evinlo

EVINLO EXPLAINERS

Evinlo, explained

How Evinlo turns what your Apple Watch records into a few calm sentences about your day, without anything leaving your iPhone.



ALGORITHM

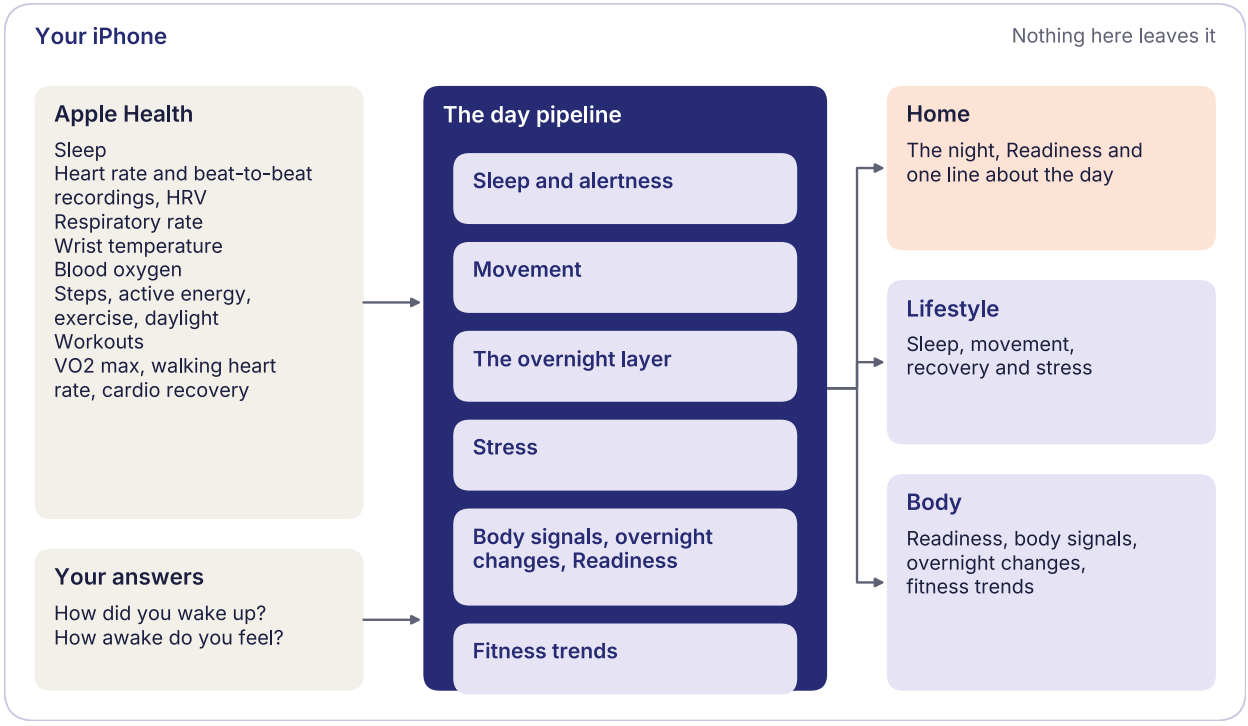
Sleep and alertness 1.3.0 · Readiness and fitness trends 1.0.1 · every other area 1.0.0

WRITTEN

October 2026

The one-minute version

Evinlo reads what your Apple Watch and iPhone have already saved in Apple Health. It works out how you slept, how your body looked overnight, how your day is going, and how your fitness is moving. Then it tells you, in plain words, how that compares with **your own usual**.



Everything Evinlo does happens on your iPhone. It reads Apple Health and your answers to two short questions, works every area out in one pipeline, and shows the result on three tabs.

IN SHORT

- **On your iPhone, and only there.** No server, no account, no analytics. Evinlo's code makes no network requests.
- **One pipeline for everything.** Sleep comes first. Movement, your overnight values and stress follow. Body signals, overnight changes and Readiness are worked out from them.
- **You are the reference.** Every value is compared with your own recent nights and days, never with other people.
- **Two scores, the rest in words.** Sleep and Readiness have a score from 0 to 100. Stress, movement and fitness are described, not scored.
- **Open and versioned.** Every rule is in the code, has a version number, and is replayed on synthetic people before it ships.

This explainer walks through the whole system once. The other nine explainers each take one part and go deep (see the map at the end).

What goes in

Evinlo only reads. It never writes to Apple Health, and it asks for each type of data once, in one system sheet.

