



Let your brand resonate with

Amplifier

Research & Development Project
by AdTonos in partnership with:



A Sound Advantage





Ad buyers identify audibility as the paramount metric in digital audio advertising.

In a world where consumers are overwhelmed with information, it's not enough for your message to merely exist.

It must be heard, understood, and remembered.





Insights from AdTonos Amplifier Research & Development Project.

Innovation pulses at the heart of AdTonos. We are relentlessly pursuing enhancements, exploring untapped markets, and bringing fresh concepts to fruition.

Guided by our foundational principles of innovation, simplicity, and transparency, we've embarked on a quest to achieve unmatched audibility. Our aim is to craft not just audible ads, but ads that reverberate with impactful resonance and **drive substantial ROI**.

Welcome to the symphony of digital innovation, where every note translates to a listener reached, every harmony to a brand recalled.

Join us in exploring how Amplifier is orchestrating the future of the audio advertising!



[Play the video on YouTube](#)

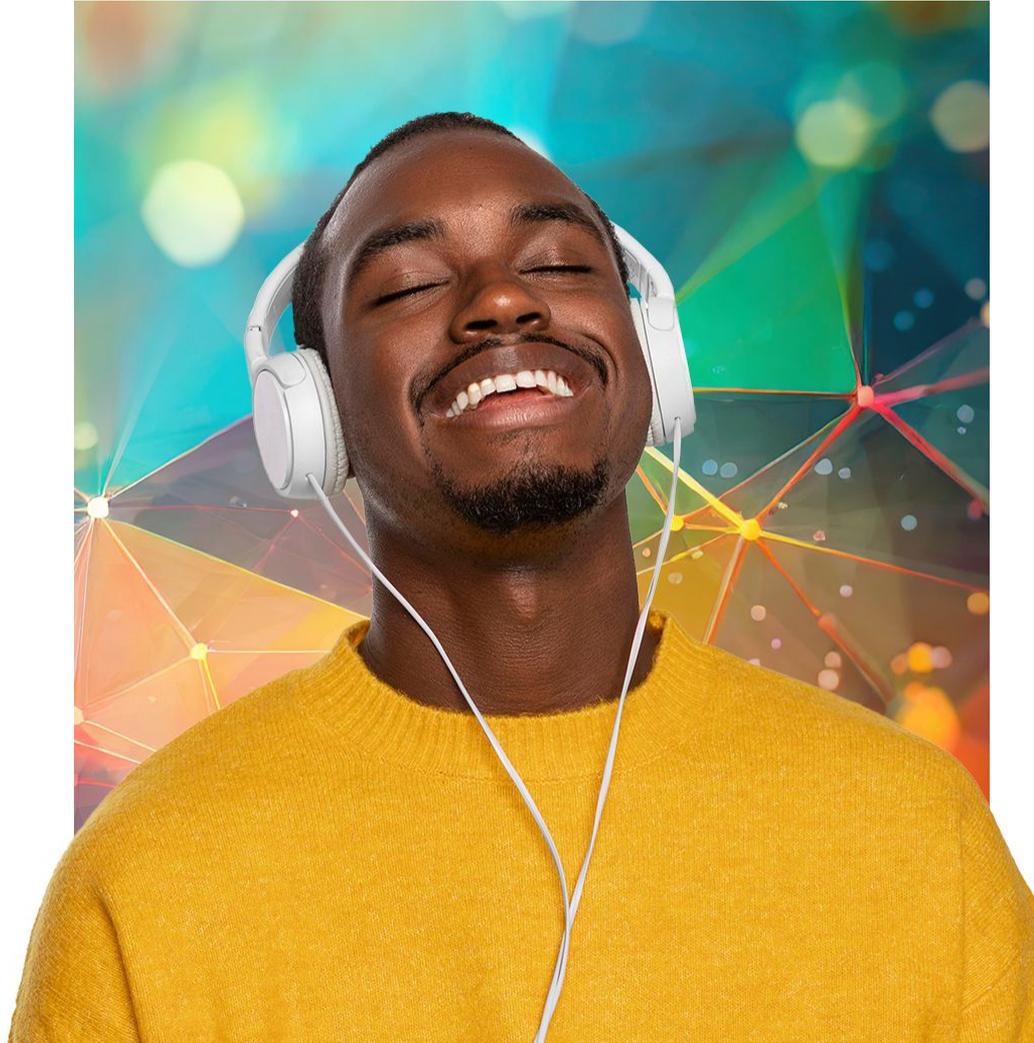


What is Amplifier?

