

# Bhulley Audio System Listening Tests

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# Introduction

This is a report on listening tests for the Bhulley Audio System (BAS) by me, The Sound Agency's Technical Director, Sid Wells, on a visit to Lahore on July 6-8, 2011. I wish to thank the BAS team for their kind hospitality during my visit.

When reading this document it is important to remember the philosophy behind the creation of the BAS. The Institute's documentation states:

*The main reason for undertaking this work was the inadequacy of the best existing reproduction and monitoring equipment to accurately reproduce and convey the unquantifiable nuances and micro tones or delicacies of music generally and particularly South Asian Classical music, wherein these are critical considerations.*

*The main concern behind this work has been that when sound reaches the listener's ear, it should be a relaxed musical sound, which retains its musical integrity qua the source. This task has involved understanding the elements of musical sound such as timbres, resonances, body (in sound), harmonics etc and how they are all put together to produce musicality in musical sound into the science and engineering of audio amplifier and speaker systems.*

*In short, the object has been to achieve 'musical fidelity' for any genre, rather than 'Hi-Fi'.*

The design of the BAS has evolved unlike any other system I have encountered. Over the last 16 years, each design version has been driven by listening to the system and testing subtle (or dramatic) changes to every element of the audio path – then re-listening and re-designing. As an example of this process, the team were unsatisfied with the sound produced by the drivers then available for the speakers, and this led to the manufacture of the innovative custom-designed drivers now used in the system.

Note: The following (taken from the BAS brochure) is not quite correct:

*Now twelve years later, the only component that is not made in the department are the electron valves used in the amplifiers.*

In fact, many components that are deemed to be of sufficient excellent quality are obtained from respected manufactures (for example the vacuum tubes, resistors and diodes used in the electronics). The team assured me that all signal path capacitors are manufactured on site.

# Testing

It was essential to embrace the concept of the design philosophy when deciding on the best way to evaluate the properties of the BAS.

Comprehensive listening tests took place over several days.

During listening tests we must be aware of the ears' ability to compensate for audio environments, adapting to the levels of detail and compression (within the ear) and therefore remember the need to re-calibrate the ear in order to make listening tests meaningful over a long period of time. We must understand that our ears in this case become a measuring instrument and like all measuring instruments, such calibration is essential.

Accordingly, I scheduled rest periods and comparative listening periods to allow my ears to reset.

# Method

First I spent several days listening to selected music tracks on a good (medium level) Hi-Fi system (a Technics Integrated Class AA amplifier driving a pair of Audax A200 speakers).

During this time several qualities of detail for each track were noted. As a benchmark and for re-calibration I used my reference headphones (Audio-Technica ATH-910 PRO). Over many years in studios I have found these headphones to provide me with a reference which is honest and reasonably flat, but still evidencing a balanced level of musicality without the overemphasis and compression which are evident on many popular headphones. Headphones of course have the advantage of removing the room from the equation and allowing a wider L to R phase correlation – this being more challenging to achieve from a loudspeaker output.

The qualities of detail noted were, for example, the nuances of detecting detail of one musical instrument or voice, where it competed with other musical elements in the mix. This competition may be due to factors such as frequency or amplitude masking. In short I was looking for concrete and definable examples where the Amplifier / Speaker combination was failing to reproduce the nuances well OR was producing them very well, perhaps better than the Audio-Techs, for later comparison.

Below, I document the notes I made both prior to my visit and then my further notes on listening to the same tracks on the BAS.

During the visit I spent one afternoon listening to many of the above tracks on a well respected and popular commercial HiFi system featuring a pair of Bi-Amped Bower & Wilkins Signature Diamond series speakers played in a good acoustically treated 'listening room'. Notes taken at this time are also included.

This was done to assist in comparative listening and as a method of re-calibrating my ears.

I have left two CDs containing most of the tracks used. These are a mixture of 'Western' and 'World' music examples. If it is envisaged that the BAS should be marketed worldwide, it is possible that the team may find these CDs and notes useful while doing further listening tests.

