INTERFACES 3

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Generators
of Architectural
Atmosphere

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Generators of Architectural Atmosphere

Interfaces
Book Series

Interfaces
Interfaces investigates the interplay of architecture, philosophy, and biology through the lens of meaning in architecture. Architecture is a thread, mending the fabrics of disparate realms of comprehension. There is a fractal-like intention of this book series to expand and contract in scale of observation. It serves less as a microscopic and precise account of the science of the experience|body|building triality, and more as a kaleidoscope of thought. The allegory of a kaleidoscope seems especially appropriate when reflecting upon its construction and mechanics. A telescoping container houses three mirrors, arranged to form an equilateral triangle toward a fixed axis. When introduced to vision, an optical unfolding occurs as light, color, depth, and angle are adjusted, producing nuance and clarity with each refinement. Furthering the metaphor, our telescoping container is atmosphere; our medium of vision is meaning in architecture; our triangular mirrored prism is the reflective and mutually inclusive realms of experience|body|building — or, always the sum of philosophy|biology|architecture.

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Interfaces began as an invention of the Advisory Council of the Academy of Neuroscience for Architecture (ANFA) to open our symposiums to the world through live performances, video recordings, and open-sourced publications. We operate here under no authority but in the spirit of academic enterprise.

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INTERFACES 3

Generators
of Architectural
Atmosphere

F1 Incognito
        atmospheric equation

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We are sometimes eager to celebrate
the influence of our surroundings.

The noblest architecture can sometimes
do less for us than a siesta or an aspirin.

(de Botton 2006, 13; 17)

Elisabetta Canepa

The Atmospheric Equation and the Weight of Architectural Generators

Abstract
Atmosphere is the whole of affective meanings identifying a situation or place that allows us to resonate and tune into our surroundings. The complexity of atmosphere is well known [**F1**]. This essay analyzes the — design and aleatory — determinants that prime atmospheric effects to estimate the contribution provided by the physical environment (namely, the architect's domain of intervention). Staging atmospheres is a compositional task in which we orchestrate different architectural generators to let our bodies emotionally resonate with the multisensory entirety of forms, materials, shades, colors, sounds, and scents that constitute a place. Designed atmospheres become generators of identity and meaning.

F2 Paolo Monti
photo series *Gualtieri*, 1977
BEIC 6339054

1 "In terms of its significance for human life, *place* can be defined as any environmental locus that, in time and space, draws together individual or group actions, experiences, intentions, and meanings" (Seamon 2022, 1). A child can turn a lawn into a soccer field by naïvely tying three branches together, which gives their physical domain of movement and interaction experiential value. To further explore the difference between the concepts of *space* and *place*, see Norberg-Schulz 1979, 1988a; von Meiss 2011; Böhme 2013a, 25–26; Mallgrave 2018, 117–120; Robinson 2021, 15–18.

2 As the American historian Lewis Mumford (1895–1990) recalls, "though food-gathering and hunting do not encourage the permanent occupation of a single site, the dead at least claim that privilege. [...] The city of the dead antedates the city

Equation

In school, we learn Euclidean geometry to comprehend fundamental geometric notions like points, lines, and planes in space. Then, we study the Cartesian coordinate system to understand those elements in a numerical language. Euclid's approach proceeds logically from axioms describing basic properties of geometric objects; the Cartesian approach, introduced almost two thousand years later, employs coordinates to express geometric properties as algebraic equations. These axioms, and the related equations, are carved in our memory. Though many years have passed since high school algebra, we can recite common concepts like any two distinct points determine a unique straight line; or, any three non-collinear points determine a unique plane.

As architects, we outline and internalize this essential axiom: three elements transform *space* into *place* [1] **[F2]**. Three are the elements that gave birth to the beginning of architecture as a *place* where one permanently stays. They are three elements that — initially conceived to take care of deceased loved ones instead of living people — survived until the contemporary era: two upright slabs supporting a horizontal capstone lying upon them [2] **[F3]**. The first physical structures humans fixed to the ground were burial chambers, constructed long before any lasting shelters our ancestors erected to dwell, or simply to defend themselves from nature. This circumstance explains the spiritual origin of architecture, [3] revealing its potential to confer *meaning* to the physical environment — in response to our innate need for deepened and enriched experiences. "Architecture is," in fact, "ideally located at the intersection of [two] complementary aspects of our lives (i.e., fitness and flourishing)," confirms the philosopher Mark Johnson, "insofar as the ways we organize space and buildings address simultaneously our need for protection from the elements and our need for meaningful experience" (2018, 242).

of the living. In one sense, indeed, the city of the dead is the forerunner, almost the core, of every living city" (1961, 7).

3 Juhani Pallasmaa shared this reflection to comment on Harry F. Mallgrave's exhortation redefining the idea of culture (Mallgrave and Gepshtein 2021) during the ACE meeting held on Friday, August 20, 2021. ACE is the ANFA (Academy of Neuroscience for Architecture) Center for Education.

4 Based on the historical reconstruction elaborated by Harry F. Mallgrave (2018, 120–123), Gottfried Semper (1803–1879) was likely the first architect to employ the word "atmosphere" in a design theory text (2004 [1860–1863], 438–439 n. 85). For further details on the genealogy, evolution, and semantic network of the lexeme "atmosphere," with specific attention to the architectural domain, see Canepa 2022 (chapter II "Roots").

