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Designing Atmospheres: Theory and Science

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INTERFACES 4

New Prairie Press

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INTERFACES 4

Designing Atmospheres: Theory and Science

Bob Condia

Introduction: The Design of Atmospheres

> The anthropologist [Tim Ingold] distinguishes the theorist from the craftsman: the former "makes through thinking," while the latter "thinks through making." [...] The more pressing question remains: is the architect a theorist or a craftsman? (Mallgrave 2018, 129)

If atmosphere is as architects conceive it to be, a liquescent composition of Gibsonian affordances that suggest, propose, summon, invite (maybe predict) behaviors, then should not they consider such designing as an essential craft of applied science? Architecture as inhabitable, man-made, bounded spaces, theoretically speculates or asserts itself into the world based on refined geometrical guesses, formal ideas, and metaphoric intentions. In this projected sense, it is like an art. Palladio's San Giorgio Maggiore in Venice is such a superior geometric strategy of a circle inscribed as a dome to be unfolded into a proportional rhythm of profound Renaissance experience and acoustics. Maybe the five decades (1566–1610) necessary to build such a church makes the geometric a good way of thinking. It was certainly at the very edge of the engineering of its time. Presently, our complex digital software packages, all challenging for preeminence, make lighter-than-air spinning compositions easy to believe on screens if hard to embody. Not necessarily problematic, but the question might be in this digital simulation — *who is doing the thinking?* Theory in architecture should be design thinking in reverse, from the object towards rationalization. A quintessential frame of the architect as a craftsman comes from Louis Kahn's lecture to the students at Berkeley (1997 [1966]), where he asserts that becoming a competent professional is not the end of maturity but the beginning of thinking like an architect. How to build has always applied science of its day. Craft, in this sense, is thinking through the discipline of one's vocation. All craft is the ecstatic mastery of a medium of expression. The architect's medium of expression is atmosphere both measured by the

engineers' instruments and the artisan's body. Let us explore Harry Mallgrave's question about architects through their *medium of atmosphere*.

Architecture as a profession, generally regarded, stands between the art and science of building. One half is the applied physics of *matter* and *light*. The other half created the *mise-en-scène* of life's places for memories. Recent advances in science are confirming many of the architect's expert purposes while opening new doors to the perception of space and the meaning of architecture and urban design. Neuroscientist, Michael Arbib says that atmosphere is our emotions and feelings filling up a room. New phenomenologist, Tonino Griffero defines well atmosphere for architects. His basic definition of atmosphere: it is what you left behind when you leave a room. On top of this affordance value, we co-inhabit atmospheres with others, changing spaces with our presence as they do for us. This is a special quality of atmospheres understood as interactions between us and others, ourselves and things. "Atmospheres then seem to be bridge-qualities, founded on a corporeal communication without any real contact between user and object, and their suggestions are perceivable as virtual movements" (Griffero 2014, 16).

For example, Prof. Griffero suggests the dual experience of a glassy, corporate bank lobby on a busy downtown street. First, the employee behind the well-dressed counter, feeling pride in their participation in the power of the articulated well-lit volume on a main street, columns reaching up three stories. While the customer needing a loan, navigating a new stage without experience to guide, is made to feel small in the face of the dominance of the institution and scuttles for the corner seeking personal attention and kind advice. The space is mechanically the same for both, yet the experiences and emotions are different. I will suggest that evolutionarily all atmospheres are understood by our sensory systems in precognition, sorting by way of prior experiences and immediate desires or biological needs. Again, advise from Griffero: "in any case, in today's debate, atmosphere is not simply meant as a decorative aspect of life, but rather as a feeling or affect that, being not private and internal but objectively and spatially spread out, 'tinctures' the situation in which the perceiver happens to be and affectionally involves her" (2018, n.p.).

Peter Zumthor held his remarkable lecture on atmosphere, which became a little book simply entitled *Atmospheres* (2006). Kory Beighle says this marks the moment when atmosphere reentered the mainstream architectural discourse (Canepa 2022, chapter IV). Zumthor alleges, "I've been keeping an eye on myself, and I'm going to give you an account now [...] of what I've found out about the way I go about things and what concerns me most when I try to generate a certain atmosphere in one of my buildings. Of course, these answers to the question are highly personal. I have nothing else" (2006, 21). He identifies twelve *generators of atmosphere* (nine plus three): the body, material, sound, temperature, surrounding objects, composure, seduction, tension between interior and exterior, levels of intimacy, and the light on things; plus, three after thoughts: architecture as surrounding, coherence, and, finally, beautiful form. Such a craftsman's checklist where atmosphere intentionally invites and situates memories is well in keeping with the science of experience and the architect's suppositions. Would a checklist for architectural generators be theory or craft?

Following Zumthor's line of observing the crafting of atmospheres, I will share a few of my *atmospheric memories*, or lessons, of composition. Le Corbusier's Chapelle Notre Dame du Haut (1956), perched above

F1 Bob Condia
Chapelle Notre Dame du Haut
Ronchamp, France
Winter 1979

the village of Ronchamp, France, is well known as a modern masterwork. My first visit was as a wandering architecture student on January 26, 1979. It was minus 5 degrees centigrade and sleeting. We had taken the train from Belfort before dawn, the only way to arrive in the morning. Waiting out the sunrise and the weather while sitting in the pastry shop, we stretched our cups of coffee before the pilgrimage up the hill. From town, you see the church on the promontory and from a long way. Yet because of the trees, one's accent is like peek-a-boo with the curvy chapel as you approach up a hill on a country road. I recall it was second-year studio legend Francis Ching, who celebrated this intentional offering to anticipation. A serious fan of Le Corbusier, the promenade, for me, was pure expectancy wrought from years of fascination. After all my photographic study, especially *GA 7* (Futagawa 1971), this was one of the modern buildings I must see. When we broke ranks with the trees to finally find a clear northwest view of the chapel, framed by the caretaker's residence to the right, I got chills. The moment was my *first chills response* to a building. I literally got goosebumps. It was not the sleet. We arrived well before the opening time, but the kind overseer nun took pity on us and allowed us to enter alone. The silence was unnerving. Our footfalls were too loud for its capacity, yet we understood the crab shell-like concrete roof structure acts as an echo chamber. It was humbling and very religious. In the stillness, I ascended the stair to the celebrant's balcony for an image [**F1**], which I am sure could not happen today. Looking closely, the color of the light is in part our day, but the concave ceiling puts pressure where normally a church lifts, spreading light from the continuous slits between wall and ceiling. The thin aperture which circumnavigates the ceiling rationalizes the hollow, concrete spaceframe that sits at a few magical points. As you see, there are many sculptural affordances to saturate your memory on the one hand, yet the space settles

F2 Bob Condia
Abby of Sant'Antimo
Castelnuovo dell'Abate, Italy
Spring 1993

remarkably relaxed around you — a sort of magic that inspires pilgrims and tourists alike. All our subsequent visits have also raised chills, like a favorite Keith Jarrett piano riff, if now more moderated, less silent, by the blitz of sightseer's devotion.

A second religious place of high primeval quality was the Romanesque Crusader's Abby of Sant'Antimo (twelfth century) [**F2**]. Located near Montalcino in Tuscany, Italy, it belongs to the Monks who play the space like a musical instrument. On a fine spring day in 1993, we found ourselves entering from the bright sun into the church at the end of service, inhaling the acapella Gregorian intonation and incense. The eye shock of bright to dark primed us. The fragrance and music filled the space, which pressed into every alcove, chapel, roof truss, or articulate column capital. It was stunning. You sense that this room was made for *this exact moment* and, theoretically, that this was the designer's intention. Whether it was constructed exactly for this purpose or simply the eons taught the monks what these stone walls afford, either way, it was gorgeous. One can imagine that this was just such an atmosphere that inspired Le Corbusier (although for him, his response is to do everything in reverse). The cool present ambiance was flecked by reflective slits and projected sunlight deep into the church glimmering off the Roman columns. The acoustics are legendary, which gave me the sense that humility is my task, participation, and action of choice inside this place.

Louis Kahn's Kimbell Art Museum (1972) in Fort Worth is one of the best modern buildings of our age. Richard Brown asked him to make a domestically scaled museum for the collection that would appeal to Texans. Kahn's reply was for a "silver of light from above" brought into existence by the world's first natural light fixture and the phenomena of

F3 Bob Condia
Kimbell Art Museum
Fort Worth, Texas
Fall 2015

Marshall Meyers' cycloidal vault. The apparent simplicity and low scale of the six by three one-hundred-foot-long vaults set up a duality between an order of the vault's vistas and an intimate exchange with the artworks below the service runs. The light spreads silver (or aluminum) across the concrete vaults in a hovering manner which depends on the strength of the sun. When the sun veils behind a cloud, you immediately sense this in the moments you have with the art. There is a resultant subtle change in mood which was absolutely intended. Most museum curators cringe at just such a changing light, but here it becomes the standard of the relationship between a viewer and the building. I have been inside the Kimbell many times, beyond count, but since you do not get the same light each time, nor moment to moment, it gives an *atmosphere of constant engagement*. In the image [**F3**], my point is to demonstrate the similar qualities of the museum in a lateral vista which is seldom seen in our architect's literature. Like science, this is an experiment I can repeat time and again for similar embodied experiences if not the same results. Can this be one difference between architecture and science? In architectural craftsmanship, similarity is as good as repetition. Perhaps Kimbell's constant, minor variability is what makes it so domestic, or appealing, to Texans.

By nature, an architect collects observations as a memorial pallet for later fruition as a scientist memorizes truthful data, reviews, and reports. One more atmosphere to share is Alvar Aalto's Mount Angel Abbey Library (1970), made for the Benedictine monks. Our first visit in June 1984 followed an architect's wedding in Eugene, Oregon. Aalto's second USA building, the only one on the west coast and just ninety minutes away, was an inspiration to some of the wedding party. On this first visit, what followed was one of the most instructive, phenomenal architectural experiences of a young architect's education. After orbiting the

F4 Bob Condia
Mount Angel Abbey Library
Mount Angel, Oregon
Summer 1984

exterior of the library with sketchbooks and cameras, we ventured into the lobby with its domestic, warm, low articulate ceiling overhead. Then we introduced ourselves to the single librarian:

> There was a young monk at the front desk (we dressed in cameras and awe).
>
> I asked if it was okay for us to look around and take some pictures.
>
> "You" — he says without surprise — "must be architects?"
>
> "Yes, how can you tell?" (we dressed in cameras and awe).
>
> "Sure, look around" (I recognized a smile that must have been both pride and recognition of the building he worked in, and a touch of gentle mockery for us).
>
> As we spoke, I was scanning the room, listening to his tenor. I asked how he liked the building. He became somber saying that it was functionally outstanding since he could command the entire library from his desk position. However, "the light inside is too gray."
>
> As his voice reverberated, my panorama confirmed his assessment. Oregon's north light, even dressed in a summer's blue sky, filtered in like a cloudy day. I felt a twang of disappointment in the master's failure by agreeing with the librarian's criticism, but only for an instant, as my perspective set upon a novice in a white gown, sitting at the reading rail, apparently having brought his book to the light, concentrating, and reading in a bubble of yellow incandescent light below his lamp. A little warm space (like at a campfire) inside a somber room. Sensational: what presence of mind, what creative impulse, orchestrated this inhabitable consequence? Aalto. (Condia 2008, 50)

Here, I borrow from my account written fourteen years after the first, when [**F4**] was staged. Question: is the phenomenon still present? Yes. I hope you can see the light's bubble and the glint of pale yellow from the book in my student's hands. To the thesis of this symposium, knowing that I can recreate in a close approximation the earlier experience is something like an applied science of architecture. How Aalto's office delivered the building is a long story.

My memories now aside, let me introduce our symposium on the design of atmospheres. The first chapter is **Elisabetta Canepa**'s "Investigating Atmosphere in Architecture: An Overview of Phenomenological and Neuroscientific Methods," where she suggests that although architectural atmospheres are inherent, they can be interpreted as the multi-emotional interplay between the subjects and their surroundings triggered by differences in spatial quality. Indeed, atmospheres are like *first impressions*, meaning profound and informative occasions based on experience and mood. Various atmospheric factors combine to prime this first impression we have of a place to affect one's attunement.

Her chapter presents preliminary thoughts on an experimental protocol of corridors in virtual reality to locate and measure atmosphere. Her research models both employ *first-person evaluations* and *third-person observations*. Simultaneous multiple perspectives will investigate the complexity of the atmospheric profession of architecture, or as she says by "integrating both models and working on complementary notions: atmosphere and architecture, resonance and attunement, impressions and appraisals, nonconscious and conscious, emotions and feelings, living body and lived body, neuroscience and phenomenology, physiological measures and self-report techniques." Elisabetta's multi-faceted interrogation (experimentation, plus poetry and architecture) may well have invented a means to *see* into the atmosphere architects take for granted. An atmosphere pushed into the nonconscious is demonstrable only through the felt harmoniousness individuals occupy within the presence of a specific atmosphere. For her, resonance and attunement imply vibration and harmonics in the sense that they are non-static processes: they are in constant search of balance.

Talking with **Zakaria Djebbara**, I wondered aloud if our human evolution within atmospheres, like fish in water, is not the reason we push them deep into the background, into the periphery of our vision, and the nonconsciousness of our mind. As is sometimes the case with him, I do not know if we agree, yet I am provoked to such questions. These questions he raises for you to consider as you read "Rhythms of the Brain, Body, and Environment: A Neuroscientific Perspective on Atmospheres." For Zakaria, atmospheres are rich embodied experiences that subtly change through time and movement. In the interaction between the brain, body, and environment, various rhythms of different frequencies are constantly at play, including brainwaves, which vary depending on the state of consciousness, and environmental rhythms, expressed in measurable physiological processes. Definitively, he avows, while conscious experience is enacted through active suppression of sensations, *the gist of a scene* is perceived nonconsciously, making up the backdrop of the ongoing experience. Herewith, he (rather originally) will consider the relationship between rhythms, nonconscious processes, and transthalamic integration (everything passes through the thalamus) in the context of atmospheres and architecture. Zakaria Djebbara's place in the debate of the science and theory of atmospheres is more scientist than designer, but with credentials and empathy, he is established as both. He employs mobile electroencephalographic methods in combination with virtual reality and physiological measures as instruments allied to both professions. Let me allow Zakaria his own conclusion: "the atmospheres of our everyday life speak to all of our senses, making them experientially entangled, indistinguishable, and infamously *ineffable*. The ineffability associated with atmospheres is both what makes them intriguing and attractive but also what makes them scientifically intractable."

Presently, the inquiry into architectural atmospheres has taken on a promising energy. Evolving by way of architectural history, **Kory Beighle**'s primary argument in "A History of Tool-Atmospheres," is that the craft with the theory "has been embedded in the discipline of architecture since its foundations, not just because of an explicit interest in the topic but for the implicit nature of disciplines and their engagement with technology as a mediating force of the natural environment." Architectural practice is rooted in and grows from its apparatuses and methods, hence, it is not immune to the limits of these tools. The atmospheres architects invent are entwined with the tools of envisioning. Kory theorizes that *tool-atmospheres* develop as a methodology for understanding how emerging tools engage the process of creating and informing the atmospheres of tomorrow. My conjecture is that atmosphere is the medium of an architect's expression. Kory Beighle's question then is what are the instruments — say a constructed building — through which an architect's vision is realized. Is a building like a painter's brush or a jazz musician's sax for the public's aesthetic improvisation with the affordance and place of architecture? In this sense, theory is like a tool, and craft is a mastery of thinking.

In the architecture and neuroscience debate, **Harry Francis Mallgrave** needs no introduction. His three books *The Architect's Brain* (2010), *Architecture and Embodiment* (2013), and *From Object to Experience* (2018) are the foundation of the architect's consideration of the *biology of architectural experience*. Harry's chapter is "Atmospheric Histrionics." He suggests two central questions: "is the idea of atmosphere something new to design?" Or, "is the idea as old as the profession itself?" Although the term atmosphere is relatively new, since the seventeenth century, the knowledge that emotions fill up spaces is ancient. Perhaps atmosphere is one more casualty of the Cartesian rationalization separating the mind from the dirty, emotional body. Rational atmosphere objectifies the ephemeral. Contrarily, over the past three decades, the human sciences have made extraordinary advances in understanding who we are and how we engage the world around us. We are not disembodied minds wandering the world with a little help from an animal body, but multisensorial, full-bodied beings with a body/brain sorting the complexity of experience. It appears the architects of consequence through history have always known this. For example, consider Bernard Maybeck's design for the Fine Arts Pal¬ace at the Panama-Pacific International Exposition held along the north shoreline of San Francisco in 1915. The exposition was wildly popular at the time, and while all the buildings except for Maybeck's lagoon, rotunda, and colonnade were taken down, what remains is a testament to his "atmospheric scenography." The message Harry Mallgrave expounds is that atmosphere in the hands of the skillful designer is nothing less than the *humanization of the built environment*.

Designing Atmospheres: Theory and Science is our fourth in the *Interfaces* series for the Academy of Neuroscience for Architecture. *Interface*s are a variety of symposiums spread around the globe wherever a group of thinkers involved in the Neuroscience and Architecture debate comes together to challenge an idea and share results.

My summation of architecture, philosophy, and biology in our cause of designing atmosphere is thus: *architecture as atmosphere is an invitation or instruction for behavior via what it affords us in the moment and perceived by the body's sensory organs. It is understood pre-reflectively through architectural experience — as potential actions by the body*.

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Elisabetta Canepa

Investigating Atmosphere in Architecture: An Overview of Phenomenological and Neuroscientific Methods

Abstract
Based on the multi-component character of our emotions, we can study the affective dimension of architectural atmospheres through several approaches. This essay reviews the main research models that employ a first-person perspective (self-observation) and a third-person perspective (external observation), analyzing methodological potentials and limitations. We need a multi-perspective approach to investigate the complexity of the atmospheric vocation of architecture, integrating both models and working on complementary notions: atmosphere and architecture, resonance and attunement, impressions and appraisals, nonconscious and conscious, emotions and feelings, living body and lived body, neuroscience and phenomenology, physiological measures and self-report techniques.

Keywords
architecture
atmosphere
attunement
resonance
feeling
emotion
lived body
living body
conscious
nonconscious
first-person perspective
third-person perspective
phenomenology
neuroscience

F1 Paolo Monti
photo series *Bitonto*, 1970
BEIC 6332714
fragment

1 Jens Soentgen, a German philosopher and chemist, was the first to introduce the idea of an *atmospheric turn* (Griffero 2014; Gandy 2017). At the end of the twentieth century (1998), he noticed a novel aesthetic-experiential emergence centered on affective atmospheres, rising from the theses of new phenomenology (Griffero 2021, chapter I). This animated other disciplines towards an emotional reading of reality including cultural geography (Bille and Simonsen 2021), anthropology (Bille, Bjerregaard, and Sørensen 2015; Asu Schroer and Schmitt 2018), consumer science (Turley and Milliman 2000), tourism research (Volgger and Pfister 2020), architecture and urban studies (Wigley 1998; Havik, Teerds, and Tielens 2013; Borch 2014; Pallasmaa 2014; Tidwell 2014; Leatherbarrow 2015; Pérez-Gómez 2016; Weidinger 2018; Bille

Architecture and Atmosphere

Space, especially built space as "the basis for life and culture" (Frampton 1995, 27), is never neutral. It is charged with *affective affordances* (namely ecological qualities offering a possibility for emotional resonance) that sway the experience of perceiving subjects immersed in that space (Griffero 2020a). The emotional "potential in place" affecting people is what we call *atmosphere* (Duff 2010, 891) — "the life of a place" (Schönhammer 2018, 141).

"Atmosphere is the prototypical 'between'-phenomenon," wrote the German philosopher Gernot Böhme (1998, 112) at the beginning of what is now known as the "atmospheric turn." [1] Atmospheres are phenomena experienced "in the intersection of the objective and the subjective" (Edensor and Sumartojo 2015, 251): they are *co-constituted* by both the materiality of our surroundings and corporeality of our bodies (Canepa 2022a). The most challenging aspect is that "an atmosphere is at once a condition and is itself conditioned" (Anderson and Ash 2015, 35). We know atmospheres are spatial phenomena, but we are equally aware atmospheres cannot exist without the presence of a body that perceives them (Canepa 2022b). Only in this way does architecture come alive and become *atmosphere* — space that lives: ineffable space [2] [**F1**].

Visible and invisible

The phenomenology of atmospheres identifies a series of lived qualities making atmosphere extremely difficult (if not impossible) to describe (Canepa 2022a, chapter I). In the first place, atmosphere is *invisible*. Atmosphere is then *incorporeal* which is different from being invisible and still more indefinable on a perceptual level. Atmosphere cannot be touched, isolated, or attributed to a specific concrete source. Air is also

and Sørensen 2019; Griffero 2019; Sumartojo and Pink 2019; Condia 2020; Canepa 2022a; Canepa and Condia 2022). As professor Harry Francis Mallgrave recalls in the next few pages, we must acknowledge, "although the neologism 'atmosphere' dates from only the seventeenth century, the idea of a building's emotional resonance has always been central to architectural practice" (2023, abstract).

2 The atmospheric aura pervades our surroundings and touches our bodies in a synaesthetic and integrated manner. It causes the "play of masses" to lose clarity and transform into "ineffable space": "then a boundless depth opens up, effaces the walls, drives away contingent presences, *accomplishes the miracle of ineffable space* [...] the consummation of plastic emotion" (Le Corbusier 1948, 8: original italics).

invisible. However, air has its own sensorially perceptible consistency, caused by the pressures it exercises on our skin, alternating temperatures, and smells with which it carries. Air leaves traces of its presence on the material elements it brushes, blowing up curtains, making glass vibrate, and swirling dust [**F2**].

Since atmosphere is everchanging and without tangible boundaries, it is unthinkable to precisely locate or physically contain it. "Like clouds in the sky," atmospheres "are ever forming and reforming, appearing and disappearing, never finished or at rest" (Asu Schroer and Schmitt 2018, 1). Atmosphere is like the sea: *difficult*.

