

Limit Geometries of Architectural Filters: Precise Rationality and Poetic Emotion

Geometrías de límite en los filtros arquitectónicos. Racionalidad poética y emoción poética

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Abstract

An architectural filter is a porous material construction that regulates transverse visual relationships, and establishes degrees of connection through the intervention of light and gaze. Filtering boundaries display variable proportions of mass and air, which are instrumental to the production of the spatial experience behind the mediation of matter and geometry. A filter's structural system synthesizes geometric relations with the capacity to cause architectural atmospheres, as a result of the active border that is technically precise and sensorially ambiguous at the same time. The text sustains that the emerging atmospheres behind the filter cannot take place without a previous, precise geometric production; the poetic dimension of filtering strategies originates from its capacity to transform the concrete geometry of its contour conditions and controlled material execution into an unexpected atmosphere of emotional and incommensurable qualities.

Keywords

Architectural atmospheres; architectural filters; visual interference; phenomena of interference; limit.

Resumen

Un filtro arquitectónico es una construcción material porosa que regula las relaciones transversales visuales y establece grados de conexión mediante la intervención de la luz y la visión. Las fronteras filtrantes exhiben proporciones variables de masa y aire que son fundamentales para la producción de la experiencia espacial tras la mediación de la materia y la geometría. El sistema estructural de un filtro sintetiza relaciones geométricas con la capacidad de generar atmósferas arquitectónicas, como resultado del borde activo que es técnicamente preciso y sensorialmente ambiguo de forma simultánea. El texto sostiene que las atmósferas que surgen tras el filtro no pueden tener lugar sin una producción geométrica precisa previa. La dimensión poética de las estrategias filtrantes se originan desde su capacidad de transformar la geometría concreta de sus condiciones de contorno y su ejecución material controlada en una atmósfera inesperada de propiedades emocionantes e incommensurables.

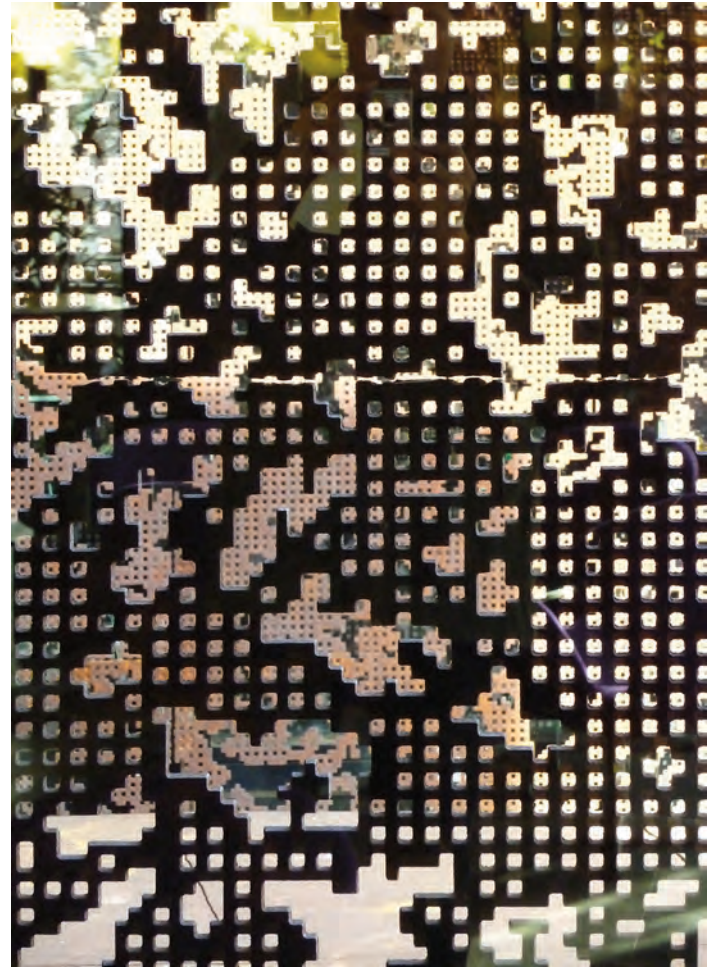
Palabras clave

Atmósferas arquitectónicas; filtros arquitectónicos; interferencia visual; fenómenos de interferencia, límite.

