

The Frequency of Happiness

What you feel, what you influence and what matters to you

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HOW THIS BOOK WAS MADE

AI assistance was used for research, editing, translation and images. The authors remain responsible for the editorial choices and content. The labels RESEARCHED, PROVISIONAL and PHILOSOPHY are editorial signposts, not a formal grading of evidence quality.

The atmospheric images were created with AI. Diagrams are schematic illustrations, not measurements or medical images. The online edition and PDF are built from the same chapter files.

See how to read this book and the sources and editorial notes.

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Dedication

For those trying to understand what supports them.

And for the people who help them along the way.

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Prologue: the evening the music changed

This book began with two experiences. After a difficult relationship, Jeanette was looking for steadiness and a direction of her own. Bastiaan noticed how music could change the feel of an evening. Those experiences raised a question: what influences how you feel, and where do you have a choice?

A living room, a radio

Imagine a quiet evening at home. You check your phone again. No message. A song on the radio brings back memories. You stay seated, absorbed in a conversation that is already over. Then you choose different music. You get up, tidy a little and make tea. You still miss the person. Yet the next half-hour unfolds differently.

The person in this story is a composite. This is neither a client report nor a measured experiment. We use the situation to explore something familiar: a change in your surroundings can influence attention, mood or behaviour. The effect varies with the person and the moment.

From experience to inquiry

A better evening does not tell you which chemical changed in your brain. That requires a different kind of investigation. You can, however, notice

what you did and what you experienced. Perhaps the music helped, perhaps moving or making tea, perhaps mainly the passage of time. That curiosity is where this book starts.

Part I considers music, food, movement, breathing and your surroundings. We place research alongside everyday experience. Where evidence is limited, we say so. A practical exercise need not work for everyone to be worth exploring.

What happens when things become difficult again?

A walk does not resolve a conflict. Calm breathing does not pay a bill. The daily possibilities therefore lead to a second question: how do you live with circumstances you cannot readily change? Part II explores different answers from psychology and philosophy. Sometimes they complement one another; sometimes they disagree.

Some passages may fit your life; others may say little to you. You need not adopt them all. Read, try something small and notice what follows. You can skip an exercise, reconsider an idea or ask someone for help.

Why this title?

Frequency is used here as an image for recurring patterns in attention, feeling and daily life. There is no single measurable frequency at which a person is happy. Music does have measurable frequencies; thoughts do not use them to attract events. We maintain that distinction throughout the book.

Start with what interests you. Read the guide to the book first if you want to know how we distinguish research from philosophy. For something practical, choose one of the five themes in Part I.

Reader's guide: research, assumptions and philosophy



This book brings research on mood and behaviour into conversation with philosophical questions about happiness. That can be useful when we distinguish measurements from interpretations. An old insight does not become scientifically proven because a brain scan appears to resemble it.

Recognising the evidence

1

Researched

Also consider method, population and limits.

2

Provisional

An indication or limited evidence.

3

Philosophy

A perspective to reflect on.

These labels are editorial signposts, not formal evidence ratings.

Recognising the evidence. Schematic explanation.

The colours help you read that distinction. They are not a seal of approval for an entire chapter. For each study, consider the participants, comparison and duration. A small experiment with healthy volunteers, for example, tells us little about treating depression.

RESEARCHED This claim has been studied empirically. The text describes findings and limitations. The label does not mean that an outcome applies to everyone, that every study has been replicated or that an association establishes a cause.

PROVISIONAL This is a tentative explanation, a disputed theory or a finding with limited supporting research. A convincing explanation can still turn out to be wrong.

PHILOSOPHY This is a philosophical idea, tradition or metaphor. You can consider whether it helps without accepting it as fact. Age, popularity and personal resonance are not evidence of effectiveness.

The Buddhist image of the second arrow, for instance, can help distinguish pain from our reaction to pain. The Default Mode Network is a concept from brain research. These accounts can inform a discussion, but they are not the same mechanism.

Frequency in the title sometimes refers to measurable rhythms, such as breathing, and sometimes to the tone of daily life. There is no single measurable frequency of happiness. We do not use the term to explain manifestation, attraction or influence over matter.

The exercises are invitations. Adapt them, skip them or stop if they feel uncomfortable. Persistent low mood, panic, trauma or difficulties with eating deserve professional support. This book is not treatment. In immediate danger, contact your local emergency service. In the Netherlands, call 112; for suicidal thoughts, 113 or 0800-0113 and the chat at 113.nl are available day and night.

Part I is available free. The course also includes the full book, with Part II on relationships, meaning and philosophy. Both editions use the same revised text.

CHAPTER 1

What Is an Inner State?



