



Sweat speaks: Stories of embodiment, emotion, and erasure on a heating planet

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ABSTRACT

Sweat permeates our human lives, yet it is a bodily reality whose functions and meanings we are often conditioned to avoid, minimise, or hide. In taking sweat as its lens of analysis, this work reasserts the significance of a transboundary agent whose narrative interpretations are frequently sanitised and simplified. Here, sweat itself is recognised as a vital storyteller, emerging through tangible bodily choreographies of effort and exertion, emotion, social and cultural identity, and a warming planet. This contribution is situated at the broad intersection of sensory studies and feminist environmental humanities, and works to demonstrate sweat's political and theoretical utility in connecting everyday embodied experiences with the systemic drivers of social and ecological injustices.

1. Introduction

Sweat punctuates the intimate rhythms of our daily lives, accompanying us through affective states and modes of being and doing in the world. Sweat marks key events and moments emerging over the human life course, and for different reasons. The hormonal sweat of menopause, the stinky sweat of adolescence, the sickbed sweat of fever and infection, the healthy sweat of exertion and exercise, the laden sweat of sexual desire. The nervous sweat of anticipation. The clammy sweat of sudden fear. The enveloping sweat of dense humidity. The cleansing sweat of a sauna. Cold sweats. Hot sweats. Sweat is a story that contains multitudes, and in what follows we begin to listen, and to follow sweat's weave through a collection of stories about the human body and the ways in which it experiences and responds to the shifting conditions of life.

Doing so demands a corporeal reckoning, and a deeper recognition of the meaning of the stories that our bodies narrate and hold. In attending to sweat, this work is guided by the theoretical connections emerging from both sensory studies and feminist environmental humanities, particularly drawing on posthuman and more-than-human scholarship. Scholarship at this broad intersection has firmly established the sensory disconnections and systemic, identity-based marginalisations embedded within the production of Western world views, and demonstrated how together they sustain pervasive structural politics of social and ecological oppression, violence, and erasure. Scholars have demonstrated overarching and everyday mechanisms through which this devaluation of the sensory body enables unjust power regimes to operate. These include through the strategic delegitimisation of emotions of opposition and the cultivation of emotions of compliance by governance structures

(Ahmed, 2004), the dismissal of lived experiences of environmental harm as subjective, unscientific, and therefore unreliable (Alaimo, 2010), and the devaluation, suppression, and erasure of the sensory cultures of marginalised communities through colonial and neo-colonial violence (Rose, 2004). In drawing the threads of this work together, the intention is to theoretically and literally stay with sweat, and in following its movements through and between bodies to recognise its own agencies. However, in recognising that the feeling, sensing body has been and continues to be constructed, controlled, and co-opted within systems of power, the invitation throughout this paper is to situate sweating and non-sweating bodies within these larger dynamics.

Sweat relies on the pores of the skin for its emergence and agency, and its theoretical movement is informed by concepts that materially and conceptually engage with the structures and experiences of the body without separating them from the socio-cultural environments they exist within. We are, as Samantha Frost (2016) points out, 'biocultural creatures' deeply embedded in symbiotic relationship with the earth and with each other in the everyday. In using this term, Frost (2016, p. 4) emphasises "the material, social, and symbolic worlds" that together constitute lived human experiences, unsettling the ideological separation of human lives from the physical bodies, habitats, and social conditions that constitute every aspect of our survival. Sweat is inseparable from the human body's largest organ – the skin – and the various thermal and affective atmospheres it moves through. The skin acts as a critical site of human identity, forming "the centrepiece of the vocabulary of personhood" (Jablonski, 2006, p. 21), containing the body and bounding the self. And yet as Alaimo (2010, p. 156) emphasises, it is also through the skin that we live as "permeable, emergent beings, reliant upon the others within and outside our porous borders". Sweat emerges

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at this intersection between identity and function.

One of the central contributions of visceral and embodied scholarship, particularly on the agency of water (Neimanis, 2012, 2017) and skin (Nieuwenhuis, 2019) is an emphasis not only on that which is material but on that which is movement in understanding the meaning of relational boundaries. Conceptual and literal porosity is particularly suited to deconstructing dichotomies, including mind/body, individual/collective, and culture/nature. Porosity has been drawn on by scholars to rematerialise social and ecological interdependence and identity through and as the body, producing nuanced points of meaning and distinction that are particularly helpful in engaging with sweat. Nieuwenhuis (2019) engages with skin as a fluid and “porous geography” that absorbs the material and affective atmospheres of the body, and through which emotions become located and active within those atmospheres. Such permeability challenges notions of individual containment and control, rendering the concept of holes ontologically “intriguing, frightening, destabilising” even as they enable material existence (Nieuwenhuis, 2019, p. 7). In a situated engagement with the embodied environmental politics of disaster and systemic inequality, Tuana’s (2008) exploration of ‘viscous porosity’ likewise invokes the porous skin. While Nieuwenhuis’ analytic emphasises fluidity, Tuana’s (2008, p. 194) use of viscosity engages with the tensions of dynamic movement by emphasising the “sites of resistance and opposition” that resist systemic material and political change. As Nieuwenhuis (2019) emphasises, skin’s dual function as both protective shield and porous gateway highlights that what is let in is as vital as what is kept out.

