the absolute sound

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Audeze LCD-X Headphones

State of the Art

Arnie Nudell

Editor's note: Arnie Nudell is the co-founder of Infinity Systems and one of the true legends of high-end loudspeaker design. His Infinity Reference Standard (IRS) pushed the boundaries of what was possible, and remains to this day one of high-end audio's most iconic products.

My adventure began on a crisp October evening in Denver, Colorado, where many music lovers and audiophiles were attending the Rocky Mountain Audio Fest. The RMAF is one of the newest high-end audio shows to feature audio-based products of nearly every genre. I attended the 2013 RMAF not only to see what was new in high-end loudspeaker but also to peruse the area of the show called Can Jam, which includes almost every imaginable product even remotely connected to headphones, an area of audio in which I had only recently taken an interest.

Another of the reasons for my attendance was an outgrowth of my recent participation in *The Absolute Sound*'s great new major volume, the *Illustrated History of High-End Audio, Volume One: Loudspeakers*—an invitation to dinner with friends and colleagues that I hadn't seen in a number of years. The dinner was to be hosted by Jim Hannon, the vice president/group publisher of *The Absolute Sound*, and would take place on the Saturday night of the show. Robert Harley and Jonathan Valin and his wife, Kathy, were also to attend. The dinner was a very festive occasion, with great conversation, food, and wine. We discussed everything from our favorite recorded music, to how the harmonics of a violin were so difficult to reproduce by audio systems, and finally, to what we thought were the best-sounding exhibits at the show. Obviously, all of us were having a wonderful time and suddenly near the end of our get together, I was asked by Jonathan Valin, "Why don't you review for *The Absolute Sound*?" To say that I was taken by surprise is an understatement. My answer was that I would have to think about that since I'd never written a review of any product in my long years of working in audio. Undeterred, he then asked if I did accept the review challenge, what would be the first thing I'd like to review? Without a second of hesitation my reply was a state-of-the-art headphone. Needless to say he was astonished since everyone at the table knew that in my long career in audio I was mostly involved in designing high-end loudspeakers. Their next question was simply, "Arnie, why headphones?"

The answer to that question is the *raison d'être* of this review. It was generally known by many of my friends in the audio field that I really didn't really cozy up to headphone listening. However, it had become apparent that a whole lot of other folks did. Because my music listening habits had been so different, I thought maybe I was missing out on something really great, and started to look for an explanation of why, given all of the great loudspeaker-based audio equipment available, so many people opted for headphones.

I started a rather amusing personal journey by asking questions of young people walking down the street with their in-ear headphones and iPods in their pockets. I got many of the same answers from those that I asked, relating to the privacy of their music-listening experience, and the great enjoyment they took in being able to access thousands of recorded songs via their media players. I could see that these young people were really into their music in a way that many older people did not understand.

In a way I envied that they found this kind of passion in music from a source that I knew so little about. So, curiosity getting the better of me, I decided that I would try to duplicate their experience—at least, in my own way. I began by purchasing a pair of Audio Technica ATH MR 50 headphones, which were highly recommended for the music I generally listen to and were

also inexpensive. Additionally I purchased a Schiit Asgard 2 headphone amplifier, and with those items I began my personal-audio quest. I started simply, using my Google tablet and my smartphone to download an application called Tunein, with which I was able to listen to Internet stations all over the world. I selected a number of stations offering baroque music, jazz, and classical and flamenco guitar. It was a simple matter then to choose the station from Tunein, plug the tablet or smartphone into the Asgard 2, put on the Audio-Technica headphones, and listen to music every morning while drinking my first cups of coffee. I soon found that I could completely relax and listen to music in a very different manner. Well, well, I thought, I'm really starting to get it; I'm enjoying music in this new personal way.

The next major step in my quest was to explore computer audio, where I had the possibility of installing many music files using the program JRiver Media Center 19 as my player/server. This, of course, is a monumental deviation from the simple iPod approach, since high-resolution files could now be played with my computer rig. As my friends and close colleagues would tell you, I've never stopped pursuing every aspect of audio reproduction, ultimately looking for greater sonic realizations of live music. This time it happened with headphones instead of loudspeakers.