What	Where it comes from	What Evinlo uses it for
Sleep, with stages	Apple Watch, or another sleep tracker that saves to Apple Health	Sleep, alertness, and when your night and your waking day start and end
Heart rate	Apple Watch	Body signals, Readiness, stress; around a short night, whether the watch was worn
Beat-to-beat recordings, heart rate variability (HRV)	Apple Watch	Body signals and Readiness. HRV is how much the time between heartbeats varies
Resting heart rate	Apple's daily estimate	Shown next to your sleeping heart rate, and stands in for it on a night without one; fitness trends
Respiratory rate, wrist temperature, blood oxygen	Apple Watch, while you sleep	Body signals; the first two also count for overnight changes and Readiness
Steps, active energy, exercise minutes, time in daylight	Apple Watch and iPhone, merged by Apple Health	Movement; stress uses steps and energy to set movement aside
Workouts	Any app that saves workouts	Movement; stress sets the time during and after a workout aside
VO2 max, walking heart rate, cardio recovery	Apple Watch	Fitness trends

Two more things go in, and neither is Apple Health data:

- **Your answers** to "How did you wake up?" and "How awake do you feel?". Both are optional, one tap each, and stay on your iPhone.
- **Your settings**, such as units, and a sleep need you set yourself if you want to.

Evinlo reads nothing else. It reads no food or drinks, no symptoms, no location and no contacts.

How it works, step by step

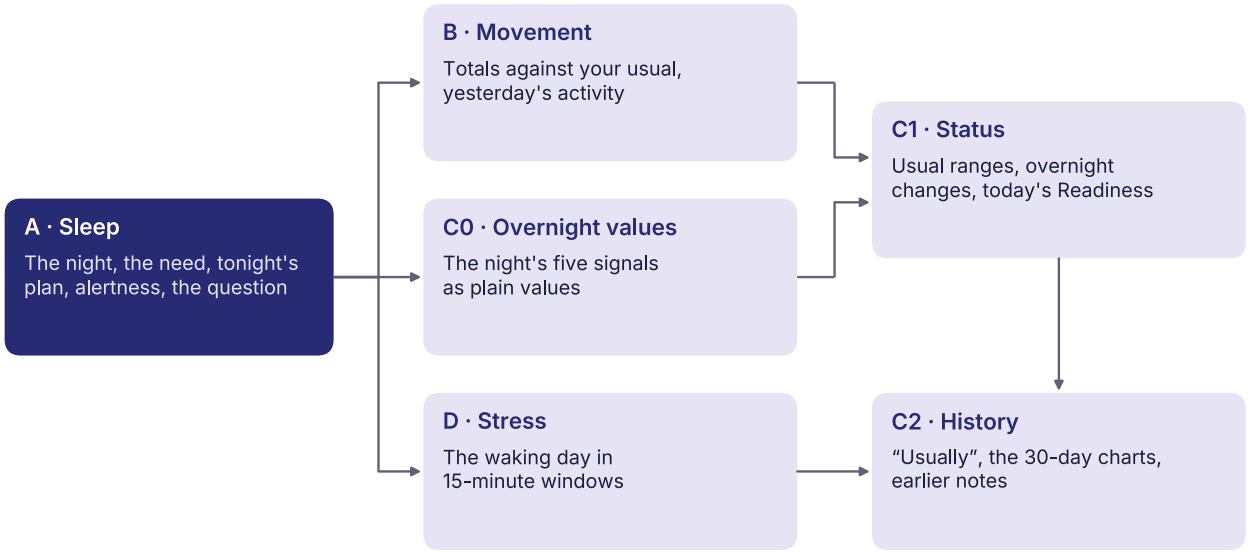
Step 1: read Apple Health, on the iPhone

Every area reads through **one** reading layer. That keeps a few rules in one place:

- **Totals are never sums.** Your watch and your iPhone both count steps. Adding them up would count the same steps twice, so Evinlo asks Apple Health for its merged totals, the same ones the Health app shows.
- **Nothing recorded is not zero.** An hour without data stays empty. Evinlo never fills it in with a guess.
- **One reading is one reading.** Apple Health packs older heart-rate readings into series. Evinlo unpacks them, so a day reads the same before and after that happens.

Step 2: one day pipeline

Every page of the app asks one thing: “show me this day”. The **day pipeline** answers it, in stages. It is the only place where the areas are put together.



The stages of the day pipeline. Sleep comes first, because every other area needs to know when you slept. Movement, the overnight values and stress follow side by side. Status and history come last.

- **Sleep first.** Your night decides where your waking day starts, which night your overnight values belong to, and what your sleep need is tonight.
- **Then three stages side by side:** movement, the night’s overnight values, and stress.
- **Then the status:** your usual ranges, the check for overnight changes, and today’s Readiness score. Readiness needs yesterday’s activity from movement, so movement comes before it.
- **Then the history:** “usually 82”, the 30-day charts, earlier notes.

Two rules make the screen calm. **No provisional numbers:** a score appears only once every night it depends on has been read, so it never changes in front of you while older history loads. **One failing area hides nothing else:** it says “Couldn’t calculate this” with Try Again, and the other areas carry on.

