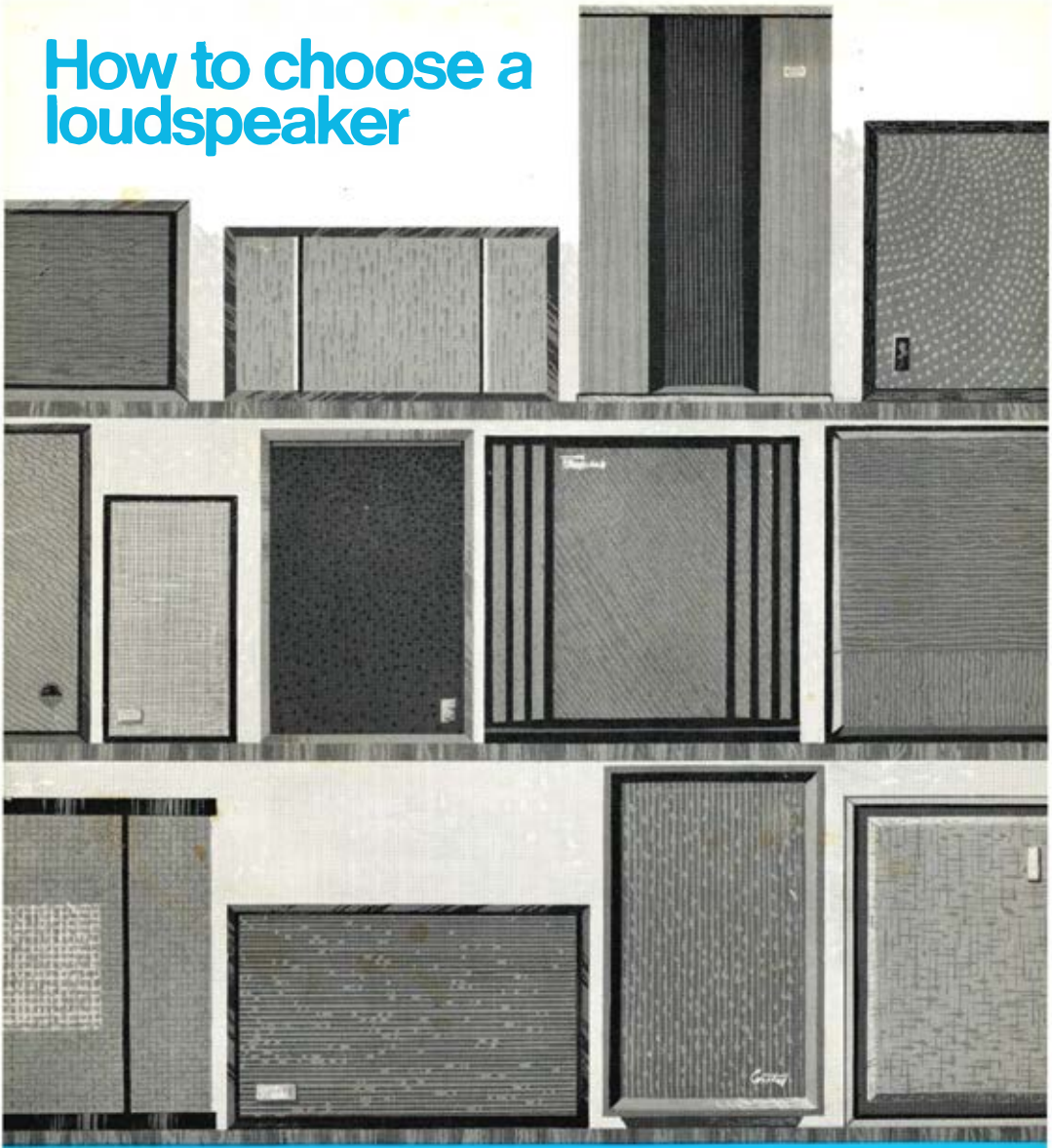
How to choose a loudspeaker



How to choose a loudspeaker

So you want to choose a loudspeaker?

