evinlo

EVINLO EXPLAINERS

Readiness, explained

How Evinlo turns what your body showed overnight, last night's sleep and yesterday's activity into one score for how ready your body is for effort today.

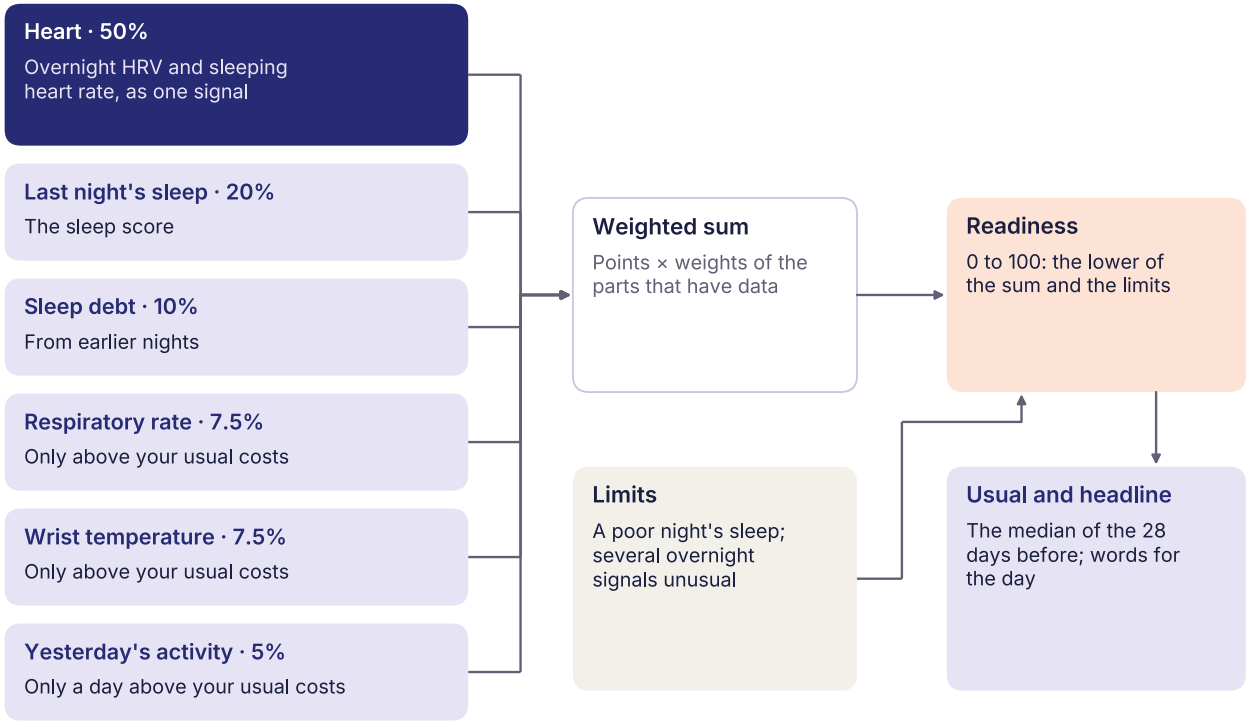


ALGORITHM
Readiness 1.0.1

WRITTEN
October 2026

The one-minute version

Sleep describes the night. **Readiness** asks a different question: how ready is your body for effort today, against your own usual? It gives one score from 0 to 100, says what moved it, and compares it with your usual day.



Readiness in one picture. Six parts, each from the area that owns it, earn points; their weighted sum is the score unless one of two limits is lower. The usual and the headline come from the days before.

IN SHORT

- **The heart counts half.** Overnight HRV and sleeping heart rate, as one signal against your own usual, are 50% of the score. A heart right at your usual earns 65 points, so an ordinary day lands in “Good” with room above it.
- **Five smaller parts:** last night’s sleep score, sleep debt from earlier nights, respiratory rate, wrist temperature and yesterday’s activity. The last four can only cost points.
- **Two limits that hold.** A poor night’s sleep, and several overnight signals unusual together, cap the score whatever the parts add up to.
- **Nothing is worked out twice.** Every part comes from the area that owns it, so Readiness never disagrees with the sleep page or Body signals.
- **It describes, never interprets.** No “recovered”, no “ill”: a score, what moved it, and your usual.