# Listening notes on the reference tracks

## Paul Westerburg

### Time Flies Tomorrow

A nice easy track start with, easy to listen to, with a simple, clear arrangement. The intro verse sets up the balance between voice and instrumentation. The tracks lifts greatly with the entry of the bass, which should be perceived strongly but clearly.

On the A200s there is an upper bass frequency resonance, which muddies the bass and guitar, and also the second vocal part (panned centre). Also the top of the snare is lost.

On the BAS there is no muddying. The bass is powerful and clear with no interference with the vocal and guitar delivery. The snare top is clear.

### Angels Walk

There is a bell tree at around 20 secs. On the Audio Techs you can distinctly hear them panned left and right but on the A200s the Left/Right distinction is lost and the bell tree appears mostly on the left.

On the BAS the bell tree's Left/Right image is clearly defined.

## Compilation CD – *Float Away*

### Relaxing

On the Audio Techs, the vibraslap pans all the way up to and has a momentary cross over with the congas at 17 secs. Also, placing the very quiet early shaker pans is just possible. On the A200s there is a distinct gap at the cross over and the shaker panning is not clear.

On the BAS the vibraslap cross over and the shaker panning are both clear.

### Land of Anka

There is a very tricky balance here between the vocal and the bass. The deep register of the vocal causes a great conflict between them which produces a very indistinct and muffled delivery on the Audio Techs. The A200s handle it slightly better.

On the BAS this difficult area is handled beautifully with a very musical vocal delivery and wonderful bass definition.

## Jo Hamilton – *Gown*

### How beautiful

Listen to the snare from around 47 secs, a very rich sound on the Audio Techs but lacking this richness on the A200s.

On the BAS this rich snare is very clear – a difficult distinction to hear on many systems.

### Deeper

A wonderful snare ring is evident on the Audio Techs, where the initial hit and ring is distinct. On the A200s there is no distinction and this mingles to a single snare sound. This track also exhibits a very deep bass at the beginning, which produces a vibration (RHS) in the A200s.

On the BAS the distinction between initial snare hit and ring is distinct, and the bass is powerful while maintaining clarity – there is no hint of distortion.

### Paradise

This is beautiful track but not without its challenges for reproduction. The bass and acoustic guitars for example fight for clarity in the low to mid frequencies and this distinction is lost and muddled on the A200s

On the BAS there is clarity and separation in this area as well as clarity of other detail like the ring off the early snare hits, the clear double tracking on the acoustic guitar at

1:40 and the stereo emphasis on the hi-hat at 4:04.

The following two tracks are very saturated in their mix. This is evident when listening directly off the disc with the Audio Techs.

### Liathach

Deliberately over-reverbed in the production and very saturated at eg. 2:17-2:48, causing a slight distortion on the Audio Techs and a muddy response on the A200s.

This difficult area was again handled very beautifully by the BAS providing a defined, uplifting and musical delivery.

### Think of me

Again off the disc, a slight distortion on the vocal at “still the sun” (2:35) is evident on the Audio Techs and the A200s.

The BAS handled this area with absolutely no distortion and the quality of this wonderful vocal reproduction is clear, vibrant and again very musical.

# Results of the listening tests

I have used the above examples to try to bring some rationale to the conclusions drawn from my experience of listening to the BAS.

The system has power, clarity, definition and a tone that is truly superb – but the listening experience is so much more than that.

The team will affirm that musicality is their ultimate aim, and they have striven to achieve this with many innovative ideas (giving rise to over 500 Patents), such as using wood for the speaker cones, pure silver for the hard-wired circuits, and water as the acoustic energy absorption for the infinite baffle speaker technology. The results are visible as well as audible: for example, unlike most commercial speaker systems the BAS bass drivers barely move, even at high volume levels. The team maintain that moving air molecules efficiently does not require a long throw of the cone. I think their point is proven.

