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Sound Quality & Jury Testing

What is sound quality?

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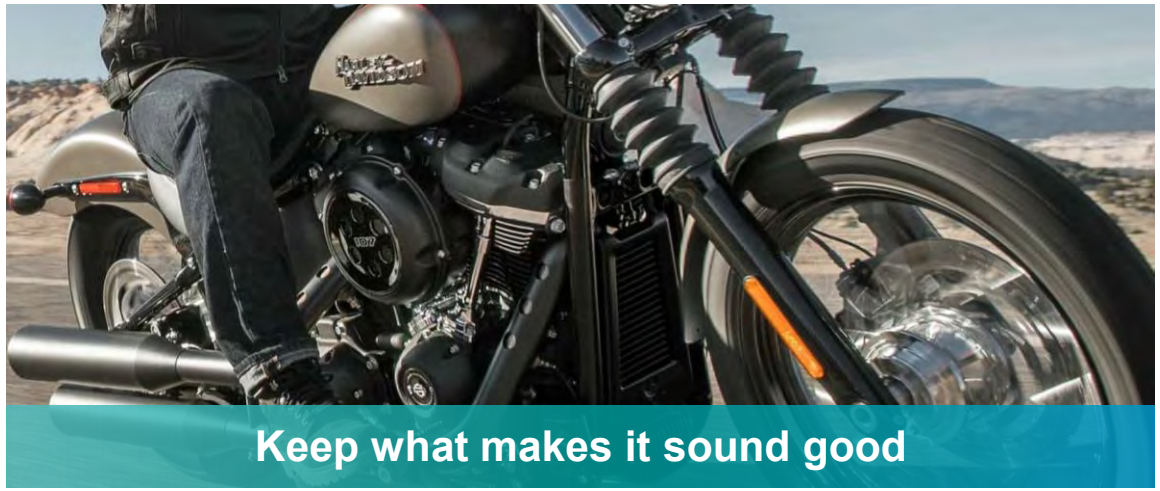
Deliver products that fit your desired brand sound



Keep what makes it sound good

Remove what makes it sound bad

The sound quality process

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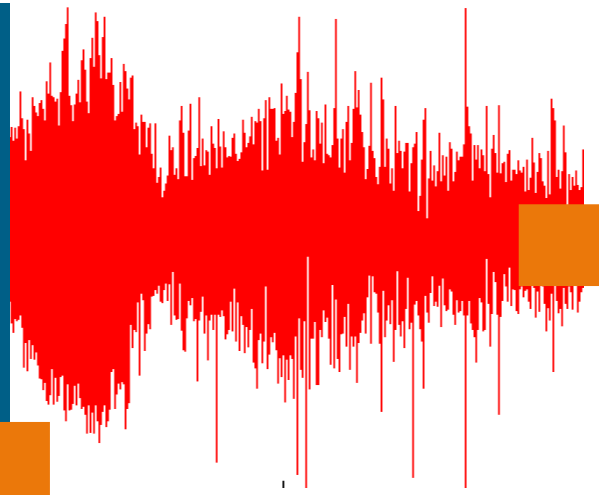
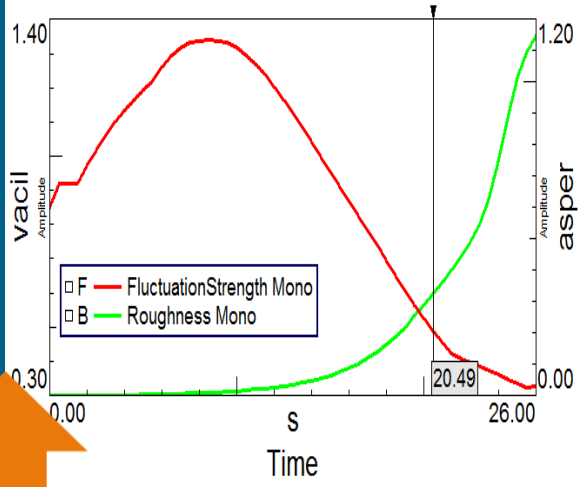
Sound recording

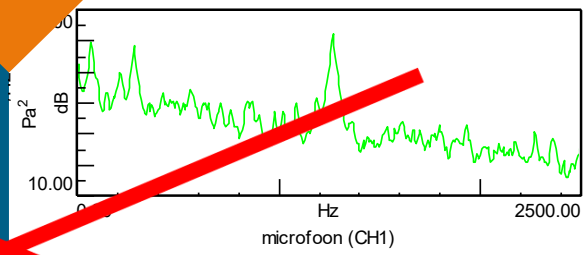


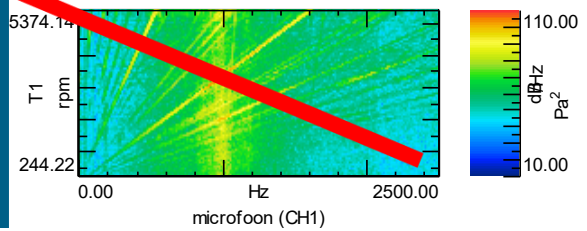
Objective qualification:

Sound quality metrics



Classical analysis





Subjective qualification:

Jury Testing

Audio replay & filtering

The sound quality process

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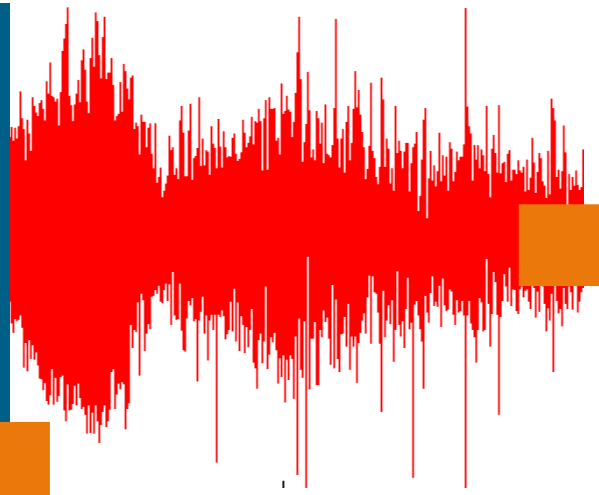
Sound recording