Over the years, architects have tried "to come to terms with the essential question of meaning in architecture" (Pérez-Gómez 1983, 7), which is a "very serious problem" (Johnson 2015, 34). Among several attempts made (Norberg-Schulz 1988b), a rigorous *reductionist strategy* was tested. In the beginning was the German Gottfried Semper,[4] around the mid-nineteenth century. More exactly, Semper was the first to endeavor, in a consistent and methodical way, "to make the process of design analogous to the resolution of an algebraic equation": "the 'variables' represented the manifold aspects of reality that architecture had to take into account; the solution was simply a 'function' of these variables" (Pérez-Gómez 1983, 7).

Unknowns

Regrettably, this logic is grounded in many challenges. First, there are multiple types of architectural meaning (Hershberger 1970), including presentational, referential, affective, evaluational, and prescriptive meanings. An intriguing premise is "architecture gets much of its meaning and significance from the ways it organises our bodily perception and experience" (Johnson 2002, 84). If we focus on personal experiences, the meaningful, qualitative essence of every architectural encounter, whether conscious or not, is felt and assimilated — more than anything — through its atmospheres (Condia 2019). Atmosphere is the *emotional-affective component of lived space*[5] that allows us to resonate and tune into our surroundings. It is the "'something-more' generated by a specific place" (Griffero 2018, 79) transcending its material foundation; it is co-produced by the people who occupy and use that space.

The philosopher Tonino Griffero, presenting his book series *Atmospheric Spaces*, explains the founding idea of the atmospheric phenomenon as

5   The locution *emotional-affective* refers to the fact we perceive atmospheres by resonating both through our *feelings* (affective appraisals on the experience as consciously felt) and their bodily correlates, namely our *emotions* (somatic feedback, nonconsciously developed, even if sometimes consciously recognizable). As the neuroscientist Eric R. Kandel explains, "an emotional state has two components, one evident in a charac-teristic physical sensation and the other as a conscious feeling — we sense our heart pounding *and* we consciously feel afraid" (Kandel et al. 2000, 983: original italics). Emotions and feelings mutually interact and influence each other. *Lived space* is the space of the subject's embodied and affective experience. It is "radically different from physical and geometrical space" since it is "structured on the basis of the meanings and values projected on [the physical space] by an individual or group, either consciously or unconsciously" (Pallasmaa 2002, 18).

6   The previous footnote illustrates the difference between bodily and cognitive components of the resonance process.

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

8   The German philosopher Peter Sloterdijk calls them "atmo-technologies." This expression indicates all the techniques used for microclimatic control of the air, without which "modern forms of existence in urban or rural contexts would be unimaginable" (2009, 92).

9   The purpose of this essay is to understand the variables at play that compose the atmospheric equation and estimate

being "a vague ens or power, without visible and discrete boundaries, which we find around us and, resonating in our lived body, even involves us" (see, for example, the introductory note to Schmitz 2019, n.p.). This means deciphering the concept of architectural atmosphere as the emotional charge of any architectonically arranged space that sways the experience of the perceiving agent — eliciting a state of *bodily resonance* and potential *affective attunement*. Being part of the co-production of the atmospheric interplay (bodily resonance), and possibly able to recognize its emotional content (if we consciously resonate), [6] does not imply we have become emotionally aligned with it (affective attunement).

Individuals can feel in tune with a specific atmosphere, but they may remain insensitive or reject it (Griffero 2021). For instance, "saying that we bodily grasp the happiness of the party as an atmosphere is not to suggest that we must feel happy ourselves" (Osler and Szanto 2021, 166); we should consider the possibility "we might even get the atmosphere wrong" (Osler and Szanto, 167). There is a distinction between *perceiving the presence of an atmosphere* (resonance) and *being involved in it* (attunement). [7] From an embodied perspective, we may assume if the bodily resonance is significantly aroused, it influences the subject's affective attunement accordingly (Fuchs and Koch 2014). Attunement is the act of appraising an atmospheric event, particularly relevant to the subject, in which we evaluate its affective content by relating the external world to our self-experience. We assign to the situation a *meaning* grounded in that which our resonance gives to us. Meaning is a matter of perception. It informs our actions and behavioral readiness.

Atmosphere is a complex phenomenon because it is invisible, intangible, without physical limits, spatially unstable, temporally ephemeral, highly subjective, often depicted by way of metaphor, and still not structured in a recognized and shared architectural theory (Canepa 2022, chapter I "A Definition Lacking Definition"). For designers, the thorniest aspect is the fact that atmosphere is composite — it is a cohesive force that orchestrates *numerous variables*. "The judgement of environmental character is," indeed, as Juhani Pallasmaa emphasizes, "a complex multisensory fusion of countless factors which are immediately and synthetically grasped as an overall atmosphere" (2014, 230).

Domain
Atmosphere is not a question of mere *physical-environmental variables*, such as air temperature, relative humidity, or light intensity; these factors can be controlled with great precision thanks to the technologies of indoor climate optimization. [8] *Qualitative variables*, of subjective origin and intricate evaluation, are also involved. The scenario becomes even more convoluted when we consider *design variables* (viz, variables that may be planned, intrinsically related to the modifiable space, and over which the architect has some control) and *aleatory variables* (which cannot be dealt with directly). It is crucial to contemplate and analyze aleatory variables because their impact is as significant as it is difficult to quantify. [9]

The premise behind this complexity is "atmosphere is the prototypical 'between'-phenomenon. [...] [It] is something between the subject and the object" (Böhme 1998, 112). An analogy with light exemplifies this relationship. Light is electromagnetic energy pulsing through empty space — a reverberant interplay between a radiating source and an interacting body, capable of absorbing, grasping, and materializing energy. "No matter how brief or accidental this resonance, it is always a mirac-

2 —— The atmospheric equation and the weight of architectural generators

ulous sight. [...] As trains of unseen waves resound through, tangle up in, and congeal inside a bodily corpus, light becomes temporarily incarnate" (Plummer 1987, 9) [**F4**].