Is musicality a discernible quality in the system? The answer is a resounding yes. Above I have listed challenging areas in some tracks I know well, where a system's *technical* audio ability is easily identified and demonstrated. The task of identifying and demonstrably describing musicality is of course somewhat more qualitative and subjective.

As well the examples listed above, I also listened to many other tracks on the system, and I can confirm absolutely that the musicality of the BAS is real, evident, effective and credible. I am now going use this term as a given to describe a sound that is rich, warm and pleasingly present, while at the same time being accurate, defined and capable of reproducing incredible detail.

Although apparent for all instrumentation, it is perhaps when listening to vocals on the BAS system that this musicality is most easily discerned and demonstrated. The vast frequency, dynamic and expressive ranges of the human voice take full advantage of the systems ability to become technically a musical instrument, capable of not only reproducing but transforming the reproduction of the human voice.

## Other examples for the team to listen to:

### Jo Hamilton: Think of me

The voice appears to be inside your head and while you are lost in this wonderful delivery. Check also the glockenspiel from around 44 secs. This is typically a very difficult instrument to reproduce well due to its complicated harmonic structure.

### Jo Hamilton: There it is

This was one of the best surprises of the system for me (among so many!) If you can, sit in the sweet spot and listen while the mix goes 3D and totally surrounds you at 2:40... I played this to a lucky few on the day and all were overawed. It is worth travelling to the Sanjan Nagar Institute just to hear this moment of musicality!

### Jo Hamilton: Winter is over

Check the subtle definition of the spinet from 1:08 and clarity of the vocal in the complex instrumentation at 1:52 (the vocal is masked here on the A200s for example).

### Float Away: Nest of stars

A wonderful vocal delivery with a subtle mix.

### Float Away: Sliabh Gal Cua - Kishor's Tune

An instrumental mix of West/East fusion, not everyone's taste but a wonderful feeling of space is reproduced.

# Recalibration time

On the second day a few hours were spent listening to many of the previous tracks on an Alternative 'Hi-Fi' system: a pair of Bi-amped Bower & Wilkins Signature Diamond series speakers, played in a good acoustically treated listening room.

The findings (to be compared with the previous comments relating to the BAS) were:

## Time flies tomorrow

The Sound is generally brighter, the bass is softer, more rounded and less defined. The system is presenting a fairly pleasant but typically 'loudness' curved sound.

## Angels walk

The bell trees are clearly defined as a L/R image

## Relaxing

The vibraslap does not reach the congas so the slight gap is evident, but the panning is well defined.

## Land of Anka

The sound is muffled and there is lack of distinction in the bass. There is serious distortion, on the RHS to start with and then both sides are affected.

## There it is

Very good detail but again too much emphasis on the bass. The 3D effect is hinted at, but does not have the huge impact we hear clearly on the BAS.

## Think of me

Definition and details are good but there is a lack of presence in the midrange, so the vocal is lost in the heavier orchestrations. The 'in your head' sound of the wonderful vocals is only hinted at.

## Paradise

Generally a good sound although the snare ring is not so well defined. The double tracked guitar is good and the stereo hat is audible, though slightly more subtle. The midrange hole in the system is evident in the lack of vocal presence.

## Deeper

There is no distortion on the bass, but again there is lack of bass clarity. The ring of the snare is not clearly defined.

# Discussion

Finally we had a discussion about possible changes to the BAS system around aesthetics, eg. possible changes in the bass and midrange driver seating, the alignment of the high range drivers and so on. We also discussed some of the phase relationships evident in the scope traces – which the team is going to consider.

