Before / After Listening (B / A-listening)

Is it possible to test devices in a more comprehensive way than just plug in the equipment and start to listen? (So-called open tests). I would like to write about a test method which I think can be very useful. The method requires work and knowledge, but it has its advantages. This article originated in 2001 when we were asked: Do open tests lead us to select equipment which fully connects us to the music?

Introduction

B / A listening tries to remedy the problems with open tests due to a lack of reference and influence from different parts in the reproduction chain. It becomes difficult to trace the contribution of the component under test when uncertainties about other changes in the reproduction chain have not been eliminated. The only conclusions to be drawn from such open tests are that with a specific combination of program material, loudspeakers and other equipment and under the specific circumstances, the listeners had a certain impression. When we think of the number of variables that can be changed, the assessment of an individual component is not particularly useful or sometimes even misleading.
Normally, people hear the net result of the entire chain from recording, mixing and mastering (through monitor loudspeakers), to subsequent playback via signal source, pre-amplifier, power amplifier, speakers and listening room. It becomes difficult to identify where, on the long way through the reproduction chain, some of the natural colour and nuances in the music disappear and where some new colours are added.
The B/A listening test method does not investigate the sum of the chain, just the changes due to the test component. The accuracy of detecting colourings is therefore substantially higher with B/A listening.

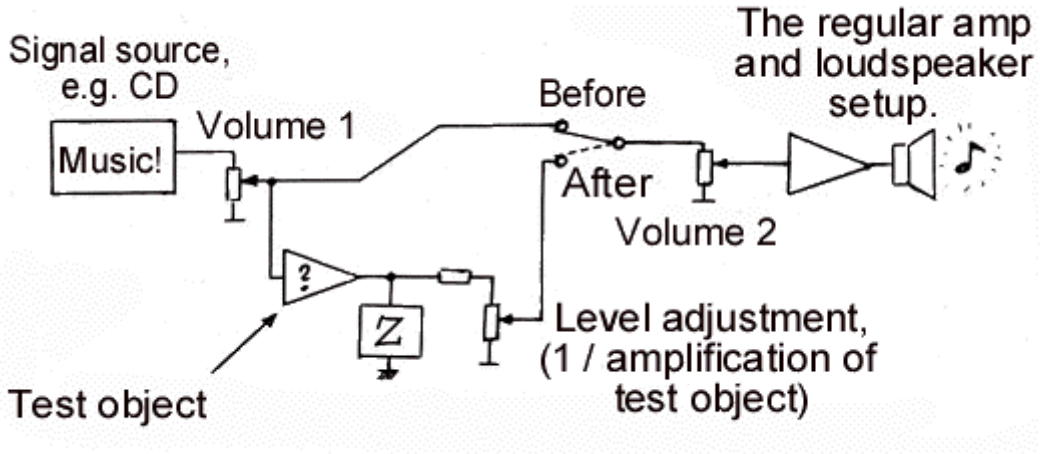
Goal

When it comes to sound reproduction, the foundation is that reality is the reference. Reality can be acoustic music performed in a room, or in other cases, the recorded music the producer/composer heard in the studio. We are trying to recreate reality. The reproduction is good when you come close to reality. Ideally, neither original information is lost, nor something added along way through the reproduction chain. In other words; Transparency is the goal and colourations are not desirable. The objective of the test is to be able to select components in a chain to be optimal for reproduction, this means as transparent as possible. The test is simply an optimization method.
Some people say that the chain is no stronger than its weakest link. Others argue that any improvement of a single part, whatever the quality level of the individual part is before improvement and quality levels of other parts of the chain, always results in a (technical and sometimes audible) improvement of the entire chain. Both arguments may seem real but they are contradictory. A contradiction-free summary is that all parts affect the recreation of reality and the less errors found in each individual part, most often the less in the whole reproduction chain. It is generally therefore important to strive for as small errors as possible in each individual part, to achieve high transparency in the system and good reproduction.

Approach

The actual realization of the test is as follows (if the test object is a power amplifier): The test amplifier is connected as an extra link in a complete reproduction system. The output of the test amplifier is connected to a load that emulates a pair of speakers. This load is identical to a speaker load from the amplifier's point of view, in terms of simulation of (complex)

impedance, impedance distortion and moving mass. The load behaves like a speaker with extremely low efficiency. It generates also the voltage associated with the coils movement in a magnet field the same way as other speakers. The output level from test amplifier that appears on the load (the 'After'-signal) is then adjusted with an attenuator to have same level as the input signal (the test amplifier's I/O gain is cancelled so it forms a circuit that has a total adjusted gain of 1).
Now the signal is connected into a pre-amplifier with subsequent power amplifier and speakers. The signal before the test object (the 'Before'-signal), which is used as reference in the test, is connected into another input in the non-test pre-amplifier. How the music signal behaves is not critical. It can be anything that the ear can discern, because we are not interested in the sounds itself, but only of how the music changes/degrades when passing through the test amplifier. However, with some music signals it may of course be easier to detect changes than with others and experienced listeners can contribute with choices of appropriate musical material. Level matching of Before and After signals must be better than 0.1 dB difference. (0.05 dB usually is used by LTS).