As I studied this field more intensely, I found that in the last several years two companies were pursuing planar-dynamic headphones, and that really rang my bell. Why? In the early 80s, Infinity had started manufacturing planar-magnetic drivers. The availability of samarium cobalt and neodymium magnets was the key that made their construction possible. The two major companies that are currently involved in manufacturing planar-magnetic headphones are Hi-Fi Man and Audeze. Both of these companies make excellent headphones, and their upper-end offerings are quite expensive. I decided to try a mid-range Hi-Fi Man model: the HE-500, which costs about $700. Initially I wanted to buy planar-magnetic headphones that were good enough to let me determine if the design really could produce music in a better way than my Audio Technica MR 50s. I should mention that the HE-500s are open-ended, which means that music flows in two directions, one direction is obviously into your ear, and the other direction is to the outside world. These open-ended headphones gave me a much greater sense of musical space, with a much smoother and extended frequency response than the closed-ended MR 50s.

At that point I knew that this path was going to lead me to much more complex state-of-the-art headphones, headphone amplifiers, and DACs to play back from the USB output of my computer all the high-resolution files that I'd collected. Rather than just purchasing something like the expensive Audeze LCD-2 and the LCD-3, I auditioned them at shows like RMAF and also at the homes of friends or friends of friends. I was also able to get an excellent listen to the Stax 009 electrostatic headphones and the Senheiser HD 800. At this point, I really liked the fabulous sound of the Audeze LCD-3, although I found it quite dark and less open in the high end than I would have preferred. Speaking to the nice people at Audeze, I was told about a new state-of-the-art headphone that the company would be releasing shortly that had a lot of new technology which would preserve the wonderful sound of the LCD-3 but also allow the top end to open up considerably. This new headphone would be called the LCD-X. I knew immediately that this would be the high-end headphone I would review.

For the past few years, and continuing today, we've been experiencing a golden age of personal audio, especially in headphone design. In recent years the headphone market has grown tremendously where the high-end-loudspeaker-based market has inexorably decreased. I'm not going to go into my theories about why this is so, but the fact is that sales in the personal-audio market today are an order of magnitude larger than those in the hi-fi market. The Beats by Dr. Dre headphones alone generate sales of more than half a billion dollars a year, and headphone purchases are increasing every year, led by units costing over $100 per pair. As a result, almost every well-known hi-fi brand is now making headphones to be part of this booming business.

The company Audeze was created a little over four years ago. It was founded by Alex Rosson and Sankar Thiagasamudram, who met working on the tech side of the film industry. When they first started collaborating, initially they wanted to be a part of the speaker industry, but they soon realized how high the financial barriers were for entry to this market. Their first serious debut in the headphone industry was a planar-magnetic headphone called the LCD-2, which sold initially for about $1000—a pricey headphone, but Audeze sold thousands of them. The LCD-2 became an overnight sensation, much loved by cognoscenti of high-end headphones. About a year later, Audeze upped the ante by creating the LCD-3, one of the most seriously musical headphones ever made and also costing a serious amount of coin, a cool $1945. The LCD-3 became the new darling of high-end headphone aficionados, and has garnered a trove of fantastic reviews.

Planar-magnetic headphones differ greatly from the great majority of headphones on the market. Most headphones operate with a voice coil surrounded by magnets, which is attached to some sort of a cone—very similar to the way most loudspeakers are constructed. The planar-magnetic 'phone uses a very thin plastic material to form a movable diaphragm with etched conductors forming a sort of voice coil. Extremely powerful neodymium magnets are put in front and in back of the diaphragm so that the conductors are immersed in a very even magnetic field, sometimes called the iso-magnetic field. When an audio signal is passed

SPECIFICATIONS

Type: Planar magnetic stereo headphones
Style: Open circumaural
Diaphragm area: 6.17 square inches
Optimal power: 1-4W
Maximum power: 15W (200ms)
Impedance: 20 ohms, purely resistive
Sensitivity: 95dB for 1mW
Weight: 600 grams