Regarding any changes to the system I have emailed Raza with the following thoughts (with which he has concurred) and I include them here for the reader of this report:

*The system is of course a total system and the sound we hear is a product of all the components that make up this system, working together.*

*I will include a report on the circuit diagrams and schematics that I have received so it may be interesting to wait till you have seen this before making any changes; I will leave this decision to you.*

*I don't know if this is possible, but it would be ideal to make these changes to a second system so that the effects can be A/B'd against the system as it is.*

*(Personally I would find it difficult to (accurately) asses the benefit of such changes if this were not the case.)*

# Conclusions

**The BAS is an outstanding audio system presenting power, clarity, definition and superb tone. This is clearly evidenced in the system's ability to reproduce very difficult textures within a composition with a quality, vibrance and musicality which is a delight to experience.**

**The following extracts from my findings in listening tests give some idea of the experience of listening to this exceptional system:**

*The BAS handled this area with absolutely no distortion and the quality of this wonderful vocal reproduction is clear, vibrant and very musical.*

*This difficult area was again handled very beautifully by the BAS providing a defined, uplifting and musical delivery.*

*On the BAS this difficult section is handled beautifully with a very musical vocal delivery and superb bass definition.*

*On the BAS the distinction between initial snare hit and ring is distinct, and the bass is powerful while maintaining clarity – there is no hint of distortion.*

# Appendix 1: circuit analysis

## 1) High Pass amplifier

The amplifier has a first stage inverter, with the active component being half of an ECC82 and the gain being defined by R2 and R5. The gain is  $-R5/R2$ .

In fact the gain is also influenced by R8, which is in parallel with R5, but I assume that R8 is a much higher value than R5, so the effect is minimal.

The signal from the first stage is coupled via C2 to the main amplifier. This is a high gain configuration of the second half of the ECC82, followed by the EL34, followed by the triple 300B output stage. Both the EL34 and the 300Bs operate with no cathode degeneration. This gives them high gain, along with significant levels of non-linearity.

The gain is regulated, and the non-linearity controlled, by overall negative feedback from the output-side of the output transformer, back to the cathode of the first stage of the main amplifier, the second half of the ECC82.

The overall gain of the main amplifier is defined by the feedback resistors R6 and R7. The gain being  $(R6+R7)/R7$ . So the overall gain of the amplifier is

$-(R2/R5) \times ((R6+R7)/R7)$ . The  $-$  sign indicates that the amplifier is inverting.

**Output Biasing:** The output valve uses fixed-bias, using a component which is drawn on the schematic as a battery. The quiescent current through the valve will be dependent only on the valve's gm and the voltage of the battery. There is no feedback to regulate the current, as would be the case with a cathode resistor. There is also a potential risk that, if the battery loses voltage, the current could rise and burn out the valve or the output transformer.

The battery is also shown as being directly across the signal path, effectively short-circuiting it to ground at the grid of the output stage. A battery is low impedance, and also it is non-linear, so it will introduce distortion into the open-loop characteristic of the amplifier. I can only assume that the schematic is a simplification of the actual circuit, which includes a mechanism to control these effects. Perhaps the battery symbol actually signifies a more sophisticated circuit.

There are no components shown on the schematic to control the open-loop gain at high frequencies, and so stabilise the amplifier. It may be that the resistor values are chosen such that the capacitances of the anodes provide this function.

## 2) Low Pass Amplifier

The Low Pass amplifier is similar, but the input stage, rather than being a separate inverter, is included in the main amplifier.

The output stage uses three 6550 valves instead of the three 300Bs. The output valves are auto-biassed. The auto-biasing reduces the overall power available from the amplifier, and means that the low frequency cut-off is defined, at least in part, by the decoupling capacitor between the output valves' cathodes and earth. This configuration seems more logical for the high pass amplifier. However, it may be that the characteristics of the output valves are better suited for low frequencies, and also lend themselves better to auto-biasing.

The gain of the amplifier is defined by feedback resistors R and R6. The gain is  $(R5+R6)/R6$ .

The amplifier is non-inverting, so the output will be out of phase with the output from the High Pass amplifier.

This may be to compensate for phase differences in the active crossover network, as a classic 2nd order LPF/HPF combination has a 180 degree phase difference between the two outputs.

There are no components shown on the schematic to control the open-loop gain at high frequencies, and so stabilise the amplifier. It may be that the resistor values are chosen such that the capacitances of the anodes provide

this function.

