



Atmospheres and extended feelings

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Abstract

Atmospheres have been the focus of reflection by many phenomenologists, and they have recently gained prominence in work coming from human geography, from performance studies, and from architecture. There are, however, widely differing interpretations of the concept of atmosphere. In particular, it is unclear whether atmospheres are extended feelings. This paper leverages recent advances in cognitive neuroscience to address this question. It employs active inference to develop a notion of atmospheres as extended inferential affective processes that involve the entrainment of interoceptive and external elements. The resulting account clarifies the role of the body in the emergence of atmospheres, and the sense in which atmospheres are extended feelings.

Keywords Atmospheres · Neuroarchitecture · Neuroscience · Phenomenology · Extended mind · Active Inference

1 Introduction

Architects are increasingly interested in, on the one hand, understanding the affective qualities of built space, and, on the other, connecting the fields of architecture and neuroscience. A meeting place of both these currents is the study of atmospheres, which are increasingly seen as an essential element of architecture (Zumthor, 2006). The difficulty is that conceiving atmospheres in ways that are amenable to the scientific explanations of neuroscience is incredibly challenging, if promising, enterprise (Arbib et al., 2023; Kirsh, 2023). This difficulty stems from the ontologically vague status of atmospheres, and it is an issue that affects research on atmospheres coming also from human geography, from anthropology, and from performance studies (Bjerregaard, 2015; McCormack, 2018; Déchery & Welton, 2020, Bille et al., 2016). In what follows, I will build on recent, third-wave extended mind versions of active inference in the cognitive sciences to advance a conception of atmospheres

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as extended inferential affective processes. These processes, I will argue, involve the entrainment of interoceptive and external elements, which explains the extension that is characteristic of atmospheres. Phenomenologists have criticised neuroscience for reducing mental life to activity in the brain, but I will show how an interdisciplinary third-wave extended mind approach can reconcile neuroscientific insights without falling prey to this critique. Moreover, the proposed account will clarify a central point of contention in existing theoretical attempts to characterise atmospheres: whether atmospheres should be characterised as extended feelings. In Section 2, I will introduce atmospheres. In Section 3, I will introduce active inference as a theory of both affective processes and extended cognition. In Section 4, I will take stock and use extended active inference as an explanatory framework for atmospheres.

2 Atmospheres

Atmosphere 1 – the mountain:

There is a kind of rain without beauty, when air and ground are sodden, sullen black rain that invades body and soul alike. It gets down the neck and up the arms and into the boots. One is wet to the skin, and everything one carries has twice its weight. Then the desolation of these empty stretches of land strikes at one's heart. The mountain becomes a monstrous place.

-Nan Shepherd. *The Living Mountain*.

As Nan Shepherd walks through the Cairngorms, her body comes to grips with the soggy ground, the wet air, and the dark rain. She plods on, until the bleak atmosphere sinks in. Shepherd is careful to place the source of this desolate feeling on the landscape itself. The feeling comes from the mountain, and through the body –the rain down the neck, the wet skin, the heavy backpack– it infiltrates the hiker's heart. Shepherd's emphasis on embodiment and on the expanded spatiality of feelings echoes phenomenological approaches to the study of atmospheres, a concept that, in the past decade or so, has become the subject of renewed philosophical interest (Anderson, 2009; Slaby, 2014; Healy, 2014; Bille et al., 2015; Thibaud, 2015; Buser, 2017; Griffero, 2017).

Admittedly, atmosphere is a somewhat hazy concept. Schmitz (2016) characterises atmospheres as situations permeated by suggestions of movement, Böhme (2018) as qualities of a space, Thibaud (2015) as mediums of perception, Stewart (2011) as force fields, Kazig (2015) as media between humans and environment. Böhme emphasises that they do not have a secure ontological position in Western thought, which partly explains the diversity of understandings. They also stand at a peculiar crossroads between subjectivity and objectivity. Arguably, they are not simply subjective projections onto a neutral environment, and yet, their expression requires embodiment, and everyone experiences them slightly differently. Consequently, they are generally referred to as “half-entities” (Schmitz, 2016), “quasi-objects” (Böhme, 2018), or “quasi-things” (Griffero, 2017). The issue is further

complicated because thinkers in geography approach atmospheres through the lens of affect theory (e.g., Anderson, 2009) and philosophers approach them phenomenologically, with similar terms (e.g. affect) meaning slightly different things in the two traditions. As Trigg (2021) indicates, a somewhat common ground is the idea that atmospheres are affective phenomena that manifest spatially and are grasped pre-reflectively and corporeally.