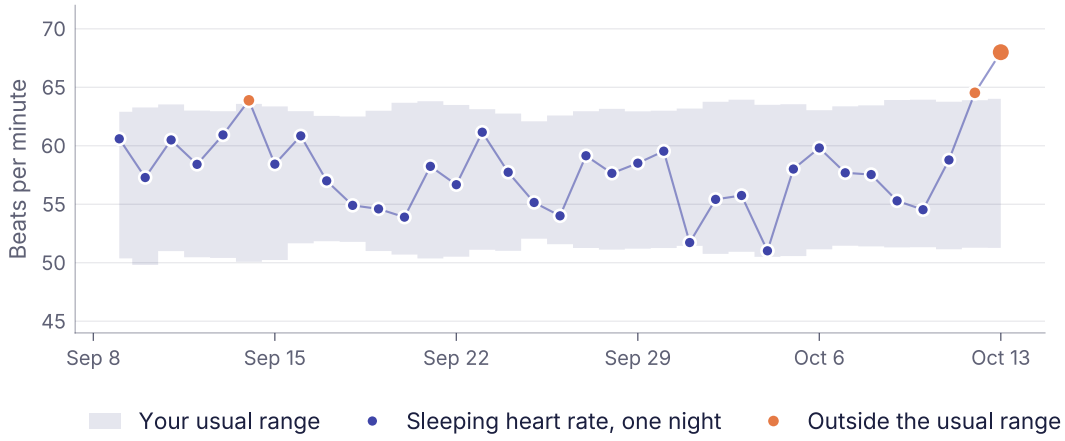
To stay fast, the pipeline keeps a small **feature cache**: for each night and day, the reduced readings the calculations start from (sums per hour, the value of each HRV recording, which 15-minute windows were at rest). Every score, range and status is worked out again from them on each refresh. The cache can always be rebuilt from Apple Health, so it stays out of your backups.

Step 3: the overnight layer

Once a night is over, Evinlo works out five values from it, using only one Apple Watch and only the time you were asleep:

- **overnight HRV** (from the beat-to-beat recordings, as RMSSD: how much neighbouring heartbeats differ in timing, on average),
- **sleeping heart rate** (the average while you slept; not Apple’s resting heart rate),
- **respiratory rate**, **wrist temperature** (only ever as a difference from your usual), and **blood oxygen** (shown, never judged).

Each value is compared with **your usual range**: the middle of your last 60 nights, plus and minus two "spreads". The spread is a robust cousin of the standard deviation, so one odd night cannot stretch it.



Sleeping heart rate of a synthetic person over five weeks, with the usual range of each night. Each night has its own range, worked out from the 60 nights before it. The last two nights are the second and third nights of an illness-like episode the synthetic person was given: the heart rate leaves the range.

This one evaluated night is what three areas read: **body signals** (the values and ranges), **overnight changes** (did several signals move away together?) and **Readiness** (how far the heart signal, breathing and temperature sat from your usual). None of them works the night out again, so they can never disagree about it.

Step 4: each area

Area	The question it answers	What you see
Sleep	How did I sleep, against what I need?	A score from 0 to 100, your sleep need, sleep debt, tonight's plan
Alertness	How awake may I feel today?	Once your check-ins follow the model: an estimated curve for the day
Body signals	What did my body show overnight?	Five values against your usual ranges
Overnight changes	Did several signals move away together?	One of three levels. Not a diagnosis
Readiness	How ready is my body for effort today?	A score from 0 to 100 and what moved it
Stress	When was my heart rate at rest above my usual?	A timeline of the waking day; no stress number
Movement	Where does today stand against my usual?	Steps, energy, exercise and daylight, each against your usual range
Fitness trends	Which way is my fitness moving?	A direction over six months, or "No clear change"

Step 5: Home

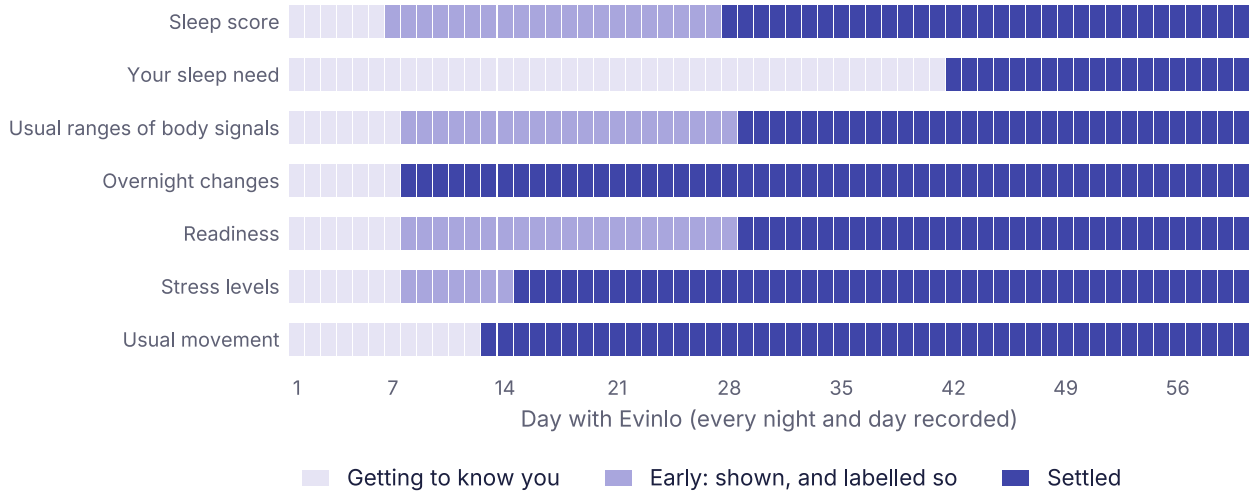
Home puts the day together: last night's sleep score and today's Readiness, each with "usually", one short paragraph about the day, the two questions when they are due, and tonight's plan. Home reads the same snapshot of the day as the pages behind it, so the two never disagree.

