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Felt and Measured Temperature: Thermosensation, Invalidation, and Isolation

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Abstract

The statement “I feel hot” and a Celsius value from infrared thermography do not measure the same object. A camera estimates surface temperature at a particular site and moment; a report integrates cutaneous and deeper inputs, rate of change, spatial contrast, nociception, autonomic state, and context. Even among healthy participants, accuracy in detecting thermal change varies widely, while innocuous cooling can be experienced as warmth and interlaced warm–cool stimulation can evoke burning pain. In neuropathic sensory states, mild cooling may become severe pain. Physiological events can also occur without awareness. A single unremarkable thermogram therefore means no surface-temperature anomaly was detected under those conditions; it does not prove that recurrent thermal experience is absent. Conversely, symptom report alone cannot diagnose a particular neuropathy or autonomic disorder. Quantitative sensory testing measures detection and pain thresholds but depends on cooperation and standardization; thermography is sensitive to environment, acclimatization, region selection, and timing. We found no study directly testing whether this discordance causes social isolation. Indirect evidence from chronic pain and persistent unexplained symptoms links disbelief, unexplained normalization, self-doubt, and withdrawal with isolation. Rather than upgrading this indirect evidence to causation, we propose: qualitative work beginning with patients’ language; 21-day event-contingent repeated measurement; simultaneous standardized thermography, quantitative sensory testing, and perception ratings; and prospective measurement of communication, invalidation, and isolation. Sensation is not a thermometer, and a thermometer is not a lie detector for sensation.

Keywords: thermosensation · thermography · quantitative sensory testing · cold allodynia · paradoxical heat sensation · medical invalidation · social isolation

Apparent discordance may begin with different measurement objects

Core temperature, skin temperature, perfusion, sweating, warmth, and burning gather under the word “heat” but are not one variable. Core thermometry addresses central temperature; infrared imaging estimates emitted radiation at the surface; quantitative sensory testing measures when a stimulus is first detected and when it becomes painful. A patient’s report is a perception integrating these inputs with rate of change, attention, prior experience, and threat appraisal [1, 2, 3, 4].

Thus “Why do they feel hot when the camera is normal?” should first become “Did the measurements target the same site, depth, time, and phenomenon?” A normal result says the device threshold was not crossed under those conditions. It did not measure absence of sensation. Yet subjective intensity does not automatically establish a particular disease or elevated surface temperature either.

Healthy thermosensation does not follow one common scale

Vabba and colleagues heated the hands of 31 healthy adults with radiant heat and compared actual temperature direction with reported change. Mean accuracy was 73%, but individuals ranged from about 41% to 92%, with no correlation to cardiac interoceptive accuracy. This small foundational study cannot be generalized directly to patients, but it demonstrates wide individual variation and relative independence across interoceptive channels [5].

Body regions also differ in resolution. In 60 adults tested at 13 sites, Stevens and Choo found an approximately 100-fold regional range, greater sensitivity to cooling, and age effects. The assumption that the same half-degree means the same thing everywhere on the body does not hold [6].

Small stimuli can be amplified—and even reverse direction

Paradoxical heat sensation—reporting warmth during cooling—is an experimentally defined phenomenon, not a metaphor. In 1,090 patients with somatosensory lesions, it occurred in 30% of the neuropathic-pain group versus 2% of healthy controls and tracked reduced thermal sensitivity more than pain intensity. In 100 healthy participants, precooling increased its risk about 1.9-fold [7, 8]. These findings do not diagnose an individual, but establish that directional transformation is physiologically possible.

A thermal grill of interlaced innocuous warm and cool bars can evoke burning or pain. Even on healthy skin, relatively mild 29°C and 37°C stimuli can produce pricking or burning at small sensitive spots. After nerve injury, normally innocuous cooling may become severe cold allodynia [9, 10, 11]. Input magnitude and experience magnitude are not one-to-one; this does not license classifying every mismatch as neuropathy.

There are at least four discordance patterns

Simultaneous measurement permits four outcomes: concordant perception and surface signal; perception without device signal; device signal without awareness; and transformation of direction or intensity, such as cooling felt as heat or a small change as pain. In a 24-hour study of 27 women with menopausal hot flushes, only 47% of objective sternal skin-conductance events were reported, while only 56% of reported events had an objective recording [12] . Skin conductance is a sweating surrogate, not temperature itself—a limitation that further illustrates why physiological events and experience can diverge in both directions.

