

Surround Sound – Cheat Sheet

L-R Speakers at 60 degree angle – gives best image for stereo separation and illusion of a centre.

LCRS – Dolby Stereo (also referred to as 3-1)

- 2 analogue audio tracks on the optical sound tracks of the film, are decoded into 4 discrete tracks. LCR and Surround channels.
- Because tracks are matrixed together onto 2 channels, there is a lot of crosstalk between channels, they must be monitored using matrix playback.
- In matrix – left channel information is fed to the left, right channel info fed to the right, centre info is fed to both channels at a reduced level in phase, surround channel is fed to both channels at a reduced level out of phase. Surround channel is passed through a 7 kHz low pass filter and is delayed slightly from the front speakers because there is some of the other channels' signal in the surround channel. The delay causes the brain to identify the front speakers at the origin of these sounds and the same sound in the surround channel is ignored and only the surround information is perceived. This is a practical example of a use of the Haas effect.
- Surround channel has frequency response of 100 Hz to 7 kHz with an adjustable delay of 20 ms.
- Dolby Stereo Variable Area (SVA) is recorded on photographic film and has a total frequency response of 12.5 kHz.

5.1 – Dolby Digital, DTS – channels are discrete unlike Dolby Stereo

- L-R Speakers are at 60 degree angle from each other, centre channel in the middle and surround speakers are at 110 degrees on either side of listening position.
- LFE channel is limited to 120 Hz bandwidth.

6.1 – Dolby EX and DTS-ES – additional centre surround speaker at the back

7.1 Sony Dynamic Digital Sound (SDDS) and 70 mm Dolby Stereo format (analogue 70 mm only had 1 surround channel)

Digital Surround Sound Formats

- Dolby Digital or AC-3 encoding – used for data reduction and encoding of discrete surround sound channels digitally as opposed to Dolby Surround Encoding which uses matrix encoding on 2 analogue audio channels.
- Bitrates can range from 32 kbit/s to 640 kbit/s
- Used on 35 mm film and DVD discs.
- Sample rates available are 32 kHz, 44.1 kHz, 48 kHz and LFE channel is sampled at 240 Hz.

- A 90 degree phase shift is normally introduced into each of the surround channels during encoding, which improves the smoothness of front-back panning and reduces crosstalk between centre and surround channels during Dolby Surround encoding.
- Downmix control information can be included along with audio data for a 2-channel representation of the surround information can be reconstructed in the decoder.
- Dialnorm allows for dialogue information to be consistent, measured as the difference between average dialogue level vs peak level.

DTS

- Bit rates allowed are 32 kbit/s to 4.096 Mbit/s, 8 source channels possible, Sample rates up to 192 kHz, variable bit rates and lossless encoding are available.

SDDS

- Sony ATRAC compression used
- 7.1 channels allowed
- only used on theatrical film releases, not consumer format

MPEG-2 BC – multichannel extension added to the end of the frame of a MPEG1 encoding containing the C, LS, RS channels. Upon decoding from the L0/R0 the 5.1 channels are revealed. Bitrates around 600 – 900 kbit/s.

MPEG-2 AAC – Encodes 5.1 data encoded into single bitstream. Comparable bitrates to Dolby Digital AC3.

MLP (Meridian Lossless Packing) – lossless data reduction format for DVD-Audio discs. Sample rates up to 192 kHz allowed and 16 and 24 bit resolutions, and up to 6 channel surround sound. Downmix to two channel playback from multichannel material is also available.

Ambisonics – utilizes psychoacoustic properties to reproduce 360 degree sound field, can be adapted to any speaker configuration, 2, 3 or 4 channels of information can represent different amounts of surround information relating to the position of sound in space with 4 channels being full 360 degree spherical reproduction.

Sources:

Audio Post Production for Television and Film by Hilary Wyatt and Tim Amyes
Pg 206 – 208, Pg 239 – 243

Sound and Recording
Chapter 17 – Pg 469 – 520