

Perceiving and creating atmospheres: how ecological-enactive cognition can explain and inform architectural practice

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Abstract

The notion of *atmosphere* has taken prominence in contemporary architecture discourse, used mainly to denote the affective characteristic of inhabitable spaces. In this paper, we employ the ecological-enactive approach to cognition to explain how atmospheres are perceived and created. According to that approach, cognitive systems actively explore meaningful possibilities for action in their environments. We thereby construe the perception of atmospheres as the *possibilities for being in certain moods by exploring what the place affords*. The perception of atmospheres is, therefore, a meaningful activity that is primarily related to the organism's biological interests, which we argue, is a type of meaning that cannot be fully conveyed descriptively. From this, it seems to follow that architects cannot foresee the atmospheres of a place during the designing phase of their projects. We avoid this undesirable conclusion by evoking the material engagement theory and the situated aspect of cognitive performances. Accordingly, skillful architects can imagine the intended atmospheres of a place by creating what we call *proto-atmospheres*, which involves creatively thinking through and with their tools.

Keywords: atmosphere; architecture; design theory; meaning; enaction; ecological psychology; material engagement theory

1. Introduction

The concept of *atmosphere* is central for contemporary architecture and design, where atmospheres are often described in terms of the moods they evoke in those who inhabit a place. This prominence is due to a paradigm shift about architectural qualities that took place in the late 18th century. Atmospheres then became the focus of aesthetical analyses in philosophy of architecture during the 20th century, a theoretical approach that is known as atmospheric turn (Canepa, 2022)¹.

Whereas the classical approach to planning and design focused on measurable properties of spaces, nowadays a more salient question is how designed spaces generate meaningful sensations or effects in their inhabitants.² The concepts of *character* and *atmosphere* thus became relevant aesthetic categories with ‘the identification of *Stimmung* – “tone or mood” – as essential for artistic communication in romantic philosophy and architectural theory’ (Pérez-Gómez, 2016, pp. 24–25). The German phrase *Stimmung* derives from *Stimme*, ‘voice’, and from the verb *Stimmen*, to tune, pitch, or harmonize. *Stimmung*, which is currently translated as a ‘changing mood’, ‘atmosphere’, ‘humor’, or ‘temper’, was formerly used to denote the unity of environment and man. In its original meaning, Pérez-Gómez (2019) explains, the word did not suggest change, but rather a ‘stable “tunedness” of the mind, *the attunement of embodied consciousness*’ (p. 315). According to him, to foreground the atmosphere allows architecture to be grasped both as a cognitive and an emotional communicative setting. The renowned Swiss architect Peter Zumthor (2006), similarly, explains that good quality in architecture is related to its ability to “move” someone. What causes this movement is, in a word, the atmosphere. In a similar vein, Wigley takes the atmosphere to be the ‘central objective of the architect’ (1998, p. 18), stating its fundamental role in experiencing the character of a space. The presence of atmosphere in architectural

¹ For a comprehensive history of the use of atmosphere in architecture and adjacent fields, see the first chapter of Griffero & Tedeschini (2019), and Pérez-Gómez (2016).

² The famous words of the Roman architect Marcus Vitruvius (1st century BC) perfectly capture the classical approach: architecture should be thought first and foremost accounting for *strength*, *utility*, and *grace* (Vitruvius, 1955). “Strength”, or *firmitatis*, is related to the solidity of the building’s foundations and to the choice of materials. The arrangement of sites according to its use, and the convenient disposition of elements stand for “utility”, or *utilitatis*. “Grace”, or *venustatis*, concerns the pleasing and elegant appearance of the work, and the scale of its symmetric parts.

discourses nowadays reveals a renewed attention to corporeality as essentially multisensorial and composite (Canepa, 2022).

The above shows that the use of *atmosphere* in architecture and design highlights the affective and meaningful relations that take place between embodied agents and their environments. Interestingly, those relations are central to two recent developments in the cognitive sciences, namely, ecological psychology and enactivism. Ecological psychologists, following James Gibson (1966, 1979/2015) and Eleanor Gibson (1969), explain perceptual cognition as picking-up information for action through the active exploration of an environment. Doing so takes into account the embodied dynamics between cognitive agents and the environmental layout. Enactivists, following Varela and colleagues (1991/2016), explain how organisms bring forth worlds of significance for the maintenance of their identities as living systems. In the enactive framework, embodiment also takes a central role in cognition. Together, ecological psychology and enactivism—or simply put ecological-enactive cognition (henceforth, EEC)—provide valuable tools to explain how we perceive and engage with a place’s atmosphere. This combined approach implies that the meaning of an atmosphere only arises during the engagement between agent and environment—which may seem puzzling if one thinks that architects have to foresee and conceptualize the intended atmospheres of their projects. Following the EEC line of explanation, then, we offer a picture of how architects and designers are capable to imagine and to create atmospheres by engaging with their tools. For this, we argue—in typical EEC fashion—that creativity in architecture is not a projection of an idea whose existence could be decoupled from the processes of interacting with material means, like pencil, paper, clipboard and computer programs, to name but a few different media. Instead, creativity emerges through the manipulation of those materials. Likewise, imagination is constrained and enabled by material means, not something that is exclusively “in the head”. To summarize, the experience of a place’s atmosphere by a person is imagined and created by the architect through material engagements.

