

A Naturalistic Account of Kundalini Practice, Interoception, and Contemplative Attention

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Abstract

Practitioners of kundalinī and haṭha yoga describe a central channel, the suṣumnā, along the body's midline, together with a family of techniques for drawing attention to it. Classical sources treat this channel as an instructional and experiential map rather than a dissected structure. This paper reads those practices naturalistically and makes a two-part claim. First, midline-directed attention paired with slow breathing that lengthens the exhale engages autonomic and attentional systems whose effects can be measured: a parasympathetic shift, changes in cortical activity associated with sustained attention, the recruitment of interoceptive awareness, and, with repetition, the structural change that ordinary neuroplasticity produces. The practice raises the amplitude and reach of an integrative, body-anchored signal. Second, that signal generates candidates rather than certainties, and its value depends entirely on the discrimination trained on top of it; the strength with which an insight is felt is not evidence of its truth. The paper gives this calibration problem its own treatment, names the practitioner term for its failure mode, and uses autism as a worked example, since the autistic interoceptive profile of heightened subjective sensibility alongside unreliable objective accuracy is the same loud, miscalibrated condition the practice is built to train. It reviews the individual and interpersonal benefits that make such training worth study. The account does not require the channel to be anatomical, and it does not reduce the tradition to physiology. It closes by arguing that a naturalistic reading lets contemplative technique be examined and used without metaphysical commitment, and without the reductive posture that has damaged earlier scholarly encounters with Indian tradition.

Keywords. kundalini; sushumna; interoception; interoceptive sensibility; contemplative practice; contemplative neuroscience; midline attention; interhemispheric coordination; neuroplasticity; autism; subtle body; shambhavi mudra; calibration; cognitive diversity.

1. Introduction

Yoga in its haṭha and kundalinī forms describes a subtle anatomy: channels, called nāḍī, through which a vital current is said to move, and a central channel,

the *suṣumnā*, running along the spine. Awakening is described as the rising of *kundalinī* through this central channel. No dissection has ever found the *suṣumnā*. This absence has been read in two opposite ways: as evidence that the tradition describes something non-physical, or as evidence that it describes nothing at all. The present paper takes a third position. The classical descriptions are read here as an experiential and instructional map, a set of directions for where to place attention and what tends to follow, rather than as anatomy. Read that way, the practices point to something the nervous system does, and that something can be studied.

The claim has two parts, and both are narrow. The first is that sustained attention to the body's midline, paired with breathing that lengthens the exhale, recruits autonomic and attentional systems whose activity can be measured, and that repeated practice changes the brain the way any repeated skill does. The second concerns what to do with what the practice produces. These methods raise the amplitude and reach of an integrative, body-anchored signal, the felt sense of insight, pattern, and connection that practitioners report. That signal is real and worth taking seriously. It is also uncalibrated, and the amplitude of a felt insight is no measure of its accuracy. Making use of the signal takes time and training laid on top of it, no matter how innately gifted the practitioner, and a central section of this paper is given to that problem.

Two commitments frame what follows, and the first is about respect. A naturalistic account of a mechanism is not a claim that the tradition is merely that mechanism. The map being usable does not shrink the territory, and to show that a signal can be trained is not to show that it is empty. Scholarship that has approached Indian contemplative traditions in a reductive register has caused real offense, most visibly in the reception of psychoanalytic readings of Hindu mysticism (Kripal, 1995). This paper declines that posture. The second commitment is that the discrimination these practices require is not a modern skeptic's addition to them; the traditions themselves carry it, under the heading of discernment, and the reading here recovers that emphasis rather than imposing it.

2. The Central Channel in Classical Yoga

The textual history of yoga's subtle body is well documented (Mallinson & Singleton, 2017). The *nāḍī* are counted in numbers ranging from the symbolic to the astronomical, and the three that recur are *iḍā* and *piṅgalā*, paired on either side, and *suṣumnā* at the center. The practices aim to still the side channels and draw the current into the central one. Across sources the *suṣumnā* is associated with centrality, balance, stillness, and the dissolution of the ordinary dualities of experience.