Part I, The Science of the Inner State

Three perspectives on one experience

- 1 **Attention**
Thoughts, focus and uncertainty
- 2 **Feeling**
Emotions, urges and needs
- 3 **Body & situation**
Sensations, demands and surroundings

This framework does not measure brain waves, hormones or health.

Three perspectives on one experience. Schematic explanation.

How you feel is related to what happens in your body, what you notice and what you experience. Researchers can measure aspects of this, such as brain activity and heart rhythm. No single measurement captures your whole experience. This chapter introduces some bodily processes involved in feelings.

The brain as an oscillating system

RESEARCHED Hans Berger first recorded human brain activity with surface electrodes in 1924 and described the alpha rhythm. What an EEG measures is not the firing of individual neurons, but the summed

postsynaptic potentials of large populations of pyramidal cells in the cortex, which rhythmically move in and out of phase. That synchronization produces oscillations with a power spectrum we divide into bands.

Brain rhythms are often grouped as delta, theta, alpha, beta and gamma for research. The boundaries used vary somewhat. Certain patterns are more common during sleep, attention or movement, but one band does not correspond to one feeling. Measurement location and the task being performed also matter. Frequency alone cannot establish happiness, tension or a level of consciousness.

Lutz and colleagues (PNAS, 2004) found differences in gamma activity between eight experienced meditators and a comparison group. That is an interesting group difference in a small study. An association with practice hours does not establish that meditation caused it, and gamma activity is not a happiness score. The study does not provide a personal training target.

Brain rhythms describe electrical activity in the brain. EEG records associated signals through electrodes on the scalp. These findings do not show that thoughts use a particular frequency to control events outside the body.

Neurochemistry: not “happiness hormones” but systems

RESEARCHED The popular language of “happiness hormones” is misleading. No single neurotransmitter encodes an emotion; they modulate networks, context-dependently.

Schultz’s research on dopamine neurons showed that some of their activity tracks differences between expected and received rewards. Berridge and Robinson also distinguish wanting a reward from enjoying it.

Dopamine has several functions; describing it solely as the chemical of happiness, desire or prediction is too simple.

Serotonin (5-HT) modulates mood, satiety, and behavioral inhibition via at least fourteen receptor subtypes. Its importance appears indirectly from acute tryptophan depletion studies (ATD): have subjects drink an amino-acid drink without tryptophan, and the serotonin precursor in the brain drops within hours. In people with depression in remission this often elicits a temporary relapse (Delgado et al.); in healthy people without vulnerability the effect is small, which immediately nuances the simplistic “serotonin deficit = depression” story (see the influential critical review by Moncrieff et al., 2022).

Cortisol participates in the stress response and also follows a daily rhythm. Stress, sleep, illness, medication and the timing of measurements affect its levels. Research on group averages does not provide a simple personal threshold for excessive stress. Both the level and the pattern can matter.

What heart rate variability can and cannot tell us

RESEARCHED HRV is the variation in time between successive heartbeats. Breathing and autonomic control of the heart contribute to it. Heart rate often rises a little during inhalation and falls during exhalation. This is called respiratory sinus arrhythmia.

Measurement method, breathing rate, age, fitness, medication and timing affect the result. Higher is not automatically better. A watch cannot determine whether you feel safe, have experienced trauma or regulate emotions well.

Thayer and Lane’s neurovisceral integration model uses HRV to study relationships between the brain, heart and regulation. It is a research

model. When observing yourself, sleep, symptoms and how you feel matter at least as much as a number. Ask a healthcare professional about medical abnormalities.

Embodied cognition: the direction is mutual

Theories of emotion differ in the role they assign to the body. James and Lange emphasised perceiving bodily changes. Later work by Damasio, Critchley and Barrett, among others, examines relationships between bodily signals, prior experience and interpretation. These theories are not interchangeable or definitive explanations of every feeling.

The interaction is especially interesting in practice. A walk or a change of posture may sometimes influence your experience. That effect needs to be considered in its setting; a general theory does not tell you which exercise will help you.

The state as a regulatory system

An inner state can be described from several perspectives. They are related, but they do not form a dashboard with separate happiness controls. A small change in your day is an experiment whose outcome you still need to observe. Not noticing a difference is information too.

The next chapter uses a simple model to explore these interactions. We then look at music, food, movement, breathing, light and social circumstances.

CHAPTER 2

The Inner-State Cycle



A poor night's sleep can make a difficult conversation harder. That conversation may then disturb your sleep. Many people recognise interactions like these. The Inner-State Cycle is our way of drawing them clearly. It is a teaching model, not a validated explanation of depression or recovery.