These theoretical constitutions are not contradictory, but rather emphasise the dynamic responsiveness inherent in movement itself. It is this dynamism that Musser (2021, 2023) captures through profound and rich engagement with sweat’s analytic capacities within Black feminist theory. In *Sweat, Display, and Blackness: The Promises of Liquidity* (2021), Musser centres Black bodies of flesh and of wood within an exploration of ‘liquidity’, situating the multiplicity of Black sweat within a capacious web of relationality. For Musser, liquidity is a quality that eschews binaries even as it makes visible sites of connection and separation. It is this innate ambiguity, Musser (2021, p. 95) argues, that allows sweat to articulate both the violence of systemic oppressions and ruptures while simultaneously demonstrating and offering forms of “expressivity that escape capture”. Musser (2021, p. 103) demonstrates the socio-political vitality and versatility to be found in embodied narratives when the “possibilities of interiority” are recognised. It is through liquidity that Musser underscores the agency of sweat itself, and in so doing articulates an elusive materiality whose liberatory potentiality is tied to its evasion of epistemological or ontological certainty and control.

To follow sweat’s weave through human experience is to follow a collection of stories about the human body and the ways in which it experiences and responds to the landscapes it inhabits. This paper brings diverse sites and experiences of sweat into conversation, following Veland et al.’s (2018) call for pluralist narrative interventions in shaping more sustainable futures. The aim of this work is to locate the sweating body in the techniques of both intellectual and embodied storytelling, and so draws on biological and social science literatures, as well as accounts of artistic performance. The sections of the paper are informed by a scoping review of the most visible themes and approaches returned for ‘sweat’ keyword searches across academic and public databases. While these provide a snapshot of dominant narratives around sweat, it remains a partial engagement with the myriad ways in which sweat is known. The structural framing of ‘stories’ is used to highlight the multiple, co-constitutive, simultaneous, and evolving ways in which sweat acquires meaning in human lives. This emphasis on both plurality and partiality offers a vantage from which to view these distinct meanings as connected within broader narratives of human and planetary survival, without confining or conflating them within a singular or dominant method of knowing (see Haraway, 2019; Nooijer and Sol Cueva, 2022).

The paper proceeds in four sections. First, sweat’s evolutionary function in maintaining the body’s safety in different environments is

established, drawing on biological research on sweat’s sensory functions and influences in, on, and between bodies. Second, various cultural experiences of sweat are presented, establishing how sweat becomes infused within a range of spatially and socially dependent meanings, interpretations, and behaviours. Third, the use of sweat as a vehicle for artistic expression and cultural reflection is explored, drawing on contemporary performance extracts that harness these meanings to highlight or challenge the norms they make visible. And fourth, sweat in the context of planetary climate change is considered, drawing on research into heatwave impacts to situate the sweating body as and within collective environmental politics. These sections build on each other in spatial and social scale, and while they are delineated here the intention is to bring disciplinary modes into conversation as simultaneous and intersecting rather than linear or discreet. The intention of this paper is to enable scholarly attention to sweat at different time-scales, in different modes, and in different contexts as a provocation and as an invitation. As such, the paper concludes with some connections and possibilities for further development.

1.1. Sweat as biology: role and regulation in, on, and between bodies

Sweat tells many stories. First and foremost, it tells an evolutionary story of physical survival. Sweat glands are located over most of the human body and are controlled by the central nervous system, with the hypothalamus responsible for regulating temperature and responding to changes in core body temperature as well as to hormonal, emotional, and physical activity changes (Wilke et al., 2007). This section establishes why we sweat and what happens within our bodies and beneath our conscious attention when we do.

The human body experiences two distinct types of sweat. The first type is thermoregulatory sweat, a secretion of water and electrolytes through eccrine sweat glands located over almost the entire body which acts to reduce the temperature of the body when it experiences heat stress (Wilke et al., 2007). Excessive heat from ambient temperature, humidity, illness, exercise, or even eating can lead to heat stroke, illness, and death if not addressed (Wilke et al., 2007). Thermal sweating is essential to cool the body, particularly the heat-sensitive human brain (Jablonski, 2006). While all mammals sweat, only humans utilise evaporative perspiration as a heat management strategy due to our evolution away from fur (Everts, 2021). This capacity enabled our transition to bipedal physical activity in the open, hot, semi-arid environments of our earliest ancestors (Best et al., 2019). As anthropologist Nina Jablonski (2006, p. 66) puts it, “the humble sweat gland thus must assume pride of place in human evolution ... it is plain old unglamorous sweat that has made humans what they are today”. Both Jablonski (2006) and Ong (2012) point to the invention of clothing, the discovery of fire, and the development of architecture as behavioural extensions of our need to control the temperature of our fur-less bodies. Beyond thermal safety, eccrine sweat conveys significant information about an individual’s health, and may be clinically stimulated and tested for bio-markers of diseases (for example see Basu et al., 2013; Ray et al., 2021). Sweat sensing technology is increasingly explored in modern health care, with sweat stickers and wearable sensors being developed that allow for continuous sweat collection and analysis (Ghaffari et al., 2021).

The second type of sweat is emotional or psychological sweat, which occurs primarily through apocrine glands in the armpits, mammary, anal, and genital areas (Kobiela et al., 2015). Apocrine glands produce a viscous secretion of lipids, proteins, and steroids, which produce pheromones and characteristic body odours when broken down by bacteria on the skin (Baker, 2019). Emotional sweating is a physical reaction to mental, emotional, or sensory feelings of stimulation, arousal, stress, fear, and pain (Chalmers and Keele, 1952; Kobiela et al., 2015). Unlike thermoregulatory sweating, emotional sweating is not necessarily related to temperature and decreases during sleep and relaxation (Kobiela et al., 2015). Emotional sweating may manifest as a

“cold sweat”, which can trigger the eccrine glands on the palms of the hands and soles of the feet (Kobiela et al., 2015). This is the inheritance of a mammalian flight response whereby hand and foot sweat may have increased the surface friction and grip of tree-dwelling ancestors, enabling them to escape from threats (Adelman et al., 1975).