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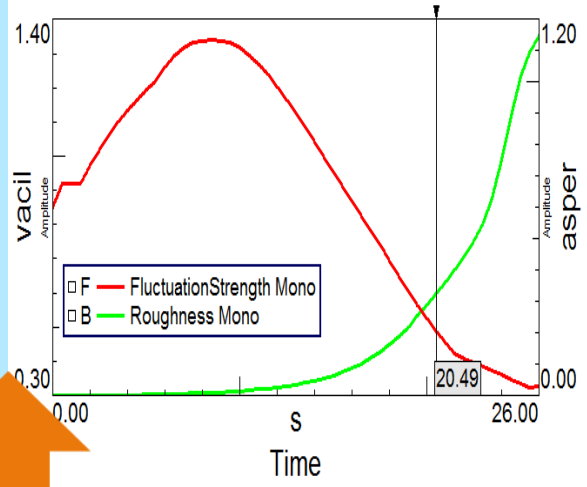
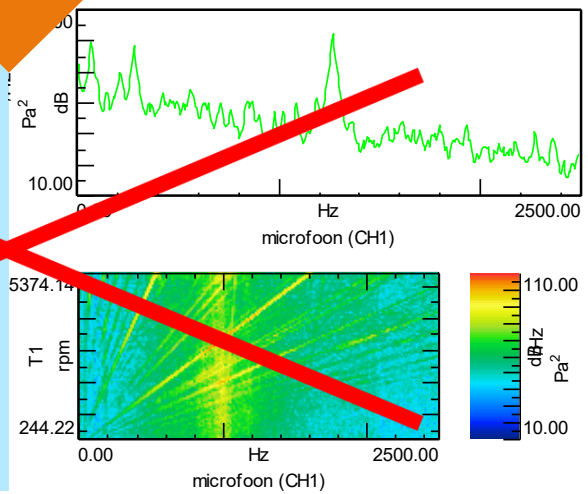


Classical analysis



Jury Testing

Binaural measurement systems

LMS SCADAS XS with LMS SCADAS 3D Binaural Headset

G.R.A.S. 45BB KEMAR Head and Torso

Binaural measurements

- Stereo recording just like human hearing
- Ideal for replay
- Requires **artificial head** or a binaural headset
- Can be used for direct replay
- Recorded data is automatically **equalized** for analysis

Equalization for analysis

- The effect of head and torso is removed from the recording
- The measured signal “looks” as if measured by a microphone

The sound quality process

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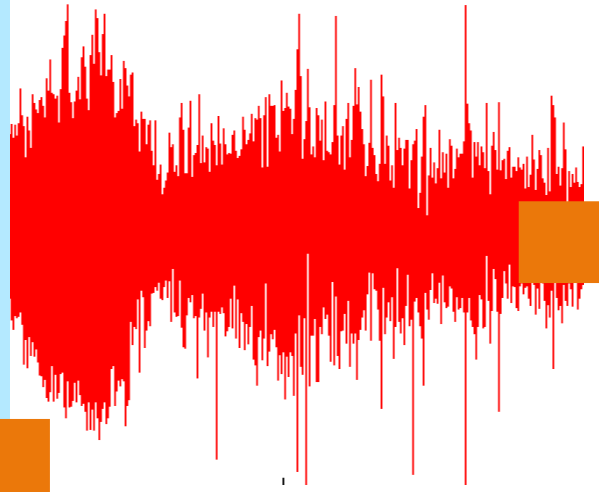
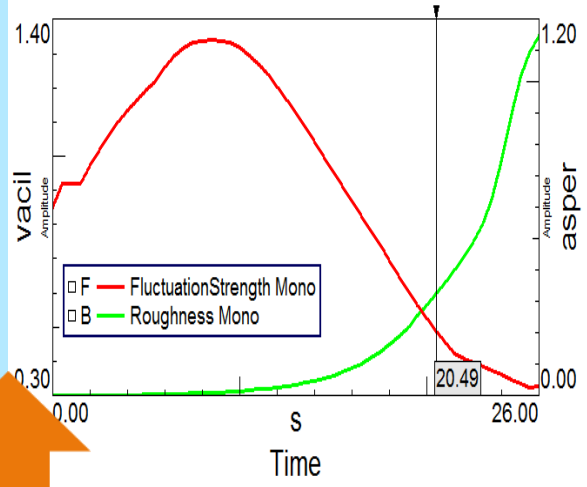
Sound recording



Sound quality metrics



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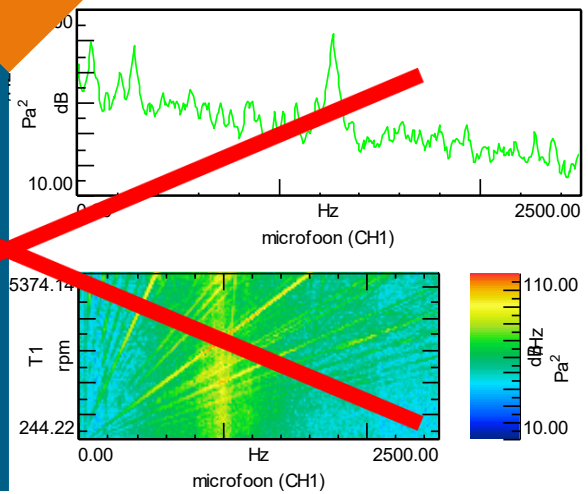

Jury Testing

Why can't we just look at microphone data?

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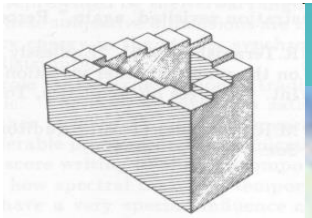
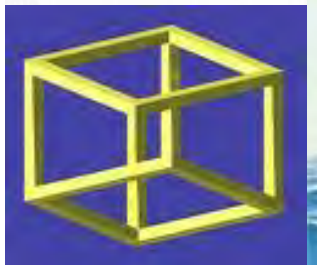
Microphone

?

