# FROM SIGNAL GENERATION TO REACTION ANALYSIS: A REVIEW OF SOFTWARE TOOLS AND AI MODELS IN AUDIO STIMULATION RESEARCH

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***Abstract.*** *Audio stimulation has emerged as a valuable methodology across clinical neuroscience, cognitive research, and human-computer interaction, driving demand for dedicated software tools capable of delivering precise stimuli and capturing human responses. This paper reviews existing platforms, tools, and models relevant to audio stimulation research, examining their design approaches, core capabilities, and limitations in supporting end-to-end experimental workflows.*

*A survey of prominent tools reveals clear functional fragmentation across the field. Stimulus delivery platforms such as PsychoPy and OpenSesame provide precise, programmable audio and visual stimulus presentation with basic response logging, but offer no intelligent reaction analysis. Biosignal feedback tools such as BrainBay enable real-time processing and threshold-based neurofeedback from EEG and physiological signals, but lack structured audio stimulus generation. Adaptive paradigm frameworks such as BART (Brain Analysis in Real-Time) support real-time physiologically-triggered stimulation, yet remain confined to fMRI environments with no machine learning component.A new generation of AI foundation models – including ZUNA (Zyphra, 2026), focused on EEG signal quality reconstruction, and NeuroLM (Jiang et al., 2024), a multi-task framework for EEG classification - demonstrate the growing maturity of machine learning approaches to brain signal analysis, but operate entirely independently of any stimulation pipeline.*

*This review identifies a clear and unaddressed research gap: no existing platform integrates programmable audio signal generation with automated, machine learning-driven reaction analysis within a single unified environment. A unified platform spanning stimulus design, biosignal acquisition, and intelligent reaction analysis would represent a significant advancement for both experimental neuroscience and applied brain-computer interface research.*

**Key words:** Audio Stimulation, Signal Generation, Reaction Analysis, Software Platform, EEG, Biosignal Processing, Neurofeedback, Brain-Computer Interface, BCI, Machine Learning, Foundation Models, PsychoPy, OpenSesame, BrainBay, BART, ZUNA, NeuroLM, Literature Review, Research Gap, fMRI,

Adaptive Stimulation

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