This paper is structured as follows: we begin in the next section reviewing current discussions about the concept of *atmosphere* in architecture, which we then relate to EEC’s perspective in section 3. In section 4, we explore the challenge of conveying an

atmosphere's meaning during the design phase of a project. We argue that this process cannot be entirely carried out by any representational means, and in section 5 we explain how the engagement with design tools allows for the skilled architect to create what we call *proto-atmosphere*. In section 6, we discuss how this situated process is tied to embodied imagination.

2. Approaching atmospheres

'Atmosphere' generally refers to some diffuse character of a spatiality, something that is hard to put into words. In its lay use, 'atmosphere' is applied not only to built spaces, but sometimes also to natural environments and even to persons. For instance, someone may say that a room feels cozy, and that a restaurant feels inviting. A cliff may feel threatening or stimulating depending on one's hiking skills or adventurous spirit. Similarly, some people ascribe auras and such to others, as a mother may say that her child irradiates joy. Entering a cozy room, facing a cliff and interacting with one's child are then reliable sources of certain emotional states. Therefore, it seems tempting to conflate atmospheres with moods. But despite these concepts being sometimes used interchangeably (e.g. Crippen & Rolla, 2022), we suggest a criterion for disambiguating them. Both can be taken to capture the same phenomenon, but from different points of view and with different emphases. The notion of *mood* refers primarily to the agent and their affective states evoked by engaging in an environment or with another person. *Atmosphere*, on the other hand, refers primarily to the environment and its possibilities, as it is occupied by an agent.³

As mentioned, although some ascribe atmospheres (or something like it) to other people, here we focus on atmospheres mainly as the characteristics of planned spaces. In a similar vein, although we can in principle say that some objects have an atmosphere of their own—say, a loved one's urn, Elton John's piano or Julia Child's stand mixer—it seems they borrow their magnitude from their historical background and social importance. Again, we choose to reserve the term 'atmosphere' for places instead. As for

³ See Hasse (2019) and Canepa (2022) for other ways of differentiating those concepts.

more mundane objects, such as portraits, books and cradles, we can take them to have many potential atmospheres that are actualized when they figure in specific environments, depending also on the people who interact with them, as we indicate below.

That being said, we follow Gernot Böhme (1993), who developed the theoretical concept of *atmosphere* from those common usages of the term. He argues that, above all, atmospheres are ontologically indeterminate. That is, an atmosphere is not a property of the environment by itself, nor exclusively of the subjects that experience them. Accordingly, atmospheres are neither objective nor subjective, but they have what he calls “thinglike” and “subjectlike” aspects. That is, the qualities of things that articulate the presence of the atmosphere (its thinglike aspect) and the aspects which belong to subjects that are ‘sensed in bodily presence by human beings and this sensing is at the same time a bodily state of beings of subjects in space’ (Böhme, 1993, p. 122). In the architectural context, the relational nature of atmosphere originates from the contact ‘of the perceiving subject with the architectonic landscape, exciting their emotional responsivity and influencing their cognitive abilities’ (Canepa et al., 2019, p. 7). The relational aspect is relevant for reasons that we will discuss in the following sections.

Böhme then proposes an aesthetic theory or paradigm which is concerned with the reception as well as with the production of atmospheres. Architects, designers, musicians, writers, painters etc., have a prominent role in this new aesthetics since their respective disciplines have developed extensive practical knowledge about atmospheres. Although some of this knowledge may be implicit, their work can inform us about how the concrete properties of objects are related to the atmospheres that radiate from their combination. Böhme’s proposal is a theory of perception that has atmospheres as its primary “object” (understood broadly), which is concerned with ‘the manner in which one is bodily present for something or someone or one’s bodily state in an environment’ (Böhme, 1993, p. 125). Böhme’s proposal, then, challenges the reduction of experience to judgment, as it is typically done by an objectivist aesthetics (see also Pérez-Gómez, 2019). In the case of architecture, the objectivist approach denounced by Böhme mistakenly attributes meaning to 3d-models or decorated spaces in situations and contexts that could be

thought of and reproduced without human interaction. The alternative advanced here agrees that meaning in architecture depends on atmospheric qualities rather than specific styles or syntaxes, exploring the relations between embodied cognition, particularly EEC, and atmospheres. Some theoretical possibilities opened by reconceiving the role of atmospheres and its relation to our embodiment have been explored in recent years (Canepa, 2022; Jelić et al., 2016; Jelić & Staničić, 2020; Pérez-Gómez, 2016, 2022). Our addition to those endeavors is to explore how the skillful manipulation of material means allows the architect to anticipate or imagine the intended atmosphere of a planned space.