One possible interaction

- 1

Event

What do you notice?
- 2

Interpretation

How do you interpret it?
- 3

Response

Feeling, body and behaviour
- 4

Consequences

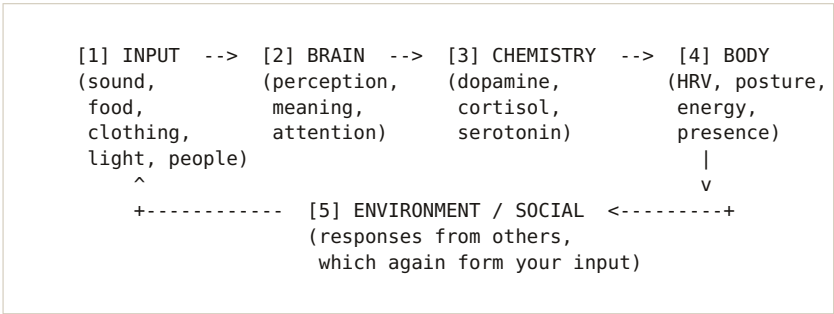
What happens next?

These connections are questions to explore, not a fixed biological sequence.

One possible interaction. Schematic explanation.

I call this model the Inner-State Cycle. It consists of five links.

The five links



Link 1, Input. Everything that enters your system: the sounds you hear, the food you eat, the light that falls on you, the clothes against your skin, the touches, the people you talk with. Inputs are the raw material of your state. And the decisive insight: of all the links, this is the one you have the *most direct* access to. You cannot simply change your feeling, but you *can* put on a different playlist, open a window, eat something else, walk into a different room.

Link 2, Brain. The input is not passed on raw; it is interpreted. Your brain hangs meaning on it, directs attention to it or not, places it in a story. The same rain can be “gray and depressing” or “soothing to listen to.” This link is why the input alone is never the whole story: it also depends on how you read it. Here the thinkers of Part II take hold later, Stoicism, Byron Katie, Tolle, who all say: between the stimulus and your suffering sits your judgment.

Link 3: bodily processes. Perception and emotion involve several hormones, neurotransmitters and brain networks. Threat does not simply equal cortisol, reward dopamine and connection oxytocin. These relationships depend on the person and context; this model does not measure them.

Link 4: body and behaviour. When tense, you might clench your jaw, speak faster or avoid contact. Pain, illness and tiredness can also affect how you think and respond. These are interactions, not a fixed sequence.

Link 5: surroundings and relationships. Your behaviour can influence how others respond. Their behaviour is also their own and is shaped by many other factors. This model never makes someone responsible for rejection, abuse or another person’s choices.

Why it is a cycle, and why that changes everything

The crucial word is *cycle*. This is not a straight line from cause to effect, but a loop that feeds itself. And a loop that feeds itself can turn two ways.

In the downward direction it works like a trap. Grief (chemistry) makes your posture hunched and your gaze dull (body). That closed presence makes people leave you alone or withdraw (environment). That isolation becomes your new input, which your brain interprets as “I am alone, no one sees me” (brain), which deepens the grief (chemistry). Each round makes it a little worse. This is exactly how a dip can become a depression: the loop turns, and turns, and pulls itself down.

You can try changing one manageable part of the pattern: a break, a meal or contact with someone you trust. Sometimes that helps; sometimes little changes. You do not have to force an upward spiral, and a small step being insufficient is not a personal failure.

The evening in the prologue prompted us to develop this model. The atmosphere changed after the music changed. We did not measure brain activity, hormones or heart rate. The story describes what we noticed, not the biological chain that caused it.

The boundary of the model, and the bridge to Part II

The cycle can help you explore an everyday pattern. It does not explain why someone grieves or how depression should be treated. Relationship loss, illness or unsafe living conditions often require more than a different habit. Part II therefore also considers connection, boundaries and meaning.

For now, we stay with everyday possibilities. Music comes first: easy to try, with effects that vary greatly between people and situations.

Use the diagram as a reminder. Choose one change and observe what happens. A model is useful only while it leaves room for experiences that do not fit the diagram.

CHAPTER 3

Sound and music: choosing what you hear



A song can comfort, distract, move or unsettle you. Sometimes you notice immediately; sometimes only when the music stops. What feels helpful depends on taste, memories, mood and the situation in which you listen.

Music and reward

In 2011, Salimpoor and colleagues studied eight people who reliably experienced chills with particular music. PET measurements provided evidence of dopamine release in the striatum during intense musical

pleasure. Additional fMRI measurements helped compare activity around anticipation and peak pleasure.

This tells us something about musical experience in a small selected group. It does not mean every song releases the same amount of a chemical in everyone. fMRI also measures changes in blood flow as an indirect measure of activity; it does not itself measure dopamine release.