Emotional sweat has been prompted and studied in various controlled settings, measured through changes in participant sweat rate, or the electrical conductivity of the skin. The capacity of researchers to induce emotional stress in participants through mundane stressors such as mental arithmetic exercises (Allen et al., 1973), experiences of email distractions (Akbar et al., 2019) or crossing a busy road (Birenboim et al., 2019) highlights how sensitive this response is to stress and emotional disruption. The use of sweat as a barometer of internal emotional and psychological states is epitomised by the historical (but now largely contested) use of the polygraph test, which used palm sweat conductivity to assess the truth of participant responses (Jablonski, 2006). The relationships between sweat and emotional stress highlights the interdependence of physical conditions and emotional experiences within the body. MRI imaging has revealed that while thermal and emotional sweating activate different areas of the brain, all sweating “integrates emotional function, internal awareness, and attentional arousal in humans” (Kojima and Hirano, 2016, p. 903). This suggests that just as emotional stress may cause the body to sweat, so too can the sweating body give rise to emotional stress.

Human sweat also plays a critical but largely invisible role in the selection, creation, and maintenance of social bonds central to the human species, facilitating both harm avoidance and empathetic connection (Pause, 2021). Chemical signals transmitted through the production of body odours and smell convey a range of conscious and subconscious information that influences kin recognition and affect (Schäfer et al., 2020), friendship compatibility and social preference (Ravreby et al., 2022), and the romantic or genetic compatibility (van Hout, 2020; Wedekind and Penn, 2000). Rikowski and Grammer (1999) ran a now-famous t-shirt experiment in which they asked male participants to wear a t-shirt for several days and then had female participants rate the t-shirt odour based on their attraction to it. The results suggested that the women’s rating of odour matched their ratings of facial attractiveness, and also related to their stage of the menstrual cycle. Sweat also subtly transmits emotional information between bodies, conveying moods ranging from happiness to fear (Ravreby et al., 2022), and states and traits around anxiousness, nervousness, dominance, and aggression (Pause, 2021; Sorokowska, 2013). Importantly, it is not only that our emotional states can be recognised by others, but “contagiously transferred via chemosignals” by prompting a similar emotional state in the recipient of the odour (Pause, 2021, p. 240). While these smells can be masked, their social and emotional content is more difficult to conceal or manipulate than other sensory data (Pazzaglia, 2015).

1.2. Sweat as culture: places and practices

The second set of stories sweat tells are around the socio-cultural meanings that it becomes imbued with, and the associations and values it comes to embody. Experiences of sweat are highly contextually and relationally sensitive, lending it a distinctive capacity to reflect how particular cultural values and norms are embodied within spaces and communities. Experiences and perceptions of the smell, feel, and sight of sweat shift radically depending on who you are, where you are, who you are with, and what you are doing.¹ Because of this, sweat is associated with a wide range of context-specific feelings, including embarrassment, disgust, and discomfort (Waite, 2014; Waite and Stanes, 2015), sexual

¹ While there is a deep sensory relationship between smell and sweat, a thorough account of smell is beyond the scope of this work. Those interested in exploring smell further may wish to start with the work of Alain Corbin (1986, 2021).

desire (Rikowski and Grammer, 1999; Wedekind and Penn, 2000; Singh and Bronstad, 2001), aliveness and anticipation (Allen-Collinson and Owton, 2015), comfort and ease (de Vet, 2017) and kinship (Chao, 2022). This section explores some of these diverse associations with sweat, focusing on how places, practices, and systems inscribe meaning.

In many parts of the world sweat is ritualised or centred in communal practices, as in the healing rituals of Indigenous sweat lodges throughout the Americas, Middle Eastern *hammams*, Korean *jjimjilbangs*, Russian *baanyas*, and Finnish saunas (Everts, 2021). Elsewhere, sweat is associated with intimacy and relaxation at home alone or with family and friends (Waite, 2014; Waite and Stanes, 2015), as a sign of sexual desire or disgust at the nightclub (Misgav and Johnston, 2014) as a display of belonging and expertise in sport (Allen-Collinson et al., 2018), or a sign of health and fitness at the gym (Waite, 2014; Waite and Stanes, 2015), or even a sign of business diplomacy (Sysiö, 2022). Across these examples, sweat is inscribed with diverse and shifting associations that situate the body in visceral and culturally-valued modes of feeling, sensing, and doing.

And yet, in many Western contexts sweat is associated with a more limited set of meanings, and has often been regarded as an unmentionable process and a taboo (Cregan-Reid, 2016; Steadman, 1935). In ancient Greek physiology, sweat was thought to be composed of harmful impurities, and through a close association with pollution and stench, became associated with disease and social stigma (Stolberg, 2012). Such inheritances continue, with Australian women (Waite, 2014) and men (Waite and Stanes, 2015) reporting general feelings of shame and disgust around the sight and smell of sweat on themselves and on others, which becomes heightened in public spaces such as on public transport or at work and less pronounced or absent in private or designated spaces, such as the gym. In public, sweat’s association with smell highlights the role of sensory interpretation in the “moral construction of the self and others”, such that bodily odour merges with factors of race, class, and gender to influence perceptions of not only who smells good or bad, but rather who is good or bad (Synnott, 1991, p. 437). A review of experiences of hyperhidrosis, a medical condition involving excessive sweating, found that people reported significant feelings of shame, embarrassment, anxiety, self-disgust and a sense of stigma as a result of their condition, exacerbating the cycle of stress and sweat (Parashar et al., 2023). This emotional impact combined with the disruption of daily activities, clothing choices, and social interactions demonstrate the significant physical and mental health challenges of extreme sweating (Parashar et al., 2023).

