



HI-FI+ GUIDE TO PERSONAL AUDIO

Sponsored by HiFiMAN and Echobox Audio





#AUDIOEVOLUTION

Echobox is a company founded and run by music-lovers and audio geeks. We've been watching the personal audio industry for years, researching and analyzing everything from the types of music people listen to, how and where we listen, and, most importantly, the **quality of audio**. The truth is, there are a lot of fashion oriented headphones and earphones in the market today. Most sound mediocre, are built like dollar store toys, or are just way too expensive for the quality they provide. We've founded Echobox to help personal audio evolve in a way that does justice to good music. Our goal is simple: make great sounding audio products that are **well built** and **affordable**.



@echoboxaudio



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www.echoboxaudio.com

The Explorer

The Explorer represents the evolution of portable audio, and our refusal to accept the limitations of digital audio. Smartphones, with their mediocre DACs, integrated, noise-prone circuitry and lossy files, just don't do justice to the emotion behind our favorite music — that's why we've carefully crafted the Explorer using nothing but the highest quality components to recreate a portable listening experience that's as close to real vinyl as it gets on-the-go.



The Finder X1

The Finder X1 is a revolutionary new HiFi earphone that, in many ways, is the first of its kind. Combining innovative structural engineering and the highest quality materials, we have created an earphone that sounds powerful, lively and transparent, while setting a new industry standard for durability.

HI-FI+ GUIDE TO PERSONAL AUDIO

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ENCYCLOPAEDIA HEADPHONICA

The personal audio world has spawned distinctive terminology and expressions all its own and this 'new language' is not always easy to understand. *Hi-Fi+* explores and explains the specialised lingo in ways that should appeal to veterans and newcomers alike.



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FROM THE EDITOR

WELCOME to the *Hi-Fi+ Guide to Personal Audio 2016*. This guide represents the fifth in a continuing series of informative, product-themed, digital buyer's guides published by *Hi-Fi+* over the course of each year.

Personal audio is rapidly gaining traction both within and outside of the high-end audio world—growth that we think will expose a much wider audience to the joys of high quality music reproduction, both at home and on the go. Looking ahead, we foresee several important trends:

- **Sound quality matters:** Headphones, earphones, and their related electronics were once regarded as mere 'accessories', but not anymore. As the personal audio marketplace matures, the sound quality of personal audio components has skyrocketed, compelling music lovers to take them seriously.
- **An explosion of options:** Audio shows over the past year have convinced us there are now more well qualified

and seriously performance-minded manufacturers entering the personal audio marketplace than ever before.

- **High-end sound anywhere and everywhere:** In the past the highest quality personal audio components mostly lived on desktops or in audio racks, but a new generation of portable streaming high-res players means that high quality sound can now follow us wherever we go.
- **High-end sound to fit budgets large and small:** As superb (but admittedly expensive) top-tier personal audio components scale new performance heights, lower and mid-tier components also continue to improve at a torrid pace. Is the era of high-end sound for Everyman now at hand? We think so.

This Guide presents:

- "What's Next?" sections revealing a wealth of new personal audio products,
- Talks with six gifted designers of masterful top-tier headphone amplifiers,

- Interviews with seven forward-looking designers whose products specialise in delivering both high performance and high value,
- 'Think pieces' that ask how, where, why, or even if personal audio has a place within the traditional loudspeaker-centric high-end audio universe,
- An in-depth look at how proper fit can help your earphones sound their best,
- An index of *Hi-Fi+* personal audio reviews from issue 100 to present, and
- An in-depth glossary to explain personal audio acronyms and terminology.

As always, our goal is to help readers to derive deeper satisfaction from the music they love, while having great fun with carefully selected audio equipment and music systems. We wish you all the best personal audio has to offer, and happy listening.

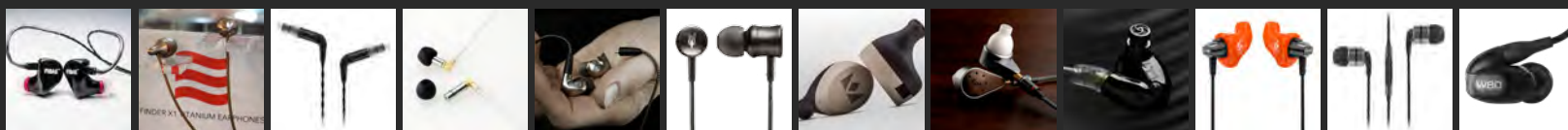
Chris Martens
Publisher, *Hi-Fi+*

WHAT'S NEXT IN PERSONAL AUDIO?

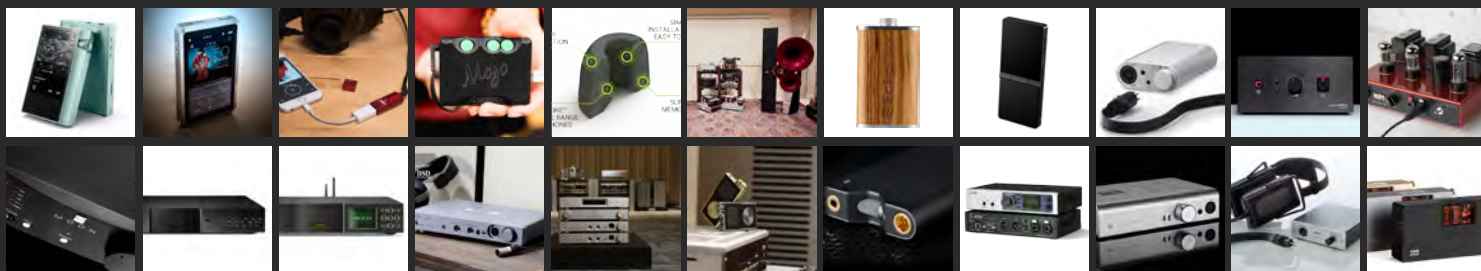
HEADPHONES



EARPHONES AND CIEMS



PERSONAL AUDIO ELECTRONICS AND ACCESSORIES



COOL PERSONAL AUDIO PRODUCTS COMING SOON

WHAT'S NEXT IN HEADPHONES?

In this section we have invited manufacturers of full-size headphones with new products they wish to highlight to submit short and (mostly) fact-centred descriptions of their new models, for our readers' information, entertainment, and edification.

We have asked manufacturers to refrain from submitting product highlights laced with florid marketing bombast, but as you will see some are better at this than others. Even so, we trust you will be able to separate out fanciful marketing claims from the hard facts you'll need and want in order to form your own "must audition" lists for new products you wish to check out. Enjoy.

Abyss Headphones Diana

Diana is the world's thinnest planar magnetic headphone. She's stylish, made in the USA from precision-machined aluminium, offers durable ceramic finishes, and features touch points covered in fine handcrafted leathers and Alcantara®. Diana will have a new robust version of our patent-pending, critically damped planar speaker drivers for hard-hitting bass and excellent detail retrieval. Diana will ship with a custom cable set by JPS Labs.

Diana is priced around USD \$3,000, with expected availability by end of year, 2016.

www.abysheadphones.com



AudioQuest NightOwl Carbon closed-back headphone & NightHawk Carbon semi-open headphone

Descended from AudioQuest's award-winning NightHawk semi-open headphone, the closed-back NightOwl improves upon its predecessor's outstanding fit and finish, provides exceptional sound isolation, and includes a highly durable cable with mic and smartphone controls. Distinct from NightHawk, which features a semi-open design featuring AQ's biomimetic sound-diffusing grille, NightOwl conceals a vent beneath the central circular portion of its ear cups that exits through a hidden airflow-resistive port, creating an aperiodic damping system.

Meanwhile, compared to the original NightHawk, NightHawk Carbon boasts acoustic, ergonomic, and cosmetic refinements; adds a second pair of ear pads; and includes NightOwl's more versatile cable, while retaining its predecessor's low distortion, remarkable comfort, and non-fatiguing sound.

Both models are priced at USD \$699. Expected availability: Fall/Winter 2016.

www.audioquest.com





SONOROUS III

Clear, transparent sound combined with a vast sound stage is generated owing to the driver unit integrated with the front plate.

We've achieved sound quality that faithfully reproduces the source music and is pleasant to listen to.



www.snext-final.com

Base Audio Reflex G7 semi-open-back headphones

The unique design of the G7 headphone allows us to reduce distortion and sound coloration often associated with other headphones on the market today. The semi-open nature of the G7 headphone enables it to produce a wider soundstage and deliver a more transparent sound. Every aspect of music quality and sound reproduction was considered during the design and testing of the G7. As a result, we created an open-air, clean sounding, lightweight headset that is less fatiguing and more enjoyable to wear than many headsets on the market today. The accuracy of G7 headphones makes them a perfect choice for audiophiles, musicians, and professional audio engineers. Made in America, priced at USD \$299.

www.base-audio.com



Beyerdynamic DT 1990 Pro open-back headphones

The latest model in the DT legend series, the DT 1990 PRO is an open-back studio reference headphone for mixing and mastering. Handcrafted in Germany, the headphone offers 250 ohm, 45-mm dynamic Tesla neodymium drivers. The DT 1990 PRO comes with a single-sided, detachable cable with a mini-XLR connector. A soft headband and sets of replaceable ear pads offer comfort during long studio sessions. Accessories include two (differently tuned) pairs of velour ear pads that offer a choice of either analytical or more musically balanced sound characteristics, two sets of 3-meter signal cables (one straight and the other coiled), and a hard-shell premium case. Available now, priced at USD \$599.

<http://north-america.beyerdynamic.com/shop/dt-1990-pro.html>



Final Sonorous III

SONOROUS III employs the same driver technology as the flagship SONOROUS X model and has been tuned for a clear, transparent sound signature with a wide sound stage and heightened bass response. The dynamic driver has been integrated with a polycarbonate-strengthened front plate featuring 30% glass composition to help keep vibration in check.

The SONOROUS III headphones incorporate Final's signature Balancing Air Movement system that optimises the airflow around the whole driver resulting in a powerful and balanced listening experience. SONOROUS III's closed ear cup design and full-size ear pads offer superior sound isolation against external noise. The soft padded headband allows the SONOROUS to offer highest levels of wearing comfort for long listening sessions. Available now, priced at £299.

<http://final-audio-design.com/en/>



HiFiMAN HE1000 V2 planar magnetic headphone

HE1000 V2 remains a cutting-edge, full-size headphone intended for reference use in the home or studio. With a thickness of less than 0.001 mm, its Nanotech planar magnetic driver is so thin it is not visible from the side with the naked eye. New V2 features include an improved headband design that is lighter and stiffer yet that accommodates a wider range of head sizes. The ear cups are also slimmer, further reducing weight and increasing comfort. Beveled ear pads are thicker with a larger asymmetrical angle to yield better bass and improved sound stages. The weight of the HE1000 V2 has been reduced to 420g (14.8oz). Available now, priced at \$2,999.

www.hifiman.com



Meze 99 Classics walnut wood closed-back headphones

Meze's closed-back 99 Classics headphone were conceived to deliver a fun yet balanced sound. Following a successful 2015 Indiegogo campaign, the 99 Classics have won awards and recommendations both for its sound performance and design excellence, especially at its price point.

The 99 Classics features a set of 40mm dynamic Neodymium drivers, enclosed in real walnut ear cups, that deliver Meze's signature 'fun and dynamic' sound. The 32-Ohm 99 Classics are easy for smartphones and tablets to drive, allowing for increased portability while eliminating the need for supplementary amplification. The 99 Classics weighs just 260g and features two sets of Kevlar OFC cables, a 6.3mm adapter, and a hard EVA carrying case. Available now, priced at USD \$309.

<https://mezeheadphones.com/collections.all>



MrSpeakers ETHER Flow and ETHER C Flow planar magnetic headphones

MrSpeakers' new ETHER Flow and ETHER C Flow headphone represent an evolution in the design of the firm's original ETHER and ETHER C models. MrSpeakers discovered that as sound waves passed through the magnet arrays in the original headphone driver motors they experienced diffraction and reflections that imposed resolution-cloaking noise on the music.

To address this problem, MrSpeakers' TrueFlow technology introduces new waveguides on the front and rear sides of the magnet arrays, minimising diffraction and reflections while dramatically smoothing airflow. The result: significant increases in clarity, detail retrieval, and overall smoothness—especially through the upper bass to lower midrange. ETHER Flow and ETHER C Flow headphones include premium DUM-series cables and EVA carry cases. Available now, priced at £1,750.

www.mrspeakers.com

UK Distribution: www.electromod.co.uk



oBravo HAMT-Signature hybrid dynamic/AMT-driver headphones

Last year *Hi-Fi+* editor Alan Sircom reviewed the HAMT-1 and wrote, "Best of all is the sound, which is at once deep and powerful, big and bold, and subtle and refined. It's like strapping a little pair of Wilson Audio loudspeakers to your ears."

The new HAMT-Signature raises the bar yet again. New patent-granted Acacia wood ear cups enhance the acoustics, while new Mundorf Mcaps help the Air Motion Transformer tweeter deliver even clearer, more crystalline highs. A carbon fibre headband has been introduced along with a hollow titanium lifter, removing 80 grams from the total weight, providing excellent comfort. The hand-stitched leather and Alcantara combination adds extra quality and durability. Available in Q4 2016, priced at USD \$3,999.

www.obravoaudio.com

UK Distributor: www.glaive.co.uk



 SCHITT
AUDIO

MrSpeakers



CAVALLI AUDIO



electromod
the sound connection

Sonoma™ Model One Electrostatic Headphone System

Named after the Sonoma Workstation, the world's first multichannel DSD recorder/editor, 'Model One' is the first headphone system from Sonoma Acoustics, a company founded by pioneers of high-resolution audio. Utilizing the revolutionary High-Precision Electrostatic Laminate (HPEL) transducer from Warwick Audio Technologies, the Model One has been optimized for high-resolution audio performance. The system features acoustically-inert, injected-magnesium ear cups; top-grain leather ear/headband pads; custom ultra-low capacitance cables; a wide-bandwidth, low-distortion, discrete FET Class-A amplifier; Reference ESS SABRE DACs; premium AKM ADCs; a proprietary, 64-bit, fixed-point double-precision DSP; premium USB cable; and a high-performance outboard PSU.

The result: superior channel matching, extended bandwidth (over 60kHz), unmatched transient/time response, exceptional low-level detail reproduction, and outstanding comfort. Available Q4 2016, priced at USD \$4,995.

www.sonomaheadphones.com



SoundMAGIC Vento P55 closed-back headphones

SoundMAGIC's Vento P55 on-ear headphone represents the next stage in the evolution of the SoundMAGIC brand. Italian for "wind", the name Vento was chosen by Head Designer, Tony Xu, to express the control the Vento P55 headphone has over moving air. With a three-year development period, the Vento is the first SoundMAGIC headphone where every single component is manufactured in-house. The proprietary driver has been developed from the ground up by SoundMAGIC's team of expert engineers, and tweaked to deliver unrivalled precision and a vastly superior soundstage. With a stainless steel headband, aluminium ear cups and soft leather ear pads, the SoundMAGIC Vento is designed to withstand daily use, but comfortable enough for extended listening sessions. Available now, priced at £189.99.

www.soundmagic-vento.com



Stax SR-L700 electrostatic earspeaker

The SR-Lambda earspeaker range had its start 36 years ago, but 2016 marked the arrival of several important SR-Lambda models, including the top-of-the range SL-L700 model. The SR-L700 is an open-back headphone that incorporates an oval shaped push-pull electrostatic driver—one patterned directly after the driver used in Stax's flagship SR-009 headphone. The driver uses a hand selected thin-film diaphragm and fixed electrodes machined through three-layer stainless etching using a heat diffusion process. To ensure long-term comfort, the SR-L700 features an adjustable 10-click headband assembly and lamb leather ear pads. Completing the package is a low capacitance wide hybrid signal cable featuring 6N pure copper core wires, plus six silver-plated high-purity copper perimeter wires.

Available now, priced at £1,195.

<http://www.symmetry-systems.co.uk>



Ultrason Edition M+ Black Pearl Headphones

Hand-made in Germany, Ultrason Edition M+ Black Pearl headphones are named after the finish of their high-gloss PVD metal-coated cups. Featuring a new over-ear design for mobile use, they weigh just 228g and include a 1.2m cable with gold-plated, angled 3.5mm 4-pole connector and integrated remote control and microphone.

Edition M+ Black Pearl headphones feature Ultrason's S-Logic® Plus technology which utilises decentralised driver positioning, delivering sound naturally to your outer ear, resulting in a more three-dimensional image. They have a frequency range of 7Hz - 39kHz and maximum SPL of 96dB. The ear cups and headband are covered in comfortable, soft Ethiopian sheep's leather and offer superb acoustic isolation properties. Available now, priced at £579.

www.ultrason.audio/english.html

UK Distributor: www.synthax.co.uk/ultrason/

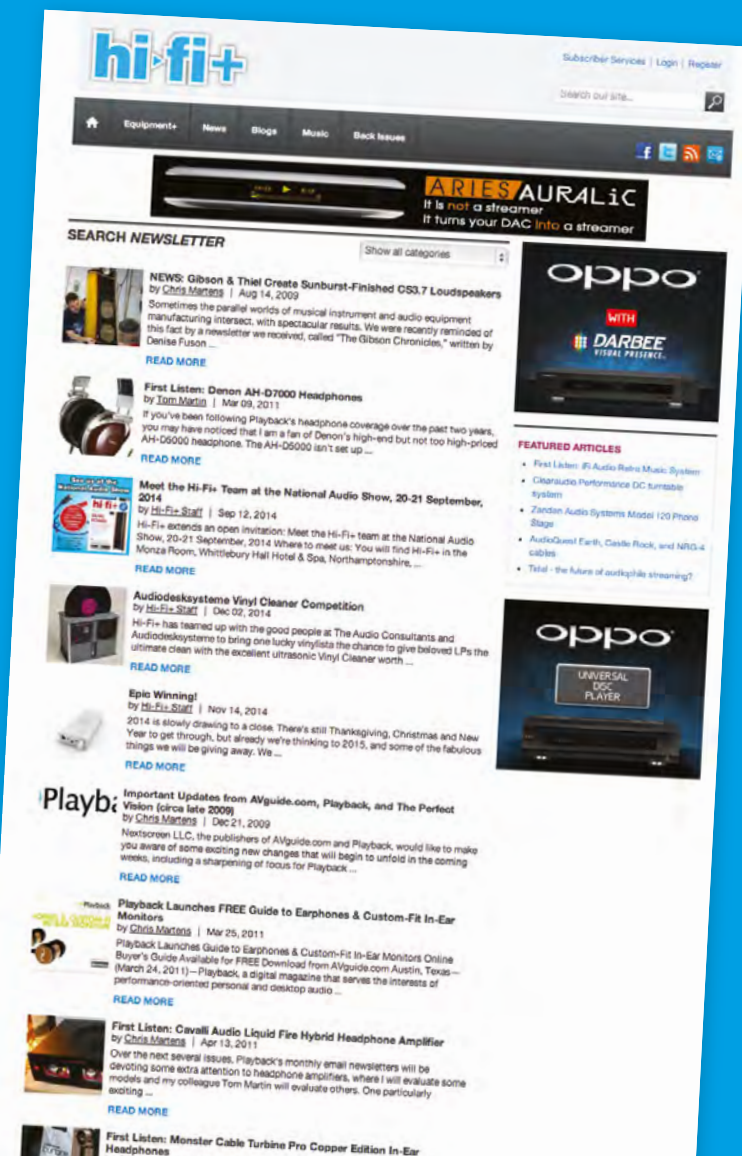


hi-fi+

Want regular updates on the hottest audio products?

Sign up to our weekly newsletter!

Go to hifiplus.com to sign up today



WHAT'S NEXT IN EARPHONES AND CUSTOM-FIT IN-EAR MONITORS?

In this section we have invited manufacturers of earphones and CIEMs with new products they wish to highlight to submit short and for the most part fact-centred descriptions of their new models, for our readers' information, entertainment, and edification.

We have asked manufacturers to refrain from submitting product highlights laced with florid marketing bombast, but as you will see some are better at this than others. Even so, we trust you will be able to separate out fanciful marketing claims from the hard facts you'll need and want in order to form your own "must audition" lists for new products you wish to check out. Enjoy.

Custom Art FIBAE™ design

Custom Art is proud to introduce its patent pending Flat Impedance Balanced Armature Earphone (FIBAE™) technology – the world's first, revolutionary, in-ear monitor design to provide both flat impedance and electric phase response.

Typically the sound of balanced armature-based IEMs varies greatly when they are used with different sound sources.

Custom Art's FIBAE technology changes the fundamental character of balanced armature drivers, changing them from inductive to resistive loads, in the process solving one of the oldest problems in the industry – dependence on output impedance of a sound source for correct earphone output. With FIBAE™ technology your earphones will always perform their best with any DAP or headphone amp.

Single and multi-driver FIBAE models are available. Estimated release: Q4, 2016. Price TBA.

www.thecustomart.com



Echobox Audio Finder X1

By combining innovative structural engineering and the highest quality materials, we've created an earphone that sounds powerful, lively, and transparent, while setting a new industry standard for durability. The Finder X1 features titanium housings, a tangle free silver plated copper cable, German made PEEK diaphragms, and a set of three interchangeable acoustic tuning filters, which allow for customization of the sound based on user preference. Complete with a specially designed carry case designed to help organize your tips (including medium size Comply T-400 Isolation Series tips) and filters on the go, the standard Finder X1 without a mic sells for USD \$199, while the Apple certified microphone-equipped Finder X1i sells for USD \$229. An Android version will follow shortly.

www.echoboxaudio.com



Etymotic ER4-XR

Etymotic's brand new ER4-XR is an earphone for music lovers and hi-fi enthusiasts who want uncompromising accuracy in the midrange and high frequencies, but appreciate a bit of extra presence in the lower end. The ER4-XR is built with precision machined, anodized, and laser-etched aluminium body and offers user-replaceable detachable cables. The package includes an assortment of ACCU-Fit ear tips, with the triple-flange ear tips reducing sound by an average of 35dB and the foam ear tips providing slightly more sound reduction at 42dB.

Etymotic invented noise-isolating earphones, and the ER4-XR continues the tradition of using balanced armature transducers to produce industry leading high definition sound quality and superior noise isolation.

The Etymotic ER4-XR is available now for £329.99.

www.etymotic.com



THE FINDER X1

The Finder X1 is a revolutionary new HiFi earphone that, in many ways, is the first of its kind. Combining innovative structural engineering and the highest quality materials, we have created an earphone that sounds powerful, lively and transparent, while setting a new industry standard for durability.

PEEK Drivers — German-made PEEK (Polyether Ether Ketone) drivers produce an exciting sound signature with unprecedented dynamics and detail.

Titanium Shell — All-titanium shells grant the Finder a unique combination of unrivaled durability and feather-light comfort.

Silver Plating — Silver plating improves the cable's conductivity, ensuring uncompromised signal purity.

Acoustic Filter Tuning — Our acoustic filter tuning system (Bass, Balance, and Treble) helps you find the sound you love, no matter what your taste may be.

THE EXPLORER

The Explorer represents the evolution of portable audio, and our refusal to accept the limitations of digital audio. Smartphones, with their mediocre DACs, integrated, noise-prone circuitry and lossy files, just don't do justice to the emotion behind our favorite music — that's why we've carefully crafted the Explorer using nothing but the highest quality components to recreate a portable listening experience that's as close to real vinyl as it gets on-the-go.

Genuine Wood — Every Explorer is crafted from solid blocks of real hardwood, ensuring a timeless, one-of-a-kind design.

Authentic Sound — TI Burr Brown PCM1792 DAC and TPA6120A2 amp section recreate a rich, smooth, unusually spacious listening experience.

Connected — WiFi and Bluetooth connectivity allow use of apps, streaming services, and cutting-edge peripherals.

T I D A L — Every Explorer comes with a free three month trial of TIDAL HiFi, giving you unlimited access to 40 million CD-quality tracks via streaming and locally stored audio.

GET READY FOR SOMETHING DIFFERENT

Echobox is a company founded and run by music lovers and audio geeks who believe that most portable audio gear is either low quality or overpriced, and we want to help audiophiles step into the digital age. We know that people who truly love their music are never satisfied with "good enough," and listening on-the-go should be no exception.

As a company, we believe in the power of music to change the world for the better. That's why we donate 1% of all company profits to charities that use music to make the world a better place.

Find us on www.echoboxaudio.com



Final F7200

The Final F7200 offers an ultra small, lightweight design for a perfect fit and incredibly high sound isolation. A super-sealed fit close to the eardrum creates a high resolution sound with a wide soundstage and rich bass.

With the F7200, Final meticulously downsized the earphone housing and created a design consisting of the minimum possible elements. With a diameter of 5.5mm and a housing weighing only 2g, this miniaturized earphone is made of stainless steel and inhibits unnecessary vibration and achieves clear sound quality. Final's unique method of using full-range balanced armature drivers across all models recreates bass tones with a fullness you would never imagine from the housing size.

The F7200 is available now for £389.

final-audio-design.com/en/



MEE Audio Pinnacle P1

MEE Audio's Pinnacle P1 earphone is the result of two years of design, engineering, and refinement. With its proprietary acoustic design and innovative zinc-alloy construction, the MEE Audio Pinnacle P1 offers a combination of beauty and performance.

To improve performance at the extremes of the frequency range the Pinnacle P1 utilises a proprietary 10mm moving coil driver with 50Ω impedance. The dynamic driver delivers a full-bodied bass note and slightly warm tonal character while retaining high levels of resolution and refinement. Built to last, the Pinnacle P1 is made of a zinc alloy that is stronger than aluminium and lighter than stainless steel and features interchangeable, replaceable cables with MMCX connectors.

The MEE Audio Pinnacle P1 is available now for £179.99.

www.meeaudio.com/



Meze 11 Neo – a new generation of earphones

This slick earphone was engineered with one thing in mind: to transpose the Meze sound signature in a durable pair of affordable earphones that aims at becoming the “best under \$50”.

The Meze 11 Neo comes in two colour variations: Gun Metal and Iridium. The aluminium casing contains a set of 8mm titanium coated Mylar membrane drivers with a rated impedance of 16 Ω. The 7N OFC cable with mic is compatible with all 3.5mm port smartphones, tablets, and audio devices. With portability in mind, the Meze 11 Neo comes with a carrying pouch also containing a cable clip, spare silicone ear tips, and also a set of Comply™ foam tips. Available now, priced at USD \$49.

<https://mezeheadphones.com/collections.all>



Noble Audio Katana

Here at Noble, we craft some of the finest universal and custom in-ear monitors available today. July saw the launch of our latest model named Katana (priced from USD \$1,850/£1,350), designed to be a co-flagship reference alternative to the more musical Kaiser 10 and featuring nine proprietary Noble drivers per side.

Bringing our latest universal fit geometry and creative aluminium aesthetic to the entire product line, in March we launched our new Classic IEM line featuring the Trident (from USD \$399/£275), Savanna (from USD \$499/£350), Savant (from USD \$599/£420), Dulce Bass (from USD \$699/£485), and Django (from USD \$999/£695).

All models are currently in stock and prices are inclusive of shipping worldwide.

www.nobleaudio.com





oBravo EAMT-1 hybrid dynamic/AMT-driver earphones

oBravo's EAMT-1 is the world first coaxial, hybrid AMT earphone, featuring a 8mm × 8mm AMT tweeter with a 13mm Neodymium Dynamic driver in a unique coaxial configuration. The AMT diaphragm is made of Mylar ribbon, bonded with conductive aluminium strips. The low mass pleated AMT diaphragm is suspended within an intense dipolar magnetic field; when a current passes through the aluminium strips, the ensuing bellows-like motion of the folded pleats moves air five times faster than a conventional cone driver.

As one listener observed, "The thing with these in-ears is that you very quickly stop analysing the music because they're just so much fun and before you know it you've been listening for five hours."

The EAMT-1 is offered with earpiece housings precision made of ceramic (EAMT-1c, USD \$4,799), acacia wood (EAMT-1w, USD \$4,599), and aluminium (EAMT-1a, USD \$4,399) materials.

www.obravoaudio.com

UK Distributor: www.glaive.co.uk



RHA CL1 earphones

RHA recently announced two new High-Res earphones, including the flagship CL1 Ceramic. The latest audio innovation from Glasgow, Scotland, the CL1 features a dual transducer configuration with the CL Dynamic driver and a proprietary ceramic plate transducer. The unique combination uses a passive crossover, dividing frequencies at 8kHz; the CL Dynamic is engineered for rich bass and treble performance, whilst the ceramic plate transducer uses the piezoelectric effect to accurately reproduce high frequencies. The CL1 housings are made of high-density ceramic, with a detachable cable system designed for use with the included OFC or silver-core cables. Eleven sets of ear tips including Comply™ Foam, a protector case, clothing clip, and cleaning cloth are also provided. Available now, at £349.95.

www.rha.co.uk



Snugs Earphones Custom-Fit Tips for IEMs

Snugs custom-moulded ear tips use the latest 3D scanning and manufacturing technology, measuring the exact ear size and shape to ensure a comfortable fit. Snugs tips are available for most popular IEMs, creating a perfect in-ear seal that helps drivers perform at their best, giving powerful bass response, crystal clear vocals, and sparkling trebles.

Constructed of lightweight yet robust soft medical grade silicone material, Snugs tips come in a wide range of colours and can be moulded with different colours for the left and right sides, simplifying channel identification. When travelling or commuting, custom-fit tips also offer the best passive noise isolation, without loss of clarity and detail and with no need for batteries. Available now, priced at £179.

snugsearphones.co.uk



SoundMAGIC E80C earphones

SoundMAGIC created the E80C earphones with the goal of offering studio-level sound quality to everyone. Listening with the E80C opens up the world of studio quality sound with a neutral and poised sound stage that never sounds artificially boosted or enhanced. Equipped with a 3-button remote with automatic switching between Apple and Android smartphones, the E80C is truly versatile. To achieve true-to-the-original sound, the E80C drivers incorporate new high purity copper winding material specially imported from Japan. This material raises the impedance of the E80C's, meaning they will require more driving power to achieve their full sonic potential. A high-resolution digital audio player or headphone amplifier will bring out the best sound. SoundMAGIC's E80C is available now, priced at £79.99.

www.hifiheadphones.co.uk/soundmagic-e80c-in-ear-isolating-earphones-with-mic-gunmetal.html



Westone Signature Series W80 earphones

The W80 features eight proprietary drivers impeccably tuned with a passive 3-way crossover to create an unbelievably immersive listening experience. Masterfully engineered, the W80 makes no compromises delivering reference level audio by integrating full size dual bass drivers with dual mid and quad high drivers--all fed through ALO Audio's proven hi-fi "Reference 8" signal cables. The result is the most comfortable, ergonomically designed earphone on the market with a wider, deeper, and a far more "holographic" presentation with improved dynamic range, increased micro details, enhanced black backgrounds, expansive harmonic content, with tremendous accuracy and an extensive sound stage. The W80 is available now in select countries, and will be available worldwide by November 2016. Priced at USD \$1,499.

www.westone.com



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WHAT'S NEXT IN PERSONAL AUDIO ELECTRONICS & ACCESSORIES

In this section we have invited manufacturers of personal audio electronics and accessories with new products they wish to highlight to submit short and (mostly) fact-centred descriptions of their new models, for our readers' information, entertainment, and edification.

We have asked manufacturers to refrain from submitting product highlights laced with florid marketing bombast, but as you will see some are better at this than others. Even so, we trust you will be able to separate out fanciful marketing claims from the hard facts you'll need and want in order to form your own "must audition" lists for new products you wish to check out. Enjoy.

Astell&Kern AK70 portable high resolution audio player

The new AK70 is the first portable player from Astell&Kern to feature a digital line out via USB for a range of connection options.

Other features include a single Cirrus Logic CS4398 DAC with support for high-resolution audio up to 32-bit/384kHz PCM (downconverted to 24bit/192kHz PCM) and double-rate, 5.6MHz DSD (converted to PCM). The AK70 has 64GB of internal storage with a single microSD card slot for additional storage. The player features Wi-Fi connectivity for OTA firmware updates, streaming music from DLNA compatible devices, and support for the AK Connect app, which controls the player from iOS or Android devices. A USB DAC function enables playback of hi-res audio from a Mac or PC.

Available now, priced at USD \$599.

www.astellnkern.com



Audio-Opus Opus #1 digital audio player

Opus #1 is a new digital audio player from Audio-Opus. The Opus #1 plays all popular lossless audio formats including DSD and PCM files up to 24bit/192kHz resolution and conveys the sound exactly as it should. The included optical output can be used to feed audio data to an external DAC for use with full-size hi-fi systems or dedicated headphone amps to bring out further sonic details.

Slots for two microSD cards of up to 200Gb each, together with on-board storage of 32Gb make the Opus #1 a heavyweight in terms of capacity, and the clear screen and intuitive navigation make it a breeze to navigate through your music collection.

The Audio-Opus Opus #1 is available now, priced at £449.

www.hifiheadphones.co.uk



hi-fi+

See our other guides here



AudioQuest DragonFly Black/ DragonFly Red USB DAC-headphone amp-preamp

Whereas the original DragonFly was designed specifically for use with computers, these latest models incorporate Microchip Technology's PIC32MX microprocessor—a low-noise, high-efficiency solution that enables compatibility with Android and Apple mobile devices. The new DragonFlies also use improved 32-bit ESS Sabre DAC chips—the 9010 in Black and the higher-performance 9016 in Red—both of which employ minimum-phase filtering for naturally detailed sound. DragonFly Red includes the latest ESS headphone amp and a bit-perfect digital volume control residing on the 9016 DAC—a smart implementation that ensures maximum fidelity, dynamic contrast, and signal-to-noise ratio. The latest DragonFlies are software upgradeable through complimentary Windows or OS X desktop applications.

DragonFly Black and Red are available now, priced at USD \$99 and \$199 respectively.

www.audioquest.com



Chord Electronics Mojo portable headphone amp/DAC with supplementary Mojo Cable Pack and USB adaptor module

Chord's legendary mobile DAC and headphone amplifier has become a landmark product in the audio landscape. Hugely capable, it features proprietary technology encased in aircraft-grade aluminium and is even made in the UK. New for autumn 2016 is the Mojo Cable Pack and (USB) adaptor module, the first in a series of supplementary modules for Mojo. The pack comprises a wide range of Mojo-specific connections to accommodate most devices, including USB, TOSLINK cables, and various adaptors.

The new module is indicative of a new range of add-ons for Mojo coming in 2017. Although not confirmed at press time, these are thought to include an SD card storage module, Wi-Fi capability module, and a Bluetooth add-on.

Available now, priced at £399.

www.chordelectronics.co.uk



Comply™ Foam Tips (from Hearing Components, Inc.) launches a new line of precision-engineered universal ear tips

Traditionally, most of the ear tip product families within the Comply™ Foam Tips range have been offered in four size ranges (100, 200, 400, or 500), each designed to fit the differently sized sound outlet tubes of specific groups or brands of earphones.

Now, Comply's new Universal Foam Tips—made with patented SmartCore™ technology—offer a one-size-fits-all solution, allowing shoppers to easily grab a pack of Comply tips secure in the knowledge that they will fit the vast majority of earphones on the market. Comply Universal Foam Tips provide the same sound isolation, secure fit, and soft comfort for which Comply's traditional size- and model-specific ear tips are known.

Available now, priced at USD \$12.99.

www.complyfoam.com/universal





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HIFIMAN pioneered the high-res portable player and remains a worldwide leader. However, for some, our reference players have been too bulky for ultra portable applications.

Enter the SuperMini – a great-sounding, affordable portable that is huge on performance yet compact in size.

Comes supplied with a set of balanced in-ear phones.



Darin Fong Audio - Out Of Your Head virtual speaker software

Darin Fong Audio is the developer of Out Of Your Head software—audio DSP software that replicates the experience of listening to high-end speakers using only headphones.

This software works with all headphones or IEMs, and accurately reproduces the sound of different brands of high-end speakers (in stereo on up to 7.1 channel configurations) with the affordability, privacy, and portability of headphones.

Out of Your Head software is not a crossfeed or Dolby Headphone-like system, but rather is a DSP-modeled solution based on measurements of real rooms with real speakers. Our latest engine offers low latency and is suitable for gaming and streaming applications with 7.1-channel audio.

Available now for PC or Mac, priced from USD \$24.95 to \$149.00.

Online demo at <http://fongaudio.com/demo>

Free trial at <http://fongaudio.com>



Echobox Audio Explorer streaming digital audio player

Since the dawn of the MP3 age, people have become used to bad sound. Most streaming and download services use low-quality MP3 files, and smartphones process audio with mediocre audio components chosen for cost rather than quality. Echobox's Explorer bucks the trend by using professional-grade audio hardware to provide a streaming enabled, hi-fi audio player that recreates a truly lifelike listening experience, along with a unique form factor that is timeless. Explorer is available in four different wood types (Maple, Mahogany, Zebra Wood, Ebony), and features the TI "Burr Brown" PCM 1792 DAC paired with a whopping 4,000 MAH battery. The Explorer ships standard with three months of TIDAL HiFi service.

Available for pre-order now, priced at USD \$599.

www.echoboxaudio.com



HiFiMAN SuperMini portable digital audio player

The SuperMini is a stylish portable player for music lovers on-the-go. In addition to offering best-in-class sound quality, the HiFiMAN SuperMini accepts a wide array of audio formats, is expandable, and easy to operate.

The SuperMini combines ultra lightweight design (2.4 oz.) and compact size with remarkable performance that rivals its larger siblings. The SuperMini's robust output will drive all but the most power hungry headphones and despite its slim chassis, it features both normal and balanced outputs. And to make sure you can enjoy your tunes for a very long time, the HiFiMAN player boasts an amazing battery life of 22 hours. As an added bonus, SuperMini is shipped with a high performance set of balanced in-ear phones so it is ready to rock right out of the box.

Available now, priced at USD \$399.

www.hifiman.com



King Sound M-03 universal dynamic/electrostatic headphone amplifier

The King Sound M-03 is the world's first portable (430g) combination electrostatic and dynamic headphone amplifier. The M-03 amplifier provides a multi-pin ESL output capable of powering all King Sound electrostatic headphones, plus a 3.5mm balanced output for driving conventional dynamic headphones. Analogue inputs are via a faceplate-mounted 3.5mm jack.

The M-03 claims power output of 300vrms (ESL output) or 125mW @ 32 ohms (dynamic output) with frequency response of 2Hz - 24kHz and 112dB SNR. The M-03's onboard 6200mAh battery provides between 10–13 hours of playback time depending on load, or it can be used as a USB power bank.

The M-03 comes in multiple colours with a protective case.

Available now, priced at USD \$450.

<http://kingsaudio.com.hk/m03.html>



Linear Tube Audio MicroZOTL2.0 Deluxe headphone amp/preamp

The Linear Tube Audio MicroZOTL2.0 Deluxe is a headphone amplifier, preamplifier, and 1wpc stereo amplifier. The MicroZOTL2.0 utilizes David Berning's patented ZOTL circuitry, which uniquely eliminates output transformers and their distortion. Unlike other output transformer-less amps, ZOTL puts very little stress on the tubes, giving them a very long life, and has a very low output impedance, allowing the amp to pair with nearly any headphone or speaker. LTA's re-envisioned, upgraded version of Berning's original design has been enthusiastically reviewed by Stereophile, The Absolute Sound, CNET, and several other publications, and is considered a reference for transparency and musicality as a headphone amp and preamp by several reviewers.

Available now, priced at USD \$1,695.

www.lineartubeaudio.com



Moon Audio Dragon Inspire IHA-1 headphone amp/preamp

The Dennis Had-designed Dragon Inspire IHA-1 headphone amp/preamp is a single-ended, zero feedback design using directly coupled 6SN7 triodes. There are no resistors or capacitors in the signal path and balanced outputs are from hand-wound air-gapped output transformers. The power supply features dual filter chokes with valve rectification via 5Y3, 5U4 or 274B valves.

Power output is 1.125w @ 32 ohms or 750mW at 570 ohms The extremely linear amp delivers full bandwidth from 9Hz–33kHz, while THD is close to perfection (second-order and all remaining harmonics are more than 65dB down with the amp driven to 1.125w @ 32 ohms). There are two stereo analogue inputs and one analogue output (via RCA jacks).

Available now, priced at USD \$1,599.

www.moon-audio.com/dragon-inspire-ih-1-tube-headphone-amp.html



MOON by Simaudio Neo 230HAD headphone amp/DAC

The Neo 230HAD headphone amplifier/DAC is based on our reference Neo 430HA: it incorporates a pure analogue amplifier using a transconductance circuit. The 230HAD produces 1 watt/channel @ 50 ohms, with output impedance of just 1.25 ohms. Consequently, it will effortlessly drive most headphones.

The 230HAD DAC section can be used with virtually any digital source and supports PCM files at up to 32/384 resolutions and DSD files up to DSD256. Finally, within the confines of this compact yet stylish chassis is an ultra quiet line stage preamplifier with two inputs and two outputs (fixed and variable). Combine all this with a 10-year warranty and the Neo 230HAD represents a complete desktop solution.

Available now, priced at USD \$1,500.

www.simaudio.com/en/product/101-headphone-amplifier-dsd-dac.html



Naim Audio DAC

Capable of partnering and upgrading a wide range of Naim Audio products, the DAC has more in common with our CD players than with conventional DACs. Its Burr-Brown converter chips, for instance, are also found in our flagship CD555 CD player. The DAC overcomes the jitter inherent in standard digital connections by reading data independent of its timing signal. Its digital filtering, based on a 40bit floating-point SHARC DSP chip running unique Naim Audio code, sets new standards in its class. Our DAC is DSD compatible and able to play DSD64 and DSD128 files and, with eight S/PDIF and two USB inputs, it's adaptable to any system configuration and can grow to meet any need.

Available now, priced at £2,460.

www.naimaudio.com/product/dac



Questyle

Audio Engineering

Reference System Gold Edition

[CMA800P · CAS192D · 2*CMA800R]



Current Mode
Amplification

DSD
Direct Stream Digital



Ultra low THD+N: 0.00022% (20Hz-20kHz)
ROGERS Ceramic PCB



Questyle Audio Technology Co., Ltd | Questyle North America Inc.
Facebook: questyleAudio | Twitter: questyleAudio | Instagram: questyleAudio
www.questyleaudio.com

Naim Audio NAC-N 272 streaming DAC/preamp/headphone amp

The NAC-N 272 combines our latest innovations in digital audio technology with classic analogue preamplifier engineering, complete with a class A headphone amplifier. Paired with one of Naim's power amplifiers, the 272 is an ideal choice for those seeking the convenience of a single-box streaming system with app control, but that crave hi-fi performance. It boasts an impressive array of inputs including high-resolution (up to 24bit/192kHz) UPnP™ streaming, Spotify Connect, iRadio, Bluetooth (aptX), USB, multiroom, TIDAL, and an optional DAB/FM module. Six digital and three analogue inputs cover integration with a range of sources. It's also performance upgradable by adding an optional Naim XP5 XS, XPS or 555 PS power supply.

Available now, priced at £3,400 (£3,705 with DAB/FM module).

www.naimaudio.com/product/nac-n-272



Questyle Audio Engineering CMA600i headphone amp/DAC

Questyle's CMA600i represents a serious attempt to provide many of the benefits of the firm's top-tier multi-component headphone playback systems (for example, the combination of the CAS192D DAC and the CMA800R headphone amplifier), but in a single-chassis design at a far more accessible price. Highlights include:

- Pure class A Current Mode Amplification with fully balanced output design,
- Fully balanced headphone outputs via 4-pin XLR connectors,
- 3X clock with asynchronous transmission structure,
- AKM AK4490 DAC chip,
- Patented "True DSD converting" technology,
- Support for PCM 44.1k-384k /16-32bit converting,
- Support for True DSD64, DSD128, DSD256 and DoP64/DoP128 converting,
- Support for Optical and SPDIF inputs up to 192kHz/24bit, and
- An independent preamplifier circuit also using Current Mode Amplification.

Available now, priced at £1,089.

www.questyleaudio.com/product-600i



Questyle Audio Engineering hi-end headphone reference system

Questyle's hi-end headphone reference system comprises special Gold Edition versions of four key products: the CAS192D DAC, the CMA880P preamp, and two CMA800R amplifiers. What sets these Gold Edition components apart (beyond their distinctive golden faceplates) is their use of special ceramic PCBs along with uprated, selected components, which together give the system superior sonic performance and technical specification. Other benefits include:

- Ultra-low THD+N: 0.00022% (20Hz - 20kHz),
- The lowest permittivity and dielectric loss among similar materials,
- A dielectric constant that is fairly stable across a wide frequency range, ensuring the extremely low signal loss and stable transmission, and
- Ultra-low coefficient of thermal expansion and stable working at 280°C.
- The result is a world-class headphone system

Available now, priced at £10,746.

www.questyleaudio.com



Questyle Audio Engineering QP1r high-resolution portable DAP

The Questyle Audio QP1r is the world's first high-res DAP to offer a fully balanced, pure class A Current Mode Amplification. It supports ALAC, APE, FLAC, AIFF, WAV, WMA Lossless formats and can decode high-res PCM files at resolutions up to 24/192kHz as well as DSD64 and DSD128 files. Accordingly, the QP1r reveals much higher musical sound quality than is possible with typical MP3 players or smartphones. As a hi-end portable DAP, it is necessary to process the highest-level studio formats with very low power consumption, which the QP1r does. With dozens of optimizations for operating system firmware, player programming, and digital audio circuit confirmation, Questyle's QP1r offers a sophisticated yet easy-to-use hi-res playback solution.

Available now, priced at £749.

www.questyleaudio.com/product-qp1



oppo

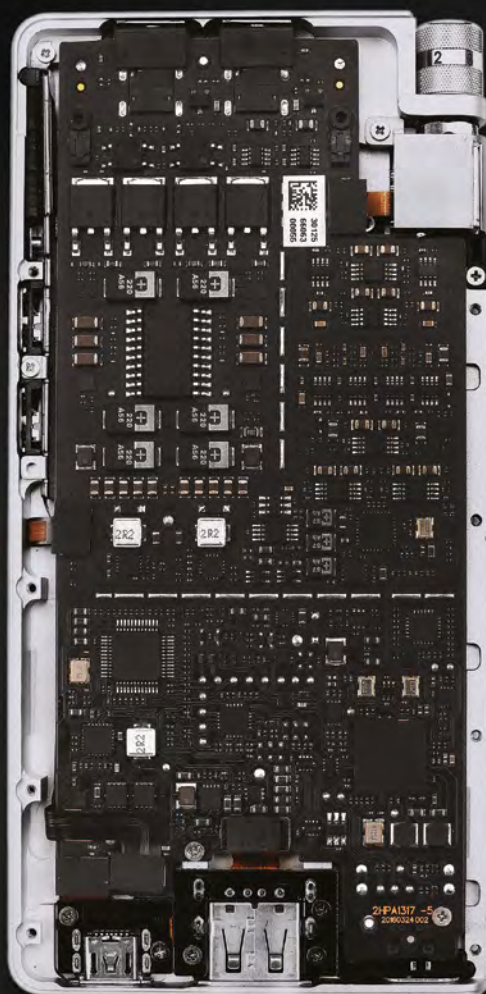
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A HIGH-END AUDIO ENGINEERING MARVEL
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An update to the renowned multi-award winner



Just some of the HA-2 model awards



NEW DAC

Featuring the brand new ESS ES9028-Q2M Sabre³² Reference DAC chip delivering high-resolution performance with extremely low noise and distortion.

High Resolution Audio

Support of PCM up to 384 kHz 32-bit and DSD up to 12 MHz (DSD256) for maximum resolution and compatibility.

Ultra-Slim Design

Our obsession with circuit board design has led to a product so slim that stacked with a smartphone it is still thinner than many amplifier models alone.

Clean Signal Path

By using an analogue potentiometer (the familiar volume knob) and analogue bass boost circuits, we avoid re-digitizing the audio signal for the absolute cleanest signal path.

Rapid Charging

Our patented VOOC rapid-charging technology can get you to 70% capacity in only 30 minutes. HA-2(SE) also functions as an external battery pack for your mobile devices.

Dual Gain

Two gain level settings provide optimal headphone matching, from power-hungry over-ear domestic headphones to the most sensitive in-ear-type earphones.



Read more about this amazing feat of engineering at www.oppodigital.co.uk

RHA Audio Dacamp L1 portable headphone amp/DAC

Unveiled in August 2016, RHA's Dacamp L1 is the company's first portable headphone amplifier and DAC, which features dedicated channel processors. The Dacamp L1 uses one ES9018K2M chip and class AB amplifier per channel to produce high-resolution audio signals for headphones ranging from 16-600 ohms via 3.5mm single-ended or mini-XLR balanced outputs. Compatible with mobile and desktop devices, including Apple iOS smartphones and tablets via direct USB connections, the compact Dacamp L1 draws design inspiration from classic home hi-fi equipment, with aluminium casing and physical dials for gain and EQ control. With a 10-hour battery life and support for the highest quality audio formats including 384kHz/32-bit PCM and DSD256, the Dacamp enables hi-fi listening on-the-go.

Available now, priced at £399.95.

www.rha.co.uk



RME ADI-2 Pro DAC and headphone preamplifier

The ADI-2 Pro is RME's new mastering grade converter, USB 2.0 DAC, and high-end headphone amplifier. The main PCB is a 10-layer design with custom copper thickness, guaranteeing sonic transparency as well as ample but separated power for the headphone outputs. It's fully class compliant, connecting to iOS, Mac, or PC devices, and supports sample rates up to 768kHz and direct DSD playback.

Two state-of-the-art headphone amplifiers, with independent EQ per side, offer a maximum output level of +22 dBu, and maximum output power of 1.5 Watts per channel, constantly delivering the correct power to the drivers in all headphone types, including balanced types, regardless of impedance.

Available in Q4, 2016, priced at £1,349.00.

www.synthax.co.uk



Schiit Audio Jotunheim balanced, discrete, configurable desktop control center

The Schiit Audio Jotunheim goes well beyond conventional headphone amp/preamp/DAC combinations with a unique modular architecture. Owners can choose to use it as "just an amp," or they can add either a balanced DAC module or passive RIAA phono module—and be ready for the future when digital technology changes. Featuring Schiit's fully discrete Pivot Point™ differential gain stage, balanced and single-ended inputs and outputs, and 5000mW power output into 32 ohms, Jotunheim is powerful enough to drive any full-size headphones, quiet enough for use with sensitive CIEMS, and well suited for driving powered monitors (or traditional power amplifiers).

Available now, priced at USD \$399 (as amplifier alone), or USD \$499 (amplifier with optional DAC or phono module installed).

www.schiit.com/products/jotunheim



Stax SRS-3100 electrostatic headphone system

This year the Japanese firm Stax has begun to offer complete electrostatic headphone systems incorporating specific Stax electrostatic ear speakers bundled with matching electrostatic amplifiers (or, as Stax prefers to call them, 'energisers'). One such bundled system, which promises exceptional value for money, is the SRS-3100 system, comprised of Stax's new-generation SR-L300 electrostatic ear speakers coupled with the firm's elegantly simple class A, FET-driven SRM-252S energiser. Although the SR-L300 ear speaker is the least expensive of Stax's new SR-Lambda models, it shares many design features with the more costly SR-L500 and SR-L700 ear speakers. Best of all, the SRS-3100 system gives listeners access to the famously rich and balanced Stax electrostatic sound at a price a tick below £800!

Available now, priced at £795.

<http://www.symmetry-systems.co.uk>



Woo Audio WA8 Eclipse battery-powered valve-driven headphone amp/DAC

The WA8 Eclipse is the world's first all-valve (not hybrid) battery operated headphone amplifier with DAC. This product required three years of development and nine different prototypes. We wanted to build a compact battery-operated headphone amplifier that didn't sound "small". After testing nearly every small amplifier on the market we found they could not compete with our \$699 WA6 desktop amp. So, we set out to make a superior compact amp/DAC and the result is the WA8, which performs at the level of our award-winning WA7 Fireflies.

WA8 Eclipse features the ESS SABRE 24 bit/384kHz DAC compatible with Mac, PC, iOS, and Android. WA8 lets audiophiles enjoy their high-end headphones almost anywhere.

Available now, priced at USD \$1,799 - \$1,899.

<http://woaudio.com/products/wa8eclipse.html>



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COMPROMISE



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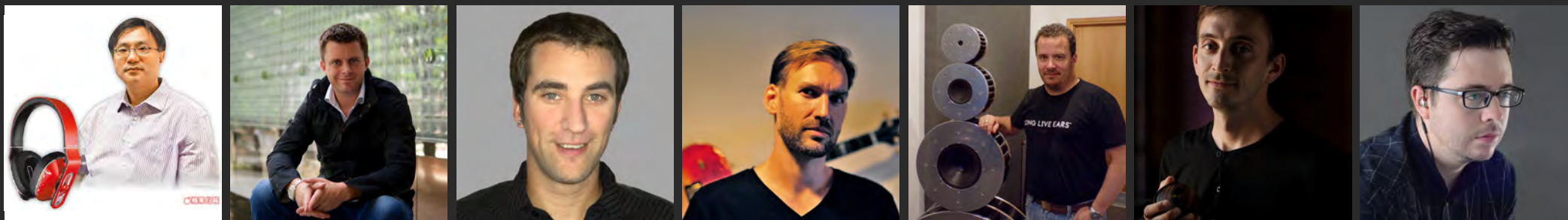
High-resolution, portable DAC and
amplifier with fully balanced configuration
including dedicated channel processors.

MASTER DESIGNERS: PERSONAL AUDIO

SIX OF THE BEST: *HI-FI+* INTERVIEWS MASTERFUL HEADPHONE AMPLIFIER DESIGNERS



HI-FI+ INTERVIEWS SEVEN VALUE-MINDED DESIGNERS: ACHIEVING AFFORDABLE EXCELLENCE IN EARPHONES & RELATED ELECTRONICS



Dr Alex Cavalli of Cavalli Audio

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Alex Cavalli: The impetus was a project my son was working on for his elementary school class almost two decades ago. The project involved tubes (valves), and after giving him some help, my interest in tube amplifiers was rekindled. I thought it might be a fun hobby to build some tube amps again, and found myself wanting to try a few ideas. After some research, I decided to focus on headphone amps because power amps are big and more expensive. I found my way into the DIY headphone world in the late 90s with Head-Wize, and then Head-Fi.org

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

My design interests are in all of these areas: I just don't have enough time to get to them. (Yet.)

That said, we have traditionally focused on designing and building the best desktop headphone amplifiers we can. And we are about to release our first portable amp – the Liquid Spark – to much anticipation.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

I don't think I have a favorite, because my interest is in the designs themselves.

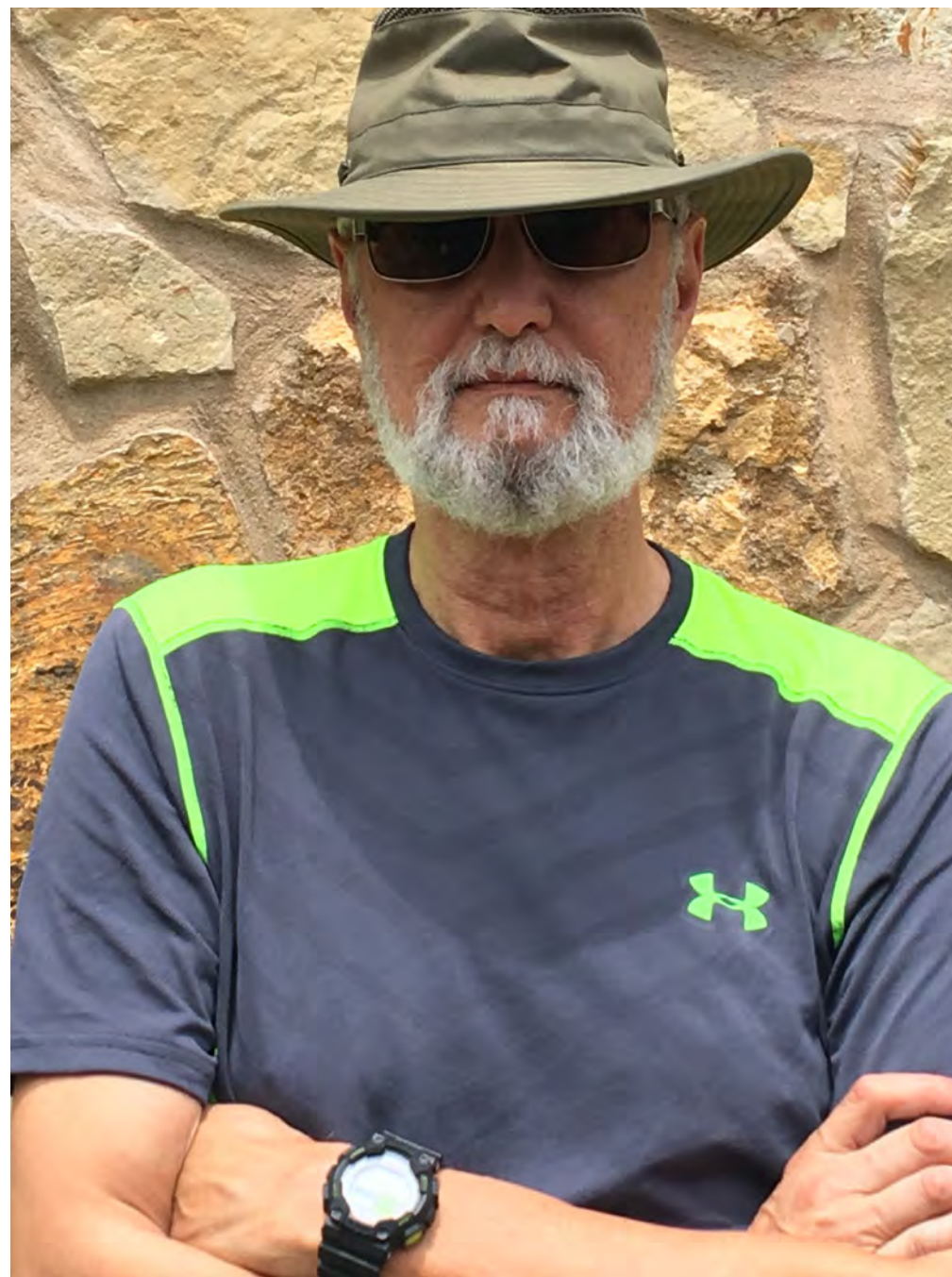
I enjoy starting from a topological level, before moving to solutions to some practical problems. Those solutions may wind up utilizing solid-state devices, tubes, or any combination thereof (hybrids). This is evident in the Cavalli Audio product line, which includes:

- Our solid-state Liquid Gold and Liquid Carbon amps,
- Our upcoming Liquid Tungsten tube amp, and
- Our Liquid Crimson and Liquid Glass hybrid amps.

I enjoy the challenges inherent to each type of design and the effort it takes to make a really good amp in each category.

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

There are some obvious differences and some subtle ones. One primary and obvious difference is that dynamic headphone amps





Cavalli Audio's popular tube hybrid Liquid Crimson headphone amplifier

recognize these differences when designing amplifiers for headphones.

What are the distinctive 'hallmarks' or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

I have been very fortunate to have created some very well regarded headphone amplifier designs. Maybe the best way to answer this is with a comment from a listener at one of our shows. After listening to a Liquid Gold for a while he turned to me and said something like, "I'm paying you the highest compliment I can, your amp sounds like nothing." I always try to create amps that are as transparent as possible within the engineering and price constraints for the target product. I like to think that I've done a reasonably good job of this so far, though perhaps not a perfect one.

are required to deal with a wider range of load impedances than speaker amps. A headphone amp designer needs to account for this.

The flip side is that, in general, headphones tend to present highly resistive loads which makes it easier for a well-designed headphone amp to completely control the drivers, a job much more difficult in

speaker amps with their need for high damping factors to control the voice coils (although, it's also true in my experience that headphone amps generally perform better if they have low, less than 1 ohm, output impedance).

Another obvious difference is power output. Headphones don't need the kind of power that speakers do.

And another difference is sensitivity to noise, especially with IEMs.

The subtle differences are less tangible and have to do with how an amp sounds with headphones. In general, an off-the-shelf speaker amp will not sound terrific with headphones. This means that the "sonics" of headphone amps are a little different from speaker amps, and designers need to

Do you think it is possible to create 'one size fits all' amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

I think this might be possible, though I don't know anyone who has yet achieved it. I do have some designs tucked away for future prototyping that I think can do this, but only after we build them, and after people hear them, will we truly know the answer to this question.



The three peaks of the Cavalli range (L-R): the flagship Liquid Gold, the flexible Liquid Glass, and the Liquid Lightning for electrostatics.

I think the primary issue with a magic amplifier like this is noise. In general the more power the amp has to deliver the more inherent noise is generated in the electronics. The secondary issue is that such an amp will require multiple gain settings that all have equally good sonics. But I still think it can be done.

One trend working in favor of a “one size fits all” solution is that designers of planar magnetic headphones are making them more sensitive, requiring less power to reach ear splitting volumes. The trend working against this concept is that IEM designers seem to be making their IEMs more sensitive too.

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems?

Or, are they simply different to one another? Explain.

This is hard to answer and highly subjective to each person. It is impossible to create with headphones the kind of “wall of sound” and special effects that one can do with speakers. Headphones won’t give you the kick-in-the-gut bass response that speakers can.

Having said this, I believe that headphones are a better listening experience for individual listeners. They are more intimate, can be much more detailed, and their

holography can be spectacular. The nuances of the music, with a good headphone rig, can be quite astonishing. And the closeness of the experience – that is, being immersed “inside your head” – is impossible to create with speaker systems (at least so far as my experiences go).

Maybe what we need are headphone amps with subwoofer outputs so that with open back headphones you can have physically driving bass with the headphone experience. In fact, one Liquid Gold owner has tried this.



What are four of the most revealing headphone or earphone demonstration tracks you've heard thus far?

Here are 4 +1 that I like.

- 'Bubbles' – Yosi Horikawa – *Wandering* (EP).mp3

Some pretty avant garde stuff, especially with regard to the texture of the sounds.

- 'Shine On' – Eric Bibb – *Diamond Days*.mp3

Bluesy, but with a Rock beat and tempo so that it's very approachable.

- 'Dreaming in Colour' – Art of Noise – *The Seduction of Claude Debussy*.mp3

It's an electronic classic that has every electronic music cliché in it, and it even contains female vocals to boot.

- 'Gabriel's Oboe' – Yo-Yo Ma – *Yo-Yo Ma Plays Ennio Morricone*.mp3

Just a beautiful piece of music performed exceptionally well.

- 'Get Your Hopes Up' – Taylor Eigsti – *Lucky To Be Me*.mp3

Just because we all need some Jazz now and then.

The innovative Liquid Glass allows the headphone user the ultimate in 'tube rolling', thanks to a variety of bases for different valves!

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

My answer to this is always the same, especially when asked by potential customers what choices they should make. I always say, the most important thing is that you are happy with the listening experience you are having. You can't do any better than to really enjoy and appreciate listening to music through your system.

But I also would say, take some time to find out what's out there. Find out what's really good and what maybe is not. More and more products and manufacturers are entering this once small community of high end headphone listeners. There is much to learn about, with more to learn at nearly every show as new products are continuously unveiled.

But the key here is to listen, listen, listen.

In five years' time, how do you anticipate that the world of personal audio will have changed?

A couple of things. I think the trend towards higher value at lower cost, for most of the market, will continue. I also think that our industry is in early stages of consolidation, which will create some larger and more mature personal audio companies. How this will happen is not yet clear, but I definitely think it will, to some degree, beginning soon. +

Thorsten Loesch of iFi Audio

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Thorsten Loesch: iFi is a subsidiary of AMR, which allows for quite a bit of 'trickle-down' technology that would have otherwise not been accessible to the mass market. From digital to analogue, from tube to solid-state, we take what we've learned from AMR and apply to the more 'miniaturized' tech that you see in iFi.

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

The majority of our products are geared to match the kind of devices that real world people use in their day-to-day lives: computers, smartphones, tablets, and gear of that sort. That being said, we also enjoy creating unique solutions at both ends of the proverbial hi-fi extreme. For example, we have the Pro iCAN, which is a high-end headphone amplifier that can also serve as an ultra transparent line-stage pre-amp that boasts of separate tube and solid state circuits.

At the opposite end, we have the iPOWER 5v, which is an audiophile DC power supply for customers who use devices like the Raspberry Pi as a computer audio source. Both products are unique in their own right.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

Audio is subjective. This is something that many people lose sight of. Because of the very nature of how we as people respond to different aural palettes, we work hard to give our products the kind of flexibility that allows the customer to help fine tune the sound to meet their own preferences.

Now when it comes down to the famous question of tube vs solid-state, the truth is that we love both!

For sure, good sound is easier to obtain with tubes, but with today's understanding of solid-state, a transistor-based design should not sound poor. The big question to us is: why choose one when you can have both? This is why the Pro-series headphone amp/preamp has two very special and uniquely switchable tube (2xGE5670s) or solid-state (J-FET) circuitries.

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets





headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

In principle, the challenges are similar. There are some differences, however. With headphones, noise floor levels that are easily tolerated in a speaker-based setup can quickly become obnoxious.

When it comes to headphone amplifiers vs. pre-amplifiers, the simple fact is that there are many headphones in the market that require more available current and/or voltage output than what the common pre-amplifier circuit can provide.

As for the headphone amp vs. a traditional power amplifier: The standard power

amplifier is optimized for high power, which means it tends to sound worse when it is fed relatively low-signal levels that you find with headphones.

So dedicated designs are needed. We've come to find that the common pro-audio derived 'cookie cutter' designs that mate cheap Op-Amps with a discrete Class B transistor stage simply don't cut it.

What are the distinctive 'hallmarks' or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

In an ideal world, the perfect amplifier would be completely neutral. In the real world, however, this is never the case. Since

Moving away from the portable, the Pro iCAN is iFi Audio's desktop flagship headphone amp.

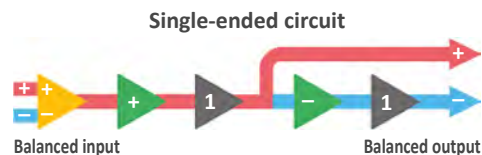
adding more circuitry rarely improves the performance of an audio component, we like to keep the signal circuitry as simple and direct as possible.

For example, the Pro iCAN headphone amplifier literally uses a single active-stage (duplicated for the second polarity in the balanced signal path); whereas in competing designs we have found anywhere between three to five stages daisy chained together!

The Pro iCAN circuit...



...compared to this more commonly found circuit.



Furthermore, we are all aware that both the recordings we love and the devices we listen on are far from ideal. We've looked into many of the DSP 'fixes' that have been

around for some time now, yet in even the highest quality systems, we've found that DSP tends to impede sound quality.

So what we've done is implement two distinct technologies that allow for a more realistic listening experience. The first unique solution is X-Bass®, which is designed to correct headphone/speaker low bass response. This is complimented by our second unique solution, the 3D-Holographic® Matrix. This circuit corrects certain distortions within most music recordings, and will give both loudspeaker and headphone users a wider, more realistic sense of acoustic space.

We implement these technologies by analogue means and do so without compromising the minimal signal path. X-Bass® and the 3D-Holographic® Matrix are designed in such a way that, if bypassed, they literally disappear from the signal path and do not exist and are not enabled. They form an integral part of the circuit as if designed in from the go.

Do you think it is possible to create 'one size fits all' amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

Covering the headphone sensitivity spectrum between the 83dB/1V AKG1000's and the most extreme IEM's (rated at 132dB/1mW/32 ohm) at 147dB/1V is a challenge—and that is putting it mildly!

We believe we have answered this challenge with our products.

The micro iDSD is the world's first (and as far as we know) the only portable DAC/headphone amp to be shown to match power hungry headphones such as the HiFiMAN HE-6 (90dB/1V) while also performing brilliantly with ultra-sensitive IEM's such as the Shure 535-LTD (133dB/1V). We actually use both of these in our own demonstrations. The micro iDSD does this thanks to a number of iFi's unique technologies, with iEMatch® at the forefront.

It's also worth noting that our Retro Stereo 50 all-in- one Tube HiFi system includes separate outputs for normal headphones (6.3mm) and IEM's (3.5mm), with each delivering the correct loudness for each device type.

The flagship iCAN Pro iCAN draws on the same ideas, but uses different implementations to allow the widest possible range of headphones to be operated with equal quality.

Finally, for users of products not equipped with iEMatch® (iFi and others) we offer iEMatch® technology as a stand-alone adapter product to help match high-sensitivity IEMs and headphones with normal sources, such as A/V receivers, airplane entertainment systems, computers, etc.

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems? Or, are they simply different to one another? Explain.

Headphone and speaker based systems are in many ways like oranges and apples. Both can be sweet and juicy (or not) and both are definitely good for you.

Factors other than just sound quality play a big role today. In modern urban living situations, playing music (or movies) at realistic levels via speakers is often just not possible. Headphones become the only viable choice for anything loud except the occasional lease-breaking party.

Yet headphone and speaker-based systems are rather different in how they present music. Open- back headphones vs. IEM's show their dichotomies in sound presentation.

With common recording techniques headphones/IEM's often suffer the greater disadvantages over speakers (since most recordings are made for speaker replay, not headphones), yet by the same token, getting a speaker-based system to play as loud, low, and clean as well as an intelligently put-together \$ 1,000 headphone system is a major challenge, regardless of cost!

Correcting some of mismatches between recordings and playback can help all kinds of systems to offer great realism and great

Core to the range is the iFi Audio Micro iDSD combined portable DAC/headphone amp.

enjoyment of music, be it using speakers, large size headphones or IEM's.

Of course, replicating the experience of a live concert, be it at the Royal Albert Hall, in Glastonbury, at a huge stadium, is never going to happen. Still, we strive to get as close as possible to the feeling of a live musical even, regardless whether the means used come in the form of a traditional set of loudspeakers or a pair of headphones.

What are four of the most revealing headphone or earphone demonstration tracks you've heard thus far?

We prefer that our customers try our equipment with their own music. There is no accounting for taste and people from different continents favour very different music.

However, the following are frequent in our own demos (list far from complete):

- **Saint-Saens: Symphony No. 3, Maestoso [CD] – Decca 4307202**
This large-scale classical piece can produce a wide and enveloping soundstage, if combined with the correct 3D Holographic® Matrix setting for the headphones used.



The large dynamic range challenges many speaker systems but is rarely trouble for headphones.

- **O-zone Percussion Group: 'Jazz Variants' from La Bamba [CD] – Klavier Records 77017**
Explosive dynamics from virtuoso percussionists make this an adrenaline-junkie's favourite.

Judicious use of X-Bass® and the 3D Holographic® Matrix help to create a cavernous soundstage and add a 'feelable' heft to the larger drums.

- **Buddy Guy: “Aint No Sunshine” (featuring Tracy Chapman) from *Bring Em In* [CD] – Jive 72426**

The warm, full sound makes for an immediately inviting and impressive intro, especially if slightly bass-light headphones with great bass definition are combined with the correct X-Bass® setting (try AKG K701). The correct 3D Holographic® Matrix setting moves the rather constricted dry studio vocals out forward from the head and opens up a soundstage with good definition.

- **Ed Sheeran: ‘Thinking Out Loud’ from *X* [LP] – Asylum / Atlantic #2564628587**

This saccharine ballad appeals to the ladies, but the overall recording quality, varied guitar styles, excellent vocals, and great dynamic range make it a rare showpiece among ‘contemporary’ music recordings. Make sure to record from LP, as the CD version is heavily compressed.

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

If possible, you should TRY before you buy, preferably with a wide range of gear. Take along your own music and your own headphones and remember to close your eyes as one’s hearing becomes more acute when (the brain) is processing less stimuli.

The truth is that few manufacturers design their products to work with the widest range of headphones, which means even well reviewed and generally excellent products

may not work well with your gear or listening tastes. Take this into account when reading reviews; just because Amp X is doing great with an open-back planar headphone for 1,000 USD does not mean it’ll be the best fit for your \$300 headphones or IEM’s.

If you don’t have any local dealers nearby, then consider hitting up dedicated “CanJam” shows, as they are a good place to get your ears on a wide variety of gear. Just bear in mind that these events are often noisy so it can sometimes be difficult to get an accurate read on how something, particularly open-back headphones, sounds at these kind of events.

Still, we’ve come to find that if you want to sit and listen longer, that means something is sounding right! Don’t fall into the trap of seeking something that blasts your ears with bass or treble. These are just fleeting aspects that fail to satisfying in the long run and can even end up causing listening fatigue!

In five years’ time, how do you anticipate that the world of personal audio will have changed?

In the west, streaming services are rapidly becoming the favourite mode of music delivery. This trend will become the norm, as the music industry is already adapting to use it as a means to raise revenue.

While today’s streaming is still largely stuck with 256k AAC or 320k MP3 files, future bandwidth upgrades and customer demand will bring uncompressed and high resolution streaming to a wider market.



The iFi Audio Retro Stereo 50 is proving popular with headphonistas and traditionalists alike!

Invariably these streaming services are tied into cell/mobile-phone data services as a delivery medium and cell/mobile-phones as delivery vehicles. We have already seen smartphones with an extra focus on audio quality in some markets.

So far the upgraded audio path is not up to delivering the quality of separate DAC/

amplifiers. As smartphone makers partner with (or acquire) audio companies this will change and ‘the HiFi Smartphone’ will become more common. This, if nothing else, is a furious death knell at the door of most DAP makers. Moving forward, the challenge will be integrating all of these devices to provide a seamless, highly polished user experience. +



Pro iCAN

Professional Balanced Tube / Solid-State Headphone Amplifier / Preamplifier

- 14,000mW headphone output
- Fully-balanced circuit/multiple headphone sockets
- Real-time tubes / solid-state amplification selectable
- XBass® and 3DHolographic® analogue correction system
(for Headphones / Loudspeakers)
- Reference class preamplifier (easily drives 600Ω load)

ifi-audio.com

14,000
mW

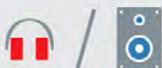
The T-Rex of headphone amplifiers,
period.

3D

30° / 60° / 90° analogue stereo correction
system for headphones and loudspeakers.

XBass®

10/20/40Hz analogue
bass correction system.



Professional headphone amplifier and
high-end preamplifier with NOS GE5670 tubes.



User-selectable amplification modes, the liveliness
of Solid-State and the luxurious sound of tubes.

Dominique Poupart of Moon by Simaudio

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Dominique Poupart: High fidelity, music reproduction, and music listening are my passions in life. I can't remember a time when it was not the case. After graduating in electrical engineering, I started working for Simaudio, which was precisely my goal then. I haven't left the company since. Before that, I had worked briefly at Classé Audio, long before the B&W takeover. Also I have worked as a reviewer for French Canadian audio magazines such as Son Hi-Fi and Québec Audio. I was known as The Kid back then.

In the past 16 years at Simaudio I have been involved in R&D for pretty much all this time and have worked on the many audio products we have launched. In the last few years I have moved to product management and we have added R&D engineers in the team. I am still involved quite a lot in new product development, but now from the top level aspect like the form factor, the user interface, the features and specifications, the esthetics etc. I basically define everything on how the product is going to be. We have a strong team spirit at Simaudio and we get the best from everyone in the team. There is no single hero superstar designer that does it all, as we believe that as a team we can go further and do better.

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

My interests lie with headphone amplifiers for home use. Although the portable is an interesting market, you have to know what you are good at and what to leave to others. I did not see a fit for a portable Moon product. However, I have learnt to never say never!

Seriously, I believe that audio reproduction at home is far more interesting since you can always aim at doing better and the end user will hear the improvement with his/her favorite—most probably open back—headphones. This is not necessarily the case with portable devices as more often than not the user will be travelling outside in a noisy environment that will prevent him from hearing the highest fidelity reproduction. Some good portable equipment exists, so what could I really bring to the table?

The 230HAD has a quality built-in DAC. This was a way to provide an efficient, compact, and complete one-box solution that is more affordable than any two-box system. It is pretty neat on a desktop. Every exec should have one!



The 430HA has the DAC as an option (it becomes a 430HAD with the DAC fitted in). This is for different customer profiles. Some already own ultra high-end systems and the 430HA adds the headphone amplification only; it isn't out of place in such dream systems. The 430HAD is for people who prefer a simpler solution, and use the 430HAD at the heart of the system as the DAC and preamp, or for a headphones-only system in small space.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

I don't believe in tube designs. If we were in the 70's my answer would probably have been different. But we are in the 21st Century and we can achieve our goals with transistors. Then why fuss with tubes? I know some people prefer them, but you can't please everyone. That is fine as life would be boring without differences. Imagine a world where all the men would prefer the same kind of woman...

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

The power supply level sits in between what a preamp and amp demands, but for exceptional performance it needs to be as regulated and clean as one for a preamp, but at the same time more powerful, closer to an amp. Also the gain level and output

impedance need to be aimed at real world requirements of various headphones. Headphone sensitivity and impedance vary greatly amongst models. A 600 ohms headphone pair has near to 20 times higher impedance than a 32 ohms model. That is a very big ratio. You don't see such large discrepancies between (types of) loudspeakers.

Finally, another important aspect is noise. Although it is something that we always strive to minimize in all of our design, I feel noise is even more critical for headphone amps as the user ends up with the audio drivers less than an inch away from their ear canal. It really doesn't take much residual noise to end up with an audible hiss when listening with sensitive headphones. This

Is the 230 HAD desktop DAC/headphone amp is a sign of a new Moon rising?

is something I cannot accept in a decent headphone amp, and certainly not in a Moon product. One of our main goals is to bring the listener closer to the music and noise gets in the way of this.





What are the distinctive 'hallmarks' or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

The amplification topology based on transconductance. My fellow engineer Thierry Dufour, now VP at Simaudio, has been working on this circuit for years, way before we had an official plan to develop a headphone amp. This demonstrates how passionate we are in the team. Indeed, this circuit is totally optimized for headphone amplification, and gives second to none audio performance. Not only are noise and distortion levels extremely low, it is totally musical and enjoyable. Both the 230HAD and 430HA benefits from this topology, although the 430HA benefits from a balanced differential version of it, and has much more power.

A distinctive and unique touch in the 430HA is the sliding window that elegantly hides the XLR output connectors when not in use. I am always very careful about the look and finish of our products. For convenience the connectors had to be located in the front, but how unsightly it would have been to place these three XLRs straight on the front panel? Some other manufacturers do this, and it is far simpler, but it just didn't cut it for me. It had to be better; it had to be sexier.

