I have problems fitting in-ear headphones in the standardized pinna. How does it affect the accuracy of my measurements?

Standard/classic rubber pinnae (like GRAS KB0060/1 and KB0065/6) were originally designed for testing hearing aids or in-ear phones from communication devices with conical or cilindrical fittings:

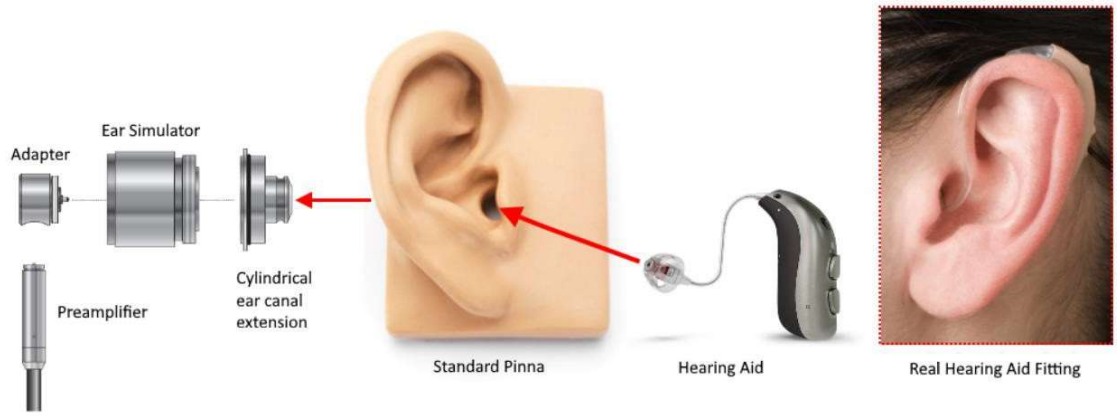

Figure 1. Standard pianne were designed to test hearing aids or in-ear communication devices with conical or cylindrical fittings.

Under the mentioned conditions, having an extremely realistic model of the ear pinna wasn´t a main goal, as the testing wouldn´t really benefit from it.

The ear canal extension connecting the pinna to the ear simulator, as shown in the figure above, is either cylindrical or conically shaped and thus far from the complexity of a human ear canal. While the cylindrical ear canal is relevant for testing hearing aids (often paired with a standardized ear mold), it can be difficult to obtain reliable, repeatable measurements with anthropometrically shapped in-ear and ear-bud headphones and in-ear hearing protectors. Furthermore, the compliance and pliability of the standardized pinna may be accurate in one dimension, but definitely not when it comes to collapsing towards the head. This presents an added obstacle when measuring devices intended to go on or over the ear. This is because the pinna protrusion and stiffness can prevent a good seal and therefore an accurate measure of low frequency performance – both in terms of audio reproduction and ambient noise reduction.

To overcome the above mentioned limitations, GRAS has developed a family of anthropometric pinnae (KB5000/1/2 and KB5010/1). These pinnae were modeled from 3D scans of around 300 real human ear canals. The result is a pinna with a more realistic oval ear entrance point that includes the 1st bend and all the way to the 2nd bend of the human ear canal. In addition to the anatomically correct ear canal, the anthropometric pinna has been made with softer materials to provide better and more realistic flexibility of the outer ear.

All these characteristics will provide more realistic fit for anthropometric shaped in-ear headphones, hearing aids, hearing protectors but also supra aural headphones (due to the more realistic collapsibility of the pinna):