The spatiality and affectivity of atmospheres have important implications for the ontology of affectivity more broadly. If they are a kind of “spatially extended feeling” (Böhme, 2018:8) then atmospheres would stretch traditional conceptions of what feelings are, perhaps to untenable limits. If the desolation originates in the mountain, where does it end? Here, views differ from thinker to thinker. While Böhme argues that atmospheres presuppose bodily presence, Anderson (2009) goes further and defends that atmospheres emanate from the assembling of bodies. In a similar vein, Riedel (2019, 269), writes that atmospheres start from the “encompassing meshwork of bodies” in a shared situation. In this conception, the body is the originator of atmospheres, which then spread out into the environment. This seems to apply quite neatly to the atmospheres emerging out of human congregations, as in the following vignette, *atmosphere 2 – the regatta*:

That October, the ruffian wind of Trieste blew in early. The trees were whipped by it, the sea was heavy, rain poured down and mists magnificently swirled. As the regatta assembled for the start, beyond Miramare, the central harbour came thrillingly to life with speedboats, inflatables and rescue craft. A big white coastguard cutter stood ready at the Molo Bersaglieri. A helicopter came and went from the Molo Audace. Loudspeakers boomed across the waterfront. All day long crowds surged this way and that, and the myriad flags and pendants of the festival fluttered in angry parallel through the tempest. It was a scene of mighty animation.

-Jan Morris. Trieste and the Meaning of Nowhere.

The crowds assemble and intermingle, their excitement growing. Notice, however, that there is more to the scene than just bodies. There are all kinds of vessels going back and forth, there are flags, and pendants, there are loudspeakers, and there is the ruffian wind of Trieste. Here, Casey (2021) makes a useful distinction between the where of presentation and the where of causation. Atmospheres present themselves *out there*, but that encompasses the paraphernalia of the regatta as much as the bodies of the spectators. We can see that atmospheres form a unified Gestalt with integrated dynamic features (Fuchs, 2013).

A different question is whether the atmosphere originates exclusively in human bodies. Böhme accepts that bodies can generate atmospheres that then go beyond the bodies (which Anderson defends is always the case). However, Böhme considers these interpersonal atmospheres only a subtype of atmosphere, which is a broader phenomenon that does not necessarily originate in human bodies. Again, this makes sense within Böhme’s understanding of atmospheres as qualities of a space. This

is a very broad notion, as is Schmitz's understanding of atmospheres as situations permeated by suggestions of movement. All spaces have qualities. And all situations are permeated by suggestions of movement, whether we cash that idea in terms of affordances, in terms of the phenomenological notion of possibilities, or in terms of potentiality (Fernandez Velasco & Niikawa, 2025; Griffero, 2019). Atmospheres –qua possibilities (and/or the qualities) of a space– are affective in that they are, paradigmatically, grasped affectively.¹ This *weak sense* is, however, different from the *strong sense* in which other authors take atmospheres to be affective (i.e. as extended feelings). The focus in this paper is on atmospheres that are affective in the strong sense. Characterising atmospheres in the *weak sense* is a different, and worthy, enterprise.

Something curious happens if we turn our attention back to *atmosphere 1 – the mountain* and look at it through Anderson's requirement that atmospheres emanate from the assembling of bodies. If we follow a conservative understanding of body, the mountaineer is the only body in the situation, so the atmosphere would need to originate from her. This seems to go against the presentation of the atmosphere and reduces it to a sort of projection from the subject onto the environment, or perhaps to a perception-like state. That atmospheres are not a projection from an internal feeling onto the environment is further supported by the fact that humans can sense atmospheres without sharing the "feeling" of the atmosphere. Consider *atmosphere 3 – the restaurant*:

One evening – it was our last day – in Tours, we had dinner in a brightly-lit restaurant where the walls were lined with mirrors, frequented by a sophisticated clientele. My father and I were seated at the end of a long table set up for the group. The waiters were paying little attention to us; we had to wait a long time between courses. At a small table nearby sat a girl aged fourteen or fifteen, suntanned, in a low-cut dress, and an elderly man who appeared to be her father. They were talking and laughing quite freely, completely at ease ... I caught sight of myself in the mirror, pale and sad-looking with my spectacles, silently sitting beside my father, who was staring into the far distance.

- Annie Ernaux. Shame.

The narrator can sense the merry atmosphere in the restaurant. Other customers are at ease, laughing, but the narrator feels out of place, sad and separated from the general mirth. Similar dynamics are present when we are bored in what for everyone else is a fun party, or when we don't get a play that other audience members are finding funny. In some cases, we are even confronted with atmospheres of exclusion, in which some bodies (e.g., queer bodies, non-white bodies) struggle to find their way through (Ahmed, 2006; Krueger, 2021; Yancy, 2016). Slaby (2014) argues that the fact that we can sense an atmosphere without engaging in it shows that they are not

¹ Of course, the possibilities of a space are also grasped cognitively, and there is a broader question of how much we can stretch the concept of affordance to encompass all of the ways in which the environment seems to present us with significant possibilities (Ratcliffe and Broom, 2020).

completely dependent on experience.² This reflection leads him to conceive atmospheres as occasions for affective engagement. We can sense the occasion for engagement without being swayed by the atmosphere.