Amplifier revolutionizes ad audio quality by employing advanced sound engineering techniques to create enhanced audio experiences that capture attention and lift brand recall.

With our state-of-the-art sound tech, Amplifier analyzes and optimizes ad audibility, ensuring that commercials are not just heard but are also **sonically distinguished** across a multitude of devices and environments on smart-speakers, earbuds, laptops and tvs.

Amplifier also measures and reports audibility based on extended criteria across any compliant channel and format.





How Does Amplifier Work?

Amplifier dynamically elevates the quality of audio advertisements to align with the capabilities of the listener's device.

Different speakers in different devices exhibit distinct ways of distorting reproduced sound, which is why the same piece of sound can sound different when played on various speakers.

Amplifier guarantees best sound quality in real-time for an unparalleled listening experience on the most common devices:



← AdTonos Inventory →



How Was Amplifier Build?

The project was structured into a four-phase approach: initial research, subsequent development, and evaluation through scientific study, designed to gather robust evidence demonstrating tangible benefits for advertisers.



The project undertook a comprehensive analysis to benchmark market standard for measuring audibility.

It was followed by an in-depth examination of sound processing and measurement across four chosen devices.

Subsequently, a redefined concept of audibility was introduced for internal metrics, tailored to enhance advertiser advantage.

Then the engineering efforts were evaluated by scientific study through MRI scans led by world renowned institution.



The Evolution of Digital Audio Advertising: Report by GroupM Nexus & IAB

The initial study conducted by GroupM Nexus in collaboration with IAB Europe on digital audio advertising dates back to 2019.

Unfortunately, due to the onset of the COVID-19 pandemic, further research efforts were temporarily halted.

However, in early 2023, a fresh report emerged, drawing insights from both buyers and sellers in the industry to identify growth drivers, obstacles, and opportunities within the digital audio space.

The study reveals that audio plays a pivotal role in complementing other media channels. The top three reasons for investing in audio advertising include its capacity to enhance broader media strategies (65%), boost brand awareness (55%), and target specific audiences (48%).

Both buyers (35%) and publishers (28%) emphasise the importance of standardisation for future audio growth.

Audibility (33%) emerges as a critical metric, following campaign recall, brand awareness & affinity, and purchase intent.

Audibility is highlighted as a technical consideration, as it serves as the foundational measurement. Without ensuring that an ad is properly heard, other aspects like brand recall and awareness cannot be accurately measured, potentially leading to negative outcomes.

As new audio advertising channels emerge, such as CTV audio ads and in-game audio advertising, audibility's significance is expected to grow in the eyes of buyers.

> [Full report](#)





Measuring audibility: Digital Audio Measurement Standards, Open Measurement by IAB and the New Audibility Definition

The most extensive standardisation approach was led by the US Media Rating Council (MRC) with support from Interactive Advertising Bureau (IAB), Radio Advertising Bureau (RAB) and NAB Committee on Local Radio Measurement (COLRAM). Their work resulted in publishing the Digital Audio Measurement Standards (DAMS) in 2018.

In summary, for an ad to qualify as an „Audio Ad Impression,“ it must be played on a digital audio player in an unmuted state with a nonzero volume, and it should not be flagged as invalid traffic (IVT).

This may spark debate among audio ad buyers, as „just above 0“ level could be as low as 0.01% of the device’s maximum volume.

What could be considered contentious in the MRC’s definition of ad audibility is the use of a fixed level that applies to all devices uniformly.