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[Fig. 1] Vine shade. Photograph by the author.



[Fig. 2] CaixaForum. Herzog & de Meuron. Madrid, Spain. 2008. Corten facade detail. Photograph by the author.

Dissipated Geometries

“If we think of voids instead of working with solid elements, the truth emerges.”

Robert Le Ricolais¹

An architectural filter is a material construction with a certain degree of porosity that allows the calibration and limitation of the relationships between sight and light, and the realms separated by matter and geometry. A filter constitutes a permeable structure that forms a porous limit with a variable, geometric proportion of matter and air, producing two differentiated sides. The proportion of voids in the mass is critical to the configuration of the space, as this is what filters the direct and simultaneous passage of natural light and the gaze between an interior and an exterior. In this text, we will propose that an architectural filter entails the material and geometric definition of an active limit, which in turn connects two sides that are initially separated, and transforms the space inside, facilitating the emergence of a dissipated atmosphere. The transformation of the material space and the new intellectual atmosphere is the result of an imprecisely perceived reality behind the filter. This architectural atmosphere manifests itself through flowing relationships that are channeled through the characteristic voids of the filter’s structure. Regardless of its natural growth in the case of nature’s spontaneous filtering structures, or its artificial construction in the case of architectural filters, these ambivalent voids are the exact points at which the interactions between the inside and the outside world happen. As we see in the voids between the leaves and branches of a vine, or in the precise design of Herzog and de Meuron’s Caixaforum’s perforated corten steel envelope that shapes the volumetric roof of the building, the permeable separation projects the geometric borders into a new atmosphere inside.

¹ Robert Le Ricolais, *Visions and Paradox* (Madrid: Fundación Cultural COAM, 1997), 10.

The construction of a filter pulls apart and binds together two contiguous spaces, leading to the distinction between two sides: one interior, containing the observer and the shadows; and one exterior, containing the views and the light source. The border defined by the filter works as much as a connector as it does as a separator in the relationships it creates between the two sides. Therefore, these elements should not be thought of as divisive frontiers but rather in the topologically opposed sense, that is, as a border of connections that becomes clearer as the definition of the filter as a spatial limit becomes more precise.

We could suppose that a filter evolves from an opaque and impenetrable separation in which a progressive opening condition starts to appear, generating a porosity that makes the division permeable to light and gaze. This variable porosity is characterized by the contour conditions that determine the transit of sensory information and, therefore, the atmosphere generated inside. The gaze, lights, and shadows qualify the perception of the new space, while progressively diffusing its contours and reaching the virtuality of the undefined.² The effect is that of a space in a continuous process of visual dissipation and mental reconstruction.³

When establishing the geometric and material limits of a physical space, the filter facilitates the initial definition of the contained space. Aristotle wrote that that which has no limits cannot be comprehensively represented in our thinking, and therefore, cannot be understood.⁴ The definition of limits allows for the spatial establishment of a viable and defined reality. Saint Thomas Aquinas wrote that the surface contours and geometric figure of an object are “the edge and confine of the limitless potentiality of all material stratum par excellence, as well as the miraculous balance and meeting point of such potentiality with the fatal contraction performed by the matter of God’s perfect form within the limited forms of existence.”⁵ In a similar manner, a filter forms a physically defined, concrete boundary with the capacity to manifest a transitory potential, establishing a perception of the medium by means of the intersection of the dissipated spaces within the *continuum* of space and time. Heidegger wrote in his 1954 text *Building, Dwelling, Thinking*: “A space is something that has been made room for, something that is cleared and free, namely within a boundary, Greek *peras*. A boundary is not that at which something stops, but, as the Greeks recognized, the boundary is that from which something *begins its presencing*. . . . Space is in essence that for which room has been made, that which is let into its bounds. That for which room is made is always granted and hence is joined, that is, gathered, by virtue of a location. . . .”⁶ To form limits means to restrict and control. A space exists based upon the definition of its limits, and it is therefore necessary to mark them out so as to create restrictions on the potential actions and options. Italian author Paolo Zellini explored the value of existence by means of the definition of its limits: “There is nothing more dangerous than the loss of limit and self control: the mistake of the infinite is the loss of the value contained within the relative perfection of that which is specifically determined and formally concluded, causing one to get lost in the nowhere or in an exitless labyrinth. [. . .] That which is complete has an end, and the end is a condition that limits, inasmuch as the *limitless* indicates the absence of any limit under its intrinsic meaning.”⁷