Rather than resolving it, the above simply complicates further the issue of the extension and affectivity of atmospheres. If they originate outside the body, are they truly affective? And if they originate inside the body, in what sense are they extended? Some researchers within cultural studies see the ontological vagueness of atmospheres as a virtue, because it can serve as a “bridge between emotion and affect, the personal and the general” (Bille et al., 2015, 36). This vagueness might not pose a problem if one works at a descriptive level. However, clarifying the affectivity and extension of atmospheres becomes paramount when we move from description to explanation. If we dilute too much what is affective about atmospheres, the claim that atmospheres are extended feelings becomes trivial, and the concept of atmospheres loses explanatory power.

In his discussion of affective life beyond the confines of the skin, Casey (2021) is explicitly wary of veering into explanation: “the path of explanation takes us quickly to causation, however, and thus to the endogenous approach we first encountered in Descartes, and still encounter today in neurological theories of emotion.” Here, neuroscientific approaches to emotion are exemplified as the epitome of reductive explanation. Griffero (2019) also makes a similar connection when he says that “Western culture, obsessed with the reductionist idea of tracing complex experiences to some “nothing but”, leads to neglecting sensible (phenomenal and sentimental) life” (24), with a footnote explaining that today, the “nothing but” corresponds to the “brain in neurosciences” (34). Both phenomenologists agree that explanation, epitomised by the neurosciences, is reductive and neglects phenomenal experience.

Much of their animosity comes down to what they take neuroscience to entail. According to Casey, it entails that the proper place of affectivity lies in the brain, which goes contra the phenomenological view. Likewise, Griffero complains that the current “neuromania” places the synthesis of subject and environment solely in the brain. In the present paper, however, I want to show how recent, third-wave, approaches to extended cognition can reconcile neuroscientific evidence with the idea that affectivity extends beyond the skull, and beyond the skin. This move in itself is neutral on whether conscious states are reducible to physical states. First-wave extended mind accounts were explicitly functionalist, at a time in which functionalism was the mainstream physicalist position, with some authors arguing that the extended mind hypothesis was entailed by functionalism (Sprevak, 2009). More recent extended mind accounts have distanced themselves from functionalism, with many moving to different forms of enactivism (Hutto et al., 2014), and with some of them explicitly embracing phenomenology (Silberstein & Chemero, 2012). Moving from phenomenological description to cognitive-scientific explanation is not to reduce one to the other. The central aim of this paper is rather to develop an

² As a reviewer suggested, a more modest conclusion from that vignette is that atmospheres cannot be reduced to one’s own individual affective experience, but they are not independent of experience altogether, as they are still experiential phenomena.

explanatory framework for the study of atmospheres that moves beyond description but that does not commit us to reducing affective processes to activity in the brain.³

Through a third-wave extended cognition framework, I will offer an analysis of the affectivity and location of atmospheres that moves from description to explanation. This way, we can leverage neuroscientific knowledge to our understanding of atmospheres, thus facilitating interdisciplinary work. This analysis will, on the one hand, dispel some of the conceptual haze around atmospheres, and, on the other, broaden the horizons (within analytic philosophy and the cognitive sciences) of what affective processes might involve. Specifically, it will answer the central question that has emerged from the above discussion: Are atmospheres extended feelings?

3 Extended affective inference

In their phenomenological critique, Casey and Griffero denounce neurosciences as reductive for circumscribing affective life to the confines of the skull. Their target is what analytic philosophers would term “internalism” (Adams & Aizawa, 2008; Churchland, 1992; Fodor, 1975; Hohwy, 2016; Rupert, 2009a, 2009b). Here, we can differentiate internalism about a target cognitive process (e.g., memory) or, in its stronger form, about all cognitive processes ranging from perception to emotion and from imagination to motor control. We can also differentiate between methodological and metaphysical internalism (see Kirchhoff & Kiverstein, 2019). Methodological internalism is the position that the unit of analysis should be the individual, or, in a more radical form, the brain. Metaphysical internalism is the position that processes in the brain are sufficient to realise the target cognitive processes.

Much of the debate surrounding internalism is not framed in terms of either presentation or causation (the distinction Casey makes about extended feelings), but in terms of constitution. And, of course, it is not only atmospheric approaches in phenomenology that stand in opposition to internalism. Extended cognition, –the view that cognitive processes are partly constituted by elements distributed across brain, body, and environment– is a rejection of both methodological and metaphysical internalism (Clark & Chalmers, 1998; Clark, 2008; Sutton, 2010; Wheeler, 2011). Even the most diehard internalist will agree that external elements drive cognitive processes in the weak sense that they exert a causal influence. The dispute does not revolve around causation. It revolves around the question of whether external resources can be part of the constitutive basis of cognitive processes.

