from the mains. The idea is to create a single sound source so there is no cancellation interference between sound sources. In this case, a single sub would do, except that it might not have the acoustic power so a clustered group might be used instead.The reason cancellation

level drops appreciably. What this does, in practice, is to make peaks and dips in the listening

constructive and there is no cancellation information anywhere.There is also the matter of coverage. The larger the listening area, the more the need to spread out sound sources. You really can't have a single sound source because the people sitting closest would get blasted out while the far away seats would be too low in volume. So there are usually left and right main speakers, either a flown array or a stack. In this case, it is sometimes better to also put the subs near the mains. That way there is no interference between the subwoofer and the mains on each side.The situation indoors is entirely different, especially in medium to small rooms. Outdoors, there is only one reflector, the ground, and for subs placed on the ground, the reflection provides

source, there are at least four first reflections. The floor bounce may be discounted if the speaker is very close to the floor but even then, you have the direct radiation and three other first reflections that are usually very strong. So what this means is that there is a sea of self-interactions, and those form room modes.Because of the problems of room modes, I think it best to use multiple subs, and to introduce dense interference with them. Instead of trying to keep

the idea is to smooth the average sound field by introducing even more diversity of placements. The grouping of modes becomes so dense as to become indistinguishable from one another.Using multiple distributed subs, the sound field is always made more smooth. The more subs are used, the less important placement becomes. I consider two to be a minimum number, and beyond four you reach a point of diminishing returns. In some cases, two subs are enough to smooth the sound field, especially if the mains have good bass output and all are carefully placed. Add another sub or two and it almost doesn't matter where you put them because there is increasingly dense interference to average the modal region and smooth the sound field.
There are at least two schools of though about placement. Welti suggests using one of a handful of symmetrical groupings, four corners or four wall midpoints being the best. Geddes proposes pseudo-random placement, with one sub in a corner, one sub above the vertical centerline and at least one more sub placed in a random position. I think the best thing is to model the room with CARA to get a rough idea where to place the subs, and measure afterwords if possible to verify and adjust position as required.What I've found is that two subs placed with CARA provide a great deal of smoothing. Four is better, but the improvement going from two to four is not nearly as great as the difference going from one to two. With one sub, the room modes are pretty well defined, two in the right places makes a big difference. Add two more and the averaging is

satisfying the corner bass sound source requirement of either Welti or Geddes arrangements. If

if not in corners, at least one sub should be placed in a corner, perhaps both. Again, model with CARA to get an idea what placements will work best for your room, and measure to confirm if possible.One last thing about room modes and placement. The more damping a room has, the better. Most framed drywall homes have pretty good damping, and some don't really have noticeable room modes. I think that's why some people never complain about them. Even so, you can usually find at least 6dB peaks and valleys, more than that if the room is small and the walls are solid. Add a pair of subs in the right places and you'll cut that in half. You can get in-room response that is quite good.Some rooms have poorly damped walls, and that makes room modes very well defined. Basements with concrete walls are hard to get right. It is best to use some form of false wall panel damper. They don't cost much, just about the same as framing a drywall inside the conrete walls. The difference is night and day.