> Plasson [the artist]: The *sea* is difficult.
>
> Bartleboom [the scientist]: ...
>
> Plasson: It's difficult to know where to begin. You see, when I used to do portraits, portraits of people, I used to know where to begin, I would look at those faces and I knew exactly (stop)
>
> Bartleboom: ...
>
> Plasson: ...
>
> Bartleboom: ...
>
> Plasson: ...
>
> Bartleboom: You used to paint people's portraits?
>
> Plasson: Yes. [...] When I painted people's portraits, I used to begin with the eyes. I would forget all the rest and concentrate on the eyes, I would study them, for minutes and minutes, then I sketched them in, with a pencil, and that was the secret, because once you have drawn the eyes (stop)
>
> Bartleboom: ...
>
> Plasson: ...
>
> Bartleboom: What happens once you have drawn the eyes?

F2 Paolo Monti
photo series *Cervia*, 1974
BEIC 6339209

Plasson: It happens that all the rest just follows, it's as if all the other pieces slip into place around that initial point by themselves, there's not even any need to (stop)

Bartleboom: ... There's not even any need.

Plasson: No. One can almost avoid looking at the sitter, everything comes by itself, the mouth, the curve of the neck, even the hands ... But the fundamental thing is to start from the eyes, do you see, and this is where the real problem lies, the problem that drives me mad, lies exactly here (stop)

Bartleboom: ...

Plasson: ...

Bartleboom: Do you have an idea where the problem lies, Plasson?

[...]

Plasson: The problem is, *where the dickens are the eyes of the sea?* I shall never get anything done until I find out, because that is the *beginning*, do you see? The beginning of everything, and until I know where they are, I shall carry on spending my days looking at this damned stretch of water without (stop)

Bartleboom: ...

Plasson: ...

Bartleboom: ...

Plasson: This is the problem, Bartleboom ...

Magic: this time he got started again on his own.

Plasson: This is the problem: *Where does the sea begin?*

Bartleboom said nothing.

The sun came and went, between one cloud and the next. It was the north wind, as usual, which organized the silent spectacle. The sea carried on imperturbably reciting its psalms. If it had eyes, it was not looking in that direction at that moment.

Silence. Minutes of silence.

Then Plasson turned to Bartleboom and said, all in one breath, "And you, sir, what are you studying with all those funny instruments of yours?"

Bartleboom smiled.

"Where the sea *ends*."

Two pieces of a puzzle. Made for each other.

[...]

This time there are two people seated on Bartleboom's windowsill. The usual little boy. And Bartleboom. Their legs dangling over the emptiness below. Their gaze dangling over the sea.

"Listen, Dood ..."

The little boy's name was Dood.

"Given that you are always here ..."

"Mmmmh ..."

"Perhaps you know."

"What?"

"Where does the sea have its eyes?"

"..."

"Because it does have them, doesn't it?"

"Yes."

"And where the dickens are they?"

"The ships."

"The ships *what*?"

"The ships are the eyes of the sea."

Bartleboom was flabbergasted. He really had not thought of that.

"But there are hundreds of ships ..."

"The sea has hundreds of eyes. You can hardly expect it to get things done with only two ..."

F3 Paolo Monti
photo series *Monterosso al Mare*, 1960
BEIC 6364393
fragment

> Quite. With all the work it has to do. And as big as it is. There is good sense in all this.
>
> "Yes, but then, excuse me ..."
>
> "Mmmmh."
>
> "And people who are shipwrecked? The storms, the typhoons, all that stuff there ... Why ever should it swallow all those ships, if they are its eyes?"
>
> Dood looks almost a little out of patience, when he turns toward Bartleboom and says, "But you, ... don't ever close your eyes?"
>
> Christ. He has an answer for everything, this boy.
>
> He thinks, does Bartleboom. He thinks and mulls things over and reflects and reasons. Then he suddenly jumps down from the windowsill. Toward the room, of course. You would need wings to jump down in the other direction.
>
> "Plasson ... I must find Plasson ... I have to tell him ... blast, it wasn't so difficult, all you had to do was think about it a little ..."
>
> He searches feverishly for his woolen hat. He does not find it. Wholly understandable: it is on his head. He desists. He runs out of the room.
>
> "See you later, Dood."
>
> "See you later."
>
> The boy remains there, with his eyes fixed on the sea. He stays there for a little. Then he takes a good look to see that no one is around and suddenly jumps down from the windowsill. Toward the beach, of course.

The *sea's eyes metaphor* (Baricco 1999, 82–84; 90–92: original italics) [**F3**] is helpful in introducing the complexity of something so elusive and ineffable as what we atmospherically feel (or have felt) — or even intended to experience. A tension emerges, and progressively grows, between the apparent non-rationality of the atmospheric phenomenon and our determination to comprehend, represent, and design it (Rauh 2018). On the one hand, architects (and others) show an increasing interest in studying atmospheres (Stec 2020; Canepa 2022a), searching for

F4 Paolo Monti
photo series *Monterosso al Mare*, 1957
BEIC 6329237

the meaning of sensations outside the visual that enliven the body of architecture. On the other hand, the ephemeral and immaterial qualities of our surroundings hold resistance to the traditional methods of analysis and discussion of spatial experiences. They require a more subjective approach, holistic as it were, interconnected with sensory, emotional, and cognitive capacities of the perceiver [**F4**].

The more elusive anything is that we have experienced and wish to recount (as in the case of the atmosphere of a place), the more precise we must be in articulating and communicating its effects on us. Just think of how many lines poets and novelists have dedicated to the sea. One possible strategy to capture the profound essence of a place is the "extension of human identity into our environment" (Bloomer and Moore 1977, 131) through one's lived experiences, memories, bodies, and their points of reference (Havik 2019). We need to search for the *atmosphere's eyes*, the initial clue that allows us to understand and answer crucial questions like the following [**F5**]:

where is atmosphere located?
where does atmosphere begin?
where does atmosphere end?
what difference does atmosphere trigger in a place or a situation?

Lived Body and Living Body

One of the few key points scholars of atmospheric dynamics in various disciplines agree on is that "there is no such thing as an unfelt atmosphere" (Osler and Szanto 2022, 183 n. 1). By the term "body," we refer to the holistic complexity of our corporeality: the biological or-

F5 Paolo Monti
photo series *Venezia*, 1960
BEIC 6342454

ganism (the *living body*, anatomical infrastructure responsive to sensory impressions afforded by the context) is completed by life experiences unique to each individual (as metabolized by the *lived body*, which allows the subject to grasp the personal nature of the received stimuli). [3] We both *have* living bodies and *are* lived bodies (Shusterman 2006, 3). "There are not *two* things that need to be integrated here, but one body, physiological and lived," as the philosopher Shaun Gallagher explains (1986, 140: original italics). The distinction between living and lived is a perceptual distinction: we undergo a physiological change, *and* our body may feel that change.

From a methodological perspective, the study of atmospheres has been and is largely dominated by a phenomenological approach, grounded on accounts of the lived body — the body experienced by the perceiving subject from a *first-person perspective*. [4] In recent years, fields surrounding atmospheric research have increasingly emphasized the living body, observable through a *third-person perspective* and supported by breakthroughs and theoretical advancements in empirical sciences like neuroscience, [5] among others (Mallgrave and Gepshtein 2021). They can shed new light on the lived body "by investigating" the living body (Gallese and Cuccio 2015, 19) of which the brain and the autonomic nervous system are constituent parts. Since atmospheres affect us on nonconscious, preconscious, and conscious levels, [6] we must study the *living-lived body* loop. This unity embeds the overall relationship between physiology and experience, jointly requiring an experimental and phenomenological analysis as envisaged by the *enactive approach* (Jelić et al. 2016). [7]

Examining the biological roots of the atmospheric event is a step complementary and not exclusive to comprehending the complexity of its

3 For what we narrowly refer to as "body" in English, German offers two words with quite distinct meanings: *Körper* and *Leib*. The American philosopher Richard Shusterman suggests, "*Körper* denotes the physical body as object, while *Leib* typically signifies the lived, feeling body or the body as intentionality or subject" (2010, 207).

4 For an accurate "atmospheric bibliography," see the authoritative work promoted by Atmospheric Spaces, an international community researching the phenomenological-aesthetic dimension of atmospheric experience coordinated by the Italian philosopher Tonino Griffero. Their literature review is online (www.atmosphericspaces.wordpress.com). It is an ongoing project constantly updated, which takes the conventional start date of 1968 — the year in which the German psychiatrist Hubertus

Tellenbach published his first book dedicated to the concept of atmosphere: *Geschmack und Atmosphäre* (meaning in English, "Taste and Atmosphere"). Alongside, visit the bibliographical repository developed by the EU-funded RESONANCES project for a more architectural viewpoint (www.resonances-project.com/lit).

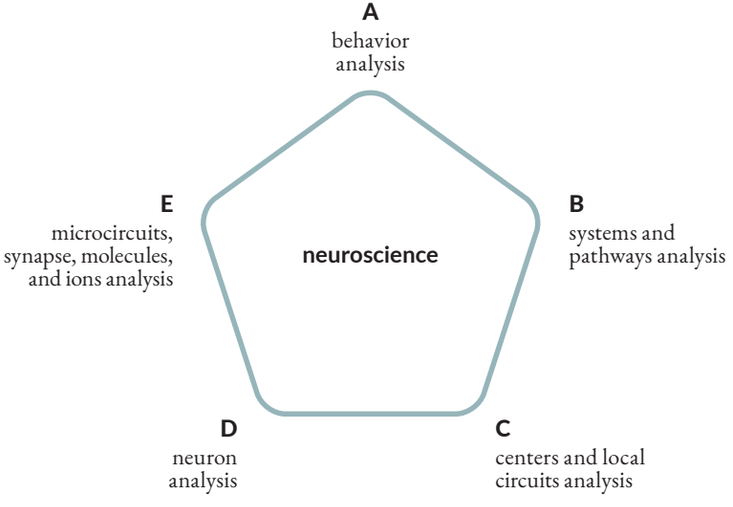
5 *Neuroscience* is an interdisciplinary domain that empirically studies human experience based on the brain or, more generally, the nervous system activity [**F6**]. Enlarging the field of focus, neuroscience resolves "to understand the biological underpinnings of our emotional life" (Albright et al. 2000, s1).

6 The neuroscientists Marco Tamietto and Beatrice de Gelder (2010) propose a focus to face the "terminological jungle" present when discussing *consciousness*. They differentiate several terms to describe perception without awareness, including "unconscious," "nonconscious," "subliminal," "implicit," "automatic," and "pre-attentive." In particular, we learn the distinction between "unconscious" and "nonconscious." "The first term is rooted in the psychoanalytical tradition and postulates the existence of an active mechanism of psychodynamic suppression of conscious information. By contrast, the use of 'nonconscious' is rooted in the experimental psychology tradition and indicates a perceptual state in which the subject does not report the presence of a stimulus or of one of its attributes (for example, its emotional content) even though there is evidence (behavioral, psychophysiological, or neurophysiological) that the stimulus has in fact been processed" (Tamietto and de Gelder, 698). In this essay, we adopt the "nonconscious" form, as suggested by the authors. See also Djebbara 2023.

7 See the theory of the *feeling body* (Colombetti 2017) for further details on how to apply the enactive method developed in cognitive science and philosophy of mind to affective dynamics.

F6 How neuroscience is structured: levels of organization and levels of explanation in the nervous system (adapted from Bermúdez 2020, 8)

A behavioral neuroscience
B cognitive neuroscience
C systems neuroscience
D cellular neuroscience
E molecular neuroscience



8 See the methodological review and the case study presented in upcoming sections.

9 Cf. De Matteis et al. 2019 (§ 40–42), where the authors discuss a "non-coincidence between perception and affective involvement."

experiential essence. One crucial question is how we can link a growing understanding and systematization of architectural atmospheres (Canepa 2022a) to the study of the brain, body, and their emotion-related mechanisms (Arbib 2021). Distilling a definition informed by interdisciplinary criteria, atmosphere turns into a describable and even potentially measurable entity — empirically accessible with experimental protocols aimed to detect our emotional responses to architectural contexts. [8]

Resonance and Attunement

We decipher the atmospheric experience as a *state of emotional resonance and attunement between the perceiving subject and their architectonically arranged surroundings*. Involvement in the co-production of an atmospheric event implies being emotionally affected by it without requiring complete alignment with it. Individuals may feel in tune with a specific atmosphere but also disregard or reject it. "Saying," for instance, "we bodily grasp the happiness of the party as an atmosphere is not to suggest that we must feel happy ourselves" (Osler and Szanto 2022, 166); moreover, we need to consider the possibility that "we might even get the atmosphere wrong" (Osler and Szanto, 167). There is, hence, a crucial distinction between perceiving the presence of an atmosphere (*resonance*) and being affectively involved in it (*attunement*). [9]

Resonance unfolds our innate predisposition to be touched by the external world. It results from the instantaneous arousal of the *first impressions* that shape our spatial experiences by interacting with the affective affordances embedded in the environment (Griffero 2020b). "We perceive atmosphere through our emotional sensibility — a form of percep-

10 Theoretical models of emotions are "as old as psychology itself, or even older" and "many different attempts at conceptualizing and measuring emotions have been made" (Küller et al. 2006, 1504). Although we have studied emotional dynamics for a long time, there are no univocal definitions. A review published in the early 1980s identifies more than ninety meanings in emotion literature (Kleinginna and Kleinginna 1981). The operational definitions presented here are beneficial for the multi-perspective approach we suggest and are currently under investigation at the P\Lab2003, directed by Professor Bob Condia and hosted in the Architecture Department of Kansas State University.

11 Aside from more differentiation, emotions are fundamentally significant or irrelevant (*arousal* component) and positive or negative (*valence* component). For further explanation of affective arousal and valence, see n. 17.

12 From an embodied perspective, resonance can trigger and prime the subject's attunement *if* the atmospheric event is particularly relevant to them.

13 See the *atmospheric equation* analyzed in Canepa 2022b.

14 Cf. Bower, Tucker, and Enticott 2019. Their systematic review found only seven projects that coupled self-assessment procedures with measures of autonomic and/or central nervous system activity to understand how the design of interior settings influences human emotions. This result means, while we intuitively believe our architectural surroundings play a crucial role in generating and experiencing atmospheres, we must still consolidate evidence of the emotion-related (neuro)physiolog-

tion that works incredibly quickly, and which we humans evidently need to help us survive," as Peter Zumthor (2006, 13) teaches us in one of the most quoted excerpts about atmospheric perception. First impressions are profound and beneficial events as they provide us with meaningful information from complex scenes, whether static or in motion, with just a glance, without needing to scrutinize every detail. Research shows first impressions occur at extreme speed, a fact highly praised by architects, proving essential for our interaction with the physical world (Bar, Neta, and Linz 2006; Djebbara et al. 2019). There are four basic modalities through which first impressions arise and manifest: [10]

A *emotions*
internal somatic feedback, nonconsciously developed, even if consciously recognizable;

B *expressions*
outwardly physiological and proprioceptive feedback, mostly nonconscious;

C *action tendencies*
behavioral feedback, mainly nonconscious;

D *feelings*
cognitive feedback of the emotional experience as consciously felt.

Emotions, expressions, and actions are the bodily correlates of feelings, mutually interacting and affecting. For example, we may sense our heart pounding [**A**], our face flushing with eyebrows twitching [**B**], or an urge to leave the room [**C**], *and* consciously feel nervous [**D**]. Through the resonance process, that is, through our bodily reactions [**A**, **B**, **C**] and — or without — the conscious experience of the felt emotional state [**D**], we perceive the presence of a particular atmosphere. If asked or externally observed, individuals show that *they* feel (or felt) excited or impassive, happy or sad. [11] The perceiving subjects are the focus. *We* are the focus.

Attunement is the potential [12] conscious act of appraising an atmospheric experience in which we evaluate its affective content relating the external world to our subjective perception of it. Through the attunement process, that is, through our *affective appraisals*, we assign to our surroundings a meaning grounded on that which resonance gives us, modulating our affective engagement and attachment with that atmosphere. Affective appraisals occur when the perceiver attributes affect-based qualities to the place-elicited stimuli, such as positive or negative, significant or irrelevant. If asked, individuals reply that *the place's atmosphere* is (or was) exciting or calm, pleasant or unpleasant. The target is the external world, filtered through our sensibility and colored by current moods, motivations, concerns, and expectations. [13]

Using a neuroscientific approach, supported by other branches of knowledge (such as psychology and phenomenology), we can evaluate — performing *in vivo* experiments — any correlations between nonconscious body/brain activation and the conscious perception of emotions towards a space. [14] In other words, *resonance* — involving both nonconscious sensations and conscious feelings — is the segment of the atmospheric experience we can assess by adopting a *multi-perspective* methodology.

Recognizing the multi-component nature of our emotional responses (conscious and nonconscious: feelings and emotions) allows us to in-

ical effects. More updated review papers confirm the same small number of research adopting an effective multi-perspective paradigm (Kim and Kim 2022).

15 *Interoceptive sensitivity* is our ability to perceive visceral information from the body (such as heartbeat, respiration, gastroesophageal sensations, itching, and pain) and interpret related physiological changes. Interoception influences our capacities to recognize and experience emotions (Barrett et al. 2004; Zamariola et al. 2019). The hypothesis is that people who are more interoceptively sensitive (that is, more attuned to their internal body signals) are more accurate in perceiving and understanding their surroundings (Murphy Paul 2021). So far, however, it has not been confirmed whether our inside body perspective influences how we perceive the outside world (Baiano et al. 2021).

vestigate the *affective dimension of architectural atmospheres* through several approaches. The preliminary, essential distinction identifies two assessment perspectives:

a *first-person perspective* (self-observation) and
a *third-person perspective* (external observation).

First-Person-Perspective-Based Research Models

In first-person observation, focus is on analyzing consciously perceived emotional states. This approach reconstructs a picture of *what* we are currently feeling (or have previously felt) in the first person. Such an account is necessary since "every subjective phenomenon is essentially connected with a single point of view" (Nagel 1974, 437). Descriptions of phenomenological content (grounded on lived experiences) "need not convey an experience of emotion in all its richness and complexity to have scientific utility and value" (Barrett et al. 2007, 375). We can metabolize, assimilate, and express our spatial experiences in a plurality of modalities (De Matteis et al. 2019). Articulating experience implies "providing a means to put words to bodily sensations" (Höök 2018, 107). We can accomplish that in three moments:

in *real-time* practicing bodily interoception [15]
and emotional introspection; [16]

after the experience has occurred;

or *before*, in order to compare the beginning status
with the altered one.

16 A rough definition of *introspection* alludes to the process through which we direct our attention inward to analyze emotional experiences as consciously felt.

17 We traditionally distinguish three components as capable of subserving all affective states (cf. the circumplex model of affect): *arousal* scores the intensity of our emotional experience, that is, how strong it is; *valence* assesses the pleasantness of our emotional experience, that is, how positive it is; and *dominance* correlates with feelings of control and how much someone feels constrained in their emotional experience. Many techniques detect these three factors; most common are Likert-type scales and self-assessment manikins. Likert-type scales are rating systems, measuring perceptions as a spectrum ranging from one extreme value to another (e.g., from "not at all" to

Multiple strategies have been developed and improved over time:

verbal self-report systems, employing written accounts (e.g., questionnaires, surveys, notes, and diary entries) or oral accounts (e.g., discussions, interviews, and audio/video recordings);

nonverbal self-report measures, which can be graphical methods (e.g., Likert-type scales and the more picture-oriented SAM: Self-Assessment Manikin) [17] or go beyond the purely visual format (e.g., PONS: Profile of Nonverbal Sensitivity, designed to decode bodily, facial, and vocal clues);

visualization tools, based on 2D techniques (e.g., drawings, body maps, and photographs) or 3D techniques (e.g., mockups and molding soft clay), which offer creative ways of processing experience;

and, lastly, there is a growing interest in *storytelling* procedures, where adopting paradigms inspired by literature methods (i.e., stories), it is possible to balance reality and imagination (Pericoli 2022).

First-person-perspective-based research models present intrinsic methodological limitations:

people can control and manipulate their evaluations in self-report ratings, conditioned by cognitive biases (such as preconceptions, warries, performance expectations, or learning effects);

introspection is a complex process, even if we tend to presume individuals are always able to understand and articulate what they feel

"extremely"). A Likert-type scale may have a varying length, a discrete set of items (coded numerically and/or verbally), or a continuous interval. The Self-Assessment Manikin (SAM) is a graphical upgrade of the Likert-type scales employed to rate valence, arousal, and dominance associated with a person's affective reaction to a given stimulus (Bradley and Lang 1994).

18 We should also consider people "differ considerably in their emotion experience" (Barrett et al. 2001, 713). The psychologist Lisa F. Barrett coined the expression *emotional granularity* to explain our ability to discriminate the specificity of felt emotions. A high emotional granularity affords fine-grained distinctions between similar emotions (namely, emotions with similar levels of valence and arousal, cf. n. 17) and describe their experiences with discrete emotional labels. Conversely, a limited emotional granularity flattens the landscape of our feelings, reducing the number and the reliability of our introspection feedback.

19 The spectrum of emotional reactions is highly fleeting and variable: on the one hand, we are all genetically unique and constantly shaped by the affordances embedded in our surroundings; and on the other, we are always different from ourselves, affected by transient factors, of environmental or personal origin (cf. Canepa 2022b).

20 Cf. the remark with which Zakaria Djebbara opens his essay in this book: despite the Interfaces 2023 symposium called *Designing Atmospheres: Theory and Science*, "the theory and the science of atmosphere are largely unbalanced, in favor of the theory" (2023, 75).

21 The neuroscientific study of emotion

or have felt (sometimes they expressly do not want to divulge their impressions); [18]

the presence of the listener (who can be a friend as well as a stranger like a scientist) interferes in the external disclosing the own internal state;

and generalizability and transferability are restricted. [19]

Despite these main limitations, self-observation methods have been extensively validated through testing, are user-friendly, and are reasonably inexpensive. Most importantly, first-person phenomenological translations of our atmospherical experiences are crucial because — in the end — only those who experience the emotional resonance can articulate it.