First-wave extended cognition view relied on functionalism, the idea that token mental states share a type if they occupy a similar role in a cognitive process, and argued for extended cognition based on the parity principle: for any external resource playing a role in a cognitive process, we should consider it part of the cognitive

³ Methodologically, this corresponds to an ecological approach to cognition “in the wild” that encompasses not just neuroscientific but also psychological and ethnographic methods (Vigliocco et al., 2023). The framework is compatible with phenomenology, but does not seek to replace it, nor to cash out phenomenological insights into third-person terms.

process if we would consider an internal resource playing the same role to be part of the cognitive process (Clark and Chalmers, 1998). The parity principle came under a lot of fire (Adams & Aizawa, 2008), which led some theorists to reject extended cognition approaches grounded on functionalism. This gave rise to the second wave of extended cognition, which embraces functional dissimilarities between internal and external elements, because external elements complement internal elements precisely in virtue of those dissimilarities (Heersmink, 2016; Menary, 2010; Rowlands, 1999; Sutton, 2010). Much of the work in this second-wave of extended cognition was concerned with analysing and taxonomizing coupled agent-environment systems (Heersmink, 2014; Sutton, 2010), and more attention was also devoted to the way in which widely distributed cognitive systems depended on skilled, embodied transformation of the environment (Rowlands, 2009; Menary, 2007; see also Kirsh & Maglio, 1994 and Hutchins, 1995 for precursors). Eventually, this shift led to a third wave of extended cognition in which the individual is no longer the necessary centre of cognitive processes but a hub among others. The most prominent third-wave approaches are developed within an active inference framework (Kirchhoff & Kiverstein, 2019). In what follows, I will succinctly introduce active inference, then explain the central ideas in third-wave extended cognition, and, finally, spell out how they apply to affective processes.

Organisms engage with their environment reciprocally in a loop spanning action and perception. To maintain their integrity, organisms must exert adaptive control over this action-perception loop. Active inference (as a normative framework; Costa et al., 2020) defends that the way organisms achieve this is by minimising the surprise of their sensory observations. Surprise being a measure of uncertainty that corresponds to how much an organism's current sensory observations differ from its preferred sensory observations (i.e. those that maintain its integrity). I will not dwell on the technicalities but suffice to say that while organisms cannot minimise surprise directly, they can minimise a proxy called free energy, which is an upper bound on surprise (Friston, 2009). Organisms minimise free energy by predicting sensory input and by changing the world so as to match their predictions. This in turn, minimises surprise over time. Through an ecological, enactive lens, free energy can be seen as a measure of dis-attunement between internal and external dynamics, and active inference as a way in which the organism achieves a grip on a particular situation (Bruineberg et al., 2018).

Here, active inference connects with Bayesian approaches to cognition (Doya et al., 2007; Gregory, 1980). These approaches conceive the brain as an inference machine trying to represent the causes of its sensory input in a Bayes-optimal way. Active inference (as a process theory; Friston et al., 2017) again provides a tractable way of understanding this process: by minimising their free energy over time, organisms are able to approximate optimal Bayesian inference. The idea is that organisms embody a generative model of the causes underlying their sensory observations. Note that organisms do not *have* a model of the environment – they *are* a model of their environment (Friston, 2013). This model encodes dynamically updating probability distributions (beliefs) about both sensory observations and their hidden causes (observable and non-observable variables, respectively). The reciprocal interaction of a generative model (the organism) and a generative

process (the environment) through action and perception results in a coupled agent-environment dynamic singularity.

Let us develop the above sketch in a bit more detail (for a lot of detail, see Parr et al., 2022). Action and perception minimise free energy in complementary ways. Perception predicts sensory input and updates beliefs to match incoming sensory input. Action transforms the world so that future sensory input matches the system's predictions (which correspond to desired states). Learning is an update of the generative model at a longer timescale than perception. In the case of human cognition, the generative model in question is a deep temporal model with a hierarchical structure (Friston et al., 2017). Macroscopic processes model statistical regularities over slower timescales than microscopic processes (Hobson et al., 2014). Thus, planning corresponds to action policy selection at a longer time scale (e.g., go to the supermarket) than bodily action (e.g., open the door). Planning requires the computation of expected free energy, which is the free energy arising out of predicted future states under a given policy.

Something interesting happens when we bring expected free energy into the active inference mix. There are some cases in which an uncertain environment becomes preferable to a familiar one. The organism might seek novelty and surprise in the short term if they minimise expected free energy in the long term (e.g., if the novel situation gives rise to the learning of new statistical regularities). Too much uncertainty, however, can be dangerous. The organism must surf skilfully through these gradients of free energy minimisation, and it is here that affect plays a key role (Joffily & Coricelli, 2013; Van de Cruys, 2017; Kiverstein et al., 2019; Fernandez-Velasco & Loev 2021, 2024). Affect emerges from fluctuations in the confidence an organism has in its generative model (Hesp et al., 2021). The agent infers subjective fitness by estimating the expected free energy of the relevant action policies. Then, positive (or negative) affective charge (i.e. valence) corresponds to increased (or decreased) confidence in the current action model.

