G.A.S.P. 2.0

Guitars with Ambisonic Spatial Performance

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The **URSS 2016 GASP Project** seeks to demonstrate alternative ways in which various guitar performance styles can benefit from re-timbralisation and ambisonic spatial production techniques.

Project Aims:

To investigate and further enhance the technical and musically creative outcomes of the GASP project (Guitars with Ambisonic Spatial Performance). For more information on the GASP project, and to listen to binaural mixes of the latest GASP productions discussed in Outcomes visit http://tinyurl.com/GASP-Derby

Objectives:

- To generate high quality multichannel guitar test recordings to enable the complete GASP production cycle to be realised, i.e. multichannel guitar signal capture, noise and crosstalk editing, arrangement by parts, identification and extraction of musical motifs, timbralisation, and spatialisation. The final sound files can then be archived as 'B-format Ambisonic' for multi-speaker arrays, and as 'Binaural' for surround sound listening over headphones.
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- To produce suitable multichannel guitar test recordings to enable 'Pitch-to-MIDI' data to be generated, enabling alternative electronically synthesised timbres in the ambisonic 3D sound stage, whilst retaining the human performance information. This utilises much of the above process, but includes waveform conversion to MIDI note performance data, which then facilitates the production of timbral alternatives using synthetic or sampled sounds, prior to surround sound spatialisation.
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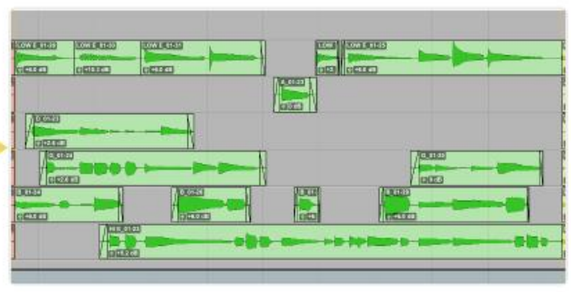
- To develop and collect user feedback on the recently developed GASP-panner Graphical User Interface intended to facilitate live performance.The user feedback will be used to provide development information for further enhanced operations. See 'Further Work' below

Guitars and pickups

We currently have two guitars used for the GASP project, a Fender Stratocaster and a Yamaha APX acoustic; both have been retrofitted with multichannel pickups. The pickups are a bespoke design such that each guitar string gives its own individual audio output, therefore allowing each string to be individually processed; The pickups are manufactured and supplied by 'Ubertar Hexaphonic Pickups'

Guitars with Ambisonic Spatial Performance (GASP) is an ongoing project where research into guitar performance utilising multiple individually processed string timbres, generated by our multichannel guitars, in conjunction with virtual guitar processing software, and processed ambisonically, provides scope for alternative guitar performance and production techniques.



Development of GASP System

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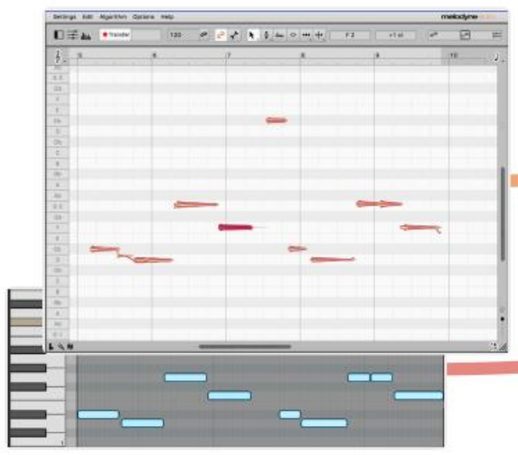

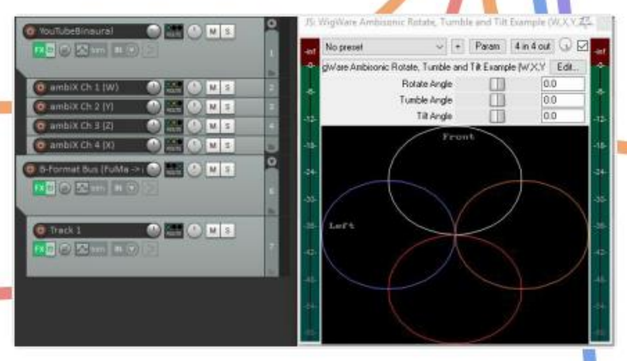

Further work

To investigate the potential for guitar performance training using the multichannel guitar system. The detailed waveform information provided by individual string waveforms is useful for research into the analysis of performance timing information and also in identifying so called 'scuffed' notes, which might be unintentional mutes, fret buzz or other performance artefacts. From an educational/training perspective this carries value for guitar tutors and learners.

To investigate the implementation of Beringher control surface which will enable real-time spatial mix control using hardware faders (as opposed to on screen controls). This will provide real-time simultaneous control over several spatial location parameters.

Real-time guitar performance of GASP remains to be investigated, however our current system may need upgrading to provide enough processing power to run 12 versions of Guitar Rig simultaneously (two GRs timbres per string).

To investigate the use of Ableton Live, utilising clip scene mode with pre-recorded arrangement parts with individual strings, providing the user with a creative interface for the live performance possibilities of prerecorded GASP material.

Outcomes

- The recording of 'Elliot's Joy', written and performed by Fred T Baker. The initial multichannel recording was made using our Yamaha acoustic guitar fitted with multichannel pickups enabling individual string recording and editing. Once recorded, the production process required critical listening of each string for the purpose of editing and replacement of 'scuffed' notes, removal of crosstalk on unused strings, and identification of suitable waveform loop points to enable a new arrangement to be created. Critical listening identified several musical motifs which were copied and pasted into new tracks with a view to enhancing the production with additional, alternative timbralisation and localisation of the identified musical motifs. New timbres were generated using Guitar Rig sound processing software, the waveform data then imported into Reaper for spatialisation using UoD bespoke Wigware panner plugins.
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- The recording of the guitar part from the track 'Pale Aura' by progressive metal band 'Periphery'. Dominic Dallali (URSS student) made this recording using our multichannel Fender Stratocaster. We used a click-track to ensure timing stability which is a feature of this genre. A similar production technique to the above was employed. Due to the syncopated nature of the guitar performance a simple percussion part was included part to enhance the sense of metre.
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- The recording of 'Hymn of Hope', written and performed by Fred T Baker. The techniques discussed above were used, however the emphasis was on experimenting with Melodyne's 'Pitch to MIDI' conversion, and subsequently timbralising with pre-recorded sound samples. Spatialisation is created in similar ways to the above through the use of UoD Wigware plugins
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- In April 2016 Google released spatial audio for its 360/Virtual Reality video platform on YouTube. This allows 360 immersive videos to have accompanying 3D audio that tracks with the users head/phone (android only at present) allowing for a more immersive and realistic auditory experience for the user. The format chosen by Google is a subset of the Higher Order Ambisonic system used by the WigWare software plug-ins allowing us to create a mix compatible with the binaural, headphone, head-tracked output of YouTube. For more details on the technical details and a demonstration of the technology behind YouTube Spatial Audio, please visit http://tinyurl.com/WigYouTubeTeardown.

A big Thank You goes to Charlie Middlicott (PhD student) for his technical assistance and critical appraisal of the ongoing GASP project.