DEEPMADE

Sound Engineered for Human Performance

Product Strategy & Development Document April 2026 — Confidential deepmade.ai

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01 The Vision

DeepMade is a generative soundscape platform engineered to enhance human performance through biometrically adaptive audio. It is built on the same neuroscience used in clinical music therapy [1][2], but positioned entirely differently.

Not as medicine, not as meditation, but as performance infrastructure for people who are moving, thinking, recovering, and living with intention.

The technology stack is ready. Apple HealthKit and Google Health Connect provide real-time biometric data access to over 95% of the global smartwatch install base. Web Audio API and native audio frameworks allow us to generate and deliver high-quality adaptive soundscapes to virtually every smartphone on the market. The infrastructure exists. The product does not.

The core proposition is simple: the right sound, generated in real time and calibrated to your physiological state, can help you focus deeper, sleep sounder, recover faster, and perform better. DeepMade is the product that will deliver that proposition at a quality level the market has never seen.

The underlying science is established. Our moat will exist not in the research itself, but in the integration of biometric data streams, the creation of new derived data from those inputs, and the real-time feedback loops that connect physiology to synthesis. This is an engineering and design problem, not a research problem.

Now is the best time to build this. Incumbents, whether wearable manufacturers, streaming platforms, or wellness apps, are integrating AI into pre-existing user experiences and business models. They are constrained by what they've already built. DeepMade has no legacy to protect. We are free to design for the terminal realities of the AI era: continuous sensing, real-time generation, and closed-loop systems that respond to humans rather than waiting for humans to respond to them.

Why "DeepMade"

The name carries a double meaning. *Deep* refers to the deep physiological states the product targets (deep focus, deep sleep, deep recovery) as well as the depth of neuroscience underpinning every synthesis decision. *Made* signals that this is engineered audio, not curated playlists or ambient wallpaper. Every soundscape is made in real time, made for you, made to work. The name positions DeepMade as precision-engineered performance infrastructure, distinct from the passive wellness aesthetic of competitors.

BRAND: DeepMade operates under the DeepMade.ai brand, a premium biometric music and wellness platform. The domains deepmade.ai and deepmade.com are registered and active.

The Opportunity

Apple, Samsung, Garmin, and Whoop have spent a decade proving that consumers will wear biometric sensors every day. Over 500 million people now have real-time heart rate, HRV, and movement data streaming from their wrists. Nike and Peloton proved that performance-oriented consumers will pay premium prices for tools that make them better. The hardware layer is mature. The data is abundant. What's missing is software that actually uses it.

The opportunity in one sentence: Half a billion people are generating continuous biometric data, and no product exists that transforms that data into real-time audio optimised for how they're performing right now.

The functional audio category (Endel, Brain.fm, Focus@Will) has validated consumer willingness to pay for audio that claims to improve focus or sleep. But these products remain small: Endel has raised approximately $15M and reports 4 million downloads; Brain.fm operates as a modest subscription business. Neither has broken into mainstream scale, and neither has captured the performance-oriented consumer who wears a Whoop or trains with a Garmin. The category exists. The breakout product does not.

Why Running and Recovery Lead

We believe **Running** and **Recovery** are the use cases that unlock breakout scale. Not because DeepMade is a running app, but because these contexts make the biometric feedback loop undeniable. When you're running with audio that responds to your stride in real time, you *feel* the technology working. When recovery audio shifts as your heart rate drops, the effect is immediate and legible. These are proof points, not product boundaries.

Running is also where the competitive gap is widest. Endel's passive ambient aesthetic doesn't translate to athletic intensity. Spotify playlists don't adapt. Nike Run Club gave up on music entirely. The runner who wears a Garmin and demands precision from their training has no audio product designed for them.

But the underlying technology, biometrically responsive generative synthesis, is state-agnostic. The same architecture that locks tempo to stride also modulates texture as HRV signals stress, or fades entrainment frequencies as sleep onset approaches. Running and Recovery demonstrate the technology. The platform serves every state.

The Longer Vision: Infrastructure, Not Just an App

If DeepMade succeeds, it becomes more than a consumer app. It becomes the intelligence layer that transforms biometric data into real-time audio optimisation.

Today, wearable manufacturers generate abundant physiological data but offer limited utility beyond dashboards and notifications. Apple Watch knows your heart rate, HRV, movement, and sleep patterns, but does nothing with that data in real time except display numbers. DeepMade represents a new category: **biometric actuation**, using continuous physiological data to *do* something useful in the moment, not just report it afterward.

The platform implications: - **Integration layer**: Garmin, Polar, Whoop, and Apple could integrate DeepMade's synthesis engine directly, offering adaptive audio as a native feature - **Hardware evolution**: A future where wearables ship with DeepMade embedded, generating audio on-device rather than requiring a separate app - **New sensor classes**: If the technology proves out, DeepMade could develop specialised sensors optimised for audio generation. Not passive monitoring, but active performance enhancement

This positions DeepMade not as "a running app" but as foundational technology for a new relationship between biometric sensing and human performance.

KEY INSIGHT: The science is proven. The hardware is ubiquitous. What does not yet exist is a consumer product that closes the loop: taking real-time biometric data and using it to generate audio that responds to your physiology, designed for active performance contexts rather than passive desk or bed use cases.

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02 The Science

DeepMade is grounded in three converging bodies of neuroscience research, each with substantial peer-reviewed evidence. Together they form a coherent architecture for how sound can modulate human physiological and cognitive states.

Auditory-Motor Synchronisation

The human brain contains a deeply wired connection between auditory processing and motor output. When we hear a rhythmic pulse, neural circuits in the motor cortex, basal ganglia, and cerebellum synchronise automatically to that tempo. This is called the frequency-following response [3][4].