An atmospheric event cannot exist independent of the individual immersed in their context — or detached from their sensibility, state of mind, and personal life story. A symbiotic balance comes to the surface that rests "at the threshold between biography and world of facts, things, and situations" (Hasse 1994, 58) [10]. With its promiscuous swirl between a subjective pole and an objective one, or rather between the subjective character of experience and stimuli of objective nature, atmospheric dynamics harmonize internal conditions to extrinsic processes, and confront specifically human points of view with material-spatial mechanisms. An atmosphere is never merely a description of the physical properties of the environment; instead, it is situated, comprising only those aspects significant to a *single person*'s emotions, feelings, thoughts, and behaviors in a *certain place* at a *given moment* (Barrett 2006).

Determinants

The first question we should address is: if the physical setting is not the unique variable generating atmosphere in this complex "equation," what are the other affecting sources? There are at least four stimulus sources: the agents, other living beings, objects, and the environment. They are mutually relevant and processed together. Each one produces multiple determinants (both controllable and random, material and incorporeal, objective and subjective) that influence *whether* and *how* we experience atmospheres. The arrangement of this "atmospheric equation" is a speculative expedient, deliberately simplified to facilitate reasoning.

multifactorial structure of the atmospheric process were discussed within the seminar "Elements of Atmosphere," organized by Elisabetta Canepa and Andrea Jelić in collaboration with the interdisciplinary group Research[x]Design in the Department of Architecture of the Katholieke Universiteit Leuven (November 10, 2021).

10   As cited and translated in Griffero 2014a, 121.

11   Cf. Stec 2020, chapter II "Relationship Between Sunlight and Architecture: Determinants."

12   This body-centered label (together with the ones in the following paragraphs) was developed in collaboration with Brittany Coudriet, a student in the course "Perception of Space: Atmospheres." We assume the *body* is the root and threshold of experiencing atmospheres: this experience

Focusing on the symbiosis between the animate body (namely, the sentient individual — equipped with senses and sensibility) and the collection of inanimate objects forming the choreography of architectural elements that populate and characterize their surroundings [**F5**], we identify four categories of determinants: [11]

- physiological determinants
- personal determinants
- sociocultural determinants
- spatial determinants.

Eventually, a fifth category arises, if the intention is empirically mapping and measuring the atmospheric dynamics:

- experimental determinants.

A.   Physiological Determinants

The physiological determinants are those related to the structural properties *of* the human body. [12] They exert a significant sway on the body resonance process activated by atmospheric affordances, triggering and conditioning *nonconscious emotions* (both interoceptive and proprioceptive feedback). [13] But that's not all. Since emotions are somatic correlates of *conscious feelings* and mutually interact, physiological determinants affect conscious feelings as well. Here is a list to start the reconnaissance:

age
gender/sex
state of health (both physical and mental) [14]

is always *unique* and *specific*. As pointed out by the American philosopher Richard Shusterman, the originator of the interdisciplinary field of somaesthetics, "though our bodies unite us as humans, they also divide us (through their physical structure, functional practice, and sociocultural interpretation) into different genders, races, ethnicities, classes, and further into the unique individuals that we are" (2006, 4).

13   *Interoceptive feedback* is produced by the autonomic nervous system and the endocrine system. These systems coordinate somatic and behavioral responses to keep basic physiological processes (including heartbeat, blood pressure, and respiratory rate) operating at optimal levels, reacting instantaneously to changes in the external environment. *Proprioceptive feedback* derives from skeletal muscle, skin, and joints

> subject's effectivity [15]
> interoceptive sensitivity [16]
> habitual body defenses. [17]

B.   Personal Determinants

The human being is a unique creature — synthetic unity of form and matter, genetically determined and simultaneously shaped by lived experiences. Personal determinants are conditioned by pressures *from* the body, which fluctuate between inborn and acquired qualifications, as well as permanent traits and transitory inclinations. *Long-term factors* acting on one's atmospheric perception skills include the following items:

> personality
> empathic predisposition [18]
> emotional intelligence and granularity [19]
> creativity and imagination skills
> individual body memory [20]
> past experiences [21]
> level of familiarity with the place [22]
> level of familiarity with the sensory inputs
> sense of agency [23]
> personal preferences for specific architectural qualities. [24]

Several *short-term factors* prime the subjective and emotionally-colored evaluations of the lived atmosphere, impacted by extemporaneous situations (such as what one is feeling, thinking, and doing at any given moment): [25]

and is noticeable, in particular, through visual clues (e.g., body posture and orientation, facial mimicry, gestural prompts, and involuntary movements).

14   Certain psychological disorders and neurodivergences provoke disturbance in emotional-affective processing.

15   The term "effectivity" refers to the real action one can take. Depending on their sensory, cognitive, and motor capacities, the agent might perceive, in a different way, suggestions — actual or virtual — afforded by a particular atmosphere. According to the neuroscientist Michael A. Arbib, "each object has an associated set of affordances; but *for each person these depend on their set of effectivities*, and the coupling may change with experience as one masters new skills and adjusts old ones" (2021, 87: original italics). For further explanation on the properties of affordances and effectivities, see Turvey et al. 1981.