This explainer follows synthetic people made by the app’s generator: **Maya** on an ordinary Tuesday; **Jonas** after a late night; and Maya again, on the same nights, with an **illness-like episode** the generator gave her (her heart rate, breathing and wrist temperature up, her HRV down, for four nights; Tuesday’s night is the third).

What goes in

Readiness reads no Apple Health data of its own. It takes each part from the area that worked it out:

Part	Comes from	What it is
Heart	The overnight layer	One signal from overnight HRV and the sleeping heart rate, in spreads from your usual; Apple's resting heart rate of the day before stands in on a night without either
Last night's sleep	Sleep	The sleep score, and your usual sleep score
Sleep debt from earlier nights	Sleep	The debt that was already owed before last night
Respiratory rate, wrist temperature	The overnight layer	How far above your usual range each sat, in spreads
The several-signals level	Overnight changes	Whether several overnight signals were unusual together
Yesterday's activity	Movement	Active energy in the 24 hours before you fell asleep, against your usual day

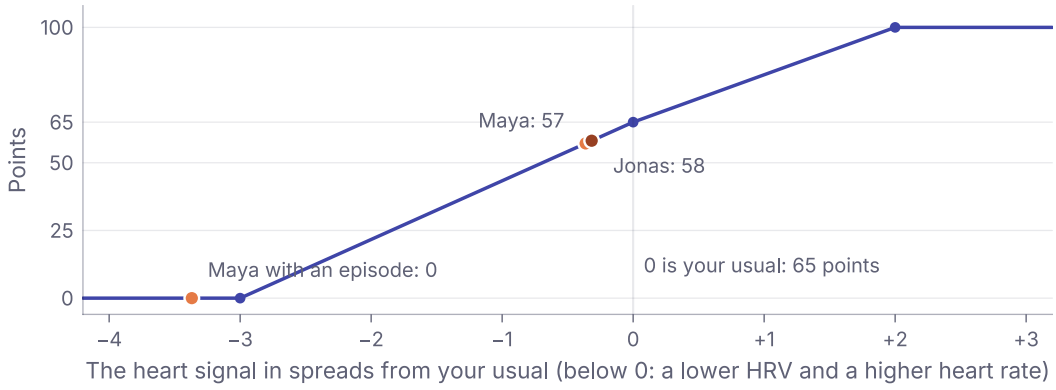
A night needs a heart value with a usual of at least 7 nights behind it. Without one there is no score, and the app says why (see the experts' part).

How it works, step by step

Step 1: the heart, half of the score

HRV (heart rate variability: how much the time between heartbeats varies) and the sleeping heart rate mostly say the same thing, so Readiness counts them **once**, as the heart signal of the overnight layer. Each is expressed as its distance from your usual in **spreads**, a higher HRV and a lower heart rate counting as favourable. A spread is how far your own nights usually scatter around their middle; *The overnight layer, explained* shows how it is worked out. The better-measured of the two, usually the sleeping heart rate, is the anchor; the other moves it by its share of the weight, and by no more than 1.5 spreads times that share. A handful of noisy HRV recordings can therefore neither hide a raised heart rate nor make one up.

The signal becomes points along a line: **0 points at 3 spreads worse than your usual, 65 at your usual, 100 at 2 spreads better.**



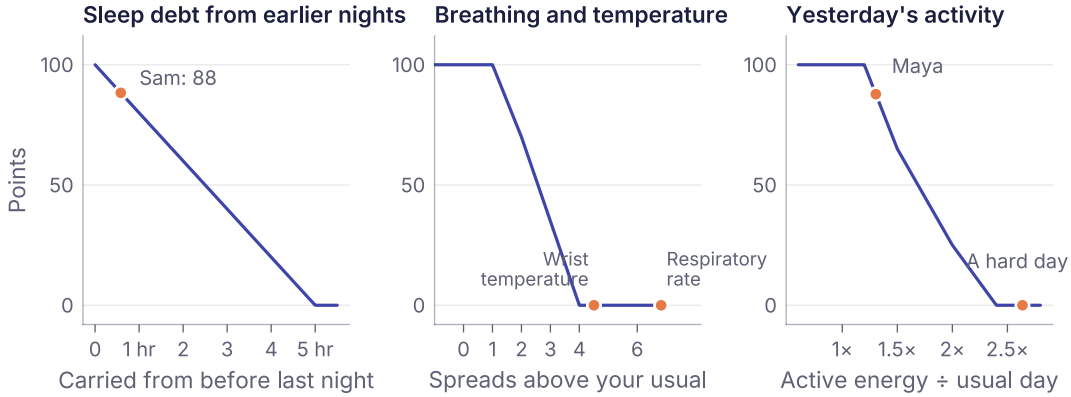
How the heart signal earns its points. Maya's Tuesday signal was a little on the unfavourable side of her usual; with the episode it was more than 3 spreads away, which earns nothing.