- Movement cadence is directly influenced by beat frequency. Research consistently shows that tempo-matched audio at target BPM reduces perceived exertion at equivalent effort levels [5][6].
- The effect is not motivational. It is neurological. The motor system literally entrains to the auditory input, reducing the cognitive cost of maintaining rhythm.
- **Implication for DeepMade**: real-time cadence input from a wearable allows the synthesis engine to lock BPM to the user's actual movement, creating a closed feedback loop between body and sound.

Neural Entrainment & Brainwave Modulation

Brainwave entrainment is the synchronisation of neural oscillations to external auditory stimuli. Different frequency bands correspond to distinct cognitive and physiological states:

Brainwave Band	Associated State
Delta (1–4 Hz)	Deep sleep, tissue repair, immune function
Theta (4–8 Hz)	Deep relaxation, creativity, REM sleep onset
Alpha (8–14 Hz)	Relaxed focus, stress reduction, learning readiness
Beta (14–30 Hz)	Active concentration, problem-solving, alertness
Gamma (30–100 Hz)	High cognitive load, memory consolidation, peak performance

Binaural beats are created by presenting slightly different frequencies to each ear, causing the brain to perceive a third tone equal to the frequency difference [7]. This perceived tone drives entrainment toward the target brainwave state. For example, 200 Hz in the left ear and 208 Hz in the right creates a perceived 8 Hz binaural beat, nudging the brain toward alpha state [8].

Isochronic tones provide an alternative entrainment mechanism that functions without headphones, a significant practical advantage for athletic contexts.

Binaural Beats in Sports & Athletic Performance

A growing body of research specifically examines binaural and rhythmic audio in athletic contexts:

- Studies show beta-range entrainment (14–20 Hz) increases alertness, reaction time, and sustained attention, relevant to both athletic performance and focused cognitive work [9].
- Alpha-range entrainment post-exercise has been shown to accelerate heart rate recovery and reduce cortisol levels [10].
- Gamma stimulation has been linked to improvements in working memory and executive function, directly applicable to deep focus and study states [11].
- Clinical work at LUCID (Toronto) and academic labs at Toronto Metropolitan University has validated music-based neural entrainment in randomised controlled trials, providing a scientific foundation the broader category can leverage [12][13].

The Evidence: What the Research Actually Shows

The science is real, but it is important to be precise about effect sizes and what mechanisms are strongest. This honesty strengthens the case for DeepMade by identifying where the largest opportunities lie.

Performance Improvement Effect Sizes

Intervention	Effect Size	Real-World Translation	Source
Generic music vs silence	g=0.31 (small-medium)	~3-4% performance improvement	Terry et al. 2020 meta-analysis [5]
RPE reduction (low-moderate intensity)	~10%	Same effort feels easier	Karageorghis 2012 review [6]
Synchronous tempo-matched audio	+7% efficiency	Better running economy	Bood et al. 2013 [14]
Motivational music (time to exhaustion)	+18-20%	Significantly longer endurance	PLOS One running study [14]
Binaural beats + music (combat sports)	η^2p=0.29-0.33 (large)	Striking performance improvement	Frontiers 2025 [15]

The critical insight: Generic music delivers modest benefits (3-4%). **Synchronized, tempo-matched, biometrically-responsive audio delivers 7-18% improvements.** That gap is DeepMade's opportunity.

Recovery and Sleep Evidence

Intervention	Effect	Source
Theta binaural beats post-exercise	Significant HF/LF HRV shift toward parasympathetic	Frontiers 2014 [16]
0.25 Hz binaural beats	Shorter N2 and N3 latency (faster deep sleep onset)	Nature Scientific Reports 2024 [17]
Music intervention on HRV (meta-analysis)	Increased HFnu, decreased LFnu	Lin et al. 2024 [18]

The Honest Assessment of Brainwave Entrainment

Brainwave entrainment is plausible but not consistently proven. Of 14 studies examining whether binaural beats reliably shift brain oscillations, 5 supported the entrainment hypothesis, 8 contradicted it, and 1 showed mixed results [19]. The frequency-following response exists in auditory cortex, but whether this spreads to global brainwave changes that drive behavioral effects is uncertain.

Our position: We include binaural beats as one layer of the synthesis architecture, but we do not stake the product on entrainment alone. The mechanisms we have strongest evidence for are:

1. **Auditory-motor synchronization** (robust, well-replicated)
2. **Arousal modulation** (tempo and intensity directly affect autonomic state)
3. **Attentional capture** (audio occupies bandwidth that would otherwise process fatigue/pain)
4. **Respiratory entrainment** (cyclic audio patterns can pace breathing without instruction)

The Stacked Mechanisms Approach

No single mechanism delivers 20% improvement. But multiple mechanisms working together can compound:

Mechanism	Evidence Strength	DeepMade Implementation
Auditory-motor sync	Strong	Tempo locked to real-time cadence

Arousal modulation	Strong	Phase-based harmonic progression
Distraction/attention capture	Strong	Continuous evolving texture
Respiratory entrainment	Moderate	Volume/texture swells at breath rate (recovery)
HRV biofeedback	Moderate	Real-time adaptation to recovery metrics
Brainwave entrainment	Weak-Moderate	Binaural/isochronic layer (hedge bet)
Leading tempo	Untested	Audio tempo gradually pulls user toward target cadence

The pitch: 5% from tempo sync + 5% from arousal modulation + 5% from reduced perceived exertion = compound benefit that no single-mechanism product delivers. DeepMade stacks every proven mechanism into one integrated system.

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03 Competitive Landscape

The functional audio category has been developing for two decades. Several companies have built real products with real users. None has captured the full opportunity.

The Key Players

Endel — Closest Competitor

endel.io

The most direct analogue. Endel has patented generative soundscape technology that adapts to time of day, weather, heart rate, and location. 4 million downloads. Deals with Warner Music for artist collaborations. Available on iOS, Android, Apple Watch, Alexa, and Apple TV. Raised approximately $15M to date.

Their weakness: fundamentally passive and ambient. The experience is designed for people sitting still, at a desk, in bed. Walking cadence is a peripheral input, not a core design principle. No serious athletic performance orientation. The audio quality, while functional, lacks the premium design intentionality that a performance-focused user expects.