Your usual: personal baselines

“Usual” is the heart of Evinlo. Some rules hold everywhere:

- **Robust statistics.** The middle is a median, the spread comes from the median absolute deviation. A single odd night barely moves either.
- **Fixed windows.** 60 nights for overnight values, 28 days for the daytime heart rate and yesterday’s activity, 14 days for sleep timing.
- **No look-ahead.** A day is only ever compared with the days before it.
- **Like with like.** Wrist temperature starts a new usual on every new watch. Each HRV method has its own usual. Stress keeps a usual level per watch generation.
- **It follows you, slowly.** A lasting change becomes the new usual over weeks. That is right for your body, and it is why sleep is scored against your *need*, not against your habit.

Until Evinlo has enough nights and days, it says so instead of guessing. This is what that looked like for an ordinary synthetic person whose watch recorded every night and day from the start:



The first 60 days of a synthetic person, as the app showed each of them at 16:30 that day. Light: Evinlo is still getting to know the person. Mid: shown, and labelled as early. Dark: settled.

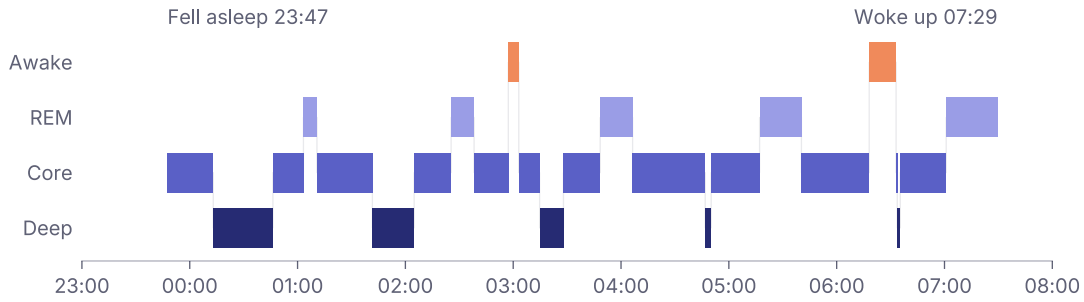
On this person the sleep score appears on day 7 and settles on day 28. Usual ranges, Readiness and stress levels start on day 8; stress levels settle on day 15 and the usual ranges on day 29. A usual for movement is there from day 13. The sleep need counts as personal from day 42; until then Evinlo works with an estimate that starts at 7 hr 30 min and says it is still learning. Two parts take longer and are not in the chart: the alertness estimate needs at least 40 check-ins, and fitness trends need values in at least 8 weeks, spread over at least 12.

A worked example

Meet **Maya**. She is a synthetic person: the app's generator made her nights and days, and no part of her comes from a real person. She falls asleep around half past eleven, wakes on her own, and wears her watch every night. It is **Tuesday, 13 October 2026, at 16:30**. Every number below is what the app shows for her at that moment (the screenshots in the next section are the same moment).

Her night

Maya fell asleep at 23:47 and woke up at 07:29. She slept 7 hr 21 min. Her estimated sleep need is 7 hr 35 min. (The generator gave her a true need of 7 hr 45 min; Evinlo only sees her nights, and its estimate is ten minutes under it.)



Maya's night, stage by stage, as Apple Watch recorded it.

Her **sleep score is 92**, a little under her usual of 96. Here is how it adds up:

Part	Weight	Effective weight	Points
Duration: 7 hr 21 min against a need of 7 hr 35 min	40%	44.4%	95
Continuity: wake time, the longest block, awakenings	25%	27.8%	80
Timing: the middle of the night against the last 14 days	15%	16.7%	100
Stages: deep and REM sleep against her own usual	10%	11.1%	98
Efficiency	10%	not counted	Apple Watch doesn't record when you went to bed

Efficiency can't be counted, so its weight is shared out among the others. The weighted sum is 92.0. A night shorter than its need can also be capped: at 97% of her need, the cap is 93, so it does not apply. **Score: 92, "A restful night".**

Her Readiness

Readiness asks a different question: how ready is her body for effort today? It reads the overnight layer, her sleep, and yesterday's activity.