A permanent dialogue takes place between opposites when a filter configures the limits of architecture. The German Early Romantic poet Novalis (1772-1801) wrote: “All that is visible is locked into the invisible, the audible to the inaudible, the sensible to the insensible. Maybe even the thinkable to the unthinkable.”⁸ The same idea was explored by Gabriele D’Annunzio (1863-1938), who wrote about music in 1900 through one of his characters, Stelio Efrena in *Il Fuoco*: “Have you ever thought that the essence of music does not come from sounds? It can be found in the silence that precedes the sounds and in the silence that follows. The rhythm emerges and

2 The term *Limit* comes from Latin *limes* – a real or imaginary line that separates two areas, two countries or two territories; an end reached at a specific time. During the age of the Roman Empire, *limes* referred to the name given to the no-man’s land where borders were imprecise or undefined. Said land remained undefined and without sovereignty, comprising a transitory area between one land and another, between one country and the next. Rome ceded these areas of trade and conflict between barbarians and Romans to peasant-soldiers. *Limes* had their own legal and civil systems. Marcel Duchamp explored a similar notion in his term *inframince*, which referred to the space existing between the air and the sea.

3 To dissipate: to cause to spread thin or scatter and gradually vanish. Merriam-Webster.

4 In his *Metaphysics*, Aristotle examines that which can be confirmed due to its actual existence and not its potential qualities. The main subject is *ens qua ens* – being as being.

5 Cited in Paolo Zellini, *Breve storia dell’infinito* (Milan: Adelphi, 1980) (English version: *A Brief History of Infinity* (London: Penguin Books, 1980), 76.

6 Martin Heidegger, “Building, Dwelling, Thinking,” *Poetry, Language, Thought* (New York: Harper & Row, 1971), 154-155. Another philosopher, Ludwig Wittgenstein (1889-1951), appreciated the characteristics of the limit in the autonomy of the subject’s will: “The subject does not belong to the world, but is a limit to the world.” Wittgenstein, Ludwig: *Tractatus Logico-Philosophicus*, 5.632. Cited in Paolo Zellini, *Op. Cit.*, 114.

7 Paolo Zellini, *Op. Cit.*, 11, 13.

8 Novalis as cited in Paolo Zellini, *Op. Cit.*, 50.



[Fig. 3] Dominus Winery. Herzog & de Meuron. Napa Valley, California. 1997. Facade view. Photograph by unknown author.

lives in these intervals of silence.”⁹ Similarly, we can assume that the perception behind the filter is a counterposition between freedom and prohibition, between the visible and the invisible, between sound and silence, between light and shadow, between void and matter, between reality and fantasy. As such, these structures have no meaning without this dual, instrumental condition. The experience moves away from the technical aspects that produced it, to become something greater. The perforated matter acquires the same level of relevance in the perceptive process. The holes collaborate with the geometric configuration of the filter and the resulting interior space.¹⁰ Given this porous quality as formed by geometry, mass, and air, we may understand the holes as another form of matter, compelling us to regard filters as a collection of interstices that facilitate an osmotic and multi-directional flow in a permanent play of dialogues, rhythms, and cadences.