Scale context: 4 million downloads over 6+ years represents modest traction. For comparison, Calm has 100M+ downloads; Headspace has 70M+. Endel has proven the concept but not achieved breakout scale.

Brain.fm — The Science Credibility Player

brain.fm

The most scientifically serious focus and productivity player. Uses AI to generate audio with rhythmic neural phase locking designed to influence brainwave states. Strong peer-reviewed backing. Subscription business with solid retention.

Their weakness: purely static and functional. No biometric input. No adaptive real-time loop. No physical performance use case. The audio sounds algorithmic and functional, not desirable or emotionally resonant.

Scale context: Brain.fm operates as a profitable niche business but has not achieved mainstream consumer scale. They've proven willingness to pay but not mass-market appeal.

LUCID — The Clinical Analogue

Toronto-based digital therapeutics company using emotion AI and binaural beats for dementia care and anxiety treatment. Clinically validated. Pursuing FDA approval and Medicare reimbursement. Featured on CNN. Backed by institutional health investors.

Their position: deliberately clinical, deliberately slow. Their regulatory path and target population are entirely different from DeepMade. However, their published clinical evidence directly validates the underlying technology DeepMade is building on.

Others

Product	Position	Limitation
Focus@Will	Curated music for attention	No generative engine, no biometrics, static playlists
myNoise	Customisable soundscape generator	Manual, no intelligence, no adaptation
Hemi-Sync	Original binaural beat programmes	1970s product UX, no consumer app sophistication
Headspace / Calm	Meditation and sleep audio	Curated content, no generative or biometric layer

The Competitive Gap

Mapping the landscape against two axes (biometric responsiveness and performance orientation) reveals a clear gap:

THE GAP: Existing products either treat biometrics as ambient context (Endel) or ignore them entirely (Brain.fm). Existing products design for passive states (desk, bed) rather than active performance. No product combines real-time biometric feedback, generative synthesis, and a design sensibility built specifically for physical and cognitive performance. DeepMade owns that space.

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04 Key Risks and How We Address Them

Building conviction in DeepMade requires acknowledging the hard questions. Below are the primary risks we see and how the roadmap addresses each.

Risk 1: The Biometric Loop May Not Be Perceptible

The concern: Users might not *feel* the audio responding to their physiology. If the adaptation is too subtle, the core value proposition disappears. If it's too obvious, it feels gimmicky.

How we address it: PoC 2 (The Movement Loop) is specifically designed to test this. Running and rowing are ideal contexts because the feedback is immediately legible: tempo locks to stride, intensity shifts with heart rate. We measure both objective performance (pace, power) and subjective perception (RPE, enjoyment). If users cannot perceive the loop in these high-signal contexts, we know before building further.

Risk 2: Lab Science vs Real-World Efficacy

The concern: The referenced studies demonstrate effects in controlled settings. Real-world performance during actual exercise, with wind noise, distractions, and variable effort, may not replicate lab results.

How we address it: We do not claim clinical outcomes. We claim *perceived benefit* and *desirability*. PoC 1 tests whether DeepMade sounds better than Endel. PoC 2 tests whether users *prefer* it during real activity. The science provides the architecture; user preference provides the validation.

Risk 3: Running as Hero Use Case Has Constraints

The concern: Many runners avoid earbuds for safety (traffic awareness). Bone conduction has audio quality limits. This may narrow the addressable market for our flagship use case.

How we address it: We lead with rowing, cycling (indoor), and gym contexts where earbuds are standard. Running enters as a secondary hero use case with clear acknowledgment of the safety tradeoff. The same technology serves all movement contexts; we choose proof points strategically.

Risk 4: Incumbents Could Replicate

The concern: Apple, Spotify, or Endel could build the same thing with more resources. The moat is execution, not IP.

How we address it: Speed and focus are the moat. Incumbents are integrating AI into legacy products; we are building AI-native. Their incentives are to protect existing business models; ours is to capture the gap. First-mover advantage in a well-executed vertical beats second-mover with more resources in an unfocused portfolio.

Risk 5: "Feels Like It Works" vs "Actually Works"

The concern: Placebo effect is real. Users may report benefit because they expect benefit. This undermines the neuroscience credibility claim.

How we address it: We design PoCs with blind comparisons (PoC 1) and measurable proxies (PoC 2 pace/power data). We never claim medical outcomes. We position as performance infrastructure, not therapy. The standard we must meet is: *users prefer DeepMade and return to it*. That is a product success, not a clinical trial.

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05 The Product

Session States

DeepMade organises the user experience around six distinct session states, each with a defined neurological target and

synthesis profile:

Session State	Neurological Target & Synthesis Approach
Moving	Auditory-motor sync at target cadence. Beta/gamma entrainment. Tempo tracks real-time HR and stride. Modes: rowing, running, walking, cycling.
Recovering	Alpha entrainment. Parasympathetic activation. Respiratory pacing at 4-6 breaths/minute. HRV-responsive intensity.
Sleeping	Full sleep cycle support from onset through wake (see Sleep Mode detail below).
Focusing	Beta entrainment with gamma micro-bursts. Sustained attention support. Cognitive load optimised.
Working	Alpha-beta boundary. Flow state induction. Adaptive to time of day.