Maya's heart signal on Tuesday was −0.36 spreads: her overnight HRV of 40 ms sat toward the lower end of her usual 31–65 ms. That earns 57 points, 8 under the 65 of a day at her usual. With the episode, her HRV was 23 ms and her signal −3.37 spreads: 0 points.

The heart counts with how well it was measured. Its 50% is scaled by the signal's confidence: full with HRV and sleeping heart rate, two thirds with the sleeping heart rate alone, a third when only Apple's resting heart rate of the day before stands in. Below a half, the score is labelled "Limited".

Step 2: the five other parts

- **Last night's sleep** earns the sleep score itself.
- **Sleep debt from earlier nights** earns 100 without debt, falling in a straight line to 0 at 5 hours. Only debt owed *before* last night counts: last night's own shortfall is already in its sleep score.
- **Respiratory rate and wrist temperature** earn 100 up to 1 spread above your usual, 70 at 2, 35 at 3 and 0 from 4. Below your usual costs nothing.
- **Yesterday's activity** earns the movement section's points: 100 up to 1.2 times your usual day, 65 at 1.5, 25 at 2, 0 from 2.4. A quiet day costs nothing.



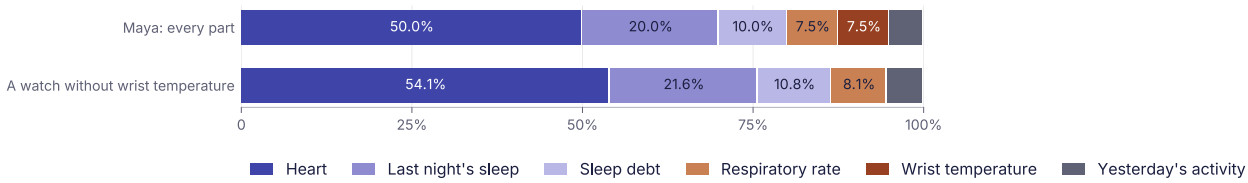
How the smaller parts earn their points. Left: Sam, who wakes to an alarm on workdays, carried 35 minutes of debt into Friday 18 September. Middle: Maya's breathing and wrist temperature with the episode. Right: Maya's Monday, and a day of more than twice the usual activity.

Sam's 35 minutes from earlier nights earned 88 points. With the episode, Maya's respiratory rate sat 6.8 spreads and her wrist temperature 4.5 spreads above her usual: 0 points each. On Monday Maya used 1.30 times her usual active energy, which earns 88; a synthetic person given a hard day of 2.64 times their usual earns 0.

Step 3: the weights, and parts without data

Part	Weight
Heart	50%
Last night's sleep	20%
Sleep debt from earlier nights	10%
Respiratory rate	7.5%
Wrist temperature	7.5%
Yesterday's activity	5%

The weighted sum is the points times the weights of the parts that have data, divided by the sum of those weights. **A part without data is left out**, its weight shared among the others in proportion, and the page names it and says why.



The share each part has of the score. Maya has every part. On a watch without wrist temperature, the other parts share its 7.5%.

