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The Thermodivergence Framework

Five Coined Terms for Thermal Equity, Individual Thermal Reality, and Climate Justice Vocabulary

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Abstract

This paper presents the canonical definitions, scientific justifications, and governance framework for five coined terms that together form the intellectual foundation of thermal equity: **thermodivergence** (noun), **thermodivergent** (adjective), **thermotypical** (adjective), **thermodiverse** (adjective), and **thermodivergence spectrum** (noun phrase). Each term's claim of coinage has been verified through a 100-year corpus search across PubMed, Web of Science, Scopus, Google Scholar, and Google Books Ngram Viewer — none returned a single result prior to this work. Together these five words provide an interlocking vocabulary that names individual thermal experience as a dimension of human diversity: not a complaint, not a disorder, but a physiological reality shaped by sex, life stage, health, neurotype, and time. The paper identifies five axes of thermodivergence, shows how the vocabulary applies across ten domains from building science to climate justice, and presents a three-layer intellectual property architecture that separates open vocabulary (CC BY 4.0) from narrative authority and proprietary technology. It serves as the permanent open-access origination reference for The Thermodivergence Foundation and the authoritative source for all thermodivergence-prefixed terminology.

Keywords: thermodivergence, thermodivergent, thermotypical, thermodiverse, thermodivergence spectrum, thermal equity, thermal comfort, thermal perception, thermoregulation, thermal sensitivity, thermal adaptation,

thermal preference, individual thermal experience, inter-individual thermal variation, intra-individual thermal variation, building science, ASHRAE 55, ISO 7730, PMV model, predicted mean vote, personalised thermal comfort, occupant-centric design, HVAC, indoor environmental quality, neurodiversity, sensory processing, autism, climate justice, heat vulnerability, heat stress, urban heat island, menopausal thermoregulation, vasomotor symptoms, sex differences thermoregulation, life-course physiology, thermal design, heat adaptation, global boiling, climate change, why am I always cold, why am I always hot, temperature sensitivity, feeling cold all the time, hot flushes, menopause symptoms, office too cold, office temperature, body temperature regulation, heat intolerance, cold intolerance, CC BY 4.0, coined terminology, canonical vocabulary, open-access vocabulary

1. Introduction

No two people experience temperature in quite the same way. A pregnant woman in her third trimester generates 15–20% more metabolic heat than her baseline. A menopausal woman's core temperature can swing by 0.5°C during a vasomotor episode. An autistic individual's heightened thermal sensitivity may turn a 4°C room-temperature shift into something intensely distressing. A newborn's surface-area-to-volume ratio is four times that of an adult, with underdeveloped sweat glands and immature thermoregulation. Yet the built environment, climate policy, and scientific discourse all rest on the assumption of a singular human thermal experience — one comfortable temperature for everyone.

Until now, there has been no shared language to name these differences in how people feel temperature. No vocabulary that treats individual thermal reality as something worthy of science, design, and accommodation. This paper provides that vocabulary: five deliberately coined terms, each term's claim of coinage verified as absent from all prior scientific literature, that together form the intellectual foundation of thermal equity.

The paper makes three contributions. First, it defines five canonical terms — thermodivergence, thermodivergent, thermotypical, thermodiverse, and the thermodivergence spectrum — with formal definitions, etymologies, usage examples, and verification of each term's claim of coinage. Second, it brings together the scientific evidence base spanning building science, sex and gender differences, life-stage physiology, health conditions, neurodivergence, and climate change. Third, it sets out the governance framework of The Thermodivergence Foundation, an independent non-profit steward of this vocabulary, including its three-layer intellectual property architecture and ten-domain application map.

Every term in this paper originates from Asim Patel, Founder of The Thermodivergence Foundation (ORCID: 0009-0006-2732-8323). All definitions are released under Creative Commons Attribution 4.0 International (CC BY 4.0), and this paper serves as the permanent open-access origination reference.

2. The Thermal Perception Gap

The built environment and climate discourse are built on the assumption that everyone experiences temperature the same way. The evidence tells a very different story.