3. Ecological-enactive cognition and the meaning of atmospheres

As stated in the introduction, we rely on an approach to cognition that combines ecological psychology and enactivism to explore how the perception and the production of architecture takes place. These are two of the main branches of embodied cognition, a research program that attained notoriety in the 1990's and continues to grow to this day (Engel et al., 2013). In general, embodied theorists emphasize how a proper understanding of cognition should not seclude the brain and its internal activity from the organism's body and the environment it inhabits. Accordingly, embodied cognition takes the dynamic system formed by brain, body and environment as the fundamental unity for investigating how mental processes unfold. This combined approach can be an insightful one to engage with the concept of *atmosphere*, or so we will argue.

Ecological psychology was first put forth by James Gibson (1966, 1979/2015) and Eleanor Gibson (1969) and has become a prolific research program on its own. It studies how organisms pick up information for action in their environments. Central to this approach is the notion of *affordances*. In its most general sense, affordances are possibilities for action perceived by an organism given its morphology and the layout of the environment they are in. Perceiving affordances is not a matter of processing internal representation about distal sources, but a matter of directly perceiving an environment rich with possibilities for action. Consequently, the affordances presented to an organism are perceived in accordance with its embodiment. For instance, whereas cats see walls as

walkable-on and jumpable-over, most humans (except perhaps parkour enthusiasts) perceive the same structure as inhibitions to follow a certain path. Recent developments link affordance selection not only to the organism's bodily morphology, but also to its cultural background and current interests (see also Brancazio & Segundo-Ortin, 2020; Rietveld & Kiverstein, 2014) as well as to its bodily skills (Chemero, 2009).

Another development of the research program on embodied cognition is enactivism (Varela et al., 1991/2016). According to enactivists, cognition emerges as an organism autonomously explores its environment through *sense-making*.⁴ Sense-making is the process through which the physical world is transformed into a world of meaning for the organism, where 'meaning' is understood in its most fundamental level, that is, as a biological and pre-linguistic feature of organism-environment interactions.⁵ More precisely, sense-making is the detection of environmental aspects that are meaningful for the living being either because they are favorable to its self-sustainment, or because they threaten its systemic unity. So construed, sense-making is the link between biological maintenance and cognition (Thompson, 2007). Crucially for our purposes, it has been linked to *affectivity* (Colombetti, 2014, 2017; Mojica & Gastelum Vargas, 2021), for the continuous strive for self-maintenance involves the affective characteristic of *concern for itself*.

Many recent developments from both enactivism and ecological psychology point to their overall convergence (Baggs & Chemero, 2021; Carvalho & Rolla, 2020; Heras-Escribano, 2019; Kiverstein & Rietveld, 2018; Travieso et al., 2020). The fact that enactivism and ecological psychology share common roots and themes is so widely accepted that even though there are some rare pleas for separation (Heft, 2020; Varela et al., 2016), some authors incorporate aspects of both views unproblematically (Gallagher, 2017; Malafouris, 2013; Noë, 2004). This combined approach to cognition—as we call it,

⁴ Not all enactivists, however, share the same view of sense-making. See Hutto & Myin (2013) for criticisms of earlier enactivist accounts, and Ward et al. (2017) for a synthetic, yet somewhat biased, differentiation of the three main varieties of enactivism.

⁵ Although some have attempted to “scale down” linguistics and explain linguistic behavior in terms of more basic capacities, such as sense-making and sensorimotor autonomy (Di Paolo et al., 2018).

EEC—has been proven fruitful, and we aim to expand its utility by applying it to the discussion about atmospheres and architecture.

Consider again the indeterminate—or better yet, dual—ontology of atmospheres evoked by Böhme (1993). It can first be approximated to EEC via the notion of *affordance* (see also Griffero, 2019). As Gibson puts it, ‘an affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behavior’ (J. Gibson, 2015, p. 121). Like atmospheres, then, affordances require both an agent and an environment, and are not located exclusively on either side of that relation. Naturally, the actions a place offers to an individual influence how they perceive its atmosphere. For instance, if a room has a comfortable couch and low lights, for most people, it invites chilling out and inhibits other actions (say, filling your tax forms or exercising). The point here, however, is not that atmospheres are simply the possibilities for action offered by a place. Our point is to emphasize the affective states that arise from agent-environment interactions, as suggested by Thibaud (2014), Canepa et al. (2019) and Canepa (2022). Canepa and colleagues, for instance, take atmospheres to be a ‘state of resonance and identification (sensorimotor, emotive and cognitive) between an individual and their surrounding built space’ (2019, p. 7). This can be summarized by the idea that the atmosphere is the *possibility for being in certain moods by exploring what the place affords*.