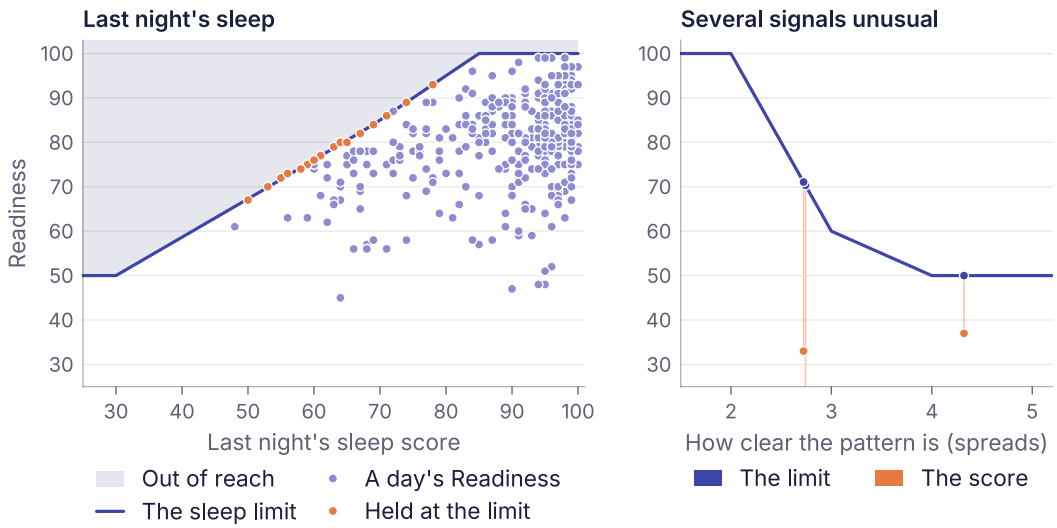
On a synthetic watch without wrist temperature, the heart counts 54.1%, last night's sleep 21.6%, sleep debt 10.8%, respiratory rate 8.1% and yesterday's activity 5.4%; that person's Tuesday scores 75. There is no score without the heart part.

Step 4: two limits

Two conditions limit the score, whatever the parts add up to. The score is the lower of the weighted sum and the limits, rounded half up.

- **Last night's sleep.** A sleep score of 30 or less limits Readiness to 50; 52 limits it to 69; 69 to 84; from 85 there is no limit, with straight lines in between. A night without a sleep score (in the first week) is limited by its hours instead: under 5 hours at most 69, under 6 hours at most 84.
- **Several signals unusual**, the highest level of the overnight-changes check. Take the second-largest of the three components' distances from your usual tonight, and the same of the night before plus half a spread, and use the smaller: no limit at 2 spreads, 60 at 3, 50 from 4.

A limit is **listed only when it matters**: when it is below 85 or below the weighted sum. A single signal, however far away, can never limit the score, and neither can "Worth keeping an eye on".

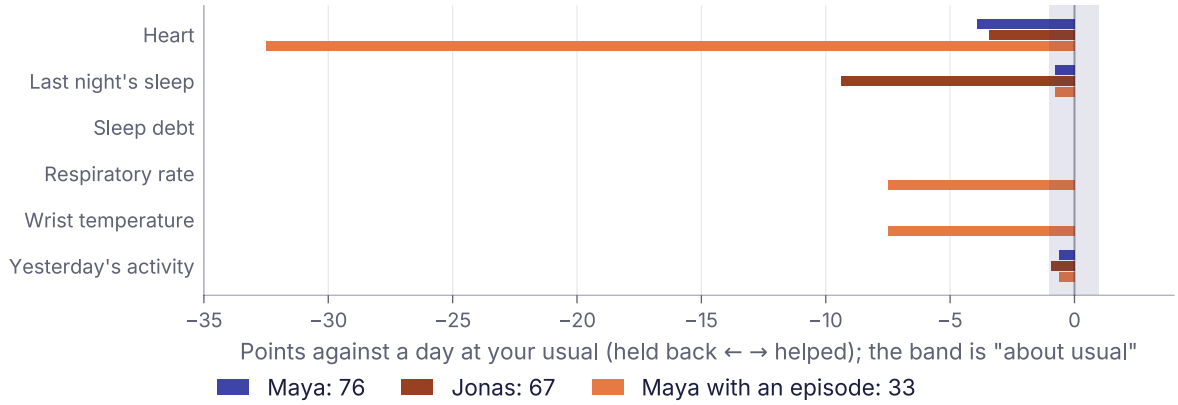


Left: every scored day of Maya, Maya with naps, Jonas and Sam, against last night's sleep score; above the line is out of reach. Right: the nights of the episodes that read "several signals unusual", with the limit and the score.

On those four sleepers the sleep limit held the score on 19 of 452 days. With the episode on Tuesday, the second-largest distance was 4.50 spreads, and 2.22 the night before; the smaller of 4.50 and 2.72 (2.22 plus half a spread) sets a limit of 71. It is listed, but the parts had already taken the score far lower.