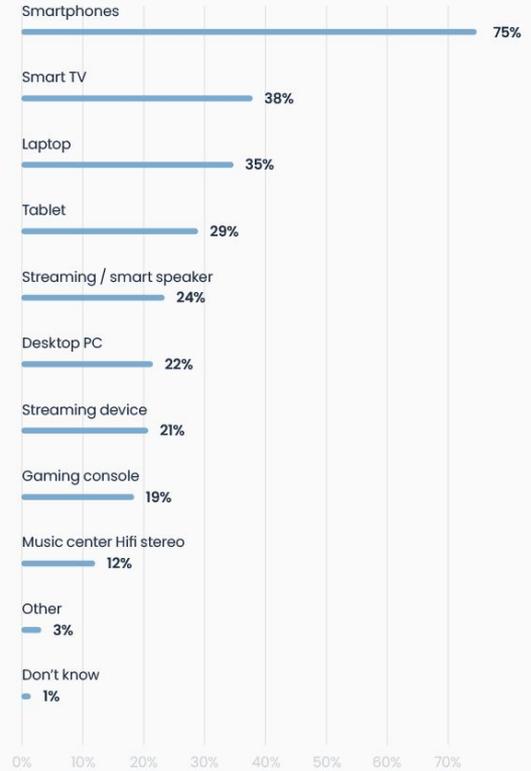
In the Amplifier project, AdTonos conducted an investigation into audio ad quality on four of the most popular digital audio listening device types: laptops, mobile phones (including tablets) with headphones, smart speakers and televisions (including smart tv).

This resulted in a group of devices that accounts for most of audio usage. Within each group, a specific device was chosen for further analysis, based on market data, popularity, and sales dynamics.





Digital Audio Usage By Device In the U.S. as of June 2023.



Source: Statista.com, <https://www.statista.com/forecasts/997213/digital-audio-usage-by-device-in-the-us>

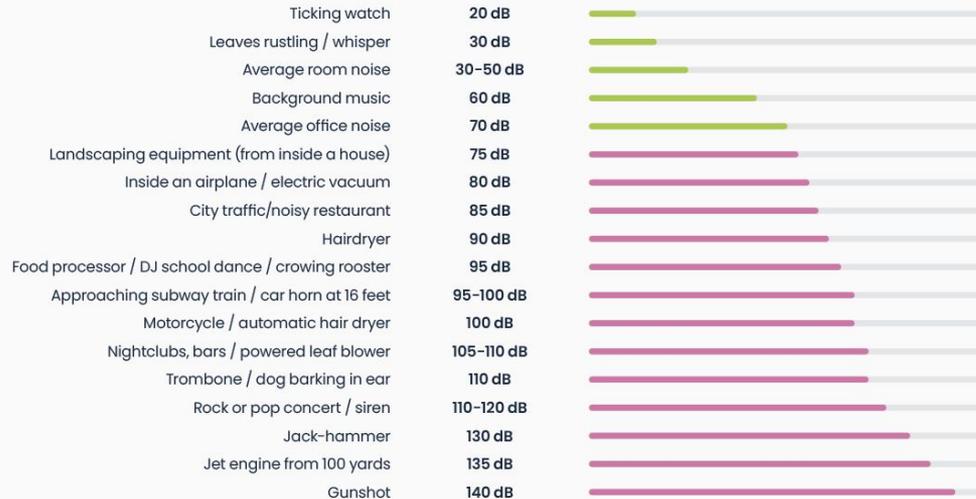


Within each group, a specific device was chosen, based on market data, popularity, and sales dynamics. The table below provides details of the selected devices for AdTonos' analysis and development, including their maximum volume (MV), volume level steps (VLS), and the calculated minimum volume level (cMVL).

Device type	Dominant Model	MV	VLS	cMVL
Smart speaker	Amazon Echo 3	79 dB	10	7.90 dB
Headphones	Apple AirPods 3	100 dB	15	5.67 dB
TV	Samsung QN9X	93 dB	100	0.93 dB
Laptop	Macbook Pro 13	82 dB	16	5.12 dB

This raises the question of whether the audibility definition established by the Media Rating Council (MRC) may be inadequate, as cMVL levels shown in this table are still at least by half more quiet than average **volume of a ticking watch**.

Noise Levels by Different Environments



Sounds at or below
70dB are safe

Sound above 70 dB can harm hearing over time



The reviewed definition carries the potential to yield a positive impact on the return on investment (ROI) for ad buyers, subsequently bolstering publishers' revenues by introducing much-needed simplicity and transparency to the ecosystem.

Within the Amplifier ecosystem, AdTonos commits to use Audible Ad Playout definition under specific conditions:

The ad must not be filtered or flagged as invalid traffic (IVT).

The player and the device's volume settings, through which the ad is delivered, must result in the ad playing at a volume exceeding 10 dB for a minimum of 25% (any quartile) of the ad's duration.





