

Strategies to Improve X3D v4 Sound Component

1. 3D spatialization algorithms for Sound node attenuation ellipsoids (see)
 - a. McDermott 2014: Bouncing Reflections, Reflected Path
 - b. RESound: Interactive Sound Rendering for Dynamic Virtual Environments, <http://gamma.cs.unc.edu/Sound/RESound>
 - c. Others, perhaps including parameterized/extensible algorithms
 - d. Consider ordered list of supported algorithms, corresponding to computational complexity and X3D player support
 - e. Define corresponding list of enumerations for each spatialization algorithm
 - f. Scoping within scene graph: boolean *global* variable for localization, computational efficiency?
 - g. Boolean attributes to enable/disable, also to facilitate disabling attenuation effects
 - h. Consider composable regions of higher/lower fidelity or salience
2. Audio material properties
 - a. Add to *Material* node, or add new *AcousticMaterial* within Shape node
 - b. Properties: absorption, dispersion, others
 - c. Frequency distribution of attenuation
 - d. Characteristics of transmission media, perhaps refraction
3. Scene graph integration: simplified geometry for satisfactory sound reflection
 - a. Direct integration within *Shape* node
 - b. Consider further restrictions via *Collision-proxy* or *Collision-acoustic*
 - c. Consider bounding box restrictions in addition to (overriding) outer attenuation ellipsoid
 - d. Fast Fourier Transform (FFT) precomputations: allow? How to include?
4. World Wide Web Consortium (W3C)
 - a. W3C Audio Group <https://www.w3.org/2011/audio>
 - b. W3C Audio Publications, Milestones <https://www.w3.org/2011/audio/wiki/PubStatus>
 - c. File formats: match accepted standards, royalty-bearing formats can only be optional
 - d. Streamable input: simply file-format capability? perhaps other aspects with common metadata
 - e. Filter chains, Web audio models <http://www.webaudiomodules.org>
 - f. W3C Audio and Video <https://www.w3.org/standards/webdesign/audiovideo.html>
 - g. W3C Accessibility <https://www.w3.org/standards/webdesign/accessibility.html>
 - h. Compatibility with hardware acceleration developments
 - i. Follow WebVR developments <https://w3c.github.io/webvr> to ensure matching (or at least compatible) aspects related to wearable devices and user settings/preferences.
5. X3D Standards Evolution
 - a. X3D v4.0 scene-related acoustics model
 - b. X3D v4.1 (MAR) user customization for AR/VR
 - i. Head shadow, head motion, pinna and shoulder response, interaural distance
 - ii. Head related transfer functions (HRTF) https://en.wikipedia.org/wiki/Head-related_transfer_function
 - c. Other ISO and industry standardization efforts?
 - d. X3D player implementations in C/C++, Java, Javascript
 - e. Example scenes demonstrating auralization effects with corresponding visualization assists
 - f. Three Dimensional Sound (TDS) Simulator improvements to support/evaluate X3D
 - g. Careful observance of Web3D Intellectual Property Rights (IPR) Policy to achieve royalty free (RF) solution