Sleep Mode Architecture

Sleep is a first-class feature, not an afterthought. The synthesis engine supports full overnight sessions that follow natural ultradian rhythms:

Session Type	Duration	Phases	Target Use
Quick Drift	15 min	Unwind > Descend > Drift	Fast sleep onset for good sleepers
Gentle Descent	30 min	Settle > Release > Descend > Drift	Extended transition for anxious minds
Deep Preparation	45 min	Arrive > Settle > Release > Descend > Drift	Full relaxation sequence
6 Hour Sleep	6 hr	Onset + 4 cycles (Light > Deep > REM) + Wake	Complete night with gentle wake
7.5 Hour Sleep	7.5 hr	Onset + 5 cycles + Wake	Full ultradian rhythm support

Sleep cycle structure: Each 90-minute cycle progresses through light sleep (N1/N2), deep sleep (N3/SWS), and REM, with entrainment frequencies matched to each stage: - **Onset**: 8-10 Hz alpha descending to 4-5 Hz theta - **Light sleep**: 6-8 Hz theta/alpha boundary - **Deep sleep**: 1-2 Hz delta (lowest intensity, tissue repair and memory consolidation) - **REM**: 4-5 Hz theta (slightly elevated intensity for dream state support) - **Wake**: Gradual ascent through 8 Hz alpha to 11+ Hz beta

The audio adapts across the night: earlier cycles have longer deep sleep phases; later cycles have extended REM. Wake sequences begin 10-15 minutes before target wake time with graduated intensity increases.

The Five-Layer Synthesis Architecture

Each session is generated in real time from five independent synthesis layers, mixed dynamically in response to biometric inputs and session state:

Layer	Function
Layer 1 — Foundation	Low-frequency drone or tonal base. Sets the key and harmonic centre. Establishes the neurological anchor frequency.
Layer 2 — Rhythmic Engine	Tempo and pulse layer. Drives auditory-motor sync for movement. Adapts BPM to cadence input in real time.
Layer 3 — Entrainment	Binaural beat or isochronic tone layer, tuned to target brainwave state. Sits beneath conscious perception.
Layer 4 — Texture	Generative ambient and harmonic material. Provides musical interest and prevents listener fatigue. Evolves slowly over session.
Layer 5 — Dynamics	Real-time intensity and density modulation driven by biometric data. Heart rate, HRV, and movement intensity shape the mix.

Platform Strategy

DeepMade is being built as a React Native application targeting iOS and Android simultaneously. The development sequence is:

- Browser PoC using Tone.js to validate synthesis architecture without native overhead
- React Native shell with Tone.js WebView as first mobile form
- Native audio engine integration for background playback and low-latency biometric response
- Apple Watch standalone app with audio generated on-wrist, fully independent from iPhone
- BLE wearable integration for Garmin, Polar, Wahoo heart rate straps

Native Audio Engine Architecture

The browser-based PoC demonstrates synthesis viability, but production deployment requires a native audio engine. The performance advantages are significant:

Capability	Web Audio API	Native Engine (AVAudioEngine / Oboe)
Latency	20-50ms typical	<10ms achievable
Background playback	Limited/blocked	Full support
System integration	None	Lock screen, CarPlay, Siri
Biometric sampling	Polling required	Push notifications available
CPU efficiency	JavaScript overhead	Metal/GPU acceleration

Why latency matters for biometric responsiveness: At 180 BPM running cadence, each stride is 333ms. A 50ms audio latency means the beat arrives 15% late—perceptible and disruptive. At <10ms native latency, audio feels instantaneous and the motor synchronisation loop tightens.

Synthesis capabilities at native level: - **Granular synthesis**: Real-time granular processing with thousands of grains for organic texture evolution - **Physical modeling**: Computationally expensive but produces more natural-sounding timbres than additive synthesis - **Spectral processing**: FFT-based manipulation for psychoacoustic optimisation - **Multi-channel rendering**: Spatial audio, ambisonic encoding, binaural rendering

Background operation: Web Audio suspends when backgrounded on iOS. Native engines continue generating audio during screen-off, app-switch, and notification states—critical for a product designed for physical activity.

The native engine roadmap: 1. **iOS**: AVAudioEngine with AudioUnit processing chain 2. **Android**: Oboe library for low-latency audio across device fragmentation 3. **Apple Watch**: AVAudioEngine in watchOS for fully on-wrist generation 4. **Cross-platform**: C++ audio core with platform-specific bindings

Spatial Audio Opportunities

Modern headphones (AirPods Pro, Sony WF-1000XM series, others) support head-tracked spatial audio. This opens psychoacoustic opportunities beyond stereo:

The Forward Pull Effect

Positioning audio elements slightly ahead of the listener creates a subtle “pulling” sensation. Research in spatial audio perception shows that sounds originating from in front draw attention and suggest forward motion. For running and cycling, this can reinforce the sense of momentum.

Implementation approach: - Primary rhythmic elements positioned 15-30° forward of center - Binaural rendering via HRTF (Head-Related Transfer Function) - Head tracking maintains “forward” regardless of head position

Effort-Based Spatial Shift

As intensity increases, the soundscape can expand spatially: - **Warmup phase**: Audio concentrated in front, intimate staging - **Push phase**: Audio widens to 180° arc, enveloping presence - **Recovery**: Gradual narrowing back to centered, calming focus

This creates a physical sensation of “opening up” during high effort and “settling in” during recovery, reinforcing the physiological state through spatial perception.

Binaural Rendering Without Head Tracking

For devices without head tracking, static binaural rendering still provides: - Accurate left/right binaural beat delivery (critical for entrainment layer) - Sense of depth and space superior to stereo panning - Forward/behind positioning for rhythmic elements

Technical Requirements

- HRTF dataset (MIT KEMAR or custom measurements)
- Real-time convolution engine for binaural rendering
- Head tracking API integration (CoreMotion on iOS, equivalent on Android)
- Fallback to static binaural for unsupported devices

The DeepMade Sonic Signature

DeepMade requires an iconic audio signature—a 2-3 second sonic identity that introduces every session. This serves both brand recognition and neurological priming functions.