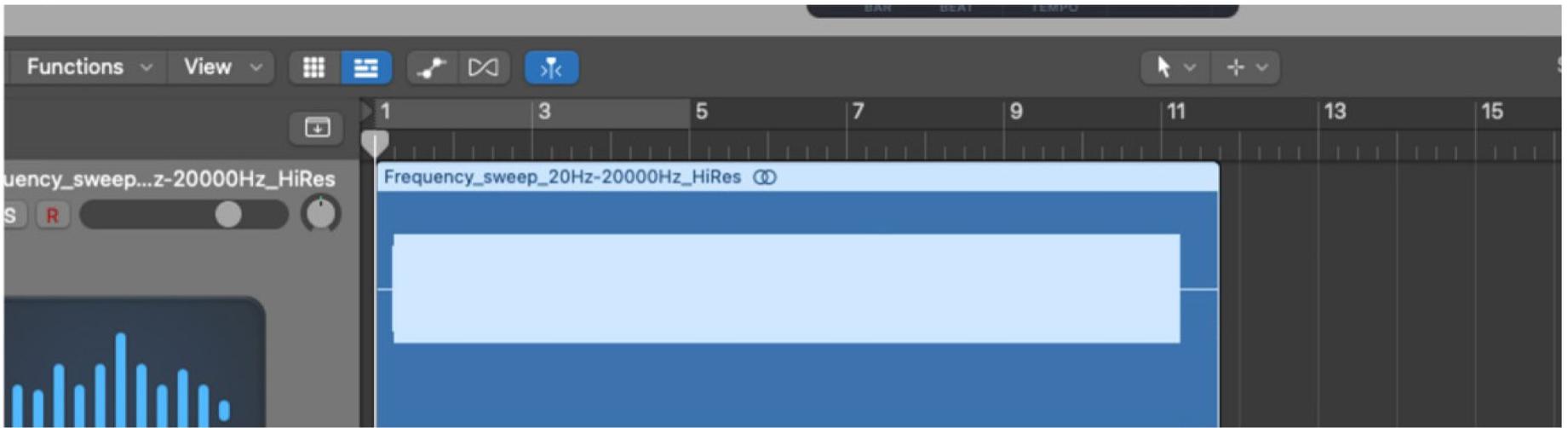
Sound Laboratory: The Heart of Audio Excellence

It is commonly assumed that the human ear, at its peak capability, can perceive frequencies ranging from 20Hz to 20,000Hz (20kHz). In reality, this range can vary due to several factors.

Every manufacturer of audio equipment strives to ensure that their device, whether it's a speaker, headphones, or any other audio device, reproduces recorded audio files as faithfully as possible.

However every device introduces some degree of distortion or imperfection, whether it's more or less pronounced. For example, instead of playing a sound at an actual -4dB, it might reproduce it at -3dB or -5dB.

Different speakers in different devices **exhibit distinct ways of distorting reproduced sound**, which is why the same piece of sound can sound different when played on various speakers.



Investigating Distortion to Deliver the Perfection

AdTonos sound engineers aimed to accurately measure the extent to which the selected devices (smart speaker, tv, earbuds and laptop) distort frequencies. This data served as a foundation for compensating for these distortions in the sound amplification process.

In a result, the listener will hear the sound of the ad more closely aligned with how it was intended to sound, as Amplifier will have corrected the device's distortion.

The foundation for conducting this study was the utilisation of a „frequency sweep” to be played on selected group of devices. This is an artificial sound model that AdTonos sound engineers generated using a Digital Audio Workstation (DAW).

It smoothly transitions from 2 0Hz to 20 kHz, covering the entire spectrum of frequencies audible to humans. Importantly, it maintains a consistent volume throughout its duration, meaning that each frequency is played at the same volume, with variations no greater than 0.1 dB.

> [Frequency Sweep](#)



To capture the sound, AdTonos engineers used three microphones: Shure SM81, Sennheiser MKH40P48, and Neumann M149. In the audio industry, each of these microphones is typically used in a slightly distinct manner.

Shure SM81 is commonly favoured for recording acoustic instruments like guitars or strings. Sennheiser MKH40P48 is often chosen for wind instrument recordings, while Neumann M149 is frequently employed for capturing vocals.

Recording the sound by those three microphones allowed engineers to reduce their own distortions in capturing the sound.

The sound engineers opted to utilise a combination of these three microphones with the aim of achieving a broad sound image while minimising any potential influence from the unique tonal characteristics of each microphone.