## 3) Pre-amplifier

The Line Pre-amp is an high input inverting stage with gain  $-R2/R5$  followed by a cathode follower for a low-impedance output.

## 4) Volume control

The volume control is drawn on the schematic as a multi-tap auto-transformer. This is an unusual way to implement a volume control. The more common variable resistor offers better linearity and makes it easier to achieve the low levels required when the volume is near its minimum. The logarithmic nature of the ear's sensitivity to sound means that, to achieve reasonably sized steps in volume, the transformer taps need to be very closely spaced near the earthy end of the transformer.

If the volume control operates by moving a wiper across exposed sections of the auto-transformer it is important that it does not make contact with more than one turn at a time. This would produce a local shorted turn in the auto-transformer, which would almost certainly impair its operation.

## 5) Active Filter

The active filter looks like a pair of Sallen-Key second order filters. However, the schematic of the low pass filter shows the capacitor C7 connected only to the anode of diode D2. I would expect it to be connected to the cathode (pin 8) of the ECC83 valve, and the anode of D2 to be connected to the junction of R8, R9 and R11. It would then have the same configuration as the high pass filter, which is correct for this type of active filter.

It may be that the schematic is incorrect and does not reflect the actual circuit.

However, it is noticeable that the frequency response of the low pass filter falls off as expected at 20dB/decade, but it then recovers to have a stop-band response of only around -15dB. This may be caused by the circuit not following the classic Sallen-Key configuration.

The weak stop-band figure is probably not too significant, as the bass loudspeaker itself will have limited response at high frequencies, and so will contribute a low pass filter response to add to the response of the active circuit. However, it should perhaps be investigated.

## 6) Passive Filters

(Loudspeaker Crossover Networks)

The Crossover networks consist of a first order inductive low pass filter for the low-mid driver, a pair of bandpass filters for the mid and high drivers, and first order high pass filters for the super-high drivers. The published frequency response curves show good complementary responses, indicating good component selection.

*Sid ed: I noted that the construction of the volume control auto transformer allows for individual pads for each of the transformer taps, I am not sure if there is a mechanism to avoid any possible impairment caused by the shorting of two adjacent pads. There are also several areas in Nigel's circuit analysis that will need careful consideration. Any changes made in result of this consideration must be carefully monitored and again A/B'd to the current prototype to ensure the musicality of the BAS is maintained.*

## Appendix 2: the 300B

This is an interesting article from the web about the use of the 300B as an output stage valve. I include it for your interest only:

(By Geoff Husband, 2004)

### *Introduction*

*The Western Electric 300b has a long and distinguished history, which I don't intend to go into here beyond this brief resume! It was designed in the '30's specifically as a power valve for audio - cinema amps specifically. Since then it's been used in several configurations, but the one that everyone is familiar with is as a power valve in Single-Ended mode. It was this valve, more than any other that kept the Single-Ended torch burning during the bleak, transistor dominated days of the 70's and 80's. This was especially true in the Far East, notably Japan where original WE 300b's (increasingly difficult to obtain and after 1988 out of production) fetched astronomical sums and were used in hand made valve amps complete with such delights as silver wound transformers. This tiny backwater of high-end mavericks would have remained as it was had it not been for the opening up of the communist and ex-communist world, notably China and Russia.*

*Why? Because these economies, starved of technological exchange with the West continued to run much of their*

*electronics on valves rather than transistors. With the fall in demand for valves from their military, factories specialising in valves turned their minds to breaking into the western market. One of the first fruits of this were Golden Dragon and Sovtec's copy of the WE300b. Suddenly instead of costing upwards of 3000e to buy a pair of NOS WE's they could be had for 100e each. This made the 300b a relatively cheap valve and various manufacturers, in particular Audio Innovations in Europe, designed SE valve amps at a price the average (obsessed) audiophile could afford. Now we move on to the present where SE 300b amps can be bought from China for 600e complete with valves, and there are literally hundreds of different 300b amps available - right up to one's costing 100,000e +... For some the 300b is still the king of valves...*