Part	Weight	Maya's value	Points
Heart: overnight HRV and sleeping heart rate, as one signal	50%	HRV 40 ms, toward the lower end of her usual 31 to 65 ms	57
Last night's sleep	20%	Sleep score 92	92
Sleep debt from earlier nights	10%	None	100
Respiratory rate	7.5%	Inside her usual range	100
Wrist temperature	7.5%	Inside her usual range	100
Yesterday's activity	5%	Above her usual day	88

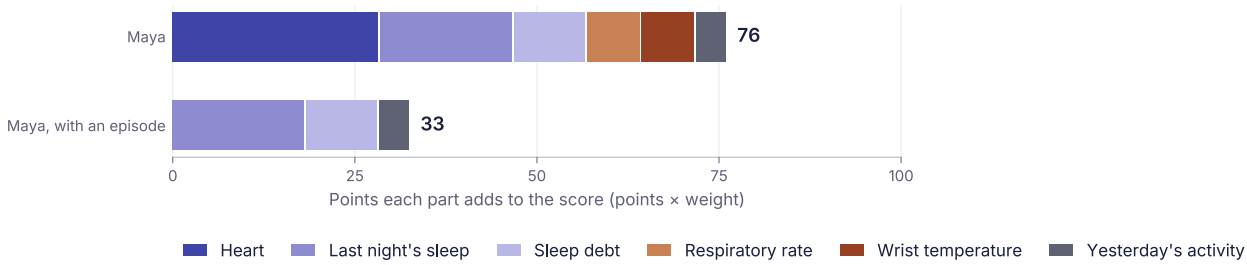
A heart right at her usual would earn 65 points. Hers earns 57 because her HRV sat a little low. Unrounded (57.14 for the heart, 87.78 for yesterday's activity), the points add up to 76.36, so her **Readiness is 76**, against a usual of 82. Home sums the day up as "An ordinary day so far".

The rest of her day reads the same way. All five body signals are inside their usual ranges, and the check for overnight changes found nothing unusual. Her heart rate at rest has stayed mostly at her usual daytime level of 67 bpm. By 16:30 she has walked 1,401 steps; on a weekday her usual by this time is 2,671 to 6,727, so movement reads "A quieter day so far". Tonight she needs 7 hr 35 min, with no catch-up, so Evinlo suggests being in bed by 23:30.

The same night, a different body

Now give Maya the same nights and an illness-like episode: the generator raises her heart rate, breathing and wrist temperature, and lowers her HRV, for four nights. Last night was the third.

Her **sleep score stays 92**: she slept just as long and as well. But her overnight values tell another story. Her sleeping heart rate was 68 bpm, above her usual 51 to 64 bpm, and the other signals moved too: 4 of 4 left their usual ranges. The night before, the check already read "Worth keeping an eye on". Two nights in a row of several signals away from her usual make it **"Several signals unusual"**, and her **Readiness falls to 33**, against a usual of 80.

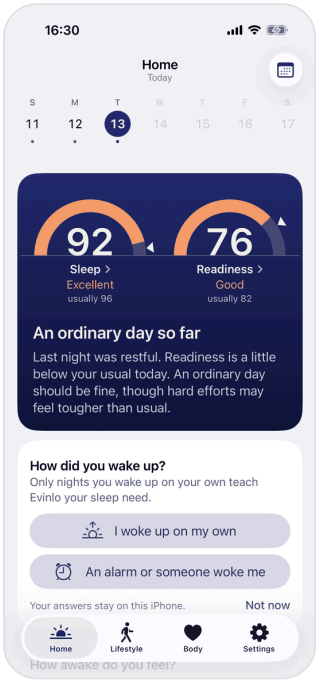


How each part adds to Readiness, on Maya's ordinary Tuesday and with the episode. Each segment is a part's points times its weight. The heart, the respiratory rate and the wrist temperature drop to 0 points with the episode; sleep, sleep debt and yesterday's activity are the same.

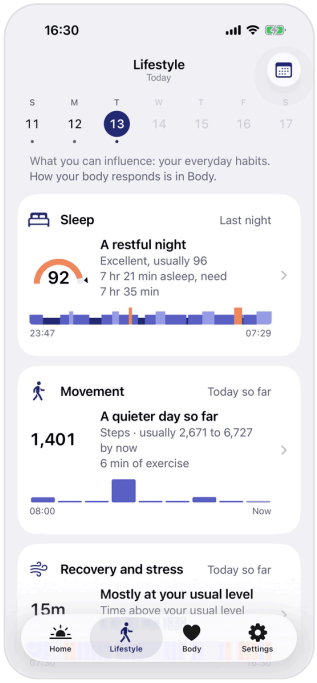
The app does not say she is ill. It says what changed, that a short or late night, alcohol, a hard day and travel move these signals too, and that she should see how she feels before planning effort. **Overnight changes are not a diagnosis.**

What you see in the app

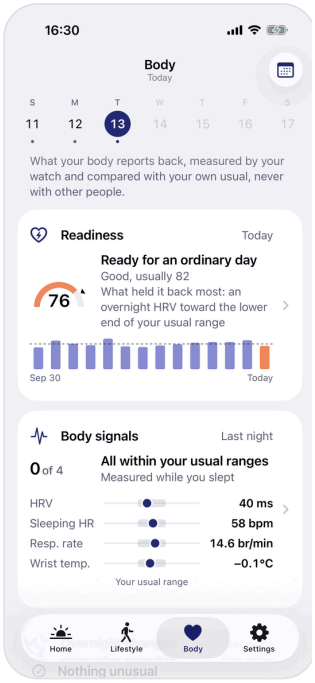
These are Maya's screens at 16:30 on that Tuesday, taken in the app's synthetic data mode. The top row is her ordinary day. In the bottom row, Home and the Overnight changes page show the same day with the episode, and the last screen is a new person in their first week.