16   Namely, the ability to perceive visceral information in the body (such as heartbeat, respiration, gastroesophageal sensations, itching, and pain), in order to detect and interpret physiological changes. Interoception is assumed to have implications for 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 and clues) are more accurate in how they perceive and understand their surroundings (Murphy Paul 2021). So far, however, it has not confirmed whether our inside body perspective influences how we perceive the outside environment (Baiano et al. 2021).

17   In parallel to our interoceptive sensitivity (i.e., the ability to focus on internal bodily sensations and detect them: cf. n. 16) and our emotional granularity (i.e., the ability to discriminate and verbally communicate the specificity of one's emotions: cf. n. 19), we must consider our habitual body defenses, which may act nonconsciously. "When an emotion emerges, one often

tends to defend against it by bodily counteraction: suppressing one's tears or cries, compressing one's lips, tightening one's muscles, keeping a stiff posture, 'pulling oneself together,' etc." (Fuchs 2013, 624).

18   The hypothesis is that the more people are interpersonally empathic, the higher their arousal when atmosphere emotionally affects them (cf. Canepa et al. 2019). Arousal is the component defining the physiological and/or subjective intensity of a specific emotion. Moreover, certain studies have investigated a possible link between interoceptive processing (cf. n. 16) and affective perspective-taking (i.e., empathy): see review in Baiano et al. 2021, 254–256 (table 1).

19   Namely, the ability to recognize, understand, label, and express one's emotions (Brackett and Simmons 2015) elicited, in this case, by atmospheric interaction. "Individuals differ considerably in their emotion experience" (Barrett et al. 2001, 713): for example, examining the pleasant-unpleasant dimension, some people have highly differentiated emotional experiences, whereas others have quite homogeneous emotional experiences. Lisa F. Barrett coined the expression "emotional granularity" to describe individuals' abilities to discriminate the specificity of their emotions. A subject with high emotional granularity can make fine-grained distinctions between similar emotions (i.e., emotions with similar levels of valence and arousal), describing their experiences with discrete emotional labels. Dr. Barrett (Barrett and Bliss-Moreau 2009) discerns between *arousal focus* (i.e., the amount of information about felt activation, self-rated in verbal reports of emotional experience) and *valence focus* (i.e., the amount of information about felt pleasure), both of which contribute to emotional granularity overall. Arousal focus appears to correlate with interoceptive sensitivity (Barrett et al. 2004), whereas valence focus seems to be linked to efficiency in perceptual processing of affective stimuli in the environment

(Barrett and Niedenthal 2004). Emotional granularity research has evolved in recent years, thanks to Dr. Barrett and colleagues' seminal work. However, investigation on emotional granularity is still in its infancy. It is crucial to establish and test a model analyzing the physiological and psychological processes that underpin it (Smidt and Suvak 2015). The last observation about emotional intelligence applied to atmospheric perception regards the inability to properly recognize the prevailing emotional tone of an atmosphere causing *blunders*, which further affect the overall atmosphere.

20　Body memory re-enacts our individual, specific variations incorporated throughout our entire lives. "What we once had acquired as skills, habits, and experience have become what we can do today" (Fuchs 2012, 11). It, therefore, "influences the circular relations between affective affordances, bodily resonance and emotional response in a given situation" (Fuchs and Koch 2014, 5).

21　There is no such thing as a neutral perception. Perceptual mechanisms take root in hidden knowledge and past experiences. "We continually compare what we see with situations that we have previously met and assimilated. [...] We do not see what we see but what we expect to find. [...] Our memory acts on our perceptions and influences our judgements beyond 'objective' truths" (von Meiss 2011, 27).

22　Places people encounter regularly inspire feelings of belongingness, place attachment, personal identity, and sense of agency. Familiar atmospheres also influence our degree of satisfaction, openness to notice changes, and the place-meaning process.

23　Sense of agency refers to the "phenomenal experience of initiating and controlling an action" (Braun et al. 2018, 5). Sense of agency, like the subject's effectivity (cf. § "physiological determinants," n. 15), shapes the suggestions afforded by a given spatial element. A lit door, for example, affords opening and entering if we can reach the handle; but the sense of agency may follow, changing one's emotional reactions and behavioral intentions (e.g., we feel embarrassed and unauthorized to violate the privacy of others' rooms).

24　For example, colors and materials.

25　These factors are distinguishable by their high level of variance and instability (above all, mood).

26　The philosopher Tonino Griffero explains a present atmosphere depends on the co-perception of past and expected atmospheres, serving this example: "the atmosphere of a hospital is tense precisely because we anticipate the situation to follow (the visit, the diagnosis, etc.) and we remember earlier ones (further waits, etc.)" (2014b, 37). Seated in the same waiting room, we might perceive an exciting atmosphere if we are there for our first prenatal appointment or an uneasy moment if we must receive a histological examination. One should additionally consider another aspect of hypothetical feelings: "the tendency to perceive the built environment in terms of its contrast or similarity to other environments, and to exaggerate features congruent to the place's atmosphere" (Peri Bader 2015, 260). That is, if the environment is envisioned as a "hospital," people prefigure a sequence of stereotypical atmospheres onto it, even if none are current realities.

27　In experiencing their surroundings, individuals generally undertake two opposite approaches: conscious and selective control to notice small details and enjoy them, aroused by elements of interest, novelty, or variance to the ordinary; or spontaneous, nonconscious indifference. It is fundamental to bear in mind two golden rules: people rarely pay attention to architectural features but rather move through environments in habitual and automatic ways (Vecchiato et al. 2015); and people's attention is drawn to emotionally charged stimuli — involuntarily (Rigoulot et al. 2008).