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through the conductors, the magnetic field created by the current flow interacts with the iso-dynamic field causing the conductors and therefore the diaphragm to move back and forth. The purpose of the iso-dynamic field is to ensure that the relationship of the current flow to the force exerted on the diaphragm is constant regardless of the position of the diaphragm. This so-called push-pull configuration allows the transducer to have very low distortion as a consequence of the extremely accurate motion of the entire diaphragm and its inherent lightness, which permits extremely fast rise times that allow transients to sound musically correct. The LCD-X features a newly developed and processed diaphragm made of thinner and lighter material that uses new Fazor technology. The Fazor elements in the magnetic circuit were developed for the LCD-X (and are standard in all Audeze headphones made since January, 2014) and help guide and manage the sound flow in the headphone. This new Fazor technology and planar-magnetic design have come together to create a headphone of unusually extended frequency response, very low distortion, lightning fast transient response, improved phase response, and remarkable 3-D holographic imaging. [Owners of LCD-2 and LCD-3 headphones should contact support@audeze.com if they are unsure if their units include Fazor elements, and to find out of they can be upgraded.]

The LCD-X ear-cups are made from polished anodized aluminum with sloped ear pads of either premium lambskin leather or leather-free microsuede microfiber fabric. The ear pads are designed with specially crafted foam offering the proper firmness and acoustic balance. The LCD-X headphones are certainly no lightweight, weighing in at 600 grams (nearly 1.3 pounds). Even though these are perhaps the heaviest headphones ever made, they are amazingly comfortable for long-term listening. When they start to press on the sides of my head too strongly after a few hours of listening, I generally pull up the top of the headphones to slightly change their position, and the comfort factor is then restored for further listening.

Reviewing an audio product is extremely challenging, because it is difficult to describe the intensity of human emotional experience when one listens to music. It involves putting on a two-dimensional page the magnitude of the three-dimensional sonic experience. I will try to describe how a piece of musical information actually sounds to me through a given chain of the tangible media, comprising headphones, a computer, a DAC, music data files, an amplifier, and cabling. The first few minutes of listening in my own environment suggested to me very quickly that the LCD-X headphones were extraordinary, and would require equally state-of-the-art equipment in order to review them properly, no different than if I were reviewing a very high-end speaker system.

The Audio Chain

I was extremely fortunate to have a number of state-of-the-art DACs, headphone amplifiers, and a variety of different cables at my disposal in order to select what I would ultimately use in my final review of the LCD-X headphones. After months of auditioning many different components, I chose what I consider the best gear for this job. Perhaps my favorite player/DAC is the Modwright Oppo 95, which I have owned for several years. I only used it sparingly for this review since this model of Oppo does not accept streaming data from my computer. Much of my listening was computer-based, using the J River Media Center 19 program playing many of the files on my computer and also using a Digsitor external optical drive, which uses a lithium-ion battery for its power supply, and is connected to a USB port.

The DAC that I finally selected for the majority of my listening is the Resonessence Mirus, which I have compared with a number of very expensive DACs, including the EMM Labs DAC2X. The Mirus is the new flagship of the young company Resonessence and I liked it so much that I ultimately purchased it. I also auditioned many headphone amplifiers and found that the best audio seemed to be derived from those using a vacuum-tube front end for voltage, and a zero-feedback MOSFET design for current. The headphone amplifier that I ultimately selected was made by an Italian company called Pathos, and its headphone amplifier went by the name of Aurium. This amplifier had an output of just under 2W into 32 ohms and easily drove the LCD-X to a sound that I thought was nearly as good as it gets. (As an aside, the LCD-X headphone is extremely efficient, with its impedance at a very low 22 ohms. As such, it can be plugged directly into a smart phone or a tablet, playing music with barely any strain or distortion.)

The last pieces of equipment that I used are probably the most controversial. Many people still believe that wires, be they interconnect cables, power cords, or USB cables, are mostly irrelevant to ultimate sound quality. I can tell you, with my many years of experience in the audio industry, that they are not only *not* trivial choices, but are actually critical to the ultimate sound quality. I alternate between three USB cables which I consider the top contenders. They are: the J Cat USB cable, the Lightspeed USB cable, and Synergistic's latest example of its USB cable. Each of these cables has its own strengths and virtually no weaknesses. I sometimes alternate these cables depending on the kind of music to which I am listening. I always try to use balanced cables if the equipment contains the requisite balanced inputs and outputs. After relentless comparisons between many other balanced cables, I have carefully selected a 2m balanced cable made by a small company in Boulder Colorado called M G Audio, which I have come to feel is the best I've ever heard by a fairly wide margin. This cable is about as musically agnostic as any I've used.