In building science: The Predicted Mean Vote (PMV) model has been the primary tool for thermal comfort design since Fanger (1970), yet it predicts only 30–50% of individual thermal sensations (Schweiker et al. 2018) — unexplained variance typically reaches 84%. Kingma & van Marken Lichtenbelt (2015) showed that metabolic rate estimates for women systematically overshoot by 35%, producing buildings that are systematically too cold for female occupants.

Across the lifespan: A newborn's surface-area-to-volume ratio is 4× that of an adult, with underdeveloped sweat glands and no behavioural thermoregulation. Pregnancy pushes basal metabolic rate up 15–20% and blood volume up 45%. Menopause brings vasomotor symptoms to 80% of women (Gagnon et al. 2025). By age 70, sweat gland function has dropped 30–50% (Zhang et al. 2025, across 141 studies). The same individual can have profoundly different thermal needs at different points in her life.

In health and neurodiversity: Thyroid disorders shift metabolic rate by 30–40% (hypothyroidism) or 60–80% (hyperthyroidism). Multiple sclerosis disrupts thermoregulation in half of all patients (Christogianni et al. 2024). Autistic perception involves elevated neural noise (Foss-Feig et al. 2019) and altered sensory gating (Duerden et al. 2015). Raynaud's, fibromyalgia, and diabetic neuropathy further reshape how a person experiences temperature.

In climate change: India's 2024 heatwave was the longest on record, with over 44,000 documented heatstroke cases. Fifty-seven percent of Indian districts face high or very high heat-vulnerability (CPR

2024). Women-led community heat-mapping in Surat by the Mahila Housing Trust has revealed urban heat-island intensities reaching 8–10°C in dense Indian cities. Yet climate adaptation discourse still has no vocabulary to express that rising temperatures hit different people in very different ways.

3. The Five Coined Terms

This paper declares and introduces five deliberately coined terms — words that did not exist in any scientific or public vocabulary until this work. Each term's claim of coinage has been verified through a 100-year corpus search across PubMed, Web of Science, Scopus, Google Scholar, and Google Books Ngram Viewer, and none returned a single result. Together they form an interlocking vocabulary: thermodivergence names the phenomenon; thermodivergent describes the individual; thermotypical names the assumed norm; thermodiverse describes the population; and the thermodivergence spectrum maps the full continuum of human thermal experience.

3.1 Thermodivergence

Thermodivergence. Noun. The state, condition, or phenomenon of an individual's thermal perception departing from any chosen comparator. The comparator may be a population mean, an externally imposed norm (e.g. ASHRAE 55 setpoint), the individual's own prior thermal baseline, a singular other person, or the ambient environment itself. Because the comparator is not fixed, users of this term are encouraged to explicitly state the comparator(s) against which divergence is being measured — e.g. 'thermodivergence from the ASHRAE 55 setpoint,' 'thermodivergence from her own pre-pregnancy baseline,' or 'thermodivergence from the population mean in a 50-person office.'

Etymology: Greek *therme* (heat) + Latin *divergentia* (the state of turning apart; separation). Parallel to 'neurodivergence' in the neurodiversity paradigm.

Usage: 'Thermodivergence is not a disorder; it is the natural condition of every human being at some point in their life.' / 'Designing for thermodivergence requires moving beyond single-setpoint climate control to individual-level thermal personalisation.'

Database	Search Query	Date	Results
PubMed	"thermodivergence"	2026-03-09	**0**
Web of Science	"thermodivergence"	2026-03-09	**0**
Scopus	"thermodivergence"	2026-03-09	**0**
Google Scholar	"thermodivergence"	2026-03-09	**0**
Google Books Ngram	"thermodivergence"	2026-03-09	**0**

3.2 Thermodivergent

Thermodivergent. Adjective. Describing an individual whose thermal perception departs from statistical norms, from externally imposed environmental assumptions, or from their own prior thermal baseline, across five axes of divergence:

1. Horizontal (at a point in time): Divergence from the comparator population's perceived mean thermal comfort at that moment.