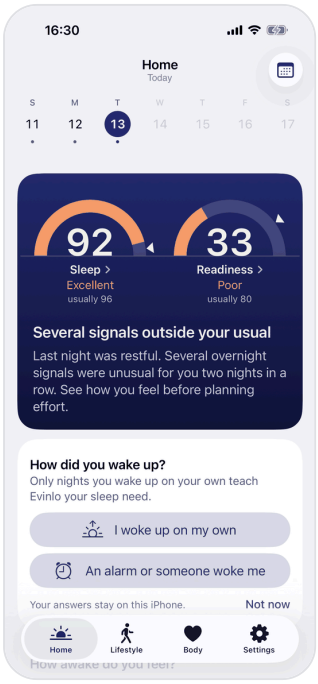
Home: her two scores with "usually", and one paragraph about the day.



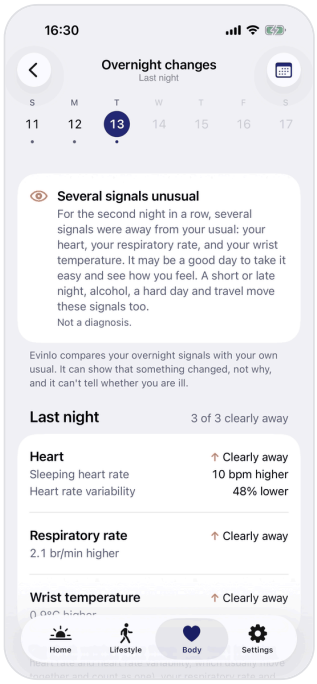
Lifestyle: sleep, movement, and recovery and stress, each with a short line.



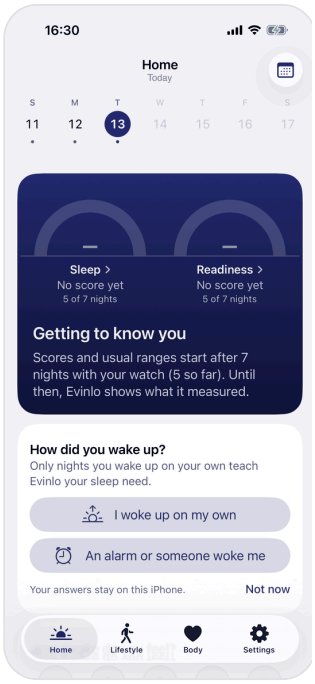
Body: Readiness, body signals, overnight changes and fitness trends.



Home with the episode: "Several signals outside your usual".



Overnight changes with the episode: three of three clearly away, and "Not a diagnosis".



Home in the first week: "Getting to know you", 5 of 7 nights.

Honest limits

- **Evinlo is not a medical device.** It describes measurements and compares them with your usual. It never says you are ill, recovering or well. Overnight changes are not a diagnosis.
- **A watch estimates.** Sleep stages are estimates, not a sleep lab. HRV rests on a handful of one-minute recordings a night. Optical heart rate depends on fit and movement. Wrist temperature is skin temperature, not body temperature.
- **Many things move the same signals.** Alcohol, a late meal, heat, travel, a hard workout, medication and the menstrual cycle all do. Evinlo can show *that* something changed, not *why*.
- **Evinlo cannot see alarms.** It asks how you woke up, and otherwise looks for an alarm's pattern. Some patterns, such as rotating shifts, only your answers reveal.
- **Your usual follows you.** A slow, lasting change becomes the new usual. That keeps the comparison fair, and it means Evinlo will not flag a drift that takes months.
- **The numbers in the rules are choices.** Many come from studies; many are design choices, checked with the evaluation tool. The scoring reference says which is which for every rule.
- **The first weeks are thin.** With few nights there is little to compare with, and Evinlo says so.
- **Maya is generated.** Her nights are calmer than a real person's. Real nights move in more ways at once, so your own numbers will look less tidy.

For the experts

Versions

Section	Version	In code
Sleep score, sleep need, sleep debt	1.3.0	`SleepAlgorithm.version`
Alertness and the daily check-in	1.3.0	`AlertnessModel.version`
The overnight layer	1.0.0	`OvernightAlgorithm.version`
Body signals	1.0.0	`BodySignalsAlgorithm.version`
Overnight changes	1.0.0	`IllnessAlgorithm.version`
Readiness	1.0.1	`ReadinessAlgorithm.version`
Stress	1.0.0	`StressAlgorithm.version`
Movement	1.0.0	`MovementAlgorithm.version`
Fitness trends	1.0.1	`FitnessAlgorithm.version`

Every result carries the version that produced it. Scores are never stored: after an update they are worked out again from Apple Health, recent days first.

