Optimal Audio and Video Reproduction at Home

Improving the Listening and Viewing Experience

Loudspeaker Placement Guide

Vincent Verdult

Version 1.0
March 2019

© 2019 Taylor & Francis. All rights reserved.

1 Introduction

The most important step towards good sound is to determine the optimal listening position and the positions of your loudspeakers in the room. Putting your loudspeakers in the right places should be your top priority in designing the listening room, because loudspeaker placement affects almost all sound-quality aspects, especially spectral balance, clarity, dynamics, and localization.

The advice given in this loudspeaker placement guide is a summary from my book *Optimal Audio and Video Reproduction: Improving the Listening and Viewing Experience*. Check it out if you want to find out more and want to understand the underlying principles of this summary.

Find out more at: vincentverdult.nl **or** routledge.com

All rights reserved. Copyright 2019 from *Optimal Audio and Video Reproduction at Home* by Vincent Verdult. Reproduced by permission of Taylor and Francis Group, LLC, a division of Informa plc.

This material is strictly for personal use only. For any other use, the user must contact Taylor & Francis directly at this address:
permissions.mailbox@taylorandfrancis.com.
Printing, photocopying, sharing via any means is a violation of copyright.

2 Placing Loudspeakers

- Do not place loudspeakers horizontally, unless they are properly designed for it.
- Remove the grilles from your loudspeakers for an improved reproduction of high frequencies.
- Mount small loudspeakers on a rigid, nonresonant, and mechanically stable loudspeaker stand. The stand can be mass loaded to make it less prone to vibrations.
- Use hardened steel spikes with narrow points to rigidly couple the loudspeaker stand to the floor.
- Use four small lumps of compressed mastic, Blu-Tack, or a similar sticky gumlike material to couple the loudspeaker to the stand.

© 2019 Taylor & Francis. All rights reserved.

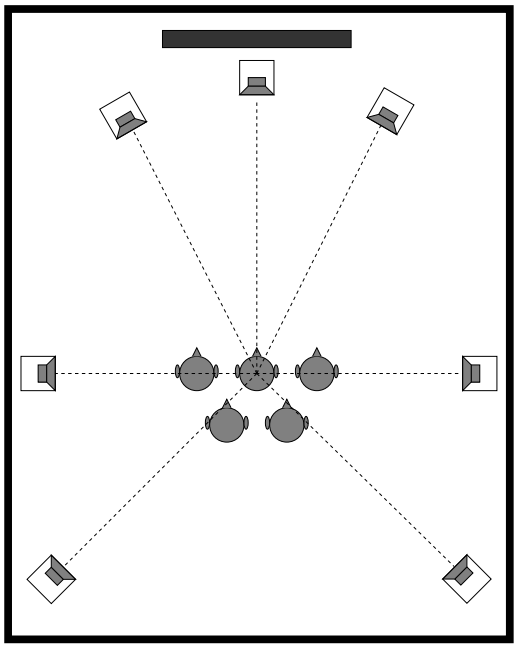

Figure 1: Typical loudspeaker positions in a 7.1-channel surround sound system. The prime listening position is the position where the lines drawn from each loudspeaker converge. Copyright 2019 from *Optimal Audio and Video Reproduction at Home* by Vincent Verdult (figure 4.1). Reproduced by permission of Taylor and Francis Group, LLC, a division of Informa plc.

© 2019 Taylor & Francis. All rights reserved.

3 Placing Front Loudspeakers

- Ideally all your main loudspeakers should be placed symmetrical with respect to the left and right room boundaries. Beyond that, symmetry for the front loudspeakers is more important than symmetry for the surround loudspeakers (see figure 1).
- If your room has nonparallel surfaces (sidewalls or ceiling) position your front loudspeakers at the narrow end of the room.
- Never compromise on the symmetry of the front loudspeaker arrangement. The prime listening position should form a triangle with the front left and right loudspeakers. Place the center loudspeaker and the video display centered between the left and right loudspeakers (see figure 1).
- Put the center loudspeaker at the same distance from the prime listening position as the left and right front loudspeakers. The three front loudspeakers should form a gentle arc with the center loudspeaker exactly centered on the arc between the left and right loudspeakers. Alternatively, place the center loudspeaker between this position on the arc and the line connecting the left and right loudspeakers and use an appropriate time delay and level setting in your A/V controller or receiver.
- Place the left and right front loudspeakers at the same height, such that the high-frequency driver is at ear height when you sit in the prime listening location: about 1.2 m or 4 ft from the floor.
- Place the center loudspeaker beneath the video screen such that its height is as close as possible to the heights of the left and right front loudspeakers. The height difference between the high-frequency drivers should be less than 10 cm for each meter of distance between the center loudspeaker and the listener (1.26 inch for each foot).
- Place the left and right front loudspeakers 2 to 3 meters apart (6.6 to 10 ft); or up to 5 m apart (16 ft) in larger rooms.
- Place the left and right front loudspeakers within 15° from the sides of the screen.
- Place the left and right front loudspeakers at 30° from the center loudspeaker. If they end up too far away from the sides of the video screen, you can slightly reduce this angle up to a minimum of 22°.
- Fine-tune the distances to the walls for the front loudspeakers to obtain the smoothest possible frequency response. Make the distances to the nearby walls as different as possible and use figures 4.36 and 4.37 from *Optimal Audio and Video Reproduction at Home* as a guide.