> *Example: A woman wearing a wool sweater in a 22°C office where 80% of colleagues are comfortable in t-shirts.*

2. Vertical over time from population: Divergence from the comparator population's mean at different life stages.

> *Example: A 50-year-old menopausal woman requiring 4°C lower room temperature than her own baseline at age 45.*

3. Vertical over time from self: Divergence from the individual's own prior thermal baseline at different points in their life.

> *Example: A woman who felt comfortable at 21°C before pregnancy but requires 19°C in her third trimester.*

4. Absolute from externally-imposed norms: Divergence from standards like ASHRAE 55, ISO 7730, or building setpoints designed without recognition of thermal diversity.

> *Example: A thyroid patient with metabolic rate 40% below mean requiring 20°C in a building coded for 22°C.*

5. Absolute from ambient conditions: Divergence from what the environment physically delivers — including humidity, thermal radiation, wind, and light.

> *Example: 'I feel freezing in 22°C with high humidity and air-conditioning wind' or 'I feel burning in 20°C under direct sun.'*

At each point in their life, every person is thermodivergent to more than one comparator.

Database	Search Query	Date	Results
PubMed	"thermodivergent"	2026-03-09	**0**
Web of Science	"thermodivergent"	2026-03-09	**0**
Scopus	"thermodivergent"	2026-03-09	**0**
Google Scholar	"thermodivergent"	2026-03-09	**0**
Google Books Ngram	"thermodivergent"	2026-03-09	**0**

3.3 Thermotypical

Thermotypical. Adjective. Describing thermal perception that aligns with assumed population norms or design assumptions.

Etymology: Greek *therme* + *typikos* (representative of a type). Parallel to 'neurotypical' in the neurodiversity paradigm.

Critical note: 'Thermotypical' is not universal. In a population of 100 women ages 45–55, the majority may be thermodivergent relative to 'standard' office setpoints. Thermotypical is relative to context and design assumption, not to human nature.

Database	Search Query	Date	Results
PubMed	"thermotypical"	2026-03-09	**0**
Web of Science	"thermotypical"	2026-03-09	**0**
Scopus	"thermotypical"	2026-03-09	**0**

Google Scholar	"thermotypical"	2026-03-09	**0**
Google Books Ngram	"thermotypical"	2026-03-09	**0**

3.4 Thermodiverse

Thermodiverse. Adjective. Describing a population or group displaying natural variation in thermal perception.

Etymology: Greek *therme* + Latin *diversus* (turned in different directions). Parallel to ‘neurodiverse’ in the neurodiversity paradigm.

Scientific basis: Thermal preference varies by 8–10°C even across healthy populations (Filingeri 2025). Women make up just 12–18% of building science research samples despite occupying 50% of workplaces. No population is thermally homogeneous.

Database	Search Query	Date	Results
PubMed	"thermodiverse"	2026-03-09	**0**
Web of Science	"thermodiverse"	2026-03-09	**0**
Scopus	"thermodiverse"	2026-03-09	**0**
Google Scholar	"thermodiverse"	2026-03-09	**0**
Google Books Ngram	"thermodiverse"	2026-03-09	**0**

3.5 Thermodivergence Spectrum

Thermodivergence spectrum. Noun phrase. The full multi-dimensional continuum of human thermal perception, from those experiencing extremes of heat sensitivity to those experiencing extremes of cold sensitivity, encompassing horizontal (population), vertical (temporal), and absolute (normative) axes of divergence.

Conceptual framework: The thermodivergence spectrum moves beyond binary thinking (comfortable versus uncomfortable) and single-point design assumptions (22°C for everyone). At any given moment in a 100-person office, thermal needs span 18–25°C. Over a lifetime, a single individual’s thermal needs may range from 18°C to 28°C.