This little book is intended to help you select the most vital part of your sound system. It describes a short programme of listening tests which will enable you to evaluate any loudspeaker irrespective of size, price or specification. By following this simple advice you will avoid disappointment and choose a speaker to give you years of listening pleasure.

What about printed specifications?

Treat them as a guide, not as a gospel. The human ear is more sensitive than all the audio instruments we have today. Two loudspeakers with identical specifications can sound poles apart, even specimens of the same model differ widely. Many published data are in any case 'so much wishful thinking' or averaged figures for a large number of samples.

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A-B Testing

The basis of all subjective comparisons of speakers is the A-B listening test in which two loudspeakers placed side by side are compared by switching from one to the other whilst reproducing the same programme. There is no substitute for this test which is more revealing than reams of technical specifications and measurements. However, it is necessary for such listening tests to be carried out with certain precautions otherwise the results can be misleading.

How important is sensitivity?

Not very, unless you are expecting to achieve full orchestral volume in a large room with a five watt amplifier. With ten or more watts per channel most modern speakers give adequate sound level in normal rooms.

It is however confusing to compare loudspeakers of widely differing sensitivities without compensating for the change in volume at switchover. There is a strong tendency to prefer the louder one and this is often misleading. If you find yourself in this position, you should try to arrange for each speaker to be driven by a separate amplifier with gain adjustment.

The Listening Room

The best place to audition speakers is in your own lounge or listening room. A most important requirement is a low level of background noise, otherwise the more subtle aspects of reproduction will be masked. Moreover, the acoustics should not be too lively, a well carpeted and curtained room with plenty of soft chairs makes for more critical listening conditions. A hard bright room, which is fine for playing live music, is likely to obscure faults in loudspeakers.

Of course a home listening test is not always possible and the initial stages may take place in a dealer's showroom, but the rules still apply, so beware the dem' room which is like a railway station and just as noisy.

A most important requirement is a low level of background noise

Speaker Placement

Initial testing should be carried out in mono, because stereo reproduction involves additional factors which tend to confuse judgement of essential qualities. The two loudspeakers should be placed close together.
It is quite useless to have the speakers several feet apart as the effect of room acoustics can swamp the differences between them.

At the later stage, when the field has been narrowed to two or three favourites, a final test in stereo should be carried out with spaced pairs of speakers, but again the speakers in each channel should be close together.
Never try to audition more than three speakers at a time. Apart from being mentally confusing, it is physically impossible to locate more than three speakers so that differences in room acoustics or their effects on each other remain negligible.

If you need to consider more speakers, select the better of two and compare this in turn with the others.
Wherever possible sit down and relax whilst listening and have the speaker axes on a level with your ears or tilted towards you. If you stand close to a compact system on the floor you will not hear a true balance.

Place the speakers a few feet from the walls to minimise reflections and sit five to ten feet away, not more, particularly in a small room.

Never try to audition more than three speakers at a time

Auxiliary Equipment

Use the finest pickup, turntable and amplifier available. Mediocre equipment can lead you to choose a speaker which compensates for its peculiarities. Even if the rest of your equipment is not of the highest standard you should choose the best speaker you can afford.

Choosing the Test Programme

Without doubt, the finest test material is live speech and music picked up in studio or concert hall on high grade microphones and relayed directly to the listening room. Professional engineers always work this way because it provides an opportunity to compare the reproduced sound with the live performance.

As such luxurious refinement is rarely available to the amateur, he has to rely on records or broadcast music of uncertain origin. Such programme material is liable to peculiarities of balance and it is therefore unwise to make a choice on hearing only one or two examples. It is essential to listen with a range of varied music originating in different studios to be sure of a valid assessment.

The following records have been found suitable for listening tests. Both stereo (*s*) and mono (*m*) numbers are given.