Third-Person-Perspective-Based Research Models

"There is now increasing evidence that nonconsciously perceived emotional stimuli induce distinct neurophysiological changes and influence behavior towards the consciously perceived world" (Tamietto and de Gelder 2010, 697). Notwithstanding that "architecture is an act of conscious willpower" (Le Corbusier 2015 [1930], 68), it is rarely at the forefront of our attention on a daily basis (Peri Bader 2015). As emphasized by Frank Lloyd Wright, architecture is the "background or framework" of our existence (1992 [1908], 95). "People usually do not focus on architectural features but rather live the space in a habitual and automatic manner" (Vecchiato et al. 2015, 15). Two premises are essential:

nonconscious (or at least marginally conscious) perception of emotional affordances is the predominant way to experience our built surroundings;

emotions contribute to processing environmental stimuli, driving behavior and decision-making even without explicit access to our autonomic and somatic responsivity.

Supported by these assumptions, *atmosphere* — particularly the resonance stage — becomes the primary constituent of our spatial experiences. Examining the role of bodily, nonconscious sensations in atmospheric dynamics is still an open scientific question, crucial in understanding how we experience designed environments. [20]

While first-person observations are limited to consciously perceived emotional states (namely feeling), third-person observations evaluate nonconscious and preconscious emotions on three different levels: [21]

on the *experience level*, studying behavioral outputs (action tendencies or interferences on task performance) and corporeal expressions;

on the *body level*, recording physiological activities;

and on the *brain level*, monitoring neural functioning.

In numerous academic disciplines such as applied marketing research and consumer science (Bell et al. 2018), attempts have been made to move beyond first-person observation and the only use of subjective indicators of psychological factors. Architectural studies began integrating quantification of emotions with biometrics and virtual reality

saw the light at the dawn of the nineteenth century when psychology turned into a scientific discipline distinct from philosophy. For a brief historical reconstruction of the brain basis of emotions, the current state of the art, and a scientific critique of the classical theories of emotion (including basic emotion approaches and causal appraisal approaches), see Barrett and Satpute 2019.

(Bower et al. 2019; Mostafavi 2021; Kim and Kim 2022). Explicit behavior decisions, expressive reactions, and (neuro)physiological measures record those effects that self-report tools cannot identify. Different techniques (Karakas and Yildiz 2020), in constant development especially in terms of resolution and wearability, are available:

action tendencies (experience level): when compared to other markers of emotional responsivity, methods for detecting action tendencies are limited (Delplanque and Sander 2021). They include, for instance, posture measurements, laboratory paradigms to evaluate approach-avoidance motivations, speed monitoring, and tests with sensors based on accelerometer data;

effects on task performance (experience level): from a behavioral perspective, nonconsciously perceived stimuli can interfere with explicit outputs of an ongoing task by, for example, altering reaction time, influencing attention engagement, or modifying perceptual sensitivity;

expressive responses (experience level): continuous emotional signals come from our body via multiple sensory modalities and are noticeable especially through visual clues (e.g., body posture and orientation, facial mimicry, gestural prompts, and involuntary movements), auditory clues (e.g., prosody and vocal acoustics), and their integration. When the key emotional dimension to examine is valence, studying facial expressions is one of the more reliable methods. Two techniques are often used: Facial Expression Analysis (FEA), detected by video captures, and Facial Muscle Activity (FMA), monitored by Electromyography (EMG) electrodes, which record the electrical activity produced by skeletal muscles;

physiological activity (body level): this group refers to the activation of the autonomic section of our peripheral nervous system, articulated into the sympathetic, parasympathetic, and enteric apparatuses. The autonomic nervous system coordinates somatic, emotional, and behavioral responses of an organism regulating its homeostasis, which maintains the essential physiological processes at optimal (or, at least, acceptable) levels. It can give prompt integrated responses to variations in the external environment, acting largely nonconsciously. Examples of physiological markers of emotional correlates are Electrodermal Activity (EDA), Heart Rate (HR), Blood Pressure (BP), Respiration Rate (RR), Skin Temperature (ST), Muscular Potentials (MP), Pupillometry (P), Eye Movements (EM), and Hormonal Secretions (HS);

neural activity (brain level): this last investigation stage explores the emotion-related effects on the central nervous system, specifically brain functioning. Two main inquiry procedures are currently in use: neurophysiology and neuroimaging techniques. Neurophysiology includes Electroencephalography (EEG), which scan the brain's electrical activity, and neuroimaging includes Functional Magnetic Resonance Imaging (fMRI) and Positron Emission Tomography (PET), which measure hemodynamic changes (blood flow).

Multi-Perspective Research Models

Self-reports and (neuro)physiological measures are complementary strategies for gathering data on feelings and emotions, though their results do not always correlate (Bower et al. 2022). They might even seem contradictory when people, for example, claim they felt no emotion, but

22 Adopting the term "marker" is a tribute to the neuroscientist Antonio Damasio and his *somatic-marker hypothesis*. Somatic markers are conscious and nonconscious emotion-triggered bodily feedback. They "probably increase the accuracy and efficiency of the decision process. Their absence reduces them" (Damasio 1994, 173).
23 Cf. n. 14.

24 The MSCA fellow Elisabetta Canepa designed and carried out the first RESONANCES experiment at the Kansas State University P\Lab2003 during the academic year 2022–2023. Her supervisors were Bob Condia (K-State), Andrea Jelić (KU Leuven), and Valter Scelsi (UniGe), assisted by a multidisciplinary team: Kutay Güler — VR and eye-tracking expert (K-State), Luca Andrighetto — psychologist (UniGe), and Irene Schiavetti — biostatistician (UniGe). In outlining the theoretical framework and designing the experimental protocol, several international scholars advised Dr. Canepa, including architects, philosophers, and scientists. The P\Lab2003 team helped in all experimental trials: a huge thanks go to Brittany Coudriet, Yvette Fabela, DJ Plankinton, Amanda Shearhart, Jacob Shreve, and Marvy Whittaker. The K-State APDe-

their nonconscious reflexes show otherwise. To properly detect, qualify, and quantify our resonance (that is, a combination of emotions and feelings), a *multi-perspective approach* is required. "Any conscious event has both neurobiological and phenomenological features". Therefore, "knowing about brain activity [...] alone will not provide a full scientific account of emotion experience" (Barrett et al. 2007, 376). Harmonious insights are needed from both the first and third-person perspectives.

A fundamental methodological question is evaluating which research approaches are more informative than others as *emotional markers* (Delplanque and Sander 2021). We must establish what combination of markers (phenomenological, psychological, behavioral, physiological, and neurophysiological) can best analyze emotional responses and check if exposure to the built environment alters the selected emotional markers. [22] Only then can we assess atmospheric qualities' effect on our emotional states. Eventually, if we intend to incorporate a neuroscientific methodology, we must ascertain if nonconscious bodily and neural correlates of atmospheric emotions are consistent with their conscious accounts. Subjective indicators (Schönhammer 2018) may be an effective *baseline* from which quantitative measurements can be compared and verified.

Although architecture's emotional influence on our lived experiences has been broadly theorized (Goldhagen 2017; Canepa 2022a), we have yet to consolidate empirical evidence interdisciplinarily. [23] This is particularly true if we reflect on the multisensory nature of atmospheric interactions (Pallasmaa 2016): validated experiments are scarce and research methods are disparate (Schreuder et al. 2016; Spence 2020). Separating the idea of resonance from that of attunement helps to find neuroscience-informed strategies for comprehending how architectural atmospheres affect us consciously and nonconsciously.

The atmosphere's eyes

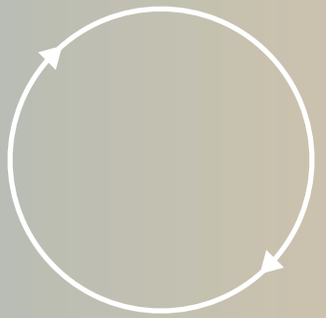
After establishing possible research methods and confirming the importance of integrating first-person accounts with third-person measures, within the EU-funded RESONANCES project, [24] we designed an experimental paradigm to study the affective dimension of architectural atmospheres. Our multi-perspective approach embeds the overarching spectrum of complementary notions analyzed in the previous sections to grasp the complexity of the atmospheric phenomenon [**F7**].

atmosphere —— architecture
resonance —— attunement
impressions —— appraisals
nonconscious —— conscious
emotions —— feelings
living body —— lived body
third-person perspective —— first-person perspective
neuroscience —— phenomenology
(neuro)physiological measures —— self-report assessments

We set out to analyze atmosphere as a *priming condition* for spatial experiences grounded on our definition of the atmospheric dynamic as a state of emotional resonance and possible attunement between the perceiver and their surroundings. Hypothetically, atmosphere *might* prime us to sense, feel, and appraise differently. Priming "reveals the powerful ways in which our past experiences can influence our present and future

Atmosphere

resonance
impressions
nonconscious
emotions
living body
third-person perspective
neuroscience
(neuro)physiological measures



attunement
appraisals
conscious
feelings
lived body
first-person perspective
phenomenology
self-report assessments

Architecture

sign College supported this research project by giving access to the lab facilities.

25 Or *affective priming*, also called *affect priming*.

26 I decided to concisely describe our experiment here. What matters is illustrating how to apply a multi-perspective research model, moving from first-person insights to third-person measures, from phenomenology to biology, and back again.

27 For further discussion about atmospheric generators see Canepa 2022b.

behavior" and contributes to "perception, memory, decision making, and action" (Doyen et al. 2014, 13). Working on affective atmospheres, the notion of *emotional priming* [25] is vital. Its effects depend on the degree of involved consciousness (Lohse and Overgaard 2019); we may even suppose nonconscious perception sways our emotional experience of the subsequent event, situation, or space.

The priming potential of atmospheres is a deep-rooted intuition among architects. Le Corbusier, for example, grasped it very well when describing the transition between outside and inside:

> In Broussa in Asia Minor, at the Green Mosque, you enter by a little doorway of normal human height; a quite small vestibule produces in you the necessary change of scale so that you may appreciate, as against the dimensions of the street and the spot you come from, the dimensions with which [the interior space] is intended to impress you. Then you can feel the noble size of the Mosque and your eyes can take its measure. (Le Corbusier 1931, 167)

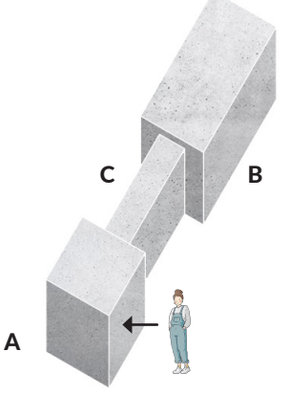
The feeling of airiness and confusion coming from the urban context leaves a residual emotion in the next space, the vestibule, which — in turn — emotionally prepares the following experience, contrasting its intimate atmosphere to the grandeur of the central hall, "a great white marble space filled with light" (1931, 168).

We hypothesize priming effects in architecture occur when our embodied engagement with atmospheric affordances prepares and influences a subsequent, related experience, mainly without our awareness of the priming factor — as with sound in movies. To verify this idea, we analyzed a series of corridors with altered light quality (via luminosity and color), assuming light is a primary *generator of atmosphere*. [26] In a pre-

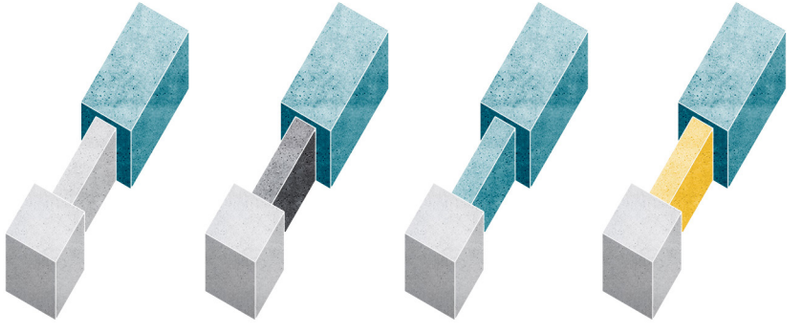
F8 RESONANCES
experiment:
layout diagram

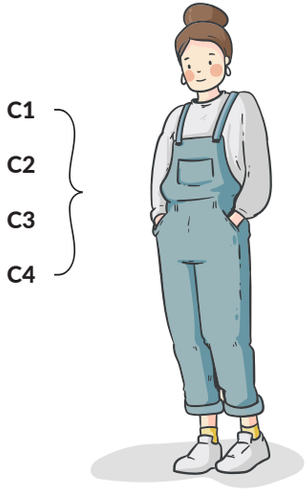
vious study (Canepa et al. 2019), twenty different configurations were assessed. Light manipulation emerged as the most arousing generator of atmosphere, [27] without showing a significant correlation in test subjects' dispositional empathy. This response to light could be because it has strong sensuous power and a broad spectrum of action, affecting our perception regardless of empathic disposition to emotional resonance.

Each experimental session was composed of four corridor iterations, randomly presented and freely explorable in virtual reality. All iterations had the same layout: a corridor connecting two rooms [**F8**]. Participants entered the starting room [**A**] and performed a relaxation exercise to collect baseline data; then they opened the first door and walked along a 5-meter corridor [**C**], following a natural pace. Through the second door, participants accessed the final room [**B**], where they browsed an art installation before replying to a questionnaire (virtually simulated). After answering the queries, they returned to the point of departure [**A**].



F9 RESONANCES
experiment:
corridor variations





28 Before running the experiment, test subjects completed three questionnaires to profile their *emotional intelligence*, *personality*, and *empathic sensibility*. Cf. n. 18.
29 Electrodermal activity (EDA) is a continuous process generated by imperceptible and involuntary changes in the electrical behavior of the skin, which serves as our interface with the physical world. EDA is a sensitive marker of humans' sympathetic autonomic nervous system activity by measuring sweat gland function. As sweat glands are more active, due to physiologic or emotional stimulation, the electrical conductance of the skin increases, given that sweat conducts electricity (Subramanian et al. 2021). EDA provides data on the amount of sweat secretion, making it a strong indicator of emotional arousal. Its increases vary directly with self-report-

The starting and ending rooms remained constant, whereas the light in each corridor varied in brightness and color. We examined four variations [**F9**]: a bright corridor (**C1**: in continuity with the first room), a dark corridor (**C2**: as opposed to the first room), a blue corridor (**C3**: in continuity with the ending room), and an amber corridor (**C4**: as opposed to the ending room). The aim is to determine *whether* and, if so, *how* different atmospheres prime the emotional experience of the next room, which we assess in terms of resonance and attunement. If we can detect any change in participants' first impressions of the same ending room, this data would indicate the corridor's atmosphere resonated with their sensibility, affecting their emotional engagement and evaluation. We investigated the *resonance* mechanisms foremost through the *living body* then filtered via the lived body; the *attunement* appraisals were analyzed merely through the *lived body*, which contributes to attributing to the surroundings a meaning backed by our nonconscious impressions.

First-person perspective, informed by a phenomenological approach to the architectural lived space, was applied to the *conscious* essence of resonance and attunement, assessing *feelings* through self-reports. As soon as participants entered the final room, they virtually answered six questions.[28] Three items evaluated atmospheric resonance based on the basic dimensions commonly adopted to describe emotional responses:

arousal, scoring the intensity of the felt emotional experience;

valence, grading the pleasantness of the felt emotional experience;

and *dominance*, rating the felt emotional experience's influence.

ed arousal levels, regardless of whether the experience is described as pleasant or unpleasant (Lang et al. 1993). The EDA signal has two components (Amiez and Procyk 2019): the *skin conductance level* (SCL) is a background tonic profile associated with slow alterations elicited by the environment that serves as an individual's mean-value baseline; the *skin conductance responses* (SCRs), on the contrary, are the rapid phasic changes that occur in response to particular eliciting stimuli, generally external. SCR is the component used to detect autonomic arousal variation and is interpretable as a form of individual stimulus-response. The term *electrodermal activity* (EDA) is often associated only with the component of the *skin conductance response* (SCR), also known as *galvanic skin response* (GSR).

Three items sifted through attunement intentions using these cognitive markers:

sense of agency to inspect how much individuals evaluate the emotional experience as under their control;

sense of presence to monitor how much individuals evaluate the emotional experience as engaging;

and *approach-avoidance motivation* to comprehend how much individuals evaluate the emotional experience as attractive and satisfying.

Third-person perspective, supported by a neuroscientific methodology, was applied to the *nonconscious* dimension of resonance, tracking *emotions* through autonomic measures of arousal. Participants wore four electrodes strapped to the fingers of their non-predominant hand. The sensors utilized were non-invasive, portable, and compatible with VR technology. Three physiological markers were combined [**F10**]:

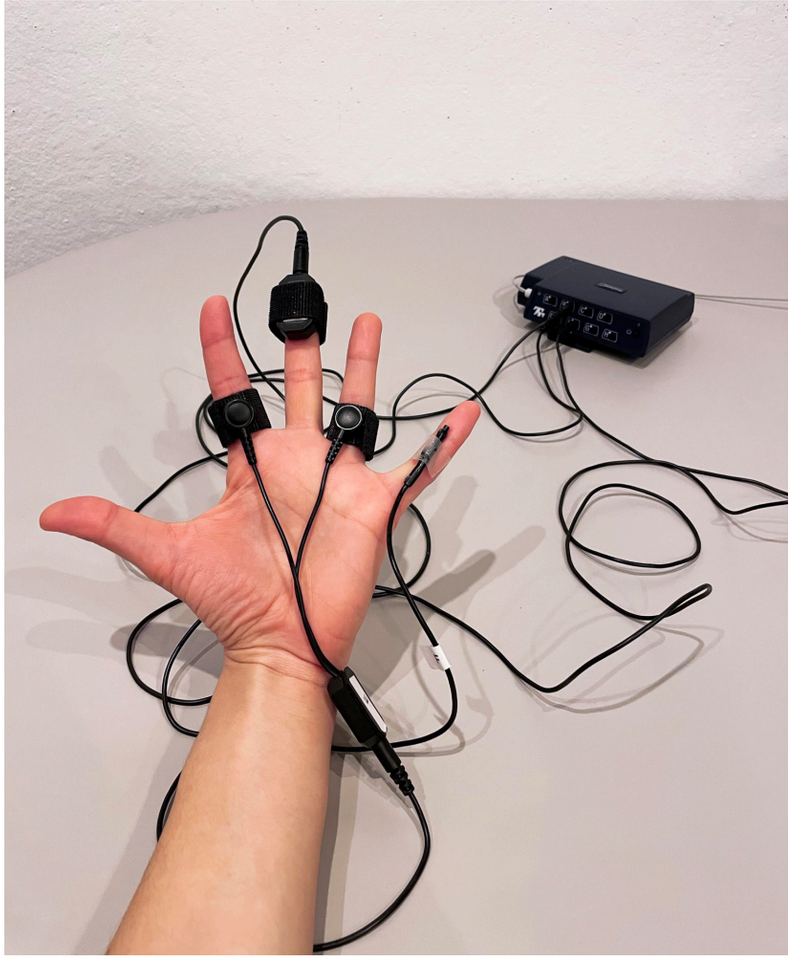
electrodermal activity; [29]

skin temperature; [30]

and *heart rate*. [31]

To better visualize our architectural hypothesis about atmospheric primes, we should imagine the experimental paradigm as an *equation* [**F11**]. Starting and ending rooms are always the same, never changing: same colors, same materials, same proportions, and same light conditions.

F10 RESONANCES
experiment:
wearable sensors for tracking
physiological arousal



30 The *skin temperature* (ST) sensor is designed for continuous temperature monitoring using the skin as an indicator of body temperature, rising in response to higher levels of arousal, independent of valence.
31 In general, an arousal increment correlates to an increase in *heart rate* (HR), determined by the number of heart contractions per minute.

The test subject is the same. They are relatively constant since they cannot modify their psychological and physiological properties significantly in ten minutes, except for the learning effect, which grows after each sequence. Only the corridor changes. *If* a difference emerges in participants' first impressions (nonconsciously and/or consciously: as emotions and/or feelings) when they open the second door, then the corridor's emotional resonance occurred and was intense enough to prime the experience that followed. This few-instant effect on our first impressions proves the presence of an atmosphere in the corridor, capable of emotionally affecting us.

We may have found our way to *see* atmospheres — namely, as we know, the dimension of the ineffable and ephemeral par excellence of our architectural experiences. It is a critical step toward better *understanding architecture* since, as Robert McCarter and Juhani Pallasmaa argue, "architecture has meaning, and matters to us only when it is experienced" (2012, 5). Investigating atmospheric resonance and attunement helps us to decipher the spatial choreography and temporal montage of affective affordances that set the stage for our experiences. The synergy of architecture, biology, and phenomenology is vital in pursuing this research effort about design agency.

F11 Resonance equation
(cf. Canepa 2022b)

- x physiological determinants
- x personal determinants
- x sociocultural determinants
- x spatial determinants
- x experimental determinants
- x priming factor

Atmospheric corridors
randomly tested

C_X [C1, C2, C3, C4]
C_Y [C1, C2, C3, C4]

$$C_X\ [X + X + X + X + X + X] =$$
$$C_Y\ [X + X + X + X + X + X]$$
$$?$$
$$C_X\ [X + X + X + X + X + X] \neq$$
$$C_Y\ [X + X + X + X + X + X]$$

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Figure Credits

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Zakaria Djebbara

Rhythms of the Brain, Body, and Environment: A Neuroscientific Perspective on Atmospheres

Abstract
Atmospheres enjoy ambiguity beyond the constraints of words. While the theory of atmosphere is well-established, its scientific testing remains challenging due to this ambiguity. Focusing on the effect of atmospheres, I discuss nonconscious processes and rhythms in the body and brain concerning behavior and atmosphere, arguing that the body's active engagement with the environment is crucial in our experience. Our sensory suppression of the atmosphere is actively used to adapt our behavior, making it a phenomenologically rich process. I conclude by providing a neuroscientific hypothesis on the mechanisms behind the enacted atmosphere and its impact on human cognition.

