Acoustics

When working in rooms, spaces, areas, etc. Your surroundings alter the sounds you hear a great deal. Nobody said that what you hear is what is actually played back, just like the way that the ear works by increasing and decreasing certain frequencies naturally.

When in a room, the distance between the wall, floor and ceiling, the dampening of the materials and so on, all work together in altering the sounds.
Most people have experienced to be in a church or other stone type building or anything with a dome, and heard the enormeous reverbs and delays that can occur, but also that you are able to hear people further away than you normally would – or from angles you didn't expect because their voices are guided around the room because of the materials and angles of these.

Many have also tried to listen to music and then walk around the room (the audio engineers most annoying habbit when visiting "normal" people) and hear the altering of the frequencies.
Because standing in corners the bass can be louder, when standing in the middle of a room you might hit the spot where all the frequencies phase out each other or simply where a certain frequency is just at a 0 in pressure and therefore cannot be heard, or at least becomes very subtle.

Acoustic "phenomenons", can also be used to our advantage. It is not all about dampening rooms and getting rid of frequencies, because sometimes we could be in need of increasing the volume of something.

Let's say, a subwoofer – which put in the middle of a room is not to much use.
A subwoofer is "omni directional", meaning that it sends out it's signal in all directions – this is because of the natural behaviour of the lower frequencies which it represents.
Placed in the "middle" of the air, sending out sound in all directions, is called 1/1 omni or 4π.

4π because it can be considered to playback in the four pie like areas of a bubble – representing the omni spreading playback.
So placing it on the floor will be 1/2 omni or 2π. - when cutting the amount of spread to half, we also increase the sound pressure level på 6dB. Meaning the a subwoofer placed on the floor actually plays twice as loud as it's actually doing, and half of the volume comes only from the acoustics of the floor causing the volume increase.

But what if this isn't loud enough? We could then move the subwoofer to a corner of our room and even further half the amount of flooring, compared to the standing on the floor only – which will again halve the amount of π. So it becomes 1π. Or 1/4 omni.
Increasing the sound pressure with further 6dB, now causing an 18 dB increase from what the subwoofer actually plays – basically doubling the value of your woofer, if you can only afford a small one, but need a bigger one, but have a great corner which you can place it in.

Standing waves and room modes

In a room, there is always a mode.
A room mode is considered the frequencies which have their playground there. Any room, no matter how anechoic it may be, has a mode. Maybe a very subtle one, but it's there.
Room modes should not be considered harmful or destructive, but more as a guideline as to why something may sound wrong in a certain room, or maybe even sound better in a certain room but like nothing when you get to another room and setup.

As written earlier, about sine waves and sound in general, sound frequencies are cycles of air pressure changes, constantly being over or under the normal air pressure.
And the amounf of change per. Second leads to our frequency. - and since that we know the speed of sound (or at least can argue a certain physical standard value for this) – we can then determine the wavelength of the frequency.

The wavelength is important to us, because it tells us when the sound/frequency starts and stops, and when it restarts it's cycle.
The speed of sound is considered to be 342 m/second. Some argue that the value 340 is the value to use, others that anything between 335 and 350 is fine. I will argue, that using the value 342,3 is best if this was a physical experiment, but sticking to integers is probably easier, so 342 m/second it is.

Now, it should be noted that this is when we are talking about air, as in free space here on earth at sealevel and 20 degrees celcius (which by now already has ruined the argument of the values because it's very uncommon to have such constant meterological values). Not up on a mountain, at an under the sea enchantment party, in an airplane, no, on plain ground, in a room, sealevel.
The reason for this, is that when altering the atmospheric pressure, the speed of sound changes, altering the wavelength - so under water where the pressure is much higher than one, the speed of sound is faster and in outer space with no air, the speed of sound is zero (0).
(so theoretically your voice is different when atop a mountain or in an airplane, than when standing on the ground).

The wavelength can be determined by a simple calculus.
Wavelength, λ = speed of sound, c / frequency, f.
So: $\lambda = c/f$

So given that the speed of sound is 342 m/second and we need to know the wavelength of 100 hz, we can then divide 342 with 100 and get 3,42 meters.
And what can we use this for then?

This frequency is now considered a standing wave, or the room mode.
But this only works in one dimensional rooms, from one wall to another parallel wall. (hint: building a room without parallel walls and no matching distances between wall, floor and ceiling will greatly reduce the amount of room modes annoying your setup).

A frequency of 100 hz, in a room with walls parallel, hard surfaces etc. Spaced 3,42 meters or half 1,71 meters apart will experience the phenomenon.
The sound itself is not standing still, but the name inclines this, because it's called a standing wave and will be experienced as such, because if you position yourself right in the middle of where the wave crosses 0 in air pressure, the wave, because of the room mode and wavelength – will always have the value of 0 and therefore this frequency cannot be heard in this area.

Which is why walking around a room can sometimes sound like that some frequencies are just not present at some points.

All this room mode talk, is to to give you an idea of how important it is to know about these, and why it explains why so many control rooms, studios and so on, setup in a living room or a bedroom

can sound from bad to useless.
(not saying the home studios in a bedroom can't sound good, but this is a good explanation if this is the case).