A more precise device does not automatically give a more complete answer

Thermographic values vary with room temperature and humidity, exercise, caffeine, topical products, acclimatization, camera geometry, and region selection. A still image acquired after symptoms resolve may miss the event's dynamics. Standardization is essential, but insisting only on a standardized symptom-free moment may erase the event under study [4] .

Quantitative sensory testing narrows the gap by separating cold and warm detection from cold and heat pain thresholds. It remains a psychophysical test dependent on attention and response, standardized stimuli and instructions, and site-, age-, and sex-specific references. Consensus recommendations position it as complementary rather than a stand-alone diagnosis. Small-fiber neuropathy likewise requires converging clinical signs, QST, and measures such as intraepidermal nerve-fiber density—not one symptom alone [2, 3, 13] .

A normal test cannot finish the sentence

A negative test is valuable evidence that lowers the probability of the condition or abnormality tested. Moving from "this test did not detect its target" to "therefore your experience is absent" exceeds that scope. Qualitative work on persistent unexplained symptoms shows that patients object not simply to normal results, but to normalization without explanation and loss of an opportunity to speak. A normal result embedded in trust and a next hypothesis is socially different from one that closes the conversation [14] .

The pathway to isolation is plausible but not directly established

A synthesis of invalidation in chronic pain, drawing on literature with more than 7,770 participants, repeatedly found disbelief, lack of understanding and compassion, stigma, and self-judgment, alongside threats to identity and isolation. Interviews with 40 people living with chronic illness described being left behind, watching others' lives from outside, and falling out of relational time [15, 16] . Neither evidence base directly studied people with felt–measured temperature discordance.

The sequence “episodic invisible sensation → one normal measurement → disbelief and self-doubt → concealment and withdrawal → isolation” is therefore a pathway model to test, not an established causal chain. Medical invalidation has recently been conceptualized as communication or self-belief that undermines perception and autonomy, but its definition and measurement remain evolving [17].

The next study must place events and relationships on the same timeline

Stage one is maximum-variation qualitative and cognitive interviewing with 20–30 participants. In participants’ own language, it records location, depth, timing, triggers, what explanation followed a normal test, and from whom symptoms became concealed. Existing invalidation measures should not be merely translated; Korean content validity and cognitive testing must come first [18].

Stage two is 21 days of event-contingent repeated measurement. At onset, peak, and recovery, participants record body maps; heat, cold, burning, and pain intensity; ambient temperature; feasible continuous local skin temperature; activity and stress; disclosure; and immediate feelings of being understood or doubting oneself. Within-person baselines, slopes, lags, and repeatability take priority over between-person absolute temperature.

Stage three is a standardized rest–warm/cold challenge–recovery visit with simultaneous thermography, local perfusion or sweating surrogates, thermal detection and pain thresholds, and momentary perception. Examiners remain blinded to the subjective map while symptom, mirrored, and adjacent regions are compared. Only then should a fourth stage prospectively test communication patterns against longer-term isolation and participation. Treatment trials follow—not precede—repeatable phenotyping and measurement validity.

Take both data streams seriously without over-interpreting either

Clinical reasoning need not choose sides. A patient’s sensation is a genuinely experienced outcome requiring precise questions about location, timing, intensity, and impairment. Device output is also real data, interpreted according to what, when, and where it measured. When they diverge, the task is not to separate truth from falsehood but to locate the missing axis: surface versus depth, static value versus rate of change, detection versus pain threshold, or symptomatic versus symptom-free time.

This synthesis is not a diagnostic guide. New unilateral sensory change, weakness, altered consciousness, persistent fever, skin-color change or tissue injury, and severe systemic symptoms require separate safety evaluation. Respecting discordance and recognizing red flags are two conditions of the same clinical care.

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	Selected identifiers, hashes of acquired official abstracts and open full text, claim boundaries, and the proposed study are recorded in the public ledger. No patient data were used.
Funding	No external funding.
Competing interests	The authors and publisher share research infrastructure with Baekrokdam Korean Medicine Clinic. This relationship is not evidence for any test or treatment.
AI use disclosure	AI tools assisted query expansion, literature classification, bilingual drafting, and claim–evidence checking. Bibliographic details and central numbers were rechecked in PubMed and open full text, and direct evidence was separated from inference.
Ethics	This critical synthesis uses public literature only. The proposed human study must not begin before protocol finalization, Korean instrument validation, and separate ethics review.

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