28　People may react differently to the same atmospheric situation if they are primed with a story about what happened or would happen in that place, as Isabella Bower (Ph.D., Deakin University) suggested to me in a private conversation.

29　We can take into account a broad variety of tasks, such as a practical task or a contemplative task, a high cognitive load task or a stress-free task, an out-of-the-ordinary task or a routine task, a real-time task or a memory task.

30　If we consider, for example, domestic spaces, people have subjective concepts of "home," and differently interpret basic activities such as relaxing, entertaining, or dining.

31　The term "affectability" describes our body's susceptibility to affective affordances. The process of bodily resonance influences our overall emotional perception and evaluation of a given atmosphere. As

current mood
anticipations and expectations [26]
attention span of one's emotions, thoughts, and movements [27]
presence/company of other subjects (not necessarily humans)
suggested narratives [28]
motivations and tasks to be performed [29]
ongoing activity and intended function of the space
subjective conceptualization of ongoing activity or function [30]
current bodily affectability [31]
current permeability and responsivity levels [32]
human-technology interaction. [33]

C.　Sociocultural Determinants

The sociocultural scaffolding of experience brings an additional degree of complexity in comprehending how individuals perceive architectural atmospheres. Sociocultural patterns prime our emotional reactions to atmospheres by acting *upon* our bodies:

family background
education level and quality
socioeconomic milieu
individuals' sociocultural history
individuals' sociocultural understanding skills [34]
sociocultural behavioral codes [35]
atmospheric expertise [36]
cultural influences on how we use and experience one's body [37]
semantic knowledge and linguistic habits [38]
intersubjectivity and intercorporeality mechanisms. [39]

Thomas Fuchs and Sabine Koch notice, a *lack of resonance* or an *amplified resonance* (e.g., provided by a steaming cup of coffee in our hands or by a comfortable position) alters "the perception of corresponding affective affordances in the environment" (2014, 4).

32 This aspect is linked to the previous one in explaining emotions are somatic correlates of conscious feelings: they interact and condition each other (cf. also n. 5). According to Thomas Fuchs and Sabine Koch, which hark back to the theories of German-American psychologist Kurt Lewin (1935), our bodies have variable degrees of permeability and responsivity. "The tired body," for example, "is more permeable than the wake body, the drunk body more permeable than the sober body" (2014, 3). See their embodied affectivity model.

33 The digital technological transformation of our society interferes with how we experience reality (and its atmospheres), affecting both interaction and isolation. An example is the way smartphones and wireless headphones alter how we perceive and use our environs, absorbing and diverting attention.

34 We must be aware both familiar and unfamiliar factors can prompt biases in spatial perception and interpretation due to automatic sociocultural associations (Kwon and Kim 2021, § "discussion").

35 Sociocultural behavioral codes might impact, for example, one's sense of agency (cf. § "personal determinants," n. 23).

36 Particular atmospheric situations could privilege individuals who are skilled in appreciating the atmospheric vocation of architecture. The hypothesis suggests a correlation between architectural background/ expertise and emotional intelligence (cf. § "personal determinants," n. 19), resulting in a deeper and more meaningful experience. In this vein, the first step should be challenging today's prevailing bodily reductive conceptions in architecture (Imrie 2003; Boys 2018).

37 One example is our culture-specific openness, or restraint, to outward emotional expression (cf. n. 17).

38 The German architecture critic Ulrich Conrads (1923–2013) reveals a curious aspect related to the impact of spoken language on our spatial experiences. He noticed this correlation during his stay in a small Tuscan house: "inside the rooms the loudly spoken word turned into inarticulate reverberation, but over a distance, from one room to another, only the glottal and sibilant sounds of our consonant-dominated language prevailed. We realized that in this house one had to speak in Italian — a vocalic, open, musical and loud language — or simply keep quiet in a way that we found to be almost painful. The house was plainly not built for our language" (Leitner and Conrads 1985, 31).

39 We construct emotions in response to others; in dialogue with others. The presence of other bodies conditions one's movements and intentions, just as one's perceptions of the place. For example, the presence of human figures — or, sometimes, merely human components (cf. § "spatial determinants," n. 42) — might increase a sense of safety. Marketing researchers, who have been adopting an experimental approach to examine atmospheric effects on consumer behavior for years, often monitor crowded situations. For further information about store atmospherics, see the classification of atmospheric factors presented by Berman and Evans (1995) and revised by Turley and Milliman (2000). The latter systematize five categories: 1. — external variables; 2. — general interior variables; 3. — layout and design variables; 4. — point-of-purchase and decoration variables; 5. — human variables.

40 When we study people's emotions, we normally assume the totality of factors influencing their health, wellbeing, and satisfaction (such as thermal comfort, lighting, acoustics, and indoor air) meet the optimal criteria. Nevertheless, in some experiments

focused on emotional responses to multisensory environmental stimuli, researchers noticed "temperature evokes emotions only when it reaches uncomfortable levels" (Schreuder et al. 2016, 14).

41 Particularly furniture and decorative choices.

42 Sensory clues related to human presence (e.g., footprints, photographs, or faces portrayed in artworks and advertisements)

can have relevance in affording social interaction and enhancing place identity, considering the premise that "environment perception is largely a social phenomenon" (Schönhammer 2018, 148). Cf. § "sociocultural determinants," n. 39).