Keywords
neuroarchitecture
neuroscience of atmospheres
suppression dynamics
transthalamic pathways
rhythms

1 I will use the concept "atmosphere" in the architectural phenomenological context throughout the essay, that is, the *character of a space*.

Introduction

The following essay is a mélange between my lecture at Kansas State University, APDesign College, in March 2023, and the discussions the following few days. "Designing Atmospheres" was the symposium name, followed by the subtitle "Theory and Science." Note that the theory and science of atmosphere [1] are largely unbalanced, in favor of the theory (Böhme 2017; Griffero 2019; Canepa 2022). One reason for this imbalance may be due to the lack of consensus what the atmosphere *is* (Canepa 2022, chapter I) making it difficult to put through scientific testing. The problem arises from the practical exercise in the delineation of what it is, naturally affirming what it is not. It enjoys ambiguity, vagueness, and intangibility: it is *ineffable*. Yet, when theorists attempt to put it into words, a general perspective emerges. It alludes to multisensory and emotional engagement, encompassing the overall character, mood, and feeling created through architectural features, such as light, texture, sound, thermal qualities, and spatial configurations. These are arguably features that are present in everyday life, implying the existence of an everyday atmosphere. As long as we sense the world, there must be a perceived atmosphere — if not in the foreground, then surely in the background, continuously affecting us in ways that remain ineffable till we lay out the mechanisms for its impact. My approach in this essay will be scientific. Instead of focusing on the experience of atmospheres, I focus on the *effect*. This, I believe, will give us a way to design atmospheres.

The following neuroscientific perspective attempts to write to non-experts about the neuroscience and psychology behind nonconscious processes and rhythms in the body and brain. This essay is heavily guided by my personal research. I attempt to provide the first step in overcoming the quantification of atmospheres by twisting the question about space and form into *time* and *experience*. In other words, instead of taking

2 A similar argument has been puth forth by Jelić and colleagues (2016).

the atmosphere to exist in the form and space, I consider it to be an enacted and lived experience [2] that puts a greater focus on our biological rhythmic nature, paving the way for our adaptive skills in the domain of nonconscious processes. To help elucidate my way of thinking about this, consider the distinction between the external world and internal processes. Where does the experience of the atmosphere emerge? I argue that the emergence is contingent on both external features and internal processes in a bidirectional fashion with the body taking up a central role (Varela, Thompson, and Rosch 2016). The role of the body is to engage with the environment integrating sensory and motor information into a single coherent and contingent temporal alignment (O'Regan and Noë 2001). This essentially gives the active engagement with the environment a constitutive role in our experience — this is where I think neuroscience and architecture may begin having a conversation informing one another (see also Arbib 2021).

The essay is structured in the following way. I first provide examples of rhythmic nonconscious impact via sensorimotor dynamics, demonstrating how architectural features, as picked up by the visual periphery, can affect human behavior. Then, I turn towards the body's rhythmic and active nature in adjusting and adapting to the environment. Our nonconscious adaptive skills, I suggest, play a crucial role in our immediate understanding of space, that is, the gist of scene perception (Oliva and Torralba 2006; Djebbara et al. 2019), as the atmosphere is typically picked up by our peripheral senses. An important premise I draw on is that atmospheres play the role of the background of our lives, which we naturally suppress during our everyday interactions. However, I argue that suppression is not lost on us — instead, it is actively used to adapt our behavior, making the suppression dynamics inherently important to atmospheres. I elaborate on this premise before I provide a neuroscientific hypothesis on the underlying mechanisms of the enacted atmosphere and its impact on human cognition.

Nonconscious Adaptive Skills

Although Timothy Wilson (2004) provides an in-depth discussion on the usage of "unconscious" over "nonconscious," I prefer sticking to the latter as it holds the least psychoanalytical baggage, fits better with current literature of cognitive neuroscience, and essentially better frames my points. Similar to atmospheres, "the unconscious is notoriously difficult to define" (Wilson 2004, 23). Yet, Wilson provides a useful working definition, namely that the *adaptive [unconscious] nonconscious*: "mental processes that are inaccessible to consciousness but that influence judgments, feelings, or behavior" (2004, 23). We can disambiguate and interpret our environments to initiate a behavior effortlessly and nonconsciously, which is an immense biological advantage ensuring survival. Without these skills, the interaction with the world would be overwhelming and unbearable. However, the adaptive nonconscious processes are not always accurate and are limited to our attentional resources, the available sensed information in the environment, and prior experiences.

An example of where our adaptive skills fail us is in the experiments of Simons and Levin (1998). Their research question was on the topic of change detection and they wanted to know if failing to detect changes is based on the passive nature of mediated stimuli or an active one. To test this, they equipped two researchers, closely resembling one another, with a map of campus and had them ask unsuspecting pedestrians

about a specific building, that is, a navigation task. After about ten to fifteen seconds of conversation between experimenter A and the pedestrian, two other experimenters carrying a door rudely walked between the pedestrian and experimenter A. Experimenter B who was carrying a portion of the door stayed behind, swiftly changed position with experimenter A, and continued asking for directions as the door passed. However, despite obvious differences in voice, appearance, and clothing, only 7 out of the 15 pedestrians claimed to have noticed the experimenters' change. A possible explanation is the limited attentional resources during the interaction due to the navigational task, where the role of attention is to actively suppress noisy information making the important pieces of information stand out (Carrasco 2011). Keep in mind, the sensory system is constantly active, sampling information about the environment as well as internal organs. This is a necessary biological step to maintain a *homeostatic balance* — a concept we shall return to.

Unfortunately for architects, for everyday interaction of non-architects, it is the architecture that is the noise that is being suppressed in favor of another objective or task. Walking home from the office entails a plethora of architectural interaction, yet, our conscious thoughts are occupied by social plans, what to make for dinner, or the football game tonight. The interaction is left to the nonconscious adaptive skills, which effortlessly move the body through the structure of the city, circumventing other moving bodies. As architects, this may be unfortunate news, as the hours spent designing cities and homes appear to go unnoticed. The truth is that suppression dynamics play an important role in our attentional resources as well as our awareness (Djebbara, Fich, and Vecchiato 2022). Furthermore, as we have different bodies and brains, interactions are not easily generalizable, which typically means losing some groups of

3 I put "visual" in paranthesis here because the suppression of noise is in fact of all peripheral sensations relative to an going task. For instance, while reading this, you do not experience the clothes on your body or the floor under your feet. These are peripheral sensations relative to your ongoing task, which currently is to read.

4 *Optic flow* is a concept developed in ecological psychology by James J. Gibson (1986) describing the pattern of visual motion that is perceived by an observer as they move through an environment. It is how visual information changes on the retina as we move through the world. The flow provides crucial information about our own movement, the movement of objects in the environment, and the shape and layout of the environment itself.

society in the swing of the pen during the design process (Tvedebrink et al. 2022). Suppression dynamics, which appear to be left with the nonconscious processes, are paradoxically phenomenologically rich. Despite the lack of conscious experience, which is the hallmark of phenomenology (Gallagher and Zahavi 2012), the suppressed nonconscious noise is constantly affecting us beyond our awareness. One might think of this as the *hidden power of architecture*.

In the visual modality, the suppressed noise can be thought of as the peripheral (visual) [3] information that currently holds little-to-no value relative to an ongoing task. This has famously been demonstrated in experiments of selective attention, which is the act of paying attention to a specific element of the environment for some amount of time. Due to the limited amount of attention we have, *selective attention* enables us to tune out irrelevant information and concentrate on what matters (see, for instance, the Monkey Business Illusion: Simons and Chabris 1999). The argument I make here is that the information is not entirely lost. It simply does not rise to conscious awareness, but it remains phenomenologically rich to the nonconscious adaptive skills. For instance, demonstrating how changing the optic flow [4] affects the walking speed in human locomotion, Ludwig et al. (2018) highlight the significance of the flow of sensory information. Ludwig and colleagues instructed their participants to walk down a corridor on which they had projected stripes at varying distances that were orthogonal to the direction of travel. Their participants were required to complete a perceptual discrimination task involving the orientation of a bar projected to the back wall while moving along the walkway. They consistently discovered a decrease in walking speed as the distance between projected lines grew closer together. In other words, when the rate of change in the periph-

eral vision had a high frequency, the optical flow suggests that we are moving very fast and the natural adjustment is to slow down our walking speed.

That animals use the same method to control their behavior suggests that this may be a fundamental strategy in nature. For instance, budgerigars were made to fly through a tunnel with either horizontal or vertical lines painted on either the left or right wall in a superb study by Bhagavatula and colleagues (2011). By combining the line directions with the walls, they were able to show that changing the direction of the line not only caused budgerigars' flight velocities to significantly change but also changed their trajectory so that they flew closer to the vertical lines. They were, however, significantly faster when horizontal lines were painted on both sides. It is interesting to note that the horizontal and vertical lines altered the permitted behavioral outcomes in different ways because they enact different responses. Hummingbirds, honeybees, and bumblebees have all been observed using visual control strategically (Srinivasan et al. 1996; Baird et al. 2005; Dakin, Fellows, and Altshuler 2016). A summary of these studies and others has been dealt with elsewhere (Djebbara et al. 2022).

These cases support the contention that everyday interaction with architecture affects us through phenomenologically rich (yet, nonconscious) peripheral dynamics that go unnoticed but manifest in our bodies and behavior. The underlying dynamics that enable such adaptive behavior are referred to as *sensorimotor dynamics*. It is the study of how sensory information, such as tactile or visual feedback, affects motor actions, which, in turn, affects the sensory input. In the study of perception and action, particularly in the context of comprehending how organisms interact with their environment, the idea of sensorimotor dynamics is frequently used (Vecchiato, Jelić, et al. 2015; Vecchiato, Tieri, et al. 2015; Djebbara et al. 2019; Djebbara, Fich, and Gramann 2021). Importantly, the coupling between the brain's sensory and motor regions, that is, sensorimotor dynamics, can reveal how the brain integrates sensory and motor information to produce nonconscious adaptive behaviors.

As demonstrated, our adaptive skills require no conscious effort — it just happens in the background of our lives. I think of everyday atmospheres in the same way. It is the backdrop of our lives, setting the contextual constraints through nonconscious sensorimotor adaptation. It systematically suppresses irrelevant signals, freeing up attentional resources that can be used for mind-wandering and contemplation. While the suppression dynamics, that is, the pattern of suppression, is an important question, the brain is only beginning to appear important. There is, however, a premise as to why the brain attempts to suppress and adjust to the environment in the first place.

Homeostasis and Process Philosophy

Biology teaches us at least two important lessons:

> the organism is the physical consequence of *adaptive changes* as a response to environmental changes;
>
> everything oscillates or displays some *resonant* or *rhythmic behavior*.

These two lessons are crucial to understanding the role of the brain in architecture. During the rebuilding of the United Kingdom's Commons

Chamber post the Second World War, Winston Churchill famously stated "first we shape the buildings, then buildings shape us." He preferred to keep the adversarial rectangular pattern rather than switching to the semi-circular or horseshoe shape that some legislative assemblies prefer. Despite the truth to this statement, Churchill got it all backward. Biology teaches us that the environment shaped us first, then we got control of it, allowing us to engage in a process of self-shaping through the built environment. Before this privilege, the environment shaped us through constantly changing processes. This interaction between a cell and its surroundings, through various processes, is what ensured the cell's survival. Inside the cell, chemicals are constantly being released by biochemical processes to balance the environment's ongoing fluctuations. The *homeostatic balance* is a fundamental process in all living cells that aims to maintain the physiological processes of the organism within a constrained acceptable range (Damasio 2010). For example, if the environment is perceived as being too cold, the organism must account for the error (cold) by moving to a warmer location or by producing heat through shaking and regaining a sustainable balance. These adjustments need to be accounted for immediately as once the damage is done, it may be too late (Sterling 2012). Timing thus naturally plays an imperative role in avoiding death and eventually extinction.

Temporal concepts, such as dynamics and change, are important aspects of our biology. Nicholson and Dupré rightfully attempt to put time back into biology (Dupré 2014; Nicholson and Dupré 2018). They see biology as the study of dynamic processes that take place over time rather than mere static structures or systems. According to their argument, conventional biological theories have the propensity to emphasize reductionist and mechanistic interpretations of living things, which has hindered our comprehension of the complexity and diversity of biological phenomena. Instead, we should turn to a *processual philosophy of biology*, which acknowledges the significance of context, history, and contingency in influencing the evolution of life while embracing the complexity and diversity of biological processes. That is, we should not focus on the state of things, but on their *dynamics* and *development*, which is an inherent property of homeostasis. [5]

Sensing the world is an active process that unfolds in an oscillatory fashion (Buzsáki 2004; Leszczynski and Schroeder 2019). Instead of passively viewing the center and processing the relatively coarse peripheral information, when viewing a scene, we use saccades to move our fovea to various parts of the scene to create a fuller grip of the environment. This process depends on sensory and motor neurons, cooperating through functional synchrony and rhythmic activity. Note here the emphasis on *process* rather than *substance*. Stimuli, as referred to in cognitive neuroscience, are not individual discrete sensory packages of information independent of time. According to ecological psychology, stimuli are arrays of energy overlapping with responses eventually occluding one another. [6] This means that, at any given time, no stimulus can be thought of in isolation because it is always connected to both its previous and incoming stimulus and response (Gibson 1977; Spivey 2008). They co-exist due to co-conditional sensory and motor dynamics. Following this continuous process-oriented (as opposed to discrete substance-oriented) theory of cognition, the act of adaptation can be thought of as the synchronization or temporal alignment of neural rhythmic behavior (Singer 1999).

Adaptation emerges from our embodied and active engagement with the world ensuring a coherent fit between an organism and its environ-

5 Homeostasis also has a predictive version referred to as *allostasis* (Sterling 2012). This view suggests that the changes need to be done before they damage occurs, otherwise, it is simply too late. Allostasis is different in the sense that it attempt to predict outcomes before they occur.

6 We could ask ourselves: what came first, the perception or the action? This is an age-old debate famously discussed by the psychologist William James on the topic of actions and emotions (see, for example, James-Lange theory).

ment. This particular view is referred to as *enactivism* (Thompson 2007; Varela, Thompson, and Rosch 2016). It is an approach to cognition and behavior that emphasizes an organism's sensorimotor capacities and body, essentially viewing cognition and behavior as ongoing, dynamic processes that are tightly intertwined with our bodily experiences and our interactions with the environment. Any moment is thus an adaptative process from the prior moment toward the future moment, making enactivism a future-oriented take on human nature.

Our future actions can be thought of as the function of perception. Or better yet, perception serves as *embodied predictions* (Clark 2015; Friston et al. 2017). Enter *affordances* (Gibson 1986). Affordances are a fundamental idea in enactivism. They refer to the possibilities for intervention and action that the physical world offers and are determined by the "fit" between an organism's physical structure, capacities, and the action-related properties in the environment (Clark 1999). Enactivists contend that these affordances are jointly constructed by the organism and its environment rather than being inherent properties of the environment. This means that an organism's sensorimotor capabilities, prior experiences, and context all influence how it perceives affordances — but how about atmospheres? What does atmosphere have to do with our nonconscious adaptive skills, our enacted being, and now affordances?

So far, I have suggested thinking of the atmosphere as the backdrop to our everyday life, constantly affecting us. Instead of considering what it is like to experience an atmosphere, I suggest approaching it through its effects, which makes it tractable. The evidence presented suggests that we couple with the environment nonconsciously expressed through

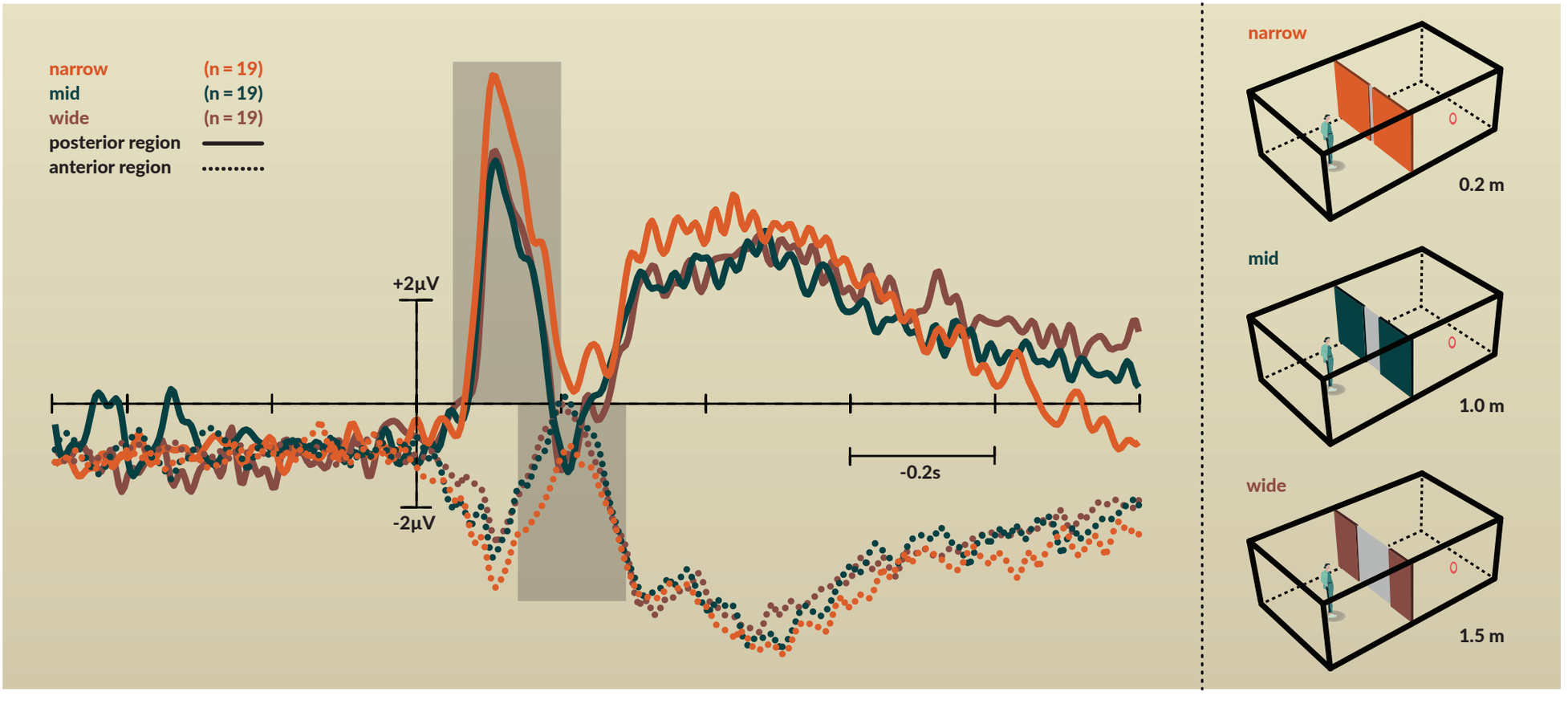
our adaptive behavior. More specifically, it is suggested that peripheral information, though unnoticed, is phenomenologically rich, in the sense that the sensorimotor dynamics we suppress are informative in a nonconscious way. And now, we have established that affordances shape these dynamics — at least, that is the hypothesis.

Sensorimotor Brain Dynamics and the Built Environment

The hypothesis can be stated more precisely: we should be able to measure systematic changes, covarying as a function of the perceived affordances over the sensorimotor brain region. This was precisely what we did in two studies in Berlin, Germany. The first study attempted to understand the temporal relationship between *perceptual processes*, e.g. visual cortex, and *motor-related processes*, e.g. motor cortex, by asking participants to pass through a door into another space (Djebbara et al. 2019). Equipped with virtual reality (VR), a mobile electroencephalogram (EEG), and 120 m^2 of laboratory space, we had the kind of control necessary for such an experiment. Participants' task was as simple as waiting till the door turned either green or red, signaling whether to pass or not to pass, respectively. Should the door turn green, their task was to pass into the second space and look for a floating red ring, which would elicit a monetary reward upon touch. By manipulating the affordances of an everyday object, like the door, we wanted to understand how the perceptual and motor-related processes were affected by changing affordances, that is, a 1.5-meter wide passable door, a 1.0-meter wide passable door, and a 0.2-meter narrow impassable door.

We found that perceptual processes related to passable doors occur in very similar ways, however, the impassable door was processed signifi-

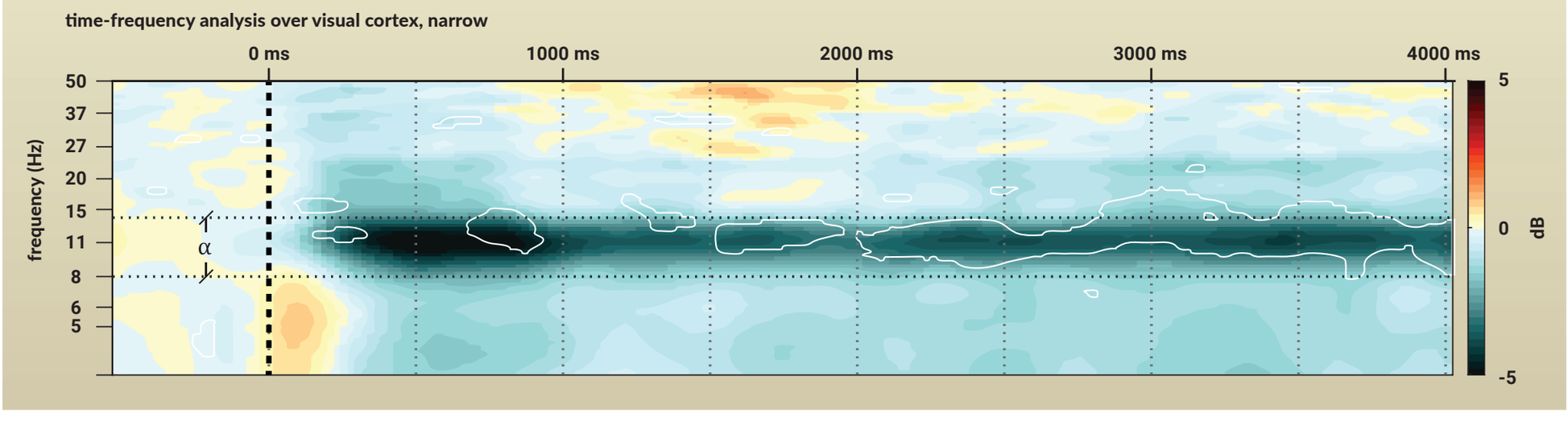
F1 The right-hand diagrams depict participants in three rooms, each with a door varying in width that either allows or forbids them from moving into the next room and offers a variety of affordances. The left side of the figure displays the event-related potentials measured over the visual and motor cortices. These are scalp-recorded voltage fluctuations that are time-locked to an event and reflect stages of information processing in the brain. They reflect the summed activity of postsynaptic potentials generated when many synchronized firings of cortical pyramidal neurons with similar orientations occur when processing information (Luck 2005).



