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Titel	Why Is the Upper Sauna Bench So Hot?
Subtitel	Temperature stratification, convection, ceiling height and bench position—and what they mean for the body
Author	Dr. Karsten Gröning
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Short answer: The upper bench is hotter because a sauna develops a strong vertical temperature gradient. Air heated by the stove becomes less dense and rises; cooler air descends and is reheated. This convective circulation produces thermal stratification: the upper part of the cabin is much hotter than the lower part. Bench height therefore determines which part of this thermal field surrounds the body. A high ceiling with benches that remain low can place the hottest air above the bathers, wasting usable heat and leaving the feet relatively cool. A well-designed sauna places the upper bench close enough to the ceiling—and the foot level high enough—that most of the body lies within the warm upper zone. The effect is physiological as well as technical: moving upward increases convective and radiant heat load, reduces the margin for heat loss and can accelerate skin warming, sweating, cardiovascular responses and body heat storage.

Two people can sit in the same sauna, under the same ceiling and beside the same heater, yet experience very different thermal conditions simply because one is seated higher than the other. This is not a subjective illusion. It is a direct consequence of the way heat and air move inside the cabin.

The upper bench is deliberately placed in the warm part of the sauna. Understanding why explains several practical design rules at once: why sauna benches are tiered, why ceiling height matters, why cold feet are often a construction problem, why lying down changes thermal sensation and why changing benches is an effective way of changing the thermal dose.

In a sauna, height is a temperature control.

Why is the top of the sauna hotter?

The heater warms both surrounding surfaces and the air. Air that becomes warmer expands, its density decreases and buoyancy drives it upward. Cooler, denser air moves downward and toward the heater, where it is heated again.

This produces a convective circulation within the room. Because buoyant warm air preferentially occupies the upper cabin, temperature does not become uniform from floor to ceiling.

The result is thermal stratification: horizontal layers with progressively different temperatures according to height.

What is thermal stratification?

Thermal stratification means that the cabin has a vertical temperature gradient rather than one single 'sauna temperature'. The ceiling region is hottest, the occupied upper zone somewhat cooler, and the lower cabin and floor considerably cooler.

The exact gradient is not universal. It depends on heater design, room geometry, ventilation, insulation, surface temperatures and the stage of heating. Finnish VTT research showed that ventilation layout can materially change the vertical temperature distribution [1].

For this reason, statements such as 'the sauna is 90 °C' are incomplete unless the measurement height and position are known.

> **A sauna does not have one temperature. It has a temperature field.**

Why doesn't convection mix everything evenly?

Convection creates circulation, but circulation does not necessarily eliminate stratification. Buoyancy continuously separates warmer, lighter air upward from cooler, denser air below.

Mixing by the heater plume, ventilation, people and fanning reduces local differences, yet a substantial vertical gradient can remain.

A well-designed sauna therefore works with stratification rather than pretending it does not exist.

How large can the temperature difference be?

There is no reliable universal number such as a fixed number of degrees per 10 centimetres. Measurements from different saunas show very different profiles.

What is consistent is the direction: temperatures generally increase strongly with height. Experimental and field measurements can show a relatively cool lower zone beneath a much hotter upper occupied zone [1,2].

Any simple rule that every 10 cm always equals a particular temperature increase should therefore be treated as an approximation, not a law of sauna physics.

Why is the upper bench positioned near the ceiling?

The purpose of the upper bench is to place the bather inside the useful hot zone. If the bench remains too low while the ceiling is high, much of the hottest air occupies space above the person's head rather than surrounding the body.

Traditional Finnish design therefore relates bench position to the ceiling rather than simply specifying a seat height above the floor. Practical Finnish design guidance commonly places the upper bench roughly 1.0–1.2 m below the ceiling [3].

Within the International Sauna Academy's quality-oriented construction framework, the upper bench should be no more than approximately 1.0 m below the ceiling. This deliberately places the bather high in the usable thermal zone.

Why ceiling height matters

Increasing ceiling height increases room volume, but it also changes where the hottest layer sits. If the benches are not raised with the ceiling, the bathers remain below part of the heat they paid to produce.

A very high ceiling can therefore create an unused reservoir of hot air above the occupied zone. Heater power may be increased to make a low bench feel hot enough, while the ceiling region becomes unnecessarily hot.

Quality-oriented sauna design consequently treats room height and bench height as a coupled problem. The Academy's working range of approximately 2.00–2.40 m room height is intended to keep the occupied thermal zone controllable while preserving adequate headroom.

Why can your head be hot while your feet are cold?

When a person sits upright, the head may be 70–100 cm higher than the feet. In a strongly stratified sauna, those body regions therefore occupy different thermal layers.

