Resolving Immersive Audio Home Cinema Loudspeaker Layouts Using The Cinema Designer

Part 1: Dolby Atmos And DTS:X

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[Editor's Preface:
Guy Singleton, Managing Director at The Cinema Designer (TCD), has been designing and installing advanced home theatres for years and is an Imaging Science Foundation (ISF) instructor. Guy has developed a dedicated theatre design tool, which includes Dolby Atmos and DTS:X layouts (Auro-3D—Q1 2018). I am particularly interested in a signal height loudspeaker/channel layout that will work well with all three Immersive Sound formats. At *Widescreen Review* we use the Auro-3D loudspeaker/channel layout, which we have found to work exceptionally with Dolby Atmos and DTS:X. And with Auro-Matic upconversion available on most Immersive Audio preamp/processor/controllers and AVRs, the Auro-3D loudspeaker/channel layout is the sensible choice, as Auro-Matic does a superior job at creating an Immersive Sound experience from any non—or even native Immersive Sound-encoded soundtrack or music performance. With that in mind, I invited Guy to write an introduction to The Cinema Designer and what the design tool does. In a future issue, the question of what loudspeaker/channel format to use to best satisfy the reproduction of Auro-3D, Dolby Atmos, and DTS:X will be explored.]

Introduction

To give you some background information on The Cinema Designer (TCD), it is a double CEDIA Award-winning cloud-based design tool that allows installers to design any dedicated cinema or media room in minutes. The key to TCD's appeal is that it allows users to create technically impeccable dedicated cinema or media room designs, support documents, and aesthetic renders within minutes, as well as creates a 3D CAD drawing for any room in under 30 seconds. The home theatre design software is available to users all over the world, and what's really beneficial to users is that it provides all relevant documentation for theatre design, allowing any company to enter the CEDIA awards, regardless of the size of the organization.

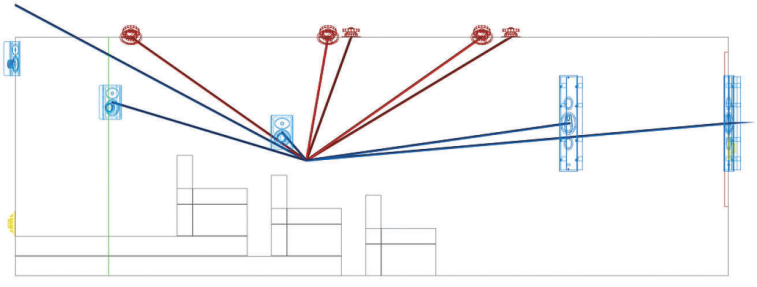
TCD was created with the sole intention of raising the standards of media and theatre room designs for the CI industry, whilst presenting itself as a beneficial timesaving tool for professional theatre installers. The primary aim of this product is to create peer-reviewed standard designs and to take away the subjection when it comes to theatre design in order to raise the bar across the whole industry.

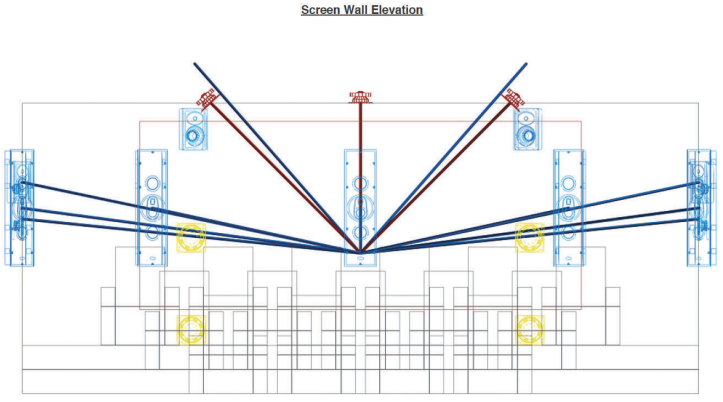
TCD does in minutes what would typically take a cinema designer weeks to design, creating nine drawings comprised of four isometrics: a top plan, four elevations and a PDF file—amounting to around 25 pages ready to produce for the client.