The defining mechanisms of a limit announce the existence of an infinite dimension without revealing a total or overall view or giving direct or full access to a visual truth outside: imagination and memory are always allies in the spatial characterization behind a filter. Filters create timeless effects from the coalescence of light and gaze, and imply a sense of both fugacity and eternity. The physically tangible and concrete avoids any correspondence with a limitless temporal or spatial extension. The limit composed by an architectural filter presents a transcendental order with regards to the space it delimits. Such a limit is created in a technically and constructively exact way, and becomes activated by the intervention of flowing agents through the mediating structure. Like a poem, written with a specific and rigorous meter that takes the reader beyond the physical pages of the book, the permeable limit is built with material contention and geometric discipline, and becomes permeable to the exchange of relationships and participation between both sides. This circumstance blurs the precision of the initial execution, and intentionally attains a state of sensorial instability. The permeable basalt walls of the Dominus Winery in Napa Valley, California, by Herzog and de Meuron (1997), illustrate the dramatic merging of both dimensions in the production of space. The stones that were extracted from the site excavation were carefully classified after their sizes and put inside manufactured wire cages. Once the gavion walls were up, a unique experience of visual dissipation emerged: a psychic ambience, a new architectural atmosphere, a space for emotion. The conditions imposed by the permeable membrane allow the materially defined geometry to manipulate the transverse relations and to produce psychically charged atmospheres. The technical construction of matter and voids

9 D’Annunzio cited in Paolo Zellini, *Op. Cit.*, 50. This consideration of silence as a critical component of sound is also explored in the works of composer John Cage, in pieces like *4’33”* (1952).

10 The research of Robert Le Ricolais is of particular interest regarding operations with holes as an integral part of structural design operations. See note 24.



[Fig. 4] Dominus Winery. Herzog & de Meuron. Napa Valley, California. 1997. Facade view. Photograph by unknown author.

involves the structurally and geometrically contained contours that are subsequently superseded, reaching a trance-like emotional state in the process.¹¹

This changing state of openness determines a visual dissolution of the limits between interior and exterior. It is behind the filter where we experience a delimited but also infinite atmosphere. As the space projects itself beyond its own boundaries, we get a simultaneous perception of proximity and distance that changes depending on the relative position and movement of both the light source and the observer. The porous separation controls the degree of interaction between one side and the other, bonding both domains together in a process that is constantly evolving. In this place, intuition and memory as constructors of space become fundamental, and any attempt to classify the generated atmosphere is highly complex. This quality of visual dissipation is what allows the perception of a specific architectural atmosphere. In this regard, the filter moves away from stylistic issues, manifesting itself as a timeless invariant in architecture. The atemporality of these architectural filters makes it possible for these mechanisms to achieve certain complexities that are proper to more contemporary architectural realities.

11 Simone Weil writes that “Freedom is a limit and that the limit is something in trance at every overcoming stage.” See Paolo Zellini, *Op. Cit.*, 22.

12 Rainer Maria Rilke, *Mitsou. Histoire d'un chat* (1921) (Paris: Rivage, 2008), 20. Translation by the author.

13 “There is no life with no contour interpretation,” wrote Spanish philosopher José Ortega y Gasset, “[...] This interpretation shows how the living react to new circumstances by comparing them with past experiences that they keep in their memory.” See José Ortega y Gasset, *Viajes y Países* (Madrid: Revista de Occidente, 1957), 123.

14 “A project with an isotropic plan and an infinitely extensive structure meets a chance boundary. An element with a genuine internal structure is cut off by an undefined contour that depends on a perimeter that is foreign to it in the exterior. It is after this precise contour condition that is established outside of its inner pulse that these projects can construct a place.” José Antonio Sosa Díaz-Saavedra, “Condiciones de contorno,” *Arquitectura COAM*, 345 (Madrid: COAM, 2006), 32.