The Science of Sonic Branding

Research into audio logos reveals consistent patterns across the most successful examples:

Brand	Duration	Notes	Key Characteristics
Intel	3 sec	5	D-major, ascending, resolved
Netflix	3 sec	2	“Ta-dum” with tension/release
Mastercard	3 sec	4	Melodic, resolved on root
Nokia	2.5 sec	13	Melodic phrase from Gran Vals

Key design principles identified: 1. **Duration**: 2-3 seconds optimal—long enough for recognition, short enough for frequent use 2. **Note count**: 3-5 notes balances memorability with distinctiveness 3. **Interval choice**: Perfect fifth (3:2 ratio) universally perceived as stable and pleasing 4. **Resolution strategy**: Traditional logos resolve to root; *incomplete* patterns create anticipation (Zeigarnik effect)

The Zeigarnik Opportunity

The Zeigarnik effect describes how incomplete patterns are remembered better than completed ones. An audio signature that *doesn’t quite resolve* creates subconscious anticipation—the brain seeks completion. For a session introduction, this primes the listener for what follows rather than providing premature closure.

Applied to DeepMade: The signature ends on a note that implies continuation (major 2nd above root) rather than resolving to root. The session itself becomes the completion.

The DeepMade Signature Design

The implemented signature follows these specifications:

- **Duration**: 2.5 seconds
- **Notes**: 4 (Root → Fifth → Octave → Major 2nd)
- **Root frequency**: 180 Hz (between G3 and G#3, avoiding specific key associations)
- **Timbre**: Layered synthesis—pure sine (clarity) + triangle harmonic (warmth) + sub-bass (depth) + attack transient (organic onset)
- **Character**: Expansive, ascending, anticipatory—suggests preparation for performance
- **Resolution**: Does not resolve—ends on major 2nd for Zeigarnik anticipation

The signature is currently implemented in the browser PoC and plays at session start. Future refinements may include: - Subtle personalisation (different timbres for different session types) - Spatial rendering (signature expands from center to surround) - Haptic pairing for Apple Watch (vibration pattern synchronized to audio)

Brand Value of Audio Identity

Mastercard’s sonic branding development reportedly took 2 years and involved testing across cultures, contexts, and formats. The investment reflects audio identity’s strategic value: every session start, every notification, every app launch reinforces brand recognition through a channel competitors cannot easily replicate.

DeepMade’s signature is designed to work across: - Session introduction (full signature) - Notifications (abbreviated 2-note version) - Phase transitions (textural echo of signature intervals) - Marketing content (recognizable audio watermark)

Data Collection for Efficacy

The synthesis engine is designed with efficacy measurement built in. Real-time audio parameters are displayed to users, and data collection requirements are defined for each mode:

Sleep Mode Data Requirements

Category	Metrics	Availability
Biometric Inputs	HR, HRV, Movement, Breathing Rate, SpO2, Skin Temp, Sleep Stage	HR/HRV/Movement available now via HealthKit; Sleep Stage requires Watch integration
Outcome Metrics	Time to sleep onset, Wake episodes, Time in deep sleep, Time in REM, Sleep efficiency %, Morning HRV, Morning resting HR, Subjective quality rating	Derivable from available biometrics + user input
Learning Signals	Optimal onset Hz curve, Personal cycle length, Deep sleep timing preferences, Wake window sensitivity, Volume threshold, Chronotype adjustment	Requires longitudinal data collection

Activity Mode Data Requirements

Category	Metrics	Availability
Biometric Inputs	HR, HRV, Cadence/Pace, Movement, Power/Watts, GPS	HR/HRV/Cadence/Movement available now; Power requires compatible sensors
Outcome Metrics	Avg HR per phase, Cadence lock %, Perceived effort (RPE), Performance vs target, Post-session HRV	Derivable from available biometrics + user input
Learning Signals	Optimal tempo lead rate, Intensity response curve, Phase duration preferences, Warmup length optimization, Peak HR correlation	Requires longitudinal data collection

Recovery Mode Data Requirements

Category	Metrics
Biometric Inputs	HR, HRV, Breathing Rate, Skin Temp
Outcome Metrics	HRV recovery rate, HR recovery curve, Time to baseline, Subjective relaxation rating
Learning Signals	Optimal breath rate, Best entrainment Hz, Session length preference

Data availability key: - Available now via HealthKit/Health Connect - Planned integration (native app) - Critical for feature (blocks functionality without it)

The PoC displays a real-time “Current Sound Profile” panel showing entrainment Hz, brainwave band, filter frequency, waveform type, intensity, and tempo/breath rate. A “Data Collection for Efficacy” panel shows context-aware data requirements that change based on mode (sleep vs activity).

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06 Development Work to Date

DeepMade is currently in active early development. The following has been completed or is in progress:

Completed

- Brand identity established as DeepMade.ai. Domains deepmade.ai and deepmade.com registered.
- Product concept fully developed with detailed neuroscience grounding across all five session states.
- Three session state identities defined: Carry Me (recovery/relax), Drive Me (steady performance), Push Me (high intensity).
- Five-layer synthesis architecture designed and specified.
- Comprehensive competitive and scientific research conducted (this document).
- Cinematic stealth website deployed on AWS Lightsail infrastructure.
- Development infrastructure in place: Brainv2 AWS Lightsail server (Ubuntu, 4GB RAM), Claude Code for remote development.

In Progress

- Web Audio API browser PoC deployed at deepmade.ai/POC-Audio, implementing full six-layer synthesis architecture across **six modes** (Rowing, Running, Walking, Cycling, Recovery, Sleep).
- **Sleep mode fully implemented** with 5 session types:
  - Quick Drift (15 min), Gentle Descent (30 min), Deep Preparation (45 min)
  - Full night sessions: 6 Hour Sleep (4 cycles), 7.5 Hour Sleep (5 cycles)
  - Sleep cycle architecture: onset > light > deep > REM phases with matched entrainment frequencies
- Advanced synthesis features implemented:
  - **Pink noise (1/f) generation** for natural, fractal texture evolution
  - **Respiratory entrainment** for recovery and sleep sessions (breath-paced volume swells at 4-6 breaths/minute)
  - **Leading tempo** feature allowing audio to gradually pull user toward target cadence
  - **Harmonic progression** with phase-specific timbral shifts (consonant warmup > dissonant push > resolved cooldown)
  - **Mode-specific nature textures**: water sounds with oar stroke cycle (rowing), breath-synced wind (running), forest with birds and crickets (walking), air rush with drivetrain hum (cycling), rain with drops (recovery/sleep)
  - **DeepMade Sonic Signature**: 4-note audio logo (Root > Fifth > Octave > Major 2nd) with layered synthesis, plays at session start for neurological priming and brand recognition
  - **Convolution reverb** with synthetic impulse response for depth and space
  - **HRTF spatial audio** positioning rhythm layer ahead of listener for forward pull effect
  - **Stereo widening** via Haas effect for expansive soundstage

