Shake, Rattle and Roll:

An attempt to create a "spatially correct" Ambisonic mixdown of a multi-miked organ concert

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Oh yeah, slides.
When was my talk again?
Shit.
What?
What?
- Olivier Messian, “Livre du Saint Sacrement”
What?
- Olivier Messian, “Livre du Saint Sacrement”

Where?
What?
- Olivier Messian, “Livre du Saint Sacrement”

Where?
- On the three Klais organs of Cologne Cathedral
What?
- Olivier Messian, “Livre du Saint Sacrement”

Where?
- On the three Klais organs of Cologne Cathedral

When?
What?
- Olivier Messian, “Livre du Saint Sacrement”

Where?
- On the three Klais organs of Cologne Cathedral

When?
- July 2009
So what?
So what?

- The world's first

*Wavefield Synthesis Live Transmission*

from Cologne Cathedral to TU Berlin.
=> microphone concept targeted at virtual sources
=> microphone concept targeted at virtual sources
=> organs spatially separated with lots of height and ambience
=> microphone concept targeted at virtual sources
=> organs spatially separated with lots of height and ambience
=> hey, wouldn't this be a great showcase for Ambisonics?
Can we create a “spatially correct” ambisonic mixdown of a multi-miked organ concert?
Querhausorgel
Schwalbennestorgel
Tuba stops (one of 2 divisions)
<table>
<thead>
<tr>
<th>Source</th>
<th>Microphone</th>
<th>Polar pattern</th>
<th>$\theta$</th>
<th>$d$</th>
<th>$h$</th>
<th>$\epsilon$</th>
<th>$\Delta s_{\text{Mic}}$</th>
<th>$\Delta t_{\text{Mic}}$</th>
<th>$z$</th>
<th>$\Delta t_{\text{Mixdown}}$</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1 horiz.</td>
<td>Sennheiser MKH 800</td>
<td>Fig8</td>
<td>0</td>
<td>30.6</td>
<td>23</td>
<td>0</td>
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<td>0.1126</td>
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<td>Fig8</td>
<td>0</td>
<td>34.7</td>
<td>23</td>
<td>90</td>
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<td>0.0000</td>
<td>41.63</td>
<td>0.1224</td>
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<td>H3 horiz.</td>
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<td>Fig8</td>
<td>0</td>
<td>38</td>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0.0000</td>
<td>44.42</td>
<td>0.1306</td>
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<tr>
<td>H4 vert.</td>
<td>Sennheiser MKH 800</td>
<td>Fig8</td>
<td>0</td>
<td>37.3</td>
<td>23</td>
<td>90</td>
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<td>36.24</td>
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<tr>
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<td>Fig8</td>
<td>0</td>
<td>32.7</td>
<td>23</td>
<td>90</td>
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<td>Fig8</td>
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<td>28</td>
<td>23</td>
<td>0</td>
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<td>0.0000</td>
<td>36.42</td>
<td>0.1066</td>
<td>&quot;</td>
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<tr>
<td>H8 vert.</td>
<td>Sennheiser MKH 800</td>
<td>Fig8</td>
<td>0</td>
<td>28.7</td>
<td>23</td>
<td>90</td>
<td>0</td>
<td>0.0000</td>
<td>36.78</td>
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<tr>
<td>Q1 L/R</td>
<td>2x Schoeps MK 5</td>
<td>Omni</td>
<td>-13</td>
<td>30</td>
<td>12</td>
<td>21.8</td>
<td>5</td>
<td>0.0147</td>
<td>32.31</td>
<td>0.0803</td>
<td>Pair angle 1°</td>
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<tr>
<td>Q2 L/R</td>
<td>2x Schoeps MK 5</td>
<td>Omni</td>
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<tr>
<td>Q3 M/S</td>
<td>Schoeps MK 5 / MK 8</td>
<td>Omni / Fig8</td>
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<td>20</td>
<td>6</td>
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<td>20.88</td>
<td>0.0526</td>
<td>S at -124°, no elev., -10dB</td>
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<td>34.74</td>
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<td>Sub-Cardioid</td>
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<td>30</td>
<td>27</td>
<td>41.99</td>
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<td>40.36</td>
<td>0.0855</td>
<td>Pair angle 2°</td>
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<tr>
<td>F1</td>
<td>Schoeps CCM41</td>
<td>Hyper-Cardioid</td>
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<td>61.3</td>
<td>21</td>
<td>18.91</td>
<td>28.7</td>
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<td>64.8</td>
<td>0.1062</td>
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<tr>
<td>F2</td>
<td>Schoeps CCM41</td>
<td>Hyper-Cardioid</td>
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<td>59.3</td>
<td>21</td>
<td>19.5</td>
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<td>0.1006</td>
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<td>Announcer</td>
<td>Sennheiser MD 421</td>
<td>Cardioid</td>
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<td>10</td>
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</table>

$\theta$: Azimuth angle, $0^\circ$ is due north, positive is counter-clockwise (measured)

d: Distance on the floor between virtual listening spot and source (measured)

h: Height of source above listening spot (estimated)

$\epsilon$: Elevation angle, $0^\circ$ is on horizontal plane, $90^\circ$ is zenith ($\tan(h/d)$)

$\Delta s_{\text{Mic}}$: Distance from microphone to source (estimated)

$\Delta t_{\text{Mic}}$: Delay of sound due to microphone distance from source ($\Delta s_{\text{Mic}} / 340 \text{ m/s}$)

z: Total distance from listening spot to source ($\sqrt{d^2+h^2}$)

$\Delta t_{\text{Mixdown}}$: Additional delay required during mixdown ($z / 340 \text{ m/s} - \Delta t_{\text{Mic}}$)
Panning considerations

=> azimuth + elevation: easy (just pan it!)
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=> distance: not so easy.
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  * wave front curvature (proximity effect)
  * dry/reverb ratio
  * early reflections
Panning considerations

=> azimuth + elevation: easy (just pan it!)
=> distance: not so easy. friggin hard!
  * level reduction (~ 1/r² energy loss)
  * high frequency damping
  * wave front curvature (proximity effect)
  * dry/reverb ratio
  * early reflections
Problems

=> “false walls”
Problems

=> “false walls”

=> wrong early reflections
Problems

=> “false walls”

=> wrong early reflections

=> missing correct reflections
Conclusion

It's fun.
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It's enjoyable.
Conclusion

It's fun.
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It's nowhere near realistic and conceptually flawed.
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It leaves lots of space for Tonmeister creativity.
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So: Ambisonics is a viable production format for panned mono sources (i.e. everything on the market)
IMHO.
Thank you for your attention!

Any questions?