Moon's 430HA full-sized headphone amplifier is a part of the company's popular Neo line.

Do you think it is possible to create ‘one size fits all’ amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

Yes it is possible. I believe we did it with our MOON 430HA. This question actually resembles the goal we had given ourselves for the 430HA. It required a lot of work, testing and listening. Hard work, but it was fun! So it is certainly possible although some aspects of it are really required for only a handful of very power hungry headphones. Like 8W per channel of output power for example. But we wanted to create the best headphone amp there is and be confident to tell all customers, you may choose any headphones you like without any second thoughts. This is similar to a (pair of) 1000W monoblocks for loudspeakers. We managed to have this much power without having more noise or distortion, so why not?

Also, our volume control is very precise, with 0.1dB steps across a large range. When you have this kind of output power, with some headphones most users will end up using only the lower 40dB region, while some others may use the upper 40dB region with little overlap. With a potentiometer-based design, this would have yielded poor performance, as most of the time user would have been using their volume control in an area where tracking is not very good. In the MOON 430HA, there is less than 0.1dB difference between channels, regardless of volume setting. So the sound is located dead centre at all time. It may not seem

that significant on the surface, but isn't it annoying when the sonic presentation shifts from side to side when changing the volume?

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems? Or, are they simply different to one another? Explain.

It is simply different. I might shock people in an interview where the subject is personal audio, but still I prefer loudspeaker-based hi-fi. Not because it is better, but because I personally enjoy a big wide soundstage and a room filled with sound. It is more physical and to me, more realistic. But this is all the more reason to make an outstanding headphone amplifier for those times when you have to be quiet when listening to music.

In reality headphones-based systems are better in many aspects and I genuinely do enjoy listening to headphones. The absence of room interaction removes such a whole lot of issues with acoustics that loudspeakers have to deal with. Also the scale of electrical and acoustic power to achieve similar SPL for the listener is hugely different. So this should not come as a surprise that headphones are more coherent and far more accurate. And if you put the money factor in, the headphone system clearly outperforms the traditional hi-fi easily as one would have to spend quite a lot more in traditional hi-fi. You would

With a sliding door to hide a full set of balanced outputs, the Neo 430HA is extremely flexible.



have to choose very wisely just to approach the definition, transparency, etc. of what a Moon Neo 230HAD driving a good pair of headphones can achieve.

What are four of the most revealing headphone or earphone demonstration tracks you've heard thus far?

- **'Scherzo'**
Artist Gustav Mahler, Symphony no. 5,
Album Rafael Kubelik – Bavarian Radio
Symphony Orchestra,
Format DSD256 / High Definition Tape
Transfers (HDTT)
- **'Hello'**
Artist Jorane
Album 16mm
Format 16-bit, 44.1kHz / Tacca Musique
- **'Soft Moon Shine'**
Artist Nils Petter Molvaer
Album Hamada
Format 16-bit, 44.1kHz /
Thirsty Ear Records
- **'Long Distance'**
Artist Jamey Hadad, Lenny White &
Mark Sherman
Album *Explorations in Space and Time*
Format Binaural Recording at 24-bit,
176.4kHz / Chesky Records

The all-in-one Moon 230 HAD is an ideal companion for desktop headphonistas!

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

First, I would say, evaluate your current needs and then think of the future. What kind of headphones do you currently own and are you planning to upgrade them in the future? With this in mind, make a short list of headphone amplifiers that offer the right inputs for your needs. If you own (or prefer) power hungry headphones, ensure that these amplifiers are up to the task, power wise. Forget models that don't even disclose a power rating. Then from your list, choose the models from reputable brands; unfortunately, there are many small

audiophile-type companies that open and close quickly. Finally, audition the remaining models with your own pair of headphones, and if possible, with a better pair of headphones that you might eventually upgrade to so you can hear the potential improvements.

One quick test to perform is having no music playing while the volume is set to maximum; Listen for the silence. Is it truly silent or is there hum, buzz, or hiss? Can you live with them? Hum and buzz are never really acceptable, as they will impair the listening experience at all times. A small hiss is acceptable (there is always some residual noise), but the lower the better.



From the models remaining on your list, listen to both well-recorded demo tracks that can highlight the strengths and weaknesses of the amplifier and also listen to your favorite types of music. You need to have fun and enjoy the listening experience at all times.

In five years' time, how do you anticipate that the world of personal audio will have changed?

The biggest game changer I foresee comes from a rumour (now substantiated, Ed.) that seems more and more serious about Apple releasing the future iPhone 7 without any headphone jack. This will have a profound long term impact in the market. There will be literally hundreds of new headphones with Lightning connector that inevitably will include a tiny DAC/headphone amp integrated into them that no one notices or cares about. And there will probably be even more Bluetooth headphones. This creates opportunity and some might score big with this. Time will tell. Serious listeners will still prefer 'analog' headphones powered by a specialist-made headphone amp. However, the perception of younger people toward headphones will change over time and this may marginalize the audiophiles further still. We must all act, and when I say all, I mean the manufacturers, the audio press and your readers, toward making the younger generation discover what high quality sound is all about, and encourage them passionately to enjoy listening music through hi-fi. +

Wang Fengshuo Of Questyle

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Wang Fengshuo (Jason Wang): I have been involved in hi-fi since childhood, with crazy enthusiasm. I collected most of the world's famous headphones. But then I was disappointed that I was not able to find the right headphone amp to best express their potential in the market. Considering my background in semiconductors and my quest for such an amp, I decided to design the best amp to exactly dig out the potential for these headphones.

For my specialty, I believe a new design must be a total innovation of technology; it's a creation, rather than just modifying some components. Thus I created "Current Mode

Amplification" technology and imported it into my headphone amp design.

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

Yes, there is a lot of diversity in this industry and Questyle, to the best of my knowledge, is the only company that covers top high-end desktop hi-fi as well as making a top-tier portable DAP.

Questyle first started out from top high-end headphone amps/DACs, such as our CMA800R and CAS192D, with our innovative

technology of "Current Mode Amplification" and native "True DSD" playback, etc. We are also the first firm to adopt Ceramic PCBs (printed circuit boards) into audio designs, the only purpose of which is to bring out the very best sounding audio gear to meet even the most critical audiophiles' satisfaction.

At the same time, we are incorporating the most high-end technology and most high-end sound performance into our portable audio products. In today's market, audiophiles have a huge demand for high-end sound quality in a portable form factor; thus, we created the multi award-winning QP1R. Therefore, I believe that Questyle is the only audio company that truly offers high-end performance and sound quality in both the desktop and portable DAPs categories and is the market leader.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

We prefer solid-state design. As a designer, I think tubes were good components in early times, but with current technologies and design, tubes simply cannot meet critical requirements, such as speed, inner detail, ultra-low distortion, and

Questyle's CMA600i combines a high-grade DAC with its unique Current Mode headphone amp.



accuracy, as well as compatibility with other components. Furthermore, it's impossible to apply a tube design in high-end portable devices. Therefore, we gave up on tube design. It doesn't mean we can't design products with tubes, but that tubes simply can't meet the requirements of our uncompromising designs.

I feel solid-state components are much more compatible and more flexible in application and further meet our requirements for high-end sound and products that we are proud to put our brand name on.

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

First, amplifier distortion requirements for headphones are much lower than for speakers. Secondly, headphone transducers are much closer to the ear. Thus, headphones require much lower distortion, critical SNR, fast dynamics, and much more detail from the amp. Typically, a speaker demands less than 1% distortion, which is reasonable, but with a headphone amplifier distortion always needs to be around 0.001%, or even less. This creates distinct challenges for headphone amplifier designers.

The four-box Golden Reference is one of the best headphone DAC/amp combos ever made!





What are the distinctive ‘hallmarks’ or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

We created “Current Mode Amplification” technology. It’s our patented design. On structure, it’s a pure Class A circuit design, using all discrete components. Comparing with competitors on the basis of performance, Current Mode Amplification provides faster dynamics, ultra-low distortion, and ultra-wide frequency response. The end result is that it provides much more detail and accurate information.

Do you think it is possible to create ‘one size fits all’ amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

Sure, we believe there absolutely must be a device that can do so, so we created it: our QP1R!

Our QP1R inherits our patented “Current Mode amplification” technology. The Current Mode Amplification circuit itself can do so. It’s not limited by any chipset; it can be defined with its output power or output amplitude. It provides large dynamics, great power, and ultra-low distortion. It’s designed with three different gain settings: High/Medium/Low, and can drive anything from ultra-sensitive, low impedance IEMs, to power hungry, high impedance headphones. In the system settings, the user simply needs to just select the desired Gain setting to match their headphones or IEMs.

The QP1R features the Questyle’s Current Mode amplifiers in a elegant Digital Audio Player.

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems? Or, are they simply different to one another? Explain.

Actually I think speaker-based hi-fi systems can achieve great sound performance, while a good headphone-based system can also do so. It mainly depends on the user’s listening situations. In some places, headphone-based systems are more suitable, while in other places a speaker-based system might be better. This is why Questyle develops products that are not only suitable for either situation, but are designed to excel in both, simultaneously!

What are four of the most revealing headphone or earphone demonstration tracks you’ve heard thus far?

- **Leonard Cohen: “Here It Is”, *Ten New Songs* – Columbia**
- **Allan Taylor: “Beat Hotel” – *Hotels & Dreamer* – Stockfisch**
- **Norah Jones: “My Dear Country” – *Not Too Late* – Blue Note Records**
- **Elvis Presley “His Latest Flame” – *His Latest Flame/Little Sister* – RCA**

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

What things to listen for actually really depends on how the music was recorded. The recordings must be good quality and must contain enough detail. When buyers choose a device, they should choose the one that matches their taste and provides good quality, as well as representing a good value for one’s hard earned money.

In five years’ time, how do you anticipate that the world of personal audio will have changed?

I am extremely optimistic for personal audio and believe it will have another big boom in popularity in the coming years. Comparing personal audio to a traditional hi-fi system, personal audio is much more convenient in use, more practical, more suitable for portable applications, more affordable, as well as offering further diversity by providing the listener with more choices for high quality sound, as well as value. Thus, I strongly feel that it’s easier to reach a much larger audience, by offering high performance sound that is both convenient and affordable, to the average music lover. I further believe that, for these reasons, personal audio will appeal to more and more people, and that our industry will experience growth and popularity, as well as big leaps in technology, like never before!

In closing, I would like to thank *Hi-Fi+* for this opportunity to be interviewed. +

Jason Stoddard of Schiit Audio

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Jason Stoddard: I kinda fell into it. The whole story is in the *Schiit Happened* book, but here's the short version. I used to design speaker power amplifiers for Sumo, but—after starting an ad agency and being out of audio design for 15 years—I was dragged back into it via the gift of headphones and a headphone amplifier. This caused me to sit up, look around at where audio was in 2009, and decide, “Hey, you know, I could do some really cool stuff here...”

After some experimentation and about a year of development, we launched Schiit with the Asgard and Valhalla, a Class-A solid-state and an all-triode OTL headphone amp, respectively. Only one existed at launch (Asgard), so of course the first order was for Valhalla—and it was from a reviewer. Whoops.

Back then, we started in our garage, with my wife stuffing boards and me doing test and assembly. Now, 6 years later, we're up to 12,700 square feet of industrial space in Valencia, CA.

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on



portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

I'm all about the desktop. The desktop is where a lot of people live—whether they're working in an open-plan office, or sitting in a dorm room, or have a super-crazy custom home office, there are a lot of desktops. Headphone listening is important on the desktop, whether you're trying to isolate yourself from the world around you, or immersing yourself in music.

Until very recently, I've been leery of combo amp/DACs (because, seriously, do you want to throw out a perfectly good amp when digital tech changes—which occurs with more frequency than amp design changes, that's for sure). Now that we've just introduced Jotunheim, though, some people will say, "Hey, that's a combo amp/DAC." But that's only one thing it can be. Since it's modular, it can also be just an amp or an amp/phono or amp/whatever (when we come up with new modules). The main thing is that it sidesteps the obsolescence problem when used as a DAC/amp.

Portables? I don't have much to say there. I've played with ideas for big portables with no switching supplies, but the battery design, charging system, heat, and size give

me pause. Maybe I'll take another swipe at this in the future, but it may be better to leave this to companies that are really excited about portables. There are some fine products out there.

DAPs? Oh heck no, let someone else throw themselves on that software/support nightmare. Even if it's based on something as

"easy" as Android, the reality is that as soon as you've launched a DAP, you're a software company. That's not us.

And—it's important to note—I'm really only the analog side at Schiit. I have lots of support. Mike Moffat does the digital side, and Dave does a lot of things, from his own designs like Wyrđ, to helping make my stuff

actually work, to all of the firmware on our more complex products.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

Okay. Let me say this first: what I like is not necessarily what you'd like. Listen for yourself, and decide for yourself. Plus, I go



The new Schiit Jotunheim design brings new flexibility to lower-cost headphone systems.



Balanced headphone operation has hitherto not been an option at this price level.

back and forth between tubes and solid-state depending on the current state of product development.

But, in general, I usually like tubes for gain, solid-state for output. Tube output has too many gotchas—either low current capability for OTL designs, or the need for a really, really good output transformer in transformer-out designs. There are some

great transformer-output tube amps out there, but we're not the experts on those—best to leave them to companies who specialize in those designs.

So, that leaves hybrid—tube gain, and solid-state output stage. Done well, a hybrid will allow you to maximize the best qualities of each type of amp, while minimizing its pitfalls. This is especially true when you're using unconventional output stages to mitigate some of the problems with solid state. Lyr 2 uses a sliding-bias stage that manages its transition out of Class

A—and uses same-type MOSFETs (all N Channel) to sidestep mismatches between N- and P-channel devices. Mjolnir 2 uses a circlotron-style output stage that also uses same-type MOSFETs and is inherently differential and balanced. Hybrids offer a lot of opportunity. This is why we have three separate hybrid amps in the line, at three distinctly different price points. And this is probably why Mjolnir 2 is usually my preferred amp.

That said, solid-state can be very, very nice. Again, I go back and forth. If you're looking for hard-core consistency, I'm probably not the best example.

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

Yes...and no.

Yes, because headphone amps have to deal with a much wider range of impedance and sensitivity than speaker amps. Popular speakers are usually 4-8 ohms, and 85-95dB sensitivity. Popular headphones are 16-600 ohms and 90-125dB sensitivity. To cover all headphones, you need an amp that can put out high voltage into high impedance loads, while also being capable of good current output into low impedance loads—and it needs to be insanely quiet, by the standards of speaker amps. This is why you see so many headphone amps with switchable gain,

to extend the range of headphones you can use with it.

No, because headphone amps are relatively flea-powered compared to even the smallest speaker amps. You don't need to worry so much about back EMF and damping factor. You can deploy some very unconventional or problematic* topologies (such as true Class A designs) for headphones much easier than for speakers.

* Yes, problematic. Sumo had a 100W Class-A stereo amp that doubled its output power into 4 ohms. It dissipated about 1200W at idle. That's not a lot of fun, especially in the California desert in summer. The 30-35W dissipation of a Class A headphone amp is, on the other hand, lower than a single conventional light bulb.

What are the distinctive 'hallmarks' or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

One-line answer: cost-no-object-ish design in a we-know-not-everyone-has-a-trust-fund budget.

Slightly longer answer: We do fully discrete designs with massive linear power supplies, true Class-A designs, high-voltage tube hybrids, balanced designs, exotic topologies (like circlotrons and our new current-feedback Pivot Point topology), and purist approaches like relay-switched stepped attenuators—but with efficient execution so they don't break the bank. We're not about

mating up a switching supply to a standard headphone amp output chip and active volume control IC, in a fancy case with a touchscreen and standard Bluetooth input.

Not that either approach is ‘right’ or ‘wrong’—some customers want exotic topologies and tubes. Some want convenience and cosmetics. We’ll always lose the feature wars, because we’d prefer to concentrate purely on sonic performance. Whether we succeed at that is a question best for the owners and for the reviewers.

Aaaannd...to be totally clear, I’m not saying that you can’t make a feature-rich product sound good. I’m sure it could be possible. But it’s not our focus.

Do you think it is possible to create ‘one size fits all’ amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

Absolutely. Heck, our Ragnarok does CIEMs to speakers...and puts the full 60W/8 ohms out to the balanced headphone jack. Also, pretty much all of our amps are comfortable with CIEMs up to power-hungry headphones, with the exception of Valhalla 2, which is a current-limited tube OTL design.

Why? There’s not necessarily any difference between a great speaker amp and a great headphone amp...as long as the amp is quiet enough to use with CIEMs. In fact, our least expensive headphone amp (Magni 2) is a fully discrete, Lin-topology miniature speaker

amp. And Ragnarok, as mentioned, runs CIEMs to speakers from the same jack.

There’s a misconception that higher power equals higher noise, but that’s not necessarily the case. Higher gain equals higher noise, and traditional speaker amp shortcuts, like unregulated linear power supplies, equal higher noise. But if you’re designing a discrete amp from scratch and have full control over all the noise-producing factors, then it’s easy to produce a dead-quiet, low-gain amplifier that’s perfect for CIEMs...that can also be switched to higher gain for harder-to-drive headphones.

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems? Or, are they simply different to one another? Explain.

My quick take? They’re different.

Headphones are great for immersing yourself and shutting out the rest of the world. Yes, this is in part an evil, task-related answer, because people tend to butt in less often when you’re wearing headphones. But it’s also a wonderful-way-to-enjoy-the-music answer. Headphones isolate you, which allows you to go deeper into the performance.

But headphones are a solo experience. They’re also not so hot at imaging. In fact, I tend to discount discussions of things like “headstage,” because, the fact is, the best-



imaging headphones are far behind well-set-up speakers. At least IMO.

And that’s what speakers are great at: reproducing a better sense of an actual performance in front of you. Large speakers are also great at reproducing the visceral punch of the music, which also enhances realism. But speakers—especially large speakers—aren’t for everyone. Not everyone has a large, dedicated room where speakers can be carefully positioned—or neighbors

Schiit has pioneered the use of hybrid electronics design from the outset.

who are far enough away not to complain when the music gets loud.

Full disclosure: I listen on headphones more than anything, but I also have powered monitors on the desk as well as dedicated stereo and home theater spaces, so my opinions reflect all these experiences.

What are four of the most revealing headphone or earphone demonstration tracks you've heard thus far?

You're going to laugh, because I don't really listen to anything special when developing products (in terms of, say, binaural recordings, which are specifically recorded for headphone listening, but very, very thin on the ground).

Instead, I have a few tracks that I use, including the MFSL Gain 1 recording of Muddy Waters' Folk Singer (since it uses a digital filter on the encode side that matches our multibit closed-form filter), as well as Midnight Oil's Blue Sky Mining (well-done for a conventional multitrack recording) and probably two dozen or so rotating tracks that are usually marginal (because I'm listening for how our products deal with marginal recordings—Crash Test Dummies on LP is actually very good as it skates the line between bright and too-bright—and mixes it with some unexpected LF content.)

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

Oh boy. Everyone in the industry is gonna hate me for this one.

First, find the headphones you like, *before you spend a dime on an amp* (or amp/DAC, or any other piece of gear.) The transducer (headphone) dominates the audio experience. If you don't like a headphone, an amp won't magically transform it.

When you get down to selecting an amp, try to listen to it on your headphones, in the same environment you're going to use it in. For example, if you're going to be using it in a quiet home environment, don't make decisions based on a quick listen at a noisy audio show. You may not hear a high noise floor, or know if the volume control has enough range for your needs. Same thing goes for a portable amp being used on a bus or a subway. You may want features like bass boost for those times, but you won't know that in a quiet store.

In five years' time, how do you anticipate that the world of personal audio will have changed?

In terms of basic amp design? Probably not very different. It's very rare to find a new topology (or even a useful twist on an old one.) There will be some change as the good parts increasingly come in surface-mount packages, and there will probably be better options in terms of switching power supplies for heat- or space-limited applications. But, in general, the analog side of things is relatively stable.

However, I do expect there are going to be all kinds of experiments in ancillary technology, from trying to correct frequency response to your head shape to HRTF in real time...but the success or failure of these technologies isn't something I'd speculate on. I'd hope for Bluetooth 5.0 with sufficient bandwidth for uncompressed audio...that would make the use of phones much more palatable as a source. +

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For more details visit www.hifiplus.com or search for 'Hi-Fi+' on the App Store



Jack Wu of Woo Audio

Hi-Fi+: How did you get involved in headphone amplifier design and what do you consider to be your specialties within that field?

Jack Wu: It all started out with a passion in music. When I was little, I grew up in a surrounding often filled with music playing in the background and with hundreds of pieces of audio electronics hand-made by my father. Naturally, my childhood experience was a great inspiration force for me to continue my audio journey.

In 1999, I migrated to New York with my parents and my brother. Limited by NYC living space, we were unable to play music on loudspeakers so we were looking for a small audio system solution. I auditioned a pair of Sennheiser HD650 headphones at a J&R electronics store and was very intrigued by their sound. At the instant, my curiosity was piqued as I was thinking if headphone



listening would be as enjoyable as listening on speakers. I was so excited at the thought and bought the headphones home to talk to my father if we could improve the sound of headphones. The answer was a headphone amplifier. After a few weeks of collecting parts, prototyping, and listening tests, the Woo Audio WA1 tube headphone amp was born.

There's a lot of diversity in headphone amplifier products with some designers focusing on desktop units, others on portable units, still others choosing to create combination amp/DACs, and some specialising in high-res portable DAPs (digital audio players). Where do your own design interests lie, and why?

There are many audio formats throughout the audio industry. Some of them, like tapes, are still being used while digital formats are trending. We want to design products to accommodate these formats and thus you see we offer a large portfolio in a range of products.

Which do you favour: solid-state or valve (tube) based designs, or perhaps hybrid combinations of the two? Why?

There are merits in solid-state designs when they're done right. However, our primary

The amp that launched Woo Audio – the WA1.



focus is in valves (vacuum tubes) based design. Tubes are our genetic heritage, so to speak. You are going to see more tube-based products from us.

What are the distinct challenges or technical requirements of headphone amplifier design? In other words, what sets headphone amp design apart from, say, the design of preamplifiers or power amplifiers for conventional hi-fi systems?

There has been a growing demand for support for low efficiency headphones while high efficiency headphones are also keeping a healthy pace. Making a headphone amp to drive all these headphones effectively is technically challenging. A proper headphone amp would require an incredible low noise floor, high power output (relative to typical headphone requirements), and excellent dynamic range even at low volume playback. Listening on headphones does not mean you

have to suffer the sound coming from right between ears. With a good amplification, you can have an out-of-head experience.

What are the distinctive ‘hallmarks’ or signature elements of your headphone amplifier designs? What distinguishes your products from those of your competitors?

We try to avoid a sound signature in our products. Our design goals are to reproduce the music faithfully, with sound quality that is as natural as possible. You should expect an organic sound with a great depth and width in the soundstage that can connect to your mind and soul.

Some products are focused on measurements. Ours are made for listening pleasure.

Do you think it is possible to create ‘one size fits all’ amplifiers that can work equally well with power hungry full size headphones and ultra-sensitive CIEMs—and everything in between? Why or why not?

There is no such thing. Everyone's ears are different. Everyone has a different pallet by which to judge what is good sound. Just like beers and wines, there are thousands of choices.

Down deep, do you see headphone or earphone-based systems as being superior to or perhaps not quite as good as traditional speaker-based hi-fi systems? Or, are they simply different to one another? Explain.

A high-end speaker-based system is still the best thing to arouse all your senses.

Woo Audio's ingenious and elegant WA7d Fireflies Duo pure Class A headphone amplifiers are deceptively powerful performers.



Headphones are supreme in rendering details, imaging, and intimacy, but lack the physical, ‘whole body’ contact with sound waves that speakers afford. The presentation is very different between loudspeakers and headphones. With speakers, you feel the music in the space of your listening room. In headphones, you have to imagine the distance from the sound source to the listener based on how music is reproduced.

Headphone-based systems are highly accessible in terms of usage and cost of entry. The performance of speaker-based system is at least loosely limited by room acoustics, where with headphone-based

system the audio performance is consistent regardless of room acoustics or listening position. Either way, when the music gets my toes tapping, then I know I’m listening to a good audio hi-fi system.

What are four of the most revealing headphone or earphone demonstration tracks you've heard thus far?

So many choices... My go-to tracks for music for demonstration are acoustic recordings. Here are some of them.

- 'Chopin Concerto No.1 III', Chopin, Liszt: Piano Concerto No. 1, by Yundi Li
- 'Blue Rondo a La Turk', *Dave Brubeck's Greatest Hits*, by Dave Brubeck Quartet
- 'Polytonality', *Ex-Spiral*, by Takeshi Inomata and Separation
- "Nichts kann mich erretten BWV 74 Nothing can save me", Bach: Cantatas, by Anne-Sofie von Otter

What advice would you give to buyers as they work to evaluate and select new amplifiers? What things would you suggest they listen for so as to make wise choices?

Start with good quality music, at least CD quality. If your source is bad, the best hi-fi system won't rescue the sound. Try to pick a type of music that is new to you. This would give you a different perspective on how the system performs.

The flagship WA-234 Mono amps are good for headphones and loudspeakers alike!

In five years' time, how do you anticipate that the world of personal audio will have changed?

Healthy competition, advancements in technology, and innovations in better materials will shape the future of personal audio. In the last two years, personal audio grew exponentially. This is good news as the industry is embracing the idea of personal hi-fi and creating a strong social awareness that good sound exists beyond the earbuds included with your smartphone. +



Gary Hsieh of 1MORE

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

Gary Hsieh: First, I believe it is a question of supply and demand. Most headphones offer quality sound, trendy design, and comfort, but it is hard to find premium headphones with a relatively affordable price. In recent years, 1MORE has changed the ecosystem completely. Nowadays, branded smartphones no longer bundle poor quality headphones. Instead, they attach RMB99, RMB199 or RMB299 headphones, whereas the midrange headphones now have become mainstream products.

Second, typically speaking, sitting on top of the mountain are all the premium quality international headphone brands that are priced between USD400 – USD4000, which is unaffordable for the mass consumers. 1MORE doesn't want to simply climb that mountain; we want to turn it upside down so that everyone can reach the peak.