- **Real-time Sound Profile panel** displaying: entrainment Hz, brainwave band, filter frequency, waveform, intensity, tempo/breath rate, and descriptive explanation of current audio function
- **Data Collection for Efficacy panel** with context-aware metrics that change based on mode (sleep vs activity)
- Stacked mechanisms approach validated in synthesis architecture: auditory-motor sync, arousal modulation, brainwave entrainment, respiratory pacing, and texture evolution operating simultaneously.
- Native audio engine architecture documented: AVAudioEngine (iOS), Oboe (Android) for <10ms latency and background playback.
- Spatial audio opportunities identified: head-tracked forward pull effect, effort-based spatial expansion, binaural rendering for enhanced immersion.

Next Steps

- Complete Tone.js browser PoC with movement session (Drive Me / Push Me states)
- Informal listening test against Endel with blind comparison across 5–10 participants
- BLE heart rate integration for real-time cadence and HR input
- React Native application shell

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07 Why DeepMade is Different

1. Built for Performance, Not Passivity

Every existing product in this space is designed for people sitting still. Endel is for your desk. Brain.fm is for your desk. DeepMade is the first generative audio product designed specifically around physical and cognitive performance states: training, deep work, recovery, sleep. The session state architecture reflects how humans actually move through their day.

2. Real Biometric Responsiveness

Endel accepts heart rate as an input but treats it as ambient context. DeepMade uses biometric data as the primary driver of real-time synthesis. When your heart rate climbs during exercise, the rhythmic layer accelerates and the intensity layer responds. When recovery begins, the synthesis shifts. The music is a direct reflection of your physiology, not a playlist that happens to know your heart rate.

3. Premium Design Intentionality

The functional audio category suffers from uniformly poor product aesthetics. Brain.fm sounds like a tool. Endel sounds pleasant but generic. DeepMade is being built with the same design seriousness as the best wearable technology. Every sonic decision is intentional, every interaction is considered. The product should feel as desirable as Whoop or Oura, not as functional as a white noise machine.

4. The Science as Architecture, Not Marketing

Most consumer products in this space use binaural beats as a marketing claim, a buzzword on the App Store listing, rather than a core design principle. DeepMade’s entrainment layer is engineered to specific neurological targets for each session state, using the same frequency protocols validated in clinical settings. The difference between an 8 Hz alpha target and a 20 Hz beta target is not cosmetic. It is the difference between a relaxation session and a focus session, built into the synthesis itself.

5. The Hardware Ecosystem is Ready

LUCID’s clinical path targets a small, high-friction market. Existing functional audio apps ignore the half-billion people wearing biometric sensors daily. DeepMade targets healthy, performance-oriented consumers: athletes, knowledge workers, students, anyone seeking an edge in how they perform and recover. The total addressable market spans wellness, fitness, productivity, and sleep, each a multi-billion dollar category. And critically, the biometric hardware is already on their wrists.

6. Soundscapes vs Traditional Music

Traditional music is popular for exercise and focus, but any performance benefit is accidental. A song might happen to have the right BPM for your running cadence. A familiar track might trigger memory associations that improve mood. These effects are real but unintentional, inconsistent, and impossible to optimise.

More critically, traditional music comes with structural constraints that make it unsuitable for adaptive performance audio:

Licensing is prohibitively complex. Every song involves multiple rights holders (composition, recording, publishing), each requiring separate negotiation. Streaming services spend billions annually on licensing. For a startup, the legal and financial overhead of music licensing is a distraction from the core technology problem.

Adaptation doesn't scale. Some products layer secondary audio (binaural beats, tempo adjustments) over licensed recordings. This approach is fundamentally limited. You cannot meaningfully adapt a finished recording to real-time biometric input without degrading it. The song was mixed for aesthetic purposes, not physiological ones. Layering entrainment frequencies on top creates interference, not integration.

The artist is the bottleneck. Every licensed track requires someone to have written, recorded, and cleared it. DeepMade's generative engine produces unlimited original material tuned to specific physiological targets. There is no catalogue to exhaust, no back-catalogue licensing deal to negotiate, no dependence on external creative supply chains.

The Copyright Holder Opportunity

An intriguing strategic question: can DeepMade participate in traditional music distribution as a copyright holder rather than a licensee?

Generative audio that DeepMade creates is original work. Under current copyright frameworks, the entity that directs the creative process (selects parameters, curates outputs, makes aesthetic decisions) holds rights to the resulting material. DeepMade could generate curated "albums" or "playlists" of standalone soundscapes, register them as original works, and distribute through Spotify, Apple Music, and other streaming platforms.

This inverts the typical music tech relationship. Instead of paying for content, DeepMade earns from it. Instead of negotiating with labels, DeepMade becomes a micro-label. The brand built through the performance app creates demand; the streaming presence generates passive revenue and additional discovery.

This is not core to the immediate product roadmap, but it represents a potential revenue diversification and brand extension once the primary synthesis engine is proven and the DeepMade brand has recognition among performance-oriented listeners.

7. Iconic Audio Brand Identity

Most apps have visual logos. DeepMade has a sonic signature—a 2.5-second audio mark that introduces every session. This serves dual purposes:

Neurological priming: The signature prepares the brain for the session ahead. The ascending contour and deliberate non-resolution (ending on major 2nd rather than root) creates anticipation via the Zeigarnik effect. The user's brain seeks completion—which the session provides.