Recent scholarship cautions against treating any of this as one fixed system. Across its Sanskrit origins and its later global transmission, *kundalinī* has been a

plural phenomenon, a multiplicity of visions rather than a single authoritative model (Borkatky-Varma & Foxen, 2025). The history of modern practice compounds the point, since the postural and breath-centered yoga most readers know today was shaped as much by exchange with Western esoteric and harmonial currents as by direct descent from the classical texts (Foxen, 2020), to the degree that what counts as yoga is itself a contested modern question (Foxen & Kuberry, 2021). Reading the *suṣumnā* as an instructional map rather than a doctrine is consistent with this scholarship: there is no single correct anatomy to defend, only a recurring set of directions for attention and a recurring family of reported results.

These descriptions are instructional. They tell a practitioner where to direct attention and what sequence of felt states to expect. A useful comparison is the way a singer is taught to place the voice “in the mask” or the breath “in the diaphragm”; the instruction is anatomically loose and experientially precise, and it works. The *suṣumnā* functions in that register. It is a place to put attention, defined by where attention goes and by what happens when it stays there.

One technique is worth isolating, because it recurs and because it has a clear physiological reading. In *śāmbhavī mudrā* the eyes turn upward and inward toward the point between the brows while attention rests there. Classical sources frame it as a seal that gathers and steadies awareness. Its physical components, the convergence and elevation of the gaze held under steady attention, are ordinary and trainable, and their effects are taken up below.

3. What Midline Attention Does in the Nervous System

Breath and the autonomic shift

The most reliable physiological effect in this family of practices comes from the breath. Slow breathing, and in particular breathing in which the exhale runs longer than the inhale, biases the autonomic nervous system toward parasympathetic activity and raises heart-rate variability, a marker of vagal tone and of the capacity to recover from stress (Zaccaro et al., 2018; Gerritsen & Band, 2018). The brief retention and long exhale described in many of these practices are, mechanically, a way to produce that shift. A practitioner taught to hold the breath and feel the center is, among other things, down-regulating sympathetic arousal.

Interoception, the channel being trained

Much of what these practices cultivate is interoceptive: attention to the internal signals of the body, the breath, the heartbeat, the diffuse sensations of the trunk and viscera. Interoception is not one capacity. Researchers separate interoceptive accuracy, how well a person objectively detects an internal signal such as the

heartbeat, from interoceptive sensibility, how strongly a person subjectively attends to and reports internal sensation, and from the awareness of how well those two correspond (Garfinkel et al., 2015). These dimensions can dissociate, so that a person feels the interior loudly while reading it poorly. The practices considered here train attention to this channel and, with repetition, work to bring the loud subjective signal and the accurate reading of it into closer correspondence. This is the faculty that *śāmbhavī mudrā* and the breath techniques engage, and it is the hinge for the case taken up later in the paper.

Midline attention and bilateral recruitment

The body's midline is a special case in the nervous system. Most sensory and motor pathways are crossed, so that one hemisphere serves the opposite side of the body. The midline is the exception: the muscles and receptors of the face and trunk, and the apparatus that coordinates the two eyes, are served by both hemispheres at once. Directing sustained attention to a midline point, and converging the two eyes upon it as *śāmbhavī mudrā* does, is therefore a task that draws on both hemispheres together. This is the defensible core of the traditional emphasis on the center: midline tasks are bilateral tasks. The step from there to a claim about the operative variable in the practice is conjecture, marked as such here and revisited in the conclusion.

Interhemispheric coordination, stated carefully

It is tempting to extend this into a stronger claim, that the practice strengthens communication between the hemispheres by acting on the corpus callosum, the main fiber bundle connecting them. The evidence does not support a clean version of that claim, and this paper does not make it. The corpus callosum's role is mixed. Its projecting fibers are predominantly excitatory at the cellular level, yet many of them terminate on inhibitory cells, so the net effect in some regions and tasks is suppression of the opposite hemisphere rather than excitation of it. Whether callosal transfer is, on balance, excitatory or inhibitory was unresolved when the question was posed directly (Bloom & Hynd, 2005), and it remains so. The popular picture in which the callosum chiefly holds the hemispheres apart, and a divided brain is the source of human imbalance, is an interpretive synthesis (McGilchrist, 2009) rather than a settled result.

