kalmoa

How Kalmoa works

The technology in plain language, and the science it stands on.

Kalmoa reads how you are doing mentally and emotionally from your own body, not from a questionnaire. You wear a comfortable headset for about five minutes, and the Kalmoa app turns that short scan into a clear, readable picture of your mental wellbeing. This document explains how that works, and then walks through the established science it is built on.

Part 1 · How the technology works

Most wellbeing tools ask you how you feel and trust your answer. The problem is that we are not always reliable narrators of our own state: we talk ourselves up on a bad day, or brush off strain we have gotten used to. Kalmoa takes a different route. It **measures the body directly**, so the result cannot simply be talked up or down the way a questionnaire can.

Under the hood, Kalmoa works in three steps.

1 Scan	2 Engine	3 Report
The app shows specific images and the headset plays a structured sound sequence and measures how your brain-body system responds.	That response is compared against a large reference model to find relevant patterns	The findings become the clear, personal Deep Report and Well-Being Index in the app.

The scan: gently asking your body a question

Your brain is in constant, two-way conversation with your body: it is always quietly reading signals from your heart, lungs, gut and muscles. Most of that traffic happens on a subconscious level, yet it shapes whether you feel calm or on edge, energetic or drained. Kalmoa listens in on that conversation. During the scan, the headset plays a carefully structured sequence of sounds whilst you are looking at the scan app that shows specific images to trigger a brain response. Think of each sound and image as a gentle *question* to the brain-body system. Inside the headset, a small, reproducible reference white noise field is generated; as your system responds to the sounds and images, it subtly changes that field, and the pattern of those changes is the data.

This is not a medical scan. Kalmoa does not perform an ECG, EEG or MRI, and it is not looking for anything anatomical. It is non-invasive and comfortable: no needles, no lengthy testing. It simply observes *how* your system reacts to a set structure of prompts.

The engine: one line means little, the pattern means a lot

The scan data is sent to the Kalmoa cloud engine. On its own, a single reading says almost nothing. Meaning comes from comparison. The engine holds a reference model built on **more than 40,000 reference scans**, and rather than reading any one scan result in isolation, it evaluates your whole pattern: where it deviates from the norm, which deviations actually matter, and how the pieces fit together. Our system compares your patterns to all the others and from that pattern recognition it can accurately find similar pattern complexes. These similarities are the basis of the content for the Deep Report and WBI.

The report: your Wellbeing Index, in plain language

Finally, the findings become a report you can actually read and understand. It is more than a single score. It is organized around a **Wellbeing Index**, a profile across seven dimensions of psychological functioning that gives an at-a-glance picture of where you stand. Around that profile, the report goes deeper in three layers:

The current picture: how you are functioning right now, in plain words, so both your strengths and your points of strain become visible.

Underlying themes and patterns: the recurring tensions or ways of coping that help explain how you arrived where you are, and what tends to keep you there.

Directions for support: concrete focus points matched to your pattern, meant as a starting point for reflection, not a fixed prescription.

Modern AI LLM is used only in this last layer, to turn the findings into clear, well-written text adapted to you. It is a communication tool, not the science: the substance always comes from the measurement and the comparison with the reference model.

A simple way to picture it

Think of a music-recognition app like Shazam. It does not understand a song by analyzing one note. It captures a *pattern*, compares that pattern against a huge database, and returns the most likely match. Kalmoa works at a far more complex level, but the logic is the same: capture a structured response pattern, compare it against a large reference model, and translate the best-matching patterns into meaningful language. And just as Shazam gets sharper with a bigger, cleaner music library, Kalmoa gets sharper as its reference base grows.

One thing to be clear about: Kalmoa is a **decision-support tool**, not a diagnosis. It does not read your thoughts or replace professional judgement. It gives you, and any professional you choose to involve, a fast and structured view of your inner dynamics: a better starting point for a conversation, not the final word.

kalmoa

Part 2 · The science it stands on

Kalmoa does not rest on a single new or untested idea. It stands on five separate fields of science, each developed independently over decades and each supported by peer-reviewed research. The interesting part is **convergence**: many different research groups, using very different methods, keep pointing the same way. Here are the five pillars, each in plain terms with a real-life example.

1. Interoception: your body is always talking

Interoception is the brain's sense of your body's internal state, the inward-facing counterpart to sight and hearing. It reports on your heartbeat, breath, gut and muscle tension, mostly below conscious awareness, yet it colors everything you feel. Over the past two decades researchers have tied this sense directly to emotion: how accurately someone can feel their own heartbeat, without checking their pulse, relates to how vividly they experience and regulate emotion (Garfinkel et al., 2015; Craig, 2002; Critchley et al., 2004). A recent review concludes emotional experience is intimately tied to interoception (Greenwood and Garfinkel, 2025), and this internal signaling is measurably disturbed in anxiety, depression and post-traumatic stress, where the brain-body conversation becomes noisy or muted (Critchley and Garfinkel, 2017; Quadt et al., 2018; Khalsa et al., 2018).