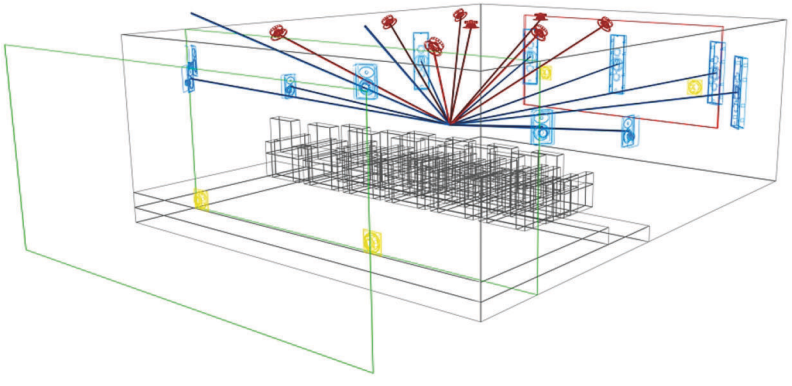
How Does TCD Work?

Creating CAD drawings and working out the mathematics associated with technically correct cinema designs can take days, if not weeks depending on the ability of the installer/cinema designer. What TCD does is bring the entire cinema design process into one place: the user enters in the dimensions of the room, ascertains the orientation of the space and picks a screen from a dropdown selection box—the aspect ratios for the screen adapt to any changes the user makes to the seating configuration.

TCD takes into account if a screen is acoustically transparent or not, which then affects loudspeaker placements, factors in if there is ambient light in the room that can't be controlled, and creates a list of suitable projectors that will excel in that specific environment based on lumen factors. Users can then select a projector for the room, and TCD will show where that projector should be positioned. TCD guides a user to select an appropriate lens, then guides the user step by step through the seating plan.







The software takes into account sightlines, allowing the user to reduce the distance, change the arm width, seat depth, riser height and reduce the gap between the seats.

TCD then guides the user through the process of selecting correct loudspeakers, subwoofers and processors for the room, which includes Dolby Atmos and DTS:X and layouts (with a CEDIA Whitepaper compromise coming soon). I expect Auro-3D layouts to be live in the software in Q1 2018.

The software also takes into account the carpets, chairs, plasterboard, or if there's fiberglass present, altering the reverberation time whilst telling the installer exactly how much m2 of acoustic treatment to order. A Sabine equation / RT60 calculation tool is also included within TCD for accurate and predictable room results. At the end of the cinema design process, the user can experiment with different renders by choosing different ceilings, décor, carpets and panels—ready to present all documentation to the client.

What Makes TCD Unique?

What makes TCD unique is that it is unique: there is nothing like it in the world. This was one idea that was developed in its entirety from concept to completion. I also run the UK integration firm, Imagine This, and we use TCD every week in our home cinema designs and proposals. In fact, I first created TCD in order to create accurate cinema designs more quickly. I needed the software to quickly produce technically accurate designs that adhere to industry standards in minutes, which also means spending less time on wasted man-hours for projects that might not take place should the client change their mind.

One of TCD's key, unique features lies in its ability to create a 3D CAD drawing in approximately 30 seconds: TCD inserts all of the loudspeakers, screens, seating etc., perfectly in a 3D CAD drawing, creates the render and then provides saleable documentation to hand to a client. A cinema designer doing all of the calculations that TCD outputs (including producing the 3D CAD drawing) by hand could spend weeks producing designs longhand.

Immersive Sound Format Loudspeaker Placement; Dolby Atmos And DTS:X

A standout unique and innovative feature that TCD offers lies in its high-render channel-count algorithm, which allows users to correctly and quickly design cinemas with high-render channel counts. Trinnov Audio's recommended loudspeaker whitepaper was recently incorporated into TCD, allowing home cinema installers to confidently design technically accurate 32-channel count Dolby Atmos and DTS:X home cinemas in a matter of minutes.

In fact, using TCD is the only way home technology professionals can accurately design technically perfect high-spatial-resolution home theatres in such a short space of time.

Trinnov's Altitude range provides from mono up to 32 discrete rendered channels, and in the future even up to 64 independent outputs; however, this presents a problem for theatre installers, as accurate loudspeaker placement becomes more and more complicated the higher number of channels there are.