These affective processes are grounded in a complex mechanism of interoceptive inference, which is the regulation of visceral cycles via a deep generative model (Seth & Friston, 2016). Allostasis, the anticipatory control of metabolically steady states involves long timescales and, consequently, deep generative models of the causes of interoceptive changes (Sennesh et al., 2022). It is this deep temporal dynamic system of interoceptive inference (with visceromotor areas such as the anterior insula cortex at the top of the hierarchy) that, so the story goes, instantiates affective processes (Seth & Friston, 2016; Seth & Tsakiris, 2018). Expectations about free energy are central to maintaining allostasis, and it is in this context that we get a sense of affective processes as affective inference. While affective experience (e.g., moods) might emerge simply out of the integration of interoceptive sensations and the affective charge ensuing from confidence estimations, emotions correspond to models of affective dynamics. They are higher-level, culturally learned models that serve to maintain allostasis, drive action, and influence perception (Barrett, 2017).

If active inference as a whole is about the attunement in the organism's grip of the environment, then affective inference orients us towards the possibilities

for action in the world as we strive towards optimal grip (Kiverstein et al., 2019). Affect is not simply a cognitive evaluation of the state of the world – it is always action-oriented. When we think of emotions as “models” of affective dynamics, these are holistic models that are both descriptive (i.e., evaluative) and directive (i.e., action policies). Active inference takes on emotion strengthen the connection between valence and action. The idea is that “at the same time as emotional experiences feel good or bad, they also prepare or make us ready to act on relevant affordances” (Kiverstein et al., 2019, p. 2858). Affect can influence action so as to guide the organism to an overall reduction of uncertainty over time (Hesp et al., 2021).

Let us now look at extended cognition proposals using the framework of active inference. As we saw, interactions of the generative model and its generative process result in the dynamic entanglement of agent and environment. This process is mediated not only by internal neural resources but also by cultural practices (Kirchhoff & Kiverstein, 2019). Neural, bodily and external elements both cultural and physical diachronically constitute the basis on which this dynamic entanglement of agent and environment unfolds. The individual agent then becomes a locus of coordination rather than the centre of cognition. Note that even in the most internalist interpretation of active inference, the constitutive basis of cognition ought to be diachronic rather than synchronic. The reason for this is that different parts of the deep hierarchical generative model operate at different time scales, so that any given cognitive process will be instantiated by neural events that do not temporally overlap. This reading of active inference can then be seen as a third wave of extended cognition, a deterritorialized cognitive science in which cognitive processes are seen as widely distributed both spatially and temporally. In their monograph on third-wave extended cognition, Kirchhoff and Kiverstein (2019: 16) outline four central tenets of third-wave extended cognition within an active inference framework:

1. **Dynamic Singularity and No Fixed Properties:** some cognitive processes are constituted by causal networks with internal and external orbits comprising a singular cognitive system. In other words, cognitive processes have no fixed properties but comprise different orbits across different dimensions.
2. **Flexible and Open-Ended Boundaries:** the boundaries of mind are not fixed and stable but fragile and hard-won, and always open to negotiation (...)
3. **Distributed Assembly:** the assembly of cognitive systems is not always orchestrated by the individual agent but is sometimes distributed across a nexus of constraints, where some constraints are neural, some are bodily, and some are environmental.
4. **Diachronic Constitution:** cognition is intrinsically temporal and dynamical, unfolding over different scales of behaviour.

To get a sense of these four tenets at work, let us take the example of queuing (Hutchins, 2010). Imagine Ed wants to go see a movie. When Ed arrives at the cinema wanting to buy a ticket, the order of arrival of the other moviegoers is

immediately clear. Ed just needs to put his body at the end of the queue. What would otherwise be a highly complex problem (everyone wanting to buy a ticket remembering everyone else's order of arrival) is simplified through an embodied cultural practice. Because Ed has been enculturated into the practice, he can see the order of the bodies on an imaginary line as a representation of the order of arrival, which in turn facilitates a series of inferences, such as how long he might need to wait. Regarding the first tenet, the external elements do not simply complement or augment internal elements of a cognitive process (as the second wave would have it). Imagine Ed arrives at the cinema and decides to join the queue. It is not simply that queuing helps Ed to keep track of the order of arrival. The very process of keeping track is radically transformed through a collective, embodied practice. Ed just joins the line and waits. Therefore, internal elements do not have fixed characteristics, and neither do external elements. A queue is a line of people, but so is a wall of football players defending a free kick. The order of bodies in a line only represents order of arrival within the context of a broader cognitive ecosystem. In Hutchins's words, queueing is a culturally and embodied enacted representation (2013). When looking at things through the lens of third-wave extended cognition, internal and external elements interact with each other over different timescales and they are transformed as a result.