=

Ear





Optical illusions

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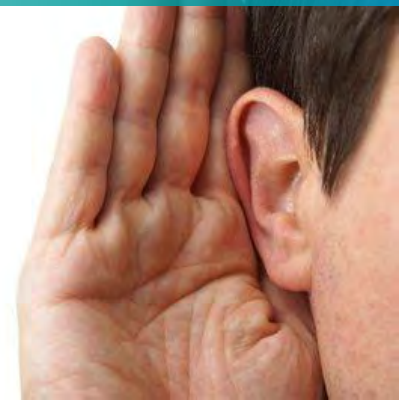
Audible illusions



Why can't we just look at microphone data?
Inner ear masking effect

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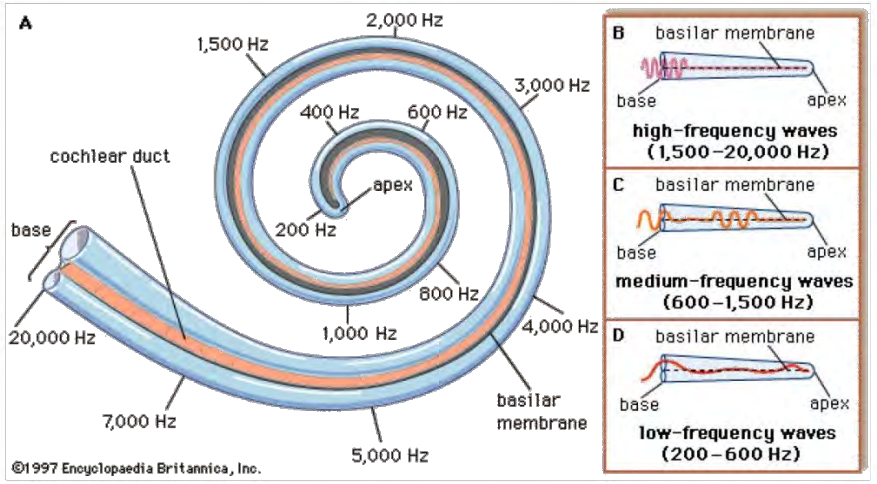
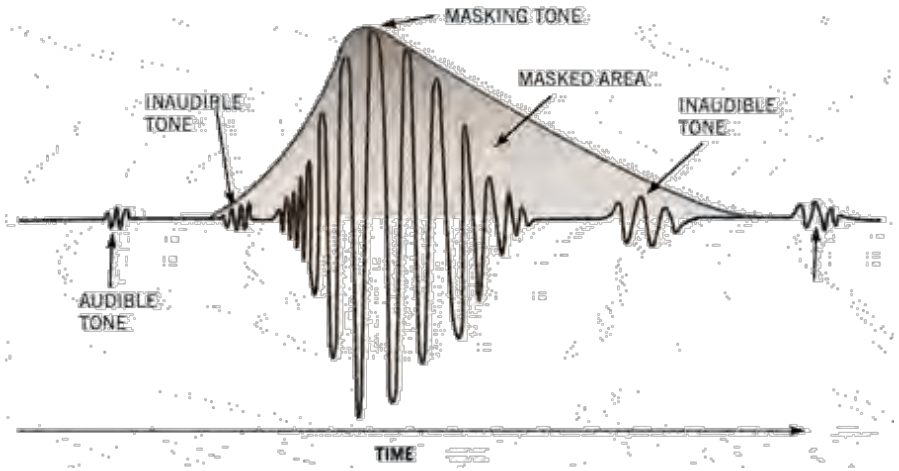
- Sound frequencies trigger inner ear fluid resonance in specific locations along the cochlea
- Fluid motion triggers hair cell nerve response
- Fluid motion is saturated by dominant frequencies

Frequency masking =
Inability to hear tones with close frequency spacing

Temporal masking =
Inability to hear tones with close temporal spacing

Masking is the basis for MP3 sound compression!





The sound quality process

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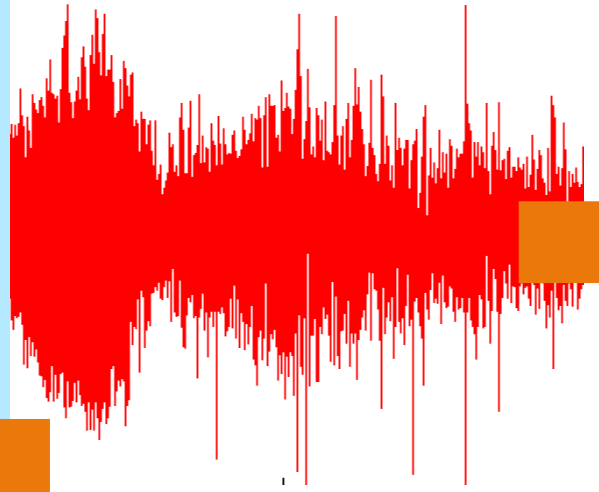
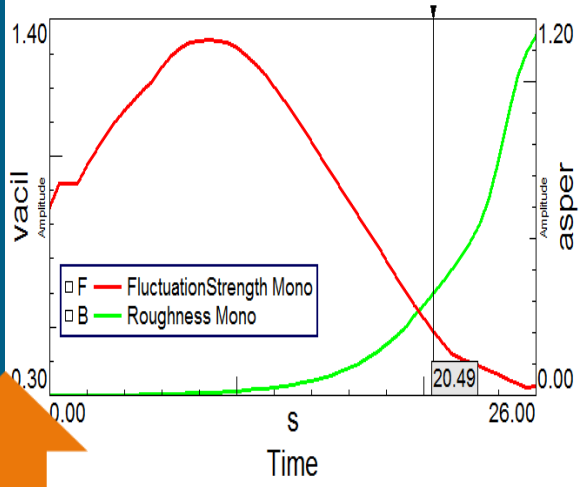
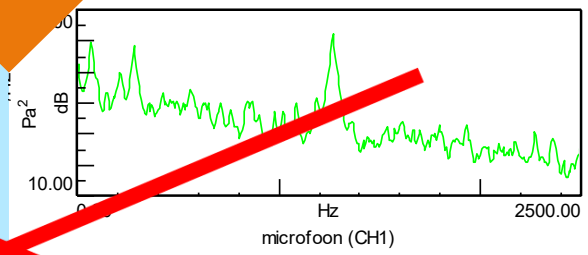
Sound recording

