

Neural Entrainment through Auditory Beats

Research Informing the Design of Gamma
Frequency Drone-Based Music

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White Paper

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**Monaural gamma stimulation
within immersive ambient drone
textures provides a multimodal
and scientifically grounded
method for amplifying the
neurophysiological and
phenomenological effects of
Floatation[®] technology**

Executive Summary

Auditory beat stimulation is a promising method for modulating neural activity and cognitive states. Two primary approaches, binaural and monaural beats, leverage subtly different auditory mechanisms, yet both can influence cortical oscillations.

This white paper reviews current research on auditory beat entrainment with a focus on gamma-frequency stimulation (40 Hz), and its application to designing Drone-Based Music (DBM) to integrate with Floatation® technology. DBM is an immersive auditory environment of sustained harmonic tones and rhythmic modulations, developed to guide neural synchrony and deepen relaxation, focus, and awareness.

The key insight is that while both binaural and monaural beats can induce neural entrainment, monaural beats demonstrate stronger effects in the gamma range. These findings provide a clear scientifically grounded foundation for creating DBM that enhances the neurophysiological and phenomenological effects of Floatation® technology.

1. Introduction

Auditory beat stimulation uses rhythmic auditory patterns to influence neural synchrony.

- Binaural beats occur when two slightly different frequencies are presented separately to each ear, producing the perception of a third tone equal to the frequency difference (Garcia-Argibay et al., 2019).
- Monaural beats result from the physical interference of two tones played together in both ears, producing an amplitude-modulated signal without requiring binaural integration.

Both approaches can drive the Frequency Following Response (FFR), in which neural oscillations align with external rhythmic stimuli. This mechanism forms the basis for designing Drone-Based Music (DBM) that enhances the effects of Floatation® technology.

DBM is an immersive form of sound design combining auditory beat entrainment with ambient drone compositions. Using continuous tonal layers and subtle gamma-frequency modulations with melodic ebb and flow, it enhances the Floatation® experience through multimodal integration of auditory and somatosensory input.

2. Mechanisms of Neural Entrainment

The Frequency Following Response (FFR) reflects how neural populations synchronise to rhythmic auditory input. Exposure to periodic acoustic modulation—via binaural or monaural beats—induces measurable cortical alignment, observable through Electroencephalography (EEG). Recent evidence suggests that monaural beats produce stronger cortical entrainment than binaural beats, particularly in the gamma frequency range. This makes monaural beats especially suitable for designing DBM to integrate with Floatation® technology where high-frequency cognitive modulation is desired.

3. Factors Affecting Entrainment and Perception

3.1 Carrier Frequency

Binaural beats are most reliably perceived when carrier tones fall between 400–500 Hz, ensuring clear auditory distinction (Perez et al., 2020). For DBM, this carrier range supports clear perception of the beat while maintaining immersive, ambient qualities.

3.2 Exposure Duration

Prolonged exposure (typically 6–10 minutes) enhances neural entrainment without habituation (Garcia-Argibay et al., 2019; Seifi Ala et al., 2018). DBM can gradually introduce gamma-frequency beats during the Floatation session to stabilise entrainment.

3.3 Masking Conditions

Auditory beats remain effective under white or pink noise masking, and can be integrated into drone textures. Care must be taken to avoid overlapping musical frequencies with the target gamma beat frequency, preserving clear neural entrainment.

4. Main Outcome of the Literature Review: Gamma Frequency Entrainment

Perez et al. (2020) conducted a single-blind, sham-controlled study comparing binaural and monaural beats in theta and gamma bands. Their results showed:

- Both binaural and monaural beats modulate cortical activity.
- Monaural beats elicit stronger entrainment in the gamma range, supporting their use as the core component of DBM for Floatation® technology experiences.

5. Implications for DBM Designed for Floatation® Technology

For DBM designed to integrate with Floatation® technology, monaural beats are the most efficient and reliable mechanism for gamma-frequency neural entrainment.

Recommended parameters based on current evidence:

- Target frequency range: 30–50 Hz (gamma band)
- Carrier tones: 400–500 Hz
- Exposure duration: 6–10 minutes with gradual induction
- Masking: white/pink noise acceptable; avoid overlapping musical frequencies

These guidelines ensure that drone compositions support perceptual clarity and neurophysiological alignment, optimising the Floatation® experience for cognitive enhancement and heightened awareness.

6. Conclusion

Both binaural and monaural beats can entrain cortical oscillations. For gamma frequencies, monaural beats demonstrate stronger entrainment, making them ideal for DBM integrated with Floatation® technology. As Floatation® technology has been shown to increase gamma synchrony, incorporating monaural gamma stimulation within immersive ambient drone textures provides a multimodal and scientifically grounded method for amplifying its neurophysiological and phenomenological effects.

References

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ABOUT US

DavidHugh represents a new category of wellness innovation. Founded in Cambridge by husband-and-wife duo Dr. Melody Chen and Dr. David Wickett, the company integrates design, biomechanics, and neuroscience to develop and manufacture technologies that advance human potential.

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