Tell us about the discipline of designing products with affordable excellence in mind. How do you keep performance high and prices low at the same time?

When you start to work on a headphone, data gathering is vital. What makes the user unsatisfied? What makes them

complain about headphones? What are their suggestions for improvement? These comments offer wisdom, but often designers tend to overlook them.

Why do I call this IQ100? It's a refining process where 'pain' is consumer criticism. For example: 10 pain points for product structure, 10 pain points for electronics, 10 pain points for software, 10 pain points for outlook, etc. We then must attempt to collect all these numbers and gather them accordingly.

By collecting and sorting out big data, we can determine the 20 'most significant pain points'. Then this allows us to decide which three need to be solved urgently. I believe that by solving the three most significant pain points, the user will enjoy our product and it will become their preference. This refinement of consumer feedback makes research and development more efficient and therefore more affordable.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

Perhaps a combination of both, whether it is over-ear headphones or in-ear headphones, we must take into consideration aesthetics, acoustics, ergonomics, and other design factors.

My successful work in touch-screens prepared me to focus on meticulous details—something that lends itself to work on in-ear headphones, but we use this same attention to detail for over-ear designs.

When you have the opportunity to do a new, 'clean sheet of paper' design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product? How do you balance these variables?

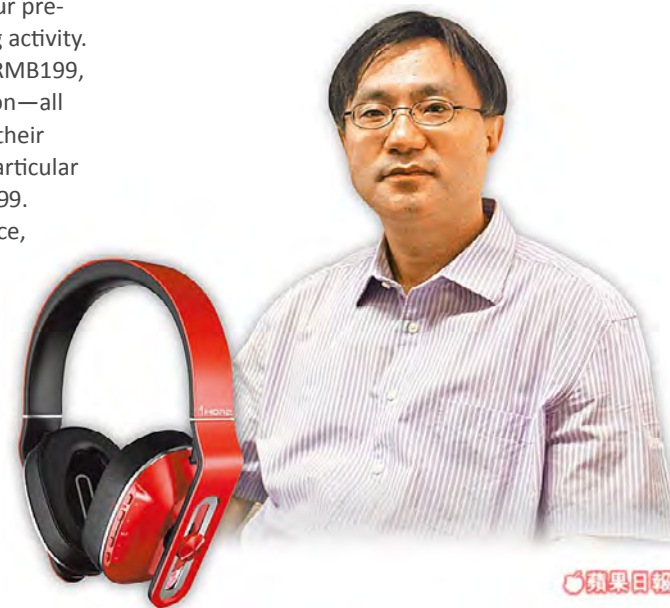
There are two ways to do it. When we first start working, new product data gathering is crucial. We must be able to understand the user's needs. For example, during our pre-launch, we organize a price guessing activity. Users suggest a range in prices like RMB199, RMB149, RMB129, RMB99, and so on—all sorts of prices. Ultimately we value their opinions, but set the price of that particular product at the lowest range of RMB99. Additionally, no matter what the price, based on a craftsman's spirit we attempt to exceed expectations, to diminish pain points, and surpass their needs.

Another way of doing it: don't ask, don't tell. To see things as they really are, from a natural point of view, get back to basics and comply with human needs as an art.

I prefer to balance both of these approaches so one helps the other.

What are the distinctive 'hallmarks' or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

Our distinctive 'hallmarks' or signature elements will be Pop-Pro: Popular Profession. We are positioned as having a Nordic minimalist precision aesthetic with a Southern European warm and passionate sound. This unique balance distinguishes our products from the competitors.



What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

It is best to outline my principles:

- Technology is only a tool; music is emotion.
- A perfect transducer doesn't exist, but we can never stop improving.

Design goals:

- Pleasant, intimate, and transparent listening experiences.
- Make distortion of any kind as low as possible
- L/R symmetry.
- Smooth and wide soundstages.
- Flat but pleasant frequency response.
- Match the human loudness curve at a defined volume.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

We usually evaluate the performance by both lab tests and listening tests. We always exceed the industry standard benchmarks.

What do you consider to be some of your 'landmark' designs—the products of which you are most proud thus far? Why those particular designs?

First, the 1MORE Triple-Driver In-Ear Headphones, featuring an all in one dual Balanced Armature + Dynamic Driver—a design that received an iF Design Award 2016

Second, the 1MORE Capsule Dual-Driver In-Ear Headphone, featuring a hybrid single Balanced Armature BA + Dynamic Driver, fitted within a small ergonomic capsule.

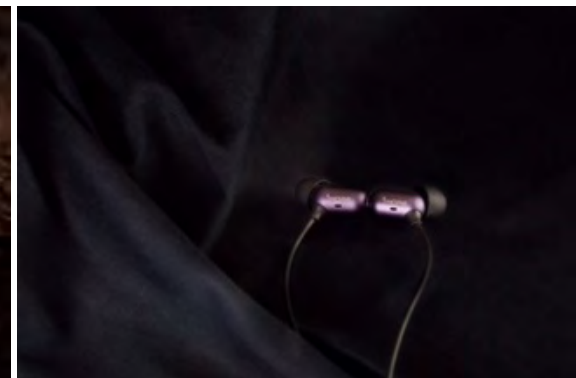
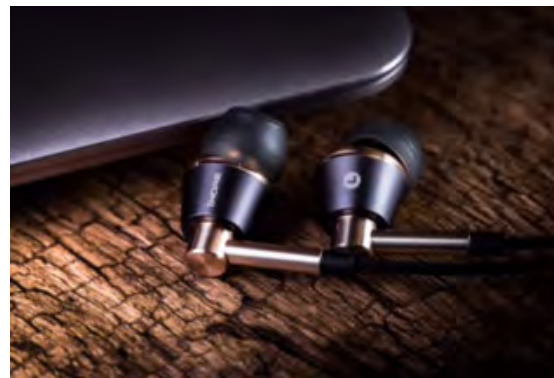
What advice would you give to headphone or earphone buyers on a budget?

When it comes to selecting a good headphone within a limited budget, here are the factors to take into consideration: quality sound, comfortable fit, appealing design, durable usage, and value.

In five years' time, how do you anticipate that the world of personal audio will have changed?

I anticipate that personal audio will become a fashion guideline in the future with wearable audio accessories. We also see the integration of smart wireless devices with personal audio devices. For example: the development of VR technology, which will require high quality audio integration. +

1MORE's range of single, dual, and triple driver earphones and over-ear headphones are all designed to look good, sound great, and – starting from just \$20 – not break the bank!

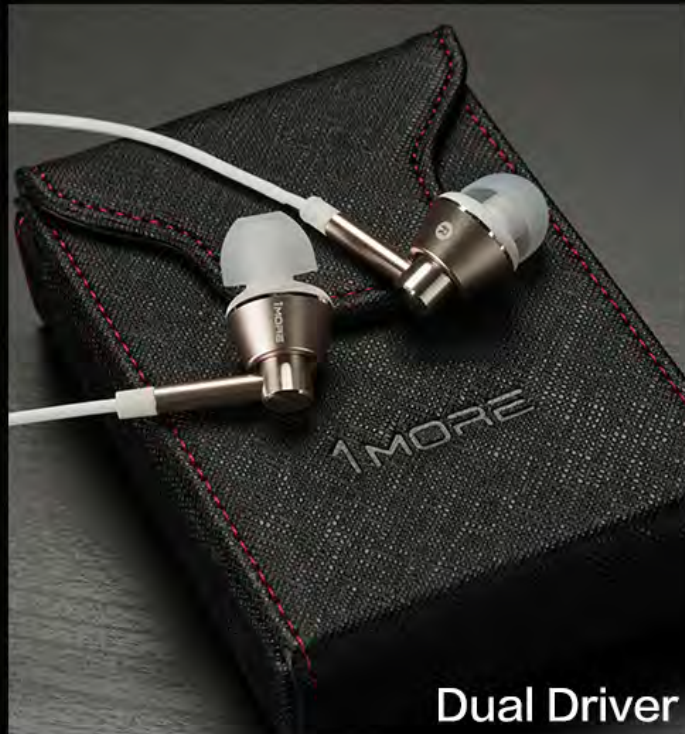


1MORE

AWARD WINNING SOUND QUALITY, DESIGN,
AND VALUE



Triple Driver



Dual Driver



MK802

James Strong of Atomic Floyd

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

James Strong: We are at the beginning of what we hope will be a very exciting journey and believe this segment is a great place to start from.

Tell us about the discipline of designing products with affordable excellence in mind. How do keep performance high and prices low at the same time?

Ironically in production the more you produce the better the quality. So one of the benefits of universal type IEMs vs customs is that we can deliver high performance and great value acoustics at the same time.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

Currently we are focusing on in-ear headphones, but watch this space! In my experience designing open-type headphones are the easiest, followed by closed-type headphones, followed by high performance closed-type IEMs. Balancing acoustics, comfort, and durability with a considerable size limitation makes for the greatest challenge.



When you have the opportunity to do a new, ‘clean sheet of paper’ design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product? How do you balance these variables?

This is a great question. Cost and sale prices are the very last filter to be applied when developing our products, but can be the first for many competitors. We lead with an acoustic concept or ‘north star’ and allow the performance to drive every decision we make.

What are the distinctive ‘hallmarks’ or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

The Atomic Floyd SuperDarts Titanium is our flagship dual driver product and the culmination of many years of development. It encapsulates everything that Atomic Floyd stands for, in particular, uncompromising attention to detail and build quality. Built by selecting only the highest grades of materials, they are obsessively engineered to take advantage of the ultra-lightweight Titanium housing. Each earpiece is precision machined from solid Grade 2 Titanium in a 45-minute state-of-the-art process.

What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

There are now so many different input devices and audio sources in the market, not to mention genres of music, that we are very

careful how we tune the products. Ultimately with our current range of earphones we set out to engineer products that deliver acid-sharp clarity in the mids and highs, while producing very natural lows that don’t decay too quickly or cause fatigue.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

We relentlessly lab test our products before releasing them, but ultimately the best test is giving them to people to use. It is not the fastest process, but delivers the best results. Consequently, it can take us much longer to develop new products, but we believe this give us a superior and longer lasting product.

What do you consider to be some of your ‘landmark’ designs—the products of which you are most proud thus far? Why those particular designs?

The Atomic Floyd HiDefDrum was one of the first products we launched in 2008. Despite it being copied by several well known Chinese brands we are still producing it today. Acoustically and mechanically it is a very robust product that can handle pretty much anything put in its path. It’s a long lasting product in every way and I love that.

UK-based Atomic Floyd launched its SuperDarts Titanium dual-driver flagship earphone design to substantial acclaim.



What advice would you give to headphone or earphone buyers on a budget?

I would always recommend investing in universal type earphones since they can offer the best value for money acoustics.

In five years' time, how do you anticipate that the world of personal audio will have changed?

We believe the roll out of 5th Generation (5G) Mobile Networks and improved connectivity on commuter routes will have a significant impact on the quality and consumption of personal audio. +

The HiDefDrum was one of Atomic Floyd's first earphone designs, and remains popular today.



George Gill of Echobox Audio



Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

George Gill: As a company, we believe that the audio industry, and people's experience of music, became what they are today as a result of the MP3 craze of the 90s and early 2000s, and the resulting drop in an entire generation's expectations of audio quality. We want to help restore the "standard" of audio quality that people expect to a level

that does justice to music that artists and engineers pour their hearts and countless hours into. Music is good for your soul, and you shouldn't have to be rich to have a really special experience with the music you love.

Tell us about the discipline of designing products with affordable excellence in mind. How do you keep performance high and prices low at the same time?

Our earphones use nothing but premium materials from top to bottom: titanium housings, silver-plated cables, high-tensile strength material for our drivers, replaceable filters, gold plated connectors, the highest quality foam tips available—the works. Top quality multi-BA monitors and customs aside, we really don't understand why some other earphones cost so much—they really don't need to. Without seriously cutting-edge features as justification, an earphone should never cost more than a night out on the town.

Making an affordable smart device, on the other hand, is no mean feat: there are huge numbers of parts, features, and specifications that are needed to make a touchscreen device that performs the way people expect it to. We spent extra money on our portable,

Echobox's latest product is the crowd-funded and distinctive Explorer Digital Audio Player.





streaming DAC/amp unit, and the time it took to implement them, because our device is built for the specific purpose of enjoying music. Luckily we were able to cut corners on some of the parts that make full-featured smartphones expensive and difficult to manufacture, like external speakers, ultra-thin internal components, large HD screens, extra RAM, and the like.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

Every product is unique. The biggest challenge when it comes to earphones is size—it's a real marvel of modern engineering to be able to cram a speaker that sounds great into such a tiny space. Making it comfortable and attractive definitely adds to the challenge, but really the size is the biggest limiting factor—nobody wants

something big and bulky hanging off their face. It's just not practical if you want listening to music to really be a part of your everyday life.

Android devices are entirely different monsters. PCB engineering and assembly is the “big black box” of the current generation. Most people have only a vague idea that this chip on a green thing with lots of wires crunches 1s and 0s really fast, but the intricacies of PCB design, and the challenges of properly programming software to do everything you want it to do reliably and quickly, are not to be underestimated. Anything with silicon in it is a challenge of the highest degree to do properly.

When you have the opportunity to do a new, ‘clean sheet of paper’ design, which comes first: the intended performance target, the hoped for cost target, or perhaps

the ultimate retail price of the product? How do you balance these variables?

Every product we design is for a specific purpose: making high quality audio accessible to everyone. Within that single parameter, we really just go nuts—our whole team, from engineers to management, and even sometimes our investors, are constantly sharing ideas, throwing stuff against the wall to see what sticks, and working together to decide what we should pursue next. That might sound chaotic, but the reason we all work together so well is because we share a common vision of the future, where high quality audio gear is affordable and integrates seamlessly into our everyday lives, so we are usually all thinking along the same lines. We want to live in a world where people can create, perform, and enjoy music as easily as possible. In our eyes, music makes people happy and helps gives meaning to life, so if we can help people

Look past its flask-shaped design, and the Explorer is a sophisticated and ergonomic digital player in its own right.

enjoy their music more, and more often, we've done our job.

Our engineers are our real backbone, of course—they are tasked with the unpleasant duty of throwing cold water on some of our ideas based on the limits of what is actually, technologically possible, but they also surprise us constantly and are always giving us new hope for what we are capable of as a company.

What are the distinctive ‘hallmarks’ or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

Above and beyond all else, we strive to produce the best sound at our price point,

but we also try to focus as much as possible on ergonomics. We believe that most products are either designed to sound good or look good, but in our opinion, few companies pay close enough attention to ergonomics and the ways audio products are supposed to integrate into the daily lives of their owners. We want to change that.

Like most people, we really love curves. I'm sure you can tell; the housings of the Finder are curved in a way that makes them easy to handle, the back of the Explorer is curved to fit the shape of your hand, and all our products are designed around the human body. We believe technology should accommodate people, not the other way around.

We also think it's a shame that either fashion-focus or complete disregard for style has taken over most consumer products. I think anyone reading this magazine will agree when I say that, when it comes to audio gear, style without good sound is nothing more than a fashion statement. But that doesn't mean class has to suffer.

Most of the people on our team are artists in one way or another (musicians, writers, painters, etc.), and we consider the design and engineering that goes into our products to be just as much an art as anything else we do. After all, music is art, and while there's a certain ethos to using a great-sounding piece of gear despite questionable aesthetics, there's usually no good reason it can't also look good.

We are also completely committed to never using anything but the highest quality materials in our products' physical construction. Silver and gold for conductive properties, titanium, real wood, and machined aluminum for durability and class—we never skimp. Everything we make is designed to speak to our devotion to quality and attention to detail.

In summary, our real focus is, and always will be, the best sound quality possible at a reasonable price, but we think form and build is really important, and not just for looks, but for quality and usability as well.

What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

We want our products to exemplify an exciting take on neutrality. All but one of our employees are either musicians or die hard audiophiles, and we would never release any products that don't really help put feeling behind the music while representing the intentions of the artist properly. We try to make sure our products are going to sound great with as many genres as possible, without sounding boring or dull.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

We measure, we listen, we share with our friends and family, and even bring in our contacts in the music/audio industry: producers, audio engineers, musicians,



fellow audiophiles, reviewers, even members of online forums like Head-Fi—really anyone we can think of who has a good ear and really loves music. We want our gear to sound great to as many people as possible—fun, but never at the expense of quality and detail.

What do you consider to be some of your ‘landmark’ designs—the products of which you are most proud thus far? Why those particular designs?

Well, it has to be the Explorer (*Echobox’s portable streaming headphone amp/DAC, Ed.*). The flask-shape design has gotten us a good bit of the attention we’ve received, especially outside the audio sphere, and its design really says a lot about the history of our company. Our engineers came up with the idea at first, mostly because it’s such an iconic ergonomic design in the history of personal items—it hugs against your leg or chest, and the spout was the perfect place for a really nice, classy volume knob to show off just what the Explorer was built for. It was also originally wrapped in leather, and the screen was much smaller and on the opposite side.

The rest of our team came together to suggest changes like the wooden body, increasing the screen size and moving it to the concave side to improve ergonomics and durability, the vents in the bottom to help keep the circuitry cool, and other, finer points that brought the design where it is today.

To our team, the Explorer really embodies the open, collaborative nature of our company, as well as our focus on ergonomics, industrial design, and creating truly unique products.

Really, both of our products exemplify our commitment to proper form, quality materials, and good ergonomics, but the Explorer is just so distinctive that I’d be lying if I said anything else.

What advice would you give to headphone or earphone buyers on a budget?

Try before you buy, and read reviews. Lots and lots of reviews. Trying is important, because without actually hearing something, you just can’t know if you’re really going to love it. That said, it’s easy to demo a product and fall in love with the sound, but if you’re not careful, it’s just as easy to wind up disappointed in the long run when things start falling apart or just don’t turn out to work the way you wanted them to.

In five years’ time, how do you anticipate that the world of personal audio will have changed?

I honestly believe that, for all but the truly most technologically advanced audio gear, whose prices are often determined by rare and expensive materials or thousands upon thousands of hours in R&D, the price gap between mediocre and high quality will keep closing as more and more people continue remembering what good music is supposed to sound like, and discovering just how truly

mindblowing the sound from a personal audio system can really be.

Far beyond the scope of the concept’s application in economics, technological advancement is characterized by a massive, universally democratizing “trickle down” effect—massive enough to transform supercomputers the size of buildings that cost millions of dollars, into something vastly more powerful and sophisticated that fits in your pocket, and is accessibly priced, in the space of 30 years.

Now that streaming services exist, and people are waking up from the fascinated stupor of being able to carry thousands of songs on the go without a book full of CDs or cassettes, the focus is back on quality, and I think everyone who really listens to and appreciates music will benefit from that in a very real way. +

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David Friesema of Etymotic Research

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

David Friesema: I think it's important to realize that not everybody has the budget or desire to justify spending a significant amount on audio products. Focusing on offering products at various price points can help cultivate an interest in high quality audio from customers that might otherwise feel excluded by the high cost of entry.

Tell us about the discipline of designing products with affordable excellence in mind. How do you keep performance high and prices low at the same time?

Certainly designing to a lower price point presents its share of challenges. It usually comes down to a balance between material choices, accessories offered, and where the earphones are built. For example, our lowest cost earphones tend to use dynamic drivers instead of balanced armature drivers, which are less expensive but can still provide great sound when integrated with our acoustic design. Our most expensive earphones are hand built in the USA and have a higher percentage of components that are locally sourced. Our least expensive earphones are built outside the US with parts mostly sourced overseas.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

Since releasing the first commercial high-fidelity insert earphone back in 1991 our company focus has been exclusively in the ear. At some point, if time permits, I think it might be fun to design a line of circumaural headphones. I think we would bring a different design perspective than what is currently available.

When you have the opportunity to do a new, 'clean sheet of paper' design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product? How do you balance these variables?

I'm not sure you can pick one thing and only focus on that. First and foremost, it's important to understand what type of product you want to design and who the target user is. Once you understand that, it's much easier to define the other variables. At that point, I usually focus on how I want it to sound, but that's quickly followed by how it will be implemented, rough estimates of cost, methods of distribution, dealer margins, and ultimate value for the customer.

What are the distinctive 'hallmarks' or signature elements of your earphone and/or headphone designs? What distinguishes



your products from those of your competitors?

From the beginning, we've always targeted an accurate, uncolored reproduction of the source as the primary goal of our earphones.

We've challenged the trends and industry wide belief that more drivers always equate to better sound. From a pure fidelity standpoint, we're able to deliver the flattest most accurate response with a single driver



without any of the phase compromises that are often found with multiple drivers.

What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

In some ways, this is simpler if pure fidelity is your target voicing. It becomes less about tailoring the frequency response to an arbitrary preference and more about finding a way to best reproduce audio as the mastering engineer intended it to be heard. For a deep-insertion earphone, the

most important aspect is to make sure that it properly reproduces the acoustic resonance at 2.7kHz that is lost when you insert the earphone into the ear canal. Etymotic's target frequency response takes this into account and has been well established for over two decades. The design challenge is always to make it match that target as close as possible. Occasionally, there are mild deviations from the target based on user feedback. For example, on the recent ER4 redesign, we introduced the most accurate earphone we could in the ER4SR but also offered the ER4XR, which has the same basic

The Etymotic ER4XR adds some low-end oomph to the super-accurate ER4 earphone design.

response as the SR but adds a small low frequency enhancement that some users prefer. Establishing what constituted an acceptable bass enhancement was a bit of a departure from our normal design goals and we did spend a fair amount of time listening to various tunings to find the exact corner frequency where we felt the low end was brought up enough but didn't encroach on the lower midrange.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

I like to think that we are a measurement savvy company that understands the value of listening. During development we spend countless hours making acoustic and mechanical measurements. That said, it's important not to listen with your eyes. Taking the time to really listen to the designs and make adjustments during development is invaluable. Sometimes little tradeoffs here and there can result in a noticeable improvement in the listening experience. I find that it's also valuable to let others outside of the development circle listen along the way. There is quite a lot of value in a fresh set of ears.

Etymotic's hf5 designs combine the company's extensive research with good looks.



What do you consider to be some of your 'landmark' designs—the products of which you are most proud thus far? Why those particular designs?

The product we are most known for has to be the original ER4 earphone. At the time, insert earphones (also called canalphones by some back then) were basically non-existent. When they were first released, I am not sure most people who encountered them knew how to react to them ("You want me to stick this how far in my ear?"). Over time, we developed a bit of a following for the earphones as the entire market segment grew. The original ER4 sold with minimal changes for over 25 years and it is still the design that most people associate with Etymotic earphones.



The ER4 Micro Pro retains the noise-reducing abilities that made Etymotic famous.

What advice would you give to headphone or earphone buyers on a budget?

I would give the same advice to earphone buyers who aren't on a budget: it's worth taking a bit of time to read and research what you are looking for in an earphone. Do you want a neutral sounding earphone? Do you want a particularly tailored frequency response? Do you want higher levels of noise isolation or will you need to be aware of your environment while listening? If at all possible, try to seek out hi-fi shows, CanJams, or any hobbyist gathering where you can listen to a few different earphones to find what you like. If that isn't possible, there is a lot of information online that can help guide a decision. There are great earphones to be found at many price points and the most expensive ones aren't always the best sounding.

In five years' time, how do you anticipate that the world of personal audio will have changed?

I think there's going to be a bit of stratification between traditional wired headphones and the wireless segment. I believe that wired headphones will continue to be popular with no compromise hi-fi enthusiasts but I think we'll see significant growth in the wireless and wearables segment of the market. Personal audio continues to play an increasing role in our lives, from how we consume media to how we communicate and interact with the outside world. I expect that we'll see greater integration of earphones and other electronic devices and that this will be a driving force for innovation in the development of personal audio. +

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Davies Roberts of Flare Audio

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

Davies Roberts: I have a fascination to re-create perfect sound. The traditional acoustic approach to all speaker designs distorts original information into a tone unique to each traditional acoustic product. This really frustrated me and I wanted to unlock new technology that removes these distortions. Earphones are placed really close to our eardrums, and thus they enable me to achieve the highest possible degree of accuracy.

Tell us about the discipline of designing products with affordable excellence in mind. How do keep performance high and prices low at the same time?

The key to designing products that use your own technology is simplicity and locating the core issues. Solving the core issues with sound has enabled me to design a new range of earphones using ideal materials such as titanium whilst keeping the cost low. I focus entirely on driver movement symmetry and by achieving that and delivering it to our ears without sound reflections or damage from the enclosure I am able to keep the costs down whilst achieving the highest possible audio quality.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

I would describe myself as an inventor first and a designer second. I won't commit to designing any product until I have worked out a technology to perfect its sound delivery. It seems pointless to me to design a product that has sonic flaws; they would drive me crazy and I would not be proud to have designed it. Once the technology has been worked out I then look at it's core visual identity and create a design that embraces the fundamental technical values. Most of my designs so far have been quite industrial looking with a contemporary feel. I like clean lines and symmetry as it follows the golden ratio.

When you have the opportunity to do a new, 'clean sheet of paper' design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product? How do you balance these variables?

Initially costs never come into it. It is always the need that is the priority and technical result. Once a need has been identified, technology is created to address it. Then once we have the technology solved the design of the product starts. It's at this stage that I estimate manufacture costs and then assess where it will best fit into the market.



What are the distinctive 'hallmarks' or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

Unique sound. All Flare products have a totally unique sound because of the approach I follow. I describe the Flare sound as listening to the beauty of unadulterated music, rather than the low-resolution tone that the traditional acoustic designs have.

What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

In my opinion voicing should only be reserved for use by acousticians who design acoustic products such as pianos, acoustic guitars, and violins. Voicing should have never been accepted for any type of speaker device. If you are voicing a product then you are accepting that there are distortions in the delivery and you are trying to hide them from users, which in turn will also remove detail.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

I design by thinking at a particle level. All the patent-pending and patented technologies I have developed have been invented this way and all our designs are created using symmetry as a core concept. By focusing on particle interaction and how the particles vibrate it allows me to understand how to perfect a technology and product without actually building it. Once I am happy with the technology concept in my mind we move

to the prototype stage, which is when we start listening and using our scopes with actual product. The prototypes then allow us to identify any discrepancies and tweak anything that is not performing perfectly.

What do you consider to be some of your 'landmark' designs—the products of which you are most proud thus far? Why those particular designs?