Step 5: what moved it

For each part, Readiness works out how far it moved the score from a day on which that part sat at your usual: its points minus its points at your usual (65 for the heart, your usual sleep score for sleep, 100 for the others), times its share. A point or more down is "held back", a point or more up "helped", anything less "about usual". The moves add up to the difference between the day's weighted sum and that of a day at your usual.



What moved Readiness on Tuesday, in score points against a day at each person's usual. For Maya only the heart held the score back; for Jonas, mostly last night's sleep; with the episode, the heart, breathing and wrist temperature.

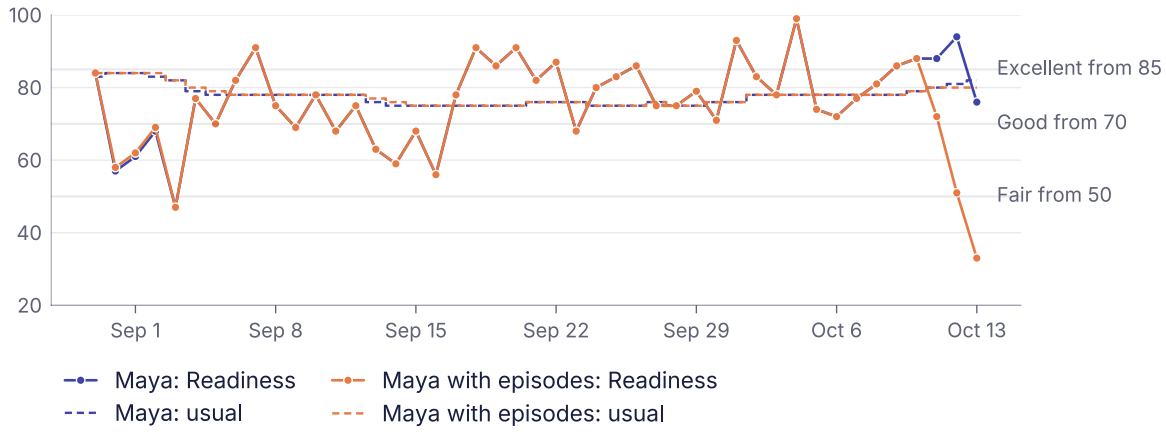
Maya's heart held her score back by 3.9 points; her sleep (92 against her usual 96) and her activity moved it by less than a point. Her weighted sum is 76.36: **Readiness 76**, against a usual of 82. With the episode, the heart took 32.5 points and breathing and wrist temperature 7.5 each: the weighted sum is 32.79 and her **Readiness 33**, against a usual of 80.

Step 6: usual, bands and headline

Your **usual** is the median of your scores of the 28 days before, with at least 7 of them. The score uses the shared bands (85 Excellent, 70 Good, 50 Fair, below Poor), and a headline, the first that applies:

Headline	When
Well below your usual today (or “A low Readiness today”)	A score below 50, or the several-signals limit lies below the weighted sum
Held back by a short night, or by last night’s sleep	The sleep limit lowered the score; or last night’s sleep cost most, the heart held nothing back and the score is below your usual
Below your usual today (or “A lower Readiness today”)	Well below your usual (10 points or more), or below 70
Ready for effort	85 or more, or well above your usual; never while several signals are unusual
Ready for an ordinary day	Otherwise

The words of the two low headlines follow the comparison with your usual: “below your usual” only when the score is below it, otherwise “A low Readiness today” (under 50) or “A lower Readiness today”.



Maya’s last six weeks, and the same weeks with episodes. The dashed lines are the usual of each day: the median of the 28 days before it.

The score is final the first time it is shown: it needs nothing but the day’s own inputs. “Usually 82”, the 30-day chart and the headline need the scores of the days before, so they arrive a moment later.

A worked example

Meet **Jonas** again, the synthetic person from *Sleep, explained*. On Monday night he fell asleep after two and slept 5 hr 16 min; his sleep score is 50, against a usual of 97. It is Tuesday at 16:30.