> **In real life:** *You walk into a room and feel that something is off before you can put it into words. That is interoception at work: your body registered the tension before your conscious mind caught up.*

2. The predictive brain: probing beats watching

The old picture of the brain was a camera passively recording the world. Modern neuroscience says almost the opposite: the brain is a prediction machine, constantly guessing what is about to happen inside and outside the body and adjusting in advance, a forward-looking regulation called allostasis. When reality does not match the prediction, that mismatch is exactly what the brain learns from (Barrett and Simmons, 2015; Friston, 2010; Seth and Friston, 2016; Seth, 2013). Emotions, in this view, are the brain's best interpretation of the body's state in a given moment, assembled from bodily signals plus memory and expectation (Barrett, 2017). The practical lesson: if the brain and body form an active, self-correcting loop, watching them only at rest tells you little. You learn far more by gently challenging the system and watching how it responds and settles, which is precisely what the Kalmoa scan does.

> **In real life:** *To understand how a car really runs, you do not just look at it parked. You start the engine and listen to how it responds. A gentle, structured prompt reveals what quiet observation never would.*

3. Emotions leave a bodily signature

Emotions are not only felt in the head; they are written into the body in consistent, recognizable ways. Antonio Damasio put this on the map with his somatic marker hypothesis: bodily states carry emotional meaning and even steer our decisions, often before we are aware of them (Damasio, 1996). The strongest evidence came later, from very large studies that asked thousands of people, across cultures as different as Finland and Taiwan, where in their body they feel each emotion. The resulting body maps were strikingly similar everywhere: anger, fear, love and joy each activate the body in their own characteristic pattern, largely independent of language or culture (Nummenmaa et al., 2014; Volynets et al., 2020). Underneath those felt maps sits measurable physiology: the autonomic nervous system shifts in structured, repeatable ways as emotions change (Kreibig, 2010), and those signatures fade or blur in conditions like depression. Because emotional states leave organized signatures rather than random noise, they can be recognized as patterns. Pattern recognition works when there is a genuine pattern to find.

> **In real life:** *Anger warms the chest and hands; fear drains the limbs and knots the stomach. People describe the same physical maps whether they grew up in Helsinki or Taipei.*

4. The brain and body respond to structured sound

Sound is one of the best-studied inputs in psychophysiology, the science of reading the body to understand the mind. Carefully chosen sounds reliably tilt the balance of the autonomic nervous system and change heart-rate variability, the small, healthy beat-to-beat variation that is one of the most sensitive everyday markers of how well someone is coping with stress (McConnell et al., 2014). The brain also synchronizes to musical structure, and music reliably evokes and shapes emotion through well-mapped brain systems (Koelsch, 2014). More surprising still: sound we cannot consciously hear, the very high-frequency components of natural sound, still changes brain activity and the body's automatic regulation, often without the listener noticing anything (Oohashi et al., 2000; Kuribayashi and Nittono, 2017; Jogasaki, Kawai, Nishina et al., 2025). Structured sound is a reliable, comfortable, non-invasive way to produce a measurable response in the brain-body system, which is exactly why Kalmoa uses it.

> **In real life:** *A piece of music gives you goosebumps, or a slow playlist quietly settles your breathing. You did not decide to react; your body responded to the sound on its own.*

5. Validated reference models: turning a number into meaning

The first four pillars explain why a scan can carry real information. The fifth answers the question that decides whether any such system is trustworthy: once you have measured someone, how do you know what the measurement means? The established answer, used throughout medicine, is comparison. You build a normative reference database, a large, well-characterized collection of measurements from many people, work out what the normal range looks like while accounting for factors like age and sex, and then express each new result as how far it sits from that norm. This is not new: decades ago an approach called neurometrics showed, in a paper in *Science*, that comparing a person's brain measurements against such a database could distinguish clinical conditions with high accuracy (John et al., 1988). The method was later given a rigorous statistical footing and validated to standards regulators accept (Thatcher et al., 2003; Thatcher, 2010). Kalmoa's reference model works on this principle, comparing your pattern against more than forty thousand reference scans. The larger and better-characterized that base, the sharper the comparison.

> **In real life:** *A body temperature of 37.5 means nothing on its own. It only becomes meaningful once you compare it to the normal range. A single scan works the same way: the reference base is what turns a reading into insight.*

The chain, seen together

These five pillars form one chain of reasoning. The body and brain are in constant two-way contact, so there is something real to measure. The brain actively regulates and predicts, so it can be probed rather than only observed. Emotional states leave organized bodily signatures, so there are genuine patterns to find. Structured sound is a reliable, non-invasive way to elicit those signatures. And comparison against a large reference base turns the measurement into individual meaning. None of these are speculative claims; they are well-established findings, produced independently by many research groups over decades, converging on a single conclusion: the body carries reliable, structured information about mental and emotional state, that information can be measured, and it can be turned into meaningful individual results. Kalmoa combines these established foundations into one integrated, practical assessment.