Moreover, the concept of *field of affordances* (Bruineberg & Rietveld, 2014) further explains why the same place may elicit different emotional responses for different people. According to Bruineberg and Rietveld (2014), not all affordances present themselves with equal salience to everyone (or even to the same subject at different times) for they are constrained by the person’s current interests and goals, as well as their historical background.⁶ We suggest an analogy to the idea of *field of affordances* applied to atmospheres: the same physical space may have different atmospheres for different people because it may evoke different moods for them, given their specific embodiment, history and current goals. As Canepa synthesizes it:

⁶ The field of affordances is a subset of the landscape of affordances (Rietveld & Kiverstein, 2014), which for us humans includes cultural items and norms. For a discussion, see Brancazio & Segundo-Ortin (2020).

It is impossible to think of an atmospheric event separated from the individual immersed in the architectonic context or detached from their mental state, from the interior processes that animate their sensibility (as much sensory as affective), and from the episodes of life that develop their personal past (2022, p. 31).

Griffero (2018) illustrates that point by imagining a case in which two individuals enter a bank, where one is trying to get a loan and the other is a bank employee. The person who enters the building in search of a loan perceives its impressive entrance, high ceiling and sturdy columns, for instance, as emanating an overwhelming power that is set against them. The bank employee, on the other hand, may perceive the same exact structure as empowering, giving them safety and confidence to negotiate. Perhaps over time, the latter comes to ignore its atmosphere due to their daily activities in that place, taking it as a given—which in turn shows that the same person can perceive different atmospheres from the same place at different times. Moreover, the atmosphere of a place may change depending on how people behave in it. For instance, a couple in an angry mood arguing out loud in a church can easily disrupt its pious atmosphere. Likewise, a sudden outburst of laughter at a funeral may change the atmosphere from somber to comical (and certainly cause some indignation). In both cases, the physical properties of the space remain the same, yet different atmospheres emerge in virtue of how people interact with and within it.

Another key point of convergence between architectural theorizing about atmospheres and EEC is the fact that perception of atmospheres involves affective states or moods, as indicated above. These, in turn, can be linked to sense-making and the elementary notion of meaning invoked by enactivism and EEC more generally. Recall that how we bring forth the meaning of a place is continuous to our biological needs. We make sense of our surroundings by developing ways of engaging with it that matter to us. In other words, affective states are essential to our self-maintenance and therefore to cognition in the enactive approach, for it is our concern about our biological,

sensorimotor and sociocultural identities that motivates how we bring forth meaningful relations with our surroundings and with other people (Mojica & Gastelum Vargas, 2021). Notice, however, that this kind of meaning is not linguistically articulated (at least in a first approximation, as we discuss below), for it fundamentally refers to the importance of a place to our biological integrity. Specifically regarding architecture, Johnson makes a similar point:

Trying to turn buildings into quasi-sentences and parts of buildings into quasi-phrases or quasi-words in order to show that and how they can be meaningful should make it evident that there is something fundamentally wrong, in the first place, with the view of meaning as entirely conceptual, propositional, and linguistic (Johnson, 2015, p. 34).

This idea can be further explored by noticing that the niches we inhabit are built over large timescales to facilitate our realization as self-organized networks, an idea that Werner (2020) connects to meta-metabolism. Through the evolutionary process of niche construction (Odling-Smee et al., 2003), we bring forth worlds of significance for us (Heras-Escribano, 2020; Rolla & Figueiredo, 2021). In shorter timescales, this includes the construction of buildings and dwelling space. As Varela et al. (2016) point out, the worlds we literally bring forth are the only ones we have cognitive access to. This then allows us to understand how to perceive the atmosphere of a place is to acknowledge its significance in relation to our biological interests. If we perceive an atmosphere as inviting, comfy, hostile or threatening (etc.), it is because our experience reveals the atmosphere to be positively or negatively relevant to our biological constitution. The idea that the perceived meaning of an environment is connected to our maintenance as living beings suggests a naturalistic grounding of how we perceive places as relevant to our well-being. The architect Juhani Pallasmaa makes a similar point:

Architecture, also, has its roots and mental resonances in our biological historicity. Why do we all sense profound pleasure when sitting by an open fire, if not because fire has offered our predecessors safety, pleasure, and a heightened sense of togetherness for some fifty thousand years? (Pallasmaa, 2015, p. 62).

4. How to convey atmospheric meaning? An apparent paradox

Although the meaning we find when we explore a place by navigating through its atmosphere is entrenched in our biological well-being, it could in principle be argued that we could convey it linguistically. In fact, long before the atmospheric turn that took place in the last few decades, the work of Nicolas Le Camus de Mézières, *Le Génie de l'architecture*, from 1780s, can be taken as an attempt to capture the relevant architectural qualities identified with the physical aspects of a place, such as light and shadow, textures, sound and even smell (see also Pérez-Gómez, 2019). Consider, for example, his description of an ideal dining room (1992):