Sweat’s day-to-day association with disgust and shame throughout many Western contexts is harnessed by what Waite and Stanes (2015, p. 30) refer to as the “sensual logic of capitalism”. In many parts of the world there is a lucrative market dedicated to controlling or eliminating the smell and sight of sweat on the body through deodorants, antiperspirants, and perfumes as well as bleach and laundry detergents aimed at removing sweat stains on clothing. The commercial success of products designed to control, sanitise, and repress sweat is far from absolute at a global scale.² For example, global deodorant brands faced resistance in Chinese markets due to a widespread cultural association with sweat as beneficial for detoxification and health, as well as the low prevalence amongst East Asian populations of the ABC11 gene that causes body odour. This stymied American marketing strategies reliant on notions of sweat as social embarrassment, and deodorant use remains low among Chinese populations (Guo, 2018). Beyond odour, Waite (2014) points out that sweat is ‘designed out’ of much of public and private life

² The impact of such marketing strategies on health is sometimes contradictory. For example, while deodorants tend to be categorised as cosmetics, antiperspirants may be categorised as drugs because they block the pores of the skin so that the body is unable to sweat (McNamara, 1980). Research is also underway on the relationship between underarm deodorant and antiperspirant use and breast cancer in women (Allam, 2016; Darbre, 2003).

through the architecture and air conditioned environments of workplaces, shopping centres, homes, and various public venues and transport modalities. This public designing out of the body's 'messy materialities' (Waitt and Stanes, 2015) means that sweat, when it does appear, is often seen as aberrant and unwanted.

Within and beyond these experiences of differentiated embodiment is sweat's larger story of physical labour, and the material and social conditions under which it emerges on and through the skin. Situating the role of the sweating body in systems of labour requires a historical perspective that acknowledges both the social cohesion of communal labour and the enduring impacts of identity-based oppression and exploitation. Throughout history, the effort invested in sustaining communal life has raised a sweat of exertion and yet the social structures within which this work occurs have shifted radically over time, resignifying sweating bodies within hierarchical regimes of power and capital. Across different contexts, sweat has been - and continues to be - raised through class-based exploitation and the violence of colonial legacies. Publications referencing sweat in their title tend to illustrate the intersection of working class labour and systemic inequalities through gendered or racial lenses, starkly epitomised by the modern economy's reliance on sweatshop labour.³ As Waitt and Stanes (2015, p. 32) put it, "sweating is a constant visceral reminder that the way we live is continually negotiated along the lines of age, gender, class, athleticism and ethnicity". Sweat's association with forms of labour distinguishing working classes from wealthy elites exemplifies its broader capacity to both reinforce and challenge the hierarchical constructions of power and identity that underpin social and material politics.

Nowhere is this more compellingly articulated than in Musser's attention to the sweat of black bodies, spaces, experiences, and histories, focusing on Caribbean, African, and American genealogies.⁴ In *Sweat, Display, and Blackness: The Promises of Liquidity* (2021) and *Between Shine and Porosity: Toward a Fleshy Analytic of Sweat* (2023), Musser demonstrates that it is exactly sweat's capacious ambiguity that renders it theoretically useful within systems of power established and justified through violent separation and forced hierarchy. Within these works, the complexity of black embodiment is narrated through the racial and gendered politics of sweat, establishing a porous narrative across institutional, historical, literary, musical, athletic, commercial, communal, and spiritual spaces. Musser's analytical use of liquidity unsettles and challenges coherent or static productions of embodiment, especially those reliant on single narratives, simple binaries, and enforced epistemological boundaries. Following sweat across individual and collective spectrums of violence and empowerment, sexualisation and sexuality, objectification and agency, compliance and refusal, abjection and elevation, oppression and liberation, Musser remind us that "sweating, like breathing, is a sign not only of work but also of living itself" (2023, p. 13). Sweat contains multitudes precisely because it evades containment, and while it usefully reveals dimensions of situated human conditions, it exists and emerges beyond them.

The emotive liquidity of sweat is explored in Atkinson's (2017) ethnographic study of sweat within his own and others' Ashtanga yoga practice. Ashtanga is practiced in heated rooms and Atkinson documents his own experience of his sweating body shift from social discomfort and shame, to acceptance and equanimity. For Atkinson, sweat is recognised as "an everyday aesthetic or sensual mediator of meaning, values and identities" (Atkinson, 2017, p. 65), and the Indian practice of Ashtanga

is explored as a process of neutralising the socio-cultural weight of these associations with human embodiment. In this, sweat becomes "neither beautiful nor monstrous, neither rewarded nor punished, neither obsessed over nor ignored" (Atkinson, 2017, p. 78). The contrast between this ethos and the often emotionally-laden cultural norms through which sweat acquires its social meanings highlights how identities and relationships are mediated through bodily performances across the environments, settings, and contexts in which sweat emerges.