I am extremely proud of the R2 earphone. This was our first earphone using our patent-pending pressure balancing jet technology and it seems to have changed every listener's concept of his or her benchmark. Developing our patented space and vortex technologies were also major milestones for me as they taught me the two fundamental principles of how to control enclosure resonances and how to remove pressure without causing interference. These led to jet and other patent-pending technologies, which follow the same core principles of removing enclosure related interference.

What advice would you give to headphone or earphone buyers on a budget?

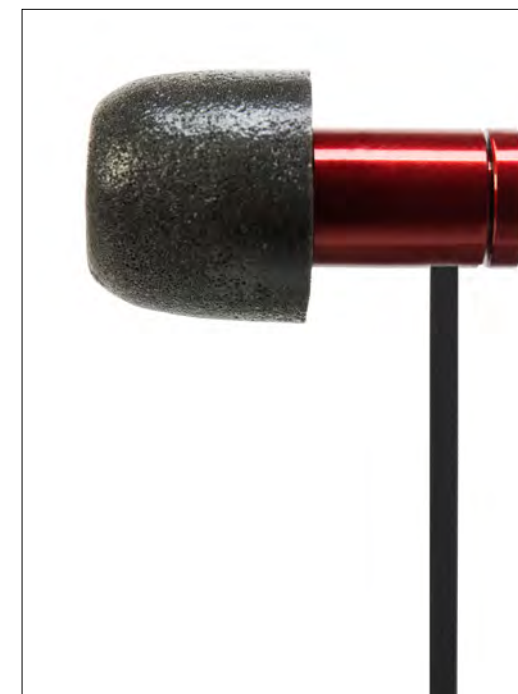
Sound, it is all about the sound, no distortion. Don't be swayed by marketing of neat plastic or some gimmicky function; always listen to the sound quality. Sound is why you are buying the product in the first place so ignore all the smoke and mirrors of whizz/bang/flash and concentrate on the beauty of the tracks you know to assess different products. If there is anything that sticks out when you play a track it's distortion. If there is anything missing, it's

Flare Audio's R2 earphone features the company's unique pressure-balancing jet technology.

been masked because it's distorting at that frequency. When you hear sound without any audible distortion your jaw hits the floor and when you hear music that sounds live, with instruments all around your head you have hit that magical place that you have been searching for, for so long.

In five years' time, how do you anticipate that the world of personal audio will have changed?

Dramatically. Flare has revolutionary technology that will change the way everyone listens to music. This sounds like an extreme statement to make, but that is how we see it. Revolution comes from finding a weakness and developing a way to kill the weakness. In total Flare has nine patents that are either pending or granted. Step by step our vision is to become a world leading sound product and technology company, so watch this space. +



Antonio Meze of Meze Headphones

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

Antonio Meze: There will always be “exotics”, in every product category, but my original vision wasn’t to give more options to rich people. Music is a very personal thing for many people, and important to the point that it is part of their identity. Any improvement to the experience of listening to music, therefore, is potentially a substantial increase in quality of life. It was—and is—for me, too. Although the technology necessary for great sound was already very mature, I couldn’t find anything that was also stylish, generally pleasant to touch (to interact with) and not obscenely expensive.

I was old enough to know that I’m not special; thus, if I experience this slight frustration, then it must be the case that many others do as well. As a designer, I had the question formulated: if you are to have only one pair of headphones, how should they be?

Tell us about the discipline of designing products with affordable excellence in mind. How do you keep performance high and prices low at the same time?

This is the interesting and challenging part of optimization. Let me use the relatively

common ground of history to illustrate: a move like the Trojan Horse strikes us as clever, rather than the millions of pedestrian soldiers pushed by the Czar in the First World War. That’s to say, if you have unlimited resources, of course you can do whatever, eventually. You don’t really need design or engineering for brute force! The goal of design is efficiency.

In the end our model 99’s, for example, are still pretty costly to manufacture. But we are not investing a lot in marketing and hope that the product will sell itself because of its qualities.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

I did both and I am working on some interesting stuff right now! For our current and past lineups, headphones were clearly more difficult because of the sheer number of parts involved. Making a comfortable, interesting IEM on the other hand is becoming more and more difficult as so many new players enter the market.

When you have the opportunity to do a new, ‘clean sheet of paper’ design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product?



How do you balance these variables?

Now that I know much more of every facet of the industry I can hold all these variables in my imagination together. It's no secret that experience helps a lot. What's more interesting is that you have to commit early in development to the standards that you imagined and accept that if even a little aspect is not quite right, you may need to scrap that product. We had that experience and while painful especially for a small company, eventually everybody is uplifted by that constant feeling that the core values are untouched.



What are the distinctive 'hallmarks' or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

I think that they have to be elegant and a bit strange at the same time. If you have both these impressions simultaneously, it's hard to not be hooked. Just because a product is relatively affordable, then automatically the expectation is that one should play safe with the style. No, quite the contrary: the affordability is another feature that adds to the 'wow'!

With our products one does not have to sacrifice good design for sound or vice versa.

What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

Sound is emotional and music is personal so it's very difficult to find that perfect tonal balance for everyone. We try to achieve a sound that is most importantly fun and easy to listen to but also as resolving as possible in its character.

The effort involves endless tweaking and variations of the internal architecture, air volume, vents, membrane, and coil materials, etc. There is no formula or easy way around it.

The 11 Neo earphone is available in several finishes, including the elegant iridium.



How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

We do most of the things that are established measurement practices in the hi-fi industry, of course. But listening is in the end the most important. We consider a product as ready for launch when it clearly stands out compared with the best products in the same category and price point.

What do you consider to be some of your 'landmark' designs—the products of which you are most proud thus far? Why those particular designs?

The 99, no question. While I might be biased by the effort put into all the iterations and prototypes before coming to the market with the final products, I think that the product accomplishes our vision: an interesting and refreshing style that is not just contemporary, but hard to pin down to a category, while having the best possible sound and materials.

I think 'landmark' designs should be like memorable characters from books or movies: you are excused to recognize only the character, while being unaware of the book or the author.

What advice would you give to headphone or earphone buyers on a budget?

Take time to test possible pairs. The headphones/earphones are such a personal piece, and an object that you'll most likely use quite a lot. It means that every little annoyance will multiply!

The smart investment, generally, is to spend more on those features that you use a lot, and less on those that become unimportant in real use. Don't get too excited about features. Look for the core function.

In five years' time, how do you anticipate that the world of personal audio will have changed?

I'm hoping that this industry will work more like information technology: exponential progress will drive costs down for everyone, all the while improving the possible (listening) experiences. Many industries are waiting for better batteries, better wireless connectivity, newer materials and production techniques; I hope at least some of these will see at least maturation if not a huge breakthrough.

I am also hoping that we'll work less with averages and more with individuals. I am talking about customization, of course.

At the same time, I feel the customers will change too, seeing their headphones more as an extension of their personality and their specific needs. They will have a better understanding of what makes a good headphone and they will be more demanding. So the headphones that meet their needs, offering at the same time good sound, quality build, and a unique design, will be more and more appreciated. +

The 99 Classics was Meze's first design and something of a landmark headphone.



Iain Smith of RHA Audio

Hi-Fi+: Given the ever-increasing number of premium-priced, high-end personal audio products entering the market, how and why did you come to focus on comparatively affordable high-performance designs?

Iain Smith: One of founding principles of RHA was that the company's two directors wanted to make products that they would personally buy, and represented real value. They wanted to build products that not only delivered outstanding performance, but were also accessible to as many people as possible. These beliefs have been rooted in the company from day one, and continue in everything we do today.

Tell us about the discipline of designing products with affordable excellence in mind. How do you keep performance high and prices low at the same time?

I don't think there's any compromise in any RHA product. We try to be realistic with our pricing models and have the advantage of not having to subsidise extravagant marketing campaigns and celebrity endorsements with inflated margins. Product quality comes first; everything else comes second.

Do you tend to focus on designing earphones, full-size headphones, or perhaps a bit of both? Is it easier to design one type of product versus the other?

We're in-ear headphone specialists. We've built up a lot of knowledge and skill in

designing, developing and manufacturing in-ears, which we've translated into a range of award-winning products. For us, it was important to ensure that the brand had a solid foundation in one product sector before transitioning to others, which is something we're about to do for the first time.

When you have the opportunity to do a new, 'clean sheet of paper' design, which comes first: the intended performance target, the hoped for cost target, or perhaps the ultimate retail price of the product? How do you balance these variables?

When the team begins work on a new project the aim is always to improve upon what's been done before. We draw inspiration from a wide range of sources, including market research and practices from outside of the audio industry, but price is never the first consideration.

What are the distinctive 'hallmarks' or signature elements of your earphone and/or headphone designs? What distinguishes your products from those of your competitors?

Every part of every RHA product is bespoke, with nothing off the shelf, to ensure that everything works together for the best quality design, comfort, and sound. Our use of metals is somewhat of a hallmark, but I think the overall quality is what sets us apart from our competitors.



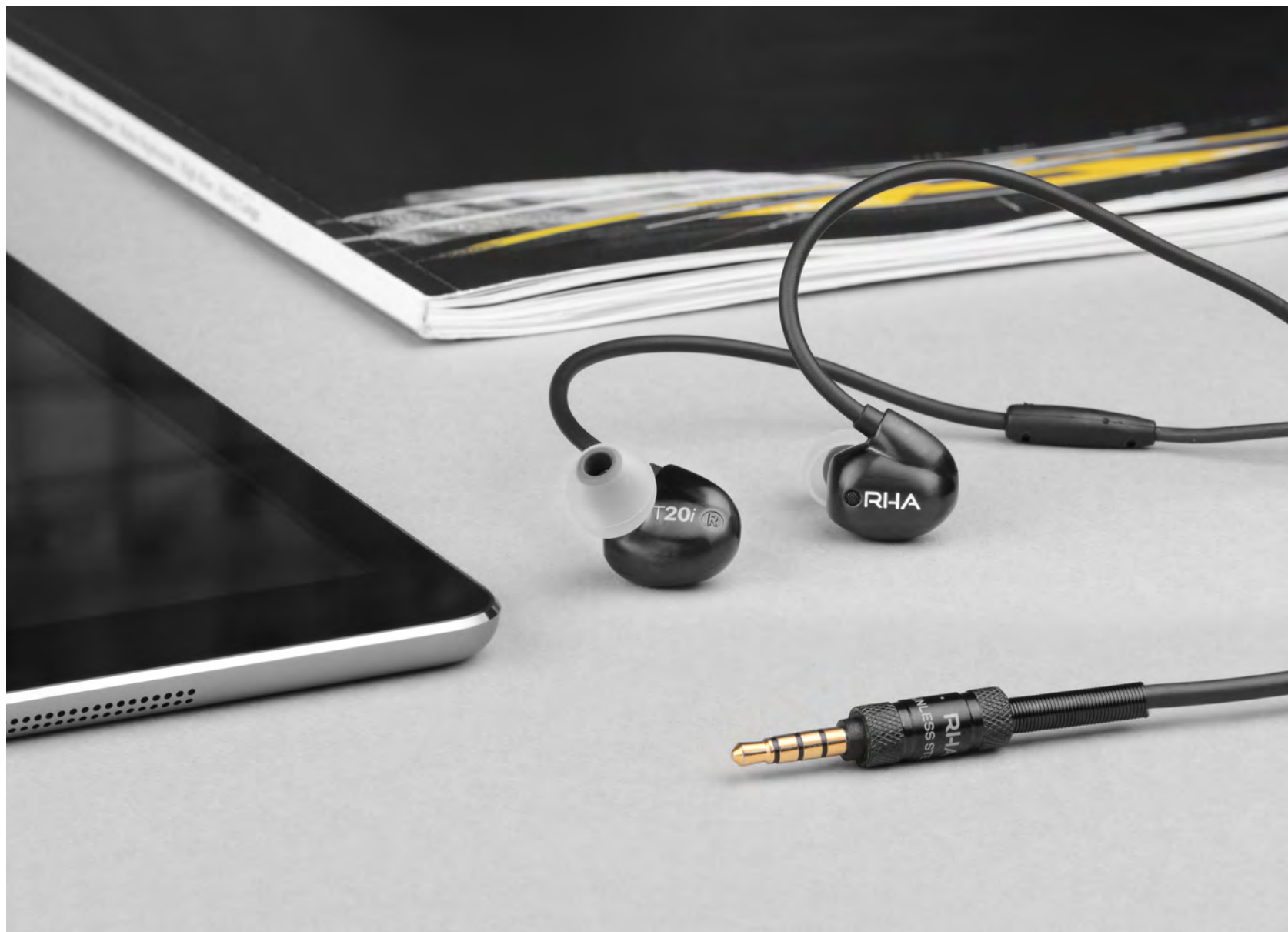
What are your thoughts on how best to voice earphone and headphone products? Tell us a bit about how you establish the desired tonal balance for your products.

We believe in true-to-life sound, which sounds a bit like a marketing gimmick, but it's a genuine aim when creating new products with RHA's signature sound. We think headphones should produce authentic sound, with the most amount of detail possible. There's nothing better than having someone say that they have heard things in their favourite tracks that they'd never noticed before using an RHA headphone.

How do you evaluate the performance of your own new designs? Lab tests? Listening tests? Other methods?

Products go through extensive testing, both technical and subjective, before we launch them. We have a team who are passionate about sound and audio, which means we're able to not only get scientific performance analysis, but also real human feedback. Even if a headphone measures exactly how we want it to in a lab, it won't go into production until the team have heard it and signed off.

The RHA T20i (in black or silver) features the company's patented DualCoil dynamic driver.





What do you consider to be some of your 'landmark' designs—the products of which you are most proud thus far? Why those particular designs?

I think the T20i is the product we're most proud of, simply because it does so much for a relatively affordable in-ear headphone. Looking at the feature list with injection moulded steel housings, a unique type of dynamic driver, tuning filter system and more, it combines a host of new and unique technologies and materials.

What advice would you give to headphone or earphone buyers on a budget?

I think that the best thing a consumer can do right now is research. The personal audio market is booming and there are more brands than ever vying for a share in the market, but not all of them are doing it the right way, and not all of them have the same priorities in mind when developing their products. The more research you do, the more you educate yourself about technologies, about sound signatures, about materials, the better positioned you'll be to find a product that meets your needs, and represents a level of value that you will be comfortable with.

The three filters supplied with the T20i mean a flat response or +3dB boosts for treble or bass.

In five years' time, how do you anticipate that the world of personal audio will have changed?

That's a huge question that's incredibly difficult to answer due to the way the market is constantly changing. For example, I think if you told a headphone manufacturer five years ago that smartphone makers were going to remove the 3.5mm jack from their products, no one would have believed you, but here we are and there are already phones on the market that have done exactly that. If I had to guess, I think we'll continue to see a rise in the quality of wireless audio technologies, in addition to the proliferation of high-resolution smartphones, DAPs, and DAC/amps as more and more consumers prioritise audio quality. +

The Fit is It: Getting the Most from your Universal-Fit Earphones

Chris Martens

Let me begin by relaying, in generic form, a topic that has come up in conversations with any number of would-be earphone listeners who have found themselves only partially satisfied with the sound quality of their universal-fit earphones.

The conversation goes something like this:

Me: “How did you find the sound quality of the [insert name of a particular earphone model being auditioned]?”

Listener (looking unconvinced): “Oh, I suppose it was really pretty good—certainly better than cheap ‘ear buds’. But come to think of it, I do wish these earphones gave me maybe a bit deeper and more powerful bass and a more full-bodied sound overall.”

Me: “Hmm, let me just you ask this: were you able to achieve a comfortable, but airtight seal with the ear tips you have installed?”

Listener (looking perplexed): “Well, I’m not sure. I would have thought so, but perhaps the ear tips fit a little bit loosely, but nothing major. I mean to say, they certainly aren’t so loose that they’re ready to fall out of my ears.”

Me: “I see. Can you tell if you’ve got an airtight seal? For instance, can you still hear a fair amount of ambient noise from the room when you’re wearing the earphones, or do the ear tips block most of that out?”

Listener (looking confused): “I think I can still hear a fair amount of room sound at least some of the time. Is that a problem.”

Me: “Yes, it’s very much a problem. In fact, that slightly loose fit could be what’s causing the bass to seem overly thin and shallow and it could also be what’s keeping the earphone from sounding as full-bodied as it should.”

Listener (looking concerned): “Do you mean that even fairly minor air leaks can have that big an impact on sound?”

Me: “Yes—emphatically yes! Air leaks between the ear tips and your ears, even if seemingly minor, can rob you of some of the performance your earphones are meant to deliver.”

Quite candidly, I have had variations on this conversation so many times and in so many countries that I am concerned that large numbers of listeners may be walking around using earphone under disadvantageous

conditions, with no idea of the sound quality and performance they are missing. What can be done about this? Read on for answers.

FINDING A GOOD FIT (a beginner's guide)

For the overwhelming majority of universal-fit earphones, listeners should strive for a fit that is:

Airtight—and not just “almost” airtight, but well and truly airtight. The right fit, in fact, will be much like the watertight fit one might achieve with a set of swimmer’s earplugs. Upon inserting the earphones in one’s ear canals, there should be an audible moment where a seal is achieved (sometimes accompanied by a faint “thwooop” sound as the seal is formed), accompanied by a marked drop-off in perceived ambient room noise.

NOTE #1: If you don’t hear that airtight seal being achieved and don’t hear that sharp drop-off in room noise, then odds are you do not have a good airtight seal. In that case, try repositioning the earpieces to get a better seal, or try different sizes or types of ear tips until you find a set that yields a proper seal.

NOTE #2: We cannot emphasize strongly enough that “almost sealed” is not good

enough. You will never, ever hear what your earphones can do if your ear tips allow air leaks. Period.

Comfortable—To work properly, ear tips should make contact with your ear canals around their entire circumference—leaving no air gaps, and to do this the ear tips must invariably apply a certain amount of pressure so as to press their outer surface against the walls of the ear canal, thus forming a seal.

The tricky part is finding ear tips that apply just the right amount of pressure. When too little pressure is applied, the ear tips may flex as the listener moves, potentially creating air gaps or even—in the worst cases—becoming so loose as the fall out of the ear.

But, when too much pressure is applied, discomfort and irritation of the ear canal can result. (The airtight seal will typically remain intact, which is good, but at the price of chafing and or long-term wearer discomfort.)

The ideal, which may take some trial and error experimentation with various ear tips, is to find a fit that consistently maintains a good seal, but without applying so much pressure that discomfort results. With ear tips, unlike garments, a slightly too loose fit is

usually not a good thing in that the resulting air gaps (and attendant noise intrusion) invariably undercuts sound quality.

Pays Attention to Human Factors in Design—

Bear in mind that earphones, earphone signal cables, and ear tips are a system where all elements are supposed to work together for optimal comfort and sound quality. Unfortunately, this isn't always the case.

Odd though it may seem, some manufacturers pay much more attention to human factors and to ergonomic design considerations than others, with some interesting (and not always pleasant) consequences.

For example, some manufacturers offer earphones with exceedingly small earpieces, which seems great from a standpoint of compactness, but which can have the unintended consequences of making the earpieces difficult to grasp and to insert, and can make the earphones almost impossible to fit for listeners who have deeply set ear canals.

Similarly, some manufacturers offer brilliant and well thought out earpiece enclosure designs, yet neglect to think-through the angles at which the signal cables attach to the earpiece enclosure. As a result, listeners might wind up with earphones, per se, that fit beautifully, but whose signal cables always seem to stick out in the wrong places at the wrong times, thus chafing against the outer ear or—in the worst cases—actually creating

pressures that tend to pull the earphones out of the wearer's ears.

Finally, some earphones provide earpiece enclosures so large and elaborate that they literally 'get in their own way', making proper insertion difficult, or potentially prevent a good fit from being achieved (because the earpieces prevent a proper in-ear seal from being formed or maintained).

SOME PRACTICAL TIPS THAT CAN HELP

If the ear tips you are using do not seal well or for long periods of time, by all means try a different size or type of ear tip. What ever you do, don't try to 'make do' with an improper fit. That leads only to madness and/or acute listener dissatisfaction. Be aware, too, that if the ear tips supplied with the earphone don't work for you, there are many good aftermarket sources for alternative ear tips.

Some listeners find that lightly moistening ear tip surfaces just prior to insertion can make it easier to achieve a good seal. Others also have found success by inserting ear tips quite deeply in their ear canals and then pulling backward on the earpieces very slightly (this seems to help the ear tips flare outward just a bit, thus making for a good seal).

If you are having trouble achieving a good fit, don't be afraid to experiment with earpiece positioning. Sometimes inserting the earpiece from a slightly different angle, or

with the signal cables orientated a different way, can make all the difference in the world.

Be mindful of cable routing: remember that not only should your ear tips seal well, but also your earphone's earpieces and signal cables need to fit comfortably as well. HINT: Sometimes switching from routing cables downward from the ear to instead route cables up and over the ear can make a huge difference in perceived fit and long-term comfort. Don't be shy; experiment!

Although this isn't always easy to do, *Hi-Fi+* recommends that, where possible, you try a sample set of the model of earphones you think you want before finalising a purchase. In this way, you can know for sure whether the earphones will offer a proper fit for you and your ears.

AFTERMARKET SOLUTIONS

Most earphones ship with a range of ear tips (typically offering sizing options S, M, L or even more) and in an ideal world one of those options should be able to give you a good fit. However, should this not prove to be the case, it helps to know that there are a number of aftermarket options that should fill the bill.

In almost all cases, aftermarket ear tips offer technical features designed to help ear tips achieve a smooth, seamless, comfortable, airtight seal between the circumference of the tip and the wearer's ear canals. The trick, of course, is finding ways to accomplish this goal without putting undue pressure on the

sides of the ear canal, since excess pressure invariably makes for long-term discomfort.

Below is a cursory survey of some of the tips available.

Comply Foam Tips



Unlike the other companies listed here, Comply does not make earphones, but rather focuses solely on manufacturing high quality, compressible foam ear tips designed as aftermarket enhancements for virtually all brands of universal fit earphones.

Interestingly, Comply can be viewed as a spin-off from the giant materials sciences company 3M Corporation (creators of, among other things, Post-It brand stick-on notes). Comply holds most if not all the core patents on the use of compressible foam materials for ear tip applications, so that many of the firms offering foam-type ear tips do so under license from Comply.

Comply tips feature an inner sleeve, typically sized to fit the dimensions of the sound outlet tubes of the earphones in question,

with a cylindrical shell made of compressible foam material. More recently, Comply has announced a new universal-fit series of tips with flexible inner sleeves that can stretch to fit the sound outlet tubes of almost all off-the-shelf earphones.

To insert Comply tips, users first squeeze the outer foam shell between their thumbs and forefingers, rolling and ‘crushing’ the shell down to compact dimensions. Then the now-compacted shell is inserted in the ear canal and held in place for about 10-15 seconds as the foam re-expands, gently moulding itself to the contours of the wearer’s ear canal, creating a nearly ideal custom fit.

My personal experience has been that Comply tips always give good results and sometimes give great results—especially in instances where otherwise fine earphones come with a less-than-ideal set of standard ear tips. Stated simply, Comply tips have a reputation as the go-to choice for listeners who have not been able to achieve a satisfactory fit with other conventional types of ear tips. Comply tips are typically offered in three basic sizes: S, M, and L.

There are also several variations in Comply tip shapes and materials, with bullet shaped Isolation models that emphasise noise isolation, Sport models moulded with extra-grippy and more aggressively-textured foam for active listeners, semi-spherically shaped Comfort models, and extra-long bullet-shaped P-series models said to provide maximum noise isolation and retention

capabilities with a deeper fit for audiophile applications. Comply also offers a variety pack that includes an assortment of Isolation, Sport, and Comfort tips.

In my experience, there can be subtle sonic differences between the results achieved with silicone shell earpieces vs. Comply foam earpieces, so a good approach might be to try a set of Comply tips on your favourite earphones to see if you like the results. In terms of sheer comfort and a customised fit, however, Comply tips are hard to beat.

<http://www.complyfoam.com/variety-pack/>

Klipsch patented oval ear tips

Klipsch was one of the first earphone manufacturers to grasp the fact that human ear canals are not circular in cross section (as many people suppose), but rather are more nearly elliptical or oval-shaped in cross section. Accordingly, Klipsch created and patented an ear-tip design that, when viewed end-on, provides a tip shape that is not round but rather elliptical or oblong (picture a rugby ball viewed from the side, but in miniature).

In practice, I have found the Klipsch ear tips to be remarkably effective in that they achieve a good seal with an uncommonly comfortable, relatively low-pressure fit (in fact, pressures are so low that listeners have been known to forget they are wearing earphones in the first place!).

Klipsch’s elliptical tips are supplied as standard with the firm’s entire range of

universal-fit earphones, but are also available for purchase as standalone accessories.

Note, though, that Klipsch’s elliptical tips are basically designed to fit Klipsch earphones; they may also fit some non-Klipsch earphones, but you will need to make that determination for yourself.

<http://www.klipsch.com/products/oval-ear-tips>



Monster Gel-type and Foam SuperTips



Monster founder Noel Lee is much more of a serious student of ear tip design and construction than you might think and some years back he encouraged his team to create gel-type SuperTips (and later on, foam-type SuperTips), which are offered in a wide range of finely graduated sizes.

At first glance, Monster’s Gel-type SuperTips look much like conventional circular, ‘bulb-type’ silicone ear tips, but on the inside they are quite different. The design provides a central silicone sleeve that slips over the sound outlet tube of the earphones, a thin semi-spherically shaped outer shell, with—this is the interesting part—a squishy, gel-type layer between the outer shell and the inner sleeve. The concept is that the gel layer will provide a just-right amount of pressure in order to gently press the outer shell of the ear tip against the inner contours of the ear canal.

Monster also makes compressible foam SuperTips, which have more of a ‘bullet

shape’ than the more nearly spherical or ‘bulb-shaped’ Gel-type tips. The other main difference, though, is that with the foam tips there is no outer silicone shell; instead, both the support section and outer ‘touch surfaces’ are made of compressible foam.

In practice, the gel-type SuperTips can offer a very fine fit with excellent noise isolation, but they are also very sensitive to correct sizing. This is why Monster makes a point of offering a finely graduated range of ear tip sizes and typically sells its SuperTips in a multi-size variety pack. I have less experience with Monster’s foam-type SuperTips, but I suspect they would work well for those with irregularly shaped or otherwise difficult-to-fit ear canals.