Consequently, to measure the sound characteristics of headphones, a specialised setup is employed – a life-sized mannequin with dedicated microphones integrated into an artificial head. In our measurements, we used a Kemar mannequin from the Danish manufacturer Gras Acoustics, renowned for its industry-standard quality.





Enhancing Audio Ad Quality in Real Time

Subsequently, sound engineers conducted a detailed comparison by juxtaposing the recorded waveform with a reference sound graph. This comparative analysis was made feasible through the use of a spectrum analyzer, a device engineers commonly refer to as a tool that visually represents sound.

The comparison illuminated disparities between the reference sound and the sound recorded by the microphones.

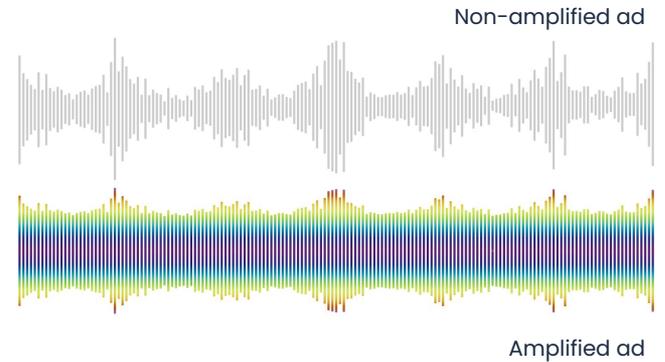
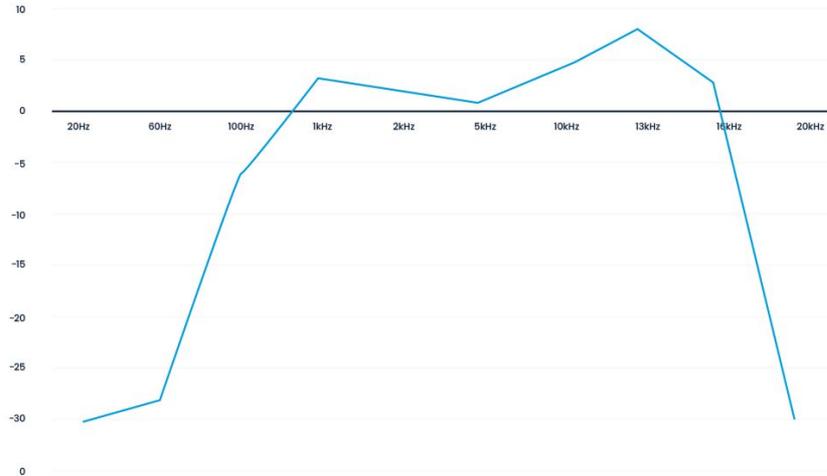
Based on these findings, sound engineers devised recommendations for correcting sound on specific groups of devices, addressing individual frequency adjustments (EQ) to ensure best audio quality.

These measurements have yielded valuable insights into sound improvement recommendations aimed at either enhancing or reducing specific frequencies for the selected group of devices.

These recommendations have been transmitted from AdTonos sound engineers to software engineers, who were tasked with developing **an automated sound correction system**, intended to guarantee equal and best audio quality for advertisements on a selected group of four devices.



Sound output of Macbook Pro 13", one of the reference devices in Amplifier.





Sonic Innovation Where Artistry Meets Science to Deliver Advertising That Speaks Volumes

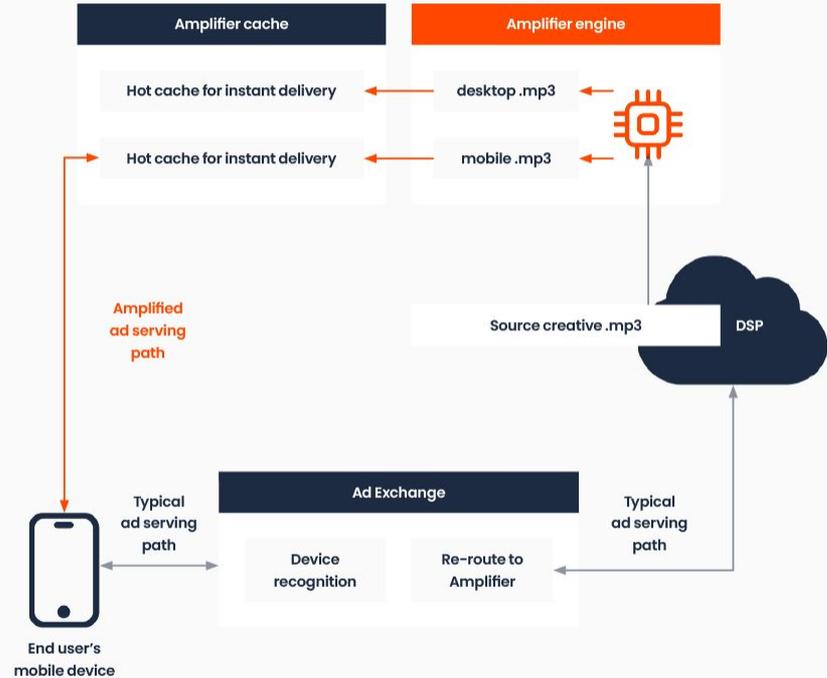
Based on the findings of the laboratory study, AdTonos has developed a suite of tools that reinforce sound quality, enhancing ad audibility.