43 Intrinsic characteristics of the geographical location reverberate on weather conditions, air components, and sunlight quality, which filter inside through open-

D. Spatial Determinants

The adjective "spatial" alludes to the obvious fact atmospheres do not exist in a vacuum. Multiple aspects of the physical environment atmospherically interact *with* our bodies — "immersed to fusion" in their surroundings (Neutra 1954, 12):

> indoor environmental quality (IEQ) performance [40]
> culture-specific components [41]
> social cues [42]
> site-specific constituents [43]
> natural (living or imitated) elements [44]
> architectural properties and forms
> (multi)sensory noise [45]
> meteorological special effects [46]
> reward-related cues. [47]

Generators of Architectural Atmosphere

Spatial determinants afford emotionally significant invitations. Such affective affordances are so closely interconnected to each other they cannot always be traced back to a specific material source. To affect the emotivity of someone occupying a space, we need an encompassing atmosphere, capable of rendering a space atmospherically perceptible in its complexity. This complexity is an inherent characteristic of architecture: "details tell nothing essential about architecture, simply because the object of all good architecture is to create integrated wholes" (Rasmussen 1962, 33).

Architects have the task (or, simply the desire) to design and stage atmospheres, given architecture "produces atmospheres in everything it

ings such as doors and windows. Those elements, influencing the general atmosphere, are critical to people's moods.

44 This item includes landscape views, natural multisensory stimulation, and nature-based atmospheres produced using biophilic design principles. People show a considerable preference and attraction for settings integrating natural elements. Nevertheless, the German professor of design

psychology Rainer Schönhammer points out "for architects and designers, in contrast to non-professionals, 'natural elements' are not a priority" (2018, 152 n. 63).

45 Excessive, unusual, unexpected, and remarkable sensory inputs can destabilize the atmospheric balance, triggering attentional shifts, discomfort, stress, and perceptual biases.

46 Designers sometimes interpret the

creates" (Böhme 1991, 36). The challenge is understanding which design factors contribute more than others to composing an atmospheric sense, conditioning the spatial perception of individuals. Philosopher Gernot Böhme articulates, "the making of atmospheres is restricted to the arrangement of the conditions under which an atmosphere can appear" (2013b, 161) [F6]. He calls these designable, determinant conditions *generators*. [48] They "are above all the geometric structures and corporeal constellations" (Böhme 2013c, 93) the architect installs [49] and can be "of an objective kind" (including material details affording motor interactions) or as "non-objective or non-physical," as light and sound (Böhme, 92).

Böhme identifies three main classes of *atmospheric character* (2013a), [50] where by "character" he alludes to the essence of atmospheres, or "the characteristic manner in which they impress" (Böhme 2001, 87). Adopting his taxonomy, we systematize the generators of architectural atmosphere as follows:

Gestural generators of atmosphere (such as dimension, proportions, forms, and geometry), distinguished by their ability to suggest movement and kinesthetic impressions (e.g., sensations of volume, load, and density, which can render a space oppressive, solemn, vast, or poignant).

Sensorial generators of atmosphere (such as light conditions, colors, materials, and textures), which produce specific sensory stimuli (among which are visual inputs, sounds, scents, and tactile feedback) that transpire from the architectonic materiality through their sensuous effects and are initially perceived in aggregate. [51]

atmospheric approach as a meteorological mise-en-scène, setting up performances of intangible factors that recall phenomena of the terrestrial atmosphere and their variations (among which are breezes, steams, and rainfall). Cf. Canepa 2022, chapter III "Atlas of Atmospheres."

47 The availability of reward-related cues (namely, stimuli associated with natural and artificial rewards such as addictive substances, sex, or appetizing food) in our environments can alter our perception, prompting both positive and risk-taking behaviors (Chiamulera et al. 2017).

48 The term "generator" helps emphasize the enactive existence of affective affordances in architectural substance (Condia 2020). It is a way to read the fundamental elements of architectural composition (or archetypes, as Norwegian architect Thomas Thiis-Evensen calls them in his 1982 book due to their consistency regardless of time, place, and function) through an emotion-based perspective other disciplines have perfected from the second half of the twentieth century (Griffero 2019). To schematize, we propose the following formula: *architectural element + affective affordance = atmospheric generator*.

49 Using the verb "to install" is not accidental. As the French sociologist Jean-Paul Thibaud says, more than being made, atmospheres are installed. Originating from the premise "to install" means "to locate in a chosen place" (a person or a thing), such a gesture becomes "an action which necessarily involves a place" (2014, 53), from which one can be inspired or conditioned. The preliminary setting not only provides a backdrop for an intended atmospheric performance, but reveals itself to be a significant generator. "Installing an atmosphere therefore always means coming to terms with an existing atmosphere, and finding ways of inflecting and transforming it" (Thibaud, 55).

50 In the beginning (Böhme 2001, chapter VII, 101–116), there were five categories: movement impressions, synaesthetic reverberations, social characters, dispositions of mind, and communicative expressions.

51 For this reason, the term "synesthesia" is frequently used, although it must be carefully treated — distinguished from the neurological condition in which "stimulation of one sensory modality causes unusual experiences in a second, unstimulated modality" (Hubbard and Ramachandran 2005, 509).