Programme	*Make*	*Number*	*Title*
1. Speech	Argo	*m* RG 484	Elizabethan & Jacobean Lyric
2. String Orchestra	Columbia	*s* SAX 5252 *m* CX 5252	Mozart: Eine kleine Nachtmusik
3. (a) Full Orchestra	RCA	*s* SB 2105 *m* RB 16233	Borodin: Symphony No. 2
(b) Full Orchestra	HMV	*s* ASD 582 *m* ALP 2033	Rimsky Korsakov: Tsar Saltan
(c) Full Orchestra	D.G.G.	*s* 138974 SLPM *m* 18974 LPM	Sibelius: Symphony No. 4
4. String quartet	DECCA	*s* SXL 6196 *m* LXT 6196	Shostakovitch: Quartet No. 10
5. Piano	IRAMAC	*s* 6504	Beethoven: Waldstein Sonata
6. Organ	HMV	*s* CSD 1541 *m* CLP 1788	Douglas Guest at Westminster Abbey
7. Soprano	DECCA	*s* SXL 2256 *m* LXT 5616	The Art of the Prima Donna
8. Dance Band	POLYDOR	*s* 237646 *m* 46446	Bert Kaempfert: Blue Midnight

VHF Broadcasts

People living in the south-east who receive their programmes by VHF from Wrotham are advised to include selections from some of the excellent BBC broadcasts now being transmitted in mono and stereo.

Most of the concerts and operas which are transmitted live from the London area are of first rate quality and certain offerings, such as Grand Hotel, are of consistently good standard. Audience applause is also a revealing test for colouration and auditory perspective.

Volume Level

It is important to select the correct volume level for listening tests. The characteristics of the ear vary considerably with volume, particularly in the lower frequencies. Bass will be over-emphasised by replaying at too high a level and vice versa. It is especially important to adjust the volume exactly for the speech test, and comparison with a live speaking voice is a simple and convenient means of achieving the right conditions. Music reproduced too softly lacks definition and weight. There is a level at which it comes to life without however sounding unduly oppressive.

What to listen for in the selected records

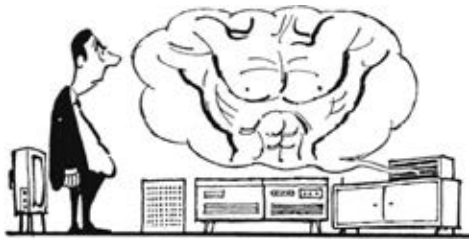
Faults in a loudspeaker present a barrier between the listener and the reality of the live performance. The main factors are colouration, lack of smoothness, faulty balance and sharp changes in directivity. Definitions of these terms are given in the glossary.

Other shortcomings include restriction of the frequency range i.e. loss of bass or extreme highs and non-linear distortion, although these faults are not so drastic in their subjective effects as the ones mentioned earlier.

By switching from one speaker to the other during critical passages, the ears will quickly learn to appreciate their shortcomings and virtues. Concentrate on the mid range rather than extreme bass and treble. The latter can be corrected in the preamplifier whereas the mid range cannot.

1. Speech

Listen for chestiness or nasal quality revealing resonances in the system. Over emphatic bass, excessive sibilance or blanketed effects indicate incorrect balance. Uneven response in the midrange imparts a tunnelly character as though the voices were heard through a long pipe.

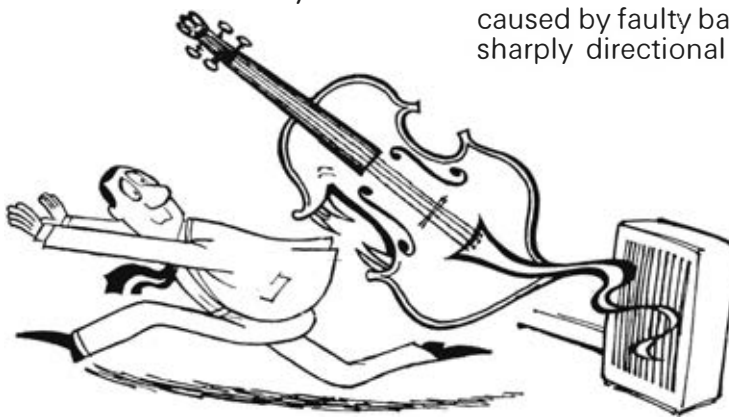


2. String Orchestra

Listen *through* the orchestra for the inner parts. Poor midrange response will cause some instruments to almost disappear. String tone should be sweet and silky, never coarse, gritty or strident.