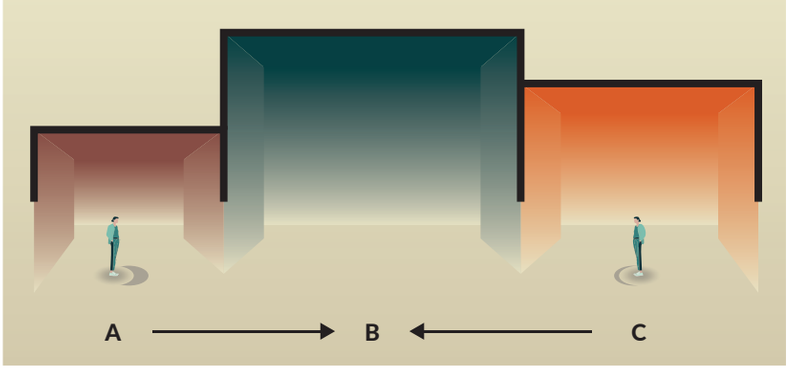
F2 Event-related spectral perturbation (ERSP) over the visual cortex for the narrow condition. The brain operates in distinct frequencies. Approaching a door that does not afford passing is expressed as significantly stronger alpha (8–12 Hz) suppression. For full details see Djebbara, Fich, and Gramann 2021.

cantly differently from the other conditions. This was also discovered to be the case over the motor cortex. Interestingly, we found that the processes related to sensorimotor dynamics are coordinated, meaning that the question "how can I act?" is tightly linked with "what do I perceive?" emphasizing the *action-perception cycle* relevant to architecture [**F1**]. These results are based on the immediate perception of the door, however, everyday interaction is, surprisingly, interactive. Approaching a door that does not afford to pass is expressed in the brain as a significantly strong alpha suppression over the visual and motor cortex [**F2**].

Surprisingly, the suppression is continuous suggesting that the affordances are continuously affecting us. These results reflect the importance of thinking in time when designing experiences as the immediate past will determine the start-position of the present, which again will affect the future. We can hardly think of any experience without situating it in time. The same goes for atmospheres. They are extended in time, and because sensorimotor processes operate in rhythms we can think of atmospheres as the slow background rhythms operating in the background, setting the stage for all other processes.



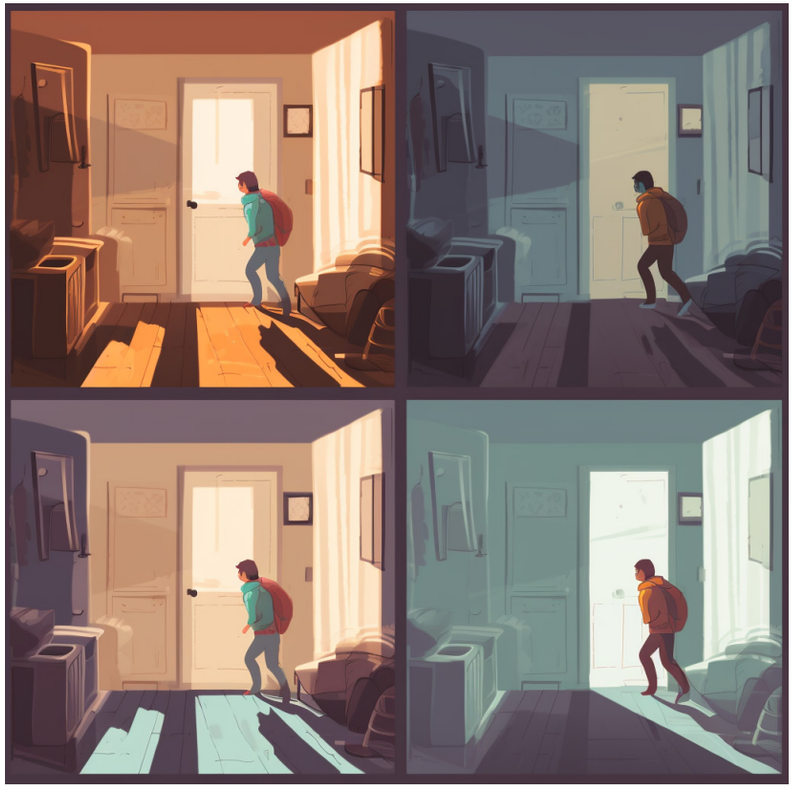
F3 A thought experiment of transitions to emphasize the importance of time when thinking about the experience and impact of the built environment. With three different spatial configurations, will the experience of space B be similar if we approach it from space A or space C?



Rhythms of Atmosphere

To be sure, the claim is not that atmospheres have fingerprint cortical waves directly measurable from the scalp. The claim is rather that when we are not consciously aware of them, they exist in our sensorimotor suppression space with specific shapes and dynamics, which all matter to our current behavior and experience. Once again, I need to invoke the temporal aspect of human experience and physiology. However, this time through a thought experiment [**F3**]. The experiment is about comparing experiences to test for their uniqueness. Consider a sequence of three spaces, A, B, and C, each with its own spatial configuration and atmosphere. Imagine walking from space A to space B, and conversely, imagine walking from space C to space B. Is your experience of space B comparable in the two situations? Our intuition, for lack of a better word, rings the alarm; these are two different experiences. Our present is constituted by our immediate past and immediate future (Husserl 2001) and because our immediate past when arriving at space B is different in the two situations, they cannot be the same experience. This thought experiment has several limitations, but it conveys an important observation about the immediate human experience, name, that there is a principle of *continuity* (Fuchs 2007) that constantly integrates our immediate past with our immediate future, that is, integration between our sensory and motor capacities, where the *trajectory* matters. Note that we are dealing here with the immediate timescale, which is not to say that the history of the perceiver does not matter — quite the opposite (Albarracín and Wyer 2000; Raviv, Ahissar, and Loewenstein 2012; Brügger, Demski, and Capstick 2021). The resulting perception can thus be thought of as an immediate contrast between the past and future, which is an essential insight from Husserlian phenomenology (see, for instance, Bogotá and Djebbara 2023).

F4 Variations of the same scene with different atmospheres. Although we fixate on the person in the picture, our peripheral vision continuously informs us about the atmospheric quality of the scene. This series of pictures do not make justice to this real-world effect, however, it captures the gist of it.



My insistence on the position of atmospheres as the backdrop stems from two insights. First, attention is a funneling skill that gives us tunnel vision by suppressing all peripheral information. Experiencing atmospheres encompasses all of our sensory qualities, requiring us to become sensitive to all such qualities at the same time over some duration to bring them to the foreground to become fully attentive of an atmosphere. This is initially an extremely effortful exercise as most practitioners of (open monitoring) meditation know (Lutz et al. 2008). It is thus not unthinkable that the effortless and typical everyday interaction with atmospheres occurs in the background, available if needed, but not part of the tunneled vision. Second, contextual information is a great predictor of human experience, cognition, and behavior because it provides important cues that help us interpret and understand the world around us. For instance, a given object may be viewed and used differently depending on the context, and a given behavior may be interpreted differently based on the context.

This is hardly news for either scientists or theorists. We know that deep contemplation works in some surroundings better than others. We also know that we behave differently if there are other people around. We also know from the vast amount of visual illusions that contextual information affects our perception — for instance, the perceived color of the black/blue and white/gold dress is negatively correlated with the assumed illumination along the daylight locus (Witzel, Racey, and O'Regan 2017). In the context of atmospheres, the character of the space, for instance, through changes in light, can have a fundamental impact on our experience of the very same [**F4**]. Natural lighting conditions in specific atmospheres, e.g., sunsets or sunrises, can be thought of as a very slow environmental rhythm operating in the background. As hu-

7 By *environmental view*, I mean a view that includes the features of the environment when considering cognition and behavior. Something similar has been suggested by extended (Clark and Chalmers 1998) and grounded (Barsalou 2008) cognition, and more generally in 4E cognition (extended, embodied, embedded, and enacted cognition: Newen, De Bruin, and Gallagher 2018).

8 *Cortico-cortical connections* simply mean "from neocortex to neocortex." The neocortex is generally shortened to cortex in the literature. However, thalamo-cortical connections mean "from the thalamus to the cortex," while the opposite means the descending direction, i.e., cortico-thalamic connections mean "from the cortex to the thalamus."

man-made atmospheres can change with a greater pace, from space to space, the rhythm can be considered to undergo a phase reset whenever we enter a new space (Zumthor 2006).

Placing atmospheres in the background consequently means raising its potential effect on our experience, cognition, and behavior. How does this "environmental view" [7] fit with the neuroscientific perspective where cognition and behavior are assumed to emerge from the interaction between major brain regions? In answering this question, we discover the importance of a very specific region in the brain, namely the *thalamus* — also known as, "the neuroscientists' graveyard" simply because it is a massively complex and dense region that many scientists have spent their careers understanding without much luck (Fiebelkorn and Kastner 2019). Are we going to fare any better?

Transthalamic Transmission

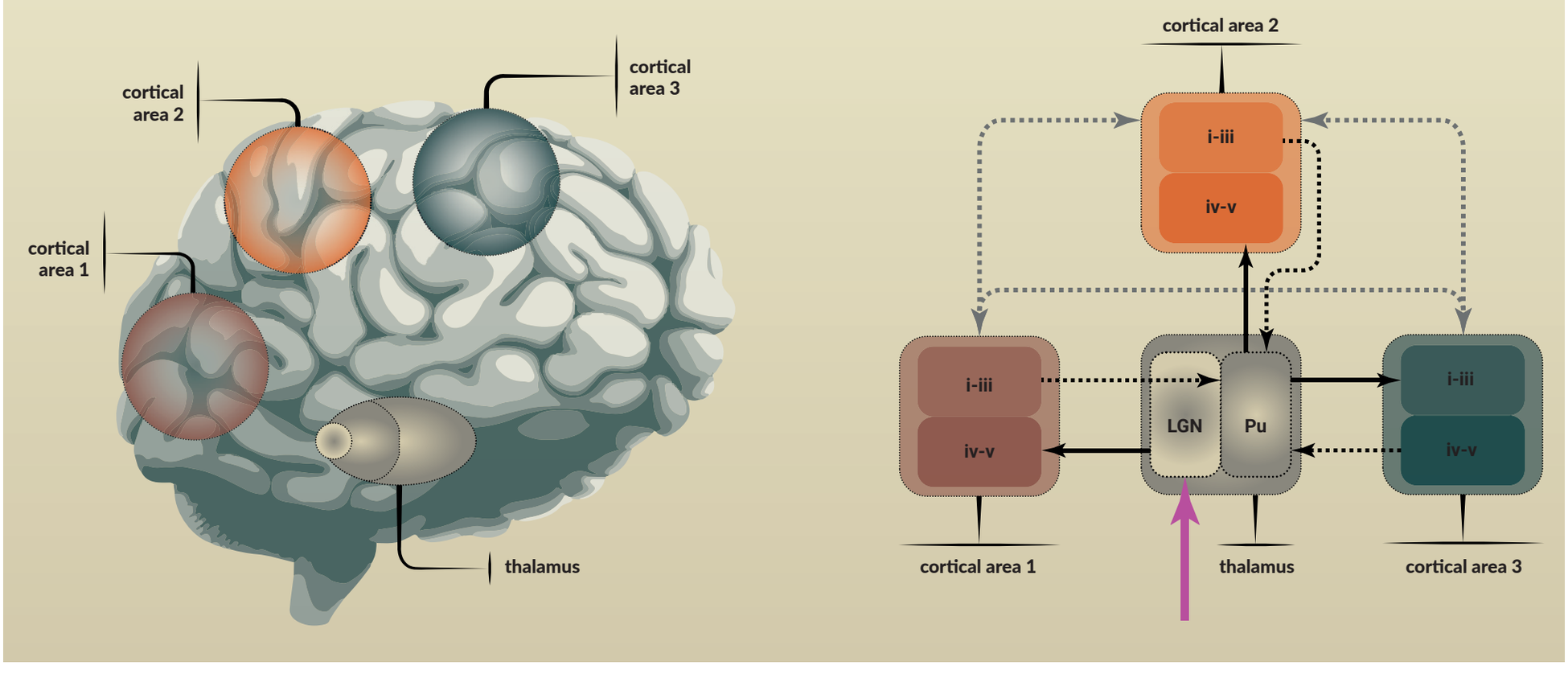
Anatomically, the thalamus can be parcellated into approximately 60 different small nuclei, linked with the cortex in distinctive ways (Jones 2007). A specific challenge lies in understanding the upward and downward connections between the cortex and the thalamus. All ascending sensory information (safe olfactory) passes through the thalamus before entering the neocortex from where it appears to be behaviorally and cognitively useful (Buzsáki 2019). The thalamus is a hub at the center of the brain, in a subcortical area alongside other deeply important structures relevant to movement and sensation (Cover et al. 2023). Indeed, motor-related processes too are known to be deeply involved in subcortical connections giving rise to basic cognitive skills, such as learning, memory, and attention (La Terra et al. 2022; Wolff, Ko, and Ölveczky 2022).

Traditionally, the thalamus is considered a relay station that gates and suppresses irrelevant sensory information so that the neocortex could operate on the currently relevant information. For instance, at a cocktail party, we can suppress the noise from other ongoing conversations and listen to the person in front of us. This view of the thalamus naturally paved the way for thinking that consciousness, which after behaviorism is considered an important factor for cognition and behavior, would emerge from cortico-cortical connections [8] (Rees, Kreiman, and Koch 2002; Dehaene and Changeux 2011; Koch et al. 2016). From this perspective, sensorimotor-related processes stemming from the thalamus are considered nothing but representations of the world with the sole purpose of representation; the cognitive process occurs in the neocortex, particularly based around the functions of the prefrontal cortex (Brown, Lau, and LeDoux 2019).

In contrast, the transthalamic perspective suggests a form of interregional communication that utilizes the thalamus as a crucial transmission center (Sherman and Guillery 2011; Sherman 2016). It is believed that this kind of transmission is critical for supporting fundamental cognitive abilities and functions like memory, motivation, attention, and perception (Saalmann et al. 2012; Schmid, Singer, and Fries 2012). That is, these pathways enable communication between various brain regions, that is, cortico-cortical connections, through the thalamus and thereby creating cortico-thalamo-cortical pathways, which can aid in integrating and coordinating cognitive processing across various brain regions (Kastner, Fiebelkorn, and Eradath 2020; Eradath, Pinsk, and Kastner 2021).

The transthalamic view results from the bottom-up, ground-work done in the laboratory at the level of single neurons and slices of rat brain (Sherman and Guillery 2006). It was discovered that the thalamus re-

F5 The left side portrays the position of the thalamus and the cortical areas relative to each other (for cortical areas relevant to the built environment, see Djebbara, Fich, and Vecchiato 2022). The right side portrays their connections, where the dashed lines represent the higher-order connections, the solid lines represent the first-order connection, and the gray dashed lines represent the cortico-cortical connections. The magenta arrow represents the ascending peripheral sensory information. The Roman numerals represent the layers in the neocortex. This schematic is highly simplistic example of the relationships (LGN: lateral geniculate nucleus; Pu: pulvinar).



9 Due to the enormous amount of downward projecting connections from several major brain regions, among other things, it is thought that the neocortex is in the game of generating predictions about the world. In other words, this view suggests that our sensorimotor processes rely less on first-order inputs and more on higher-order feedback inputs from the cortex (Wolff et al. 2021).

ceives direct peripheral sensory information and projects (or relays) sensory information upwards through *first-order* connections to the cortex. A textbook example is the lateral geniculate nucleus (one of many nuclei in the thalamus), also known as the LGN, projecting visual information to the primary visual cortex. Another kind of connection is known as the *higher-order* connection, which is thought to play a critical role in the integration of information among distinct brain regions, being strategically placed to bridge information through downward connections [**F5**]. The exciting part [9] is that the number of downward connections, that is, cortico-thalamic connections, outnumber the upward connection by 5-10 fold (Guillery 1995), suggesting that these connections may not only be associative but also have a feedback role allowing for the bridging of several cognitive processes (Wolff et al. 2021).

The difference is clear; the former perspective is centered around cortico-cortical connections, which is arguably the dominant perspective in the literature, while the latter perspective emphasizes the thalamus and bridging of information in cognition. Only the former considers the structure of the sensory information and allows it to have a structural impact on the cognitive and behavioral processes. In other words, instead of basing cognitive and behavioral processes on (dead) representations of the environment, as in the former perspective, the latter is susceptible to the (lively and rich) dynamics of the environment. If the transthalamic perspective is right, what are the next steps to understanding atmospheres from a neuroscientific point of view?

There is growing evidence that information transmission through the thalamus is critical for the communication between major brain regions empirically (Saalmann and Kastner 2009, 2011; Cover et al. 2023) and computationally (Cortes, de Souza, and Casanova 2020; Cortes et al. 2021; Worden, Bennett, and Neacsu 2021). Higher cognitive skills and behavior depend on major brain regions communicating, meaning that if atmospheres may affect the transmission in the thalamus, then atmospheres may affect us to a greater extent than expected. Note that this view does not attempt to understand the experience of an atmosphere, but *the effect on our human skills*. The skill and behavior are in the foreground while the atmosphere remains in the background, affecting us implicitly. That is, atmospheres affect our adaptive behavior through its susceptibility to ongoing sensory (suppression) dynamics that goes unnoticed due to our limited attentional resources.

The hypothesis is that if atmospheres affect us through their background presence, limited to our sensory suppression of sensorimotor information, then it should be expressed in the transthalamic pathways as a function of affordances. This view rests on the following three premises:

> the examples of *nonconscious adaptive skills* were based on sensorimotor brain dynamics;
>
> the *sensorimotor brain dynamics* are directly related to cognition and behavior;
>
> the *suppression dynamics* are actively relevant and integrated with ongoing neural processes, consequently affecting *cognition and behavior*.

If these three premises are correct, we have reasons to believe that the everyday atmosphere is constantly, in a nonconscious fashion, affecting us through phenomenologically rich, yet unnoticed, *suppression dynamics*.

10 "Neurophenomenology and Sacred Architecture: Toward an Experimental Theological Aesthetics" Symposium, School of Architecture and Planning, Catholic University of America, Washington, DC, March 23–25, 2023.

Coda

All of the above does not in any way resolve how to design atmospheres. Rather, I have provided a framework for studying the impact of atmospheres — a critical step in the process of crafting them. The act of designing, as a whole, is an arduous undertaking, which makes the creation of *guidelines* and *rules* equally challenging. Guidelines and rules of design are closely related to the idea of optimization, in the sense that some designs are considered superior to others. Before this conference, I presented at Julio Bermudez's symposium, named "Neurophenomenology and Sacred Architecture," where sacred experiences were the focus. [10] With the presence of architects, design guidelines and rules were again considered as they have an instructive power similar to a recipe. Admittedly, the discussions that emerge after a series of presentations over a few days, tend to be the most thought-provoking and captivating ones. However, post-conference discussions are also somewhat like shower-thoughts; you realize new relations and think "this is what I should have said!" At least three important points were raised during my post-conference shower that I will speculate about below.

First, the *challenge of generating design guidelines and rules* is a recurrent theme in the field. There are several ways research can be materialized by architects. One is to convert scientific results into building regulations and laws, which is essentially a top-down approach. Alternatively, a conversation between scientists and architects on how research could improve their unbuilt projects suggests a bottom-up approach where the architect is included in designing the guidelines. The challenge lies in how to shape such guidelines; *affirmative rules*, that is, "here are what you need to do", or *restrictive rules*, that is, "here are what not to do." Affirmative guidelines suggest, in the positive, what should be done, whereas restrictive guidelines prohibit certain actions and solutions. Providing a set of affirmative rules to a group of architects will eventually result in projects with limited variation, which is the hallmark of the death of creativity. However, provide a set of restrictive guidelines and we might expect highly varied projects, which is the hallmark of creativity. Just like how doctors study the principles of a healthy and functioning body, and how mechanicians study the principles of a functioning car, architects need principles on the effect of the built environment on cognition and behavior. Though not applicable to the doctor's case, the principles of a functioning car depend on the design of the car, and this is exactly what complicates the case for architects and other creative fields. The principles themselves need to be designed and translated from the literature. Evidence-based design requires a process of translation and interpretation, which will be contingent on the interpreter.

On the other hand, it is assumed that the current scientific results are mature enough to be considered as guidelines, while the truth is that most research in our field is not ready for implementation. Essentially, because being an architect requires engaging with a creative process, the knowledge accumulated in science simply needs to be available and accessible. My hunch is that neither affirmative nor restrictive guidelines can be general enough to work by principle. Instead, there is a need for *principles that describe functional relations between the human body and the built environment* from which the designers can create personalized interpretations. This is a much harder task as the scientific field has simply not matured to generate such principles.

This brings me to the last and final point; there will be a need for a new profile in the architectural industry. Research and development are

gaining popularity with architectural firms, as they realize their potential in several aspects. For instance, developing customized solutions to create performative projects, engaging with innovative solutions providing a competitive edge, generating measurable sustainability solutions, producing new business opportunities, and evaluating existing projects to enhance predictability for future projects. From a scientific perspective, this calls for a profile that can function as the bridge between the scientific literature of cognitive neuroscience to assess the projects and the architectural design process. *Assessment* and *evaluation* will become key skills alongside the *capacity to translate science into design principles*.