Responsible by design

Kalmoa is a decision-support tool, designed to inform human judgement rather than to diagnose, and it is built with privacy in mind. Its results are meant to be used alongside your own reflection and, where relevant, the expertise of a professional. Development is ongoing: Kalmoa keeps working with independent partners to strengthen the evidence base behind the platform.

Selected scientific references

Barrett, L. F. (2017). The theory of constructed emotion: an active inference account of interoception and categorization. Social Cognitive and Affective Neuroscience, 12(1), 1 to 23.

Barrett, L. F., and Simmons, W. K. (2015). Interoceptive predictions in the brain. Nature Reviews Neuroscience, 16(7), 419 to 429.

Craig, A. D. (2002). How do you feel? Interoception: the sense of the physiological condition of the body. Nature Reviews Neuroscience, 3(8), 655 to 666.

Critchley, H. D., and Garfinkel, S. N. (2017). Interoception and emotion. Current Opinion in Psychology, 17, 7 to 14.

Critchley, H. D., Wiens, S., Rotshtein, P., Ohman, A., and Dolan, R. J. (2004). Neural systems supporting interoceptive awareness. Nature Neuroscience, 7(2), 189 to 195.

Damasio, A. R. (1996). The somatic marker hypothesis and the possible functions of the prefrontal cortex. Philosophical Transactions of the Royal Society B, 351(1346), 1413 to 1420.

Friston, K. (2010). The free-energy principle: a unified brain theory? Nature Reviews Neuroscience, 11(2), 127 to 138.

Garfinkel, S. N., Seth, A. K., Barrett, A. B., Suzuki, K., and Critchley, H. D. (2015). Knowing your own heart: distinguishing interoceptive accuracy from interoceptive awareness. Biological Psychology, 104, 65 to 74.

Greenwood, B. M., and Garfinkel, S. N. (2025). Interoceptive mechanisms and emotional processing. Annual Review of Psychology, 76, 59 to 86.

Jogasaki, K., Kawai, N., Nishina, E., et al. (2025). Enhancing the regulatory function of the autonomic nervous system using sounds with inaudible high-frequency components. Scientific Reports, 15, 26820.

John, E. R., Prichep, L. S., Fridman, J., and Easton, P. (1988). Neurometrics: computer-assisted differential diagnosis of brain dysfunctions. Science, 239(4836), 162 to 169.

Khalsa, S. S., Adolphs, R., Cameron, O. G., et al. (2018). Interoception and mental health: a roadmap. Biological Psychiatry: Cognitive Neuroscience and Neuroimaging, 3(6), 501 to 513.

Koelsch, S. (2014). Brain correlates of music-evoked emotions. Nature Reviews Neuroscience, 15(3), 170 to 180.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: a review. Biological Psychology, 84(3), 394 to 421.

Kuribayashi, R., and Nittono, H. (2017). High-resolution audio with inaudible high-frequency components induces a relaxed attentional state without conscious awareness. Frontiers in Psychology, 8, 93.

McConnell, P. A., et al. (2014). Auditory driving of the autonomic nervous system: theta-frequency binaural beats increase parasympathetic activation and sympathetic withdrawal. Frontiers in Psychology, 5, 1248.

Nummenmaa, L., Glerean, E., Hari, R., and Hietanen, J. K. (2014). Bodily maps of emotions. Proceedings of the National Academy of Sciences, 111(2), 646 to 651.

Oohashi, T., Nishina, E., Honda, M., et al. (2000). Inaudible high-frequency sounds affect brain activity: the hypersonic effect. Journal of Neurophysiology, 83(6), 3548 to 3558.

Quadt, L., Critchley, H. D., and Garfinkel, S. N. (2018). The neurobiology of interoception in health and disease. Annals of the New York Academy of Sciences, 1428(1), 112 to 128.

Seth, A. K. (2013). Interoceptive inference, emotion, and the embodied self. Trends in Cognitive Sciences, 17(11), 565 to 573.

Seth, A. K., and Friston, K. J. (2016). Active interoceptive inference and the emotional brain. Philosophical Transactions of the Royal Society B, 371(1708), 20160007.

Thatcher, R. W., Walker, R. A., Biver, C. J., North, D. N., and Curtin, R. (2003). Quantitative EEG normative databases: validation and clinical correlation. Journal of Neurotherapy, 7(3 to 4), 87 to 121.

Thatcher, R. W. (2010). Validity and reliability of quantitative electroencephalography. Journal of Neurotherapy, 14(2), 122 to 152.

Volynets, S., Glerean, E., Hietanen, J. K., Hari, R., and Nummenmaa, L. (2020). Bodily maps of emotions are culturally universal. Emotion, 20(7), 1127 to 1136.