The Listening Tests

The first musical example that I have chosen is the Shostakovich string quartets numbers three, seven, and eight performed by the Hagen Quartet on a DG CD. The quality of sound of this CD is quite remarkable in itself; however I have up-sampled it using the professional Korg Audiogate computer program, from 44kHz/16-bit up to 192kHz/24-bit, to greatly relieve most of the sonic problems which unfortunately afflict all CDs.

The first movement of the Shostakovich Seventh Quartet starts with a simple Russian motif and becomes more animated and musically interesting as it progresses, with rather violent, stabbing plucks of the violin strings that are really a precursor of the third movement. This intense plucking of the second violin is a very difficult sound to reproduce correctly via any audio system, and yet the LCD-X recreates this musical performance in such a faithful way that I have to admit I have rarely heard its equal from any high-end-audio speaker-based system. The LCD-X beautifully renders

the violin body sound, the *bête noir* of most headphones and high-end speaker systems, and its extremely fast rise time produces the initial transient of the plucked string in a most convincing way.

The third movement of this work involves some of the most violent sounds that four stringed instruments can produce, all at the same time. It is fascinating to me how the LCD-X separates this mass cacophony of sound so that each player can be clearly heard, individually and together as an ensemble. Once again, the top harmonics of the violins, viola, and cello are reproduced in a spectacularly lifelike fashion. It is also interesting to note that the four players—the first violin, the second violin, the viola, and the cello—are rendered in three-dimensional space as you might hear them in a live performance. The first violin is far to the left and slightly forward, the second violin to the right of him, the viola further to the right and forward, much closer to the cello which is quite far out from the right side of the headphones. It is similar to the spatial characteristics that you would hear if you were sitting close to the players at a live chamber music concert. Furthermore, the venue of this string quartet recording is easily heard because of the superb resolution of the LCD-X (and the rest of the other components in front of and driving the headphones). This is also a wonderful example of how three-dimensional a rendering this headphone can create.

While reproducing four instruments in three-dimensional space is certainly challenging, reproducing a full symphony orchestra in a large concert hall is a much more difficult problem. Some of the best program material that I've ever heard are the DSD downloads of the Mahler symphonies offered by Blue Coast records. Of the four recordings of Mahler symphonies that I own, I chose the Mahler Fifth Symphony, with its massive orchestration, which highlights almost every instrument of the orchestra. This is a huge job for any audio system to handle in a life-like manner.

There is no doubt that the imaging of a great speaker system in a room is different from the imaging of a great pair of headphones. With the loudspeaker in a living room, the sound is very three-dimensional with great depth and sometimes equally great width. It can be likened to sitting extremely close to the orchestra where, because of your proximity, you hear great depth and width. With the LCD-X headphones, the image is more reminiscent of sitting 15 rows farther back in the hall, where the depth of sound is somewhat foreshortened, while the width is nearly preserved. What I'm suggesting is that both presentations are very acceptable and are capable of re-creating lifelike sounds in a different way. In all other ways, like the dynamics, the presentations are really the same. For example, the LCD-X headphones are capable of playing this music at full orchestral levels without any strain or distortion. In some ways, the presentation of these very loudest levels are better reproduced than by speakers because there is no room interference. Frankly, being an old speaker guy, I was really surprised that the level of realism from these headphones is sometimes better than some of the best speakers. The tremendous blast from the timpani, coming from the back right of the concert hall is startling in its sonic accuracy, and truly reminiscent of a live venue.

