



# 3D Ear Scanning Has Arrived: The New Path to Custom Hearing Aid Fittings

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*“I enjoy earmold impressions,” said no patient, ever.*

The path to personalized hearing solutions has never been easy or friction-free; it’s filled with one large speed bump—namely, the earmold impression. Ear-mold impressions were first introduced in 1890,<sup>1</sup> and while there have been material advancements over time, the procedure has been relatively unchanged for almost 130 years. Although inexpensive and relatively simple, the process for taking silicone-based earmold impressions is not designed around delivering an exceptional patient experience. Further, new technologies exist that offer a more direct path to custom products, bypassing the physical earmold impression entirely.

### **How Important Is Custom Today?**

Technological advances—notably, the rise of the RIC—along with the challenges related to the path to personalized hearing solutions have resulted in a significant market share decline in custom devices over the last 15+ years. The early 2000s saw a 70% share of custom-fit ITE products in the United States; by 2018, only about 15% of all hearing aids were ITEs.<sup>2,3</sup> All of this makes sense from a baseline economic perspective, as non-custom products require less labor for the manufacturer and less patient engagement from the provider. Still, the question must be asked: Is this the right path for the patient?

Remarkably, “about 80% of all potential customers want a custom hearing aid, but only 10-20% end up buying one, as dispensers tend to guide them towards RICs or BTEs.”<sup>2</sup> Why do people want custom? It’s in line with growing consumer sentiment. “In the era of all things digital, consumers have higher expectations: they want their interactions with businesses and the products and services they buy from them to be personalized.”<sup>4</sup> A 2019 survey by RedPoint Global and Harris Poll<sup>5</sup> finds that 63% of consumers expect personalization as a standard of service. Amidst this trend, patients are drawn to custom hearing products because they want the best possible solution, and the very nature of personalization implies that custom solutions will be better.

Custom-fit hearing solutions—whether full-shell, half-shell, or custom earmolds for RICs—are recognized as potentially improving performance in five key areas:

- Feedback prevention/reduction without constantly engaging feedback cancellation at the expense of battery life
- Stability
- Comfort
- Aesthetics
- Sound quality



**Figure 1.** The Lantos 3D Scanning System launched commercially in March 2019.

With these critical factors, high demand from patients, and presenting a unique product offering that only hearing care professionals can deliver, personalized solutions play a pivotal role in hearing healthcare.

### **How Can 3D Ear Scanning Technology Enhance the Path to Custom?**

When seeking medical assistance, people generally have the reasonable expectation that their provider will be using the very best technology available in order to provide the very best outcome. Looking across the healthcare landscape, 3D imaging and digital scanning have already had a profound impact in dentistry, orthodontics, and ophthalmology. Digitization in these areas creates opportunities to streamline workflows, enhance patient experiences, increase profitability, and improve patient outcomes. The same patients who see audiologists also see



**Figure 2.** The proprietary Lantos membrane (in black) creates a uniform, hygienic, safe environment for rapid capture of the ear's unique geometry

dentists and eye doctors, all of whom have embraced digital scanning and 3D imaging. In the midst of high-tech solutions across the medical landscape, the silicone-based earmold impression process stands out as particularly archaic.

In audiology, a modern digital alternative to the ear-mold impression provides similar benefits to patient experience and workflow efficiency as in other to medical fields. The output of 3D scanning is a

digital image file, which, in the case of an ear scan, can be uploaded directly for manufacturing. In addition to improving the patient experience by eliminating the need for uncomfortable earmold impression taking, it also streamlines the process for custom-fit products. Removing steps like packaging and shipping of physical earmold impressions will save hearing healthcare providers time and money, while reducing the logistical burden of managing these orders. Similarly, hearing instrument manufacturers benefit from this streamlined process, as they no longer need to receive earmold impressions, catalog them, model them by hand, and then create a digital rendering in order to begin production.

So why hasn't a digital imaging solution for the ear taken over in audiology yet? Factors like the tight confines of the ear canal, impediments like cerumen and hair, variability in the ear's natural compliance, and the sensitivity of the aural cavity have added substantial complexity to the development of safe, accurate ear scanning technology.