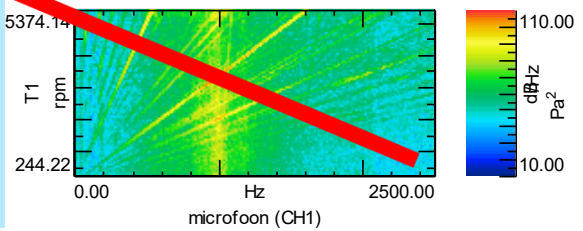


Sound quality metrics



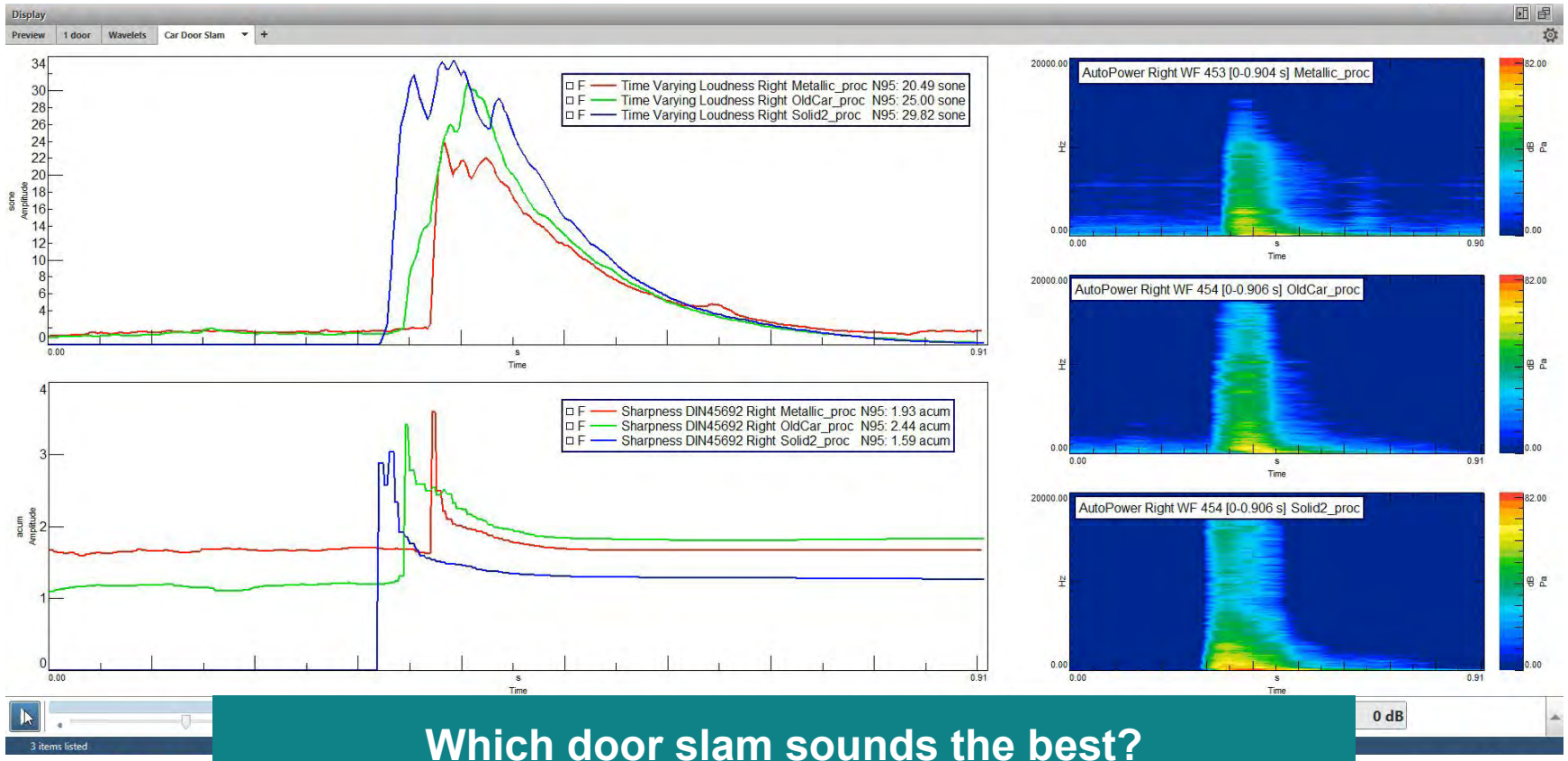
Classical analysis





Jury Testing

Sound quality metrics
Objectively quantifying subjective experience



Which door slam sounds the best?