F6 Paolo Monti
photo series *Varese*, 1975
BEIC 6364265

F7 Paolo Monti
photo series *Genova*, 1963
BEIC 6361770

Palazzo Rosso, attic
remodeling project by Franco Albini
1952–1962

52 As previously observed (n. 39), atmospheric design has a long history of research in consumer science, especially in sensory marketing. The definition of atmosphere elaborated in sensory terms by Philip Kotler (1973), who is widely credited as the initiator of literature's stream on atmospheric experience in retail spaces, laid the foundation for the following list of atmospheric generators. In this essay, the sensory analysis of atmospheric components is deliberately limited to four Aristotelian senses, even if we know the multisensory essence of atmospheric perception is broader (Pallasmaa 2014). **53** Even if several scholars (e.g., Griffero 2014a) accentuate the primacy of orosensory atmospheres (that is, based on the oral sensory unity provided by smell and taste), we hardly detect the flavor of our environments. We did so in our early childhood,

Contextual generators of atmosphere (such as sense of home, power, or wealth), manifested with symbols and signs of culturally significant content, which contextualize the social condition or historical era through which the architect desires to associate a given environment, embedding well recognizable, conventional canons.

Another possible way to identify and organize the spectrum of architectural generators of atmosphere is by analyzing the elicited sensory modalities. [52] Sight, hearing, scent, and touch are the key sensory channels for perceiving architectural atmospheres. [53] Visual elements [**F7**] of an atmosphere, to which we respond emotionally, play a leading role:

lighting sensation (e.g., brightness, saturation, and contrast)
colors
materiality and texture
form (e.g., structure, shape, geometry, and compositional rhythm)
size (e.g., dimensions, proportions, and scale)
mass and weight
proximity between objects
openings and related indoor/outdoor interplay
furnishings and decorations.

The dominant aural dimensions of an atmosphere are three:

pitch
volume
acoustic reverberation/absorbency.

Atmospheres are enriched due to olfactory cues and their combination.

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when our "first impressions of architecture were largely gustatory" (Neutra 1954, 25).
54 Peter Zumthor (2006) compiled the most famous architecturally formulated atmospheric roster, made up of twelve items: "body of architecture," "material compatibility," "sound of a space," "temperature of a space," "surrounding objects," the equilibrium "between composure and seduction," "tension between interior and exterior," "levels of intimacy," "light on things," "architecture as surroundings," "coherence," and "beautiful form."
55 By *architectural generators* we mean the set of physical determinants architects design to stage the intended atmospheric effects, regardless of what future occupants of that space will actually perceive.
56 This digression is purposefully kept to a minimum to avoid going off-topic.

Lastly, are tactile and haptic aspects in generating an atmosphere:

> affordances of touch
> shapes
> materials and textural properties
> objects' temperature
> indoor environmental quality
> ergonomic standards
> haptic feedback.

Architects have tested themselves in analyzing atmospheric anatomy. They have drawn up poetic, biographical inventories of their design approach,[54] and outlined more objective strategies, informed by phenomenological and embodied cognition theories (Canepa et al. 2018, 2019) or guided by healing therapeutic criteria (Martin, Nettleton, and Buse 2019). As the architectural historian Alberto Pérez-Gómez stresses, the difficulty is not in compiling a list (all told, an easy operation), but in understanding "our embodied experience where meaning actually appears is always *primarily* synesthetic and enactive" (2016, 31: original italics). In other words, "it is never possible to simply add one characteristic to another as a factor in an equation" (Pérez-Gómez, 31–32).

E.   Experimental Determinants

Experimental conditions required by empirical research provide the final affecting factors capable of influencing the atmospheric equation and interacting with the architectural generators.[55] We must evaluate different variables according to the unique experimental paradigm, which is something *outside* the control of the perceiving agent:[56]

> laboratory environment
> laboratory devices and sensors
> sensory stimuli: complexity and multimodality
> sensory stimuli: distraction and overload
> task performance: difficulty, duration, and familiarity
> time of exposure: duration, frequency, and repetition
> sense of presence (especially, in virtual reality experiments).

Lesson

We could indefinitely add, improve, or remove items from these lists. Deciphering the mechanisms that generate architectural atmospheres is, after all, analogous to synthesizing the essence of architecture composition. Namely: impossible. We "cannot cover all the combinations that give architecture meaning," tailoring "a recipe for right and wrong" (Thiis-Evensen 1987, 9).

"There are no recipes," echoes the philosopher Tonino Griffero, "in planning atmospheres" (2014b, 35). However, to facilitate understanding, we can follow two opposite scripts which outline a rough formula for staging the atmospheric performance. The first strategy requires designers to limit themselves by subtly suggesting potential atmospheric impressions to inhabitants through a dialogue with their architectural setting. This setting must be intentionally conceived in a "more neutral" manner to stimulate "the hermeneutic and emotional creativity of the user" (Griffero, 37). The second strategy encourages architects to sharply entice their interlocutors by immersing them in a design narrative that affords predetermined emotional responses. It is what Peter Zumthor calls the equilibrium *between composure and seduction* (2006, 41–45).
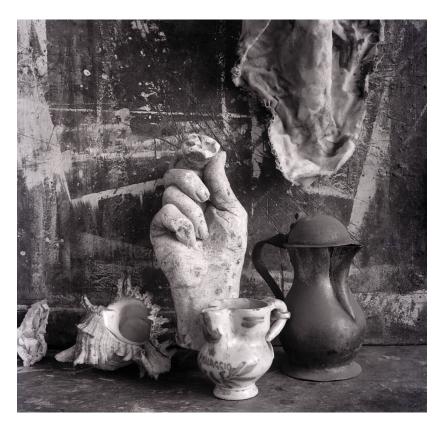
F8 Atmospheric equation
   ✗ physiological determinants
   ✗ personal determinants
   ✗ sociocultural determinants
   ✗ spatial determinants
   ✗ experimental determinants