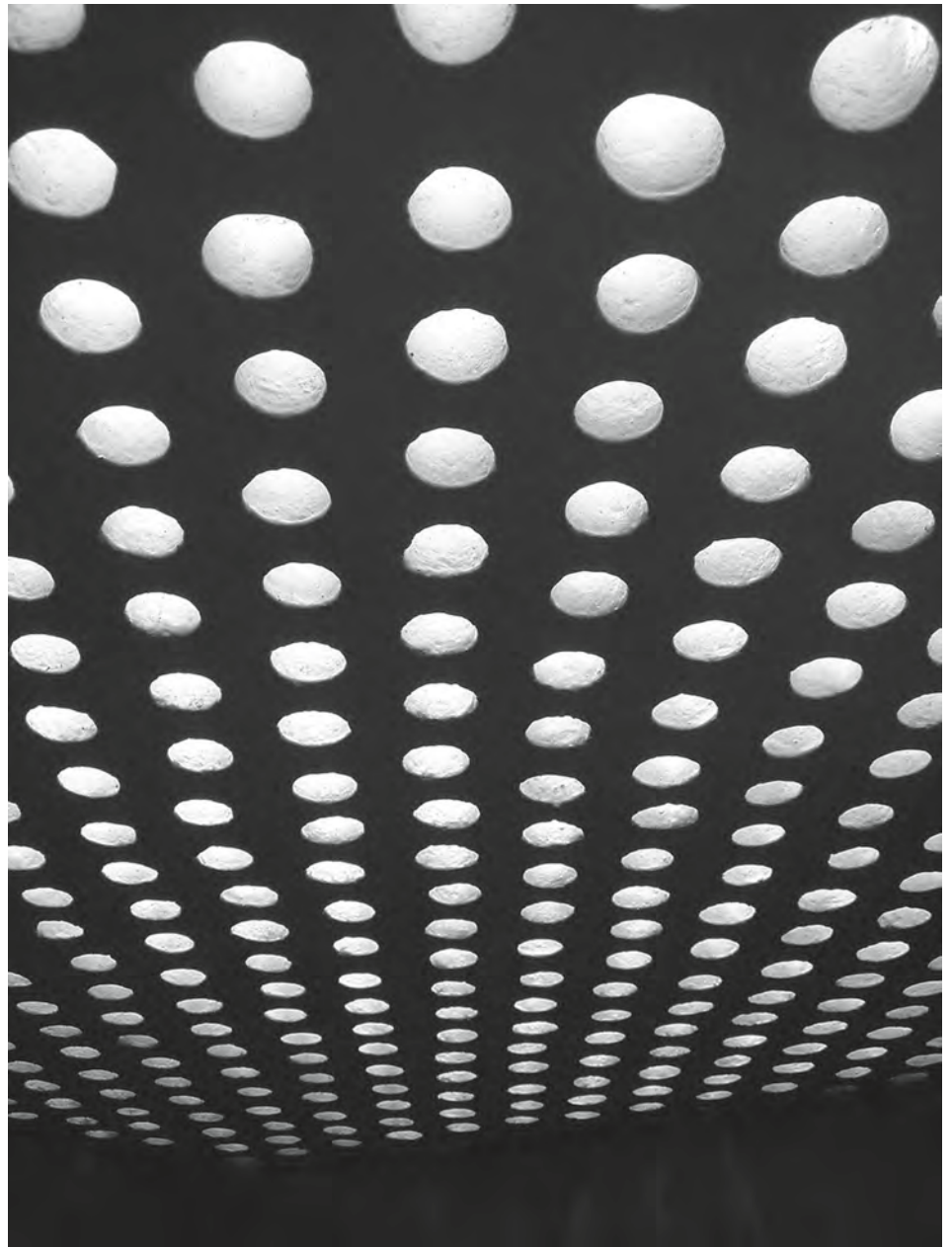
Defining Contour Conditions

“We are approaching a laminar latitude, a place where what we contemplate almost touches transfiguration, taking us beyond, through an interior pathway, to where the aesthetic experience happens in all its magnitude.”