DTS:X and Dolby Atmos do share some similarities with regards to polar angles and loudspeaker layouts, and therefore, it's easier to have a hybrid between these two codecs.

With Auro-3D, because it's channel-based and there's a surround layer, a height level, and a top layer, it's slightly more challenging because the angles and layout is different. We are currently working on a compromise layout, which covers all three formats; as with all theatre design, it's about managing compromises. It's about looking at the polar coordinates, the azimuth, the x- y- and z-axis coordinates—and basing your cinema design on a com-

Photo courtesy of Imagine This

promise. All of the designs generated in TCD are in alignment with the guidelines from Dolby and DTS, as well as incorporating the CEDIA whitepaper guidelines for loudspeaker placement for immersive audio.

TCD currently does DTS:X and Dolby Atmos at the DSP level; it will calculate high-render channel-count loudspeaker layouts using the Trinnov algorithm implemented in the software, and in Q1 this year we will bring in the Auro-3D version. As part of Auro coming on board and aligning with us, it will give us the opportunity to create a compromise version for all three codecs.

Dealers often struggle with high-render channel-count cinemas. Before this, you had 5.1 and 7.1; everybody got their head around minus 22 degrees, minus 30 degrees, 0 degrees on axis, 110 degrees—people knew how that system went together because it was fairly easy.

When you start adding in height channels that's driven by the size of the room, the height of the ceiling, the directivity indexes of the loudspeakers, its off-axis response, etc. There's a little bit more to it now with Dolby Atmos; when you think about how complicated a Dolby Atmos system will be at a DSP level, which is a 7.1.4 (which is limited to about 11 channels), and you start adding 32 channels into the mix, those polar coordinates become very complicated. I've shown TCD to a number of people who do design high-render channel-count loudspeaker layout cinemas—even to Trinnov, who are pioneers in that field—and there is no other way they can think of doing it other than to use TCD.

"Designing high-channel-count theatres for optimal results is something few people have much experience doing," said Jon Herron, High End Audio, Director of Sales, Americas, Trinnov Audio. "The Cinema Designer incorporates the experience we have gained by being involved with virtually all of the high-spatial-resolution residential systems completed to date."

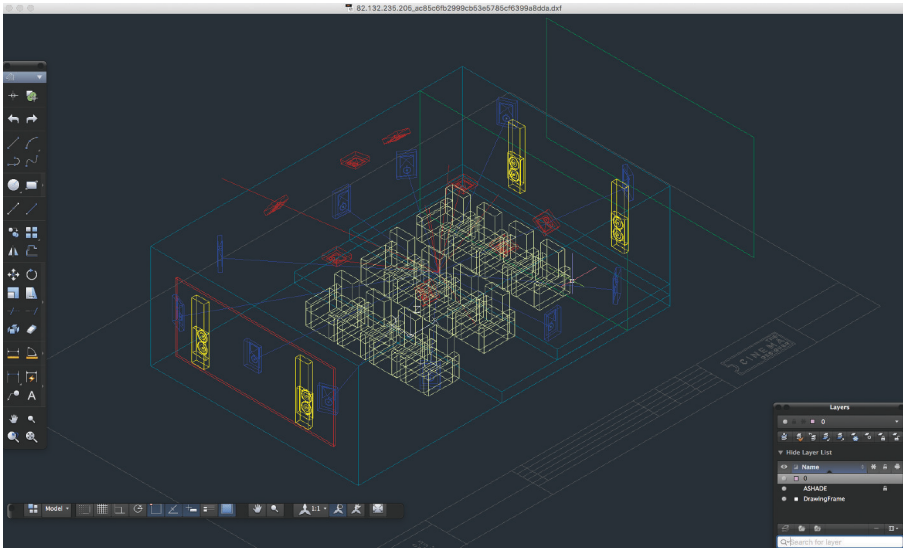
TCD's high-render channel-count feature eliminates the guesswork when it comes to placing all the required loudspeakers accurately in a room in a way that is relative to the listening area, while eliminating equipment combinations that simply won't work.