Database	Search Query	Date	Results
PubMed	"thermodivergence spectrum"	2026-03-09	**0**
Web of Science	"thermodivergence spectrum"	2026-03-09	**0**
Scopus	"thermodivergence spectrum"	2026-03-09	**0**
Google Scholar	"thermodivergence spectrum"	2026-03-09	**0**
Google Books Ngram	"thermodivergence spectrum"	2026-03-09	**0**

4. One Woman’s Thermal Life — A Thermodivergence Journey

To show what these five terms really encompass — and why a single word like ‘thermodivergent’ carries the weight of an entire human condition — consider one woman’s thermal experience across her life. At every stage her relationship to temperature changes, and at no stage does the built environment acknowledge it.

As a Newborn (0–12 weeks): Her surface-area-to-volume ratio is 4× that of an adult. Sweat glands are immature. She is thermodivergent across two axes: horizontally from the adults in the room, and absolutely from adult-normative design assumptions.

As a Menstruating Teenager (14–18): Hormonal cycles create monthly oscillations in thermal sensation. During her luteal phase she runs warm. She sits in a classroom designed to male-normative ASHRAE 55. She is thermodivergent across three axes: horizontally, vertically from self, and absolutely from norms.

In Pregnancy (Third Trimester, Age 28): Basal metabolic rate has increased 15–20%. Blood volume has expanded 45%. She feels burning hot in a 22°C office. She is thermodivergent across four axes: from population, from her own baseline, from norms, and from ambient conditions.

As a Hypothyroid Patient (Age 35): Metabolic rate drops 30–40%. She is chronically cold — the inverse of her pregnant state. The same 22°C office now feels frigid. She is thermodivergent across all five axes.

As a Menopausal Woman (50–55): Vasomotor symptoms affect 80% of menopausal women. She experiences spontaneous hot flushes interspersed with shivering chills. She is thermodivergent across all five axes simultaneously.

As a Chemotherapy Patient (Age 62): Chemotherapy disrupts thermoregulation through peripheral neuropathy, altered metabolism, and chemotherapy-induced hormonal upheaval. She is thermodivergent across every dimension simultaneously — more profoundly than at any prior point in her life.

As an Elderly Woman (Age 75): Sweat gland function has declined 30–50%. Sarcopenia has reduced her metabolic heat production. She is less able to sense temperature change and slower to respond to it. A heatwave that younger adults endure with discomfort becomes life-threatening for her — 175 excess deaths per degree Celsius for adults over 85. She is thermodivergent across all five axes, and now the stakes are existential.

One word — ‘thermodivergent’ — holds the weight of that entire human journey. It names what it means to be a thermal self that diverges, shifts, and asks the world to make room for that divergence. This is not a rare or pathological state — every person is thermodivergent at some point in their life.

“At each point in their life, every person is thermodivergent to more than one comparator.”

5. Temporal Trajectory of Thermodivergence Across Human Lifespans

The table below traces thermodivergence across the full arc of a human life, mapping the primary physiological driver, type of thermal divergence, and evidence base at each stage.

Life Stage	Primary Driver	Divergence Type	Evidence

Newborn (0–12 wk)	High SA:V, immature sweating	Horizontal; Absolute	Paediatric thermoregulation
Childhood (1–12 yr)	Developmental sweat gland maturation	Reducing horizontal	Developmental physiology
Adolescence (13–18)	Pubertal hormonal changes; menarche	Vertical from self via cycles	Endocrinology
Young adult (19–35)	Peak metabolic stability	Minimum horizontal; establishes baseline	Metabolic physiology
Pregnancy (wk 12–40)	BMR +15–20%, blood vol +45%	Horizontal, vertical, absolute	Obstetric physiology
Postpartum (0–12 wk)	Rapid metabolic readjustment	Dynamic; temporary thermodivergence	Lactation physiology
Peri/Menopause (45–55)	Oestrogen decline, vasomotor instability	All five axes; most thermodivergent	Reproductive endocrinology
Older adult (65+)	Sweat gland loss 30–50%, sarcopenia	Absolute divergence; heat stress	Gerontology
End of life (85+)	Severe thermoregulatory impairment	Extreme; 175 excess deaths/°C	Geriatric medicine

6. Intended Users and Adoption

This vocabulary belongs to everyone. The communities below represent the primary adoption domains:

The Public: Everyone. These words give people a way to name their own thermal experience and recognise that thermal divergence is a physiological reality, not a personal failing.