As Elisabetta Canepa said during a discussion on this topic: "the role of this new profile could be to act like a coach. The coach does not touch the ball but evaluates and assesses the work of the team to improve the outcome." *Every project is unique*, making assessment and evaluation invaluable as they are necessary to understand how that specific finalized solution affects its users, which will consequently improve future projects. I resonate beyond any doubt with this statement, and perhaps even more with Robert Condia's take on teaching architecture, which is arguably the role of a research department at an architectural firm. Paraphrasing his take, he stated that becoming an architect is a deeply personal journey that cannot be imparted by others through teaching alone. The desire to shape the world through design is the driving force behind this profession, and it is this motivation that can be cultivated and nurtured through mentorship and coaching.

Conclusion

The atmospheres of our everyday life speak to all of our senses, making them experientially entangled, indistinguishable, and infamously ineffable. The ineffability associated with atmospheres is both what makes them intriguing and attractive, but also what makes them scientifically intractable. In my attempt to make them tractable, I have demonstrated how the *peripheral sensory information*, though unnoticed, does not go lost, but is utilized for nonconscious adaptive skills. Specifically, I have provided some evidence for how sensorimotor dynamics display nonconscious adaptive skills, constantly informing our every move, and how sensory suppression in everyday experiences consequently remain phenomenologically rich. As atmospheres operate in the domain of our peripheral senses, that is, the backdrop to our lives, it is suggested that their impact occurs through nonconscious adaptive skills that in turn are expressed in transthalamic pathways. In my pursuit of tractability, I have suggested a potentially fruitful approach to the quantification of the *effect* of atmospheres [11] through transthalamic processes. The elusive nature of atmospheres may seem daunting, but it is precisely what draws us to them. So let us embrace the ineffable and allow ourselves to be inspired by their nonconscious effect that connects us to the world around us.

11 Not to be confused with the *experience* of atmosphere.

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Figure generated using Midjourney.

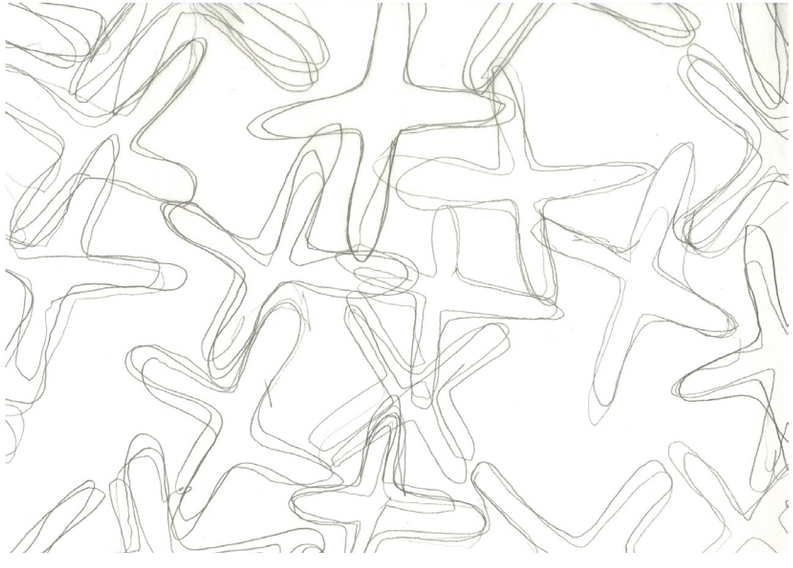
Kory Beighle

A History of Tool-Atmospheres

Abstract
In recent years, the question of architectural atmospheres has taken on an emerging vitality. Regardless of what one identifies as the point zero of these emerging discussions, as with many developments in our discipline, we must consider to what extent these movements have been and continue to be a fashionable trend, and to what extent they are a part of a longer, more substantial trajectory within the architectural discipline. At the same time, an understanding of the network of discourse that this line of inquiry is engaged with might also suggest where the trajectory is leading. Developed through the lens of numerous historical reference points, the central argument here is that the question of architectural atmospheres has been embedded in the discipline of architecture since its foundations, not just because of an explicit interest in the topic, but because of the implicit nature of disciplines and their engagement with technology as a mediating force of the natural environment. Building from an understanding of architectural practice as a process rooted in and growing from architectural tools, we will consider the nature of these tools and demonstrate the ways in which the atmospheres architects create are tied directly to the tools they engage and the collective human consumption of their work. A theory of tool-atmospheres is developed as a way of informing, not only a historical narrative of the trajectory of atmospheres but as a methodology of understanding the ways in which emerging tools engage the process of creating the atmospheres of today and tomorrow.

Keywords
architectural discipline
atmosphere
history of atmospheres
tools
tool-atmospheres

F1 Drawing the air film
Capturing atmosphere



1 Borrowed from Brigitte Labs-Ehlert and the introduction to *Atmospheres: Architectural Environments. Surrounding Objects* (Zumthor 2006), where she suggests that "for Peter Zumthor, atmosphere is an aesthetic category"(2005, 7).

2 This notion of harmony could be linked to Zumthor's discussion of "coherence" toward the end of his book *Atmospheres* (2006, 67).

3 This turn of phrase is inspired by reading Zumthor's *Atmospheres*, where his notion of the "tension between interior and exterior" (2006, 45) as well as other passages express an interest in the space between two categories and an opening up or a sense of expansiveness between directly experienced character and a less accessible inner character, where the tension of this opening is where atmosphere might reside.

The Contemporary Question of Atmosphere

In recent years, the question of architectural atmospheres has taken on an emerging vitality [**F1**]. Regardless of what one identifies as the origin of these emerging discussions, as with many developments in our discipline, we must consider to what extent the discourse has been or is a fashionable trend and to what extent it is part of a longer, more substantial trajectory within the architectural discipline. At the same time, an understanding of the network of discourse that this line of inquiry is engaged with might also suggest where the trajectory is leading.

To that end, we reflect upon the question of atmosphere from an architectural and a historical perspective, which can be defined as "what do we intuitively define atmosphere to be?"

> a mood;
> an aesthetic category; [1]
> a harmony between space and place; [2]
> the space between the outer beauty of a thing and its inner beauty, which is to say the space between measure, proportions, and materiality on the one hand and the core of a thing on the other; [3]
> or, perhaps, simply the quality of a thing; [4]
> an impression that a space makes and leaves. [5]

When one thinks of atmospheres in architecture, what comes to mind? Images flood forward from the *memory* banks, and they cannot help but be personal:

> standing in the Pantheon on a light-filled summer day, trying to capture a photograph of the light washing from the oculus, along the coffering;

4 Almost immediately in *Atmospheres*, Zumthor brings up the idea of "quality" (2006, 11), as if it is a primary aspect of concern to the general question of atmospheres.
5 In the second paragraph of *Atmospheres*, Zumthor discusses the "first impression" that a space leaves (2006, 11), where impression would seem to be about the way the space moves him or has an impact. The *force of the space* is what causes impression.
6 Meaning in English, "Imaginary Prisons."

sitting on the cool, marble floors of the Hagia Sophia and sketching the intricate, almost lace-like textures of the space's materiality;

sitting on the steps of the Duomo in Florence on a warm fall afternoon with good company as we watch the growing shadows;

walking up to Louis Kahn's Yale Center for British Art on a cold morning in February, with a subtle warmth of light and wood drawing me inside through the compressed corner entry.

But also, spaces I have never been and, in some cases, will never be able to go, come to my mind:

standing some distance away from the pyramids of Giza, with the heat of a dessert weighing on my body, but nowhere nearly as weighty as the gargantuan masses before me;

the pristine setting of the Ise Shrine with a multitude of ghostly traces — the past incarnations — hovering in the air;

the dark, shadowy spaces of Giovanni Battista Piranesi's *Carceri d'invenzione* (early 1770s)[6] or the vast volume of space in Étienne-Louis Boullée's *Cenotaph to Isaac Newton* (1784);

the voluminous sublime of John Russell Pope's Broad Street Station (1919), or similarly, the ghastly apparition of Arnold Böcklin's *Isle of the Dead* (1880), both of which I was first introduced to and fell in love with because of Peter Zumthor.

Reflecting upon each of these moments, one is struck by the realization that to think about architectural atmospheres is not merely to think about the spaces we have occupied and felt. It is something more. "What *more*?" is the question that must be reflected upon.

What More?

As many of us know, there has been a tremendous proliferation of discourse in recent years concerning the question of atmospheres in architecture. As has been pointed out by scholars such as Elisabetta Canepa (2022, 111), the *point zero* of this discourse seems to be the dissemination of Peter Zumthor's now seminal lecture entitled "Atmospheres: Architectural Environments. Surrounding Objects" (2006), which was presented in 2003 at the Festival of Literature and Music at the castle of Wendlinghausen (Germany). It was in reading this book as a young architecture student, which I was first exposed to John Russell Pope's train station in Richmond (Virginia) and the ephemeral work of Arnold Böcklin's canvas. Considering this and many of the other image-spaces Zumthor references alongside the published version of his reflection on the matter (2006) — the Palazzo Trissino Baston in Vicenza (1592), the Student Housing of Clausiusstrasse in Zürich (1936), Le Corbusier's Villa Sarabhai in Ahmedabad (1955), as well as Zumthor's own work for the Thermal Baths at Vals (1996) or the Swiss Sound Box at the Expo 2000 in Hannover just to name a few — it is clear that architects have been concerned with the question of *architectural quality* for a long time.

As a central reflection in his talk, Zumthor asks himself "what do we mean when we speak of architectural quality?" (2006, 11). He quickly

answers that question by indicating he wishes to talk about the ways in which a building, or even simply an image of a building, "manages to move" him (2006, 11). This is an important idea that should be built upon. Zumthor does so in his talk, but it is primarily toward the development of twelve components that combine to create the fabric of atmosphere. What Zumthor does not address directly in this discourse is the historical trajectory he is engaging with. Zumthor's commentary suggests that to understand the history of atmosphere, one can zoom out for a moment to understand both, what is creating the atmosphere and the process by which it is created.

Impression

To consider how atmosphere is formed and the process of its becoming, one can begin with the idea of movement, or perhaps a word more appropriate to Zumthor's line of inquiry, the idea of *impression* — making and subsequently leaving a mark (2006). The reflection can begin with the image of a hammer striking a surface, perhaps wood, and we can visualize in our minds the impression that the force leaves on the wood. The echo of that force is left upon the receiving material. One can strike the material, hammer in hand, over and over again. Mark after mark can be left, each one proportional to the force of the subsequent blow. There are individual impressions, but also a collective impression left upon the forever changed material. With this image in hand, one can argue that the places humanity creates are each a tool, just as this hammer, and that as our capacities to design and produce built form grows, so too does our ability to wield the built form as a tool, perhaps with greater precision or with greater force, to create an impression upon those who experience the places we actualize in the world.

7 In the context of the presentation of this work (Interfaces 2023 Symposium), an actual saw was used to demonstrate the point.

8 For further development of this question, see Beighle 2020 and Gänshirt 2021.

Thinking again to Zumthor's lecture (2006), we can see this is the entire point of his reflection: to develop an understanding, first for himself and then for others, of the ways in which space affects him and, in turn, which facets of spatial production he can focus upon to affect an impression upon those who encounter his products.

Tools, the multi-faceted implements, which individuals create to work upon the world beyond themselves, are often taken for granted. As such, in the passing of our everyday lives, we may not think much of the complex, layered characteristics of a tool, but upon reflection, one principal aspect of every tool is the *atmosphere* that it creates while it is being engaged, or perhaps we might say, while it is in use.

Consider a bright red circular saw sitting on the ground. It is simply there, and it holds the *potential*, but also the *actuality* of atmosphere — two simultaneous states. As I pick up the tool and pull on the trigger, it leaps to life, and without question, we are all *moved*.[7] Hearing the violence of the blade and the gears within turning, one might jump with a note of fear, while another feels a jolt of adrenaline; perhaps another feels their hair stand on end with excitement, while others move to cover their ears — the noise is just too much. If I placed the blade against a piece of wood, it too is moved, and the kerf is efficiently removed as the blade rotates and acts upon the material. The tools of the architect are just this way as well, but perhaps we do not often enough consider it so.

What are these *tools*? Is there even a limit to what an architect might call a tool?[8] Addressing this is not precisely our charge for this moment, but regardless of how far we might push the boundaries of the architectural tool, certainly, we can agree on a few, taking for instance various

forms of architectural drawing — a plan, section, axon, or perspective perhaps; then there are our 3D tools, a model or a detail mockup, even the building itself. Each of these tools acts upon different materials in the world, but certainly each of them creates an *impression* as it communicates with materials in the world beyond the tool wielder and beyond the tool itself.

So, one might be asking, what does all of this have to do with the history of atmosphere? Why is it a necessary part of the discussion?

It would seem to me that if we come to understand the role of atmosphere in this way, through the lens of the *tool-atmosphere* [**F2**], there are two or more trajectories it may open for us. The first paths we can begin to understand are the *why* and *how* atmosphere has come to be with the architect (be they makers of built form or even more simply as conceivers of space in visual, imagined landscapes or various alternative mediums), at least to the extent that these tools are being used to work upon the world. If any given tool has an atmosphere inherently at its core of being, then an awareness of how to shape that core and wield it is at the heart of the use of any tool. The second path directs us toward an understanding that we can expand the ways in which we talk about and draw connections between different atmospheres within the architectural discourse, potentially creating a common line between the work of the ancient Egyptians and the imagined visions of Boullée, or perhaps the work of the contemporary atmospherologists and Piranesi. It is all part of a common heritage, and it is so because atmosphere is a core characteristic of the tools of architectural work.

F2 Tool-image
Take 01

9 Spanish for "Cave of the Hands."

A Historical Primer

The central argument here, that is, the question of architectural atmospheres has been embedded in the discipline of architecture since its foundations, not just because of an explicit interest in the topic, but because of the implicit nature of the discipline and its engagement with technology as a mediating force of the natural environment, should be developed. Building from an understanding of architectural practice as a process rooted in and growing from architectural tools, we can consider the nature of these tools and demonstrate the ways in which the atmospheres architects create are tied directly to the tools we engage and collective human consumption of architectural work. So let us tease this out over the long arc of history. Perhaps we start from the beginning or something near it, a point near the limit of our current knowledge, at a time when humanity was a nomadic people, at times dwelling in caves.

We can reflect for a moment upon the ancient cave paintings seen around the world. Perhaps any might do, but the dramatic red handprints, covering the walls of Cueva de las Manos[9] offer a moment where the space and tool are linked almost directly. The walls of the cave are layered with handprints on the wall, cast as a negative, where a deep red hue of pigment is blown over the hand, which was held against the wall, marking the negative image of the hand's occupation of space. These hands are layered one over the other in a dramatic expression of this field of beings placing their hand on the wall and reaching through time toward the moment we now stand within. The *human hand* becomes something of a time machine as it works upon both space and time to link distant beings — the atmosphere between one moment and the other is the link.

Moving forward in time, the thermal baths of Rome come to mind. Perhaps we specifically consider the Baths of Caracalla, built in the third century CE. Even to this day, walking through the ruins, one can feel the vigorous movements of many Roman *bodies* in the space. One can feel the temperature change from space to space embedded in the thickness of the walls and the occasionally elevated floor plinth where heat was conveyed into a bath. The built space was a tool that acted upon the inhabitants of the space with a sense of harmony between a collective cultural act and the grounded physicality of the light washing across the massive volumes that formed that space. There is a beauty in a space like this, even in looking upon the weight of its ruin, which was ingrained in the core of its conception as a tool to work upon the social order of ancient Rome, though they were not able explicitly to refer to the shaping of atmosphere, the word would not even be part of the human lexicon for centuries (Canepa 2022, 44–46). Noted architectural historian Alberto Pérez-Gómez links the development of atmosphere in Roman thought, specifically through the lens of Vitruvius, to *harmony* when he writes that the "order drawn from the heaven's start dance is evidently symbolic of cosmic *armonía*" and he goes on to indicate that this *armonía* "is equally connected to the experience of nature, namely the experience of air, *atmosphere*. It is linked with the invisible winds (breath, spirit) that bring about changing qualities" (2016, 44). According to Pérez-Gómez,

> For Vitruvius harmony is the fundamental quality of beauty (*venustas*), literally sexual attraction: an arrangement of parts that seduce the user/observer and creates a significant, "well-tuned" space for human activities, *the right atmosphere*, in turn, leading to a wholesome, healthy, and meaningful life. (Pérez-Gómez 2016, 43: original italics)

The Romans clearly maintained a sensitivity toward the quality of built space, understood through the lens of harmony.

This Roman attitude is one that can be seen in continued propagation, whether through written treatises or simply in the spatial artifacts that are seminal buildings over time. For example, moving forward to the Renaissance we can ignore the written context for a moment and merely observe the physical artifacts of work such as Filippo Brunelleschi's San Lorenzo in Florence. Reflecting upon the quality of the nave for instance, there is an underlying harmony between the cool rationality of the rigorously applied ordering system and the cool grey of the *pietra serena*, the grey sandstone applied liberally within the space, casting an intentional atmosphere that works upon an inhabitant to as the physical arrangement of space and the mood of the place are unified. In a similar way, one can read the same kinds of harmonious expression between ideal and built form in works such as the rough edges of Palazzo del Te in Mantua as the reaction against the cool rationalist of the early Renaissance. Still further, one could consider the opalescence of the Baroque and Gian Lorenzo Bernini as expressed in the experience of Sant'Andrea al Quirinale, Rome. The space itself and our perception of its atmosphere is a tool to convey *meaning*, but a meaning made even more forceful by the harmony between facets of the spatial tool such as the spatial composition and its material character.

Centuries further forward in time, the industrial revolution comes with its own character. We can think of the soot-filled cities of European progress that we can recall to this day through imagery like Charles Marville's photographs of Parisian slums from the late 1870s. As architects at the turn of the twentieth century considered the almost hellish landscape created in certain parts of Europe by the technological revolution at hand, a pressing need to create healthier environments emerged. We are led into the emergence of modernism in the wake of the First World War, and a search for a way forward, some embracing the *machine aesthetic*, but perhaps in service to *human health*. Idealist visions of the future seen in works such as Ebeneezer Howard's Garden City movement or Le Corbusier's Plan Voisin speak to architecture's desire to strike a balance between the quality of space and the emerging technological landscape. Seminal architectural expressions of this time, be they the clean white box of Le Corbusier's Villa Savoye in 1931, or the more humanist expression at Alvar Aalto's Paimio Sanatorium in 1933, each present artifacts shaped by the desire to create a healthier living environment, a tool born from atmosphere and spatial character.

As the modernist project continued in the aftermath of the global Depression and the Second World War, the modernity of works such as Ludwig Mies van der Rohe's Crown Hall on the campus of the Illinois Institute of Technology from 1956 present a different kind of cool rationality, but now articulated by an interest in the image of that rationality. The minimal articulations of the glass box are not the first thing one might typically think about when reflecting upon atmospheres. By some reports, the building is not always the most pleasant to occupy, and yet there is still an experienced harmony between the conception of the place and one's experience of the space that resonates as *quality* while one occupies the building. The experience of Crown Hall could be juxtaposed to another project conceived around the same time but completed a bit later in Sweden. Sigurd Lewerentz's project as Saint Mark's Church in Bjorkhagen from 1960 is clearly of a different character than Crown Hall, yet one might suggest its

quality exists in a similar way. The roughness of expression and the articulation of the parts — the surrounding objects — expose a resonance between place and space that exude quality. Window details of a simple clip tenuously holding a piece of glass in place with a heavily compressed joint compound repealing the elements establish an attitude in harmony with the heavy use of mortar to unify distinct and uncut brinks, which both resonate with a statement on part-whole relationships within the community of the church that need not be stated to be felt.

The work of Sigurd Lewerentz at Saint Mark's Church brings to mind the writing of his fellow Scandinavian architect Christian Norberg-Schultz who spoke of harmony through the lens of "'total' phenomena" that is not reducible to any specific property but rather is composed of "concrete things having a material substance, shape, texture and colour. Together these things determine an 'environmental character,' which is the essence of place. In general a place given as such a character or 'atmosphere'" (1979, 6–8). There is a link between the categories of "space" on the one hand and "character" on the other, and the suggestion that a quality *sense of place* may emerge from a harmony of these two categories. It is also interesting to note that, similarly to Pérez-Gómez, Norberg-Schultz also recalls links to ancient Rome in the development of his theory, explaining that the book's title *Genius Loci*, is rooted in historic reference to the Roman idea of the *genius* of a thing, which "denotes what a thing *is*, or 'what it wants to be,' to use the words of Louis Kahn" (1979, 18: original italics).

Moving forward from Lewerentz and Norberg-Schultz other seminal works at the end of the twentieth century continue to express quality in the harmony between the ideals of spatial production and the experience of the spatial-consumption. One intriguing reference from this time can be seen in the form of Peter Eisenman's design for the Aronoff Center at the University of Cincinnati, an addition to the institution's College of Design, Architecture, Art, and Planning (DAAP). The project, a space of learning how to be a designer, but also one of unease captures an essential contradiction in the process of learning about design of various kinds. Whether it was the explicit intent of the architect or not, the embodiment of this complex *paradox* creates a clearly felt atmosphere of confusion and confrontation that presents itself fully to casual visitors and long-term users alike. [10] Though the building is somewhat disconcerting to occupy, in a certain way, that experience expresses something about the architect's questions regarding the status of architecture at the end of the twentieth century in a way that perfectly syncs with the complexities of the process of producing such a building and the advancements of computer-aided draftsmanship that allow one to even conceive of a building so complex.

Conclusion

Each of these examples across the span of history, leading us up to our contemporary moment reinforce the earlier statement that architects have indeed been in tune with the harmonious expression of space and place within the conception and production of works of architecture across history. The language may well have ebbed and flowed through time, but the core principle that ideas and tools are capable of being wielded toward the shaping and re-shaping of the world beyond us remains a constant.