1.3. Sweat as expression: creative commentary

The third set of stories sweat tells are of aesthetic communication in artistic and creative settings, and more fundamentally through the performative aspects of everyday life. Sensory anthropologist Caroline Potter argues that political and social theory has struggled to engage with the dynamism and interactivity of the body's sensory function. In characterising the senses as inherently interconnected networks of perception "that direct the body's *total attention to its situation in the world*" (2008, p. 446, emphasis added), Potter subtly emphasises embodied awareness as a simultaneously material, emotional, cognitive, and subconscious process of situating the self in multidimensional relationality. In her ethnography on dance, Potter (2008, p. 448) argues that it is only by engaging with the "culturally-situated ways of moving in terms that capture the energy, sweatiness, ease, pain, and other 'feelings in the body'" that a more complete sensory account may be established. This section explores the capacity of creative works to integrate and communicate sweat stories, including those touched upon in the previous section, in ways that make visible and challenge the cultural narratives that shape the interpretations and identities of material bodies.

Contemporary artistic works may centre sweat as a way of commenting on the dynamics of wider cultural power and inequality that it has become imbued with. Australian performance company Dance Nebula presented a performance called *Sweat* in 2010, exploring "the power dynamics between those who serve and those who are served" in low paid services industries (Branch Nebula, 2010). In merging the literal sweat of an ethnically and culturally diverse performing cast with an exploration of the physical labour, *Sweat* draws attention to the unseen intimacy we all have with the invisible workers that support our lifestyles, and the unjust systems that support these economies of exploitation (Gallasch, 2010). Intersections of class, race, and gender are explored in American playwright Lynn Nottage, 2015 play *Sweat*, set in a working-class small town. For Nottage, the titular reference emphasises the play's interest in how "economics fracture people along racial lines" (Thomas, 2016, paragraph 12). Both works draw on sweat's ability to make the politics of power, status and class embedded in physical labour visible. In centring sweat's production through and as choreography, theatrical space becomes a platform to decensor the sweating body, and to identify and challenge the systems, perceptions, and emotions that we are conditioned to associate with bodies that sweat.

Other works engage with sweat as a more intimate spectacle of identity production. Dutch artist Anouk Kruithof's 2013–2015 project *Sweaty Sculptures* involved a sweat-workshop, where twenty five participants worked out while Kruithof periodically photographed their sweat-stained clothes. Her work explored and celebrated sweat as a residue of athletic stress, "as well as its often disregarded aesthetic and emotional manifestations" (Kruithof, 2013, paragraph 2). In this, Kruithof captured sweaty armpits as "aesthetic scars of nervousness and universal discomfort" and as a persistent "enemy" overshadowing ambitions and provoking embarrassment (Kruithof, 2013, paragraph 1). In contrast, Paul Vanouse's 2024 installation *Labour* eschewed a human frame of reference completely, focusing instead on the independent, agential labour of bacteria themselves as the "micro performers" behind sweat's odour (Vanouse, 2024). The multisensory work featured bio-reactors that incubated the bacteria involved in the production of sweat's odour, pumping the scent throughout the installation space.

³ See, for example, *By the Sweat of their Brow: Women workers at Victorian coal mines* (John, 2013); *The Sweat of their Brow: A History of Work in Latin America* (McCreery, 2016); *Blood, Sweat and Toil: Remaking the British Working Class* (Jackson, 2013); *Dark Sweat, White Gold: California Farm Workers, Cotton, and the New Deal* (Weber, 1994); and *The Wages of Sweat: A Social History Perspective on the Fight Against Sweatshops* (de Lagerie, 2013).

⁴ The capitalisation and phrasing conventions used here to describe black experiences are taken from Musser's texts.

Labour questions the production of human identities, simultaneously centering the “lowly, abject and unwelcome” associations with odour while reinforcing the complex agency of the bacteria themselves (Vanouse, 2024, p. 125). Each of these works exist through and respond to the multiplicity of sweat’s ‘situation in the world’, highlighting its laden emotional aesthetics in human bodies, as well as the more-than-human production of its odours.

1.4. Sweat as planetary: heatwaves as a climate extreme

Finally, sweat tells a planetary story connecting the personal and momentary state of the body with the unfolding patterns of atmospheric extremes. Heatwaves can trigger diverse impacts in human lives, ranging from physical discomfort and economic burdens (Zander et al., 2023), emotional distress and risks to mental health (Akompab et al., 2013; Huang et al., 2020), to illness, hospitalisation, and death (Han et al., 2022). Drawing on Verlie’s (2019) work on climate affective atmospheres, sweat directs and politicises attention to these embodied and emotional realities of climate disruption. Tracing sweat’s presence through a climate-changed world draws attention to the ways in which global systems and trends are translated into distinct personal experiences by individual bodies, and vice versa. This section works to establish the connection between the ability of human bodies to cool themselves and the ability of the earth to cool itself, engaging with the technological strategies and justice implications involved in distinct sensory experiences of a heatwave.

Take a photo of a heatwave, and you will find that nothing looks out of the ordinary. Heatwaves are invisible, silent, and odourless, characterised only by extended durations of extreme temperatures and/or humidity.⁵ Unlike the multisensory disruption of other extreme weather events such as storms, floods, and bushfire, heatwaves are apparent only when they are felt through the body. Unusually high atmospheric temperature and humidity both trigger the body’s sweat response. However, atmospheric humidity is analogous to human sweat, occurring when surface water evaporates to cool the Earth’s surface. While sweating is an effective thermoregulator for human bodies in dry heat, the saturated air of highly humid conditions impairs sweat’s ability to evaporate and thus cool the body. In cases when atmospheres and human bodies sweat together, human sweat lose its effectiveness. Vecellio et al. (2023) demonstrate that the human threshold of humidity-induced heat stress is much lower than previously thought, with dangerous limits already exceeded in recent years. This collision of ecological and human cooling strategies is only going to escalate as anthropogenic climate change continues to intensify heat stress on both fronts.