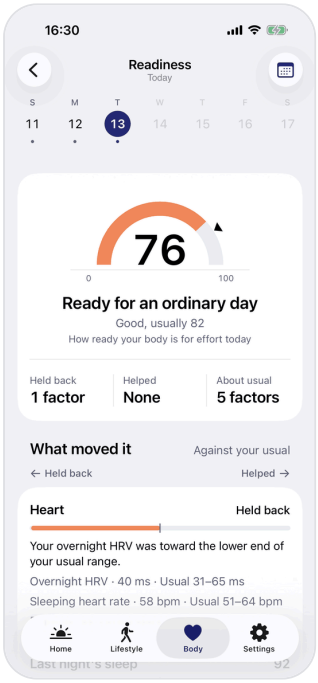
Part	Jonas's value	Points	Weight	Move
Heart	Signal −0.32 spreads; HRV 37 ms, usual 28–61 ms	58	50%	−3.4
Last night's sleep	Sleep score 50, usually 97	50	20%	−9.4
Sleep debt from earlier nights	None before last night	100	10%	0
Respiratory rate	Inside his usual range	100	7.5%	0
Wrist temperature	Inside his usual range	100	7.5%	0
Yesterday's activity	1.36 times his usual day	81	5%	−0.9

The table rounds the points; the score adds them up unrounded (58.14 for the heart, 81.45 for yesterday's activity), so the weighted sum is 68.14. His **sleep limit** at a sleep score of 50 is 67.27 (on the line from 50 at a score of 30 to 69 at 52), lower than the sum, so it applies: **Readiness 67**, against a usual of 82. The limit lowered the score and the night was short, so the headline is **"Held back by a short night"**, and the page says that last night's sleep score of 50 limits Readiness to 67.

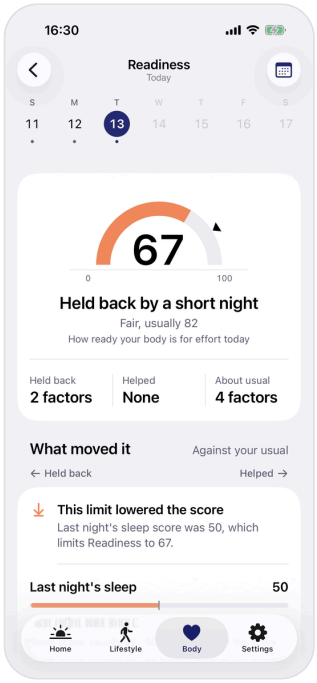
Two things Readiness does *not* do here. The sleep page shows Jonas 1 hr 34 min of sleep debt, but it is all from last night; since last night's sleep already counts through its score, the debt part earns its full 100. And his heart held the score back a little, as Maya's did: his HRV sat a little below his usual.

What you see in the app

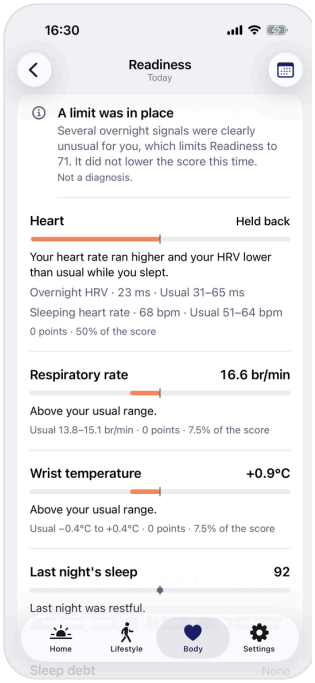
These screens were taken at 16:30 on Tuesday 13 October in the app's synthetic data mode.



Maya: 76, "Ready for an ordinary day", Good, usually 82.



Jonas: 67, "Held back by a short night"; the limit lowered the score.



Maya with the episode: a limit of 71, listed but not lowering the score, and the heart at 0 points. Not a diagnosis.

In its first week a new person sees "Getting to know your body" and how many of the 7 earlier nights are there, instead of a score.

Honest limits

- **Readiness is an estimate for general wellness.** It describes how your overnight signals and your night compare with your usual; it is not a measure of fitness, and not a medical assessment. Several signals unusual is not a diagnosis.
- **The heart rests on a few recordings.** A night's HRV often comes from four or five one-minute recordings. That is why the sleeping heart rate anchors the signal and why a thin heart signal counts less and is labelled.
- **Many things move the same signals.** Alcohol, a late meal, heat, travel, a hard workout and illness all lower HRV and raise the heart rate. Readiness shows that your body looked different, not why.
- **Activity is counted lightly, on purpose.** After a much more active day the heart signals have usually moved already, so yesterday's activity is only 5% and never limits the score.
- **The weights are choices.** Every weight, mapping and limit is a design choice, checked with the evaluation tool. The direction rests on studies; the numbers do not.