Loudness

Sharpness

Speech
- Articulation Index
- Noise Rating
- Speech Inference Level

Modulation
- Roughness
- Fluctuation Strength
- Hilbert Transform

Tonality
- Tone-to-noise
- Tonality
- Prominence ratio

Impulsiveness
- Kurtosis
- Wavelets

Sound quality metrics
Loudness example

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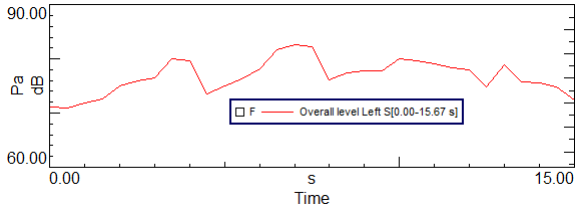
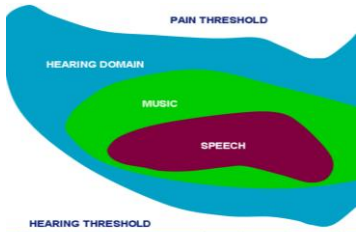
Sound Pressure Level

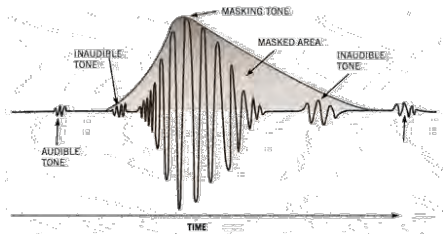
- Quantifies sound energy heard by the listener
- Only takes into account frequency sensitivity of human ear

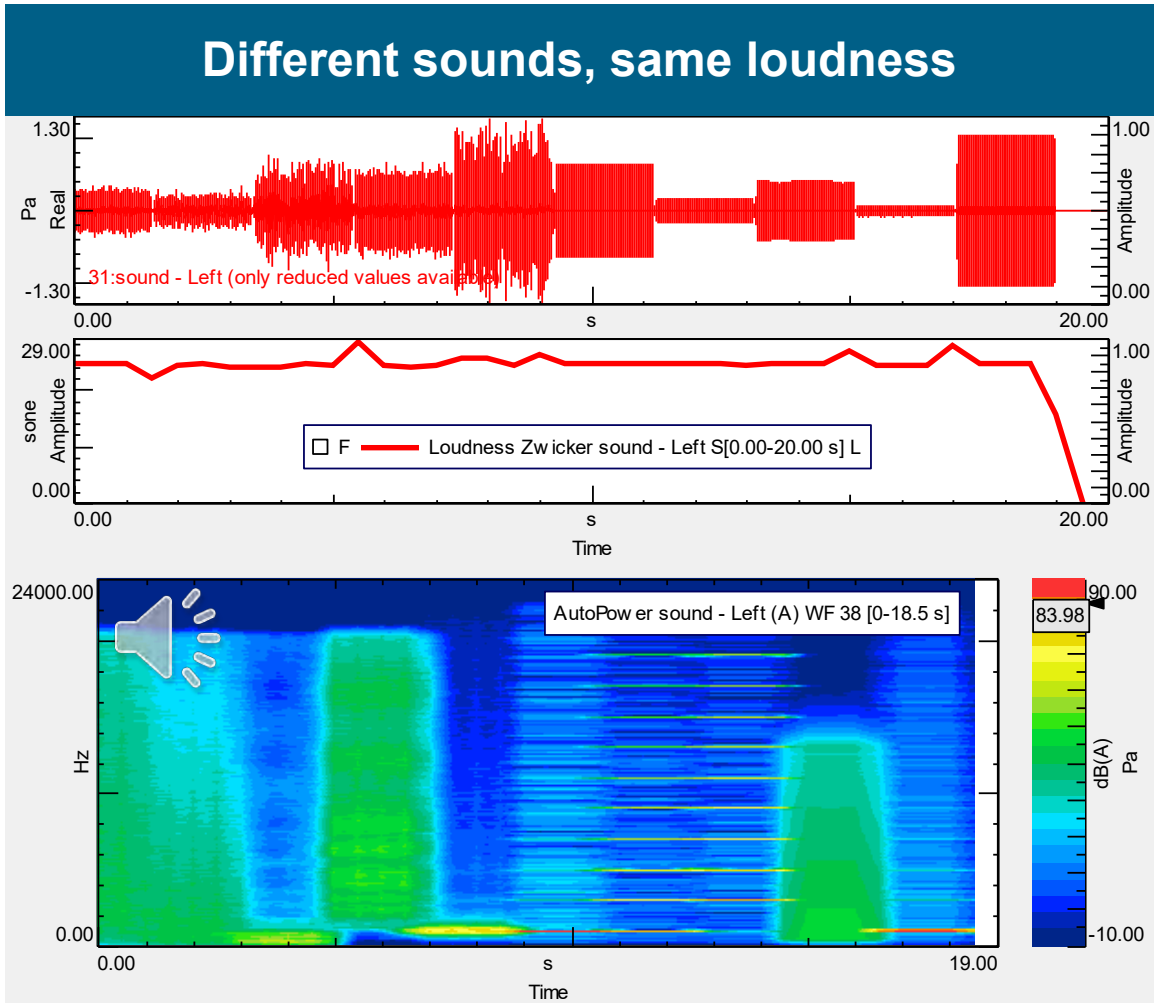


Loudness metrics

- Quantifies *perceived* loudness
- Accounts for frequency sensitivity and masking effects of human ear
- Some energy is lost!