10 It is important to note that this author studied at the College of DAAP for more than ten years and spent a significant amount of time developing an intimate knowledge of the Eisenman addition.

A theory of tool-atmospheres is developed here as a way of informing not only our historical understanding of the trajectory of the issue of atmospheres, but also as a methodology of understanding the ways in which emerging tools engage the process of creating the atmospheres of tomorrow.

Moving through this historical trajectory, we are left considering what is to come. The tools of architecture are changing, but it would seem that something lies just behind the surface of the architectural discipline — a constraint, which is the work of architecture to craft a harmony and balance between a sense of place and the physicality of the space that place is crafted within — subject and object unified.

When we speak about quality in architecture and atmosphere, both in a historical sense and also in a contemporary sense, we are speaking about this *harmony*, a harmony that is ultimately brought about by our ability to intentionally wield our tools to form an impression upon the world beyond ourselves. This concept of the *tool-atmospheres* [**F3**] that is being developed in our discussion here can help each of us grapple with the actualization of our ideas in the world, whether they be images or built space capable of leaving an impact — capable of moving someone. What does this look like in our brave new world? That's for each of us to discover.

F3 Tool-image
Take 02

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Background for the historical primer

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Figure 1: © Kory Beighle, 2011.
Blind contour drawing of a novel construction unit.
Figures 2, 3: © Kory Beighle, 2015.

histrionics: Archaic English, “stage actors”

Harry Francis Mallgrave

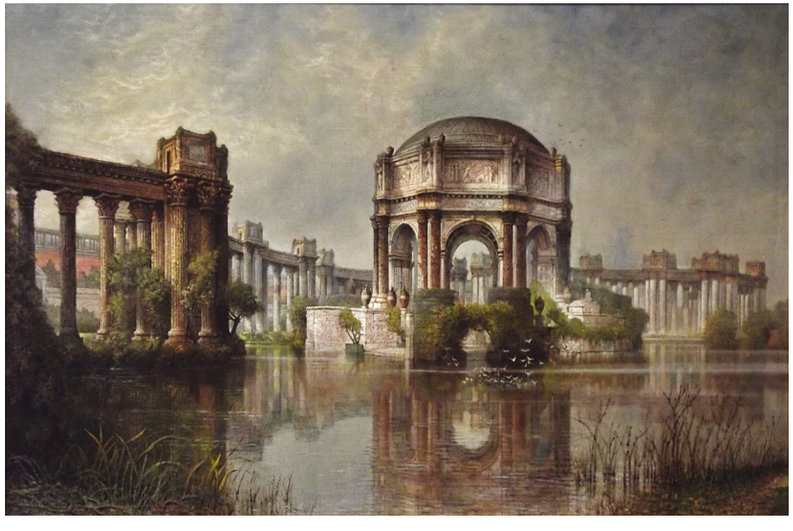
Atmospheric Histrionics

Abstract
Although the neologism “atmosphere” dates from only the seventeenth century, the idea of a building’s emotional resonance has always been central to architectural practice, going back to the first communal temples. Yet the rise of illustrated histories of architecture in the nineteenth century, with their focus on exterior building forms and their emphasis on stylistic and structural progress, tended to downplay the idea within practice. It would take the newer models of perception and embodied simulation around the start of the twenty-first century to center the idea within architectural parlance.

Keywords
atmosphere
historiography
architectural education
embodied simulation

F1 Edwin Deakin
Palace of Fine Arts and the Lagoon
Oil on canvas, c. 1915
Crocker Art Museum, Sacramento, long-term loan from the California Department of Finance

The Palace of Fine Arts was designed by Bernard Maybeck for the Panama-Pacific International Exposition, held in San Francisco, California between February and December 1915



It may seem axiomatic to say that architectural history always follows the building process, but then design is scarcely a mathematical field. It is not difficult to imagine a nineteenth-century designer working in a stylistic medium with a book from his library lying open on the drafting table, drawing inspiration (if not detailing) from a particular image. Travels and sketching may have allowed the designer to educate himself about the general currents of the past, but a published book with an abundance of images was an equally powerful stimulant in driving the eclectic tendencies of the era. If one is tired of the Classic or the Gothic, one could expand one's vocabulary with a book on the Moors or images from Siam. Here history not only advanced one's creativity but also drove building design [**F1**].

Admitting such raises an interesting question for this essay. How have historical studies themselves shaped the idea of *atmosphere* in building design? The word, as we know, is a relatively young term — first appearing as an English word in 1638, and then referring to the "vapor" (Greek *atmos*) surrounding the earth's sphere. The word acquired a broader environmental connotation by the early nineteenth century, and shortly after the mid-century found its way into the architect's vocabulary. In 1860 the German architect Gottfried Semper did so with particular flair when he pronounced it as the Dionysian lynchpin of his own design philosophy:

> I think that the *dressing* and the *mask* are as old as human civilization and the joy in both is identical to the joy in those things that drove us to be sculptors, painters, architects, poets, musicians, and dramatists — in short, every artistic creation, every artistic pleasure presupposes a certain carnival spirit, or to express myself in a modern way, the haze of carnival candles is the true atmosphere of art. (Semper 2004 [1860–1863], 438–439: original italics)

1 See Wright 1995 [1954], 127.

2 See Thiis-Evensen 1987, 387; Harries 1998, 125; Böhme 1993, 117–118.

The use of the word "atmosphere" became relatively common by the century's end, although it was not emphasized as an important dimension of design. Frank Lloyd Wright, who in his multitude of writings seems to have employed the word on more than fifty occasions, viewed it as a way to stress his own organic approach to design and its complementary relationship with nature. For instance, in his 1908 manifesto *In the Cause of Architecture*, he described the "atmosphere" of his Prairie houses in these terms:

> In most of the interiors there will be found a quiet, a simple dignity [...] and it is due to the underlying organic harmony. [...] This is the modern opportunity to make of a building, together with its equipment, appurtenances, and environment, an entity which shall constitute a complete work of art, and a work of art more valuable to society as a whole than has before existed because discordant conditions endured for centuries are smoothed away, everyday life here finds an expression germane to its daily existence. (Wright 1992 [1908], 97–98)

In a later account of these years in Oak Park, Wright credited his understanding of a building's atmosphere to reading Okakura Kakuzō's *The Book of Tea*, and in particular to the Taoist notion that "the reality of a room, for instance, was to be found in the vacant space enclosed by the roof and walls, not in the roof and walls themselves" (1956 [1906], 45).[1]

Wright, however, was very much the exception. By the onset of the 1930s and the Great Depression, references to architectural atmosphere became rare in both European and American literature, and remained that way for another half century — when architects and critics such as Thomas Thiis-Evensen, Karsten Harries, and Gernot Böhme began to challenge both the abstraction of "space" and how it overlooks the emotional experience of a designed environment. Böhme, for instance, pleaded for a "new aesthetics" in response to the "judgmental aesthetics" of the postmodern era. If the latter believed the task of design was to communicate some new idea or theory of design, the new aesthetics — inspired in part by Walter Benjamin's idea of an *aura* — presented an alternative approach to design grounded in "an indeterminate spatially extended quality of feeling" or *mood*, which can be absorbed in "one's own bodily state of being."[2] Both mood and the *human body* were put front and center, and what followed a few years later was Peter Zumthor's design for the Thermal Baths at Vals, which gave expression to such emotional and physiological values. Zumthor in his lectures also stressed that atmosphere extends beyond the traditional building values and draws upon "the people, the air, noises, sounds, colors, material presences, textures, forms too — forms I can appreciate. Forms I can try to decipher. Forms I find beautiful" (Zumthor 2006, 17). This is not simple theorizing on his part; all seems quite self-evident.

The novelty of such a dramatic turn in architectural thinking at the start of the new millennium raises two issues:

> *first*, why did the idea of atmosphere re-emerge at this time and not earlier?
>
> *second*, was atmosphere really a novel concept, or had it always been central to design thinking in earlier epochs?

The first question on why the idea returned to use around the century's end I will address later. Yet the second query raises an interesting historiographic question. Has the writing of history, as a literary form, tended to obscure or distort the fundamental values of architecture, its

mood, and expression throughout human history? After all, it is difficult to argue that the designs of Çatalhöyük, Al Karnak, the Great Bath of Mohenjo-Daro, or the Apadana of Persepolis were not grounded in *conscious atmospherics*. Architects may like the visual refinements of the Parthenon's exterior, but surely the most atmospheric part of the building — its *raison d'etre* — was the inner sanctum in which Phidias's colossal, ivory-and-gold statue of Athena held sway in all her deific majesty. So little has been written about its dramatic interior because we know so little about it. Again, the Cathedral of Our Lady at Chartres has an impressive structural system, but the essence of the Gothic monument is not so much its structure as its painted interior atmosphere created by the stained glass. It painted the proper aura for the pilgrim to plead for eternal intercession from Our Lady.

* * *

Not to state the obvious — the problem with architectural historiography is that it is all too current, or at least lacking a proper pedigree. Architects like to begin everything with Vitruvius, but of course, he was not a historian. His venerable *Ten Books* consisted of essays on engineering, construction, materials, and the use of the Orders, and his text is perhaps best summarized by his famous distinction between practice and theory. The few pages he devotes to the history of building refer only to the huts of barbaric tribes scattered about the Mediterranean, based on the premise that only Rome and Greece had attained the high art of design. Vitruvius, in a faint way, did make an allusion to the idea of atmosphere with the notion that proportional systems were embodied or grounded in human proportions — injecting at least a glimmer of humanity into the perception of architectural forms. Of the fifty or

so Hellenic sources to which he refers, none have survived. It is likely they were of a technical nature or monographs devoted to particular buildings, and almost certainly there was no Herodotus or Xenophon among them. We also presume there were Mesopotamian and Egyptian documents of an earlier vintage related to architecture, but Father Time can be a cruel master.

The monastic centers of early Medieval times kept substantial logs of their building activities and revealed some of their constructional techniques. Across northern Europe, they also passed around copies of Vitruvius. Yet nothing much happened until Leon Battista Alberti stepped forward in the early 1440s and began composing his *Ten Books*, taking a seeming relish in lambasting Vitruvius's plebian Latin which he deemed far below the high style of his beloved Cicero. A building in its design, Alberti suggests, should have the same qualities as a Ciceronian oration, an exquisite concinnity or *conncinnitas* of parts. The result would be a "beautiful appearance" (*venusta species*) or an atmospheric purity — a "great and holy" matter — akin to the appeal of verbal eloquence to the ear:

> For about the appearance and configuration of a building there is a natural excellence and perfection that stimulates the mind; it is immediately recognized if present, but if absent is even more desired. The eyes are by their nature greedy for beauty and *concinnitas*, and are particularly fastidious and critical in this manner. (Alberti 1991 [1443–1452], book 9:5, 303)

There was also a strong corporeal sense of embodiment in Alberti's thinking, whose influence, I would argue, has been understated by historians. Architecture for Alberti was nothing less than a "form of body," composed of both "lineaments" (design) and "matter" (materiality). The columns or engaged columns, he noted, are the bones of the building, the

infill walls and paneling are the muscles and ligaments, and the finish is its skin. Walls should not be too thick, "for who would not criticize a body for having excessively swollen limbs?" (Alberti 1991 [1443–1452], book 6:17, 146). There is a similar emphasis on corporeality in the work of both Michelangelo and his contemporary Giulio Romano, the last whose atmospherics are vividly on display in the interiors of the Palazzo del Te in Mantua. Concinnity and corporeality are also central to the work of Andrea Palladio. His Villa Rotunda and Teatro Olimpico were sufficiently cinematic for Joseph Losey to stage his version of *Don Giovanni* in 1979. The main floor of the Palladio's Villa Barbaro is an atmospheric *tour-de-force* through Paolo Veronese's use of quadrature and the iconographic program of the Barbaro brothers. The corporeal presence or spatial feeling of all of Palladio's rooms is everywhere evident, as found in a proportional and design sensitivity that Witold Rybczynski has described as "scaling." One example is the size of a window in relation to the interior wall of a room that enhances a sense of self (2002, 244–247).

If we move forward a century and more, a sense of atmosphere was no less prominent. One can experience it in the work of Francesco Borromini but also in one of Claude Perrault's annotations to his translation of Vitruvius, where he seizes on a passage in which Vitruvius praised the Hellenic architect Hermogenes for his stylistic innovations. Perrault pleaded for a brighter atmosphere for French interiors through structural innovations. "The taste of our century, or at least of our nation," he writes, "is different from that of the ancients and perhaps it has a little of the Gothic in it, because we love the air, the daylight, and the openness" (1996 [1684], n. 3.2, 79). Perrault's remark touched off the so-called quarrel between the "Ancients" (those adhering to Roman classicism) and the "Moderns," which would rage for another century [**F2**].

F2 Jacques-Philippe Le Bas
after Julien-David Le Roy
Temple of Minerva
Athens, Greece

3 The passage appeared in the second edition of *Les Ruines* of 1770, and was taken from his earlier writing on Christian churches.

The rediscovery of Athenian monuments in the mid-eighteenth century provided the turning point in architectural deliberations. In 1749 the Englishmen James Stuart and Nicholas Revett announced their intention to visit Athens, "the Mother of elegance and politeness," and record her monuments, but it was the late-comer Frenchman Julien-David Le Roy who, after his own hasty visit, beat the Englishmen to the printing press, as it were, with *The Ruins of the Most Beautiful Monuments of Greece*, which appeared in 1758. Its atmospheric and highly picturesque engravings — similar in atmospheric intensity to those of Giovanni Battista Piranesi — stunned the architectural world because here was an image of classical design quite different in its scale, proportions, and emotional intensity from later Roman works. Le Roy was so moved by the atmospheric weight of the Parthenon lying in ruins that he came up with a physiologically based theory of "successive sensations," the optical ranges or play of light and shadow that impresses the eye as one moves around a deeply silhouetted colonnade from different perspectives (1758 [1770], 367–386). [3] In fact Le Roy had picked up on the new aesthetic of the "picturesque" that Edmund Burke (1757) was at the same time modeling with his theory of the sublime.

A ferocious Graeco-Roman debate ensued, which pitted Piranesi, the defender of all things Latin, against his nemesis Johann Joachim Winckelmann, who in 1764 (2006) issued *The History of the Art of Antiquity*. The last was in many respects the foundational work for the new field of art history with its importation of the word "style" into parlance, and his exaltation of Greek art as the epitome of classicism. Equally seductive in French architectural circles, at least, was the book *The Genius of Architecture* (1992 [1780]) by Nicholas La Camus de Mézières, which settled squarely on the theme that every architectural environment should possess a particular atmosphere and convey an appropriate mood. A boudoir, for instance, should be a comfortable "abode of delight" allowing the lady to "yield to her inclinations" for luxury and taste, while a dining room — if "fair Hebe" is to show her presence and "dispense the nectar of the gods" — should allow "gaiety, freshness, lively colors, and the character of youth and beauty set the tone of the decoration" (1992 [1780], 115, 136). It was this penchant for atmosphere in pre-revolutionary days that set the standards for the playful iconography of a Claude-Nicholas Ledoux or the more potent atmospheric drama of Étienne-Louis Boullée's *Cenotaph to Isaac Newton* (1784). The quest for atmosphere was still alive in design.

* * *

The guillotine of the French Revolution would soon curtail such aristocratic diversions and force a more somber mandate upon design, but in the background, another cultural phenomenon was emerging — the publication of histories of architecture. The stimulant was the creation of French academic institutions in the mid-eighteenth century, the famed Academies of Painting and Sculpture, Dance, Inscriptions and Belle Lettres, Science, Music, and (in 1671) Architecture. The last, led by Francois Blondel, was a school and every school needs a course of study; history now became one pillar of the program. In 1674 the king's minister Jean-Baptiste Colbert sent the architectural student Antoine Desgodetz to Rome on a mission to measure the principal Roman monuments and decipher the proportional code of the classical orders. Yet Desgodetz's findings revealed that, contrary to expectations, there had been no single-dimensional canon used in Roman antiquity. Moreover,

the textbooks of Sebastiano Serlio and Andrea Palladio had numerous inaccuracies when placed next to Desgodetz's "very exact" measurements (1682).

The first secretary to the Royal Academy of Architecture was André Félibien, who two years later published *Des Principes de l'Architecture, de la Sculpture, de la Peinture* (1676). In 1687 his son and successor Jean-François Félibien wrote the first general history of architecture through its most celebrated architects. It is a remarkable work for its day, in which he drew upon literary sources to discuss the buildings of Babylon, Nineveh, Tyre, Egypt, Dedalus, Greece, and Solomon's Temple. He then turned to the architecture of Rome and the Christian era, which he concluded by praising the architecture in northern Europe, and the rise of a new and different Gothic "taste" — the *Gothique ancien* and the *Gothique moderne*. The former (today called the *Romanesque*) is lauded for its solidity and grandeur, whereas the high Gothic style to Félibien's classical eye displays a "rather grand excess of delicacy" (1687, preface: iv). Nevertheless, the cathedrals of Chartres, Amiens, and Reims were works of high accomplishment. In another work appearing in 1699, Jean-François Félibien interprets the cavernous interiors of ancient Gothic style as a reflection on a leafy and shady forest of earlier religious rituals (1706, 105).

British historians of the same period were of a different manner. In 1655 Roger Dodsworth and William Dugdale published their survey of English and Welsh monasteries — *Monasticon Anglicanum*. Dugdale followed three years later (1658) with *The History of St. Paul's Cathedral in London*. Monographs on the colleges of Oxford and Cambridge were prepared by Anthony Wood and David Loggan later in the century, but the foremost architectural historian of this era was Christopher Wren.

He keenly followed developments in French practice, and in his notebooks from the 1670s, he argued that the Greek orders should not be applied in a "strict and pedantick" manner. One reason for this was that he believed the Greeks developed their orders from Tyre and the Phoenicians, who had built the Temple of Jerusalem. An eclectic, Wren admired the Byzantine buildings such as the Hagia Sophia; he practiced in the Gothic style (most famously with Tom Tower at the entrance to Oxford's Christ Church College), and restored Westminster Cathedral. He wrote voluminously but his notebooks were only published later (Wren, 1750).

British publications in the first half of the eighteenth century were dominated by its full-blown Palladian Revival — a curbing of baroque excesses by bringing classicism back to Vitruvius's most honored disciple. The movement was led by Richard Boyle, the third Earl of Burlington, and his wellspring was Inigo Jones, who, in his capacity as Surveyor of the King's Works, had traveled to Italy, studied Palladio, and purchased many of his drawings. Jones's designs were featured in Colen Campbell's *Vitruvius Britannicus or the British Architect*, which appeared in 1715, the same year as a new translation of Palladio by Giocomo Leoni came forth (Palladio 1715 [1570]). Burlington even built his own variation of Palladio's Villa Rotunda at his suburban estate at Cheswick, from which a publishing industry of lavish and expensive folios emerged in the 1720s. This classical movement also found a worthy counterpart in the novel aesthetic of the *Picturesque* movement that came about later in the century, which resulted in a bounty of books expounding the new garden aesthetic. Hence we have the curiosity of grand Palladian manors being constructed in exquisitely artful but seemingly natural settings with lush vegetation, dammed lakes, and garden follies to amuse their equally cultured owners.

The rediscovery of Greece in mid-century would lead to classical and neoclassical movements in design across Europe and in North America. Yet this was only the start of historical interest, as historians, travelers, and archaeologists soon began recording in great detail not only the multitude of European styles throughout its history, but also the architectural styles of the Middle East, Islam, Egypt, and Asia. Napoleon led his army and a team of archaeologists deep into Egypt at the start of the century and revealed the scale and decorative schemes of monuments at Luxor and elsewhere. The extent of the British Empire led to historical research in India, China, and other parts of southeastern Asia. The full beauty of the Byzantine Empire was also brought to light, while Britain and France devoted much ink to the investigation of Gothic architecture, which early British writers believed to be their native style.

The Gothic of course exerted enormous influence on design practice in both countries. The French Revolution had damaged and destroyed many of France's medieval monuments, but the Restoration, beginning in the 1820s, led to a bounty of historical studies of the period, led by Arcisse de Caumont's *Essai sur l'architecture religieuse du Moyen Age, Principalement en Normandie*, which appeared in 1825, five years before Victor Hugo's novel *Notre-Dame de Paris*. The study of France's past engaged students at the newly constituted École des Beaux-Arts, and led to a debate that would culminate with the structuralist or semi-functionalist writings of Eugène Emmanuel Viollet-le-Duc. British historians were no less dedicated in their pursuits, beginning with Thomas Rickman's popular *An Attempt to Discriminate the Styles of English Architecture* of 1817. He opened a pathway for the moralism of Augustus Welby Pugin, and eventually the art-and-crafts theology of John Ruskin.

The Renaissance period also experienced its historical revival around mid-century, leading to the so-called American Renaissance of the 1870s. What was taking place in North America was nothing less than the professionalization of the practice of design, as the first students — beginning with Richard Morris Hunt, Henry Hobson Richardson, and George McKim — returned home from the Ecole des Beaux-Arts with highly tempered continental perspectives. It was also around mid-century that the first general histories of architecture appear, led in Britain by Thomas Hope's *An Historical Essay on Architecture* (1835) and James Fergusson's *History of the Modern Styles of Architecture* (1862).