As for tenet two, this is the idea that the boundaries of cognitive systems are "fragile developmental and cultural achievements" (Sutton, 2008, p. 213). For third-wave extended cognition, the individual is no longer the necessary centre of cognitive processes but a hub among others. Otto might be the centre of the cognitive process of remembering that extends to his notebook (Clark and Chalmers, 1998), but that's not necessarily the case for Ed. Ed can decide whether to join a queue, but that doesn't transform him into the centre of the cognitive process. The centre and the boundaries of cognitive processes depend on the activity under study (Hutchins, 2010). This leads us to tenet three, which owes much to dynamic systems theory (Kelso, 1995). In third-wave extended cognition, cognitive assemblies are seen as self-organising processes. Out of the non-linear interactions among the elements in a system (e.g. the bodies in a queue, the box office, etc.), a structure emerges (e.g. the queue). Once that structure has emerged, a series of constraints keeps the system in place. The constraints come not only from within the brain or even the individual but also from the interaction of different individuals: from the bodily possibilities of the people queuing, from social norms such as not skipping the line, and at times from environmental features such as ropes demarcating how the queue should progress. By satisfying these constraints, cognitive systems configure and reconfigure themselves (Hutchins, 2014).

Individual agents are embedded in complex systems of cultural practices, which also evolve over time (Malafouris, 2010). Cognition unfolds at different temporal scales, as the final tenet states. The elements constituting a cognitive process are diachronically distributed (Kirchhoff, 2015). The duration of all of the elements constituting a cognitive system do not necessarily overlap with the duration of the system in question. The queue preceded Ed and will outlast him once he has gotten his ticket and left. And as we have just seen, the cognitive process only emerges because

all of the individuals in it have been enculturated to the practice of queuing, thus creating the relevant constraints for the queue to emerge.

Another way to put this idea of “extended active inference” is that the attunement to the environment depends on the organism inhabiting a particular cognitive niche (Costa et al., 2020). Niches can be seen as collectively leveraged and optimised generative models. Constant and colleagues use the example of desire paths. Some people cut through the grass in their commute, their traces eventually becoming a trail, which in turn more people follow. Here, the path is a shared way of reducing uncertainty (e.g., it informs one of the shortest way to the metro). Through niche construction, organisms are able to “upload” the inferential processes directly to the structure of the environment, so that cognition is diachronically distributed across a culturally transformed informational structure.

An important element here is that cognitive systems are nested within each other in a pattern of multiscale integration (Allen & Friston, 2018; Ramstead et al., 2021). One can study the brain as a cognitive system or one can study cognition at the level of the individual, or of large-scale assemblies. Internal states might be inferentially secluded at one scale but become absorbed into higher order dynamics at a higher scale, with global dynamics constraining local dynamics, a common feature of self-organising dynamical systems (Hobson et al., 2014). Therefore, cognitive systems have flexible and open-ended boundaries. The overall picture is one in which widely distributed elements constraint the relevant dynamics for cognition. Out of these constraints, inferential processes, including affective processes, unfold.

Going back to our earlier discussion of atmospheres, it is quite clear that externalist views of cognition can move from description to explanation without falling into the “neuromania” feared by Griffero and Casey. In the third-wave of extended cognition in particular, the individual (let alone the brain) is no longer considered the indisputable centre of cognition. Nevertheless, the brain is not to be ignored, as it doubtlessly has an important function in cognitive assemblies. Viewing cognition as widely distributed goes hand in hand with methodological pluralism (e.g. integration of ethnography, computer science, psychology, etc.) but it certainly leaves plenty of room for the neurosciences (and for phenomenological methods). Explanatory cognitive science does not necessarily reduce cognition to the brain, but it certainly takes neural structure as part of the constraints that determine the emergence of cognitive processes.

4 Atmospheres, revisited

Slaby (2014) describes extended affective processes such as music listening as “phenomenal coupling”, and highlights how the piece of music itself manifests affect-like, expressive qualities (Levinson, 2009), with a similar expressive quality being ascribed to atmospheres. Thus, atmospheres are for Slaby “tools for feeling” in direct analogy to the “tools for thinking” of second-wave extended cognition. The agent structures her affective environment just like she structures her epistemic environment. This wilful transformation of the environment on the part of the agent is, Slaby argues, a form of “emotional niche construction”. The overall picture is a

move in the right direction. Slaby finds solid ground on descriptive, phenomenological approaches to atmospheres, and then links them to explanatory work from the cognitive sciences. We can take Slaby's idea as a starting point and move it further with the help of extended active inference. To begin with, let's contrast the idea of emotional niche with the cognitive niche of active inference. One should resist the multiplication of types, else we might end up saying that concerts are auditory niches, perfumeries are olfactory niches, etc. They are, in a sense. It is simply that these are not different types, but different dimensions of niche construction. Niche construction has cognitive aspects and emotional aspects, but what all of these different niches are under extended active inference is collectively leveraged and optimised generative models.