Recognising sweat as an active social protagonist is critical in locating personal and social responses to extreme heat within the broader environmental politics shaping, and shaped by, climate change. Specifically, this embodied approach enables the actions, strategies, technologies, beliefs and philosophies involved in changing relations with thermal heat to be recognised as indicators of evolving adaptation pathways and the justice paradigms they entail. For example, de Vet’s (2017) case study of residential practices in Darwin, Australia details practices that allow people to stay “weather-connected” in their tropical savanna climate. This contrasts in meaningful ways with Hitchings and Lee’s (2008) analysis of sensory climate erasure through the mundane

⁵ There is no given temperature or humidity range for a heatwave as it is dependent on the relative conditions of a particular area and its impact on human occupants. The World Meteorological Organisation’s defines a heatwave as “periods of unusually hot and dry or hot and humid weather that have a subtle onset and cessation, a duration of at least two to three days and a discernible impact on human activities”. Heatwaves in marine regions, typically lacking human occupants, currently lack a clear definition (Amaya et al., 2023). Both points are relevant to broader discourses around the anthropocentrism through which climate processes and impacts are evaluated and responded to.

and normalised expectation around air-conditioned space in Singapore’s tropical climate. In these cases, the presence or absence of sweat on individual bodies reflect place-based and culturally specific strategies of responding to and living with climate and its emerging changes. The shift from sweat as a dynamic bodily response to atmospheric conditions to one controlled or eliminated by technology directs attention to the ways in which strategies and practices of heat adaptation harness the recognition and/or elimination of embodied climate knowledges within strategies of response.

Attention to bodies in extreme heat underscores that it is not atmospheres that dictate heatwave impacts, but rather the specific physical, socio-political, and economic conditions of the bodies that are exposed to them. As such, the social and material inequalities embedded within our communities are made visible through sweat. How much someone sweats during a heatwave is determined by a constellation of factors including access to quality housing and personal mobility options, the degree of social support they can draw on to stay safe, and being able to pay their electricity bill (Bolitho and Miller, 2017). It is a climate justice issue that inequitable distributions of wealth and material security within our communities effectively insulate some bodies from climate change impacts while other bodies are exposed to everything ranging from discomfort, illness, and death. Della Bosca (2023) argues that the ability of particular households to physically and emotionally insulate themselves and essentially eliminate heat impacts enables a form of embodied climate denial that may stymie comprehensive public demand for systemic climate change action. This argument calls for a more nuanced sensory analysis that brings the risks of environmental exposure into conversation with the risks of environmental disconnection.

Potter (2018, p. 454) posits that the transboundary capacity of heat both within the body and at its boundaries “creates connections not only between body and environment, but also between humans and cosmos and between life and death”. What happens to these existential connections when we consider that technologies like air conditioning may act as “new bodily prostheses, which offer possibilities not previously available” (Burkitt, 1999, p. 147) to shield some but not others from the discomfort of environmental affect? It is critical to recognise that these prosthetic possibilities are not available to all bodies, and that notions of personalised atmospheric control carry weighty implications in a shared climate. Sweat is a dynamic process of presence, one that centres the interactive and intimate body. Considering the role and implications of sweat in response to heat stress requires attention to differentiated bodily relationships with landscapes and atmospheres, as well as the socio-economic contexts of particular bodies that shape those relationships. In the context of climate change, sweat shifts from a mundane response to situational heat to a bodily sensing of the existential threat that environmental insecurity presents. Attention to sweat drives home the embodied reality of climate change as a personal, sensory, and emotionally affective process. In short, climate change is not only expressed in measurements of CO₂ and global average sea rise, but is intimately felt through the physical feedback mechanisms of the body. To ignore these corporeal impacts of climate change is to continue the very practices and relationships with physicality that have caused it.

2. Sweat speaks but what does it say?

Throughout this paper, sweat emerges as a vital and multidimensional communicator. It conveys the body’s sensory ability to signal, and respond materially to, the atmospheres and emotional states it passes through. In an era so often defined by the systemic pursuit of capital, power, and the pursuit of invulnerability, sweat accentuates the physical and emotional dependencies and sensitivities that constitute human survival. And sweat materialises the sensory legacies of our mammalian evolution, even as we embody the meanings, tensions, and opportunities of the spaces, values, systems, and practices we move through today. Following these stories from their myriad sources and into our own and other’s experiences makes visible the multiple and intersecting

narratives that occur through and as the body. Reflecting on these, the question remains whether and how this allows us to more expansively question, assess, and respond to systemic environmental and social injustices differently.

This final section considers where attention to sweat may further the collective project of envisioning and actively navigating towards more grounded, just, and sustainable modes of corporeal co-existence in the context of concomitant social, political, and ecological crises. Thinking with sweat through biological, cultural, expressive, and planetary lenses, this work responds to Musser's (2021) advocacy that the liquidity of sweat helps us to think about the self collectively in ways that connect affect and power to their material traces without invoking analytic singularity, transparency, or permanence. In considering the versatility of this liquid analytic in extending and connecting broader theoretical discourses around embodied identity and material ecology, some areas of connective potential are sketched below. However, the intention is provocative and invitational rather than proscriptive or exhaustive.