Hint: Do not be surprised if you find you need slightly different ear tip sizes for your left and right ears. This is common with Monster’s gel-type SuperTips. SuperTips come as standard on some but not all Monster earphone products, but are also sold as aftermarket accessories for use with non-Monster earphones.

http://www.monsterproducts.com/Monster_SuperTips_Sampler_Pack_with_Gel_and_Foam_Tips

SpinFit Tips



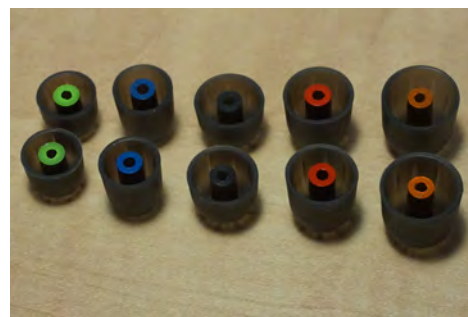
SpinFit tips offer a clever, and patented, variation on traditional ‘bulb-shaped’ ear tips. Most tips are designed so the outer ‘bulb’ of the tip is aligned with the inner sleeve of the tip that slips over the sound outlet tube of the earphone. However, SpinFit tips are much different in that their outer ‘bulb-shaped’ shells are essential decoupled from their inner sleeves by special, articulating cushion that allows the outer shell to tilt and swivel in 360 degrees—moving independently from the inner sleeve to achieve the best fit in the ear canal.

The result, says SpinFit, is a fit that is typically deeper in the ear canal, yet more comfortable, and that provides superior noise isolation, more extended low-frequency response, and more finely resolved high-frequency details.

There are presently two models of SpinFit tips on offer: model CP800 (offered in sizes S, M, and L) and model CP100 (offered in sizes XS, S, M, and L). Both models sell for USD \$20.

<http://www.spinfit-eartip.com>

Westone Star Tips



As a premier manufacturer of both custom-fit in-ear monitors and of universal-fit earphones, as well as one the largest manufacturers of custom ear mould products in the world, Westone knows exactly how varied in size and shape human ear canals can be. Seeking an ear tip solution that would be extremely flexible and comfortable to wear and that would also be easy to install and straightforward to manufacture, Westone developed its patented Star Tip design.

From the outside, Westone’s Star Tips look fairly conventional; they feature a central silicone sleeve that slips over the sound outlet tube, with a thin, roughly ‘bullet shaped’ outer silicone shell. On the inside, though, lies the critical design detail that sets the Star Tips apart; thin inner surfaces of the outer shell feature tiny, fluted ribs that at once make the tips relatively firm along their longitudinal axis, but extraordinarily flexible when squeezed from the sides. As a result, the Star Tips are easy to insert (thanks to those longitudinal ribs), while their

ultra-flexible sidewalls easily curl and curve to conform to the shape of even the most convoluted ear canals. What’s more, as a very clever ergonomic touch, each of the five available sizes of Star Tips is colour-coded (green = XS, blue = S, black = M, red = L, and orange = XL) so that users can tell at a glance which size of tip they hold in their hands.

What’s in the name? If you view the Star Tips from the rear side, the fluted ribs on the inner surfaces of the tips outer shell create a sort of ‘starburst’ pattern; hence, the name Star Tips.

My practical experience has been that Star Tips work extremely well and offer a great combination of day-to-day usability and long-term comfort. Star Tips come as standard on most Westone universal-fit ear phones, but are also offered as aftermarket accessories both in single-size packages or in a multi-size Star Fit Kit, which we would recommend as a good starting point for first-time users. +

<https://www.westone.com/store/music/index.php/star-silicone-tips-combo-pack.html>



A Headphone Manifesto: Why Headphones Matter

Chris Martens

I have been an audiophile for more decades than I care to count and through many of those years I did virtually all of my listening through loudspeaker-based systems, as also may be the case for many of our readers. But over the past seven or eight years an ever-increasing amount of my listening has centred on headphone-based systems, which have become a growing source of musical delight for me.

To be perfectly candid, many of the audiophile friends, colleagues, pundits, and manufacturers I've met over the years have regarded my newfound interest in headphones with no small amount of scepticism, if not a mixture of disdain or even outright alarm. As is often true in British English, but is also true in the 'States, much is conveyed through pained facial expressions or barely concealed rolling of the eyes, rather than through direct verbal criticism or confrontation. You can probably imagine the scenarios for yourself.

I chance to tell a colleague that I have found it very rewarding to listen to headphone 'X' through headphone amplifier 'Y' and my conversation partner responds with the sort of look normally reserved for dealing with loved ones who have suddenly manifest signs of mental illness. Typically, the colleague might go on to say, with the kind of sniff that usually accompanies informing close friends



that they are in the process of committing an egregious social faux pas, “So you, um, say you actually like spending time with (long pause)... headphones?”

The message, spoken or otherwise, couldn’t be any clearer: in certain high-end audio circles, headphones are simply not thought to be proper transducers for serious, discerning, blueblood music lovers. Even among those who have a more ‘enlightened’ take on headphones, there remain many who view the headphone world as something to be ‘endured’ rather than ‘enjoyed’.

No sir, headphones and earphones are, at best, thought to be simpleminded toys for simpleminded listeners, or so some commonly embraced high-end myths would have it.

All of this would be fine, save for the fact that those ‘circling the wagons’ in defence of hidebound audiophile traditions are missing one key fact: today’s best headphones (and earphones) offer such high levels of performance that in many respects they challenge the presumed performance supremacy of loudspeakers—and they do so for about a 10 pence on the pound price differential!

I’ll just come right out and say it: in terms of musical performance per unit money, modern headphone-based systems typically offer unbeatable value vis-à-vis loudspeaker-based systems. What is more, in terms of absolute performance standards, today’s finest headphone-based systems often check

more performance ‘tick boxes’ than typical loudspeaker-based systems can—except, of course, for loudspeaker systems to which vast sums of cubic money have been applied.

For me, this point was driven home by an experience I had a few years ago. In the weeks running up to a major audio trade show, I had spent time reviewing an extremely high-quality headphone-based system that sold for about USD \$10,000 (an admittedly large sum to spend on a headphone rig, but then true top-shelf performance in the audio world is never cheap). Suffice it to say the headphone system sounded extraordinarily good, though at the time I’m not sure I grasped just how good it really was. Then, at the trade show I attended a significant product rollout event featuring a new high-end loudspeaker selling for more than USD \$60,000 per pair, as shown in a system whose net price was well in excess of USD \$250,000. As is often the case at such events, there was a pre-demonstration presentation from the speaker manufacturer where the designer was introduced, product highlights and key design features were discussed, and various performance claims were made—all with considerable flourish. According to the manufacturer, the new speaker promised ‘incomparable resolution and subtlety’, ‘profound bass extension’, and ‘muscular, real-world dynamics’, and so on.

Finally, though, the eagerly awaited moment of truth arrived and the demonstration session began (featuring, by pure chance,

several of the same recordings I had used in my recent headphone system review). The results of the demonstration were eye opening, but not in the way I anticipated. I expected to be wowed by the new speaker, but in fact I found its performance more than a little flat and underwhelming. Why? The simple answer is that the costly speaker system, genuinely excellent though it was, failed to retrieve a number of the sonic subtleties and significant pieces of musical information that I knew those recordings contained, and that the recently reviewed headphone-based system had captured with almost casual, offhand ease. I wouldn’t go so far as to say the headphone system made the just-launched loudspeakers sound like they had an ‘Emperor’s New Clothes’ problem, but the headphone system certainly made it clear that the ‘imperial’ loudspeaker’s sonic wardrobe was not as sumptuous as the manufacturer had claimed—not by a long shot.

Honestly, the performance contrast I observed hit me with the lightning bolt-like force of a full-on epiphany and in that moment my notion of the order of things in the high-end audio universe was significantly shaken, if not upended. Perhaps for the very first time I began to grasp that in certain respects superb headphone-based systems not only could compete on a level footing with far more costly loudspeaker-based systems, but also could in some meaningful ways potentially outperform them (and for a fraction of the price). I didn’t, as they say, see that one coming...

Over time, I’ve found that a number of music lovers and listeners young and old have had similar moments of musical/audio epiphany, which goes a long way toward explaining the meteoric rise in the popularity of headphones, earphones, and the personal audio product category in general. At their best, personal audio systems offer the promise of delivering more musical information and higher sound quality for less money, which in a nutshell is why headphones matter.

What things can Headphone & Earphone-based systems do well?

Full-range frequency response: As most experienced audiophile recognise, there are meaningful distinctions to be drawn between semi-full-range, near-full-range, and truly full range loudspeakers, but in contrast truly full-range headphones and earphones are fairly easy to find, even in low and mid-level price brackets. The secret, quite obviously, lies in the fact that headphone drivers don’t have to move a lot of air and therefore don’t require extreme diaphragm displacement. With headphone and earphone drivers, a little movement goes a long way, so that it is comparatively easy to create designs whose output spans the entire audible range from 20Hz – 20kHz. The advantage goes to headphones and earphones.

Dynamics: As mentioned above, with headphones and earphones a small amount of diaphragm movement goes a long way, meaning that it is relatively easy to create designs that can play at realistic volume

levels (or beyond) without undue stress. Where loudspeaker based system must contend with filling small, mid, or large size rooms with sound, headphones and earphones have only to fill our inner—and in some cases outer—ears with sound, which is a much less daunting task. This addresses the issue of so-called ‘macro dynamics’, but what about ‘micro dynamics’? Here again headphones and earphones are at an advantage since their driver diaphragms, which again cover the full audio frequency response spectrum, are in most cases as low in mass (or even lower in mass) than are the tweeter diaphragms found in conventional loudspeakers. In practical terms, this means headphones and earphones can not only take large-scale dynamic swings in stride, but also can capture extremely small and delicate shifts in dynamic emphasis with terrific subtlety and nuance. Again, the advantage falls to headphones and earphones.

Resolution and Detail: High-resolution loudspeakers are things of great beauty, but the fact is that they are not easy to design or to build, and part of that difficulty centres on the fact that it is not easy to get multiple drive units of different sizes (and sometimes of different types) to speak with one united, coherent, and articulate voice. Headphones and earphones face a much simpler task, in that many of them are able to use either a single full-range driver or multiple drivers that are extremely low in mass and are therefore able to start and stop quickly, faithfully following the intricacies of audio signals with relative ease. It helps, too, that the drivers

are typically positioned less than an inch (call it 2.5cm) from the user’s ears, so that driver diaphragms don’t have to move very far to reproduce even the sharpest of transient waveforms with what the ear perceives as realistic amplitudes. Put all of these factors together and you can see how headphones and earphones are able to deliver extremely high levels of resolution and detail in a straightforward, no-fuss, no bother way.

Coherency: Most multi-driver loudspeakers, headphones, and earphones require crossover networks of some kind, which can potentially make for noticeable discontinuities over the audible frequency range. Naturally, careful crossover design and equally careful placement of drivers can help mitigate (or virtually eliminate) these problems, but my point is that this takes work and meticulous listening tests to get right. By comparison, though, many headphones and earphones are single-driver designs that are inherently coherent and that completely eliminate phase response problems. Even in multi-driver headphones and earphones, potential problems with driver placement are easier to manage than in loudspeakers—in part because the drivers can be positioned close together and very nearly the same distance from the ear. The upshot of this is that it is often easier for headphones/earphones to achieve a coherent, ‘cut from whole cloth’ sound than it is for loudspeakers to do.

Freedom from Room Problems: It is almost an axiom that loudspeakers only sound as good as the rooms in which they are

played, which means that the performance of even the finest loudspeakers is to a large extent room dependent. With headphones and earphones, however, this problem never comes up. The headphone is only responsible for delivering sound to the user’s outer ears and ear canals, where with most earphones the job is even simpler in that the earphone delivers sound to the ear canals only. If you stop to think of the many, many ways in which room acoustics can influence the sound of loudspeakers, you will immediately appreciate why removing the ‘room variables’ from the equation makes it much more possible for headphones and earphones to deliver a consistent and more or less repeatable sound from user to user.

Compactness and Convenience:

Loudspeaker systems typically take up a fair amount of space—and in some cases a great deal of space. Headphone systems are typically much smaller and can usually fit on a desktop with room to spare, while earphone systems can be so small that they fit easily in one’s pocket. In settings where space is at an absolute premium, headphone and earphone-based systems can give musical satisfactions in spaces too small to accommodate even the smallest and most compact, mini-monitor-type loudspeakers. Add in the possibilities for portable, on-the-go listening and you can see how headphones and earphones allow enthusiasts to take the high-end audio experience with them almost anywhere they might wish to go—including places where loudspeakers could never fit it.

What is more, headphones and earphones neatly solve the problem of late night listening, not to mention the problem of wishing to play large scale ‘power’ music at satisfying volume levels, but in an apartment or row house environment. In short headphone and earphones help listeners avoid having angry neighbours with pitchforks pounding on their front doors.

Value: Many high-end audio enthusiasts are by nature epicureans who, if given the choice, would like to own the best equipment possible. With loudspeaker based-systems, however, the expression “best equipment possible” is a loaded one, as the price tags for true cost-no-object high-end audio systems can range deep into six figure sums (something that might have seemed unthinkable thirty or forty years ago). As a result, fewer and fewer audio epicureans can afford to play the ‘sport’ of loudspeaker-centric high-end audio at the highest levels, or even near top-tier levels.

The situation with headphone and earphone-based systems, however, is much different. With very few exceptions (and I could probably count them on the fingers of two hands), even the most expensive top-tier headphone based systems are typically priced below USD \$15,000, with electronics included, and are often priced much lower than that. Similarly, even the most costly portable earphone-based systems would typically not exceed prices of USD \$6,000, and would in the majority of cases cost far less than that. Remember, please, that

the prices I am referencing would be for the crème de la crème of the headphone world—not for products that perhaps fall one or two conceptual ‘clicks’ below the very top class. My point is that best-in-class headphone and earphone-based systems sell for roughly 1/10th to 1/40th the price of their state-of-the-art loudspeaker-based counterparts. In practice, this means that headphones and earphones represent a new form of high-end audio where many more enthusiasts can actually afford to ‘get in the game’.

Where do Loudspeaker-based systems excel?

Imaging and Soundstaging: There is no question that the finest loudspeaker-based systems decisively outperform even the best headphone and earphone-based systems in terms of imaging and soundstaging. The key, here, is that most of us grew up with the understanding that the purpose of hi-fi systems is, at least in theory, to recreate the sense of attending and enjoying live musical events, whether those events took place in a concert venue or a recording studio. Either way, the working assumption is that the musicians are located somewhere in front of the listener and at least some distance away—depending upon whether we are listening to closely mic’d studio recordings or more distantly mic’d concert hall recordings, etc. We expect to hear musicians, again performing in front of us and at some distance away, located at reasonably precise positions on stage or within the studio recording space. Finally, we often hope to

hear various sonic cues that will convey a sense of the size, shape, and acoustics of the recording venue. Fine loudspeaker-based systems can do a superb job with each of these aspects of music playback and in ways that headphone and earphone-based systems are hard-pressed to match.

However, this is not to suggest that headphones and earphones can’t do imaging and soundstaging at all, because that is not the case. Rather, headphones and earphones offer a sonic presentation that is typically quite different to that afforded by loudspeakers. Some people complain that the sound through headphones and earphones seems ‘stuck inside their heads’, but my personal experience has been that higher quality headphones and earphones do not have this problem. Instead, they can and do present sounds that appear to emanate from far outside the wearer’s head; the problem, is that sounds rarely appear to come from in front of the listener, but rather seem to be placed on a continuum extending from the far right of the listener’s head to the far left (and often from all points in between). Similarly, depth and other spatial cues in the music are often reproduced in the lateral axis, rather than presenting themselves from front-to-back, as would be the case with loudspeakers. In short, listening through headphones is often less like listening within a three-dimensional performance space (which is the sort of presentation loudspeakers handle so well), but more like listening to live microphone feeds through a recording engineer’s console.



Those who deeply prize the three-dimensional, you-are-present-in-the-recording-space presentation that loudspeakers offer may find this factor alone will lead them to prefer speaker-based systems over headphone or earphone-based ones. Fair enough.

However, those who can appreciate the appeal of hearing the music with the sort of intimate and revealing detail that only the recording console itself could capture (arguably one of the purest of purist interpretations of recorded music possible)

may find that headphones and earphones still have much to offer.

Visceral impact you not only hear, but also feel: One valid point frequently cited in favour of listening through loudspeakers is that, at their best, they can deliver music—especially so-called ‘power’ music—with impact that can be felt in a tactile way, often as a thump in the chest or as palpable vibrations coming up through the seat of one’s pants. For obvious reasons, headphones and earphones cannot deliver

this sort of impact, since they do not excite sound waves that energise the rooms in which we listen. Depending upon how highly one prizes this sense of visceral impact, loudspeakers can again enjoy significant advantages vis-à-vis headphones.

With this said, however, I have found that with larger full-size headphones—in particular those whose ear cups not only surround the outer ear but also the delicate, pressure sensitive area just below and behind the ear lobes—headphones can create a sort of high-impact synaesthesia where powerful low-bass notes and large orchestral swells can make the listener feel as if s/he is having a ‘whole body’ listening experience.

Similarly, earphones (and custom-fit in-ear monitors especially) can create a sort of ‘total immersion’ listening experience that, while different to the presentation offered by loudspeakers, is no less engaging.

Comfort. Many traditional audiophiles listen for extended periods, and as a result complain that headphone listening can be uncomfortable over the same, protracted listening sessions. They find the process of inserting in-ear monitors of any kind invasive, the wearing of on-ear headphones to pinch their ears, and over ear headphones sweaty. They also complain that the headband and weight of a pair of headphones weighs heavy on the head over protracted periods.

While I suspect a lot of comfort concerns ultimately come down to either inertia or

unfamiliarity (making the process seem more alien to those more used to loudspeaker listening), it is worth noting that even within the headphone community itself, few are equally comfortable with headphones and earphones. However, it seems this is more of an objection that can be overcome than a legitimate reason for not investigating the headphone world.

A more social listening experience: Some of the most obvious benefits of good traditional audiophile systems are paradoxically hidden by traditional audiophiles themselves. Good loudspeaker-based systems not only replicate the soundstage and visceral impact of a live event, but can also help recreate the importance of the shared musical experience. With the exception of the ‘silent disco’ movement (where London clubbers would don headphones rather than listen through a PA system, a choice in part driven by the club owners wanting to keep on the right side of local noise pollution laws), a key part of enjoying a live musical experience is that you get to share the experience with others, and this is difficult to recreate if everyone is listening to their own music on their own headphones. A pair of loudspeakers creating their own room-filling soundfield allows anyone in the room to share the experience live, and many still enjoy communal music sessions.

Of course, the same does not apply if you are holed up in your ‘man cave’, steadfastly refusing anyone else access to your music and your system.

Summing Up:

High performance headphones, earphones, and custom-fit in-ear monitors have earned their rightful place as serious transducers capable of pleasing discerning audiophiles. While there are certain things loudspeakers can do better than headphones, the obverse is also true; headphones and earphones bring their own key performance advantages to the table.

While headphone and earphone-based system may not replace loudspeaker-based systems, they make entirely worthy companions to them. What is more, they potentially offer exceedingly high levels of performance per unit money, while making possible both private (and unobtrusive) late night listening sessions and very high quality listening experiences on the go. Add in the cost/performance advantages of headphones, earphones, and custom-fit-in-ear monitors and you can see why they have become the high-end listening devices of choice for a new generation of music lovers and open-minded veteran audiophiles alike. +



There's no reason why headphone-based and loudspeaker-based systems cannot co-exist!

Personal Audio: Is it 'real' high-end audio?

Alan Sircom

It might seem odd to most people, but there is a rift between users of high-end personal audio and the more traditional high-end audio systems. The gap is closing, but there are still many audiophiles who think high performance personal audio does not constitute 'real' or 'true' high-end audio, and feel any intrusion in the high-end space by personal audio devices is unwelcome. Is this a justifiable argument?

Let's begin philosophically. The very concept of 'real' in high-end audio is an informal fallacy; a method to try to rescue a refuted generalised assertion. The definition of high-end audio is not fixed, and any attempt at categorising what is or is not 'real' high-end audio as a result is merely trying to exclude regions of audio on some extremely ad hoc grounds. Just as high-end audio is not the exclusive preserve of open reel tape advocates, or high-resolution supporters, so the method used to reproduce these sources is not exclusively limited to full-range tower loudspeakers. From a purely epistemological standing, there are no barriers to exclude personal audio from high-end audio, but that doesn't stop old-school audiophiles from entertaining and holding a populist viewpoint.

The simplistic "it's too cheap for audiophiles to get involved" argument is probably too over-simplistic. Audiophiles who are unconvinced by personal audio are not simply the high-enders who demand inch-thick front panels and cables that cost as much as a limousine. Instead, many use high performance audio equipment at all prices. Sure, if you are seeking out the 'money no object' end of audio as some kind of financial elitism, then the relatively affordable personal audio world doesn't buy you the same kind of exclusivity (anything over \$10,000 gets you the best personal audio rig it's possible to own. Or one good audiophile power cord) but a lot of audiophile aspiration is ultimately about sound quality, and many audiophiles have systems that don't cost tens of thousands of dollars. People who own Rega Planar 3 turntables and NAD amplifiers are not elitist snobs, but many of these buyers reject personal audio all the same.

Traditional, loudspeaker-based audio systems now come in all shapes and sizes.





In part, it's the 'personal' nature of personal audio that can pose a problem for the audiophile traditionalist. Many audiophiles use turntables, and many reject streamed digital sources for CD or SACD discs. Such people are reluctant to explore a downloaded or ripped music 'space' because it undermines the importance of the record or CD collection. I'm not entirely convinced this is as much a 'thing' as a hidden issue that some simply add to their unconscious list of things that help them preclude personal audio from their audio entertainment line-up. Once again, this is more of an objection in the mind of the enthusiast than a functional limitation of personal audio per se.

I suspect some of the reluctance to include personal audio into the high-end audio world is historic, and possibly even an unconscious reaction to the aftershocks wrought by the Apple iPod. The traditional audio industry collectively failed to respond to the iPod for the longest time, and often dismissed it as a trivial lo-fi component than view it as the potential gateway device for a new generation of proto-audiophiles. This dismissive stance permeated the industry and its traditional buyers, and still holds today.

Traditional high-end audio is built to a very high standard, but that is reflected in its price tags!

Tall floorstanding loudspeakers are excellent... if you have enough space to correctly use them.

Regrettably, a lot of this hostility toward personal audio effectively ignores the development and impact of recent high-resolution audio player, amplifier, DAC, headphone, earphone, and custom in-ear monitor design. There is a vast difference in performance between a 2004-era Apple iPod playing 96kbps AAC files through the supplied ear buds, and something like a Questyle QP1R playing DSD files into a pair of custom fit Noble Katana in-ear monitors. However, if you base your conclusions on that 2004 version of personal audio without ever experiencing what a dozen years of development can bring about, it's easy to dismiss the whole personal audio subset as 'not audiophile enough'.

There are a couple of valid arguments that audiophiles hold about the sound quality of traditional audio that don't translate to personal audio. One of which is fairly obvious; the visceral, kick-in-the-gut deep bass experience that you can only get from big drive units moving air around a room. This is often overstated because we experience most of our music through – surprise, surprise – our ears. However, anyone who has ever experienced the power of an orchestra or the full onslaught of a rock drummer live will know our perception



of that force is proprioceptive in nature; how our bodies react to those air pressure changes. The curious thing about our psychology is if we hear – but don't feel – deep bass sounds, we tend to reinforce the experience with a form of autonomous proprioception: we can 'feel' the bass note through our body even when the note only has an aural component. However, if you are used to a more visceral experience from horn-loaded loudspeakers, for example, that experience is hard to replicate from personal audio.

The other criticism of personal audio by traditional audio system users is that of 'lateralization' effects. Lateralization is the experience of apparent sound sources inside the listener's head, instead of being in three-dimensional space in front of or around the listener. We localise sounds using phase, intensity, and spectral differences between ipsilateral (closest to the sound source) and contralateral (farthest from the sound source) ears. This is the great sticking point for many audiophiles: the headphones used by traditional high-enders (Stax and Sennheiser HD800, for example) tend to be more accommodating of 'out-of-head' image location while those more used to personal audio seem less discomforted by lateralization effects.

Lateralization remains one of the big differences between the present and previous generations of audiophiles, as those used to the sound of loudspeakers in free space tend to find lateralization effects

more annoying than those who have grown up listening through headphones. There seems to be little means of rapprochement between these two polar opposites in audio, although there are products that attempt (deliberately or otherwise) to mitigate lateralization effects for the listener. As this implies our reaction to lateralization effects is a learned response, the question that unfolds from this is whether the dislike of in-head sounds can be unlearned? Certainly, from personal experience and from anecdotal evidence from traditional audiophiles who have migrated to personal audio, it seems as if lateralization is not so significant a problem as some seem to think.

The simple answer to the question of whether personal audio is 'real' high-end audio is a resounding 'yes'. From a sonic standing and with a couple of relatively minor caveats, what holds for traditional high-end audio also holds for personal audio. From a pragmatic viewpoint, there seems to be no real obstacles to personal audio, or to personal audio being used in tandem with a conventional audio system. Personal audio allows you to bring your high-end audio system to places it never normally appeared, such as 30,000 feet above the ground, hotel rooms, or any place outside of the listening room. Unless you want an excuse not to leave your own man cave, personal audio is an expansion for your audio listening that everyone should try at least once. +

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** formerly Final Audio Design

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ENCYCLOPAEDIA HEADPHONICA

HEADPHONE TERMINOLOGY EXPLAINED, [Chris Martens](#)

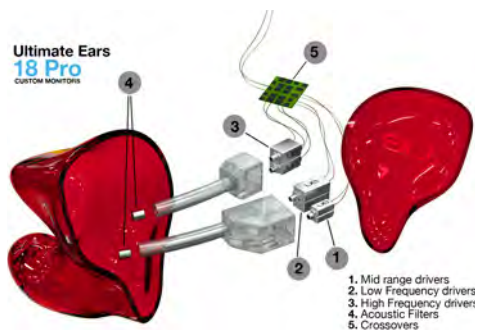


As you might expect, the world of high-performance headphones and earphones has gradually adopted specialised terminology all its own. This article is provided in an attempt to make it easier for newcomers and veterans alike to navigate that world.