- **The episode is generated.** Its effect sizes are assumptions of the generator, and real nights move in more ways at once.

For the experts

Version and order of operations

This explainer describes `ReadinessAlgorithm.version` **1.0.1**. A day carries the versions of everything it was calculated from, for example "1.0.1+overnight1.0.0+movement1.0.0+sleep1.3.0". Version 1.0.1 differs from 1.0.0 in one headline rule (last night's sleep holds a day back only when the score is below your usual); no score changed.

1. The pipeline finishes sleep, movement (yesterday's activity), the overnight values and the overnight-changes level first.
2. `ReadinessEngine` decides whether the day has a score (`ReadinessState`, below), gathers the inputs from the other areas (`ReadinessDayBuilder.inputs`) and scores them (`ReadinessScoring`): the parts and their points, the weighted sum, the limits, the rounded score, the moves.
3. With the scores of the 28 days before: the usual and the headline. The history of 30 days follows in the pipeline's last stage.

Parameters

From `ReadinessParameters.v1` (`Packages/EvinloKit/Sources/EvinloAlgorithms/Contract/ReadinessContract.swift`), the heart signal's from `OvernightParameters.v1` and yesterday's activity from `MovementParameters.v1`.

Rule	Parameters
Weights: heart, sleep, debt, respiratory rate, wrist temperature, activity	`heartWeight` 0.50, `sleepWeight` 0.20, `debtWeight` 0.10, `respiratoryWeight` 0.075, `temperatureWeight` 0.075, `activityWeight` 0.05
Heart points (spreads → points)	`heartKnots` (−3, 0), (0, 65), (2, 100)
Debt from earlier nights (minutes → points)	`debtKnots` (0, 100), (300, 0)
Respiratory rate and wrist temperature (spreads above → points)	`deviationKnots` (1, 100), (2, 70), (3, 35), (4, 0)
Sleep limit (sleep score → limit)	`sleepCapKnots` (30, 50), (52, 69), (69, 84), (85, 100)
Limit of a night without a sleep score (hours → limit)	`unscoredNightLimits` (5, 69), (6, 84)
Several-signals limit (spreads → limit), the night before with half a spread more	`severalSignalsCapKnots` (2, 100), (3, 60), (4, 50); `severalSignalsPreviousNightAllowance` 0.5
A limit is listed below	`capListedBelow` 85
Held back, helped from; the costliest part named on Home from	`directionThreshold` 1.0, `namedPartMinimumMove` 3.0
Usual: 28 days, at least 7; history 30 days	`usualScoreDays` 28, `usualScoreMinimumDays` 7, `historyDays` 30
"Limited" below; no score below (none in this version)	`limitedHeartConfidence` 0.5, `minimumHeartConfidence` 0

Rule	Parameters
Heart signal: spreads kept between −4 and 3; the other input moves the anchor by at most 1.5 × its share	`heartZMinimum` −4, `heartZMaximum` 3, `heartAgreementLimit` 1.5
Heart weights: sleeping heart rate 1, HRV k ÷ (k + 1) of k recordings (Apple's own at most 8), SDNN half, Apple's resting heart rate half; full confidence at 1.5	`appleRMSSDCountCap` 8, `sdnnWeightFactor` 0.5, `restingHeartRateWeight` 0.5, `heartConfidenceFull` 1.5
A heart value needs a usual of 7 nights; no score while the night's heart values are still arriving, 2 hours after waking	`baselineMinimumNights` 7, `waitingForSignalsMinutes` 120
Yesterday's activity (ratio → points), over 24 hours against 28 days (at least 14)	`loadPointKnots` (1.2, 100), (1.5, 65), (2.0, 25), (2.4, 0); `loadWindowHours` 24, `loadReferenceDays` 28, `loadMinimumReferenceDays` 14

Formulas

With p the points of the parts that have data and w their weights (the heart's scaled by its confidence c):

$$\text{sum} = \frac{\sum_i w_i\, p_i}{\sum_i w_i}, \qquad w_{\text{heart}} = 0.5 \cdot \min(c, 1), \qquad \text{score} = \text{round}\Big(\min(\text{sum},\ \text{limit}_{\text{sleep}},\ \text{limit}_{\text{several}})\Big)$$