The recording to which I am referring is of the San Francisco Symphony Orchestra conducted by Michael Tilson Thomas, recorded in the Davies Hall in San Francisco. Tilson Thomas configured the orchestra particularly for all the Mahler symphonies. The first violins are front left, the second violins front right, the violas on the right just behind the second violins, the doublebasses along the left wall, and the cellos on the left just behind the first violins. The woodwinds are basically in layers in the center and all the brass are far right on the stage. The reason I'm offering so much detail concerning instrumental placement in the orchestra is because this placement is so unusual; in all my years of concert-going, I've personally never seen this arrangement. So when I began to listen to this recording with the LCD-X headphones, I initially thought that the headphones were distorting the spatial images. However, when I listened more carefully, it was very obvious that the normal orchestra placements were conspicuously different, and that the LCD-X headphones were reproducing the instruments in space so correctly that it was astonishing. The sound of the massed doublebasses was remarkably correct and certainly unhampered by room acoustics. I could go on and on trying to tell you what wondrous sound and imaging this headphone system was capable of; however, I would advise you to download some of these symphonies yourself so that you might have in your collection one of the best-sounding and most accurate renditions of full symphony orchestra. I should also mention that the performance of the Mahler Fifth Symphony is first-rate.

Two female voice recordings are the next selections I would like to discuss. The first is Rebecca Pidgeon's old, familiar rendition of "The Rose in Spanish Harlem." I *should* be describing the superlative sound of her voice; however, the thing that stood out for me, having heard this recording many, many times over the years, was the very soft plucking of the doublebass accompanying her singing. For years, speaker systems produced her voice in a very realistic way, but very few of them ever got the initial pluck of the doublebass without a boomy sound. For the first time, I believe I heard that doublebass as it was put on the recording, correctly rendered. Her lovely singing is also accompanied by a piano, two violins, a guitar, and a shaker. This 24-bit/96kHz version had a wonderful three-dimensional image, the piano being very near Pidgeon, while the two violins are far left and far right and a little forward in the soundfield. The guitar sounded like Pidgeon was playing it, and the shaker was very far right outside the earpiece about as far as your right hand could extend. This headphone can really create a realistic soundfield, especially for small groups.

The next recording is the remarkable Susannah McCorkle singing Gershwin's "Summertime" accompanied by a single bowed doublebass. Through the LCD-X headphone, listening to this recording was like hearing the singer in three-dimensional space with a doublebass to her left and further back. I could close my eyes and see the two performers executing their craft right in front of me. The bowing of the doublebass was so realistic that all I could do was shake my head in wonder. And McCorkle's vocal ain't bad either.

Nils Lofgren is a fantastic guitarist. And the guitar playing and his singing from the album *Nils Lofgren—Acoustic Live* is an extraordinary example of really good rock music that is excellently recorded. Some of his guitar work can only be characterized as breathtaking, and the sound produced by the LCD-X is probably better than you would experience from the live concert. This recording was done at a concert and the vigorous clapping and

variety of noises from the audience are reproduced in a way that makes you feel you are really amongst them, while the guitarist sounds almost right in front of you. The dramatic and explosive strums of the steel strings on the acoustic guitar are reproduced with stunning fidelity, and Lofgren's voice has a sandy, throaty quality perfect for the song he was singing.

Summary and Conclusion

The reason I chose not only to use the Resonessence DAC but also ultimately to purchase it was its extraordinary resolution accompanied by its accurate saturation of tone color density with everything I played. This can be an unusual combination, in that many DACs with high resolution are very edgy-sounding or lacking in tone color. In comparison to other DACs that I listened to, this one seem to bring a measure of life to all of the music played and therefore was a great adjunct to the LCD-X.

Another very interesting DAC was the new PS Audio DirectStream. I must come clean and tell you that I was asked by Paul McGowan to listen to and comment on this new DAC with the LCD-X headphone. All I can tell you now is that soon I will buy one and I would advise you to do the same.