The order of operations

1. **Sleep** (`SleepAnalysis`): the night, the 30-night history, tonight's plan, alertness, the wake-up question.
2. **Movement** (`MovementEngine`), **overnight values** (`OvernightExtractor`, the night and the 7 nights before) and **stress** (`StressEngine`), side by side.
3. **Status:** every night of the 60-day windows evaluated once (`OvernightEngine`), then body signals, the overnight-changes level and today's Readiness score (`ReadinessEngine`).
4. **History:** the Readiness scores of the 29 days before (for "usually" and the chart), the 14-night grid and earlier notes of overnight changes, the stress usual and chart.

Each stage only adds fields to the day's `HealthSnapshot` and publishes it when it finishes. The pipeline calculates Readiness, body signals, overnight changes and stress for the last 365 days; older days show sleep and movement.

Shared rules

Rule	Value	In code
Usual range of an overnight value	median ± 2 spreads of the 60 nights before	`OvernightParameters.v1`: `baselineWindowDays` 60, `usualRangeScales` 2
Spread	1.4826 × median absolute deviation, never below a floor per signal	`SignalBaselines`

Rule	Value	In code
Early and settled usual ranges	from 7 and 28 nights	`baselineMinimumNights` 7, `baselineEstablishedNights` 28
Sleep score: early, settled	from 7 and 28 usable nights in 60 days	`SleepParameters.v1`: `calibrationNights` 7, `establishedNights` 28
Sleep need becomes personal	28 free nights, 42 days of history, and an estimate within ±30 min	`personalFreeNights` 28, `personalDays` 42, `personalMaxHalfWidth` 30
Stress levels: early, settled	from 7 and 14 days	`StressParameters.v1`: `provisionalDays` 7, `establishedDays` 14
Usual Readiness	median of the 28 days before, with at least 7	`ReadinessParameters.v1`: `usualScoreDays` 28, `usualScoreMinimumDays` 7
Usual movement	the same kind of day among 56 days (at least 8), else any day among 28 (at least 14)	`MovementParameters.v1`: `usualWindowDays` 56, `usualMinimumSameKindDays` 8, `usualFallbackWindowDays` 28, `usualFallbackMinimumDays` 14
Alertness estimate shown	at least 30 check-ins over 14 days, two tests in a row, one every 10 check-ins	`AlertnessParameters.v1`: `gateCheckIns` 30, `gateDays` 14, `gateEvery` 10, `gateConsecutivePasses` 2
Fitness trend assessed	values in 8 of 26 weeks, at least 12 weeks apart	`FitnessParameters.v1`: `minimumWeeksWithValue` 8, `minimumSpanWeeks` 12
Score bands	85 Excellent, 70 Good, 50 Fair, below Poor	shared by sleep and Readiness

Formulas

A value's distance from your usual, in spreads, with the median and the median absolute deviation (MAD) of the window:

$$z = \frac{x - \text{median}}{1.4826 \times \text{MAD}}$$

A score is the weighted sum of the parts that have data, then the lowest of that sum and every cap that applies:

$$\text{score} = \min\left(\frac{\sum_i w_i\, p_i}{\sum_i w_i},\ \text{cap}_1,\ \text{cap}_2,\ \ldots\right)$$

Maya's Readiness, with every part available (the weights add up to 1) and the points unrounded:

$$0.5 \times 57.14 + 0.2 \times 92 + 0.1 \times 100 + 0.075 \times 100 + 0.075 \times 100 + 0.05 \times 87.78 = 76.36$$

Edge cases the pipeline handles

- **A night that is still going on** reads "Your night isn't over yet" before your usual wake-up time; a night is final an hour after its last recorded sleep.
- **A night that is only partly recorded** has no score and stays out of every baseline.
- **Values that arrive late** (a watch that syncs hours later) change the day once they are there; the feature cache keeps a night's readings only once 48 hours have passed since it ended.
- **A new watch** restarts the usual of wrist temperature, and a new watch generation the usual level of stress; every other signal carries on.

- **Travel and clock changes:** nights are cut in each sample's own time zone; durations are measured between instants.

Where it lives in the code

What	Where
The day pipeline and its stages	`Packages/EvinloKit/Sources/EvinloAlgorithms/Pipeline/DayPipeline.swift`, `DayPipeline+Run.swift`
The feature cache rules	`Packages/EvinloKit/Sources/EvinloAlgorithms/Pipeline/FeatureProvider.swift`
The snapshot every page reads	`Packages/EvinloKit/Sources/EvinloModels/Snapshots.swift`
Sleep	`EvinloAlgorithms/Analysis/SleepAnalysis.swift`, `Score/SleepScorer.swift`, `Need/NeedEstimator.swift`, `Debt/SleepDebt.swift`
Alertness	`EvinloAlgorithms/Alertness/ThreeProcessModel.swift`
The overnight layer and usual ranges	`EvinloAlgorithms/Overnight/SignalBaselines.swift`
Overnight changes	`EvinloAlgorithms/BodySignals/IllnessChain.swift`
Readiness	`EvinloAlgorithms/Readiness/ReadinessScoring.swift`
Stress, movement, fitness	`EvinloAlgorithms/Stress/StressEngine+Days.swift`, `Movement/MovementDayCalculation.swift`, `Fitness/FitnessTrendCalculation.swift`
Every parameter and version	`EvinloAlgorithms/Contract/`
"Compared with your usual" in words	`Packages/EvinloKit/Sources/EvinloModels/UsualComparison.swift`
The app's one source of data	`App/Evinlo/Data/Live/LiveHealthDataSource.swift`