Brand recognition: Intel, Netflix, and Mastercard have proven that audio logos create instant recognition across contexts. DeepMade's signature is designed to be as recognizable on a podcast ad as at session start. Every use reinforces the brand in a channel competitors cannot easily replicate.

The signature is not an afterthought. It is engineered with the same psychoacoustic intentionality as the synthesis engine itself: specific frequencies, layered timbres, calculated intervals. This attention to sonic identity mirrors DeepMade's broader commitment to audio that is *made* with purpose, not generated by accident.

POSITIONING: Apple proved people will wear sensors. Whoop proved athletes will pay for performance data. Endel and Brain.fm proved people will pay for functional audio. DeepMade is what happens when you connect these pieces: real-time biometric data driving premium generative audio, designed for the way performance-oriented humans actually live.

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08 Proof of Concept Roadmap

The PoC sequence is designed to prove three things in order: the synthesis quality exceeds existing alternatives; the biometric loop produces a measurable effect on human performance; and users return habitually. Each stage builds evidence for the next and maps to a fundraising or partnership moment.

PoC 1 — Sound Quality Bar

Can we make something that sounds meaningfully better than Endel?

The Tone.js browser PoC currently in development. Build two 20-minute movement sessions (one at 160 BPM target, one at 140 BPM) and conduct blind listening tests against Endel equivalents with 5–10 participants.

This is not yet a neuroscience test. It is a quality and desirability test. The question is whether DeepMade sounds premium, intentional, and different, not just functional.

SUCCESS METRIC: 7 out of 10 listeners prefer DeepMade over Endel in a blind listening test.

PoC 2 — The Movement Loop

Does biometric input change the experience in a perceptible and measurable way?

The flagship PoC. Integrate Apple Watch or phone accelerometer for cadence input, plus BLE heart rate from any compatible device. The synthesis engine shifts BPM and intensity layer in response. Run 10 participants over the same activity three times: audio off, Endel, and DeepMade with live biometric input.

Measure performance metrics, Rate of Perceived Exertion (RPE), and subjective enjoyment. Physical activity is the ideal PoC context because the biometric feedback loop is immediately legible. You can feel the audio responding to your movement.

SUCCESS METRIC: Average RPE lower with DeepMade than Endel at equivalent effort, or performance higher at equivalent RPE. Even directional results from 10 participants constitute significant evidence.

PoC 3 — Session State Architecture

Does the same engine produce genuinely distinct experiences across all five states?

Once movement is validated, build one session each for Sleep, Focus, Relax, and Study using the same synthesis architecture but different parameter profiles. This is not a full product build. It is proof that the engine generalises without the experiences bleeding into each other.

SUCCESS METRIC: 10 users can correctly identify which state a session is designed for without being told.

PoC 4 — Retention Signal

Will people actually come back?

Wrap the movement PoC in a minimal React Native shell. Release to 50 users for four weeks with open access. Track session completion rate and weekly return rate. This is the hardest PoC and the one that determines whether DeepMade is a product or a demo.

SUCCESS METRIC: 40% or more of users complete at least one session in week 3 of the trial.

Development Timeline

Phase	Milestones
Now — Q2 2026	Tone.js browser PoC. Sound quality validation. Informal blind listening tests. Iterate on synthesis until audio quality bar is confirmed.
Q3 2026	Movement PoC with BLE heart rate integration. 10-person informal trial. RPE and performance data collected. Synthesis parameters refined based on real feedback.
Q4 2026	Generalise to Sleep and Focus sessions. React Native shell. Closed beta of 50 users. Retention data collected. Fundraising or partnership conversation begins.
H1 2027	Full five-state product. Apple Watch native integration. Proper biometric onboarding. Public launch with movement as the hero use case.

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09 The Investor Narrative

The music tech funding landscape in 2024–2025 has shifted toward companies that work with the industry rather than disrupting it, and toward products with proven revenue models. DeepMade sits at the intersection of two well-funded categories (functional audio and health/wellness tech) while occupying a position neither has claimed.

The Market Context

- Music tech startups raised over $700M in H1 2025 alone.
- The functional audio market (Endel, Brain.fm) has proven consumer willingness to pay subscription prices for audio performance tools, though neither has achieved mainstream scale.
- The wellness wearables market (Whoop, Oura, Garmin) has demonstrated that performance-oriented consumers will invest significantly in tools that optimise their physiology. Whoop alone has raised $400M+.
- Over 500 million consumers now wear devices capable of streaming real-time biometric data.
- Generative AI in music is projected to grow from $440M in 2023 to $2.79B by 2030.

The Strategic Frame

DeepMade does not require music licensing, does not compete with labels, and does not generate content that displaces human artists. It generates original synthesis in real time from a parametric engine, a fundamentally different model from Suno or Udio. This sidesteps the entire rights management problem that has consumed the generative music category.

The moats are: the synthesis architecture and its biometric integration layer; the clinical science underpinning each

session state; and, once established, the community and habitual use patterns of a performance-oriented user base.

THE PITCH: Half a billion people wear biometric sensors. Whoop proved they'll pay for performance insights. Brain.fm proved they'll pay for functional audio. Nobody has connected these: using real-time biometric data to drive audio that actually responds to your physiology, designed for active performance rather than passive listening. DeepMade is that product.

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10 Intellectual Property Strategy

The Existing Patent Landscape

The functional audio space has established patent activity. Understanding what is already protected—and what is not—is essential for DeepMade's IP strategy.

Endel's Patent Portfolio

Endel Sound GmbH has filed at least 8 patents. Their primary patent application (US20200142371, filed 2019) covers:

- System and method for creating personalized user environment based on sensor inputs
- Automatic adaptation to time of day, weather, heart rate, and location
- Methodology based on circadian rhythms, pentatonic scale, and sound masking
- Generation based on user profile, mode, state, and context

Key observation: Endel's patent focuses on *passive contextual adaptation*—the environment responds to ambient conditions and physiological state. It does not cover *active performance mechanisms* or the specific innovations DeepMade is developing for athletic and cognitive performance contexts.