Anticipation and surprise

Music contains patterns. You anticipate a chord, a pause or a chorus. Research by Salimpoor and later by Cheung and colleagues describes relationships between such expectations, surprise and enjoyment. Familiarity and musical background also matter.

Mallik, Chanda and Levitin studied musical experience with naltrexone, which blocks opioid receptors. Their findings point to the involvement of the opioid system. They do not establish a complete division in which dopamine only controls wanting and opioids only control pleasure.

Rhythm and the body

In rhythm research, brain activity can relate to the beat a listener hears. Studies by Bernardi and colleagues also found differences in breathing and heart rate across musical tempi and pauses. These are group findings under study conditions.

Your response may differ. Fast music may feel helpful while tidying, and slow music may bring back an unpleasant memory. Genre or tempo alone therefore does not tell you whether something will be relaxing for you.

Sad music

Sad music can offer recognition, comfort or beauty. Researchers including Garrido, Schubert and Sachs also describe how mood, motivation and a tendency to ruminate affect the experience. Some listeners feel lower afterwards; others feel supported.

Pay attention to what you notice. Do you keep replaying old conversations after the same playlist? Or does it help you acknowledge sadness and then continue with your day? The radio in the prologue provides an example for asking that question. We did not measure that person's brain processes and cannot explain the sequence biologically.

Binaural beats and special frequencies

With binaural beats, each ear receives a slightly different pitch, which can create the experience of a pulsing beat. Research on attention and anxiety has mixed findings. A meta-analysis by Garcia-Argibay and colleagues found indications of effects, with differences between studies and limits to the evidence.

Claims that 528 Hz repairs DNA, or that one frequency produces love or health, lack reliable clinical support. If you enjoy such music, you can listen without accepting that explanation. Expectation and a quiet listening moment may also contribute; their role has not been established for every listener.

A listening experiment

Choose an ordinary activity, such as cooking after work. Consider what you want to support: attention, rest, some energy or company. Try a few minutes of music, another sound or silence at a comfortable volume. Note

the experience and what you do afterwards. Try a different choice another day.

You do not have to reach a particular feeling. Stop or change the sound when it is uncomfortable. This is not a controlled experiment because your days differ. It can still help you build a selection of choices that suit you.

CHAPTER 4

Food and the Gut-Brain Axis



Food does more than provide fuel. Diet is related to health, sleep and mood, but these relationships are complex. A meal is not a direct happiness control. This chapter distinguishes findings in people from possible explanations drawn from laboratory and animal research.

Gut and brain: an interaction

- 1 Gut
Digestion and signals
- 2 Connections
Several pathways, many open questions
- 3 Brain & experience
Cannot be inferred from one meal

Not evidence that a product treats your mood or symptoms.

Gut and brain: an interaction. Schematic explanation.

Serotonin, tryptophan, and the blood-brain barrier

RESEARCHED Serotonin (γ -HT) is synthesized from the essential amino acid tryptophan via tryptophan hydroxylase. Crucial: about 90–95% of the body's serotonin sits peripherally, produced by enterochromaffin cells in the gut wall (TPH₁), where it regulates gut motility and secretion; the brain makes its own serotonin (TPH₂) and does not use the peripheral supply, because γ -HT does not cross the blood-brain barrier. What does enter the brain is the precursor tryptophan, and it competes with other large neutral amino acids (LNAA) for the same transporter. Here sits the elegant carbohydrate effect (Wurtman & Wurtman): a carbohydrate-rich

meal elicits insulin, which takes up the competing amino acids into muscle tissue but relatively spares tryptophan (largely albumin-bound), so the tryptophan/LNAA ratio rises and more tryptophan reaches the brain.

The causal evidence comes from acute tryptophan depletion (ATD): an amino-acid drink without tryptophan lowers plasma tryptophan within 5–7 hours by 70–90% and thereby central 5-HT synthesis. In recovered depression patients, and especially in those who are vulnerable or use SSRIs, ATD elicits a temporary mood dip (Delgado et al., 1990s; meta-analysis Ruhé et al., 2007). In healthy people *without* vulnerability the effect is small, which nuances the monoamine hypothesis: serotonin is a modulator within a vulnerable system, not an on/off switch for happiness.

The microbiome: from germ-free mice to psychobiotics

RESEARCHED **PROVISIONAL** The evidence line begins with germ-free mice. Sudo et al. (*Journal of Physiology*, 2004) showed that mice without a microbiome display an *exaggerated* HPA stress response (cortisol/corticosterone), which normalizes after colonization, evidence that gut bacteria calibrate the stress axis. Bercik and Collins showed that transferring microbiota between mouse strains also relocates anxious/exploratory behavior. The mechanism is multiple: (1) microbial production of and influence on neuroactive substances (GABA, tryptophan metabolites); (2) short-chain fatty acids; (3) the vagus nerve; (4) immune modulation.