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Demo

The sound quality process

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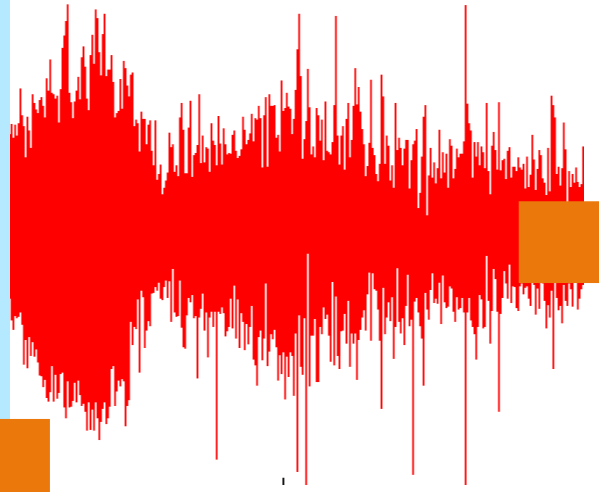
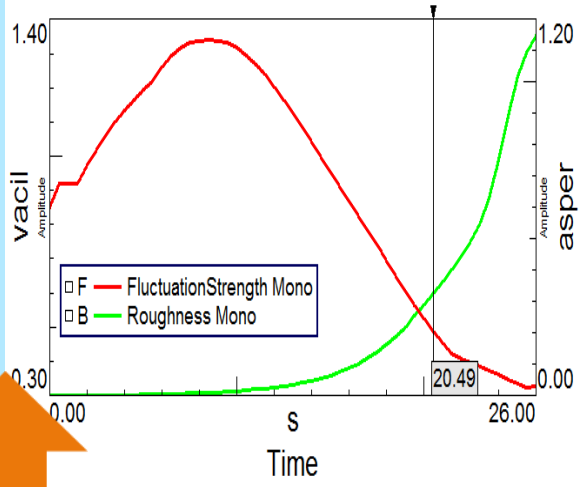
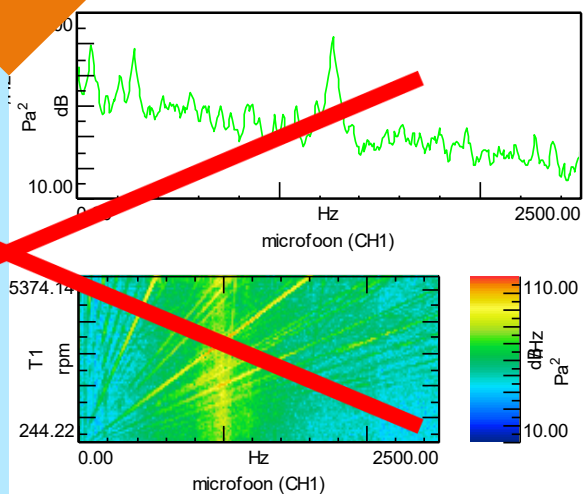
Sound recording



Sound quality metrics



Classical analysis



Jury Testing

What is Jury Testing?

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SUBJECTIVE ANALYSIS

- Gather subjective opinions on your product
- Evaluate complex sound performance
- Benchmark against competition
- Check consistency and statistics

Understand the *expectations* of your customers and design the product that *exceeds* them

Which question should I ask?
A-B comparison

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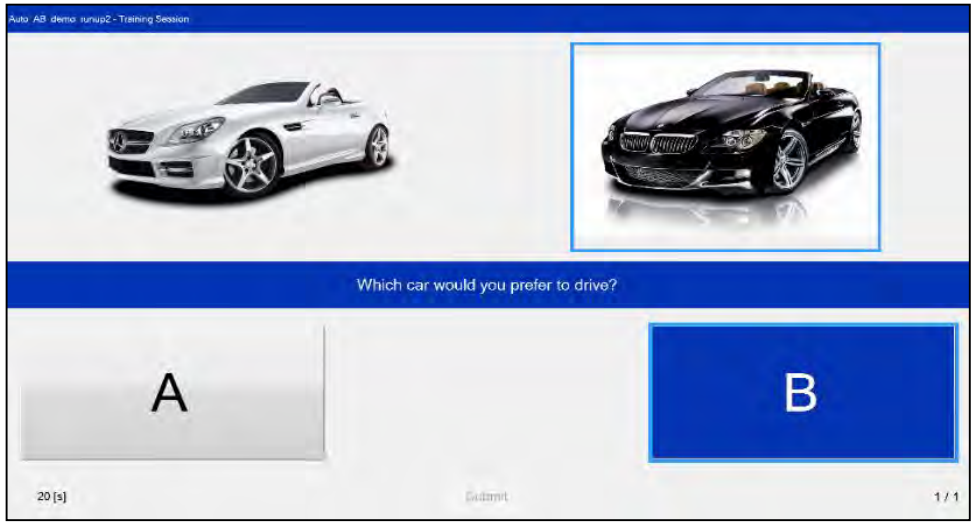
Juror selects preference between two sequential sounds

Goal:
- Relative comparison between products

Applications:
- Benchmarking against competition
- Ranking of design variants
- Ordering of sound pairs



Which question should I ask?
Category judgement

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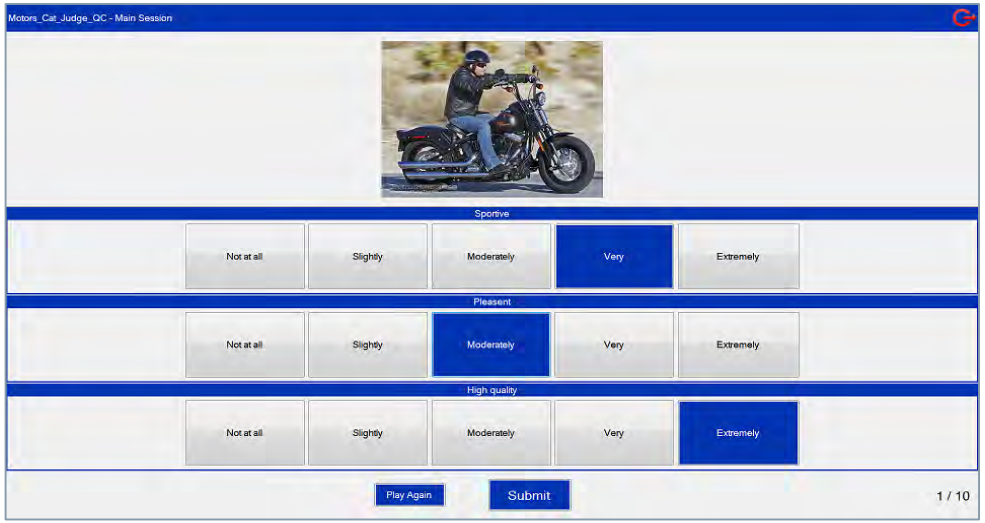
Juror rates sound quality on a scale related to a single descriptor (e.g. ‘sporty’ or ‘robust’)