3. Full Orchestra

Any one of these items will test the full frequency and dynamic range. The sound should have a full bodied, warm quality, whilst retaining plenty of bite to the strings and a free airy sound. Listen for constricted boxy effects caused by faulty balance and sharply directional tweeters.



4. String Quartet

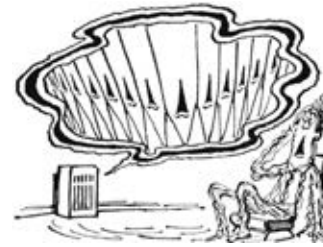
This record should sound really natural as though the instruments are in the room just behind the speakers. The cello comes out full bodied, but with true resinous bite and the violin should sparkle without sounding glassy.

5. Piano

This is one of the very finest piano recordings we know and it should reproduce naturally. The sharp percussive effects will reveal any rattles or buzzes in the speaker units.

6. Organ

The sustained heavy bass chords towards the end of the Toccata in C major are admirable for comparing the bass capabilities of speakers. Listen also for the upper parts and the cathedral ambience which test the midrange smoothness of the speaker.



7. Soprano

Joan Sutherland's voice has caught out many speakers and this disc is an excellent test for tweeter distortion and smoothness. Choose Handel's 'Let the Bright Seraphim'.

8. Dance Band

The percussion on this record will enable you to check HF response, crispness of attack and definition. It should not be too prominent and should be crisp but not edgy. Try moving sideways off the tweeter axis to assess directivity.

N.B. for an abbreviated test, items 1 and 2 will be most effective.

Stereo Image

A speaker which gives a good performance on mono may not however be ideal for stereo. Some loudspeakers give a rather vague stereo image due to excessive phase shift and transient distortion in the important midrange. A final check should be made comparing pairs of speakers in stereo and for this purpose the full orchestral records of No. 3 are all suitable. You should listen for a sharply defined stereo *picture* filling the space between the speakers.

GLOSSARY

Auditory Perspective

Sounds originating from a live orchestra in a concert hall reach the listener from a large number of instruments arranged on a wide stage in three dimensions. Additional sound is reflected by the walls and ceiling in a manner which is determined by hall acoustics and the distance between the listener and the orchestra.

In broadcasting and recording, it is the aim of the engineers to transmit these complex sounds through space and time to another environment and to recreate the illusion of sitting in the concert hall.

Most loudspeakers reproduce sounds by means of radiating devices which are small compared with the original source and are invariably arranged in a flat plane. The illusion of width and depth must, therefore, depend upon acoustical and electrical tricks performed by engineers at the transmitting point. When nearly perfect loudspeakers are used to reproduce these signals the listener will hear the sounds exactly as intended by the engineers but quite small faults in the speakers will modify the auditory perspective, altering the apparent distance of the orchestra or the acoustical ambience. In certain circumstances listeners sometimes prefer the modified perspective produced by inaccurate speakers and they are, of course, entitled to indulge their preference, but it must be clear that this is a form of distortion since the intended effect is not realised.

Balance

The relationship in terms of apparent loudness between various parts of the musical range. The critical frequency

range affecting balance is from 250 to 4000 Hz over which a smooth and level response is necessary. Boosting or attenuating any part of this range, even by quite small amounts, will produce drastic changes in the apparent balance between instruments.

Colouration

Spurious resonances in loudspeakers and enclosures add their own particular timbre to the reproduction. Bad cases such as juke box bass and 'horn tone', characteristics of some public address speakers are easily recognised but all loudspeakers are coloured to some extent although the effect is often very subtle. The best modern loudspeakers reveal only slight colouration, insufficient to be troublesome in ordinary domestic rooms. Most of the terms used to denote colouration effects in various parts of the range are self explanatory, viz. woofy, tunnelly, chesty, nasal, gritty, etc.