And it is here that I come to the point I want to make. With the growth of schools of architecture, these textbooks and their successors would become the foundation of the architect's education. The first American architectural course of study at MIT began in 1868, and was shortly thereafter followed by another half-dozen programs. All of the texts described thus far are at best descriptive: names, dates, stylistic development, materials, and structure. Robert Willis in his *Remarks on the Architecture of the Middle Ages* (1835), for instance, broke down his analyses of Italian Gothic into chapters on imposts, shafts, foliation, tracery, vaulting, doorways, decoration. His work was very enlightening and valuable in tracking down the logic of the structure and detailing, but nowhere in nineteenth-century histories (and later ones for that matter) is the emotional or atmospheric qualities of any building taken into account. James Fergusson's *History of the Modern Styles of Architecture* (1862), for example, is admired for its 312 illustrations, but nearly all are plans, sections, and exterior renderings of buildings. This information and objectivity are of course of the very nature of historical writing. Nowhere in Fergusson's 528 pages does he comment on

F3 Pierre-François-Henri Labrouste
Salle Labrouste (reading room)
Bibliothèque Nationale
1862–1868
Paris, France

the overall character or emotional tonality of the buildings. History is by nature form-driven and objective [**F3**]. Yet we know that architects could still approach design with the spirit of atmosphere in mind, because Pierre-François-Henri Labrouste began construction of his Bibliothèque Nationale in the same year that Fergusson's book appeared. The atmospheric theme of his famed study hall was reading a book in a park under the billowing fabric of a tent and with the faint rustling of trees on the room's wall panels. The spirit of atmosphere was still alive, only not so much in print.

* * *

It would be futile to trace the course of historical writing to the functionalist or formalist tendencies of the twentieth century and expect a change of orientation. Yet it is also true that the architect's concern with atmosphere never fully abated. The better architects of the past and present centuries have always centered their design skills on the creation of an engaging atmosphere, or what might be called a "humanization" of design. Atmosphere is simply the insertion of playfulness and joy into the design process — something that can only be learned from observing the work of creative designers.

All of which leads me to the first question I posed earlier. Why, if the practice of "atmosphere" was still alive, did the concept only re-emerge within architectural discourse around the start of the present century? The answer seems to be twofold. *One* is that the idea of atmosphere was a much-needed correction to the semiotic and deconstructional bloviations of postmodern theory, which had truly reached a theoretical dead-end by the century's end. *Second* and perhaps more importantly, the idea of

4 For an introduction to the field, see Odling-Smee, Lala, and Feldman 2003.

atmosphere reemerged within the context of recent (and quite major) advances in the biological, psychological, and philosophical sciences. A new perspective was opened into how we perceive and experience the world.

One underpinning was the new models of genetics based on the mapping of the human genome. With earlier models it was generally assumed that we are born with a series of genes or a genetic code, the cellular machinery of which remains relatively stable after its developmental stage. With the mapping of the human genome, however, we learned that this is not the case. "What is transmitted between generations is not traits, or blueprints or symbolic representations of traits," as Susan Oyama has made the case, "but developmental means (or resources, or interactants). These include genes, the cellular machinery necessary for their functioning, and the larger developmental context" (2000, 29). In short, no organism is ever finished but is continually reconstructing its genetic structure, cellular systems, neurological circuits, and bodily forms over a lifetime. These changes can be both short-term and long-term. Put a young child in a poor environment and the damage can be irreparable. Put an adult in a poor environment and the result will often be frustration and anger. Both genes and behavior are conditioned by the environments in which we live, and designers need to understand the symbiotic relationship we have with designed environments, both on individual development and on the trajectory of human culture.

Also at the start of this century — one area of population biology called "niche construction" began tracking the impact of massively designed environments (houses, cities, cars, nations, and digital communications) on human cognitive, social, and emotional development. [4] We have learned that our environments are continually modifying the selection pressures on human development. In Richard Neutra's extraordinarily prescient book of 1954, *Survival through Design*, he noted that:

> It is in this era of brain-physiological research that the designer, who wields the tools of sensory and cerebral stimulation professionally, can perhaps be recognized as a perpetually and precariously active conditioner of the race and thus acquire responsibility for *its survival*. (Neutra 1954, 244)

Let us as informed designers today step up and take responsibility for the welfare of the human beings for whom we design. The human organism and the environment are inextricably bound. One of my favorite characterizations of this interrelationship is a passage from a scientific paper published by the philosopher Evan Thompson and the biologist Francisco Varela:

> The nervous system, the body and the environment are highly structured dynamical systems, coupled to each other on multiple levels. Because they are so thoroughly enmeshed — biologically, ecologically and socially — a better conception of brain, body and environment would be as mutually embedded systems rather than as internally and externally located with respect to one another. (Thompson and Varela 2001, 423–424)

The third area of this ground-breaking research in recent years is directly related to matters of design. It is our new understanding of how we experience the designed environment, and the key concept is the idea of *embodiment*. It is hard to imagine but it was only a few decades ago that science worked with the dualistic model that we are corporeal organisms run by neural circuits (programs) in the brain, occasionally interrupted by that pesky bug of emotion. This model, with all of its dualisms (body/mind, perception/conception, emotion/reason) has now been

5 See, in particular, Mallgrave 2018, chapter V "Aesthetic Perception."

thoroughly discredited with what we have learned. In the passage by Thompson and Varela above, note the flawless melding here of biology, ecology, and human culture. Emotion is no longer considered something detached or apart from the act of perception, but something entirely integral to it. The body functions as an integrated or holistic organism.

Supporting these new models of embodiment was the discovery of transmodal *mirror systems* in an Italian lab in Parma in the 1990s. Mirror systems are networks of neuronal circuits in a few areas of the brain connected to our motor cortex. They underlie our making sense of the world. We have long known, for instance, that if someone walks into a room with a smile, she literally brightens the room — basic human empathy. But this feeling of empathy, we now know, is rooted in our motor cortex, and it extends not just to people but to how we perceive the world more generally. This is the model of *embodied simulation*.[5] If I see someone across a room tap the shoulder of another person, neurons in my secondary motor cortex respond as if my shoulder is being touched. If I hear a pianist playing in the next room, areas of my secondary motor cortex become active as if I were playing the piano. We thus perceive the world by simulating what we experience with our bodies — the idea of *embodiment* [**F4**].

Yet here is the rub! We experience the architectural environment through embodied simulation. One neurological study, for instance, has shown that if we look at the brush strokes of an abstract painting, we simulate the force of these brush strokes, as if we were applying the paint. If this is true for a two-dimensional painting, then how much more do we respond to a three-dimensional building? We may simulate the weight placed on a column; we may simulate the tactile qualities of running our

F4 Saint Mark's Basilica
Western façade
Venice, Italy

fingers along a metal sill or stonework. We stand tall and breathe more deeply in an expansive space; we take rest and relaxation in the view of the garden outside the window. Only through an active experience with the elements of the world — its forms, textures, sounds, smells, and meanings — does a toddler learn to activate these mirror circuits and make sense of the world. These, then, are also the elements that a talented designer weaves together atmospherically. Our perception of the environment and how we engage with it, is a primal and embodied one. As Peter Zumthor has noted in the passage cited earlier, atmosphere entails not just the material presence of building forms and their colors, textures, tactile qualities, and degree of craftsmanship, but also people, weather, noises, and sounds. If we bring a lifetime of experience to every perceptual engagement with the world, why do we not bring the same experience to the design table and enrich the world with something more than the ubiquitous glass box? Mies van der Rohe's glass tower for Berlin was sketched in 1922. Hugh Ferriss's designs for a city of towers also date from the 1920s'. Is it not time to move on?

* * *

Atmosphere can take many different forms of architectural expression, but I will close with two examples. One is a seemingly quaint but nevertheless incisive passage by the designer Claudia Stuart Coles published in *The House Beautiful* in 1901, titled "On Making Atmosphere."

> In the arrangement of any room or house, "atmosphere," the subtle something created by the personality of the owner, is the desideratum. [...] Your home is a little world of which *you* are the creator. Study the great round world, at any rate, as much of it as you can, and you will find inspiration for even the placing of a vase. Learn from the atmosphere that surrounds the earth, brood over its heights and depths, what "atmosphere" should be. Bring it into the home and every chair will be graced, every color softened. Study nature, observe its contrasts and harmonies, feel its beauty, and then — what money cannot buy you will unconsciously create. (Stuart Coles 1901, 358: original italics)

The second example is Bernard Maybeck's design for the Fine Arts Palace at the Panama-Pacific International Exposition, held along the north shoreline of San Francisco in 1915. The event, like the Columbian Exposition in Chicago of 1893, was a "white city," consisting of a number of temporary, classically-styled buildings constructed of wood and plaster on metal armatures. People entered at the east end of the fairgrounds and meandered down a central axis with squares and buildings. The Arts Palace was to be the fair's culminating event at the west end. Maybeck, however, departed from the program and interrupted the axis. In front of his Arts Building, he set aside an open area of ground, on which he built a lagoon, an open rotunda, and a free-standing colonnade — thereby forcing people to walk around and through the park to enter his Arts Palace [**F5**].

Maybeck, in fact, painted his own view of art not with the brush tones of a silverly dreamscape, but rather with the darker overtones of melancholy — or at least that was his intention. He prepared a pamphlet to explain to visitors his reasons for adding these elements to the experience. He began by recounting the exciting things that the visitor has seen along the way, and how happy they must feel after viewing the latest tools of industrial production. He then raises the question of what should be the elements that will induce the proper atmosphere for viewing paintings and sculptures and then recounts his own visit to an art gallery in Munich years before. After leaving the building, he writes, he observed the somber faces of others coming out of the museum, pensive

F5 Bernard Maybeck
Palace of Fine Arts
Panama-Pacific International
Exposition, 1915
San Francisco, California

after viewing these great works of art. This feeling "of sadness modified by the experience of beauty," he goes on to say, has "a soothing influence" on the human soul, a feeling similar to what one experiences in coming upon an ancient building in a state of ruin:

> An old Roman ruin, away from civilization, which two thousand years before was the center of action and full of life, and now is partly overgrown with bushes and trees — such ruins give the mind a sense of sadness. [...] These ruins today have a spirit of sadness because the trees and bushes are old; nature outgrew the gardeners' stiffening care. Great examples of melancholy in architecture and gardening may be seen in the engravings of Piranesi, who lived a century ago, and whose remarkable works convey the minor note of old Roman ruins covered with bushes and trees. (Maybeck 1915, 4–5)

These impressions, he goes on to say, are the reason for the lagoon, the open rotunda, and the colonnade. It gives people a chance to reflect on what they are about to experience and then he goes on to write,

> [They] will best convey the same impression to the heart and mind as those impressions made by the works of art inside, the mind of the visitor to the gallery is prepared as he enters for what he is to see, and as he comes away his senses gradually are led back to the commonplaces of human activity; the horns of automobiles, the cries of the popcorn venders, will not grate upon his ears as they would if he were plumped out directly into the hustle and bustle. (Maybeck 1915, 10)

Atmospheric scenography is thus central to Maybeck's design. He brought in trees, shrubs, and trellises and built his lagoon. His circular temple or open rotunda had no historical precedent; and its bas-reliefs up high were carefully thought out for their sobering effects. One panel titled "The Struggle for the Beautiful" featured a nude female in the center, with two male nudes at her side doing battle with Centaurs —

symbols of ugliness. The open peristyle wrapping around the rear of the rotunda also contained curious pieces of sculpture. There were a series of large, paneled chests or coffers set atop the peristyle. At their four corners were partially nude female figures with their backs to the visitors, seemingly looking into the chests. As one writer on the exposition noted, they were "looking in and possibly weeping, though you could not be sure, for their faces were averted and you saw but their backs; so that you wondered whether those chests contained something precious or something woeful, or both, and the thing had all the dramatic intensity that can be put into architecture" (Todd 1921, 317).

The other feature of Maybeck's melancholic design is that none of the featured columns or entablatures, not to mention the abundance of funeral urns on display, followed any of the accepted rules of classical architecture. All were theatrical props in his pursuit of atmosphere, and this is from an architect trained at the Ecole des Beaux-Arts in Paris. Maybeck's performance was wildly popular, by far the most popular pavilion at the exposition. With the closing of the exhibition all of the pavilions including the arts palace were dismantled — all except for Maybeck's lagoon, rotunda, and colonnade. The people and the press insisted on leaving it in place and politicians were forced to concede. All the plaster pieces languished until 1968 when (again by popular demand) city officials rebuilt the rotunda, colonnade, and gallery with permanent materials. Today, it sits as part of Golden Gate Park and remains a much sought-after reprieve for locals and tourists. Maybeck's creation is nothing less than a testament to the *power of atmosphere*.

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Symposium

Designing Atmospheres: Theory and Science

March 28, 2023
Recent advances in science confirm many of the architects' deep-rooted intuitions, improving knowledge about the experience of space and the meaning of architectural and urban design. The "Designing Atmospheres: Theory and Science" Symposium presented to an audience of students, educators, architects, and scientists a conversation about human perception of design and building, specifically talking about atmospheres, affordances, and emotions. It was an Interfaces event of the Academy of Neuroscience for Architecture (ANFA), sponsored by the EU's Horizon 2020 MSCA Program — RESONANCES Project, the Perkins Eastman Studio, and the Architecture Department at Kansas State University (K-State). The event was organized by Elisabetta Canepa and Bob Condia and hosted in the Regnier Hall of K-State College of Architecture, Planning and Design (APDesign), Manhattan, Kansas.

Speakers
Kory Beighle (APDesign — K-State), Elisabetta Canepa (MSCA Fellow — UniGe | K-State and ANFA AdCo), Bob Condia (APDesign — K-State and ANFA AdCo), Zakaria Djebbara (CREATE — AAU and TU Berlin), and Harry Francis Mallgrave (IIT and ANFA AdCo).

Lectures
Recorded videos of each lecture are available on the RESONANCES Project website (www.resonances-project.com/harvest) and its YouTube channel (www.youtube.com/channel/UCk32skDiT4Bz1AHnltT51Yg).

Support
Special thanks go to the P\Lab2003 team for the technical-organizational work, the videographer Matthew Knox, and the video editor Reid Posinski.

"What then is the relation between thinking and making? To this, the theorist and the craftsman would give different answers. It is not that the former only thinks and the latter only makes, but that the one *makes through thinking* and the other *thinks through making*."

Ingold 2013, 6: original italics

"The more pressing question remains: is the architect a theorist or a craftsman? Architects may want to respond that they are both, but are they really so magisterial?"

Mallgrave 2018, 129

Ingold, Tim. 2013. *Making: Anthropology, Archaeology, Art and Architecture*. Abingdon and New York, NY: Routledge.

Mallgrave, Harry F. 2018. *From Object to Experience: The New Culture of Architectural Design*. London and New York, NY: Bloomsbury.

Designing Atmospheres: Theory and Science

An Interfaces event of the Academy of Neuroscience for Architecture, sponsored by the EU H2020 MSCA program —— Resonances project, the Perkins Eastman studio, and the KSTATE APDesign

Kory Beighle
Elisabetta Canepa
Bob Condia
Zakaria Djebbara
Harry Francis Mallgrave
and P\Lab2003

® Steffen Lemmerzahl, 2022

A symposium organized by Elisabetta Canepa and Bob Condia

Kansas State University — Università di Genova

The Resonances project has received funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement no. 101025132 —— www.resonances-project.com

28 March 2023
8:30 —— 12:30
Regnier Hall, APDesign
Kansas State University

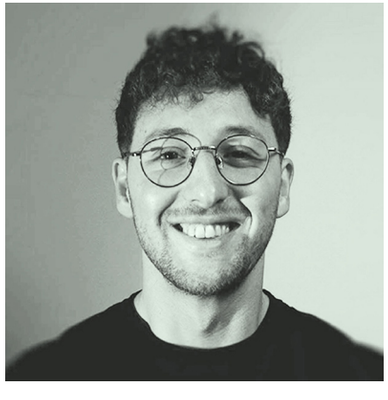
Authors

Kory A. Beighle (M.Arch., Ph.D.) holds the position of Assistant Professor in Kansas State University's Department of Architecture. His teaching responsibilities include design studios, architectural history lectures, and theory seminars. Prior to joining K-State, he was the inaugural Park Creative Arts Professor at Miami University in the College of Creative Arts' Department of Architecture and Interior Design. Dr. Beighle received a Ph.D. in Architecture from the University of Cincinnati in 2020, where the major focus of his studies addressed twentieth and twenty-first century architectural theory, particularly issues of disciplinarity and architectural tools, with a minor focus on theories of visuality. His dissertation, entitled *Architectural Alchemy: Collaging Disciplinarity in the Kaleidoscopic*, examined these issues through critical analysis of the interdisciplinary practice of Charles and Ray Eames. His work as a historian, theorist, scholar, and educator is framed through design to explore the intersection of tools, pedagogy, disciplinarity, and spatial narrative in our kaleidoscopic paradigm. His research has been recognized and presented in national and international conferences, art exhibitions, film competitions, and journal publications.

Elisabetta Canepa (MS.Eng., Ph.D.) is an architect and researcher from Genoa, Italy. She is currently an EU Marie Curie Fellow running the RESONANCES project (2021–2024) in collaboration with the University of Genoa, Kansas State University, and Aalborg University. Her research focuses on the hybrid connection between architecture and cognitive neuroscience, analyzing topics such as atmospheric dynamics, the emotional nature of the architectural experience, embodiment theory, the empathic phenomenon between humans and space, and experimentation in virtual reality. Dr. Canepa is an Advisory Council member of the Academy of Neuroscience for Architecture (ANFA), based in San Diego, California. She is a faculty member in the Neuroscience Applied to Architectural Design (NAAD) Master's Program at the Iuav University of Venice and serves as an Adjunct Professor in the Department of Architecture at Kansas State University. Elisabetta Canepa wrote *Architecture Is Atmosphere: Notes on Empathy, Emotions, Body, Brain, and Space* (2022), published by Mimesis International within the *Atmospheric Spaces* book series.

Bob Condia (M.Arch., FAIA) is a Professor in the Department of Architecture at the College of Architecture, Planning and Design (APDesign) of Kansas State University. He is the design partner at Condia+Ornelas Architects, Manhattan, Kansas. The 2017–2020 Regnier Chair of Architecture at Kansas State University, Prof. Condia teaches design as art with consideration to the biology of perception, the real, the ancient megaliths of man, and the sensible poetics of an architectural experience. He has been a studio critic for more than thirty years in architecture and interior design. Prof. Condia's place in the neuroscience for architecture debate is as an architect and studio critic, seeking the consequences of applied science for architects. Bob Condia is an Advisory Council member of the Academy of Neuroscience for Architecture (ANFA), based in San Diego, California. Regarding architectural affordances, atmosphere, and mood, he edited three books published by New Prairie Press: *Meaning in Architecture: Affordances, Atmosphere and Mood* (2019), *Affordances and the Potential for Architecture* (2020), and *Generators of Architectural Atmosphere* (2022 coedited with Elisabetta Canepa). He is the director of the *Interfaces* book series (New Prairie Press).

Zakaria Djebbara (Cand. Polyt., Ph.D.) is an architecture researcher attempting to understand how spatial configurations relate to human experience, cognition, and behavior. To reveal such relations, Dr. Djebbara employs mobile electroencephalographic neuroimaging methods in combination with virtual reality and physiological measures. His research is supported by computational modeling of human experience and neural dynamics. He currently holds a postdoctoral position at Aalborg University, Denmark, and focuses on the role of sensorimotor brain dynamics in behavioral and cognitive performance. Zak Djebbara is a member of the Lundbeck Foundation Investigator Network (Copenhagen), the Berlin Mobile Brain/Body Imaging Lab (Berlin Institute of Technology), and the Situated Mobilities and Sensing Bodies Group (Aalborg University). He edited the book *Affordances in Everyday Life: A Multidisciplinary Collection of Essays* (2022), published by Springer Nature.



Harry Francis Mallgrave (M.Arch., Ph.D.) is a Distinguished Professor Emeritus from Illinois Institute of Technology and an Honorary Fellow of the Royal Institute of British Architects. He received his Ph.D. in architecture from the University of Pennsylvania and has enjoyed a career as a scholar, translator, editor, and architect. In 1996 Prof. Mallgrave won the Alice Davis Hitchcock award from the Society of Architectural Historians for his intellectual biography *Gottfried Semper: Architect of the Nineteenth Century*. He has published more than a dozen books on architectural history and theory. His most recent book, *Building Paradise: Episodes in Paradisiacal Thinking* (Routledge, 2021), argues on behalf of a design and planning ethic centered squarely on cultural needs and personal aspirations. Harry Mallgrave is an Advisory Council member of the Academy of Neuroscience for Architecture (ANFA), based in San Diego, California.

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Designing Atmospheres:
Theory and Science

2023
New Prairie Press
Kansas State University Libraries
Manhattan, KS, USA

Designing Atmospheres: Theory and Science successfully begins to demystify the seemingly ineffable or elusive nature of architectural atmosphere by offering empirical approaches and experiments that, in relation to the clear theoretical and historical background included in its pages (not to mention the prior three Interfaces issues), advance our scientific and phenomenological understanding. The writing is convincing, the intention is clear, the timing is impeccable, the combination of (theoretical, design, historical, and scientific) voices is ideal, and the result is, unsurprisingly, excellent.

—— Julio Bermudez, Ph.D.
ACSA Distinguished Professor
The Catholic University of America

Is designing atmospheres an easy problem that we can solve scientifically? Or is it a hard problem that must be left to the sensitive experience of the individual architect? This is the scope of both perplexing and tantalizing questions covered by the discussion in **Interfaces 4**. Enjoy!

—— Lars Brorson Fich, Ph.D.
Professor of Architecture
CREATE, Aalborg University

Entering a room evokes an immediate impression —— it might be pleasant, drab, or even dangerous —— every place has a "pervasive unifying quality" as John Dewey put it, that can instantly shift our mood. Indeed, no space is neutral. Yet, this basic fact seems to have been forgotten. Decades of fascination with form and surface have divested space of place, and the growing concern with atmospheres is now compensating for this impoverishment. This volume, perhaps more than any other on the topic, searches diligently to understand how atmosphere and mood are interlinked, to rigorously question what factors come together to create this unifying quality that we call atmosphere, and how something so basic to human experience could get lost along the way. Coming closer to understanding something as elusive as atmosphere brings us a step closer to understanding ourselves, and our profound interdependence with the world around us. **Hopefully, this new knowledge and awareness may contribute to making places that appeal to the whole of our humanity**.

—— Sarah Robinson
Professor of Architecture
CREATE, Aalborg University
NAAD Master's Program, Iuav University of Venice