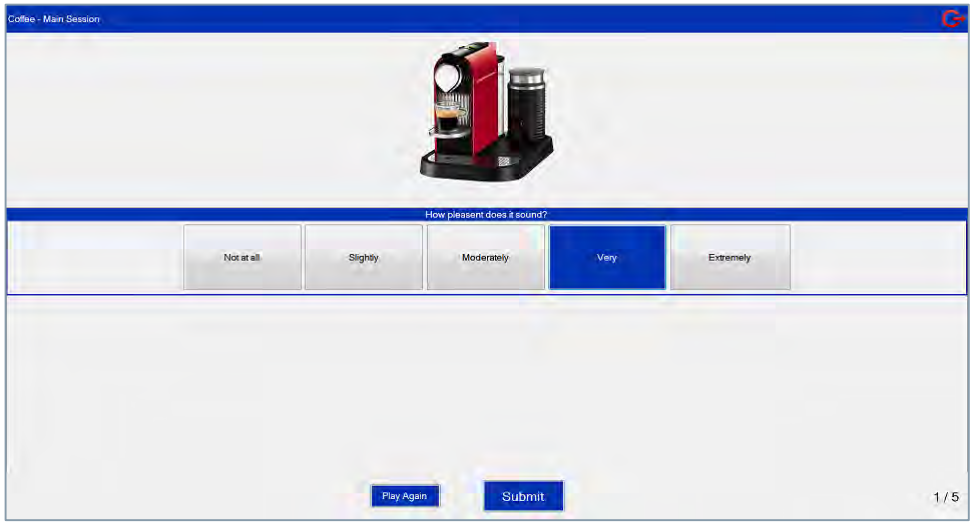
Goal:

- Break-down the sound into impressions and feelings of the jurors

Applications:

- Standalone evaluation of product sound quality
- In-depth benchmarking against competition
- In-depth ranking of design variants





Which question should I ask?
Semantic differential

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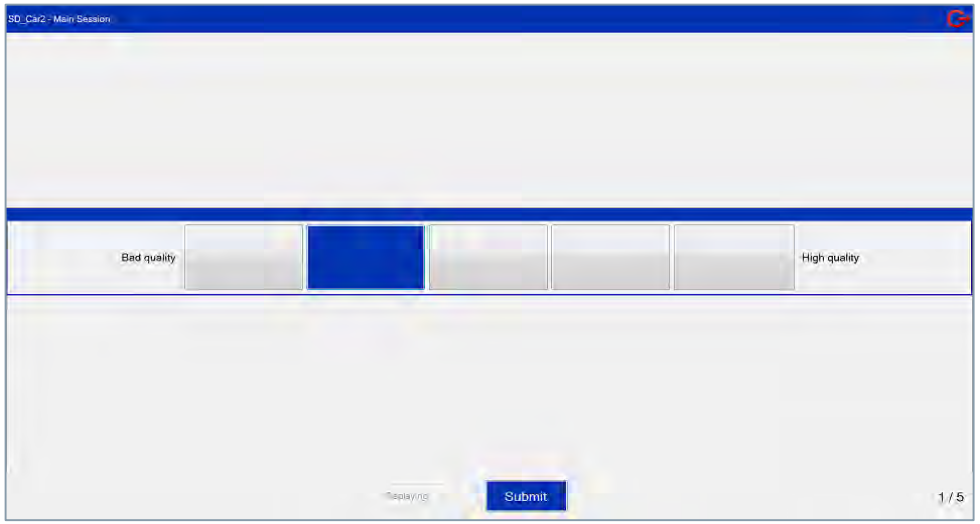
Juror rates sound quality on scale between two opposing adjectives (e.g. ‘cheap’ vs. ‘expensive’)

Goal:

- Break-down the sound into impressions and feelings of the jurors

Applications:

- Standalone evaluation of product sound quality
- In-depth benchmarking against competition
- In-depth ranking of design variants



Analyzing jury test results

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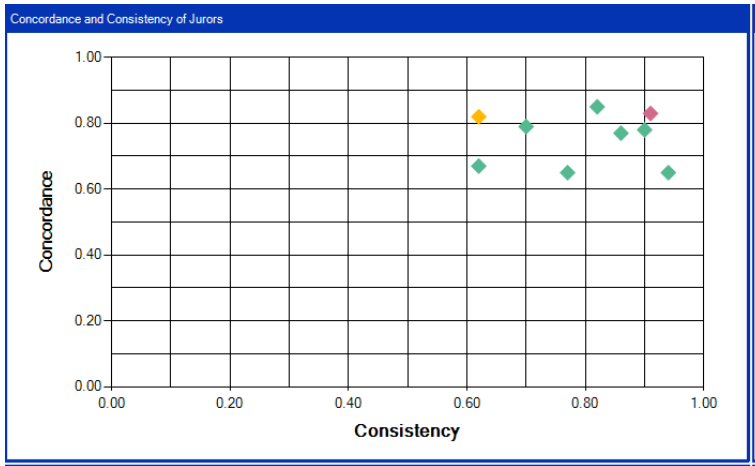
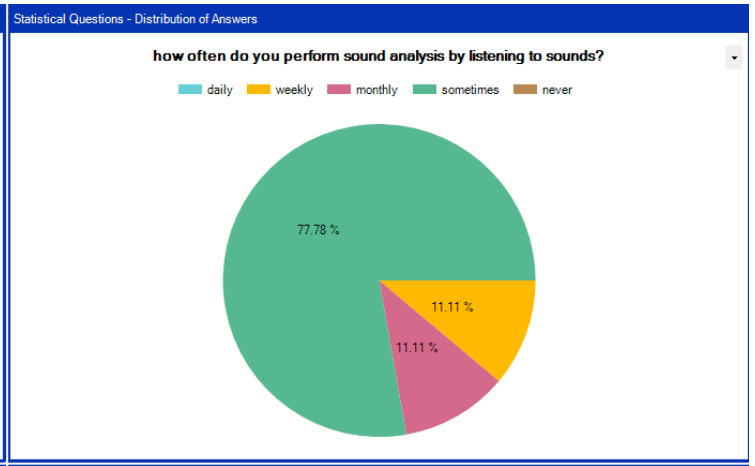
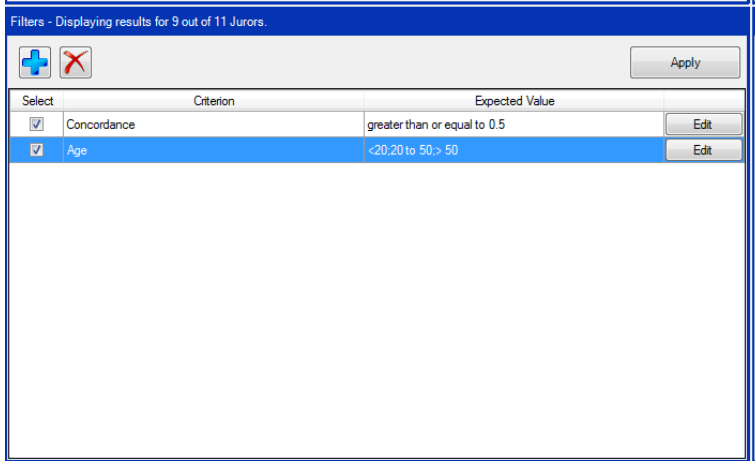
Display of concordance vs. consistency. All Jurors are mapped on this X-Y graph to easily check the quality of their answers. The colors represent the answer to the question from the pie-chart.

