Circle Sound B-Format VST

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Please Note:

This VST plugin is provided free and as-is. There is no warranty and no guarantee that it will work for any particular purpose. The user uses this software at their own risk. It is an alpha version and therefore no guarantees are made for its stability or its compatibility with different hosts.

Update Notes

09/11/2012

- Memory leak fixed.

01/11/2012

- GUI update to make the text more legible. Change in the background colour.

08/10/2012

- Minor code fixes that caused stability problems with Sonar X1.

07/10/2012

- Initial alpha release version of VST.

Alpha Version

This is the alpha version of the VST and therefore it has not been tested on any systems apart from my own. It is currently known to work with the following DAWs:

- Cockos Reaper (Windows and Mac)
- Audacity (Windows)
- MaxMSP 6 (Windows)

It is not currently known to have any incompatibilities. Let me know if you find any.

If you test the VST on your system and it is not already listed here then I would be very grateful if you could let me know if it does or does not work. You can get

in touch with me via one of the contact details on the first page of this document.

This documentation is also in draft/alpha form so please excuse the less than glossy presentation!

Using this VST and Ambisonics

I'd recommend reading this document 'Using a Non-Standard Audio Toolkit to Produce Standard Spatial Audio Mixes' to get an idea of how to configure your DAW. The author (Andrew J. Horsburgh) suggests using Reaper for Ambisonics. I would agree.

Parameters

- **Order** - The order controls the spatial resolution for the panner. The higher the order used then the more channels/loudspeakers you'll need to use for a proper reconstruction. For 2D reproduction $2N + 1$ (where N = the **order**) channels are output i.e. For 3rd order you'll need $2 \times 3 + 2 = 7$ output channels. For 3D reproduction $(N+1)^2$ channels are output from the encoder.
- **Weighting** - This is the mathematical convention used for the encoding. It essentially changes the balance in gain between the different encoding channels. It is recommended that you experiment with the different options until you find the one that sounds best for your purposes.
  - **Caution:** The Furse-Malham (Fu-Ma) weighting option only supports up to 3rd order encoding. **All 4th and 5th order encoding channels are suppressed when using this weighting option.**
  - **Technical note:** The Weighting at the encoding stage should match the weighting convention used at the decoding stage. If your decoder does not give a choice of which weighting to use then you should set the encoder weighting to match it.
- **Mono/Stereo** - This determines whether the encoder uses just a mono input (left channel of a stereo input) or if it uses both left and right channels of a stereo input.
- **Width** - The increases the azimuthal angle between the input channels:
  - If the input is set to **stereo** then the left and right channels are panned left and right respectively from each other so that the angle between

them equals the **width**. A width angle of 60 degrees with a stereo input would, in effect, be an Ambisonic replication of a standard stereo loudspeaker setup by moving the left channel 30 degrees anti-clockwise (left) and the right channel 30 degree clockwise (right).

  - If the input is set to **mono** then the effect is the same, except instead of the right channel it a duplicate of the left channel.

- **Azimuth** - This is the horizontal angle at which the source is placed. It uses the standard mathematical convention of anti-clockwise = positive and clockwise = negative. It has a range of $-180° \leq$ **Azimuth** $\leq +180°$.

- **Elevation** - This is the angle of elevation for the source. Raising the source = positive angle. Lowering the source = negative angle. It has a range of $-90° \leq$ **Elevation** $\leq +90°$.

- **NFC On/Off** - **NFC** stands for Near Field Compensation [1]. It is a set of filters that changes the distance of the source in the range, coupled with decreasing source volume for more distant sources. If it is set to **Off** then it is completely bypassed. If it set to **On** the **Distance** dial can be used to adjust the source distance.

- **Distance** - This controls the distance of the source from the centre of the loudspeaker array using Near Field Compensation filters and $\frac{1}{\textbf{Distance}}$ volume scaling. It has a range of $0.1m \leq$ **Distance** $\leq 10.1m$.

  - **Caution:** The bass boost provide by these filters can become very large - especially at higher orders - so it recommended that when moving the source closer than $2m$ you should be extremely careful to avoid any large volumes.

  - **Technical note:** Assumes $2m$ array radius for everything to be correct. The effect should work for other radii but technically is only mathematically correct for a $2m$ array. This can be adjust at the decoding stage if an appropriate decoder is used (an upcoming decoder should have this functionality built into it).

- **Output** - This, along with the **Order**, changes the number and order of encoded output channels. The output order can be seen in table **??**. The channels output from the encoder should match with the input channels of your encoder.

l	3D Output		2D Output	
VST Channe	Channel name	m, n, ζ	Channel name	m, n, ζ
1	W	0,0,1	W	0,0,1
2	X	1,1,1	X	1,1,1
3	Y	1,1,-1	Y	1,1,-1
4	Z	1,0,1	U	2,2,1
5	R	2,0,1	V	2,2,-1
6	S	2,1,1	P	3,3,1
7	T	2,1,-1	Q	3,3,-1
8	U	2,2,1	-	4,4,1
9	V	2,2,-1	-	4,4,-1
10	K	3,0,1	-	5,5,1
11	L	3,1,1	-	5,5,-1
12	M	3,1,-1	-	n/a
13	N	3,2,1	-	n/a
14	O	3,2,-1	-	n/a
15	P	3,3,1	-	n/a
16	Q	3,3,-1	-	n/a
17	-	4,0,1	-	n/a
18	-	4,1,1	-	n/a
19	-	4,1,-1	-	n/a
20	-	4,2,1	-	n/a
21	-	4,2,-1	-	n/a
22	-	4,3,1	-	n/a
23	-	4,3,-1	-	n/a
24	-	4,4,1	-	n/a
25	-	4,4,-1	-	n/a
26	-	5,0,1	-	n/a
27	-	5,1,1	-	n/a
28	-	5,1,-1	-	n/a
29	-	5,2,1	-	n/a
30	-	5,2,-1	-	n/a
31	-	5,3,1	-	n/a
32	-	5,3,-1	-	n/a
33	-	5,4,1	-	n/a
34	-	5,4,-1	-	n/a
35	-	5,5,1	-	n/a
36	-	5,5,-1	-	n/a

Table 1: VST outputs with the corresponding Ambisonic encoded channels, depending on the output format. Order indicated by colour: blue = 1st, red = 2nd, green = 3rd, cyan = 4th and magenta = 5th. (Above 3rd order there are no standard channel names.)

Origin of the VST

The original version of this VST was made a part of an assignment for the Spatial Audio module during the MA in Sonic Arts at the Sonic Arts Research Centre (SARC) at Queen's University Belfast. It has since been expanded and the code has been simplified.

References

[1] J. Daniel and S. Moreau, "Further Study of Sound Field Coding with Higher Order Ambisonics," in 116th AES Convention, Berlin, 2004, pp. 1–14.