What can be said is more modest and more secure. Interhemispheric coordination is real, it runs through several routes, and it is trainable. The corpus callosum is one route. The anterior commissure links regions of the temporal lobes. Midline thalamic and brainstem systems coordinate activity across both hemispheres without passing through the callosum at all. Bilateral, midline-anchored attention is a functional state that the nervous system supports through this redundancy, so there is no need to assign it to a single structure or to claim that practice repairs a faulty one. *Suṣumnā*-directed attention is best

read as a way of biasing the system toward that integrative state rather than as the installation of a new channel.

Attention and neuroplasticity

Repetition is where the lasting change occurs. Contemplative attention training produces measurable changes in the brain. Practice has been associated with increased cortical thickness in regions involved in attention and interoception (Lazar et al., 2005) and with increased gray-matter density after an eight-week program (Hölzel et al., 2011). The mechanisms of these practices, spanning attention regulation, body awareness, and emotion regulation, have been reviewed in detail (Tang, Hölzel & Posner, 2015). Functional studies report altered activity and connectivity in the default mode network, the system active during self-referential thought and mind-wandering (Brewer et al., 2011). These are findings about ordinary neuroplasticity: a repeated mental activity changes the tissue that performs it. The *suṣumnā* practices are, in this reading, a structured way of repeating one specific attentional activity often enough to change its substrate.

A note on coherence

One further finding is cited often and should be stated carefully. Some studies report increased synchrony of electrical activity across brain regions and across hemispheres during meditative states, including high-amplitude gamma synchrony in highly experienced practitioners (Lutz et al., 2004). Synchrony of this kind is real and measurable. Its interpretation is contested: it is not established that more synchrony is simply better, nor that it is the cause rather than a correlate of the reported experience. The honest summary is that contemplative attention changes large-scale brain dynamics in ways still being mapped, and that the direction of those changes is consistent with the traditional reports of steadiness and unification without yet explaining them.

4. Two Cognitive Styles and the Cost of Over-Selecting One

Underneath the anatomy is a claim about cognition that can be stated without committing to any map of the hemispheres. Human thinking includes at least two modes that stand in tension. One is narrowly instrumental: it abstracts, categorizes, predicts, and manipulates, and it excels at decomposing a problem into parts. The other is integrative: it holds context, attends to the whole, tolerates ambiguity, and registers relationships that the first mode discards. Both are necessary. The instrumental mode built the tools; the integrative mode is what notices when the tools are pointed in the wrong direction.

The habit of assigning these to the left and right hemispheres is a useful shorthand and a poor literal model. Both hemispheres participate in language, in

emotion, and in social cognition, and the clean anatomical division does not survive contact with the lateralization research. The distinction worth keeping is functional, between two styles of processing, and it can be made without the anatomy.

The argument here is that modern conditions over-reward the instrumental mode and starve the integrative one. Markets, institutions, and technologies select for short-horizon, abstract, competitive cognition, and they offer little advantage to the slower integrative mode. Midline practice is of interest because it trains, deliberately, the under-rewarded mode: it quiets verbal self-commentary, lengthens attention, and restores access to the nonverbal processing that instrumental pressure crowds out. The proposal is not that a breathing practice reorganizes a society. It is that a cheap, learnable practice can restore an individual's access to a mode of cognition that current conditions suppress, and that the integrative signal it recovers is worth having. What that signal is not, is self-validating, which is the subject of the next section.

5. The Cognitive Trap

The practices raise the amplitude of the integrative signal, and that is exactly where the danger begins. A signal felt more strongly is not thereby more accurate, and the central error this paper wants to name is the confusion of the two. Call it the cognitive trap: taking the vividness, the certainty, or the sheer felt force of an insight as evidence that the insight is true. The trap is not a fringe risk. It is the characteristic failure of every tradition and every person that has learned to amplify the signal without equally training the discrimination that sorts its output.