Building Engineers and Architects: Professionals who design HVAC systems and thermal control strategies. Thermodivergence offers a framework for designing around thermal diversity, and engagement with ASHRAE, ISO, and CEN standards bodies is critical.

Occupational Health & HR: Thermodivergence gives workplaces the language to recognise that thermal comfort varies from person to person, opening the door to individualised accommodation.

Medical and Clinical Practitioners: Physicians, nurses, and clinicians who see patients with thermal symptoms or thermoregulatory dysfunction on a daily basis.

Neurodiversity Communities: Autistic self-advocates, ADHD researchers, and sensory-focused professionals who already know that thermal sensory differences are intrinsic to neurodivergence.

Climate Justice Researchers: Researchers and NGOs working on climate adaptation, for whom the thermodivergence spectrum provides person-centred language for individual-level climate vulnerability.

Technology Developers: Software engineers, IoT developers, and smart-building technologists — including those working with Thermikron and BTMS.

7. Prior Art and Scientific Context

7.1 Building Science

The PMV model (Fanger 1970) remains the foundational design tool behind ASHRAE 55 and ISO 7730, yet Schweiker et al. (2018) showed it explains only 30–50% of individual thermal sensation. Kingma & van Marken Lichtenbelt (2015) found that PMV systematically overestimates metabolic rate for women by 35%. In other words, thermodivergence is already embedded in our infrastructure.

7.2 Sex and Gender Differences

Wang et al. (2025) document consistent sex-based differences in thermal preference. Filingeri (2025) traces the unique female thermal journey across the lifespan. Women make up only 12–18% of building science research participants despite occupying 50% of workplaces, and Liu et al. (2024) confirm sexually differentiated thermoregulation at the physiological level.

7.3 Life Stage and Development

Infants have surface-area-to-volume ratios 4× those of adults. Pregnancy raises BMR by 15–20% and blood volume by 45%. Menopause brings vasomotor symptoms to 80% of women (Gagnon et al. 2025), and Zhang et al. (2025) report a 30–50% drop in sweat gland function by age 70 across 141 studies.

7.4 Health Conditions and Medication

Thyroid disorders can shift metabolic rate by 30–80%. MS disrupts thermoregulation in half of all patients (Christogianni et al. 2024). Diabetic neuropathy, Raynaud's, and fibromyalgia each reshape thermal sensation in their own way, and chemotherapy triggers both peripheral neuropathy and metabolic disruption.

7.5 Neurodivergence

Foss-Feig et al. (2019) found elevated neural noise in the autistic sensory cortex, while Duerden et al. (2015) reported decreased sensory gating. Al-Khatri et al. (2025) showed that even a 4°C shift creates measurable thermal comfort differences for autistic individuals. Tartarini et al. (2024) note that thermal comfort research has lacked both the vocabulary and the participation of autistic people.

8. Climate Change Without Needed Language

India's 2024 heatwave was the longest on record, producing over 44,000 documented heatstroke cases. Fifty-seven percent of Indian districts — home to 76% of the population — face high or very high heat-vulnerability. Outdoor workers — construction labourers, street vendors, domestic workers, rickshaw pullers — carry the heaviest burden, with caste and gender compounding their exposure. Women-led community heat-mapping in Surat by the Mahila Housing Trust has shown that thermal experience varies block by block, with urban heat-island intensities reaching 8–10°C in dense Indian cities.

Within communities facing rising heat, vulnerability concentrates among those whose thermoregulation is already compromised: menopausal women, the elderly (175 excess deaths per degree Celsius for adults over 85), pregnant women, infants, and those living with health conditions. Yet climate adaptation discourse still has no vocabulary to name this reality. The language gap is a justice gap.

The thermodivergence spectrum gives climate-justice researchers, policymakers, and NGOs the vocabulary to say what has long gone unsaid: that rising global temperatures are experienced unequally at the individual level. Climate change makes this naming urgent.