Continuing an engagement with porosity and the ambiguities, paradoxes, tensions and connections, these stories form part of the constellation of practices and experiences that emerge as a negotiation – and often negation – of the sweating body. As such, sweat engages embodiment as the “physiological, psychological and sociological assemblage out of which spatially situated knowledge, ethics, subjectivities and social relations are forged” (Waite, 2014, p. 666). From Musser's liquidity, the argument continued here is that sweat provides a perverse and powerful lens partly due to its own multidimensional interiority, and partly because of its vital emergence in the face of overt human mechanisms of containment. As such, it contributes to what Frost (2016, p. 1) refers to as a “politically useful” understanding of human being that avoids the “historically specific fantasy of mastery over the self, the earth, and all its many creatures”. However, the challenge reflected across the environmental humanities is how to convey all material bodies – animal, plant, atmospheric, oceanic, biotic, and abiotic – as vitally and undeniably connected without erasing the political and cultural valency of specific and situated identity. In the context of escalating social and ecological harm, the challenge is to recognise that while mastery over the self and others is demonstrably a fantasy, that same fantasy sits at the heart of ongoing systems of colonial and capitalist rupture, and drives very real, ever escalating material violence on myriad bodies through constellations of relational identity.

The offer of sweat is to embody this paradox. To borrow from Nieuwenhuis (2019, p. 6), this tension “does not reside inside the controlling body of the mind” but rather lies in the sensory body as it experiences and responds to the conditions of its environment. In recognising that “material, social, and symbolic worlds” Frost (2016, p. 4) tie us together in dependant and relational ways, it must also be recognised that the structures, relationships, histories, and associations that shape all physical, social, ecological, and political dynamics are held in and as our bodies. The cultural and geographical contexts engaged with in this paper convey diverse but often Western experiences of bodily containment, repression, and expression. The argument here is that the bodily disgust and shame that often accompany sweat indicate the continuing embodiment of Western expectations of mastery that reinforce the human as “the animal for which animality is an issue” (Abbott, 2011, p. 87). Across cultures where human exceptionalism is surpassed only by individualistic striving for imperviousness, sweat reminds us of what Wood (2019, p. 31) terms “a line that must not be crossed”, drawing on Heidegger's (1998, p. 145) reference to our “scarcely conceivable, abysmal bodily kinship with the beast”. That is, the material, social, and symbolic vulnerabilities and dependencies of our bodies, acknowledged or not.

Attention to sweat thus takes up the visceral and radical agenda of reclaiming things “long-derided” (Wilshire, 1989, p. 96) regarding our resistance to affectivity. Bodily fluids are particularly evocative in exploring the physical and cultural conditions through which bodies experience conceptual borders and boundaries, disrupting as they do the

ideals of civilised order and cultural expectations of bodily control and containment (Turner, 2003). Their transboundary nature prompts fears of contamination and unwanted intimacy, particularly in contexts and from bodies stigmatised by race, ethnicity, class, or gender (Tullett, 2016). And yet it is the inevitable fallibility of such deterministic boundaries that renders holes, pores, and other literal and conceptual agents of permeability simultaneously “intriguing, frightening [and] destabilising” (Nieuwenhuis, 2019, p. 7). Through their presence alone, they facilitate the potential to influence and affect. The threat to power they offer is evident in Ahmed's (2004, p. 4), point that despite the subordination of emotions in Western knowledge production, still they have “remained at the centre of intellectual history” in ways that both reinforce and subvert institutional control. While narratives of control certainly shape the world, so too do the vital interdependencies of the affective world, offering the potential of disturbance through their unpredictability, complexity, and agency.

It is through sweat that we experience the multiplicities of our sensorily and socio-culturally situated bodies as they negotiate intersecting dimensions of safety and vulnerability, comfort and discomfort, belonging and exclusion. While much work has been done across the environmental humanities to destabilise and deconstruct myriad Cartesian dualisms of mind/body, culture/nature, individual/collective, staying with the politics of embodiment requires contending with how these dualisms continue to be perpetuated and supported through our own sensory drives. As the section on sweat's planetary story establishes, there is a growing need to articulate the porous and ambiguous potentials of sensory and affective attunement to drive forms of engagement (Verlie, 2019, 2021) as well as forms of denial (Della Bosca, 2023). The sections in this paper have worked to establish the ways in which sweat both connects essential bodily needs and distinguishes affectively mediated desires within situated narratives of survival. In other words, they demonstrate that while the body needs sweat, its meaning is interpreted through its own culturally-dependent preferences and aversions. Thus, sweat narrates the myriad forces of cultured environments that intersect to produce embodied meaning. Engaging with sweat invokes the full scope of multiscale affective potential, ranging from spectrums of social embarrassment, repulsion and attraction, to the recognition broader forces of systemic economic oppression or emerging climate disruption. As such, it provides opportunities to continue the work of scholars such as Shove (2003) and Walker et al. (2014) in politicising everyday experiences of architecture, clothing, technology, labour, and space through a sensory lens of political ambiguity.