© 2019 Taylor & Francis. All rights reserved.

- Aim the front left and right loudspeakers at the audience and position the audience such that everyone is covered by the 30° beams from each of the three front loudspeakers.
- Ensure that the front left and right loudspeakers have the same amount of toe-in.
- Use a listening test to fine-tune the amount of toe-in of the left and right front loudspeaker. Listen with a disabled center loudspeaker to check for two-channel imaging and listen with an active center loudspeaker to check for three-channel imaging.
- Avoid putting reflective objects in the direct vicinity of your front loudspeakers, especially in the area between the left and right loudspeakers.

4 Placing Surround Loudspeakers

- Ideally all your main loudspeakers should be placed symmetrical with respect to the left and right room boundaries. Beyond that, symmetry for the front loudspeakers is more important than symmetry for the surround loudspeakers.
- Put the surround loudspeakers at the angular positions recommended in table 1, such that they are placed symmetrically on the left and right sides of the audience (see also figure 1).
- Place all the surround loudspeakers at the same height, such that the high-frequency driver is about 1.2 m (4 ft) from the floor. Alternatively place them a bit higher to facilitate covering the entire audience, but never more than 1.5–1.8 m (5–6 ft) from the floor.
- Aim the surround loudspeakers at the listening positions such that all audience members are within the 30° beams emerging from the surround loudspeakers. Use a listening test to fine-tune the toe-in of the surround loudspeakers to ensure that all audience members experience an enveloping surround sound.
- Fine-tune the distances to the walls for the surround loudspeakers to obtain the smoothest possible frequency response. Make the distances to the nearby walls as different as possible and use figures 4.36 and 4.37 from *Optimal Audio and Video Reproduction at Home* as a guide.

© 2019 Taylor & Francis. All rights reserved.

Table 1: Recommendations for the angular position of the surround loudspeakers.

Configuration		Target	Tolerance
5.1 channels	LS and RS	110°	90°–135°
7.1 channels	LS and RS	90°	70°–110°
	LB and RB	135°	120°–150°
9.1 channels	LW and RW	60°	60°–75°
	LS and RS	90°	90°–120°
	LB and RB	135°	135°–150°

5 Placing Overhead Surround Loudspeakers

- Place the overhead surround loudspeakers on the left and right sides of the audience at the same distance from the sidewalls as the front loudspeakers.
- Mount the overhead loudspeakers in a 5.1.2 and 7.1.2 system at an angle of $80°$ with the horizontal line passing through the ears of the listener, or alternatively within the range $65°$–$100°$. Install the overhead loudspeakers in a 5.1.4 and 7.1.4 system towards the front and the back of the listener at an angle of $45°$ with the horizontal line passing through the ears of the listener, or alternatively within the range $30°$–$55°$.
- Mount the overhead surround loudspeakers at least 1.2 m (4 ft) above the ears of the highest seated listener.

© 2019 Taylor & Francis. All rights reserved.

Optimal Audio and Video Reproduction at Home

Improving the Listening and Viewing Experience

Routledge, 1st edition (2019), 356 pages, 208 illustrations

Optimal Audio and Video Reproduction at Home is a comprehensive guide that will help you set up a modern audio-video system in a small room such as a home theatre or studio control room.

This book covers everything you need to know to optimize the reproduction of multichannel audio and high-resolution video. It provides concrete advice on equipment set up, display calibration, loudspeaker positioning, room acoustics, and much more.

Detailed, easy-to-grasp explanations of the underlying principles ensure you will make the right choices, find alternatives, and separate the rigid from the more flexible requirements to achieve the best possible results.

Find out more at: vincentverdult.nl **or** routledge.com