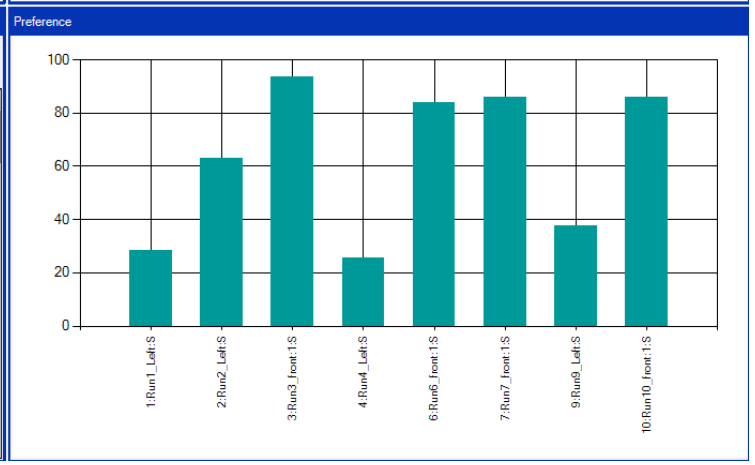




Pie-chart showing the percentage distribution of answers provided by Jurors. Use the drop-down to change the statistical question.

Set of filters to be applied on the list of Jurors. The available criteria are: concordance, consistency, reference questions, statistical questions.





Column chart showing which sounds were preferred most. As the poor-quality results will be filtered out, the overall result will adapt.

The sound quality process

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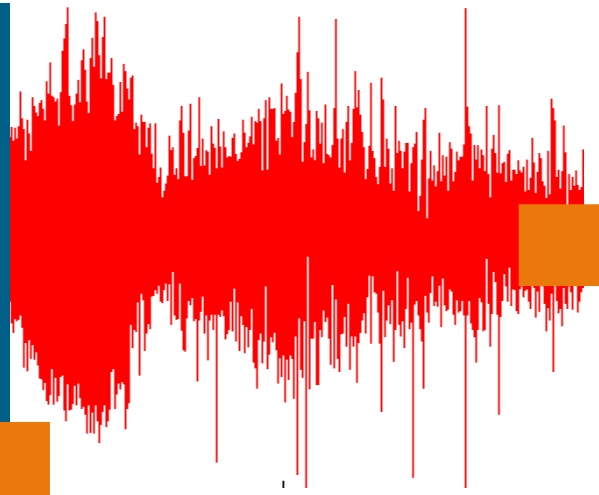
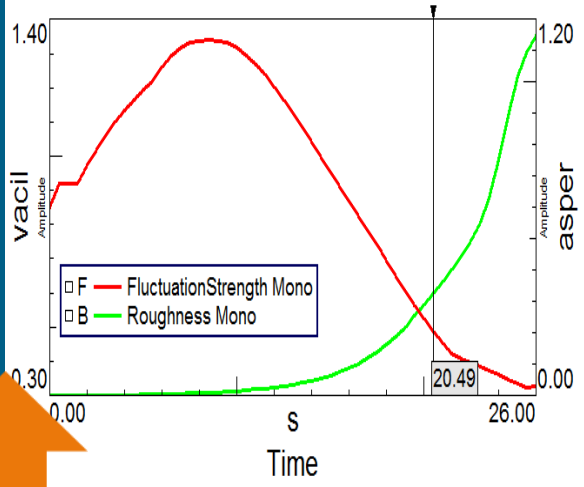
Sound recording



Objective qualification:

Sound quality metrics



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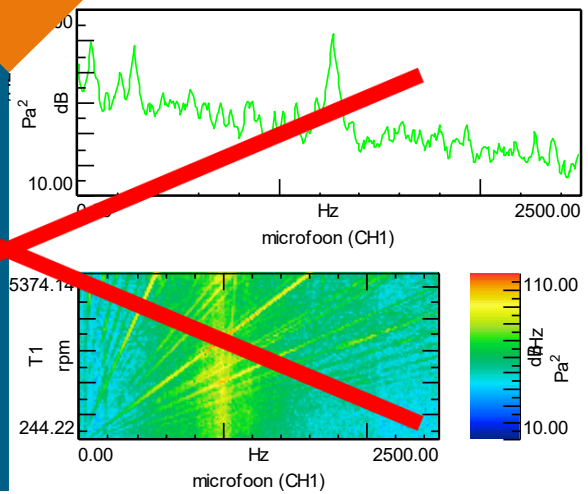

Subjective qualification:

Jury Testing

Audio replay & filtering

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