9. The Thermodivergence Foundation

The Thermodivergence Foundation is an independent, non-profit steward of this vocabulary. It is not a commercial enterprise, a standards body, or an advocacy group. Its role is custodial: to look after canonical definitions that are open-access (CC BY 4.0), peer-informed, and evolved transparently as the science deepens.

9.1 Governance Principles

Open vocabulary, CC BY 4.0: Every definition and framework is released under Creative Commons Attribution 4.0 International. Thermodivergence is vocabulary that belongs to everyone.

Canonical authority: The Thermodivergence Foundation maintains a canonical registry of approved definitions. As scientific understanding grows, definitions may be revised through transparent processes.

Independence: The Thermodivergence Foundation is independent of any commercial vendor, standards body, or government. Vocabulary development puts clarity and human dignity first.

9.2 Ten Application Domains

Domain	Current Gap	Foundation Role
Building Design & Engineering	PMV assumes single mean; 84% variance unexplained	Introduce thermodivergence into ASHRAE/ISO standards
Occupational Health	No individual accommodation framework	Thermal equity in workplace design
Medicine & Clinical Practice	Thermal symptoms scattered across diagnoses	Recognise thermoregulatory dysfunction as coherent
Sex & Gender Studies	Female thermal experience historically absent	Centre female and gender-diverse thermal experience
Life-Course Science	Thermal needs vary by life stage; rarely integrated	Link thermal divergence to developmental biology
Neurodiversity	Thermal sensory differences unnamed	Validate thermal neurodiversity
Climate Science	No person-level language for heat impacts	Individual-level climate vulnerability vocabulary
Public Health	Heat as binary risk; no heterogeneous framework	Stratify heat risk by thermodivergence profile
Technology & Innovation	No user-centred thermal language	User-centred vocabulary for thermal tech
Environmental Justice	Rising temperature treated as homogeneous	Language for documenting thermal inequality

9.3 Relationship to Thermikron and BTMS

The Biothermal Microconditioning System (BTMS) is an occupant-centric technology platform that reimagines how thermal comfort is delivered inside buildings. Rather than treating an entire floor as one thermal zone, BTMS uses a voxel-based digital twin — the Biothermal Occupancy Model (BTom) — to map thermal conditions at desk scale, combined with biological thermal actors (living plants housed in self-watering planters made from upcycled waste) and conventional HVAC to create personalised

biothermal zones. The system learns each occupant's individual comfort profile from existing sensors, anticipates thermal needs across both biological and mechanical lead times, and reports carbon at the individual level — all while retrofitting into existing building infrastructure without replacing it (Patel 2026).

The Thermodivergence Foundation looks after language and conceptual frameworks. Thermikron is the brand that brings BTMS — person-centric cooling and heating technology invented by Asim Patel (this author) — to market. The two organisations maintain a deliberate structural separation:

Dimension	The Thermodivergence Foundation	Thermikron / BTMS
Role	Language, vocabulary, frameworks	Technology, hardware, software
Governance	Independent, open-access (CC BY 4.0)	Commercial entity, proprietary
Users	Researchers, policymakers, clinicians, public	Building operators, end users

10. Canonical Verification Summary

Each term has been validated against five criteria: (1) prior art search confirming no existing term serves the same function, (2) a scientific evidence base of at least 20 citations, (3) linguistic clarity with no ambiguity against existing terminology, (4) cross-domain applicability across at least three domains, and (5) demonstrated user need and adoption demand.

Term	Category	Status	Primary Domains
Thermodivergence	Noun	Canonical	All domains
Thermodivergent	Adjective	Canonical	Building, Medicine, Neuro, Climate, Public Health
Thermotypical	Adjective	Canonical	Building, Standards, Research
Thermodiverse	Adjective	Canonical	Building, Climate, Public Health, Medicine
Thermodivergence Spectrum	Noun phrase	Canonical	Climate, Building, Medicine, Neuro

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