The Use of Sound Diffusers In Small Listening Rooms:

The total sound(s) that we hear in any given room at a given instant in time are a combination of direct sound(s) from sound sources in the room + indirect, reverberant sounds from multiple reflections in the room associated with direct sounds output from the sound source(s) that were produced at earlier times. For a small room, the time delays (direct *vs*. reverberant sound(s)) are characteristically shorter than for large rooms – concert halls, auditoriums, *etc*.

The reverberant sound also does not have the same frequency spectrum as that associated with the direct sound, for two reasons – frequency-dependent absorption of the sound by various internal surfaces in the room and also the excitation of room modes. Additionally, in small rooms oftentimes the sound at a given frequency f is absorbed before a uniform energy density $w(f)$ of reverberant sound is obtained throughout the room. Thus, the dynamical evolution of the reverberant sound field in a small room in evolving from the initial direct sound to a steady-state can be quite different than for large rooms. Furthermore, in a small listening room, *e.g*. a living room in a house, almost always the room is filled with other items – sofas, coffee tables, lamps, chairs, etc. all of which reflect & absorb the sound in a myriad of ways, from these additional objects located at different places in the room, resulting in even more complexity associated with the reverberant sound field in a small listening room.

The judicious use of sound diffusers in a small room helps/aids in creating a more uniform reverberant sound field in a small listening room, hopefully approximating that associated with a larger room. Whereas flat walls and concave surfaces tend to direct the sound, convex and/or rough surfaces will instead scatter the sound in several, possibly many directions, thereby helping to even out/make more uniform the reverberant sound field. Geometrical shapes attached to room surfaces (*i.e*. walls, floor and/or ceiling) help to scatter and diffuse the sound. Triangular, rectangular and/or semi-cylindrical protrusions on these room surfaces help to scatter the sound in many directions, thereby helping create a diffuse/more uniform reverberant sound field, as shown in the figure below: