bogJS – A JavaScript framework for object-based rendering in browsers

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ORPHEUS Project

- EU-funded Horizon 2020 project
- December 2015 to June 2018 (2.5 years)
- Will develop, implement and validate an end-to-end object-based media chain
- 10 partners
ORPHEUS will...

- ... develop a concept for the **transition of existing infrastructure**, systems and software/tools to a regular operational service of object-based audio

- ... demonstrate a new, **prodigious user experience** through the creation of a workflow application for the use of object-based audio as an emerging future broadcast technology

- ... create a **reference architecture** and guidelines on how to implement an end-to-end broadcasting chain for object-based audio
What is ‘object-based audio’??

‘object-based’ ≠ immersive audio

‘object-based’ == audio + metadata
Audio production and distribution workflow today (channel-based)

- Production for one format / system
- Adaptation afterwards hardly possible and only for some systems
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Object-based workflow

- Format agnostic
  - Adaptation to playback system
  - Support for future formats
- Accessibility
  - Multiple languages
  - Voice over
- Personalization
  - Personal mix (e.g. dialogue)
  - Variable length
- Interactivity

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bogJS - Introduction

- JavaScript framework
- Published under MIT license
- Written in ES5
- Using many parts of the Web Audio API
- 3rd party libs used:
  - jQuery
  - jQuery mousewheel
  - jQuery UI
  - jQuery Transit
  - loglevel
  - underscore.js
  - WAAClock.js
All relevant info is read from a scene file

Three options to load and play audio signals

- Single audio object (< 3min, file)
  → AudioBufferSourceNode (XHR)
- Multiple single objects grouped (< 3min, files)
  → AudioBufferSourceNodes
- One or more longer objects with same duration (any duration, file / stream)
  → MediaElementSourceNode (<audio> / <video>)

Currently implemented object descriptors: Gain, Position, Interactive, Active
bogJS – Sample Scene (SpatDIF like)

```
/spatdif/meta/audiobed/url local/path/to/audiofile
/spatdif/meta/audiobed/tracks 5

/spatdif/time 0.0
/spatdif/source/Bed0/position -1.0 0.0 -1.0
/spatdif/source/Bed0/active 1
/spatdif/source/Bed0/track_mapping bed_0
/spatdif/source/Bed0/gain 1
/spatdif/source/Bed1/position 1.0 0.0 -1.0
/spatdif/source/Bed1/active 1
/spatdif/source/Bed1/track_mapping bed_1
/spatdif/source/Bed1/gain 1
/spatdif/source/Bed2/position -1.0 0.0 1.0
/spatdif/source/Bed2/active 1
/spatdif/source/Bed2/track_mapping bed_2
/spatdif/source/Bed2/gain 1
/spatdif/source/Bed3/position 1.0 0.0 1.0
/spatdif/source/Bed3/active 1
/spatdif/source/Bed3/track_mapping bed_3
/spatdif/source/Bed3/gain 1
/spatdif/source/Speech/position 0.05 0.0 -2.52
/spatdif/source/Speech/active 1
/spatdif/source/Speech/track_mapping bed_4
/spatdif/source/Speech/gain 1

/spatdif/time 70.754
/spatdif/source/Birds1_L/position -0.86 0.0 -1.77
```

```
/spatdif/source/Birds1_L/interpolate 0
/spatdif/source/Birds1_L/active 1
/spatdif/source/Birds1_L/track_mapping http://irt.de/birds1_l
/spatdif/source/Birds1_L/gain 1
/spatdif/source/Birds1_L/interactive 0
/spatdif/source/Birds1_L/position 0.86 0.0 -1.79
/spatdif/source/Birds1_L/interpolate 0
/spatdif/source/Birds1_L/active 1
/spatdif/source/Birds1_L/track_mapping http://irt.de/birds1_l
/spatdif/source/Birds1_L/gain 1
/spatdif/source/Birds1_L/interactive 0
/spatdif/source/Birds1_L/position 0.75 0.0 -1.75
```

```
/spatdif/time 120.0
/spatdif/source/Stones_L/position -0.683 0.0 -0.685
/spatdif/source/Stones_L/active 0
/spatdif/source/Stones_L/gain 1.0
/spatdif/source/Stones_L/position 0.291 0.0 -0.771
/spatdif/source/Stones_L/active 0
/spatdif/source/Stones_L/position 0.5 0.0 -0.75
/spatdif/source/Stones_L/group Stones
```

```
/spatdif/time 123.8
/spatdif/source/Stones_L/position -0.5845 0.0 -0.6325
/spatdif/source/Stones_L/active 1
/spatdif/source/Stones_L/position 0.2915 0.0 -0.7165
/spatdif/source/Stones_L/gain 0.25
/spatdif/source/Stones_L/group Stones
```
bogJS – Further Basic Concepts

- Time changes are realized with WAAClock.

- The UIManager class provides basic functionality for a 2D user interface.

- For longer files or streams (e.g. to be used as audio-beds) MediaController class should be used.

  → Problem: decoded channel order diversity of browsers.
bogJS – ChannelOrderTest

- Can be used to detect automatically the order of the decoded multichannel tracks
- Frequency detection with AnalyserNode
- Provided test files
  - WAV files from 2 - 12 channels with a duration of 1 second
  - For each channel, an increased sinus tone frequency is used to detect the order after the encoding and decoding

```javascript
/* Simple example */
var ch = new ChannelOrderTest("mp4", 6);
ch.testChs();
// -> [0, 2, 1, 4, 5, 3]

/* Advanced example */
var ctx = new AudioContext();
var ch;
$(ch).on('order_ready', function(e, order){
    console.log("Got channel order: " + order);
    doSomething();
});
ch = new ChannelOrderTest("ogg", 4, ctx, "path/to/testfiles/");
// -> Got channel order: [0, 3, 2, 1]
```
bogJS - Demo

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bogJS - Summary

- ... has multiple options to load and play audio signals
- ... offers automatic detection of decoded multichannel track order
- ... can render scenes for Stereo (2.0) and binaural (headphones) output
- ... works on all modern browsers which support the Web Audio API
bogJS – Plans for the future

- Implementation of current and upcoming standards, especially ITU-R BS.2076 (ADM)
- JSON representation of ADM data
- Integration of upcoming SpatialPannerNode
- Providing more interpolation options by making use of the AudioParam interface
- Extend streaming capabilities
Thank you!

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https://github.com/IRT-Open-Source/bogJS