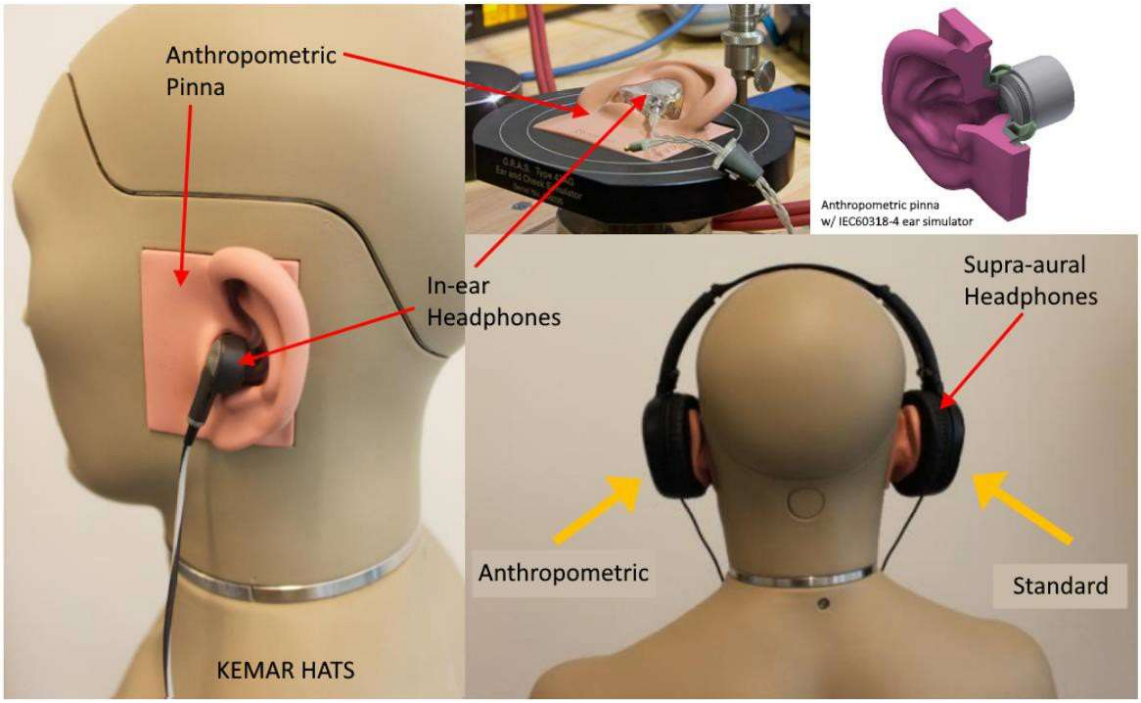

Figure 2. GRAS anthropometric pinna vs standard pinna for headphone testing.

In reality, the use of anthropometric pinna will provide a better fit and sealing that will contribute to the repeatability and overall quality of the test results. The example below shows the results for a frequency response test of anthropometrically shaped in-ear headphones (Figure 36 Left) with standard vs anhropometric pinna mounted on a KEMAR HATS. The in-ear headphones were mounted and dismounted 11 times for each pinna type:

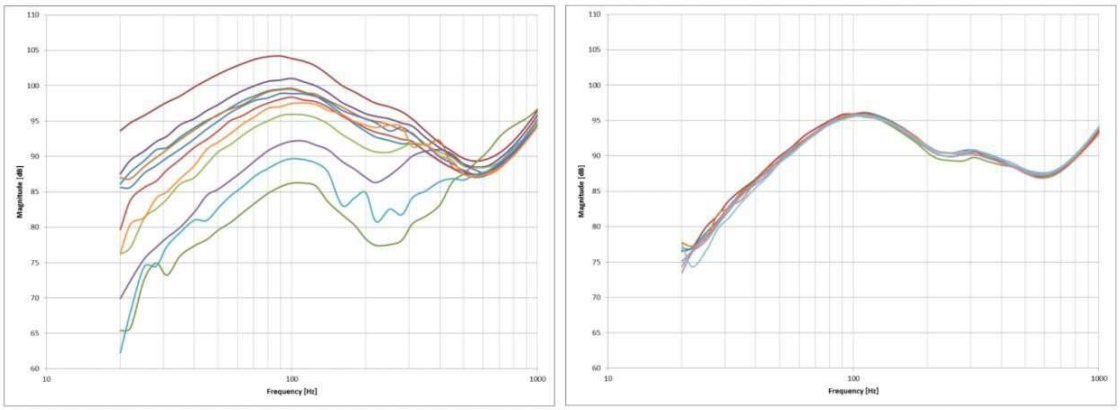

Figure 3. Frequency response test results spread comparison between standard pinna (left) vs anthropometric pinna (right).

The improved fitting and sealing obtained with the anthropometric pinna results in a clear improvement of the measurements repeatability in the entire frequency range of the test.