Layout of the test connection.

Picture from Sonicdesign.se by Ingvar Öhman

Now a listening comparison is performed between these two signals, ie 'After' is compared against 'Before'. Normally the test session starts with a non-blind listening with alternation between the signals. Then perceived difference is evaluated in blind test sessions with statistical computations to scientifically verify potential differences. All types of differences can be assessed and the only restriction is the listener's ability to perceive them. The question of whether there is a difference between the 'Before' and 'After' -signals can be answered with certain probability, and then be regarded as verifiable. Although the B/A - test method is a listening test, this part of the test is completely objective. (Stating that 'After' was discerned from 'Before' is an objective truth, if this was the case). Then follows the subjective part of the test where listeners try to describe changes in the sound with as precise descriptions as possible. Some colourations can actually provide nice effects and it is obviously up to the individual listeners if they like these colourings or not.

A little about the results:

Normally, the more accurate test setup and longer test time - the better result. Accurate system, good conditions, appropriate music material and experienced listeners increase the

likelihood of detecting differences. However, in practice it has proved that the test method easily discerned the great majority of tested equipment as coloured, even in conditions that are far from ideal. The results of tests are consistent, that is, they can be repeated with the same or in any case similar result. This even if the new test is done with entirely different test system and with new listeners. Similarly, it has proved to be much easier to discern small subtle nuances in B/A-listening compared to open tests without absolute reference.
It detects differences that are not noticed at the "open" listening. Trials have shown that colourations/degradations need to be about 20 times as large to be detected in "open" listening tests with good statistical significance.
Amplifier testing has an additional benefit in that it is possible to test those with high input signal (where listening normally becomes strenuous high) but at a more normal volume. In this way, it is easy to detect defects resulting from the higher signal levels. Also the reverse is possible; you can test the amplifier's small signal behaviour with increased real listening levels.
Detailed description and drawing of amplifier load can be seen at Sonic designs website: http://www.sonicdesign.se/amptest.htm. The article also postulates that more than 9 out of 10 amplifiers, including the highest priced, have colouring of one sort or another with this test.
In LTS B / A-listening, however, no ordinary pre-amplifier or switch is used. Everything is custom made to guarantee that no differences between Before and After are introduced which do not belong to the test component.

What can be tested?

In a sound reproduction chain we may want to examine all audio components that processes the music; audio-recording-monitoring-mixing mastering; and subsequent playback; music signal - source - amplifier – speaker - listening room. The whole recording and reproduction chain except the beginning (microphones) and end (loudspeakers) consists of a signal with varying amplitude in time and where it is easy to apply B / A-listening. The signals in and out of a component are easily comparable because they are of the same dimension. Unfortunately, it is different with microphone recordings and loudspeakers. Here the signal is converted from space and time (4 dimensions), to time and amplitude (2 dimensions) and vice versa. In these cases, it is not as easy to perform B / A -listening as the signals are of different types, so the test component cannot be inserted into the location shown in the test setup diagram, above. Information loss is inevitable in the first link. This can never be recreated exactly, - a piece of information is lost. The last link, - speakers in a listening room, where information expands, the restoration can more or less approach the origin which is the recorded reality.

AD-converters (recording system) and DA-converters (CD players) are affected by the same difficulty: In-and output signals (Before and After) is in various domains, analogue and digital. Our test method needs an analog input-output test component. But AD-and DA-converters can be tested together. We can therefore determine whether they colour the music or not in combination, but our test cannot provide the scientific evidence that they are colourless individually.

If it turns out that you can combine some components in many different ways and always get a chain with extremely small colourings, there are good reasons to believe that the colourings are very small. If a new ADC in any combination with reputedly ‘good’ DACs proves unable to provide a transparent chain, it suggests but does not prove that the new ADC is a source of audible colouring. But one can not exclude the possibility that a different DAC with the new ADC will produce minimal colouring. However that experience has not occurred in practice.

A CD player can be tested indirectly in comparison against a reference-DAC. This reference-DAC, where previous tests have been paired with an ADC and where the combination ADC-DAC has not been detectable in B / A-listening. The combination transport + DAC can be tested by digitalizing the music via a 'transparent' ADC and burning a CD and running the burned CD in the test component. The test will then run as a normal A / B-test, but through the arrangement, it becomes a B / A –listening test, because the difference between the signals is what the test component is adding, namely the test component's colourations.

A product used as a reference should of course have undergone very extensive testing for a long time where audible colourations have not been detected.
This method is suitable for testing equipment of all kinds including cables. However we must be aware that all the effects of a plugged interconnect cable does not need to prove such as a difference between 'Before' and 'After'. In many cases turns out to the dominant colouration comes up already in the 'Before' signal. This is the impact of the cable load on the output amplifier. To detect such effects, the B / A –listening must performed on the preamplifier together with the cable connected to the output.

A clarification: equipment exposed to the B / A -listening where no detected colourings are found is not to be considered as "proven" transparent, only "likely" transparent. One can comment on the failure to detect audible colourings, but it is wrong to say with certainty that no audible colourings exist in the equipment.
But the opposite is true: A demonstrated colouration proves (within the statistical probability of random chance) that the unit colours the music. This is a law of science: You can never prove the absence of something, only note that one hasn't managed to show the presence of colourations.