The doors will be to the West, preceded by a grand room in which tables will stand, bearing the successive courses in symmetrical array. The light will be taken from the East; the prospects on this side will be the pleasantest that can be arranged. Parterres, groves, fountains, waterfalls, will embellish the room at dinnertime; in the evening, the decoration will change, and chandeliers and candelabra will replace the beauties and splendors of nature. Reflections in the glasses will heighten the enchantment. [...] The dining room will have the proportions of the Ionic Order. Its dimensions will depend on the number of persons who are to be received there; make it too large rather than too small. At table, one must be at one's ease, and convenience of service is essential. The

length of the room will be in proportion to its width. [...] This is not a strict mathematical proportion; our aim is to speak to the eyes in the least complicated form (Mézières, 1992, p. 137).⁷

Despite its undeniably richness and its attention to physical details, Mézières's description still leaves something out. One way of exploring that idea is through the distinction between a place as a physical structure and as a lived space (Sepúlveda-Pedro, 2023). Accordingly, although a description such as Mézières's is able to convey some of the physical qualities of that environment, it is not the same as perceiving it as a place with which individuals engage meaningfully, in the sense discussed in the previous section. Naturally, completely understanding what is described, even though it is accurate to the finest details, is still different from grasping the atmosphere of the place described.⁸ Canepa (2022) makes a similar point:

The atmospheric field cannot be classified as a collection of neutral, homogenous, and isotropic qualities, like those that are usually associated with Euclidean space. The atmospheric field is a phenomenal reality (namely, reality as we experience it): it cannot be studied according to a mathematical model, determinable in an axiomatic manner (2022, pp. 35–36).

Canepa then correctly rejects the possibility of capturing what is meaningful about atmospheres in objectivist descriptions, i.e., descriptions that express the mere physical aspects of a place. However, she accepts that one could at least approximate atmospheric meaning through *phenomenological* descriptions—hence her “phenomenographic approach”. These descriptions typically involve metaphoric language. When we try to

⁷ Notice that the descriptions offered by Mézières focus on the analogy between the proportions of buildings and the sensations elicited by them. Moreover, they are based on exemplars and present a “summary” of the desired effects for a certain environment—they are not, therefore, descriptions of existing places.

⁸ In fact, as a reviewer pointed out, this is widely regarded as the standard position in the philosophy of architecture.

describe how we feel, and why we feel that way when we appraise a place, we generally appeal to metaphors (notice how the term ‘atmosphere’ itself is used as a metaphor in this context). Descriptions of places, when accurate and made from the first-person point of view, are naturally grounded on our way of enacting their presence (see also Böhme, 2017). This is so because metaphors are grounded in our embodied circumstances (Johnson, 2017; Lakoff & Johnson, 1980). We may describe an inviting place as cozy and warm, whereas we describe an unappealing one as cold or moldy. Warmness, for instance, is grounded on thermoregulation, a process relevant for our biological purposes. To say that a room feels moldy, on the other hand, is a metaphorical way of saying that it is somehow inimical to our well-being. So, it is plausible that metaphorical elements of our mundane descriptions of atmospheres serve an important role, namely, to indicate how our affective states evoked by a place are tied to our biological needs. Following this line of thought, Canepa writes that ‘metaphoric language becomes the liaison between the real world (exterior and material) and the mental world (interior and abstract)’ (2022, p. 36).

But this poses a puzzling question. If the meaning perceived in a place cannot be conveyed descriptively, *how can architects foresee it in the planning phase?*⁹ It cannot be merely by luck that a project turns out to be mostly the way the skillful architect wants. In fact, Canepa acknowledges this as an ‘apparently paradoxical question’ (2022, p. 25), which seems even more acute if we think of atmospheres as only materializing in the final product. In fact, given the way she frames the question about the mental and the real worlds—thus revealing a residual dualism—then the putative paradox tightens its grip. If those were incommensurable domains, atmospheres could not be anticipated by the architect’s creative procedures because those processes are presumably strictly mental, therefore, “not real”—whereas atmospheres occupy a dual dimension and cannot prescind from their material basis. As Pérez-Gómez (2019) puts it, architecture has ‘a certain fixity of form, texture and materiality necessary to convey its appropriate moods’ (2019, p. 313). However, EEC motivates a rejection of mind-world dualism.¹⁰ Our main claim in the

⁹ Naturally, the preliminary interview between architect and their clients, which foresees the planning phase, already involves some kind of prefiguration or anticipation of the intended spatiality.

¹⁰ To the extent that the positive aspects of Canepa’s phenomenographic approach are committed to representationalism—for instance, when she emphasizes the role of mental representations in the

following sections of this paper is that planning in architecture already involves an irreducible level of atmospheric engagement, given our inherently situated cognitive and affective circumstances. In other words, it is only through abstraction that we can conceive of the architect's thinking, planning and imagining processes in strictly internalistic terms. That would indeed divorce the mental and the material, as Canepa seems to assume. But because architectural practice is mediated by the skillful use of material tools, architects create what we call *proto-atmospheres* when planning. This situated performance allows them to imagine with different levels of accuracy (given their proficiency with the selected tools and overall experience) how the final product should be.

