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When the Thermometer Says Nothing Is Wrong

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It reorganizes completed research so readers can follow the question and inquiry without changing its evidence or limits. The four source papers remain independently accessible and citable in the research lineage below.

Abstract

One side of the body can feel burned or frozen while a thermometer or thermogram shows little unusual. We often try to choose between sensation and number. But an infrared camera samples one moment at the skin surface, whereas the nervous system reads temperature together with rate of change, location, contrast, pain, and threat. Healthy people vary widely in detecting the same thermal change; innocuous cooling can feel warm, and mild temperatures can evoke burning. After nerve injury, small cooling can become severe pain. Sensation is not a thermometer, but that does not make it false. Trouble begins when one normal test becomes a verdict on the whole experience. Direct research is missing, yet studies of chronic pain and illness show how disbelief and self-doubt, concealment, and relational withdrawal can deepen isolation. Rather than choosing a winner between two data streams, this essay proposes placing location, time, temperature, sensory thresholds, and social response on the same event timeline.

Keywords: scientific essay · thermosensation · thermography · cold allodynia · medical invalidation · social isolation

One body produced two readings

The body says it is on fire. The camera says 33.1°C. The opposite side is not very different, and a hand placed on the skin finds nothing remarkable. Yet clothing seems to add heat, and cold water briefly brings relief. Or the polarity reverses: the room is warm, but hands and feet feel frozen to the bone, and a breeze others find pleasant cuts like a blade.

We begin a trial too quickly. If the number is right, sensation must be wrong; if sensation is trusted, the test must be useless. Yet the readings never addressed the same object. One is a physical quantity at the skin surface. The other is an experience produced by a living nervous system. The question is not who lied, but what went missing between the measurements [1].

The camera was not wrong; it saw one frame

Infrared thermography does not see through the body. It converts infrared radiation emitted by the skin surface into temperature. Room conditions, recent activity, topical products, camera geometry, and the selected averaging region all change the value. That is why preparation and acquisition must be standardized [2].

Standardization has a paradox. A perfect image obtained after acclimatization in a quiet room—once the episode has settled—may miss the event of interest. The camera can be accurate about the surface at that moment. Its accuracy cannot retrospectively negate two hours of burning last night or cold felt beneath the skin. One frame does not falsify the film.

The body does not read degrees Celsius

The nervous system does not read absolute temperature alone. It computes direction, rate, area, contrast with adjacent skin, and whether the stimulus predicts damage. Body regions also have different resolution. When John Stevens and Kenneth Choo tested 13 sites in 60 people, sensitivity varied by roughly a hundredfold across the surface and was generally greater for cooling [3].

Anna Vabba and colleagues warmed the hands of 31 healthy adults with radiant heat and asked them to identify the direction of change. Average accuracy was 73%, but individuals ranged from 41% to 92%. Being accurate about heartbeats did not predict thermal accuracy [4]. Sensing the body is less one general score than a loose federation of channels.

The experiment in which mild temperatures become fire

Intuition expects sensation to rise gently with stimulus. In the laboratory, this line bends. Interlacing harmless warm and cool bars against the hand can create burning or pain absent when either is touched alone. This is the thermal-grill illusion. No hidden hot bar is present. A new experience emerges as the central nervous system integrates spatially mixed warm and cool signals [5].

There is a stranger result. At tiny sensory spots on healthy skin, mild stimuli around 29°C or 37°C can produce pricking or burning [6]. After nerve injury, normally innocuous cooling may become intolerable pain [7]. Physiology can therefore answer, “How can such a small temperature difference feel so severe?” The sensory system is not a linear thermometer. Possibility, however, is not a diagnosis of neuropathy in any individual.

Cooling can feel warm

Sensation can change direction as well as magnitude. When J Vollert and colleagues analyzed QST in 1,090 people with somatosensory lesions, paradoxical heat—reporting cooling as warmth—appeared in 30% of those with neuropathic pain and 2% of healthy controls. It was tied more closely to impaired thermal detection than to pain intensity [8].

Hans Henrik Andersen and colleagues also found paradoxical heat more often after precooling the skin of 100 healthy people [9]. Cooling did not physically become heating; sensory circuitry assigned the wrong direction to the input. Thermal-stimulus distortion exists, but “distortion” must describe nonlinear transformation, not dishonesty in the report.

Two measurements produce four stories

Recording sensation and device output together reveals more than agreement versus disagreement. Felt heat may accompany surface warming. Felt heat may appear without a surface change. A surface event may occur without awareness. Cooling may feel hot, or a small change may expand into pain. These should not share one label before the pattern is known.