To this end, it has introduced a new software product to its tech stack: AdTonos Amplifier.

Amplifier, an integrated system, has the capability to enhance the audio quality of any advertisement. It achieves this by equalising the waveforms within a media file to align with a specified output device profile.

This refined media file is then delivered on-the-fly with negligible perceptible delay to the client.

Leveraging state-of-the-art protocols and tools, the AdTonos software engineering team has ensured that ad delivery is optimised across all publishers and platforms without compromising transparency or deliverability.





The Science of Sound: Neuromarketing Insights

Quality is crucial in advertising, both in terms of content and format. AdTonos faced the intricate challenge of measuring with the highest precision whether improved audibility (audio quality) positively correlates with listener perception, potentially leading to an **increased ROI** for the advertiser.

To explore this theory, AdTonos partnered with Neurensics, globally renowned experts in the field of neuromarketing research, embarking on a research initiative that delves into the subconscious whilst individuals are exposed to audio ads.





Methodologies for Measuring Brain Responses to Amplified Ads

To determine the appreciation of a stimulus Neurensics uses Functional Magnetic Resonance Imaging (fMRI), which is a neuroimaging technique used to measure and map the activity of the human brain.

It is a non-invasive method that allows researchers and clinicians to observe the brain's functioning in real time while a person experiences different stimuli.

Magnetic Resonance Imaging (MRI)

fMRI is based on the principles of MRI. It uses a strong magnetic field and radio waves to create detailed images of the brain's structure. These MRI images serve as a structural reference.

Functional Mapping

As the person's brain responds to the stimuli, the fMRI scanner detects changes in blood oxygenation levels. These changes are converted into images that show which parts of the brain are more or less active during the stimulus.

Blood Oxygenation Level-Dependent (BOLD) Signal

The key innovation of fMRI is the ability to detect changes in blood oxygenation levels. When a specific area of the brain becomes more active, it requires more oxygen and blood flow.

Data Analysis

The collected data is then analysed to create functional maps of the brain, showing which regions are involved in specific cognitive functions, such as motor control, language processing, memory, or sensory perception.



Conscious and Unconscious Brain Reactions

Neurosciences during the research measures 13 emotions such as desire, lust, value, trust but also negative emotions like fear, danger and disgust that lead to the evoked feeling that people feel and can report.

For Amplifier research Neurosciences measured by fMRI whole brain activation while participants listen to audio commercials. This activation comprises conscious, but also unconscious responses to an advertisement.



Example of Emotions Mapper Used in Study

With the aid of advanced pattern analysis, neural activation patterns are reduced to the intensity of 13 relevant dimensions in a commercial context. These so-called 'mappers' are clustered in four groups and form the core of the analysis in the Neuro Ad Test of Neurensics.

Each mapper in itself is not so much based on the activation of a specific, isolated, brain area - but on activation of several brain areas at the same time by neural networks. The mappers are commonly used worldwide in fMRI research.

The example on the right: the round circle (thin, grey) represents the score of the average person at the average audio commercial (index). The black band stands for the spread of mapper activation caused by the tested stimulus.

The thin white line within the band is the average, the width indicates the 95% confidence interval. If the colour band does not overlap with the index line, there is a significant difference (at $p < 0.05$) with the average commercial.





The AdTonos Amplifier Neuro Test analysis was conducted using MRI scans from 20 participants. These individuals were residents of the Netherlands, bilingual in Dutch and English, aged 20 years and above, and represented a cross-section of the Dutch population in terms of gender, age, and educational background.