The signal deserves respect, and naming the trap is not a way of dismissing it. The integrative, intuitive, body-anchored signal is real, and it does real work. Some of the most consequential ideas in the history of thought arrived as sudden integrations rather than as the conclusions of stepwise argument; the structure of benzene is said to have presented itself to Kekulé in a reverie, and Einstein worked from felt thought-experiments well before the equations existed. To respect the signal is to take it seriously as a generator of candidates. The point is only that a candidate is not yet a result. Kekulé still had to test the ring, and Einstein still had to do the mathematics. The inspiration supplied what to consider; the work afterward determined what was true.

The contemplative world has its own name for the failure, at least in practice if not always in its popular reception. Inside the kundalinī tradition, practitioners speak of kundalinī confidence: the unearned certainty, common in the early and middle stages of intense practice, that one's vivid interior states are reliable readings of the outer world. Reported from the inside, the experience is of a signal so strong that doubt feels perverse. Reported honestly afterward, some of those certainties track reality and many do not, and there is no telling which

from the felt strength alone. The phrase is an insider usage rather than a documented technical term, and it is offered here as the practitioner vocabulary for precisely the gap the interoception research describes between a loud subjective signal and an accurate one.

This is why the discrimination has to be earned, and why no degree of innate talent removes the requirement. A person who feels the signal more strongly than others has a louder generator, not a more accurate one, and the louder the generator the more discrimination is needed. The traditions understood this. The corrective they name is discernment, *viveka* in the Sanskrit sources, the trained capacity to tell the reliable from the merely vivid, and the mature forms of these practices treat it as inseparable from the cultivation of the signal itself. The naturalistic reading recovers that pairing. The practice has two halves: raising the signal, and learning to doubt it well. A method that delivers the first without the second does not produce insight. It produces confident error, and the more powerful the method, the more confident the error it can produce.

Stated as a procedure, the discipline is unremarkable, which is the point. What the practice surfaces is treated as a hypothesis and nothing more until it has earned more. Felt certainty and the question of accuracy are kept apart. The candidate then goes out to rumination, to evidence, and to the criticism of people who do not share the state that produced it. The signal-to-noise ratio of the whole enterprise rises sharply when ordinary critical analysis is laid on top of the integrative material rather than substituted for it or displaced by it. None of this diminishes the signal. It is what lets the signal be used.

6. Autism: A Loud and Miscalibrated Interior

The calibration problem has a clear illustration in autistic cognition, and it returns the argument to interoception. The popular intuition is that autistic people, often drawn to bodily and contemplative practice, must have unusually good access to internal signals. The evidence does not support that, and the way it fails is instructive. A meta-analysis of case-control studies found that autistic participants performed worse on objective interoceptive accuracy, measured by heartbeat-detection tasks, while reporting higher confidence in their own interoceptive ability (Williams et al., 2023). The broader literature is genuinely mixed, with studies reporting reduced, equal, and occasionally heightened performance depending on the measure and the sample, and no clean finding of superior accuracy. What recurs instead is a dissociation that has been documented directly in autism: an exaggerated subjective sensibility to internal sensation sitting on top of a reduced objective accuracy (Garfinkel et al., 2016).

That profile is the cognitive trap as a standing trait rather than a passing stage. Where the *kundalinī* novice acquires a loud, poorly calibrated interior through practice, a portion of autistic people begin there. The interior runs loud; the certainty about what it means can run high; the accuracy does not keep pace.

This is not a deficit story and it is not a gift story. It is the description of a signal that is strong and miscalibrated, which is exactly the condition the practices in this paper are built to train. A method whose function is to direct sustained attention to interoceptive signal and to bring felt intensity and accurate reading into correspondence is unusually well matched to a nervous system that arrives with the intensity already present and the correspondence not yet built. For some autistic practitioners the practices may therefore land with unusual force, and the calibration they offer may matter more, not because the starting talent is greater but because the raw signal is louder and the work of tuning it is larger.

A second difference points the same way through a different channel. Autistic adults are less swayed by the framing of a choice, making more internally consistent decisions across logically identical presentations than non-autistic controls (De Martino et al., 2008). This is a narrow finding about reduced sensitivity to rhetorical and social framing, not a general claim to clearer sight, and it sits in instructive tension with the interoceptive picture: a profile that resists one source of distortion, the manipulations of framing, while remaining exposed to another, the overconfident reading of a loud interior. The honest summary across both findings is that autistic cognition is calibrated differently, along different axes, from the typical case, neither uniformly better nor uniformly worse.