The head and shoulders can receive hot air and strong radiant heat while the feet remain in substantially cooler air. The problem becomes more pronounced when the foot bench is too low or cool supply air accumulates near the floor.

The familiar complaint 'my head is burning but my feet are cold' is therefore often a room-design and air-distribution problem, not simply excessive heater temperature.

What is the 'law of löyly'?

Finnish sauna design often uses a practical rule that the bather's feet should be at or above the level of the top of the heater stones. The purpose is not mystical; it is geometric and thermal.

Raising the foot level moves more of the body out of the cool lower layer and into the warm region in which löyly circulates. Finnish design literature describes this relationship between stove height, foot bench and upper bench as central to good löyly [3].

It is best understood as a useful design principle rather than a universal physical boundary at the exact height of the stones.

Why does lying down feel different?

When lying on the upper bench, most of the body occupies approximately the same vertical level. The head, trunk and legs therefore experience a more similar air temperature than when sitting upright.

This reduces the head-to-foot temperature difference produced by vertical stratification. It does not necessarily reduce the total heat load; it makes the distribution over the body more uniform.

> **Sitting changes thermal dose vertically. Lying down makes the body's exposure more horizontally uniform.**

Does radiation also increase on the upper bench?

Yes, although the mechanism differs from air stratification. The body exchanges radiant heat with the heater, walls and ceiling according to their temperatures, geometry and view factors.

Upper wall and ceiling surfaces become hot during sauna operation. A bather positioned higher can therefore experience a different mean radiant environment as well as hotter air.

The sensation on the upper bench is consequently produced by the combined effects of convection, radiation, evaporation and—during Aufguss—water-vapour transport.

Why the thermometer can mislead

A thermometer measures temperature only where its sensor is located. A reading of 90 °C near head height does not mean the foot zone, lower bench or floor is also at 90 °C.

Moving a thermometer vertically can produce a very different value without anything about heater output having changed.

For technical evaluation, measurement height must therefore always be documented. A single cabin temperature cannot describe the full thermal environment.

Why thermostat position matters

Electric sauna heaters are commonly controlled by a temperature sensor mounted relatively high in the cabin. The controller therefore responds to the temperature at that location, not to the temperature at the bather's feet.

If the bench system is too low, increasing the thermostat setting can overheat the upper room while still failing to create a balanced head-to-foot environment.

Correct geometry should therefore come before attempts to solve comfort problems with a higher set temperature.

How ventilation changes stratification

Ventilation can either reduce or worsen vertical temperature differences. Cool supply air that enters low and fails to mix can strengthen the cold lower layer.

In VTT experiments with mechanical exhaust ventilation, introducing cooler supply air above the heater allowed it to mix with the hot circulating air, while a lower exhaust promoted mixing between the upper and lower cabin [1].

This is why bench height and ventilation cannot be designed independently.

> **Cold feet can be a bench-height problem, a ventilation problem—or both.**

What happens during Aufguss?

When water is poured onto hot stones, it evaporates and the resulting vapour-rich air is carried upward by the heater plume. The upper part of the cabin is therefore reached first and most strongly.

The increased water-vapour pressure reduces evaporative heat loss from the skin and can increase heat transfer. This is why an Aufguss can feel dramatically hotter even when the dry-bulb air temperature changes little.

Because the upper bench already lies in the hottest zone, it usually experiences the strongest combined effect.

Does the steam stay at the ceiling?

Water vapour is a gas mixed with the cabin air; it should not be imagined as a separate heavy or light blanket permanently floating at one level. The visible white 'steam' sometimes seen is actually condensed droplets, not invisible water vapour itself.

Nevertheless, the hot vapour-rich plume from the heater initially rises, and the thermal circulation carries the changed air through the upper cabin. Ventilation, geometry and fanning then determine how it spreads.

This is why the distribution of löyly is strongly linked to the same room physics that creates the upper hot zone.

Why does fanning make the upper bench feel even hotter?

Fanning moves hot, humid air across the skin, disrupts the local boundary layer and increases convective and mass transfer. It does not create thermal energy; it changes the rate at which the existing cabin environment interacts with the body.

On the upper bench, where air temperature and water-vapour content may already be high after Aufguss, this increased transfer can produce a particularly strong sensation.

The effect demonstrates an important principle: temperature alone does not determine thermal dose.

What changes physiologically when you move upward?

Moving from a lower to an upper bench generally exposes the body to a hotter air and radiant environment. Convective heat gain can increase, skin temperature rises more rapidly and the gradient available for dry heat loss becomes less favourable.

The thermoregulatory response therefore intensifies: skin blood flow increases, sweating is stimulated and cardiovascular compensation becomes more demanding.

