The evolution of surround sound /[1]

(Die Evolution des Surround Sounds)

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At the beginning of recorded sound the monophonous rendition was quite sufficient to represent a single voice or instrument. There was and still is an art to placing only one microphone to track an ensemble. It can undeniably sound good when well done. To quote Bobby Summerfield: „The best sounding drum kit you'll record is setting up one mike and putting it in front of a good sounding balanced drummer. It will sound smoking and punchy. Why? Because it's only one mike and nothing is out of phase.“ [AudioNowcast #76]

What „real“ stereo (the use of two transducers correlated by the right degree) brought along was the illusion of the width and depth of a true soundstage. Inventor Alan Dower Blumlein and Bell Labs' discovery1 opened a window onto a real or imaginary performance.

In 1970 RCA Records introduced Quadraphonic sound, in effect adding a rear stereo image to the frontal one. Inspired by Blumlein's research the mathematician Michael Anthony Gerzon developed the more flexible concept of Ambisonics a few years later. While still dubbed experimental it has survived beyond „Quad“ through it's inherent adaptability.

Back to the motion pictures, the realm that spawned Blumlein's research. Dolby Stereo, first presented in 1976 with the movie „A Star is Born“, utilized four audio channels for: frontal left and right, a center channel, designed to transmit the dialogue, and the signal for one rear speaker. In the consumer version labeled Dolby Surround the four discrete channels are matrixed into one stereo track by using phase-relationships.

The development of the by now well established 5.1 paradigm came in the late 1970s along with Francis Ford Coppola's movie Apocalypse Now. Sound designer Walter Scott Murch managed to fully surround the audience sonically by supplying a stereophonic rear ambience.

And that is mainly as far as we have come.

The state of affairs realized by „5.1“ is the first 1 to 1-1/2 steps in my conception of the evolution of surround sound, the three stages being:

Stage 1 - ENFOLD

Stage 2 - EXTEND

Stage 3 – EVOLVE

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[1] Alan Dower Blumlein (1903-1942) invented, among other things, the technique of using a coincident microphone pair to record „sounds in spaces“: the XY-technique (using two cardioid microphones mounted one above the other at a fixed angle), the Blumlein setup (using two fig-8 microphones at an angle of +- 45°) and the Mid/Side configuration (with a fig-8 facing sideways in relation to the sound source and a central mic of any characteristic). Arthur C. Keller, a scientist working in the team of Dr. Harvey Fletcher, developed AB or time-of-arrival based stereophonic recording (with two parallel spaced microphones of the same characteristic) at Bell Labs in the United States.

[2] Originally published in Resolution 05-2010 [42 f] as „Evolving recording in surround“

Stage 1 - ENFOLD

Stage 1 is characterized by (re)creating ambience, like with the early quadraphonic recordings of the 70s. The listener is enfolded by an enveloping soundstage, the rear used mainly for relaying real or simulated ambience cues. This is the state of most current surround productions in music, and one that definitely will keep it's place, e.g. for recordings of solo or duo recitals as well as for music performed by a traditional symphony orchestra.

But enfoldment is not where the journey should end!

Stage 2 - EXTEND

Stage 2 goes one step further by extending the frontal soundstage to provide a greater angle (than the usual 2 x 30°). An ensemble that is arranged in a semicircle can be recorded in such a manner as to place the listener at the middle point. The soundstage can be approximated by a 5.x setup although care must be taken with regards to lateral imaging. Phantom sources are localized far less accurately towards the far wider sides than straight ahead.

A 7.x setup (of the variety devoid of frontal elevated speakers for „height information“ /[3]) has the advantage of offering dedicated sidefills.

In a 5.x setup the angle between a frontal and the corresponding rear speaker, placed from -10° to -30° off the lateral axis, lies between 70° and 90°. In a 7.x setup the angle between then frontal speaker and the corresponding sidefill will be a defined 60°. Furthermore with 7.x the surround speakers can be placed farther back and closer together, increasing the coherence of the rear soundstage.

As a sidenote: a line of several listeners will also profit by the opposite sidefill and rear speaker not being blocked by the person sitting towards that side, increasing every listeners' sense of envelopment.

I have tracked various configurations: recorder ensemble, string quartet, wind quintet, vocal a cappella ensemble, in such a manner. The stage 2-approach greatly increases transparency with polyphonic music and can be used to significantly widen the soundstage and place the listener(s) within the action.