The emotional aspect of niches comes down to the fact that changes in the environment result in the transformation of the affective inference processes taking place therein (Colombetti, 2011). Again, affective inference emerges from fluctuations in estimated uncertainty. Back to the example of the concert, music is conceived as a dynamic build-up, fulfilment, and defiance of expectations (Huron, 2008; Koelsch et al., 2019), an approach that has also been applied to visual art (Van de Cruys & Wagemans, 2011). These patterns result in perturbations in the gradients of expected free energy minimisation, and therefore in affective responses. Other aspects of emotional niche construction aim directly at the interoceptive mechanisms underlying affective processes. This can be through particular vibrations in the music, through the arrangement of bodies in dance, or through the suggested paths of movement in architecture. In a recent experiment, adding vibratory stimuli to the torso of participants magnified the fear they felt while watching horror movies (Makioka et al., 2022). Emotional niches can tinker with the predictive dynamics underlying affective processes at a computational level or directly with the bodily and interoceptive mechanisms that instantiate the affective processes. Note that the two avenues towards engineering affective responses do not constitute an intellectual-embodied dichotomy, but two complementary aspects of one process, two sides of the same coin. Music, for instance, is not only about high-level expectations. Recent experiments examined how live concerts entrained⁴ the physiological variables of audience members (e.g., skin conductance, respiration rate, heartrate...). They found significant audience synchronies for most music pieces. And the synchrony of physiological variables was associated with self-reported appreciation (Tschacher et al., 2021).

Under this extended active inference conception, affective processes emerge in the entrainment of interoceptive and external elements. These processes embody a model of expected environment-agent attunement and drive the organism towards optimal grip. Note that affective processes unfold at many levels in the generative hierarchy, and not all affective processes figure in conscious experience: "low-level inference of the sort associated with motor reflexes... does not itself constitute

⁴ Entrainment is the process through which two systems (physical or biological) become synchronized in virtue of their interaction (for a review on entrainment and affect in music, see Trost, Labbé, and Grandjean, 2017).

conscious processing until contextualised by deep hierarchical inference at higher levels” (Hobson et al., 2014: 6). This is the sense in which affect is to some degree pre-reflective. Phenomenologically speaking, all experience always has an affective dimension, and there are many “background feelings” that reside on the “fringe” of consciousness (Colombetti, 2011; James, 1890; Mangan, 1993; Norman et al., 2010). Within active inference, affective processes are on a spectrum from low-level physiological responses (background feelings) to high-level models (discrete emotions), with differing saliency in consciousness. As for moods, they give the agent a feel for how well they are gripping the situation, and on the basis of this mood, the situation as a whole is experienced as having a particular significance (Kiverstein et al., 2020). Moods reflect expected prediction dynamics (Clark et al., 2018), and, by extension, the overall momentum of how the agent is faring (Eldar et al., 2016).

The above picture can help us address whether atmospheres necessarily originate in the body. In a sense, the answer is yes and no. Yes, because affective processes necessitate the body. No, because the body is not the necessary origin of affective processes. The reason for the ambivalence is that previous theories of atmospheres have tried to pinpoint the origin of emotion. A single origin makes sense for linear systems in which A causes B, but not for non-linear, dynamic systems (Wagner, 1999). The affective processes do not originate in the body *or* in the environment but in the reciprocal interaction of body *and* environment. The distinction Casey made between the where of presentation and the where of causation will not suffice. As with all theories of extended cognition, what we need to look at is the where of constitution. The where of constitution spreads a wide net that falls beyond the body. And yet, it always falls on the body. Any affective process necessitates a body, but as its essential constitutive basis, not as its singular cause.

To reach this conclusion, however, we do not need an extended mind account – enactive approaches that emphasize participatory sense-making processes can give us a similar picture of the role of the body in atmospheres (Garcia, 2024). Where the third-wave extended mind framework helps us is in tackling the central question that this paper set out to address: whether atmospheres are extended feelings. Once we think of atmospheres in the terms of niche construction, the answer is in the positive. So much is true of Slaby’s second-wave approach to atmospheres, but the extended active inference account departs from Slaby’s in two crucial aspects. Firstly, contra Slaby, affective processes are not simply situated within cultural scaffolds. Instead, they are diachronically constituted. Thus, they are extended not only spatially but also temporally. Secondly, affective processes are no longer centred on the agent. In this sense, they are not quite “tools for feeling”, a notion that intimates individual usage. Rather affective processes unfold in culturally transformed cognitive ecosystems and coalesce around an individual or a group.