The move of a part, with p̄ its points at your usual: move = (p − p̄) × w ÷ Σw. The heart signal, with z_a the anchor, z_o the other input and $s_o = w_o \div (w_a + w_o)$:

$$g = z_a + s_o \cdot \text{clamp}(z_o - z_a,\ -1.5,\ 1.5), \qquad c = \min\left(1,\ \frac{w_a + w_o}{1.5}\right)$$

Jonas's Tuesday, with the points unrounded:

$$0.5 \times 58.14 + 0.2 \times 50 + 0.1 \times 100 + 0.075 \times 100 + 0.075 \times 100 + 0.05 \times 81.45 = 68.14$$

$$\text{score} = \text{round}\big(\min(68.14,\ 67.27)\big) = 67$$

When there is no score

Decided in this order (`ReadinessState`); each has its own words, none shows a number:

State	Rule
The night isn't over yet; Waiting for last night	Today, while the sleep section waits for the night
No night recorded	No main sleep for the day
No score today	The night was entered by hand, is incomplete, or has under 3 hours asleep
Waiting for measurements	Today, within 2 hours of waking: an Apple Watch night without a heart value yet
Night from another sleep tracker, or no heart rate found	No heart value at all
Getting to know your body	A heart value exists, its usual needs 7 nights ("4 of 7 earlier nights")

A night from another tracker still gets a "Limited" score when Apple's resting heart rate of the day before and its usual exist. Next to a score the app can note that the heart part rests on limited data, that wrist temperature is restarting on a new watch (left out for 7 nights), or that the night may still change.

Edge cases

- **The night may still change** while the watch syncs: the score is shown and marked, until the night is final and 4 hours past the wake-up.
- **A part's points can fall inside your usual range:** the points fall from your usual value on, not from the edge of the range, so the words say where the value sat ("toward the lower end of your usual range"), never "lower than usual".
- **Several signals unusual** is never called "Ready for effort", whatever the score.
- **Apple's resting heart rate** is a value of the day before: it is shown with that day's date and never stands in while the night's own values are still arriving.

Where it lives in the code

All under `Packages/EvinloKit/Sources/EvinloAlgorithms/`: the parameters, the version and `ReadinessEngine` in `Contract/ReadinessContract.swift`; the parts in `Readiness/ReadinessParts.swift`; the score, moves and headline in `Readiness/ReadinessScoring.swift`; the limits in `Readiness/ReadinessLimits.swift`; when there is no score in `Readiness/ReadinessState.swift`; the day, its inputs, notes and breakdown in `Readiness/ReadinessDayBuilder.swift`; the heart signal in `Overnight/HeartMerging.swift`; yesterday's activity in `Contract/MovementContract.swift` (`recentLoad`).

What the validation checks

Tests in `Packages/EvinloKit/Tests/EvinloAlgorithmsTests/Readiness` (among them `ReadinessWorkedExampleTests`) pin the worked examples of `docs/scoring.md`. The evaluation tool (`Tools/EvinloEval`) replays the pipeline day by day and rescores every scored day with one input changed. Among its hard guardrails: after a night under 5 hours the score is at most 69, under 6 hours at most 84 (RG1); one small step of one input moves the rounded score by at most 2 (RG2); improving one input never lowers the score (RG3); with a sleeping heart rate, no value of the HRV moves the score by more than 16.25 points at a heart share of a half, and no value of the respiratory rate, the wrist temperature or yesterday's activity by more than 15 (RG4); no score without a complete night, a heart signal and 7 nights behind its usual (RG6); no score lowered without a named limit (RG7); the score is the rounded minimum of the sum and the limits, and the moves add up (RG9). On synthetic people it checks, against what the generator intended, that the score follows the hidden state of the night, that an illness-like episode lowers it, and that the early scores of a new person sit near the later ones.

References

- Buchheit M., "Monitoring training status with HR measures: do all roads lead to Rome?", *Frontiers in Physiology* 5:73, 2014.
- Myllymäki T. et al., "Effects of exercise intensity and duration on nocturnal heart rate variability and sleep quality", *European Journal of Applied Physiology* 112(3), 2012.
- Craven J. et al., "Effects of acute sleep loss on physical performance", *Sports Medicine* 52(11), 2022.
- Every rule, the replays and the guardrails: docs/scoring.md, "Readiness score".

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**.