

Web Audio Evaluation Tool: A framework for subjective assessment of audio

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ABSTRACT

Here comes the abstract.

1. INTRODUCTION

Perceptual evaluation of audio, in the form of listening tests, is a powerful way to assess anything from audio codec quality over realism of sound synthesis to the performance of source separation, automated music production and in less technical areas, the framework of a listening test can be used to measure emotional response to music or test cognitive abilities.

Technical, interfaces, user friendliness, reliability

Note that the design of an effective listening test further poses many challenges unrelated to interface design, which are beyond the scope of this paper [1].

Web Audio API has made some essential features like sample manipulation of audio streams possible [17].

Situating the Web Audio Evaluation Tool between other currently available evaluation tools, ...

... However, BeagleJS [8] does not make use of the Web Audio API,

Selling points: remote tests, visualisation, create your own test in the browser, many interfaces, few/no dependencies, flexibility

As recruiting participants can be very time-consuming, and as for some tests a large number of participants is needed, browser-based tests [17]. However, to our knowledge, no tool currently exists that allows the creation of a remotely accessible listening test.

[Talking about what we do in the various sections of this paper. Referring to [7].]

1.1 Meeting 8 October

- Do we manipulate audio?
 - Add loudness equalisation? (test_create.html) Tag with gains.
 - Add volume slider?
 - Cross-fade (in interface node): default 0, number of seconds
 - Also: we use the playback buffer to present metrics of which portion is listened to
- Logging system information: whichever are possible (justify others)
- Input streams as audioelements
- Capture microphone to estimate loudness (especially Macbook)
- Test page (in-built oscillators): left-right calibration, ramp up test tone until you hear it; optional compensating EQ (future work implementing own filters) -> Highlight issues!
- Record IP address (PHP function, grab and append to XML file)
- Expand anchor/reference options
- AB / ABX

1.1.1 Issues

- Filters not consistent (Nick to test across browsers)
- Playback audiobuffers need to be destroyed and rebuilt each time
- Can't get channel data, hardware input/output...

2. ARCHITECTURE

A slightly technical overview of the system. Talk about XML, JavaScript, Web Audio API, HTML5. Describe and/or visualise audioholder-audioelement-... structure.

Which type of files?
Streaming audio?
Compatibility?



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Table 1: Table with existing listening test platforms and their features

Name	Ref.	Language	Interfaces	Remote	All UI
APE	[5]	MATLAB	multiple stimulus one axis	not natively supported	✓
BeagleJS	[8]	JavaScript			
HULTI-GEN	[6]	MAX			
WAET	[7]	JavaScript	all of the above	✓	✓

3. REMOTE TESTS

If the experimenter is willing to trade some degree of control for a higher number of participants, the test can be hosted on a web server so that subjects can take part remotely. This way, a link can be shared widely in the hope of attracting a large amount of subjects, while listening conditions and subject reliability may be less ideal. However, a sound system calibration page and a wide range of metrics logged during the test mitigate these problems. Note also that in some experiments, it may be preferred that the subject has a ‘real life’, familiar listening set-up, for instance when perceived quality differences on everyday sound systems are investigated. Furthermore, a fully browser-based test, where the collection of the results is automatic, is more efficient and technically reliable even when the test still takes place under lab conditions.

The following features allow easy and effective remote testing:

- PHP script to collect result XML files
- Randomly pick specified number of audioholders
- Calibration
- Functionality to participate multiple times
 - Possible to log in with unique ID (no password)
 - Pick ‘new user’ (need new, unique ID) or ‘already participated’ (need already available ID)
 - Store XML on server with IDs plus which audioholders have already been listened to
 - Don’t show ‘post-test’ survey after first time
 - Pick ‘new’ audioholders if available
 - Copy survey information first time to new XMLs
- Intermediate saves
- Collect IP address information (privacy issues?) → geo-related API?
- Time measurement - see before or

4. INTERFACES

‘Build your own test’

Elements present to build any of the following interfaces, and many more: axes, markers, labels, anchors, references, reference signal button, stop button, comment boxes, radio buttons, checkboxes, transport/scrubber bar

Established tests (see below) included as ‘presets’ in the build-your-own-test page.