Some of the terms described here are in common use throughout the industry, while others are more specific to *Hi-Fi+*. Our publication does try to use terminology consistently, especially within our on-going series of headphone/earphone-related product reviews, so that this glossary will—we hope—help you get more out of past, present, and future *Hi-Fi+* content.

Balanced Armature Driver

A type of miniature drive unit frequently applied in earphone and CIEM designs, but also—much less frequently—used in full-size headphone designs. Balanced armature drivers feature extremely small can-like enclosures containing very small armatures wound with wire coils and suspended with in a magnetic field. As audio signals are applied, the changes in the magnetic field across the coil cause the armature to rock back and forth, pivoting on its balance point or fulcrum. As one end of the armature is driven upward, the other end goes downward (much like a child's 'seesaw' or 'teeter-totter' in motion). In order to produce sound, one end of the armature drives an actuator connected to an extremely small diaphragm, which flexes inward and outward as the armature moves up and down. Output from the diaphragm typically is routed to the listener's ears via a sound outlet tube commonly called a 'bore'.



This exploded view of Ultimate Ears' UE18 Pro CIEM shows just how tiny balanced armature drivers really are.

Balanced Headphone Amplifiers

In the world of headphones and earphones—as in traditional audio—there are two distinct topologies of amplifiers available: single-ended amplifiers and balanced amplifiers. By convention, in a single-ended amplifier the '−' output terminal is tied to electrical ground, while the '+' terminal carries the active signal. In single-ended headphone amplifier applications specifically, outputs are typically delivered through a three-conductor jack sized to fit either a 6.35mm phone jack-type plug or a 3.5mm mini-jack-type plug. In either case, one of the conductors in the jack/plug serves as the '−' or ground connection, while the other two conductors serve, respectively, as the '+' connections for the left and right audio channels.

In balanced (some would call them 'differential') amplifiers, internal circuitry is differently arranged so that in essence the amplifier has two equal but opposite halves; one handling the positive-going side of the audio signal and the other handling the negative-going side of the signal. Both the '+' and '−' halves of the amplifier are referenced to electrical ground. As a result, the outputs of each amplifier channel will have three (rather than just two) connections for audio signals: a '+' connection, a '−' connection, and a dedicated 'GND' or ground connection. In balanced headphone amplifiers, outputs are typically handled by two 3-pin XLR connectors (one for the left channel and the other for the right), where the 3-pins correspond to '+', '−', and 'GND'.



Note the multiple types of balanced output connectors on the front panel of Cavalli Audio's fully balanced Liquid Gold headphone amplifier.

Bore

Many CIEM and some earphone manufacturers use the term 'bore' to describe the sound outlet tubes associated with balanced armature-type drivers. Sometimes the outputs of multiple drivers might be routed through a single bore tube. Thus, one might read CIEM descriptions that state something like this: "Ours is a four-driver, triple-bore in-ear monitor design."

CIEM

CIEM is an increasingly popular acronym that stands for 'Custom-fit In-Ear Monitor'. The key idea is that CIEMs, unlike universal-fit earphones, have custom-moulded earpieces that are crafted to provide a precise custom-fit that exactly matches the contours of the individual wearer's ear canals and outer ears (or pinnae).

In order to have a set of CIEMs made, prospective owners must first obtain, either through a qualified audiologist or through the CIEM manufacturer, a set of ear-mould impressions, or else have the interior surfaces of their ears digitally scanned. Either way, the ear-mould impression or digital scans are used to create moulds from which the CIEM's custom earpieces are made.



CIEMs like the Noble Audio Kaiser 10 offer beautifully finished, user-specific, custom-moulded earpieces.

Circumaural Headphones

Full-size headphones generally come in two forms: on-ear designs and around-the-ear designs. The word 'Circumaural' is the correct, formal term for 'around-the-ear' designs, where the ear pads surround the wearer's outer ears, but do not rest directly upon them.

Clamping Force

The term 'Clamping Force' describes the amount of pressure that a given headphone design exerts in squeezing or pressing the left and right ear cups of headphones against the sides of the wearer's head. There is no industry standard for such forces and listener's tastes can and do vary on the matter. The key concept is to have sufficient force for the headphone to stay in place during listening (too little clamping force might make the headphone prone to slipping out of position or even falling off), but force low enough to allow comfortable long-term listening sessions.

Closed-Back Headphones

Generally speaking, full-size headphone designs follow one of two possible configuration formats: open-back or closed-back designs. In closed-back designs, as the terminology suggest, the back sides of the ear cups are completely sealed or 'closed'—making each ear cup much like the enclosure of an acoustic suspension-type loudspeaker, but in miniature. For obvious reasons, closed-back headphones do better job of blocking out external noise than open-back headphones do. However, there is much debate on which design format—open-back or closed-back—makes for superior driver performance and all-around sound quality.



Closed-back headphones like this Audeze EI-8 have ear cups completely sealed on the back side.

Diaphragm

Regardless of type, headphone and earphone/CIEM drivers invariably have some sort of diaphragm, which is the moving element that actually produces the sounds we hear.

Some headphone/earphone diaphragms are much like miniature versions of the circular woofers, tweeters, etc. that most of us have seen in conventional dynamic driver-equipped loudspeakers; these tiny diaphragms operate like tiny pistons moving inward and outward to produce sound waves.

Other headphone/earphone diaphragms are thin, planar membranes whose entire surface area vibrates to produce sound, much as in full-size electrostatic or planar magnetic-type loudspeakers.

Finally, some headphone drivers used folded membranes whose pleated surfaces move somewhat like the bellows of an accordion to produce sound, much like loudspeakers fitted with ribbon-type or Heil air motion transformer (AMT) types of drivers.

Dynamic Driver (Moving-Coil Driver)

Dynamic drivers (also sometimes called 'moving-coil' or 'pistonic drivers') are by far the most popular types of drivers for use in loudspeakers, headphones, and earphones (although many CIEMs use balanced armature-type drivers). The core elements of dynamic drivers consist of diaphragms (the cone or dome that actually moves to produce sound), voice coils (ring-shaped coils of wire wound on small, cylindrical 'voice coil formers') that are attached to the diaphragm, and magnets (which are usually cylindrical in shape with ring-shaped grooves called 'voice coil gaps' on top).

As a musical signal is routed through the voice coil, which is positioned within the voice coil gap of the magnet, the electromagnetic interaction between the voice coil and the magnetic field causes the voice coil/diaphragm to move forward and backward, thus producing sound.



Dynamic headphone drivers like this one from Beyerdynamics' T1 Tesla headphone are built much like miniaturised dynamic drivers for loudspeakers.

Ear Buds

The term ‘ear bud’ is the slang expression for the sort of loose fitting transducers worn in the outer ear, as typically supplied with smartphones, personal digital music players, etc.

Some people use the terms ‘ear bud’ and ‘earphone’ interchangeably, but we at *Hi-Fi+* see those terms as having distinctly different meanings. For us, the defining characteristics of ear buds are, first, that they are worn in the outer ear and not within the ear canal, and second, that ear buds almost always fit loosely and do not provide any sort of airtight seal with the ear canal. Note, please, that ear buds typically are voiced so that they sound normally balanced without requiring an airtight seal.



Ear buds such as this Urbanears Medis are meant to rest lightly in the wearer’s outer ear—not inserted into the ear canal.

Ear Cup

In full-size headphones, ear cups are the physical housings or ‘enclosures’ to which the headphones’ drivers are attached, and to which the headphones’ ear pads are attached. Typically, signal wire connections to the headphone are also made through the ear cups. There are many different schools of thought on ear cup construction so that you will find ear cups made of wood, moulded thermoplastics, composites, and metal.



Ear cups can be made of various materials such as these exotic wood ear cups from Fischer Audio

Earphone

Hi-Fi+ (and many manufacturers and enthusiasts) consider the term ‘earphone’ to be a contraction of the longer though more descriptive term, ‘universal-fit in-ear headphone’. For us, the defining characteristics of earphones involve the fact that, regardless of the earpiece configuration used, earphones are meant to be worn within the ear canal, with the assumption that a flexible set of ear tips (offered in various sizes) will be used to ensure a comfortable yet airtight seal between the earphone and the ear canal. The voicing of earphones presumes and indeed requires this airtight seal for proper tonal balance to be achieved.

Some people use the terms ‘earphone’ and ‘in-ear monitor’, plus the acronym ‘IEM’, interchangeably, but at *Hi-Fi+* we again feel these terms have distinct and different meanings.

As above, we define ear buds as typically loose-fitting devices worn in the outer ear, while ‘earphones’ are worn within the ear canal and require the aforementioned airtight seal within the ear canal in order to work properly, in the process achieving significant levels of noise isolation.

‘In-ear monitors’ and ‘IEMs’ are, strictly speaking, in-ear transducers worn for monitoring applications, but the practical reality is that majority of listeners doing actual monitoring work tend to choose CIEMs (Custom-fit In-Ear Monitors) for the job, owing to their superior noise isolation and more sophisticated sound quality.

In our opinion, most earphone makers who call their products ‘IEMs’ are overreaching, probably in the hope that the ‘IEM’ label will confer upon their earphones some of the perceived ‘hipness’ and sophistication of true CIEMs.



By design, earphones are compact and use sound outlet tubes fitted with flexible ear tips designed to create a comfortable yet airtight seal within the wearer’s ear canals.

Earpiece

The term ‘earpiece’ refers to the physical housing or enclosure within which ear bud, earphone, or CIEM driver(s) and crossover networks (if any) are mounted and from which the sound outlet tube(s), if any, extend.

For obvious reasons, earpieces must be large enough to accommodate the intended driver or driver arrays, yet small enough and smooth enough to fit comfortably within the wearer’s outer ears. The physical shape of the earpiece must also allow for with very wide variations in ear shapes and sizes, while at the same being easy for the wearer to grasp, to insert, or to remove.

As with headphone ear cups, there are many schools of thought on earpiece construction, so that shoppers may encounter earpieces made of wood, moulded thermoplastics, composites, metal, acrylic materials, or even cold-cure soft-gel silicone.



Manufacturers go to great lengths to balance the demands of fit and functionality in high-performance earpiece designs.

Ear Pads

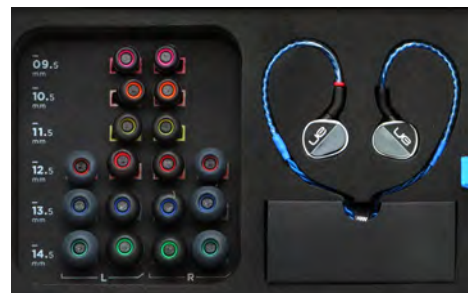
All types of full-size headphones feature ear pads that provide a comfortable, soft, and flexible interface between the headphones’ ear cup/driver assemblies and the wearer’s head.

Ear pads typically are shaped either as circular, oval, or ‘racetrack’-like rings, open at the centre to allow the sound to pass through; pads may be covered in fabric, leather, faux leather, or any combination of those materials.

Ear Tips

Almost all contemporary universal-fit earphones come with several sizes of flexible ear tips designed to provide a comfortable but airtight seal between the earphone’s sound outlet tubes and the wearer’s ear canals (even a seemingly minor air leak can upset if not ruin the tonal balance of the earphone). The sole exception would be certain ear tip designs that provide built-in vents (e.g., some of the tips used for the Cardas Ear Speakers) though vented ear tip designs are comparatively rare.

Ear tips come in a variety of configurations with popular variations including single-, double-, and triple-flange designs, and round or ‘bell-shaped’ designs that might include special features designed to enhance noise isolation. Ear tips are typically made of soft, silicone rubber, but some manufacturers have experimented with multi-layer ear tips, in some cases with noise isolation gel sandwiched between the inner and outer layers. Another popular variation involves ear tips constructed of compressible foam materials—a concept patented by the firm Comply Foam (which is a spin-off of 3M Corporation).



Modern universal-fit earphones, such as this Ultimate Ears UE-900s, sometimes ship with extremely elaborate sets of ear tips.

Electrostatic Drivers

Electrostatic drivers feature diaphragms made of thin membranes typically constructed of polyester-like materials (e.g., polyethylene terephthalate or PET) to which an electrically conductive coating has been applied. These membranes carry a high voltage (typically greater than 500V) but very low-current charge and are suspended between two metal (or metallised), mesh-like electrode grids called stators.

In operation, high voltage (but again, typically low-current) audio signals are applied to the stators. By design, the stator pairs are configured so that at any time when musical signals are present, the stators will carry opposite charges (one carrying a negative ‘-’ charge and the other a positive ‘+’ charge, and then vice-versa, as the audio signal flows back and forth). As the charge on the stators varies in response to musical signals, the diaphragm is simultaneously attracted to one stator and repelled from the other, so that the diaphragm moves back and forth within the air gap between the stators, producing sound.



The stator (or electrode) grid of the classic Stax SR-009 electrostatic headphone driver.

Headband/Headband Frame

In a general sense headbands are the frames used on all full-size headphones that reach up and over the top of the wearer's head, while holding the left and right ear cups in proper position for optimal sound and user comfort. Frames can be made of various materials including metal, moulded thermoplastics, composites, or other materials.

One key aspect of any headband design will be an adjustment mechanism of some kind that will allow the frame to expand or contract as needed in order to accommodate the varying sizes of users' heads. Two other key elements of any good headband frame will be the ear cup yokes and the headband pad or strap.

Ear cup yokes are the frame elements to which the headphones ear cup/driver assemblies attach. Some yoke designs that are minimal while others are quite elaborate. Some minimalist yoke designs hold the ear cups in fixed, or very nearly fixed, positions, trusting in the springiness of the headband frame to sufficient flex for a decent fit. Other yoke designs allow ear cups to swivel (in horizontal and/or vertical axes) to obtain a better overall fit. Trade-offs can be involved either way. As a general rule, minimalist yoke designs tend to be more rugged—say, for headphones that might be worn while participating in action sports, while swivelling designs offer greater flexibility for purposes of fit, but are somewhat more complicated to build and more prone to breakage should the headphone inadvertently be dropped.



The frame and yoke design of the Oppo PM-1 headphone allows ear cups to swivel in both horizontal and vertical axes.

Headband pads or straps are the 'suspension system' for the headphone, enabling the headphone's weight to be spread across the top of the wearer's head. One school of thought calls for padding the headphone frame itself to provide a soft, comfortable point of contact with the wearer's head. A second school of thought, however, calls for a broad, flexible strap to be suspended, sometimes via elastic or rubber suspension rings, from the frame of the headphone (so that the weight of the headphone is borne, in part, by the suspension bands or rings).



HiFiMAN's new HE-560 headphone uses a suspension strap system, as show, to help support the headphone's weight for greater user comfort.

Headphone

The term 'Headphone' refers' to full-size headphones (as opposed to earphones or CIEMs) that are worn on the head, with ear cups that either fit around or alternatively rest upon the listener's ears.

We at *Hi-Fi+* draw a distinction between headphones, which by definition are worn on and rest upon the user's head, versus earphones or CIEMs, which are worn in the user's ears but do not rest upon the top of the head.

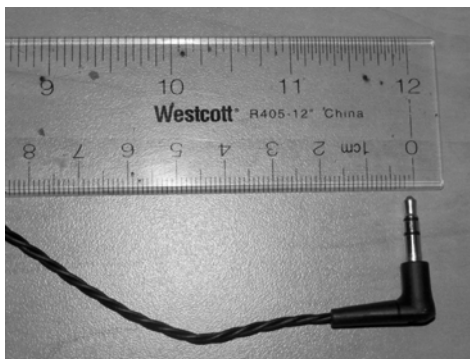
Headphone Connector Plugs

There are a handful of physical connector types commonly used for connections between headphones and headphone amplifiers (or tablets, smartphones, etc.). One useful distinction, however, can be drawn between connectors designed for use with single-ended amplifiers vs. connectors designed for use with balanced amplifiers.

Single-ended Connector Plugs: Single-ended connector plugs have three conductors—a ground "GND" conductor (shared by both the left and right channels), plus two '+/-' signal conductors (one each for the left and right channels).

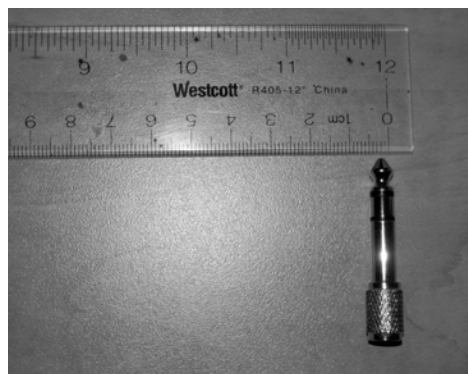
3.5mm, three-conductor, mini-jack plug: By far the most common connector for earphones/CIEMs (but also for some headphones), the small, three-conductor 3.5mm mini-jack plug is the type of connector used to plug headphones into

iPods, digital music players, iPads and other tablets, and iPhones and other smartphones. Quite recently, some manufacturers have begun using pairs of 3.5mm sockets to support balanced stereo output connections



3.5mm plugs, as on this Westone signal cable, are probably the most common in all of personal audio.

6.35mm phone/headphone plug: Think of this as a considerably larger scale version of the 3.5mm plug. The 6.35mm plug is typically used to connect full-size headphones to full-size desktop (but also some portable) headphone amplifiers. Like the 3.5mm plug, the 6.35mm plug provides three conductors (sometimes called the Tip, Ring, and Sleeve) and supports connections to single-ended amplifiers.



6.35mm plugs, like this 'garden variety' adapter plug, are essentially bigger, sturdier version of 3.5mm plugs.

Balanced Connector Plugs: Balanced connector plugs will typically provide four, or in some cases two sets of three, conductors—with separate '+' and '-' conductors for each channel, plus a separate ground 'GND' conductors in some configurations.

Three-Pin XLR connector plug: Three-pin XLR connector plugs are designed specifically for balanced signal connections and in headphone contexts are always used in pairs (one for each channel in a stereo pair of balanced mode connections). The three pins provide '+', '-', and 'GND' connections for one channel; hence, the need for two plugs to provide stereo (two-channel) connections.



Traditional three-pin XLR plugs, as on this Abyss AB-1266 headphone's right-channel signal cable, are among the most common balanced audio connectors in use today.

Four-Pin XLR connector plugs: Externally identical to three-pin XLR connector plug, internally four-pin XLRs provide separate '+' and '-' signals for both the left and right channels.



Robust four-pin XLR plugs, as on this ALO Audio cable, allow balanced audio connections from a single, sturdy, locking plug."

RSA connector plugs: RSA connector plugs, named in honour of Ray Samuels Audio, are sometimes found on small, portable, balanced output headphone amplifiers. RSA connector plugs essentially function like miniaturised 4-pin XLR connectors. Interestingly "RSA connectors" were developed by the firm Kobiconn Connector for use in certain types of camera connections, but Ray Samuels was the first to use Kobiconn Connector as a balanced audio connector in compact, portable amplifiers.



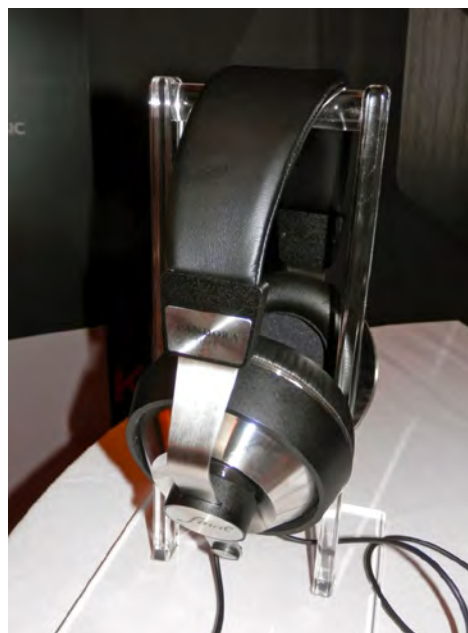
Tiny four-pin RSA/Kobiconn plugs support balanced audio connections for devices where space is at a premium.

3.5mm, four-conductor, mini-jack plugs: A handful of manufacturers have offered amplifier and headphone cables that provide balanced output connections through comparatively uncommon, four-conductor (or 'four ring') 3.5mm mini-jack plugs (where the conductors are labelled Tip, Ring, Ring, and Sleeve).

2.5mm, four-conductor, connector plugs: Yet another means of providing balanced output connections is via a comparatively new-to-the-market four-conductor (or 'four ring') 2.5mm plug. This plug is the chosen balanced-output connector for use with the popular Astell & Kern AK240 portable digital music player/headphone amp.

Hybrid Headphone & Earphone Designs

Headphone and earphone makers, as well as the team at *Hi-Fi+*, use the descriptor 'hybrid' to indicate that the product in question uses a mixed (or 'hybrid') combination of technologies. One good example would be the recently released oBravo HAMT-1 headphone, which employs the hybrid combination of the dynamic-type mid/bass driver and a Heil air motion transformer-type mid/high-frequency driver. Another good example would be the PSB M4U 4 universal-fit earphone, which employs the hybrid combination of a dynamic mid/bass driver and a balanced armature-type mid/high-frequency driver.



Final Audio Design's Pandora Hope VI headphone looks conventional enough, but it features a hybrid dynamic/balanced armature-type driver array.

Noise-Cancelling Headphones & Earphones

The term 'noise-cancelling' as applied to headphones or earphones means exactly what it says: namely, that the headphones/earphones provide active circuitry that detects external noise and then applies (to the best extent possible) an equal and opposite signal designed to cancel out the noise. For this reason, some designers (and marketers) prefer the term 'active noise-cancelling'.



PSB's M4U 2 is one of the very few active noise-cancelling headphones that manages to offer serious, audiophile-grade sound quality.

Noise-Isolating Headphones & Earphones

Recognising that active noise cancelling headphone and earphones can potentially create scenarios where the intended sonic 'cure' (active noise-cancellation) turns out to be worse than the sonic disease (noise), some designers have instead chosen to work on designs that use purely passive means of isolation or blocking out external noise. Generally, these passive designs are called 'noise isolating' (as opposed to 'noise-cancelling') headphones or earphones.

On-Ear Headphones

Unlike circumaural (around-the-ear) headphones, on-ear headphones feature comparatively small ear cups with ear pads designed to rest upon, rather than to surround, the wearer's ears.



On-ear headphones like the Klipsch Reference On-Ear have smaller ear cups and ear pads than equivalent circumaural headphones.

Open-Back Headphones

Open-back headphones feature ear cups that, by design, are open both on their front (that is, ear-facing) sides and on their back sides (so that there is virtually nothing—apart from protective grilles—but open air behind the rear sides of the headphone drivers. In many respects open-back headphones are analogous to dipolar loudspeakers in that they have rigid perimeter frames, or in this case ear cup housings, with no sealed enclosures behind the drive units at all.

For self-evident reasons open-back headphones offer little if any isolation from external noise. However, there is much debate on whether open-back or closed-back designs offer superior overall driver performance and sound quality.

Planar Magnetic Drivers

The loudspeaker manufacturer Magnepan first pioneered planar magnetic drivers and holds (or once held) many of the core patents on the technology. Therefore, today's modern planar magnetic headphones could, in a sense, be regarded as 'Magnepans writ small'. In planar magnetic drivers, the diaphragm consists of a very thin but strong membranes on whose surfaces are found conductive circuit traces typically arrayed in very precisely dimensioned serpentine patterns, with the conductive traces are spread over the entire radiating surface of the diaphragm. Many manufacturers use some form of Mylar-like material for their diaphragms, but at least one manufacturer (HiFiMAN) is using a radically thin, low mass 'nano-material' diaphragm.

Then, placed in close proximity to the diaphragm there is a precisely aligned grid or array of powerful magnets with deliberate open air spaces between the magnets to allow sound waves to pass through. Some designers favour the concept of having magnet arrays positioned on both the front and rear sides of the driver diaphragm, while others favour having an array on one side only—usually the side facing away from the listener's ears. Either way, as musical signals are applied to the conductive traces on the diaphragm, the diaphragm is attracted to and/or repelled from the magnet array(s), thus producing sound.



The planar magnetic drivers used in the Abyss AB-1266 are considered to be among the most revealing in any headphone produced today.

Ribbon Drivers

Ribbon drivers could be considered a specialised-case version of planar magnetic drivers, but with one critically important difference. In a ribbon driver, the entire diaphragm is made of conductive, thin-film, metal material, so that in a very real sense the diaphragm is—to borrow dynamic driver terminology—its own voice coil. In most case the ribbon driver diaphragm will be corrugated or 'pleated' and then suspended in the presence of very strong magnetic field. As musical signals are passed through the ribbon diaphragm/conductor, the diaphragm interacts with the surrounding magnetic field, moving fore and aft to produce sound.

Signal Cables

As is true in full-size, loudspeaker-based audio systems, headphone/earphone-based systems can be and typically are very sensitive to the quality of the signal-bearing cables in use. If you have any doubts as to whether cable substitutions can influence sound quality, let us assure you cables can impact sound in quite audible and obvious ways (and no, you don't need to be a 'golden ear' to hear their effects).

We haven't the space to go into cable technologies at this time, but suffice it to say that it is worth seeking out headphones and earphones that either ship with very high quality signal cables in the first place, or for which high-quality, third-party, aftermarket cables are available. Over time, you may discover—as we have—that judicious cable changes can help unlock hidden layers of performance in your favourite transducers.

Some pundits say wire substitution can't possibly make an audible difference, but bluntly they're wrong. You can easily prove this point by visiting a good headphone shop, trying some cable substitutions, listening carefully, and then drawing your own conclusions.

Finally, we cannot overstate the importance of choosing headphones/earphones that have removable, user-replaceable signal cables. Setting aside questions of sound quality, it is important to recognise that most headphone/earphone failures in the field are attributable to cable failures. The point is that it is simpler and cheaper to replace a set of signal cables than to have to go shopping for entirely new headphones or earphones.



Specialised headphone/earphone signal cables, such as these from Crystal Cable, can have a big impact on overall sound quality.

Supra-aural Headphones

Although you might rarely if ever hear this phrase in common usage, the term 'supra-aural headphones' is the formally correct way to say, 'on-ear headphones'. +

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