An integrated microphone system that outputs to discrete 6.0 is the XYtri I developed in 2008/[4].This geometrically simple configuration of three XY-pairs can be placed at the middle of a semi circle and can be utilized to paint a coherent picture of the sonic event with excellent results when upmixed to 7.x (with minimal matrixing) or downmixed to 5.x, 4.0 or stereo.

But extension is not where the journey should end!

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[3] While 4.0 can be interpreted in two ways, as „4.0 Surround“ with LCR plus 1 rear speaker and as „4.0 Quad“, 7.x has at least three interpretations: the speakers added in relation to 5.x are either besides the frontal pair, placed as lateral sidefills or located above the frontal pair to transport height information.

[4] http://XYtri.blumlein.net/

Stage 3 - EVOLVE

I see Stage 3 as being the next truly big step in the evolution, „transcending“ enfoldment and extension of the stereophonic paradigma. Generation 3e recordings use a 5.x or 7.x surround setup to present sonic events in a new way that is not only intended to give the listener a fresh start even with familiar musical material, but that uses the position of the listener(s) within a enveloping sonic space as the base from which to establish a new dimension of hearing.

I don't mean placing the listener at the position of the conductor of a symphony orchestra or choir, an approach I believe interesting one-time-only for most music afficionados. In stage 3 of the evolution of surround sound the recording producer becomes a sonic architect. Some of the potentially valuable setups will be:

- Recording operatic performances so that the orchestra is placed behind the listener while the stage is in front.
  As an artistic twist it is possible to experiment with placing the orchestra frontal at the overture and interludes while having it (gradually) take a back seat when the focus is on the stage, the acoustic happenings on which can be realized as in a radio play. Think (of a delicately used!) audio-pan…
- Recreating the intricate spatial environment of performances of popular and avant garde music.
- Recording spatial compositions, like e.g. Benjamin Britten's War Requiem /[5] or Oliver Korte‘s Epiphanie /[6] so that the listeners have an optimal seat, better than any single one that could be had in a live setting.
  In general I expect the number of works incorporating a substantial degree of spatial aspects to increase as audiences grow more familiar with music presented in surround and as composers realize the potential in live settings and recordings.
- Serious sound design for music.

All arts need to evolve…

LCR, 4.0, 5.1, 7.1a, 7.1b -- Final reflections on reproduction systems

Mono playback is straightforward, but I am afraid that even with seemingly simple stereo listeners compromise their reproduction setups. And when you get into the surround domain this issue becomes even more pronounced. Nevertheless, as a producer one has to be optimistic and assume that most playback will utilize a correctly set up speaker configuration.

The question remains as to what format to produce for.

[5] Benjamin Britten's War Requiem (written in 1961-62) features three distinct setups: (1) a full orchestra, choir and soprano (2) a chamber orchestra accompanying tenor and baritone and (3) a boy‘s choir fronting an organ.

[6] http://www.korte-oliver.de/index.php?id=epiphanie features a circular orchestral arrangement

I would like to currently plead for 5.1 /[7] as it is widely in use for the playback of movie DVD's. While 7.1 allows for a more even spacing and the Auraphonic 2+2+2 /[8] is able to transport height information I doubt the average consumer will reassemble their living room to be able to audition such recordings optimally. Still I suggest recordists consider tracking height channels to keep this option open for the future. Another very interesting area to explore is that of Ambisonics as a paradigm allowing for a conceptually clean and eminently flexible, non playback-centric recording, mixing and distribution paradigm, getting closer to true 3D sound!

So, no matter what stage you produce for, keep an open mind about the technical and creative options, think way ahead of what is currently en vogue and communicate your thoughts and experiments with your collegues. I feel very fortunate to be one of the explorers of a largely uncharted territory, helping discover a new world of sound.

[7] Regarding my use of „x.y“ to designate various surround formats does not imply that I neglect the subwoofer! While termed „Low Frequency Effects“ with regards to movie sound tracks I find it to be of definite value in purely or primarily music oriented productions. Besides that having a dedicated channel to carry--generally not easily localizable—low frequency content frees the satellites from having to reproduce it and allows for smaller chassis.

[8] The 2+2+2 format (www.2plus2plus2.info) developed by Dabringhaus und Grimm Audiovision GmbH augments a quadraphonic speaker layout with two frontal height speakers, placed above L+R at a height that is 1/2 the horizontal distance of the frontal speakers. If played back on 5.1 systems one of the height channels is output to the center, while the low-cut applied to both of them effectively mutes the LFE-speaker. Interestingly the use of four frontal speakers can make the (often difficult to position) center channel obsolete. Still I consider the recording concept underlying 2+2+2 to be generally based on stage 1's paradigm.