Overview and Status of Binaural Rendering in Browsers

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Audio in Browsers

- Flash (deprecated)
- Plugins (deprecated)
- HTML5 (no signal processing)
- Web Audio API
Web Audio API

• Modular routings with „Nodes“
• Basic audio processing operations
  • ChannelMerger / ChannelSplitter
  • BiquadFilter, IIRFilter
  • Gain, DynamicsCompressor
  • Delay
  • Convolver
  • Panner
  • Oscillator, WaveShaper
• JS control of C/C++ implementations
• Sample accuracy & low latency
• Widely supported

Source: https://developer.mozilla.org
Web Audio API

Source: https://webaudio.github.io/web-audio-api/
# Web Audio API Support

High-level JavaScript API for processing and synthesizing audio

![Web Audio API Support Chart](image-url)

- **IE**: 11, 17
- **Edge**: 16, 58
- **Firefox**: 59, 66, 67, 68
- **Chrome**: 65, 66, 67
- **Safari**: 11, 11.1
- **iOS Safari**: 10.2, 10.3
- **Opera Mini**: all
- **Chrome for Android**: 64
- **UC Browser for Android**: 11.8
- **Samsung Internet**: 6.2
Browser Share Worldwide

StatCounter Global Stats
Browser Market Share Worldwide on Feb 2018

- Chrome: 57.46%
- Safari: 14.39%
- UC Browser: 7.91%
- Firefox: 5.5%
- Opera: 3.69%
- IE: 3.06%
- Samsung Internet: 2.92%
- Edge: 1.86%
- Android: 1.72%
- Other: 1.47%
Browser Share Germany

StatCounter Global Stats
Browser Market Share Germany on Feb 2018

- Chrome: 33.96%
- Safari: 20.91%
- Firefox: 16.96%
- IE: 5.78%
- Samsung Internet: 5.24%
- Edge: 3.96%
- Opera: 2.33%
- Android: 1.26%
- Sony PS4: 0.3%
- Other: 1.3%
Web Audio API – Binaural Background

• Multiple options for binaural rendering:
  1. \textit{ConvolverNode}
  2. \textit{PannerNode}
  3. \textit{ScriptProcessor (AudioWorklet)}

• Same HRTF Databases for Firefox and Chrome (IRCAM Listen HRTF Database in 15° resolution for azimuth and elevation)

• \textit{PannerNode} has settings for distance model, extent (width, depth, height), etc.
BinauralFIR (IRCAM)

- JS library for custom WAA Node
- Usage of own HRTF
- Convolution with dry signals
- Can be used along with other Web Audio Nodes

- [https://ircam-rnd.github.io/binauralFIR/examples/](https://ircam-rnd.github.io/binauralFIR/examples/)
- [https://github.com/Ircam-RnD/binauralFIR](https://github.com/Ircam-RnD/binauralFIR)
Personalised Media Consumption Examples

https://lab.irt.de/demos/object-based-audio/RadioDrama/
Personalised Media Consumption Examples

https://lab.irt.de/demos/object-based-audio/360/
Personalised Media Consumption Examples
bogJS (IRT)

- JS library for **object-based** audio
- Personalized audio
- Uses **PannerNode**

- [https://github.com/IRT-Open-Source/bogJS](https://github.com/IRT-Open-Source/bogJS)
Songbird / Resonance Audio (Google)

- Libraries for different platforms
- Simple **room model** features **surfaces and dimensions**
- **Ambisonics** encoding
- Export for Omnitone

- [https://cdn.rawgit.com/resonance-audio/resonance-audio-web-sdk/master/examples/room-models.html](https://cdn.rawgit.com/resonance-audio/resonance-audio-web-sdk/master/examples/room-models.html)
- [https://developers.google.com/resonance-audio/](https://developers.google.com/resonance-audio/)
Omnitone (Google)

- JS library
- **Ambisonics decoding** to binaural (up to 3rd order)
- HRTF convolution with decoded Ambisonics signal

- https://rawgit.com/GoogleChrome/omnitone/master/examples/hoa-renderer.html
- https://www.youtube.com/watch?v=jK69EXqtRDo
- https://googlechrome.github.io/omnitone/
Things to consider with Web Audio API

- No official v1 release yet
- Not yet supported in ALL browsers on ALL devices
- Different *behaviour* / implementations (codecs, channel orderings, HRTFs,...)
- *Complexity* issues
Further development of Web Audio API

• v1 will be released within the next months
• Usage of own HRTFs planned in v2
• AudioWorklet implementations are almost there
Vielen Dank!

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