"Even within the high-end theatre community, most systems have been stuck at around 11 channels, plus subwoofers," said Herron. "Many designers are not entirely comfortable with the naming conventions, much less the use of all the 'new' loudspeaker locations available to them, nor which ones are the most important when deciding to increase the channel count beyond 11.1. This fact is not helped by the fact that Dolby, Auro and DTS all use different nomenclature for their 'extra' loudspeakers. TCD incorporates industry standards and Trinnov's own experience in designing these high-channel-count theatres into its design algorithms. It's quite remarkable."

Using TCD, users can quickly and easily produce a standards-based, scientifically designed set of drawings, complete with information about the performance that should be expected from their particular combination of loudspeakers and amplifiers. TCD allows the designer to quickly hone in on the optimal range of equipment for the particular project, producing a 30-plus-page proposal (complete with audio and video calibration reports) ready to produce for the client to review, including creating a 3D CAD drawing in 30 seconds.

Herron continued: "Most effective design teams have the ability to generate this sort of documentation. But the cycle of revisions, changed orders, etc. takes weeks—even months. The time it takes someone to create TCD designs and selling documents is between five and 10 minutes. Normally, you would have to close a client on a

Photo courtesy of Imagine This



design fee in order to justify what would otherwise be weeks of work. Think of how many more theatres you could sell if such a proposal took only a matter of minutes. People need only take TCD for a quick test drive to see how it will change their businesses for the better. We are certain that TCD will make it easier for our dealers to design and sell the high-channel-count theatres that only we have the ability to support."

Trinnov feels so strongly about the importance of TCD that it has become a requirement for the manufacturer's Level I Certification program: any company looking to achieve Level I Certification must attend a live training event and either sign up and demonstrate their ability to use TCD or demonstrate that they have all the engineering resources in place to do an equally good job designing these more complex theatres.

"Frankly, even those with suitable engineering resources would be well advised to use TCD for proposal generation and first-pass AutoCAD drawings," Herron said.

Arnaud Laborie, Founder, Chairman and CEO of Trinnov Audio has also given TCD his full backing: "I think that TCD is a game changer in the way that it allows integrators to specify a project according to industry standards, within minutes. TCD really helps to save time on the mechanical, technical aspects, making sure that the projects are compliant with industry standards, allowing the integrator to spend more time with the customer thinking about the decision that a computer cannot make: focusing on the art of creating a great home theatre."

If you want an accurate loudspeaker layout driven by the size, height, width and length of the room, the width of the seating area, the length of the seating area—all of those things impact the loudspeaker channel count—that is the real magic ingredient in TCD.

A lot of home theatre enthusiasts have a very high-technical proficiency and have a lot of experience; they put lots of time and effort into learning their hobby. If home theatre enthusiasts are looking for software that does loudspeaker placement, projector lens configuration, screen brightness calculations, etc.—then I'm sure that the majority will be able to use TCD in some capacity, however, underpinning knowledge is always beneficial.

For instance, understanding that TCD's designs are based on peer-reviewed standards can be difficult for someone who is less experienced, as they might ask: "Why can't I put my loudspeakers behind the screen?" You can open up the finished cinema room design in AutoCAD and move the loudspeakers anywhere you want—but the reason for this loudspeaker placement query, for instance, is because TCD's theatre designs are based on CEA/CEDIA CEB-22 and CEB-23 home theatre standards for design, as well as several ITU documents on audio and video criteria. This is something professional cinema installers are familiar with but perhaps would be unknown to an enthusiast.

Home theatre designers wanting to use the software should visit the TCD Web site (/thecinemadesigner.com) and subscribe to the software. **WSR**

Guy Singleton, Managing Director at The Cinema Designer, has been designing and installing awarding-winning luxury theatres for nearly 20 years. He has delivered reference-screening rooms for film directors and film producers, which includes groundbreaking developments from both audio and video standpoints. As an ISF (Imaging Science Foundation) instructor (for EMEA) and both THX and HAA certified, he has been instrumental in pushing the boundaries of state-of-the-art screen room designs for the next evolution of both picture and sound. Guy was involved early on with a 5K high frame rate (HFR) Dolby Atmos theatre for a famous film director and has subsequently included Auro 3D in his designs.