How a change is checked

The evaluation tool (`Tools/EvinloEval`) runs the same day pipeline as the app, day by day and without look-ahead, on synthetic people and on a developer's own Apple Health export on their own Mac. It judges **guardrails**: hard rules that must hold on any data (for example "a day's result does not change when later nights are taken away"), warnings for a person's own data, and synthetic guardrails judged against what the generator intended (for example "a steady person is rarely noted", "strong episodes

reach ‘several signals unusual’”). Reports hold aggregates only; no night of a real person is ever in the repository. Every figure and number in this explainer comes from `evinlo-eval export` on synthetic people.

Privacy, in one table

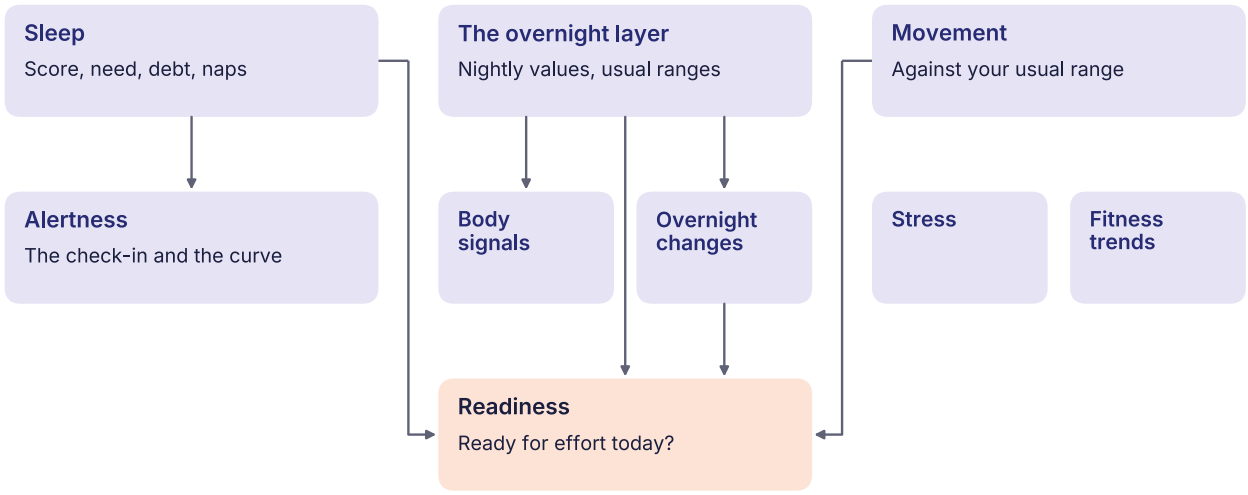
Data	Where it lives
Health samples	Apple Health only
Nights, baselines, ranges, scores, statuses	In memory, worked out again on every refresh
The feature cache	On the iPhone, out of backups, rebuilt from Apple Health at any time
Check-ins and wake-up answers, a sleep need you set	On the iPhone, out of backups, never in iCloud
Settings such as units	On the iPhone, and in your own iCloud while settings sync is on

References

- Leys C. et al., “Detecting outliers: do not use standard deviation around the mean, use absolute deviation around the median”, *Journal of Experimental Social Psychology* 49(4), 2013.
- Shaffer F., Ginsberg J. P., “An overview of heart rate variability metrics and norms”, *Frontiers in Public Health* 5:258, 2017.

- The complete reference for every rule, with its sources: docs/scoring.md. The design of the app: docs/architecture.md and docs/privacy.md.

The other explainers



The map of the Evinlo Explainers. The overnight layer feeds body signals, overnight changes and Readiness; sleep feeds alertness and Readiness; movement feeds Readiness. Stress takes only the times you slept from sleep, and fitness trends stand on their own: months, not days.

Explainer	Read it if you want to know
Sleep, explained	How the sleep score, your sleep need, sleep debt, tonight's need and naps work
Alertness and the daily check-in, explained	How Evinlo estimates how awake you may feel, and learns from your check-ins
The overnight layer, explained	How a night becomes five values and a usual range, and how the heart signal is built
Body signals, explained	What the Body signals page shows and why
Overnight changes, explained	When several signals count as moving together, and what that does and does not mean
Readiness, explained	Every part, weight and limit of the Readiness score
Stress, explained	How the waking day becomes a timeline of your heart rate at rest
Movement, explained	How your usual range works, and why there is no movement score
Fitness trends, explained	How six months of Apple's estimates become a direction, or "No clear change"

Spotted something unclear or wrong, or want to improve a rule? Evinlo is open source, and every rule can be changed through a proposal and a replay. Start at **evinlo.com/contribute**.