Some personal reflections and philosophy about "reality"

Now the question: How well does equipment that passes the B / A-listening test correlate to what people perceive to be good music agents? This question is almost philosophical. First, an important distinction: Perception of a sound (hearing) is something which can easily be objectively examined (you can hear it or not?), so we are not trying to address the question of audibility itself.

Ideas of how the music reproduction sounds are more difficult to research. If the majority of people have 'reality' as ideal, then transparent music reproducers equate to good music agents.

Do most people have "reality" as their ideal? I do not know. Can we not refer to reality, when we are bred in it? It all ends in the question of whether perception is subjective. Well, then we are probably back to preferences. People have their experiences, good and bad, which generally are filtering their view of reality. This is true even in the area of music reproduction. Nevertheless, we most likely have some sort of common opinion of how reality is perceived, otherwise we would have difficulties to communicate with each other. Thanks to this common ground we can relate and orient ourselves in relation to the world. This basis can be examined and can be used as a reference. If we examine how people perceive sounds we come to the arena of psycho-acoustics:

Psycho-acoustics

Only a few quotes: "*There were those who said 'we all hear differently' and that there can be no rules for what sounds good. I thought about it and I decided to test it* ", "*When I started to*

look at the methods of experimental psychology, it was clear that the double-blind tests were necessary ", and "*It is true that we do not all agree on what is good sound; but those who have normal hearing and no skills in assessing sound quality, display remarkably equal views.*" A summary of an interview with Floyd Toole, retired senior research officer at Harman International. (Can also be found in JAES). Similarly, experiments performed by Ingvar Öhman which compared the match-up of a sound reproduction setup directly against a live string quartet. The reproduction came so close to reality the test participants had difficulty in separating the string quartet from the high-quality reproduction. In this case B / A-tested transparent components were a prerequisite, as well as high standards of recording, speakers and listening room (totally damped / outdoor environment), were equally important to achieve this remarkable performance ,where a specially made 7-channel/12 loudspeakers installation different from today's 7-channel standards was used. (Also the recording room was reproduced in 4pi-steradianer by the speaker system).

The late John Dunlavy has done similar experiments.

Are B / A- approved equipment good music agents?

I guess here lies the answer whether the B / A-tested equipment correlates to the idea of a good music agent. I do not know what conclusions have been drawn but I guess (again) that the answer to the above question is, yes, it correlates under certain conditions:

1. The first is that the correlation only applies to the average of the test group (which mimics population / music lovers more or less). Individual differences are probable in how people perceive sound. This means that the more carefully and more extensive tests, the more reliable results.
2. The second is that for optimal result it requires that each component in the whole chain is (individually) tested with a good result in B / A methodology. If you take a component that has no audible colourations in B / A-listening and use it in an untested chain, it is unlikely that you will perceive any benefits. This is because the rest of the chain will make its mark on the sound. Therefore, in a random setup, other equipment might be preferred because of the synergy effects. A dark sounding CD can be compensated with light sounding amplifiers and so on. However, it is likely in this situation that other minor errors remain uncompensated and also new errors are intruduced. This is also the very limit of B / A-listening. It has limited value when not used consistently. A change from a coloured device to an uncoloured one in an unknown setup need not be perceived as an improvement. Neither subjectively, audibly or in measurements.

Summary

One of the real benefits of B / A-listening is, that if it is used consistently from recording to playback, higher quality audio recordings will be heard at their best. This would of course shine through extra in a transparent setup.

To make the advantages of this method and philosophy available to bigger audience will require some kind of industry standard for recording and playback. Only then is it possible to fulfil its promise, namely to contribute to sound reproduction that is true to the original event. But quite apart from the recording quality, B / A-listening still has certain advantages. The colourations of the playback system are minimized. One avoids the veils on the reproduced sound, which can provide a sense of "sameness" on reproduced materials. If you have a desire to get as close to the music on the disc as possible, then B / A-listening is very useful, even

necessary. So the final question becomes: How close does to the music do you want to get?

Mårten Kihlberg. 2001, translated 2009. Grammar and Feedback by Grant Sellek ☺

Credits

This article does not represent Audio Technical Society's attitude in general. Some are my own observations and personal and subjective ☺ reflections. Descriptions of the test procedure and results are courtesy of Ingvar Öhman and John Stålberg.

For more information on the actual test procedure: Contact LTS in Sweden to test this methodology. For answers to questions, one should be a member: http://www.lts.a.se/ A specific source of information may be the article in Audio Technology Society journal Music and Sound, who first described the method. It was published in Molt Number 1 -1991 and is written by testmetodikens author, Ingvar Öhman, who used the method since end of the 1960. He usually tries not to call it B / A testing, but rather says B / A-listening, to avoid confusing the method with any type of measurement as often happens, however, still ☺.
The article is also available to read, translated into English by Per - Arne Almeflo, on Sonic Designs homepage: http / / www.sonicdesign.se / amptest.htm