The novel conception advanced in this paper can help us make sense of *atmosphere 2 – the regatta*. The Triestinos have set up a scene in which boats will try to complete a given itinerary. The boat race is designed to have fine margins, so that expectations are built, tenuously maintained, and easily broken. Loudspeakers and the amassing of bodies further constraint the interoceptive systems of the audience. Affective processes here should be looked at not at the level of an individual engaging with a “tool for feeling” but at the level of a collectively leveraged and optimised

generative model that the audience members can engage with and further transform through their engagement.

Of course, the agent might not be able to engage, as in *atmosphere 3 – the restaurant*, or might decide not to. This is similar to a passer-by who senses the affordance but does not follow the path that goes across the grass towards the metro, because they sense it might be dangerous. Note that atmospheres are not only physical structures but cultural structures too. An agent must have been enculturated into a practice to be able to engage. If someone has never queued before, they will not see a line of people at the box office as a representation of order of arrival. And atmospheres can be restrictive, exclusionary. A shared generative model might not be shared by every individual in a given community. The narrator's socioeconomic status in the restaurant is excluding her from the generalised mirth, an exclusion that is enforced by things such as the waiters ignoring her. Naturally, the feeling that arises is one of disattunement, of losing the grip of one's environment. Furthermore, whether an agent engages with the environment in a way that results in an extended affective process depends both on context and on a larger action trajectory. One could walk by immersed in conversation and not engage with the atmosphere. What the third wave outlook does is precisely to consider the broader trajectories of affect, which extend not only spatially (from the brain to the environment) but temporally (reflecting larger sequences of action, emotion and enculturation).

This understanding of atmospheres is decentered from the individual and diachronically extended, but it is, in some respects, restrictive. For instance, it is more restrictive than some of the accounts coming from human geography. This is because the notion of affect is more restrictive. For geographers, affect is a field of pre-personal intensity, which in the body gives rise to feelings. The distinction between feelings and the broader affect might be mapped along the high-low level of the affective hierarchy in which some aspects of the larger mechanism of interoceptive inference do not pass the threshold for conscious content. However, within geography, a broader conception of what counts as a body (e.g. bodies of water) has led to a broader conception of what counts as affect and a broader conception of what counts as atmosphere, with conceptions as broad as a “meteorological atmosphere as a field of relations of affect” (McCormack, 2018:414). Affectivity is certainly not the exclusive purview of the human. Many non-human animals have affective processes. However, the further we go from the human case, the harder it is to use the notion of a deep generative model instantiated by interoceptive inference. Wolves certainly have something similar enough, but do worms, robots, rivers? The issue is that somewhere down the line we stop being able to leverage scientific advances in the cognitive sciences and thus lose explanatory power. Not only that, in our effort to decentre cognition and affect from the individual human, one risks anthropomorphising the non-human, by ascribing, for instance, human-like feelings to the weather.

Early on, I made a distinction between atmospheres that are affective in the strong sense and those that are affective in the weak sense. When we look at the expansive notions of “affect” and “bodies” in geography, the question is not only figuring out if the weather undergoes affective processes (almost certainly not) but figuring out what environmental structures count as an *affective* atmospheres in the strong

sense of affective. What this paper has done is to elaborate in much more detail what it means for an atmosphere to be affective in the strong sense: it means for it to be an extended structure of affective inference. Again, it is useful to contrast this with Schmitz's conception of atmospheres as situations permeated by suggestions of movement and with Böhme's conception of atmospheres as qualities of a space. Affordances can be engaged with affectively, and qualities of space can be grasped affectively, but this does not entail extended feelings. To illustrate this, let us go back to where we started: *atmosphere 1 – the mountain*. This is certainly an atmosphere at the level of description, and it is affective in the weak sense. However, when we move to the level of explanation, the notion of a shared generative model no longer applies to this case. That is, the atmosphere is not affective in the strong sense. The mountain has not been transformed to alter fluctuations in uncertainty, or the arrangement of bodies, or physiological signals. Surely, the affective process still emerges not solely from the mountaineer but from the coupling of mountaineer and mountain in a dynamic singularity, and this very process underlies the atmospheric presentation of the mountain. And, of course, the atmospheric feeling of the narrator is not simply a projection onto the environment. She is sensing real dynamics in the environment, real possibilities for action, and real cues about her grip on the situation, and she is doing so partly through affective inference. She is certainly engaging affectively with an atmosphere (in the weak sense). However, expanding the concept of extended feeling to any environment to which an individual becomes coupled has no explanatory power because organisms are always coupled to environments, so all environments with an organism in it would become constituents of extended feelings. What is more, such a broad conception of affective would focus too narrowly on a synchronic connection between agent and environment, therefore ignoring the ways in which affective processes are diachronically constituted over longer timescales. The current proposal is more restrictive, but it can help explain the workings of atmospheres *qua* extended feelings. And it expands our conception of affect, away from the individual and onto affective assemblies of heterogeneous elements that extend both spatially and temporally.

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