A 24-hour hot-flush study makes the structure vivid. Among 27 women monitored with sternal skin conductance and self-report, only 47% of device events were felt, and only 56% of reported events appeared on the device [10]. Skin conductance is a sweating surrogate rather than temperature—a limitation that makes the lesson sharper. What we call an objective value is still one window onto physiology.

A third reading is made in the clinic

After testing, a third reading appears between device and sensation: explanation. “This image shows no marked surface-temperature asymmetry now. It does not measure the sensation itself or an episode that has passed. Next we will examine event timing and sensory thresholds together.” This preserves the meaning of a normal result without erasing experience.

By contrast, “nothing is wrong” expands outside the clinic into “what you felt was not real.” In interviews about persistent unexplained symptoms, patients objected less to normal results themselves than to normalization without explanation and the closing of conversation [11]. A negative test can reduce one possibility; it does not automatically supply a hypothesis for what remains.

How an unexplained sensation becomes an island

Invisible symptoms easily shift the burden of proof onto the person. Every canceled appointment needs an explanation; every request to change the air conditioning conflicts with someone else's comfort. With a normal report in hand, continuing to speak risks appearing overly sensitive. Silence becomes easier. The symptom remains, but disappears from the social record.

Research on invalidation in chronic pain repeatedly finds disbelief, lack of compassion, stigma, and self-blame alongside damaged identity and isolation. Interviews in chronic illness describe watching others' lives through glass and falling behind relational time [12, 13]. A decisive gap remains: we found no study recruiting people specifically for felt–measured temperature discordance and testing this pathway. We found a possibility, not causation.

The next study needs a clock before another thermometer

One laboratory visit and a comparison of average temperatures will not resolve this problem. We should first listen deeply to 20–30 people and learn what "hot inside," "bitingly cold," or "heat flowing" means in location, depth, duration, and impairment. We should also ask what was said in clinical encounters before symptoms began to be concealed.

Then, across 21 days, capture onset, peak, and recovery. On one timeline, record body maps, sensation intensity, ambient and feasible skin temperature, activity and stress, disclosure, and whether the person felt understood or doubted themselves afterward. A recurring within-person change—and whether sensation leads or lags it by minutes—may matter more than a 0.3°C difference between people.

When sensation and number finally share a timeline

In the laboratory, thermography and momentary sensation can be recorded simultaneously through rest, warm/cold challenge, and recovery. Add thresholds for first detecting warmth or cold and for when each becomes painful. Examiners, blinded to the previously drawn symptom map, compare the site, its mirror, and adjacent skin. Falsifiable outcomes follow: equal temperature with a lower sensory threshold; equal static temperature with different recovery; or no repeatable difference at all [14, 15].

No outcome should be designed to win in advance. Repeatable thermal change means the device has caught the sensation. Repeatable threshold change strengthens a sensory-processing hypothesis. If neither appears, reconsider timing, depth, and context—or preserve the non-replication. Treatment trials come after the map stabilizes. Creating an observation that can be wrong comes before naming it.

How to carry two kinds of truth

Believing a patient's sensation does not mean assuming it reports surface temperature accurately. It means accepting experienced intensity, location, time, and interference as data. Believing a test does not mean letting it adjudicate the whole experience. It means distinguishing precisely what the device targeted from what it did not capture.

One sentence after "the temperature is normal" changes where a person stands: not "therefore there is nothing," but "therefore let us find on which axis besides temperature this experience arises." That sentence is neither diagnosis nor treatment. It turns a dead end that can produce isolation into a researchable fork. Sensation is not a thermometer. A thermometer is not a lie detector for sensation. The gap between them is where the next study begins.

Declarations

Author contributions (CRediT)	Yeonseung Choe: Conceptualization, Clinical framing, Writing – original draft, Research-system design · Baekrokdam Research Commons (BRC): Investigation, Critical synthesis, Data curation, Evidence verification
Data availability	This essay derives from critical synthesis BRC-2026-W106 and prior measurement framework BRC-2026-W001. Detailed evidence and the direct research gap remain independently accessible through research search.
Funding	No external funding.
Competing interests	The authors and publisher share research infrastructure with Baekrokdam Korean Medicine Clinic. This relationship is not evidence for a diagnosis or treatment effect.
AI use disclosure	AI tools assisted query expansion, structuring, bilingual drafting, and reader-edition transformation. Numbers and claim strength were rechecked against the public synthesis and source texts; no fictional patient or result was created.
Ethics	Only public literature was used; no individual patient data or composite case is included. This is not a self-diagnosis guide; acute neurological change, persistent fever, tissue injury, or severe systemic symptoms require separate evaluation.

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