*Of course with lots of amps around the choice of 300b's and their equivalents has expanded to the point where even Western Electric have woken up and started production again. These valves can be had for as little as 50e, direct from Russia or China, and up to 400e+ for top designer brands like WE.*

*So I decided to have a look at a few that were available to see what differences were to be found, and of course to try and optimise my nice new Audionote Quest Silver 300b*

*Monoblocks! These amps are around 'mid range' as far as 300b amps go, at about 8000e. They use one 300b each which made comparisons easy, and best of all the French distributor was happy to send me half a dozen pairs of valves to play with. A huge thanks to him, with little to gain from the TNT link (not many visitors from France) he did it all in the spirit of enthusiasm - thanks Philippe, you are a gent...*

*Before I begin a three important points. First the cost of these valves can vary wildly depending on whether they are bought direct or from distributors. Searches on the net show variations running to 200%+ so you are going to have to look yourself. The prices where given are what Philippe Heitz charges, you may well find wild variations elsewhere...*

*Secondly a reality check. Though each of these valves sounded different and identifiable I wouldn't say that the differences were at all of the 'make or break' variety. If you have a SE 300b valve amp that you are unhappy with, then it is unlikely that a valve change we exact a cure. Likewise someone with 'entry level' valves will not reach audio nirvana simply by swapping valves. However that said often with hi-fi it is the little changes that can bring happiness, so only you can really decide... I also had a pair of new WE 300b's here as reference, these courtesy of the Loth-x amp under test a few months back.*

*Lastly about the typical 300b SE amp sound. Despite what you might believe SE 300b amps do not conform to the*

*"warm and woolly" valve stereotype. If you are looking for warmth and weight go look elsewhere, an EL34 PP for example. 300b's are very open and clear in the midrange, to the point that some can sound pushy - the phrase "hear through" was invented to describe a good 300b amp. Given very efficient speakers they also can produce punchy fast bass and flawless high frequencies, but with normal speakers they quickly go flabby at the frequency extremes. So when I describe a valve as warm it'll still be much more open than most amps - everything is relative.*

### *The 300b copies*

*Two valves here are to all intents and purposes - identical. The AudioNote (120e) and Audion 300b's both hail from China (so I've only put up a picture of the AN's). The Audion uses a slightly taller glass envelope, but on close examination the internals are practically identical, right down to the tiny constructional details, the brick red plastic base and the Carbonised Anode. These are made in the same factory I am sure. And they are very good:-) Overall they are well balanced and clean. The balance is pretty neutral, and they are quiet. Compared to the best they lacked a little drive, detail and air, but we're talking minor details here, and for their cost they really are good allrounders and you'd need to be running a very revealing system to become dissatisfied. Certainly I couldn't spot any difference between them.*

*Third up comes the Electro-Harmonix (also 120e) gold pin. This is, I believe, a specially selected Sovtec with a ceramic base. It's much the same cost as the Chinese tubes, though the 'cooking' Sovtec is considerably cheaper and probably the cheapest 300b available. This did sound different to the Chinese tubes. It had a slightly smoother and more laid back presentation, though once again the difference was not enormous. It was enough that if your system is just too pushy for it's own good then these might well help calm things down whilst retaining much of the openness of the other valves. On the other hand it could sound a little unfocused at times, particularly in comparison with the JJ.*

*Fourth is the Svetlana SV300b (around 180e). This also hails from Russia with quality control and marketing being centred in the USA. Of all the valves this one was the most like the WE. It also looked very similar with the same sized bulb, and if anything both the glass envelope and internals were better made than the original. With much the same sonic signature as the Chinese tubes, this one managed to add another layer of very fine detail as if coming from a quieter background. Bass if anything was tighter and better defined than the WE but back to back I'd be pushed to tell them apart. Personally I'd really have to need that slight extra warmth that the WE's possessed to justify shelling out more than twice as much for them.*