To summarize, from the fact a complete and accurate description of an atmosphere is not equivalent to feeling the atmosphere itself, it does not follow that one cannot simulate or anticipate that feeling through other, non-discursive means. That paradox only arises if we think that the only way to convey or anticipate an atmosphere is through descriptive means (be them objectivist or phenomenological). Complete and accurate as they may be, they leave something out—and that is why we need other tools to explain how atmospheres are produced during the design phase of a project. In the following section, we discuss how the process of imagining and designing a place through material means can be seen as the simulation of its intended atmosphere.

5. The production of atmospheres through material engagement

In the preceding sections, we based our account on EEC to explain the perception of a place's atmosphere. According to that approach, perceiving an atmosphere is to engage with the moods the space affords in a subject-specific way. These meaningful relations ultimately refer to our strive for self-maintenance, a phenomenon that surfaces as our well-being but is rooted in our biological needs. As seen in the last section, this conception poses a challenge on how one can convey an atmosphere—which is a task of

perception of external spatial contingencies (see Canepa, 2022 chapter 5)—, one could argue that the dualist assumption is not merely hinted at. Our argument, however, does not depend on this issue.

major importance in planning—for even the most fine-grained description, like Mézières’s, is insufficient to capture the intended atmosphere of a place. Although phenomenological descriptions may be more successful in capturing how we perceive a place through the use of metaphors, they can only offer approximations. In order to answer this, now we discuss how material engagement allows for creativity and planning as a matter of simulation or anticipation of atmospheres.

For this we explore the work of Lambros Malafouris, who advances the material engagement theory (MET) as an extension of EEC to investigate the interactions between material culture and cognition (Malafouris, 2013, 2019). According to MET, cultural and biological evolution are inseparable synergetic processes, for the manipulation of material means has shaped our cognitive system over large time scales. Whereas other animals manipulate the material world in a predominantly utilitarian fashion—that is, by merely using tools as they are found in nature, with minimal creativity involved—material engagement is the very form of human becoming (Ihde & Malafouris, 2019). Our hominin predecessors created tools and improved them cumulatively, preserving innovation across generations. Over large time scales, the cumulative development of artifacts led to the sophistication of our cognitive abilities and enabled the richly complex modes of engagement we find in modern humans. Crucially, MET takes the adaptive interactions between agents and their environments not as evidence of disembodied or internal thought processes that are expressed through actions. Instead, our material engagements are *the thinking processes themselves* (Cf. Malafouris, 2013, p. 38).¹¹ For us humans, then, cognition is constitutively intertwined with material culture. That is:

Human thinking is, first and above all, thinking *through, with,* and *about* things, bodies, and others [...] Thinking is not something that

¹¹ MET bears some resemblance to the extended mind hypothesis (Clark & Chalmers, 1998). But these theories are different in crucial ways. Most saliently, classical extended mind is based on a functionalist criterion for cognitive performances, which in turn is incompatible with accounts that take embodiment as constitutive of cognition, and not merely a causal vehicle for it (Rowlands, 2010). Moreover, the extended mind conceives of mind and the objects manipulated by an agent as neatly divided (after all, if the mind *can* become extended, it means it is in principle circumscribed by one’s physical boundaries). As indicated above, MET conceives of mind and things as more intimately related, especially over large time scales, thus developing a more radical approach than the extended mind.

happens “inside” brains, bodies, or things; rather, it emerges from contextualized processes that take place “between” brains, bodies, and things (Malafouris, 2013, pp. 77–78).

It is especially relevant for our interests here how MET construes the production and use of cultural artifacts as a kind of cognitive process, what Malafouris (2014) aptly calls *thinging*. *Creative thinging*, in turn, is understood as the ‘capacity for inventiveness that is inseparable from the capacity to affect and be affected through movement and sensation from the phenomenal qualities of the materials that surrounds us’ (Malafouris, 2014, p. 144). Now, the creative manipulation of artifacts clearly plays a pivotal role in architectural design. Consider how the skilful architect uses the tools available to them (e.g., pencil, AutoCAD, Archicad, Revit, SketchUp etc.) to think in very specific ways. Usually, architects prefer to use pen and paper in the initial stages of designing, 3d modeling softwares to refine volumes, Building Information Modeling (BIM) apps to consolidate documentation and Computer-Aided Design (CADs) to develop constructive details. These tools may be used interchangeably according to the architect’s objective and personal preference. Usually, architects prefer to use pen and paper when speed and fluency are preferred rather than precision, such as in the initial stages of designing or when ideas need to be quickly evaluated. CAD software (e.g. Autodesk’s AutoCAD, FreeCAD, LibreCAD, etc) tend to be used mainly for 2d drawing in making design decisions that need to be represented with precision. Software for 3d modeling (e.g. SketchUp, 3dsMax, Blender, etc.) are used thoroughly to develop preliminary ideas or to produce digital renderings to illustrate the intended design. BIM software, such as Revit and Archicad, intend to be an all-in-one tool by offering coherent 3d modeling and bidimensional drawings (*Revit Software | Overview*, 2021).¹² The preference for specific tools for certain tasks can be accommodated within MET’s framework because each

¹² However, BIM softwares are used mostly to consolidate design documentation due to its overall clumsiness and complexity, which arguably hinders creative flow in the early design stages (B. R. Johnson, 2015). Moreover, and perhaps more fundamentally, because designing is to a large extent idiosyncratic—for each designer has their own creative routines—the unification proposed by BIM software is almost impossible to achieve in practice.

creative task requires different ways of thinging, to use MET's phrase. So, instead of taking that engagement as the output of internal processes, we suggest understanding the open-ended activities by the architect with their tools as a kind of creative thinging itself.