Short-chain fatty acids (SCFA: butyrate, propionate, acetate) arise from fiber fermentation. Erny et al. (*Nature Neuroscience*, 2015) showed that SCFAs drive the maturation and function of microglia, the immune cells of the brain; germ-free mice have malformed microglia that recover

after SCFA administration. Butyrate is moreover a histone deacetylase inhibitor with effects on gene expression and BDNF.

Bravo and colleagues (2011) found effects of a particular bacterial strain in mice that disappeared after the vagus nerve was cut. That finding concerns a specific animal model and intervention. Small human studies, such as Tillisch (2013) and Steenbergen (2015), examine different outcomes. Together they do not show that any probiotic improves mood or treats depression. Effects may vary by strain, dose and person.

The blood-sugar roller coaster, with the data

RESEARCHED Mantantzis and colleagues' review (2019) found no convincing evidence of a positive "sugar rush" and found more fatigue or less alertness at some points after carbohydrate intake. This does not mean every sugary meal causes hypoglycaemia or that feeling low proves a blood sugar problem. Recurrent shaking, fainting or severe dizziness should be assessed medically.

The inflammation route to depression

RESEARCHED Inflammatory processes may contribute to some depressive symptoms. Studies find raised inflammatory markers in some groups, and experimental immune activation can affect mood. Not everyone with depression has raised markers, and a marker does not explain a person's symptoms by itself. The kynurenine pathway is one mechanism being studied, not a complete explanation of depression.

Dietary patterns are one of many factors researchers examine. The findings do not provide a simple list of foods that cause or resolve inflammation in everyone. Supplements are not an automatic treatment

either; discuss them with a healthcare professional, particularly if you take medication.

The hard evidence: the SMILES trial and replications

RESEARCHED The SMILES study (Jacka et al., 2017) assigned 67 adults with depressive symptoms and poor diet quality to dietary support or social support. After twelve weeks, symptoms had improved more on average in the dietary group. Remission was reported in about 32% versus 8%, with considerable uncertainty because the groups were small. The trial did not directly compare diet with medication or establish equal effects. Many participants were already receiving other care. HELFIMED later studied a different combination, including Mediterranean-style food and fish oil; it was not an exact replication. Dietary support can complement care, not justify stopping treatment.

The old intuition, exactly weighed

PHILOSOPHY Yogic traditions use terms such as sattvic and tamasic to describe qualities of food and life. These are cultural and philosophical categories. They do not map directly onto modern nutrition research or establish a measurable food vibration. You can explore them without judging foods or yourself as pure or impure.

Practice, evidence-based

A practical starting point is regular meals and variety within your budget, health needs and preferences. A brief diary may reveal habits, but it cannot identify glycaemic or inflammatory triggers. Avoid exclusion diets

based on a few mood changes. A doctor or dietitian can help with eating difficulties, persistent digestive symptoms or medical dietary needs.

In the next chapter we shift from internal chemistry to the bodily configuration itself, posture, face, and clothing, and we weigh honestly what the replication crisis has done with those claims.

CHAPTER 5

The Body and Clothing



This chapter is a test case for intellectual honesty. The claims about posture, facial expression, and clothing belong among the best-known of popular psychology, and among those hardest hit by the replication crisis. Here we do what self-help books rarely do: we separate what the large replication studies left standing from what they overturned, and we keep only what the evidence bears.

Explore comfort

1

This position

What do you notice about comfort and strain?

2

Another option

Rest, support or a small movement

Upright does not automatically mean happier; posture is not a character test.

Explore comfort. Schematic explanation.

Embodied cognition: the strong framework

RESEARCHED

That body and cognition are intertwined is not a contested fashion but an established framework (Barsalou; Niedenthal). Interoception, the perception of internal body signals via the insula, is measurably linked to the intensity of emotion (Critchley, Garfinkel: heartbeat-detection accuracy predicts anxiety intensity). The brain constructs emotion in part from bodily state (Barrett). The direction of cause thus demonstrably also runs from body to mind. The question is not *whether* this principle holds, but *which* specific interventions have a reliable effect.

Facial feedback: an instructive crash and a nuance

RESEARCHED

PROVISIONAL

The facial-feedback hypothesis (your facial muscles feed your feeling) was made famous by Strack, Martin & Stepper (1988): subjects who held a pen between their teeth (smile muscles active)

found cartoons funnier than those who held the pen on their lips. In 2016 a large-scale *Registered Replication Report* failed (Wagenmakers et al., 17 labs, ~1,900 participants), the effect disappeared. This became a symbol of the replication crisis.