In presenting these stories together, and indeed in using the language of story, the invitation is to engage with the opportunities of indeterminacy and the agency of interpretation in embodying connections to ourselves, each other, and the environments we depend on for survival. This response suggests two avenues through which sweat informs the pursuit of more just relationalities in the face of its own ambiguity and interiority. The first is continued attention to the ontological and narrative diversity of bodies, identities, processes, and places. In presenting sweat stories as a narrative intervention to the normalised erasure of sweat from social and political discourse, the paper draws on Veland et al.'s (2018) notion that the transformational agency of stories does not require proscriptive approaches to when, where, and why they matter, but instead act to reinforce simply that they matter. If we recognise that dimensions of our individual sensory norms and experiences impact places, people, bodies and environments outside, and that these dimensions may be both unquestioned and influential, then part of the value of sensory narratives is to indicate and challenge mundane environmental and political erasures. Airconditioning practices offer a good example of this type of reflection, as it allows climate justice connections to germinate through a reoriented sensory awareness of normalised atmospheres. Heatwaves provide a particularly resonant example from which to drive home the fallacies of sensory hierarchies. Heatwaves are felt only in and as they body – there is no characteristic

visual impact, sound, taste, or smell. More than any other disaster, they rely on direct feeling for sensory response and recognition. As with the broader argument that sweat is a bodily reality that is often erased or controlled within particular spaces, the emphasis here is that invisible things still have material impacts and material agencies. In advocating for more diverse narratives, the paper offers an invitation for readers to continue to develop sensory, bodily connections to and awareness of the material, political, and emotional possibilities of being and doing in the world differently.

The active recognition of plural knowledges, particularly those historically ignored, sanitised, or co-opted, is necessary in redressing the dominant narratives of exclusion, hierarchy, and power that sensorily orient relationships with and experiences of our own and others' bodies, both human and more-than-human. Narrative diversity offers powerful opportunities to challenge normalised erasures and simplifications. For example, Chao's (2022, p. 82) engagements with Marind people's interpretations and experiences of oil palm plantations in West Papua devotes a whole chapter to skin and wetness as constitutive of "multi-species skinship". Here, sweat is one of many fluids that enables visceral and valued relations and identities between human and more-than-human bodies, yet it is also through porosity that the physical and ontological violence of plantation logics is embodied. What does it mean to hold this sweat narrative alongside, for example, the experiences of Australian men and women in public spaces, gyms, at home, and at home? In considering the distinct ontological and material stakes of differently situated sweating bodies, the challenge is to pursue the possibilities of interdependent embodiment without erasing the systemic power hierarchies that sustain some bodies at the expense of others. This requires critical and careful attention to how differences and similarities in embodied meaning are connected, produced, reinforced, and threatened through everyday practices of being.

The second, and related, avenue is to further develop theories around the political agencies and ambiguities of sensory embodiment. In recognising the "value of more potent, more complex understandings of materiality" (Alaimo, 2010, p. 2), the lesson of sweat is to lean in to the "transformative possibilities of liquidity" (Musser, 2021, p. 102). In this paper, sweat's stories emerge as porous constellations of the body, situated within porous social narratives, and reliant on porous material landscapes. As such this work has emphasised sweat's agency as existent and vital within, amongst, and beyond dichotomous notions of being. It has also sought to demonstrate that interpreting sweat also requires negotiating questions around how bodies speak, how bodies speak to each other, how art speaks to culture, and how environments speak. The sections of this paper have worked to suggest that while the cultured 'body of the mind' may resist or avoid the interdependencies embedded within these narrative flows, they are always felt and responded to in some way within and as the feeling-sending body.

One way of doing this may be to attend to the movement between diverse realities and potentialities within every day spaces, behaviours, and experiences. Sweat reinforces that bodies and their meanings are reliant not only on composition, but on movement. In sweat's narratives of motion and emotion are the conditions and tools needed to tell human stories in different ways and perhaps support a more just corporeal politics of everyday being. Väyrynen's (2018) concept of choreography in the context of corporeal peacebuilding provides a rich theoretical and material foundation from which to recognise everyday experiences of motion and emotion as central to political transitions. This notion of choreography situates mobile and emotional bodies within and as sites of politics, focusing on "mundane and daily relations that yet are connected—in some cases more explicitly than in others—with networks of power and political control" (Väyrynen et al., 2016, p. 3). In characterising bodily politics through both culturally and spatially pre-scripted conditions as well as the emergent responsiveness, everyday practices and processes become sites through which both peace and violence are called into being. In centering porous and ambiguous bodies as sites of possibility, Väyrynen (2013, p. 47) pursues a politics that is "not yet"

without negating the embodied legacies of proscriptive forces that actively resist change. In considering how this extends theories of the body as they relate to systemic change, it may be that extending a focus on the transcorporeal, multispecies, and biocultural constitutions of human bodies to include more politicised concepts of movement and emotion may better reflect the complexities of contemporary sensory life. As the sections of this paper have worked to establish, while the narratives presented are true and potential simultaneously, they are felt individually. In other words, while sweat has the capacity to invoke a spectrum of feelings from disgust, shame, anxiety, attraction, and belonging, it does not experience them all simultaneously but rather in response to particular configurations of social and physical space. There may be a political resonance with extending scholarly attention beyond the biocultural composition of bodies and into the affective shifts that influence moment-to-moment experiences of being embodied, and the behaviours and conditions available that amplify or erase the potential for new modes of being and doing.

Such an approach to movement speaks to Musser's (2021) point that sweat is instructive precisely because it evades the epistemological constraints, coherence and flattening associated with objectification, and through this ambiguity is recognised to contain connective potential while maintaining resolute interiority. There seems a productive opportunity to use this concept of choreography to more ably negotiate the tensions flagged in posthuman discourses around pursuing relational, interconnected ontologies while simultaneously recognising the distinct experiences, conditions, and challenges faced by specifically situated bodies, particularly those systemically marginalised (Neimanis, 2017). Sweat's resonance with movement and emotion in and as the body, as well as its political and affective valence between bodies offers a provocation from which to extend this line of enquiry through theories articulated through the senses, within and as the body, and between human and more-than-human bodies.

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