Directivity

Loudspeakers do not radiate sound equally in all directions. Most become very directional at higher frequencies, focussing the soprano's piercing top notes into a narrow beam along the axis of the tweeter. The directional effect diminishes progressively at lower frequencies in a manner which depends upon the individual design. Big changes in directivity, and even worse sudden changes are a major cause of unnatural reproduction.

Distortion

Harmonic or non-linear distortion is referred to here. Like all other recording and reproducing devices, loud-

speakers add their share though not so much as is sometimes suggested. Good speakers generate less than 1% at normal listening levels for frequencies above 100Hz. Badly designed horn tweeters can, however, give trouble at high volume level.

Frequency Range

The range of frequency over which a speaker reproduces efficiently. A mere statement of frequences is not however sufficient, i.e. 40-15000 Hz, for it is also necessary to specify the limits of departure from flatness, i.e. ±5dB. The foregoing would specify a very good loudspeaker by present day standards although a range of 15-18000 Hz ±2dB would be required to reproduce accurately everything heard in the concert hall.

Impedance

The ratio of the signal voltage applied to a loudspeaker to the current flowing through it is called its impedance. Its value, which is expressed in ohms, varies considerably with frequency and it is therefore impossible to state it accurately as a single figure. By convention, impedance is quoted for the range 300-400 Hz when it is roughly equal to the d.c. resistance in moving coil types.

Amplifiers are designed to deliver their rated power into a specified load impedance. If the amplifier is connected to a load having an impedance which differs substantially from that intended, the power available without significant harmonic distortion may be considerably reduced. The majority of high fidelity speakers have an impedance of 15 ohms in the U.K. and 5 ohms on the Continent. High quality valve amplifiers usually have 15 ohms output but transistorised types are designed for 4 or 8 ohms and this may bring about a fall in the impedance of high fidelity speakers during the next few years.

Multi-speaker systems

Although it is feasible to make a very good loudspeaker using a single unit the technical problems are eased

considerably by employing two or more units, each handling only part of the audio frequency band. There are, after all, very few single cylinder motor cars in existence. More cylinders increase power, flexibility and reliability—it is the same with speakers. The following components deserve mention :—

WOOFER—a speaker unit designed specifically to reproduce lower audio frequencies up to 1k Hz.

SQUAWKER—a mid-range reproducer covering approximately 200-4000 Hz.

TWEETER—A high frequency unit for the range above 1kHz.

DIVIDING NETWORK—an electrical circuit which splits the audio signal in a speaker system into two or more frequency ranges. Its function is to limit the frequencies fed to each unit to those which it is designed to handle. Crossover network and filter are alternative names.

Power Handling Capacity

The amount of electrical power which a loudspeaker can accept without undue distortion or damage when reproducing musical programme.

Sensitivity

Sometimes called efficiency but sensitivity is technically the more correct term. It is a measure of the sound output produced by a speaker for a given input. Obviously a more sensitive speaker demands a less powerful amplifier but this is not an important consideration nowadays when so many high powered amplifiers are available at reasonable prices.

Any consideration of sensitivity must take account of speaker impedance and matching because a 4 ohm model will sound louder than a 15 ohm type on a direct switchover.

Sensitivity is affected by balance. A speaker with over prominent midrange will sound louder than a smoother model. Nowadays there is little to choose in sensitivity between well balanced wide range speakers. Any significant increase in sensitivity would require a corresponding increase in size and price.

Smoothness

The absence of sharp changes in frequency response and directivity. It is one of the principal factors in avoiding listener fatigue. A smooth loudspeaker always sounds natural.

Transient Response

The ability of a loudspeaker to respond to sudden changes in signal level without inertia or hangover. Poor transient response is one of the main causes of colouration and lack of definition.

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