For the study Adtonos engineers randomly selected 16 ads from the platform's programmatic demand, of which 8 were in English and 8 in Dutch.

Filenames of the ads were anonymised using a random 8 character string.

Then, two sets of those ads were prepared: non-enhanced (referred as „flat“) and enhanced by Amplifier (in accordance with previously developed sound studio enhancing pattern for headphones).



The Science of Sound: Neuromarketing Insights

There is strong scientific evidence proving that Amplifier audio ads significantly activate positive emotions.

This study observed that by enhancing ad quality, a listener's emotional balance triggered by an ad can switch brand perception from negative to positive.

Enhancing audio ad quality delivers a foundation to improve campaign effectiveness and ROI.

Amplifier: the Scientific Evidence

There is strong scientific evidence proving that by enhancing ad quality, emotional balance triggered by an enhanced ad can switch perception from negative to positive.

The spider chart shows how individual emotions were activated by listening to non-enhanced (marked by red) and Amplifier enhanced ads (green).

The enhanced versions of ads show significant improvement in important emotions such as Desire, Lust, Trust and when combined, a greater sense of Value.

Noteworthy is the reduced activation of negative emotions by enhanced ads such as Danger or Disgust. The Attention metric is noted lower in enhanced ads as for logical reason, enhanced ads are requiring less attention to be received as in similarity of an example of more attention needed to hear someone speaking quietly.

The enhanced ads by Amplifier activate more desire, lust and trust.



Amplifier: the Scientific Evidence

The enhanced commercials, with lower negative emotion scores and significantly higher value, achieve higher effectiveness in activating behavioural intent.

However, it's important to note that since each ad had a different message and promoted various products or services, we can't draw definitive conclusions about the specific intent (knowledge, attitude, or behaviour) since it's tied to the campaign's goals, which can range from building brand awareness to driving sales.

The graph shows how three main emotion groups were activated by listening to non-enhanced (marked by red) and Amplifier enhanced ads (green).

Performance



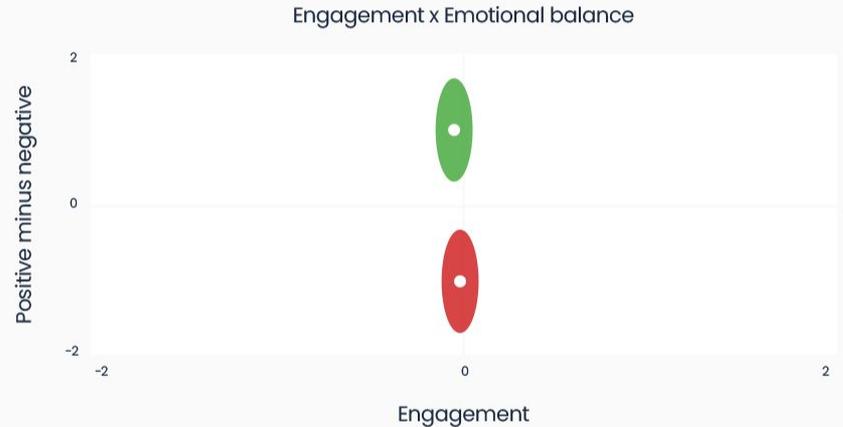
Amplifier: the Scientific Evidence

The chart displays the degree of positive engagement on the X axis. The Y axis shows the ratio between negative and positive emotions triggered by listening to the ad. If the ratio is more negative than positive, then the result was marked appropriately to the measurement below 0. T

The further to the right and the higher to the score (upper right quadrant) – the better the ad score is.

The score quadrant indicates to what extent the behavioural intention is activated. Combined outcomes of all audio commercials measurement are shown on the graph.

The non-enhanced ads are represented in red while enhanced by Amplifier are in green.





Amplifier: Elevating Audio Advertising

The Amplifier study carried out by Neurensics aimed to explore the theory that „enhanced audio quality in advertisements results in better response rates and evokes strong emotional connections“.

Sound quality has a significant impact on both the conscious and subconscious experience of the message delivered by audio ad itself.

Enhancing audio ad quality delivers a foundation to improve campaign effectiveness and ROI.

[> See the full Amplifier Report](#)





Hear you soon

www.amplifier.adtonos.com

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