*"And now for something completely different"*

*All the above are essentially copies of the WE300b original, but other companies have produced tubes with the same electrical characteristics but with quite different constructions and the two most popular of these are the JJ 300b (170e) and the TJ300b (220e) gold mesh plate. These do sound different...*

*First off the JJ's. Of all the valves these were the best built, with the thickest glass and the neatest looking internals. I'm no expert in valve design (or even beginner) but the internal structure was notably different to the others and the glass envelope the biggest. They also didn't sound the same. Of the test these were by some distance the most revealing tube. Let me explain. One of the characteristics of a high-end system is the ability to show the difference between recordings. I don't mean that you can tell if it's the Beatles or the Stones, more that the recording venue/equipment/processing differences are very clear. It's the ability to spot when Paul McCartney is singing rather than John Lennon, to spot the difference between a 'Tele' and a 'Strat' but more importantly to be able to hear where one track on an album is recorded in a different studio to another. This is a double edged sword as such a system will pick apart poor recordings to the point that all things being equal, you will begin to play good recordings rather than poor.*

*If the situation arises where you begin to avoid great music that is poorly recorded, then the process has gone too far (or you need to find another hobby). In this respect the JJ's were ruthlessly revealing, stripping bare the music to expose both its beauty and its faults. The Quest Silvers combined with the JJ's managed to walk the tightrope between music and analysis very successfully, but unlike the valves already described this would not be the case with every amp. I would hazard a guess that they could be the worse valve possible for the Loth-x 300b amp. Here they managed to make every other valve available sound as if they were missing things.*

*Now the TJ's. These are the most widely talked about 300b's on the market, They seem to have met almost universal praise so of all the valves these were the ones I just had to hear.*

*The biggest disappointment with 300b's generally is their appearance. The glass envelope is a voluptuously curved creation and they are big enough to look impressive. The problem is when you switch them on. If you switch the lights off you'll see the blue glow, but otherwise forget it. You can read by an 845, the 300b has the glow of a celibate glow-worm. Enter the TJ. The envelope is totally different, like a PX25 - big too - and by using a mesh plate the whole thing lights up, it's gorgeous and if looks are why you went for valves in the first place, then you've just got to buy the TJ's*

*But... But... Look at the pic, you can just see that the pins aren't parallel - the other of the pair was worse. They are also pretty thick. These valves were a VERY tight fit in the Quests, so much so that they damaged the valve bases so that they became loose with the other valves on test. But maybe I was unlucky. So I plugged them in. Yup, very pretty. And the sound had a beautiful beguiling tone, warm and smooth and delicious. The effect made voices sound rounded and organic. Recordings lost their harshness, things became more listenable. You can see where this is going. If the definition of the high-end is to extract as much as possible from the original recording then the JJ is the ultimate valve - the TJ take a big step back from this. It lays a warmth and ease onto everything and there is the feeling that this is an 'addition'. Add to this is the fact that they are the noisiest valve on test, with greater hum levels and you can see that my enthusiasm is not as great as some others that have tested the valves. As it is they are probably the perfect valve for the Loth-x 300b amp.*

## Conclusion

*Six valves, with all the "copies" of the WE 300b giving a good account of themselves. Given a well-balanced amplifier any will do well, but of them all the Svetlana is my personal favourite being desperately close to the WE300b. Of the two 'compatables' I find the TJ difficult to recommend, poorly made, noisy and coloured, and with a high price it's for fashion victims first and foremost. The JJ is a scary valve. It is just so revealing - you get the feeling*

*it is missing nothing. It is strong medicine, and for many ears and amps it may go too far, but once used to it you feel the others are cheating. I bought a pair for my own use. I also bought the Electro-Harmonix because they give me a tuning option for the Quests if I find a test component just too pushy for the JJ's. But if the TJ's had been better made and cheaper they would have done the job even better.*