That difference is the reason cognitive diversity is worth more than tolerance. A group whose members are all calibrated the same way shares the same blind spots and can be confidently wrong in unison. A group that keeps minds calibrated differently, including the minds least swayed by consensus framing, keeps a capacity to catch errors the majority cannot see. The individual practice and the social arrangement point one way: toward systems that train discrimination in the person and preserve difference in the group, so that a loud signal somewhere in the population is neither blindly trusted nor automatically discarded.

7. Personal and Interpersonal Benefits

The case for studying and teaching these practices rests on effects at two scales that are within reach of ordinary evidence: the individual and the interpersonal.

At the individual scale, attention training of this family is associated with improved sustained attention, reduced anxiety and stress reactivity, and better emotion regulation, and the autonomic mechanism described above gives a plausible account of why (Zaccaro et al., 2018; Tang, Hölzel & Posner, 2015). The practices are low-cost, need no equipment, and carry little risk when taught with ordinary caution. For a person whose baseline is high arousal and heavy verbal self-criticism, a reliable way to down-regulate and to quiet the inner commentary is a substantial benefit on its own.

At the interpersonal scale, the relevant practices are those that cultivate warmth and care toward others. Compassion and loving-kindness training increases prosocial and altruistic behavior and alters the neural response to others' suffering (Weng et al., 2013), increases helping behavior toward a person in distress (Condon et al., 2013), and builds durable positive emotion and social connection over time (Fredrickson et al., 2008). These are dyadic and small-group effects, measurable in how a trained person behaves toward the people around them. A practice that makes a person calmer and more able to attend to others, and that can be taught informally from one person to a few, has a natural path of transmission through small groups, and its benefits compound at the scale of a household, a friendship, or a small community. That is the scale at which they have been measured, and it is the scale this paper claims.

8. Why This Is Worth Discussing

The *suṣumnā* and its practices have been treated, by turns, as literal anatomy, as pure metaphor, and as superstition to be discarded. The reading offered here is more useful than any of those. The central-channel practices are a structured way of training midline-anchored, bilateral, interoceptive attention and of shifting the autonomic system toward recovery, and the effects of doing so are measurable, replicable in their broad outlines, and consistent with the felt states the tradition describes. Equally, the practices raise a signal that has to be calibrated to be of use, and the discipline of doubting that signal well is part of the practice rather than a constraint imposed on it from outside. The account costs nothing metaphysically. It asks only that attention and breath have bodily consequences, and that a strong feeling of insight is a reason to investigate rather than a reason to believe.

This framing carries three advantages. It lets the practices be studied with ordinary methods, since every claim in it is one an experiment could check; people who would refuse any metaphysical or religious framing can still use them, which covers most of those the practices could help; and the tradition is respected rather than reduced, because describing a mechanism does not claim that the tradition is nothing more than that mechanism. The offense of the reductive posture comes from the second move, and this paper makes only the first.

There is a further reason the naturalistic, nonverbal framing matters, and it connects to the cognitive trap. Practices transmitted as bodily skills rather than as creeds are harder to ossify into doctrine, because there is no proposition to make into a test of belonging. Their characteristic failure is not the heresy trial but the authority of a teacher who claims to be the sole source, an authority that feeds on exactly the unearned confidence described earlier. A practice taught plainly as technique, pointing back to no required belief and no indispensable teacher, is more durable against that failure than a doctrine is against dogma. That

durability is a practical reason to prefer this framing, separate from whether it is the more accurate one.

None of this is established as a whole. Its parts sit at very different levels of confidence. The autonomic effect of slow breathing is well supported, and so is the neuroplastic effect of sustained attention training. The interoceptive profile invoked for the autism case is documented, though the literature is mixed and the inference drawn from it is a hypothesis. The specific claim that midline-directed attention, rather than attention training in general, is the operative variable in the suṣumnā practices has not been tested, and it is the obvious next study. Stating these claims naturalistically is what makes such studies possible, and that is the point of stating them this way.

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