We could add more interfaces, such as:

- (APE style) [5]
- Multi attribute ratings
- MUSHRA (ITU-R BS. 1534) [16]
- Interval Scale [18]
- Rank Scale [11]
- 2D Plane rating - e.g. Valence vs. Arousal [2]
- Likert scale [9]
- **All the following are the interfaces available in HULTI-GEN [6]**

- ABC/HR (ITU-R BS. 1116) [15]
 - Continuous Scale (5-1) Imperceptible, Perceptible but not annoying, slightly annoying, annoying, very annoying. (default Inaudible?)
- -50 to 50 Bipolar with Ref
 - Scale -50 to 50 on Mushra with default values as 0 in middle and a comparison “Reference” to compare to 0 value
- Absolute Category Rating (ACR) Scale [13]
 - 5 point Scale - Bad, Poor, Fair, Good, Excellent (Default fair?)
- Degredation Category Rating (DCR) Scale [13]
 - 5 point Scale - Inaudible, Audible but not annoying, slightly annoying, annoying, very annoying. (default Inaudible?) - *Basically just quantised ABC/HR?*
- Comparison Category Rating (CCR) Scale [13]
 - 7 point scale: Much Better, Better, Slightly Better, About the same, slightly worse, worse, much worse - Default about the same with reference to compare to
- 9 Point Hedonic Category Rating Scale [12]
 - 9 point scale: Like Extremely, Like Very Much, Like Moderate, Like Slightly, Neither Like nor Dislike, dislike Extremely, dislike Very Much, dislike Moderate, dislike Slightly - Default Neither Like nor Dislike with reference to compare to
- ITU-R 5 Point Continuous Impairment Scale [14]
 - 5 point Scale (5-1) Imperceptible, Perceptible but not annoying, slightly annoying, annoying, very annoying. (default Inaudible?) - *Basically just quantised ABC/HR, or Different named DCR*
- Pairwise Comparison (Better/Worse) [4]
 - 2 point Scale - Better or Worse - (not sure how to default this - they default everything to better, which is an interesting choice)

There are also the following interfaces, which would require a slightly different ‘engine’ underneath, e.g. loading a different page for every possible pair.

- AB Test [10]
- ABX Test [3]
- JND

A screenshot would be nice.

5. ANALYSIS AND DIAGNOSTICS

It would be great to have easy-to-use analysis tools to visualise the collected data and even do science with it. Even better would be to have all this in the browser. Complete

perfection would be achieved if and when only limited setup, installation time, and expertise are required for the average non-CS researcher to use this.

The following could be nice:

- Web page showing all audioholder IDs, file names, subject IDs, audio element IDs, ... in the collected XMLs so far (`saves/*.xml`)
- Check/uncheck each of the above for analysis (e.g. zoom in on a certain song, or exclude a subset of subjects)
- Click a mix to hear it (follow path in XML setup file, which is also embedded in the XML result file)
- Box plot, confidence plot, scatter plot of values (for a given audioholder)
- Timeline for a specific subject (see Python scripts), perhaps re-playing the experiment in X times realtime. (If actual realtime, you could replay the audio...)
- Distribution plots of any radio button and number questions (drop-down menu with 'pretest', 'posttest', ...; then drop-down menu with question 'IDs' like 'gender', 'age', ...; make pie chart/histogram of these values over selected range of XMLs)
- All 'comments' on a specific audioelement
- A 'download' button for a nice CSV of various things (values, survey responses, comments) people might want to use for analysis, e.g. when XML scares them
- Validation of setup XMLs (easily spot 'errors', like duplicate IDs or URLs, missing/dangling tags, ...)

A subset of the above would already be nice for this paper. Some pictures here please.

6. CONCLUDING REMARKS AND FUTURE WORK

The code and documentation can be pulled or downloaded from code.soundsoftware.ac.uk/projects/webaudioevaluationtool.

[Talking a little bit about what else might happen. Unless we really want to wrap this up.]

Use [17] as a 'checklist', even though it only considers subjective evaluation of audio systems (and focuses on the requirements for a MUSHRA test).

[What can we not do? 'Method of adjustment', as in [17] is another can of worms, because, like, you could adjust lots of things (volume is just one of them, that could be done quite easily). Same for using input signals like the participant's voice. Either leave out, or mention this requires modification of the code we provide.]

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