toward bridging one aspect of objective measurement of subjective audio.

The way in which Rayleigh approached the problem was to follow the Golden Road of identifying the phenomena with principles of Mechanics. This puts a handle on things which you can firmly grab and manipulate. That is a correct approach which is in one way or another followed by most analysts today. The only problem with this brass ring on our merry-go-round of knowledge is that you must know when to let go when you get wrong answers.

Rayleigh knew when to let go and he clearly understood and described psychoacoustic properties, such as the perception of pitch, which forced a very careful appraisal of the analysis. Unfortunately, many present analysts persist in hanging onto, and vigorously defending, a symbolic mechanical model even though they know darn well it may not always work. This sort of thing has split some aspects of the audio profession right down the middle. Because it is accepted as bad taste to air one's dirty wash in public view, the regretable consequence has been that almost nobody talks about it.

So that's what I want to do - talk about it - and at least describe one way out of what has appeared to be an unbreakable deadlock.

Shortly after Rayleigh published his work, a smoldering mountain of things-that-didn't-quite-fit exploded into a volcano that showered down on the domain of mechanics. The details are well known, but much of the Golden Road lay buried, never to be seen again.

The reason I mention this is not that acoustics was affected, but that a more liberal view of analysis emerged than could have been anticipated by Rayleigh. No longer could an analysis be considered unacceptable if it seemed weird and you couldn't tie it to a mechanical model. The only test an analysis has to pass is whether or not it is formally acceptable mathematically and if what it predicts actually can be observed to happen.

With that more liberal view, let's take another look at subjective audio. Suppose we accept that each one of us expériences an illusion of sound when we listen to mono, stereo, quad, or what have you. Let's say we don't know how this happens and may never know, but the important thing is that it happens.

This illusion has form so let's think about it in terms of a general geometry. Not just left, right, up, down but also every attribute you need to mentally consider in order to form that illusion. This includes your own experience and training in perceiving that sound which the illusion represents. Pretty weird, eh?

Let's now assume that the program source was a very real sound field in a recording studio and that had you been there when the recording was made you would also have heard a sound. This sound would likewise have resulted in an illusion, in fact the real thing. So we start from a sound and end with a sound. Let's set aside electronically generated signals from this consideration for the moment.

Now we become abstract. Define that original sound image as being represented as a geometrical entity. It is described exactly as you think of it, except the descriptions are somehow mathematically precise. I don't know how to write it down yet, nobody knows. But if you accept the mental image, you accept that it can be described.

Now every time that sound image is changed from one thing to another, it is handled as a processing of the mathematical description. When a microphone picks up the sound, the mathematical description goes from a thing with many dimensions into another thing with one dimension. It is a transformation of the Mona Lisa as a two dimensional painting into a one dimensional string.

Step by step the mathematical description is stretched, squeezed, and possibly bruised through many forms. Finally it is transformed into a description of a sound field by the loudspeaker system. It is

back to the form we can identify with human value judgements.

Now, and only now, can subjective impressions enter the analysis. Prior to that, when the signal was in process, the objective guy has his day. Can you see the subtle distinction that enters when we try to set up such a geometrical model for the sound illusion? The objective guy can make all the measurements he wants to, but the only way he can tie this to the subjective listener is to ask how the final sound image is modified by what he measures.

Suddenly some very interesting results emerge when you start to think of a geometry of perception. For example, an objective measurement on one link of the audio chain, such as harmonic distortion in an amplifier, doesn't mean a darn thing until you chase that deformation through all its forms until it appears as something tied to the final presentation. And the only meaningful query is how does that type of distortion modify the illusion of sound?

That doesn't seem too far fetched, but what can this mean to audio evaluation. Well, for one thing if you think about it, what is revealed is that harmonic distortion in an amplifier is not the same thing as harmonic distortion in a loudspeaker if you use the type of measurement methods now common. In other words, harmonic distortion in a speaker will "listen" differently than harmonic distortion in an amplifier. Now we are beginning to get somewhere.