But the story does not end there, and that is instructive. Coles, Larsen & Lench (*Psychological Bulletin*, 2019) did a meta-analysis of 138 studies and found that facial feedback does have a small but reliable effect, provided you use the right conditions and do not overclaim the effect. The large *Many Smiles* collaboration (Coles et al., *Nature Human Behaviour*, 2022, 19 labs) confirmed a small effect of *consciously* mimicking a smile on mood, but not with the pen procedure. Conclusion: the effect is real but small and fragile, not the robust lever popular books made of it.

Botox: the sharpest test of direction

RESEARCHED PROVISIONAL If facial muscles give feedback, then paralyzing them should dampen emotion. That has been tested exactly. Paralyzing the frown muscle (corrugator) with botulinum toxin reduces the blood-oxygenation response in the amygdala when imitating angry faces (Hennenlotter et al., 2009). And in two small RCTs (Finzi & Rosenthal, 2014; Wollmer et al., 2012) one frown-paralyzing Botox injection reduced depressive symptoms significantly more than placebo.

The evidence is limited (small groups, blinding complicated by cosmetic effect), hence the partial status, but it is a striking independent argument that the body_q emotion direction truly exists.

Posture: modest but still standing

PROVISIONAL Studies by Nair (2015) and Wilkes (2017) examined upright versus slumped sitting during stress or depressive symptoms. Some outcomes, including reported energy, differed between groups. The evidence is limited and does not make posture a treatment. Choose a comfortable position that suits your body; sitting upright is not an obligation.

Power posing: what fell and what remained

PROVISIONAL The original claim (Carney, Cuddy & Yap, 2010) was that two minutes of a “power pose” raises testosterone and lowers cortisol. The larger replication by Ranehill et al. (2015) and a p-curve analysis found no reliable hormone effect; co-author Dana Carney publicly distanced herself from the hormonal claim. What remained in later analyses (Cuddy, Schultz & Fosse, 2018; Gronau et al.) is a more reliable subjective

effect: people feel more powerful (“felt power”), with weaker and contested behavioral evidence. The lesson: the hormone story was wrong; the feeling effect is real but modest. Sell it as the latter, not the former.

Clothing: enlothed cognition, with the right measure

PROVISIONAL Adam & Galinsky (2012) introduced “enlothed cognition”: the same white coat improved attention performance more when labeled a “doctor’s coat” than a “painter’s coat”, the effect depended on the symbolic meaning, not the fabric. Direct replications are mixed (some succeeded partially, others not), so we stay cautious. The underlying principle, that clothing meaning steers self-perception and behavior via priming of a social identity, fits within the broader, robust embodiment framework, even if the specific coat effect is small and variable.

Movement: here the evidence is strong

RESEARCHED Research, including reviews by Schuch (2016) and Singh (2023), suggests that exercise can reduce depressive symptoms. Studies differ in participants, supervision and type of activity. This is not a direct comparison showing that exercise will work as well as medication or therapy for an individual. Sleep, enjoyment and social contact may also contribute. Suitable activity and support matter more than training as intensely as possible.

The deeper layer: the body after trauma

PROVISIONAL Tension, tiredness and vigilance can persist after distressing experiences. Some people benefit from movement or body-oriented

support; others find attention to the body upsetting. Posture cannot tell us whether someone has trauma. Exercises may be adapted or skipped. Persistent symptoms deserve support from a qualified healthcare professional.

Practice, honestly weighed

Choose a small, manageable change: some movement if possible, a different sitting position or comfortable clothing. Notice what it offers. Disability, pain or fatigue call for adaptation, not more discipline. There is no correct presence or appearance you must achieve.

Next we look at breathing, which usually happens automatically and can sometimes be adjusted consciously.

CHAPTER 6

Breath and the Nervous System



Breathing usually happens automatically, and you can also adjust it consciously. Research links breathing rate to heart rate, and some exercises may help with tension. That makes breathing worth exploring without expecting one technique to work for everyone.

Breathing at your own pace

- 1 Notice
How are you already breathing?
- 2 Comfort
Follow without forcing
- 3 Adjust
Breathe normally or choose something else

The wave is illustrative: no fixed timing or measured heart rate.
Stop if it feels uncomfortable.

Breathing at your own pace. Schematic explanation.

The vagal brake: RSA and the mechanism of the long exhale

RESEARCHED Heart rate changes during the breathing cycle. The vagus nerve and other regulatory processes contribute to this. Slower breathing can increase HRV and affect heart rate. This does not mean that every longer exhale signals safety to the brain or always increases average vagal activity. Breathing rate, depth and measurement method matter.