Rainer Maria Rilke¹²

If the construction of an architectural filter involves the definition of a spatial limit,¹³ a filter may be understood as the definition of the geometric contour conditions of a permeable structure that is conceptually extensible to the infinite, and qualifies the character of the space inside, both internally and externally.¹⁴ The internal contour condition configures the filter’s distinctly transverse character and the perimetral edge where the filter ends, affecting all relations between one side and the other. The connections that take place perpendicularly to the predominant filtering plane, that is, between the interior and exterior, define a *transit* that determines the flow of relationships; hence, the dimension of depth becomes instrumental. A filter is significantly defined by its transverse permeability, and by its perimetral contour condition, although this component affects the filter’s internal definition

[Fig. 5] Casa das Canoas. Oscar Niemeyer. Rio de Janeiro, Brazil. 1951. Shower ceiling detail. Photograph by the author.

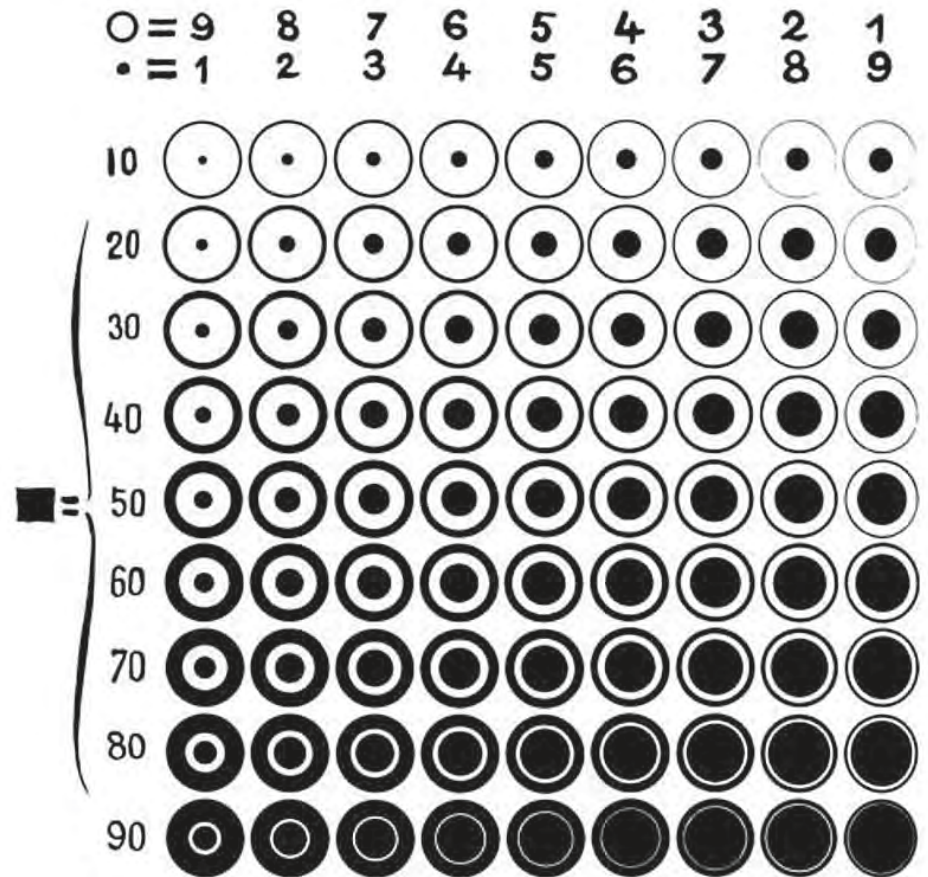


to a lesser extent. The shower at the Casa das Canoas, by Oscar Niemeyer in Rio de Janeiro (1951), offers a very particular ceiling condition: a matrix of round perforations connect the private space of the shower with the sky above and the source of zenithal light. The perimeter of the ceiling is irrelevant in the experience – it becomes lost in the darkness of the edges –, and it is the field condition¹⁵ of the identical holes that connect the user with the outside.