But that is not to say that the more diverse the set of tools available, the better the architect's imagination is, or that they can produce more creative architectures. This cannot hold a look-back into past architectures. We are certainly at an age with the largest amount of software available, and that does not mean that we are creating better or more creative spatialities today than our predecessors, when the diversity of tools was significantly smaller. We are also not committed to the idea that an architect with more tools available creates better than others. This would seem to be true only if we equate 'better' with 'efficiently', since an architect with more tools options will probably commit fewer mistakes in manifesting their intentions and plans technically, as long as they know how to operate those tools. But that narrow and misguided notion of architectural quality is problematic because it disregards how we perceive and feel dwelling spaces as being fundamentally meaningful for us (section 3). Moreover, one can master a tool without using it creatively, merely applying the established procedures, techniques and rules associated with that tool. But when it comes to the *creative* use of a tool, mastery means exploring the thinking possibilities that are opened by it. This sometimes involves bending those techniques and rules in unforeseen ways. If this is on the right track, then the architect does not need to operate BIM software with dexterity and have an outstanding hand drawing in order to be creative. They need to *know how* to explore the possibilities afforded by each tool and to use them optimally.¹³ It is even plausible that sometimes the lack of knowledge about some procedures, for example, when using a software, may lead to more creative uses of that tool precisely because they are not prescribed.

¹³ Although we do not assume a specific understanding of *know-how* for EEC, it can be taken to imply (at the very least) the stable success in achieving one's desired goals when exercising certain abilities (Rolla & Huffermann, 2021). Stability, in this context, means that the individual achieves success by exercising those abilities in the actual situation and also in sufficiently similar ones. So, for instance, an occasional success for an individual who exercises that ability is not a case of know-how because it is not stable.

The above follows straightforwardly from applying MET to architecture and design. But what is new in our present proposal is that we take the material engagement in architectural creative thinging *itself* as atmospheric. More specifically, as the architect engages with their tools during their creative processes, they create what we may call a *proto-atmosphere*, which is nested inside that of their study or place of work through creative imagining. This proto-atmosphere, then, allows them to anticipate how the designed place feels without the need to describe it. John Hedjuk somewhat anticipates this idea when he writes:

What is important is that there is an ambience or an atmosphere that can be extracted in drawing that will give the same sensory aspect as being there, like going into a church and being overwhelmed by the Stations of the Cross... You can exude the sense of a situation by drawing, by model or by good form (Hejduk, 1985, p. 58).¹⁴

That is not to say that by looking at a picture alone one has the same exact experience as being in a place. Instead, we argue in the next section that the creation of a proto-atmosphere allows for a reliable anticipation by the skillful architect—that is, one who masters the creative use of their tools—of how a place will feel like. Descriptions, of course, can help, but they are not an essential part of the process when the aim is to anticipate the atmospheric aspects of a place. What is crucial is that the architect's experience and skills allow them to imagine the intended atmosphere by engaging with their tools of choice. This is obviously possible under certain general restrictions, for, as we have seen in section 3, the particular embodiment and history of each subject modulates how they perceive and engage with(in) a place.

6. Embodied imagination and proto-atmospheres

¹⁴ Drawing here is understood in a broader sense, for it encompasses 3d modeling, digital renderings, mockups, and other techniques that allow architects to anticipate and explore the atmospheric aspects of their creations

The capacity to imagine a place, then, plays a crucial role in our account of how proto-atmospheres are created in architectural practice. It is important to emphasize at this juncture that we do not take imagination as a process that can be thoroughly decoupled from our embodied and situated conditions. If we were to concede that, we would risk diminishing the scope of EEC and the integrity of MET. Instead, we follow recent developments that account for imagination in continuity with one's past experiences and immediate action possibilities. Consider the neurophysiological findings that suggest that imagination and memory share a common neural network (see Schacter et al., 2012). These findings are part of a larger framework according to which the systematic reuse of neural networks, at developmental and evolutionary scales, is the basis of many cognitive processes (Anderson, 2010, 2014). If so, imagination can be taken as a capacity for simulation that is at least partially grounded on memory (Michaelian, 2016). In EEC terms, it means that imagining is thought of not as a description or representation of possible events, but as a simulative *re-enactment* of past experiences (Hutto, 2015; Medina, 2013). However, as Medina correctly points out by recalling Caracciolo (2013), 'although the enactive imagination may often rely on past experiences, this is only insofar as it can use them as raw material for experiences that are, in an important sense, unprecedented'. They are, therefore, 'embodied experiences in their own right' (Medina, 2013, p. 320).