The resonance frequency: why ~6 breaths per minute

RESEARCHED The cardiovascular system has a mechanical resonance around 0.1 Hz (≈ 6 cycles/minute), determined by the delay in the baroreflex loop. If you breathe at that frequency, the breath-driven heart-rate oscillations come into phase with the baroreflex oscillations, and a

resonance peak arises with maximal HRV amplitude (Vaschillo, Lehrer et al.). This is the basis of HRV resonance-frequency biofeedback: train people at their individual resonance frequency (usually 4.5–6.5/min) and HRV and baroreflex gain rise. The meta-analysis by Goessl, Curtiss & Hofmann (*Psychological Medicine*, 2017; 24 studies) found a large effect of HRV biofeedback on stress and anxiety (Hedges' $g \approx 0.8$); Lehrer et al. (2020) replicated effects across a range of outcomes. The “magic number 6” is thus not mystical but control engineering: you tune to the natural frequency of a biological control loop.

What research on cyclic sighing shows

RESEARCHED Balban and colleagues (*Cell Reports Medicine*, 2023) compared five minutes of daily breathing exercises with five minutes of mindfulness over a month. The exhalation-focused cyclic sighing group showed improvement in positive mood. This was a small study using self-reports. It does not establish that one to five sighs instantly reset mood, that this is the fastest technique or that it treats trauma symptoms.

Breathing steers the brain, not only the heart

RESEARCHED Two findings lift the breath from “relaxation trick” to “neuromodulator.” First: Zelano et al. (*Journal of Neuroscience*, 2016) showed that nasal breathing entrains limbic oscillations, the breath cycle modulates theta activity in the piriform cortex, amygdala, and hippocampus via the olfactory bulb. Concrete consequence: subjects

recognized fearful faces faster and remembered better *during nasal inhale* than during exhale or mouth breathing. The phase of your breathing modulates your emotional and memory processing.

Second: Yackle et al. (*Science*, 2017) identified in the preBötzinger complex (the breath-rhythm generator in the brainstem) a cluster of ~350 neurons that projects directly to the locus coeruleus, the noradrenergic alarm center that drives arousal and wakefulness. Switching off this cluster in mice made them calm without disturbing breathing. This is the anatomical cable between breath tempo and arousal: slow breathing dampens noradrenergic stimulation. Melnychuk et al. (2018) linked this in humans to attention (the “breathing-LC-attention” axis). The review by Zaccaro et al. (*Frontiers in Human Neuroscience*, 2018) summarizes: slow breathing (<10/min) shifts the autonomic balance parasympathetically and goes with increased alpha and decreased theta EEG power and subjective calm.

The evidence that mind steers the immune system: Kox 2014

RESEARCHED Kox and colleagues (PNAS, 2014) studied training combining breathing, cold exposure and concentration in healthy volunteers. During a controlled endotoxin experiment, adrenaline and inflammatory responses differed between the trained and comparison groups. The experiment took place under medical supervision. It does not

show that thoughts cure disease, and the findings do not directly transfer to people with medical conditions or unsupervised practice.

The old precursor, measured again

PHILOSOPHY Tummo is a Tibetan practice combining breathing and visualisation. Studies by Benson (1982) and Kozhevnikov (2013) described temperature changes in small groups of practitioners. This examines a particular practice; it does not validate every traditional explanation. We do not provide instructions for forced breathing or breath retention here.

The polyvagal lens, honestly labeled

PROVISIONAL Polyvagal theory places safety and connection at its centre. Its evolutionary and neuroanatomical explanations are disputed. Vagal function and changes in HRV do not in themselves validate the whole theory. Part II discusses the distinction between a recognisable metaphor and a tested mechanism.

A simple exercise

Sit comfortably and notice your natural breathing for half a minute. If that feels comfortable, let your exhale last a little longer without forcing it or taking unusually deep breaths. Drop any imposed pace if you feel

short of air. After a minute, notice whether anything has changed. You do not have to become calm.

When to stop

Stop if you feel dizzy, short of breath, tingling, pain or growing distress, and return to normal breathing. You can focus on the room or skip the exercise. Practise only somewhere an unexpected reaction would not create danger, never while driving, swimming or operating machinery.

Forced breathing and breath holding can cause fainting, especially in combination. Never do them in or near water. They are not part of this book's exercises. Discuss breathing exercises with a healthcare professional if you have breathing or heart problems, or if they trigger panic.

The next chapter considers light, daily rhythm and surroundings.

CHAPTER 7

Light, Rhythm, and Environment



How much light you see, when you sleep and whom you spend time with can shape your day. Research helps explain some of these relationships. It does not provide one daily schedule that is best for everyone.