The atmospheric equation is not an exact algebraic equation — long desired to solve architecture's meaning enigma (Pérez-Gómez 1983). It aspires to be a tool for better comprehending the experiential features of lived space — for gathering the emotional-affective core of spatial experience, weighting its value, and going beyond its physical constitution. Involving the fundamental principles of architectural composition (both in the overall layout and single details, through material elements and intangible qualities), the atmospheric approach provides theoretical lessons, and, hopefully, design essentials for structuring the universe of forms. Atmosphere is a full-fledged compositional dynamic in which *form* — made up of "the most permanent components of architecture" (von Meiss 2011, 11) — resonates with the human *body*, which is "our tool of tools," "the crucial medium through which architecture is experienced and created" (Shusterman 2013, 7; 2012, 227).

Atmospheric design is a compositional task in that defining atmospheric qualities (and, therefore, selecting and arranging their architectural generators) means searching for solutions that are emotionally meaningful for our architectural experience. In addition to the Euclidean and Cartesian grounding, we must learn how individuals emotionally resonate, attune their feelings, and shape their behaviors *within* and *with* their surroundings. Borrowing the words of the Norwegian architect Christian Norberg-Schulz, the atmospheric approach is "a way to 'order' reality," conferring meaning through such order. "Only when space becomes *a system of meaningful places*, does it become alive to us" (1988b, 22; 24: original italics).

This atmospheric equation [**F8**] was developed to map and navigate the jagged landscape of designable and aleatory variables that affect the or-

$$[X+X+X+X+X+X]+$$
$$[(X+X+X+X+X+X+X+$$
$$X+X+X)+(X+X+X+X+$$
$$X+X+X+X+X+X+X)]+$$
$$[X+X+X+X+X+X+X+$$
$$X+X]+[X+X+X+X+$$
$$X+X+X+X+X]+[X+$$
$$X+X+X+X+X+X] \quad = \quad ?$$

F9 Paolo Monti
    photo series *Italia*, 1960
    BEIC 6363710

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chestration of architectural atmospheres and ponder the relative contribution of factors designers can manipulate (all in all, a limited contribution). The next assignment is empirically testing the qualitative nuances of architectural generators [**F9**]. Surprisingly, systematic research and empirical evidence on the emotional impact of architectural atmospheres (or, in a broader sense, the built environment) are still few, and methodologies differ [57] — despite being widely theorized (Franz, von der Heyde, and Bülthoff 2005; Schreuder et al. 2016; Mostafavi 2021). Christian Norberg-Schulz well explains the overarching challenge.

> We experience complex phenomena which are spontaneously given as synthetic wholes. As such they are not accessible to thought because they fall apart during analysis. The objects of science may be compared with a mesh having defined properties. When such a mesh is thrown over reality, only has corresponding properties will be caught, the rest disappears through the holes. What is lost by the fishing net of science, may however be grasped by other kinds of symbolization. (Norberg-Schulz 1988b, 20)

Ultimately, we should recognize that "the atmospheric qualities of place are related to the ways in which space is used by its inhabitants, rather than the intentions of its architects per se" (Martin, Nettleton, and Buse 2020, 85). Here is where the atmospheric equation becomes even more complicated (Seamon 2017) — so much so, we regret forgetting the algebra we studied in high school.

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Acknowledgements

Generators of Architectural Atmosphere embraces Alberto Pérez-Gómez's lesson of atmosphere as a power to attune human life and explores the horizons offered by an experimental approach, challenging the inherent resistance of the atmospheric phenomenon to be objectified, quantified, and measured.

—— The editors

Atmosphere. Appellation for the moods and ambience created by architecture, adjusted for lived events in its discrete spaces and attuned to its site: amplifying and harmonizing priory meanings abiding in place. Most arduous to objectify and impossible to quantify. From Ancient Greek *atmós*, "vapour, steam," either poisonous or advantageous for the body and mind, taken in by respiration. Originally in the Sanskrit *âtman*, "inner self," a breathing, non-dualistic soul: first principle or true self of a liberated individual before identifying with phenomena. *Atmós*: moving water, foggy air, once deemed capable of bearing fleeting emotional images, like the imagination of the inner self, abiding both inside and out. Amenable finally to denote our spherical, airy, and affective abode, site of emotions and words coupled to the human breath, where we speak and are with others. Latin renders breath as *spiritus*, also the life-force and inner self. Atmospheres may thus accomplish architecture's spiritual function as we breathe and live, accommodating wise a priori habits with semantic amplification, offering poetic and ethical change, assisting our affective and intellectual self-knowing. An architectural atmosphere is a power to attune human life, one inherently out of tune for acknowledging itself as mortal, and in humble affinity with the beneficial actions of affectionate and amorous divinities.

—— Alberto Pérez-Gómez
An Alliterative Lexicon of Architectural Memories
A notion in progress

Interfaces 3 features three excellent essays on atmosphere as a phenomenological component of architectural experiences. Each complements the others to assemble both a compelling definition of the subject of atmosphere in buildings and an expansion of scientific knowledge about how perception and cognition work together to stimulate the emotions and feelings. If none of these papers settles the issue of whether atmospheric qualities can be measured, each brings us closer to understanding how we might do so in the future.

—— Mark Alan Hewitt, FAIA