Rucińska and Gallagher (2021) expand on that by arguing that our embodiment places epistemic constraints on our imaginings. That is, despite imagination being under our voluntary control, it can be epistemically relevant because imaginings are rooted in our bodily morphology. More specifically, embodiment partially constrains imagination through what they call 'rooted bodily processes', such as implicit body-schematic and sensorimotor processes, for imaginings are oriented by and dependent on the kind of experience our bodies allow for. For instance, if a person imagines walking on the beach on a sunny day it is because these experiences make sense for them, with the kind of body that they have and the movements they can execute. More schematically, when an individual is imagining certain interactions in an environment, they explore well-

established sensorimotor coordinations as anticipations for acting (see also Bruineberg et al., 2019).¹⁵ Those considerations are important to understand how creative imagination works during the architect's material engagement with their tools, for they imagine exploring the planned environment in accordance with their bodily morphology and capabilities. Notice, moreover, that their bodily characteristics, under a coarse-grained conception, are generally shared among others who will also experience that place, which grants the epistemic relevance of their imaginings. A skillful architect can imagine with some success how other people will perceive that place and engage with it. Thus, embodiment enables as well as constrains imaginative processes.

In a similar context, Van Dijk and Rietveld (2020) explore the EEC notion of imagination through what they call a “philosophical ethnography”. They apply this approach to the creative processes behind the *End at Sitting*, which is an art installation created by the architects at RAAAF conceived to question our sitting habits, then situated at the headquarters of the Mondriaan Fund. Van Dijk and Rietveld (2020) describe how the flow of creative architectural processes sometimes meets shortcomings that are overcome by the opening up to unforeseen possibilities for action that, once they are explored, reduce uncertainty. This requires the enactment of affordances across different times-scales, such as here-and-now actions during manipulation of material means, that in turn can reliably indicate which affordances will be available once the installation is ready and in place. This process can be related to the minimization of uncertainty in the EEC approach (see also Carvalho & Rolla, 2020), which is an outcome of successful architectural imagination. So, according to van Dijk and Rietveld,

the less determinate the enactment of an affordance is, because of the multitude of other relevant affordances unfolding concurrently as one acts, or because the affordance is enacted by coordinating activity across people and things [...], the more the participating in

¹⁵ Rucińska and Gallagher also explain how explicit movements constrain imaginings by reference to an example of rock-climbing practice by Sanchez-Garcia et al. (2019). Before actually climbing a wall, expert climbers do what is known as ‘marking’, that is, rehearsing the climb by overtly mimicking the movements they will make (see also Rucińska, 2021).

enacting those affordances can be experienced as imaginative in character (2020, p. 17).

In addition to their explanation, we highlight how the manipulation of material means is constitutive of architectural imagination and not merely the overt behavior of something that happens internally, “in the head” of the architects, so to speak. Hence, given its ineliminable situated dimension—even though van Dijk and Rietveld do not put the matter in these terms—we can take the creative processes to be atmospheric from the beginning. Accordingly, by using tools (which is of course dependent on our embodiment and previous training), we are able to imagine things that are usually not available without those tools. So, by using different software to accomplish specific creative tasks, the architect is able to imagine in different ways, perhaps more creative ones. Moreover, if the relevant non-imaginative or actual cognitive performances of exploring an environment are the source of meaningful relations (as we argued in section 3), and if imagination is the re-enactment of exercising those abilities, it stands to reason that the same goes for what happens in imagination. That is, imaginative procedures are meaningful on their own. Therefore, when a skillful architect imagines how the planned space should be through material engagement, their actions allow them to anticipate its intended atmosphere. As indicated in section 5, this process can be considered the creation of a proto-atmosphere, a process constrained and enabled by bodily and other material means.

7. Conclusion

In this paper, we have tried to apply the core tenets of ecological-enactive cognition to explain how we perceive and engage with atmospheres. This leads to the question of how architects can anticipate the atmosphere of a place during the planning stages of their project—given that the meaning of an atmosphere eludes even the most fine-grained description. We answer that by arguing that skilled architects can imagine and, therefore, anticipate the atmosphere of a place by engaging with material means. In doing so, we

have emphasized how bodily morphology enables and constrains imagination and tool manipulation in creative ways. One final, but nonetheless crucial observation is the potential significance of our claims. We take our conclusions to be situated at a philosophical level, and we believe they can help elucidate empirical findings according to which embodiment affects architecture and design. Researchers have argued that features such as *gender*, *ethnic background* and *social roles* also affect how people imagine and create atmospheres (see Imrie, 2003; Pérez Liebergesell et al., 2018; Tvedebrink & Jelić, 2018). Thus, understanding the underlying mechanisms that explain why imagination in architecture is relative to the architect's bodily morphology, capacities and dispositions is one step to make them aware of this potential bias and a necessary one to correct it in the direction of more inclusive spatialities.

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