Your own daily rhythm

1 Start of your day
What helps you get started?

2 During the day
Demands, breaks and contact

3 Winding down
What fits your sleep schedule?

No universal energy curve. Consider shift work, health and preferences.

Your own daily rhythm. Schematic explanation.

The photoreceptor that makes no image: melanopsin and the ipRGC

RESEARCHED Alongside rods and cones, Berson, Hattar, and Provencio around 2002 discovered a third class of photoreceptors: the intrinsically photosensitive retinal ganglion cells (ipRGC), which contain the photopigment melanopsin. They do not contribute to image formation but measure ambient brightness, with peak sensitivity around 480 nm (blue). Their axons run via the retinohypothalamic tract straight to the suprachiasmatic nucleus (SCN) in the hypothalamus, the central clock. The SCN synchronizes (entrains) to the light signal and, via the pineal gland, steers

melatonin release: light suppresses melatonin, dark releases it. This is not lifestyle advice but measured neuroanatomy: a direct, specialized cable runs from your eye to your biological clock.

Dose and timing: the numbers

RESEARCHED Outdoors is usually much brighter than indoors, even on cloudy days. Effects on the body clock depend on timing, duration, intensity and your own daily rhythm. Morning light can move the clock earlier and late-evening light can delay it, but shift work and sleep disorders require different considerations. Screen use also affects sleep through content and delayed bedtime, not only blue light.

Light as antidepressant: the meta-analyses and a surprise

RESEARCHED Light therapy has been studied in seasonal and non-seasonal depression, including by Lam and colleagues (2016). Treatment with a specialised lamp is different from an outdoor walk. Do not treat research doses as a personal medical prescription. Discuss light therapy with a healthcare professional, especially with bipolar symptoms, eye conditions or medication affecting light sensitivity.

Nature: real effect, partly understood mechanism

RESEARCHED White and colleagues (2019) found an association between at least two hours a week in nature and better reported health and wellbeing in a large survey. People were not randomly assigned a dose of nature. Two hours is therefore not a proven treatment threshold. Other

studies examine attention, stress and movement; the contribution of each is not fully understood.

Emotional contagion: the mechanism and the limits

RESEARCHED Emotional contagion is well documented (Hatfield, Cacioppo & Rapson, *Emotional Contagion*, 1994): we unconsciously synchronize facial expression, voice, and posture with others (measured with facial EMG: looking at a happy/angry photo activates within milliseconds one's own zygomaticus/corrugator) and thereby feel along. The mirroring mechanism is partly linkable to motor resonance. At network scale Christakis & Fowler (*BMJ*, 2008) showed in the Framingham cohort that happiness clusters and spreads up to ~3 steps through social networks, though that observational work has been criticized for confounding (homophily: happy people seek each other out) and must be read carefully. The controversial Facebook experiment (Kramer et al., *PNAS*, 2014, ~689,000 users) showed that manipulating the emotional tone of the news feed shifted people's own posts in the same direction, evidence for contagion even without direct contact, but ethically fiercely criticized.

A tense environment can be draining. Consider manageable changes in contact, expectations or where you rest. Not everyone can choose their home or working conditions. With threats or abuse, practical safety and help matter more than learning to tolerate the atmosphere.

“Feeling the energy of a room”, exactly explained

PROVISIONAL Quick impressions may reflect tone of voice, posture, facial expression and earlier experiences. They can be useful, but also distorted by fear, bias or incomplete information. Research on thin-slicing does

not show that you instantly know what someone feels or intends. Take your experience seriously and check your interpretation when it is safe to do so.

Practice, evidence-based

Try spending some time outdoors during the day if that is possible. Never look directly at the sun. Choose a time and duration that suit you, and notice your sleep and mood. Consider relationships too: with whom can you speak without constantly monitoring every word? There is no required light dose or social success target.

That brings Part I to a close. You have explored several possibilities, supported by evidence of varying strength. Feel free to choose one and leave the rest. Part II continues with relationships, boundaries and meaning in wellbeing.

About the authors

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Jeanette founded Luminous and guides its work. Her experience of rebuilding her life after a difficult relationship was one starting point for this book. Her work focuses on people finding their own direction after destructive relationship patterns.

Her background includes psychiatric and general nursing, Master Practitioner training in England, certification as a divorce & break-up coach, and trauma-screening training within the DASH community. This background does not make the course medical treatment.

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Bastiaan builds and maintains the platform and looks after technology, privacy and the operation of Luminous. For the book, he contributes to structure, source research and presentation. He does not provide therapeutic treatment or lead group lessons.

Luminous

Luminous brings together personal development, everyday exercises and philosophical perspectives. The companion course, The Frequency of Happiness, develops these topics through 27 lessons, a workbook and a digital AI guide.

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