There are over 100 headphones on the market today, and I'm not going to tell you I have listened to all of them, but I have listened to a fair number of top contenders under ideal conditions. Since I am writing this review for *The Absolute Sound*, I am using only its criteria, which is adherence to the sound of unamplified music, to judge the winners. I guess it could be called the battle of the flagships. Among the legions of headphones currently on the market I could only find four that I would characterize as flagships. They are: the Sennheiser HD 800, the Stax 009, the Audeze LCD-3, and the Audeze LCD-X. Each of these headphones has some flaws, but none of them has what I would consider fatal flaws, like huge variations in frequency response, or high distortion, or limited bandwidth, or odd colorations—anything that obviously distorts the music. Having listened extensively to these four flagships, the headphone that presented music in the most astonishingly accurate way is the Audeze LCD-X.

The LCD-X has the fewest and the smallest flaws of the four contenders. I'm a very meticulous guy when it comes to finding faults in any piece of audio equipment. In my experience, there are precious few transducers that are so close to flawless that pointing out their shortcomings is merely nitpicking. It was difficult to discover the flaws of the LCD-X even after listening to them for five months with the superb equipment and the superb program material I have described above. All the people of Audeze and especially its technical staff deserve enormous credit for greatly advancing the state of the art in headphones. I only have two small criticisms/suggestions. It would be nice if Audeze could introduce a gentle boost between 1.5kHz to about 3.5kHz of about 1dB. This is really not much of a change, but it would endow the headphones with a little more openness in this sonic range. The second suggestion would be to decrease the mass per unit area of the diaphragm so that it would then have even higher resolution. This could be done fairly easily by increasing the impedance of the LCD-X a small amount, to perhaps 35 or 40 ohms from the current 20 ohms. Though I can nitpick from the outside, there is no doubt that the engineers at Audeze are real artists and experts in regard to what they have created.

The Sennheiser HD 800 is an excellent headphone having perhaps the best overall imaging of any headphone on the market. Its two flaws are, however, somewhat larger than those of the LCD-Xs. The HD 800s have a rather nasty peak from about 5kHz to 6kHz, which makes amplifier selection very critical. My other criticism is of much smaller significance. The HD 800 has what I would characterize as overdamped bass, which deprives this otherwise excellent headphone of some of the qualities of music that give it life. This is the only dynamic headphone of the four flagships, and is a brilliant design using this technology.

The Stax 009 is the only electrostatic headphone in this group, which is similar to the planar-magnetic in many ways, using electric force as opposed to magnetic force. This headphone has so many great characteristics that its flaws are really hard to describe. The best way I can summarize them is to say that the Stax sounds very analytical, and therefore seems not to convey the emotion of music as well as the other contenders. It also has less dynamics in its bass region, which diminishes some of the excitement in music. Having said this, I still consider the Stax 009 to be a magnificent headphone.

The LCD-3 is a remarkable example of the planar-magnetic design. My only small criticism is that it has a darker than neutral quality that can diminish the open quality of live music. Otherwise, as I said earlier, this has been the Audeze flagship for several years, and for good reason. As I was writing the conclusion of this review, I learned that Audeze was now putting some of the technology of the LCD-X headphone in its updated LCD-3 and LCD-2. By the time you read this review these new products will have been on the market for at least three months.

We now have come full circle in my quest to understand, and participate in, personal audio. I now truly understand what it is about and why it is appreciated by so many people. It is my opinion that the LCD-X can compete with all of the very best high-end loudspeakers. This headphone, for example, has extraordinarily wide and even frequency response which extends from below 20Hz to far beyond 20kHz, and even at very loud levels, has very low distortion. It also has the great quality called continuousness, a term which I believe was coined by *The Absolute Sound*'s Jonathan Valin. *[Actually, the term was coined by HP; I just expanded on his idea.—JV.]* It means that the sound seems to be cut from a single cloth in that, from the lowest to the highest frequency, there is no difference in sonic quality. It is one of the great characteristics of a single transducer.

Many of the best speakers on the market do not exhibit all of these qualities. I am not in any way trying to denigrate great speaker systems. My point is that to purchase a truly state-of-the-art speaker system and all of its attendant pieces would cost several hundreds of thousands of dollars. For a state-of-the-art personal audio system the price would be less than $30,000. And I can assure you I have enjoyed my state-of-the-art personal audio system as much as *any* speaker that I have had in my listening room over the years.

I now understand that both headphones and speakers can offer a wonderful connection to what really is the bottom line, and that is the enjoyment of music. **tas**