If net heat gain increases, core temperature will eventually rise more rapidly as well.

> **Moving up one bench is not merely a comfort choice. It changes the physiological heat dose.**

Why doesn't sweating fully compensate?

Sweating can remove substantial heat only when sweat evaporates. In a hot dry sauna, evaporation is an important defence against heat gain.

During Aufguss, increased water-vapour pressure reduces the evaporative gradient. Sweat may increase while its cooling effectiveness decreases.

The upper bench therefore combines greater external heat load with conditions that can temporarily make evaporative cooling less effective.

Is the upper bench therefore dangerous?

No. The upper bench is a normal and intentional part of sauna design. It allows bathers to select a stronger thermal environment.

The safety issue is dose: temperature, radiation, humidity, Aufguss, duration, individual tolerance and previous heat exposure all interact.

A person who finds the upper bench excessive can move lower or leave the sauna. Bench choice is one of the simplest ways to regulate exposure without changing the entire cabin.

Is the lower bench 'for beginners'?

It can provide a milder thermal environment, but it should not be regarded as an inferior place. The lower bench is a dose-control option.

Age, health, previous sauna exposure, Aufguss intensity and personal preference all influence which level is appropriate at a given moment.

Professional sauna practice should avoid social pressure to remain on the highest bench.

Why good sauna design provides several levels

Tiered benches allow different thermal doses within the same cabin. The heater does not need to be adjusted every time one person wants less heat.

This is an elegant form of passive environmental control: moving vertically changes the surrounding temperature field.

A well-designed bench system therefore serves both ergonomics and thermoregulation.

Can the upper bench be too high?

Yes. Sufficient headroom is required for safe and comfortable sitting, standing and movement. A bench placed excessively close to the ceiling can make posture uncomfortable and increase the risk of contact with hot surfaces or ceiling structures.

The design objective is not to put the bather at the hottest possible point. It is to place the body within a useful thermal zone while maintaining appropriate headroom.

This is why the distance between upper bench and ceiling is a functional dimension, not simply a stylistic choice.

Can the upper bench be too low?

Yes. If it is too low, the bather's body remains partly in the cooler lower layer while substantial heat accumulates unused above the head.

The result can be poor thermal uniformity, cold feet and a temptation to compensate by increasing heater output or thermostat setting.

A sauna can therefore be technically 'hot enough' at the sensor and still be poorly designed for the person sitting in it.

Why room height should not be chosen independently

A sauna is not an ordinary room into which a heater and benches are added afterwards. Ceiling height determines how much vertical space exists for stratification, and bench geometry determines where the body sits within that gradient.

For quality-oriented construction, room height, upper bench position, foot level, heater height and ventilation should therefore be planned as one system.

The Academy's design values—approximately 2.00–2.40 m room height, upper bench no more than about 1.00 m below the ceiling and steps of no more than approximately 0.45 m—follow this functional logic.

What does this mean for sauna quality?

A powerful heater cannot compensate completely for poor vertical geometry. If the bather is positioned in the wrong part of the temperature field, increasing heater power may simply increase the temperature of unused upper air.

Quality is therefore not defined by maximum temperature. It is defined partly by whether the cabin places the bather in a controllable, reasonably uniform and physiologically appropriate thermal zone.

> **Good sauna design brings the bather to the heat. It does not merely produce more heat.**

A useful mental model

Imagine the sauna as a vertical thermal landscape. The floor is the cool valley; the ceiling is the hot summit. The benches are platforms that determine at which altitude the body experiences the room.

The heater creates the thermal landscape, ventilation reshapes it, and Aufguss temporarily changes both heat and moisture transfer within it.

The bather then regulates personal thermal dose simply by choosing position and duration.

So, why is the upper sauna bench so hot?

Because the sauna is vertically stratified. Heater-driven convection transports warm air upward, buoyancy keeps the upper cabin hotter, and the surrounding surfaces create an additional radiant environment.

The upper bench intentionally places the bather in this warmer zone. Ceiling height, foot-bench level and ventilation determine how effectively the body is positioned within it.

The higher thermal environment then produces a stronger physiological response through greater skin heating, vasodilation, sweating and cardiovascular compensation.

Conclusion

The upper bench is hot by design, not by accident. Thermal stratification creates a vertical gradient, and sauna architecture uses bench height to place bathers at different points within that gradient.

This explains why ceiling height and bench position must be planned together, why feet should not remain trapped in the cool lower zone and why a single thermometer reading cannot describe the sauna climate.

It also connects sauna technology directly with physiology: moving the body upward changes the heat-transfer environment, and changing the heat-transfer environment changes the body's thermoregulatory response.

The upper bench is therefore one of the simplest examples of sauna physics becoming human physiology.

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