Binaural Beats Prior Art

Binaural beat technology itself is well-established prior art and cannot be patented. Key foundational patents include:

- US5,213,562 (1993): Method of inducing mental, emotional and physical states through binaural beats
- US5,356,368 (1994): Method and apparatus for inducing desired states of consciousness
- US10,029,066 (2018): Audio apparatus for inducing brainwave using binaural beat

What *can* be patented: novel methods of generating, combining, or applying binaural beats in specific ways tied to biometric feedback or performance contexts.

Brain.fm Position

Brain.fm has patents covering their specific neural phase-locking approach to focus audio. Their IP is oriented toward desk-based productivity rather than physical performance.

DeepMade's Novel Innovations

The following innovations appear to be novel and not covered by existing patents. These represent DeepMade's potential IP position:

1. Leading Tempo Method

What it is: Audio tempo that *gradually pulls* the user toward a target cadence rather than simply matching current cadence.

Why novel: Existing adaptive audio matches user state. Leading tempo actively influences user state by incrementally shifting BPM (e.g., 2-3 BPM per minute) to guide the user toward optimal performance cadence.

Claims territory: Method for modifying human movement cadence through progressive tempo adjustment in real-time generated audio, using biometric feedback to calibrate pull rate.

2. Stacked Mechanisms Synthesis Architecture

What it is: A synthesis engine that simultaneously applies multiple entrainment and performance mechanisms, weighted dynamically based on real-time biometric input.

Why novel: Existing products apply single mechanisms (binaural beats OR tempo matching OR ambient sound). DeepMade's architecture layers 6+ mechanisms (auditory-motor sync, arousal modulation, brainwave entrainment, respiratory pacing, attentional capture, texture evolution) with real-time weighting based on physiological state.

Claims territory: System for generating performance-optimized audio through concurrent application of multiple neurological entrainment mechanisms, with dynamic weighting determined by continuous biometric feedback.

3. Effort-Based Spatial Audio Expansion

What it is: Soundscape spatial field that expands and contracts based on exercise intensity.

Why novel: Spatial audio is typically static or head-tracked for realism. This innovation uses spatial positioning as a *performance mechanism*—widening the sound field during high effort to create sensation of "opening up" and narrowing during recovery for calming focus.

Claims territory: Method for modulating spatial audio field geometry based on physiological effort metrics to enhance perceived performance state.

4. Forward-Pull Spatial Positioning

What it is: Positioning primary rhythmic elements 15-30° ahead of the listener to create forward momentum sensation.

Why novel: Spatial audio typically aims for neutral or realistic positioning. This deliberately positions sound ahead to psychoacoustically reinforce forward movement during running, cycling, and rowing.

Claims territory: Method for enhancing perceived forward momentum through anterior spatial positioning of rhythmic audio elements during locomotion activities.

5. Cadence-Locked Movement Phase Synthesis

What it is: Rhythmic audio patterns tied to specific phases of movement cycles (rowing stroke: catch, pull, release; running gait: footstrike, flight).

Why novel: Existing tempo-matched audio provides steady beats at target BPM. This innovation creates rhythmic textures that align with the *phases within* each movement cycle, reinforcing motor patterns at the micro-timing level.

Claims territory: System for generating audio synchronized to discrete phases within human movement cycles, using motion sensor data to identify and align with individual movement components.

6. Phase-Based Harmonic Progression

What it is: Harmonic content that shifts from consonant (warmup) to dissonant (push) to resolved (cooldown) based on workout phase.

Why novel: Existing adaptive audio adjusts tempo and intensity. This innovation uses harmonic tension as a performance lever—dissonance during peak effort creates productive tension; resolution during cooldown facilitates parasympathetic activation.

Claims territory: Method for modulating harmonic consonance in generated audio based on exercise phase to optimize physiological state transitions.

7. Zeigarnik Audio Priming

What it is: Session introduction audio signature designed with deliberate non-resolution to create neurological anticipation.

Why novel: Audio logos typically resolve to tonic for completion and satisfaction. This innovation applies the Zeigarnik effect (incomplete patterns create anticipation) to session introductions, priming the brain for the session that follows.

Claims territory: Method for neurological session priming through audio signature with intentional harmonic non-resolution.

Recommended Patent Strategy

Phase 1: Provisional Applications (Q2 2026)

File provisional patent applications for the three highest-value innovations:

1. **Leading Tempo Method** — Strongest differentiation from Endel; directly addresses active performance vs passive adaptation
2. **Stacked Mechanisms Architecture** — Covers the core synthesis engine; broadest protection
3. **Effort-Based Spatial Audio** — Novel spatial audio application; emerging hardware support (AirPods Pro, etc.)

Cost: ~$1,000 total ($320 filing fee each) **Protection**: 12-month "patent pending" status; establishes priority date

Phase 2: Prior Art Search (Q3 2026)

Commission professional prior art searches for provisional applications before converting to non-provisional. This identifies potential conflicts and strengthens final claims.

Cost: $1,500-3,000 per application

Phase 3: Non-Provisional Filing (Q1 2027)

Convert strongest provisionals to full patent applications. Timing aligned with product launch and potential fundraising.

Cost: $15,000-25,000 per application (including attorney fees) **Timeline**: 2-4 years to grant

Additional IP Considerations

Trade secrets: The specific parameter values, weighting algorithms, and synthesis recipes may be better protected as trade secrets than patents. Patents require public disclosure; trade secrets do not.

Trademarks: “DeepMade” and the sonic signature should be registered as trademarks. The audio logo can be registered as a sound mark (see Intel, Netflix precedents).

Defensive publication: For innovations we choose not to patent, defensive publication establishes prior art and prevents competitors from patenting the same concepts.

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