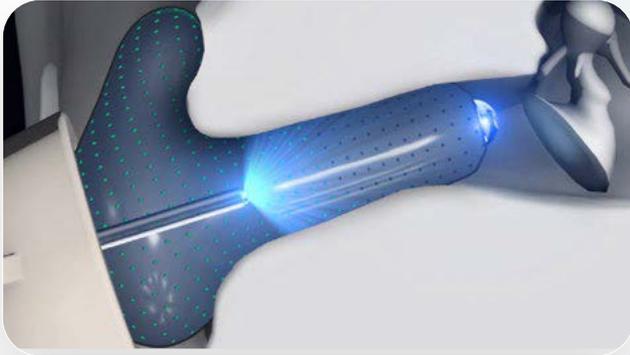
### **Enter 3D Digital Ear Scanning**

Lantos Technologies was spun out of MIT in 2009 by scientists who specialized in 3D imaging solutions for medical applications. In the last decade, the group at Lantos has developed a safe, accurate, user-friendly ear scanning system now available to the market (Figure 1). The key differentiator for the Lantos system, and what enables it to overcome the inherent challenges associated with scanning the ear, is a proprietary membrane-based contact scanning method. The Lantos 3D Scanning System has four key components:

1. A scanner with a movable camera;
2. A conforming membrane made of a soft, stretchy material that inflates in the ear (Figure 2);
3. A proprietary liquid that fills the membrane and is designed to enhance scanning (Figure 3), and
4. LantosView software that stitches the images into a 3D rendering of the whole ear's unique geometry.

## How It Works

The Lantos System uses a camera to provide real-time visualization of the ear canal, through a window on the tip of the conforming membrane (see distal end of membrane in Figure 3). This enables the audiologist to quickly and safely position the membrane in the ear canal, roughly 4 mm from the tympanic membrane (TM).



**Figure 3.** Once the Lantos membrane is inflated, a camera captures the geometry of the ear, using the membrane as a proxy for the ear's natural compliance. rapid capture of the ear's unique geometry

Once in place, the membrane is inflated with a bio-compatible, water-based liquid, where it conforms to the ear's unique shape. As the membrane inflates, it gently pushes away hair and small amounts of wax. The interior of the membrane creates a controlled scanning environment, blocking ambient light and providing a blank canvas irrespective of skin tone. As it applies gentle pressure on the ear, it provides indirect information about where the ear is compliant.

After the membrane inflates, the camera retracts and scanning can begin, starting with the concha. A sequence of still images is captured as the scanner guides the camera around the concha and into the canal. The LantosView software stitches these images together in real-time, creating a 3D rendering of the ear's natural geometry.

The resulting 3D digital image file can be uploaded directly to a manufacturer, and can be used and re-

used to build any number of hearing enhancement and protection products (one scan can result in an essentially endless number of custom devices for the patient). While fitting patients for hearing aids, you can also support their total ear care. The same scan can also be used to provide, for example, swim plugs, sleep plugs, custom hearing protection for musicians or music fans, or custom tips for consumer audio devices. These products all serve to enhance the enjoyment and safety of your patients' daily activities.

## Reviving Custom, Revitalizing Audiology

3D ear scanning for custom-fit hearing products offers the potential to invigorate the entire field of hearing healthcare. For patients, this technology offers an elevated experience that is safe, comfortable, and engaging, while optimizing the path to the superior outcome of a custom-fit personal hearing product. Clinicians can confidently capture the geometry of the ear, quickly and safely, without the risk of a blow-by or challenges associated with surgical ears.

For clinic owners, this technology opens up exciting new marketing opportunities, as well as a new path to custom-fit solutions. Beyond providing protection from the impending pressures of the OTC market, hearing care providers who custom-fit patient devices will likely benefit from the consumerization of hearing healthcare solutions: as more people learn about the benefits of hearing solutions, the population of people seeking personalized hearing products will also grow. Further, because the Lantos 3D Scanning System is cleared for use by the FDA for anyone who is trained to use an otoscope, audiology assistants may be able to perform the ear scan (depending on regulations that vary at the state level), which would free up the audiologist to spend more time on other activities.

This technology is poised to catalyze hearing healthcare and, in an industry on the precipice of a sea change wrought by OTC legislation, it could not be more timely.