The internal contour intersects two realms, characterizing the interiority of the space, the exteriority of the world, and the interactions that take place between the two. Filters facilitate our passage through formerly blank walls, extending our perception beyond their limits and thus re-building a new interior. Juhani Pallasmaa writes: “All senses are specializations of the skin tissue, and all sensorial experiences are forms of touch, and are therefore related to tactility. Our contact with the world happens in a boundary line with the self through the specialized parts of our surrounding membrane.”¹⁶ The internal contour condition of a filter conveys the unique syntax produced by the contrast and proportion between the mass and void, between matter and air. These are critical in the configuration of the balance between opacity and transparency. The transitional nature that constitutes liminal spaces slows down the relationships that take place across their transit. The material section impedes the passage of light and gaze, while the sections of air allow both to pass through, thus linking one side to the other. Both flows are

15 See Stan Allen, “Field Conditions,” *Points and Lines. Diagrams and Projects for the City* (New York: Princeton Architectural Press, 1985).

16 Juhani Pallasmaa, *The Eyes of the Skin. Architecture and the Senses* (New York: John Wiley & Sons, 2012), 43.



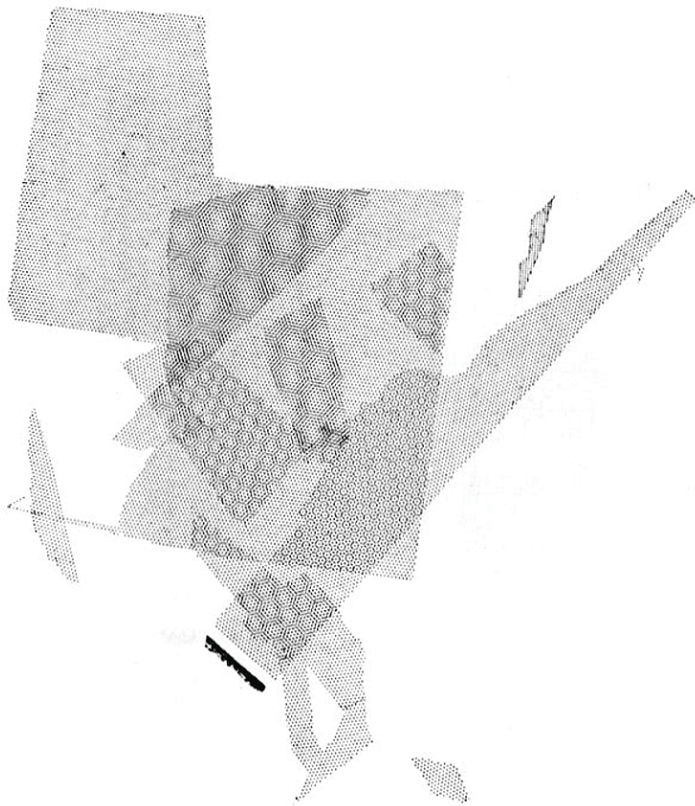
[Fig. 6] Typographic proportion diagram.
 Jacques Bertin. From *Sémiologie Graphique*.
 1967.

affected by the depth of the separation. The deeper the transverse dimension, the farther and slower the connection between both sides.

The dimensions of the perforations must fluctuate within a range with a geometric ratio that allows for a visual comprehension of the filter as a mesh, and not as a simple solid-void proportion. These ratios can be explained using the Moiré effect.¹⁷ This effect consists of the visual vibration that occurs when our eyes perceive certain combinations of black and white in an unstable proportion. The visual vibration is caused by the physiological reaction of our retina, and it leads to our brain being unable to determine which part is the figure and which part is the background. French author Jacques Bertin offered an explanation by referring to a pattern of black on white that oscillated between the proportions of 0.4 and 0.6. For this reason and the subsequent illegibility, typographers have traditionally avoided fonts that might display a similar proportion of black and white. The Moiré effect can be applied to filters in order to indicate the range of permeability in their material design. This would explain visual strategies that increase or decrease the density of an enclosure, without losing its most characteristic properties. It is within this balanced proportion between mass and void where architectural filters are visually defined in a way that guarantees a relationship between the whole and its parts, making the enclosure function as such. Therefore, the definition of a filter must avoid traditional typographic recommendation in that filters must approach a matter-and-air proportion of equal parts that tends to 0.5. This helps to configure the visual ambiguity that is so characteristic of all filters, leading to the new spatial atmosphere.

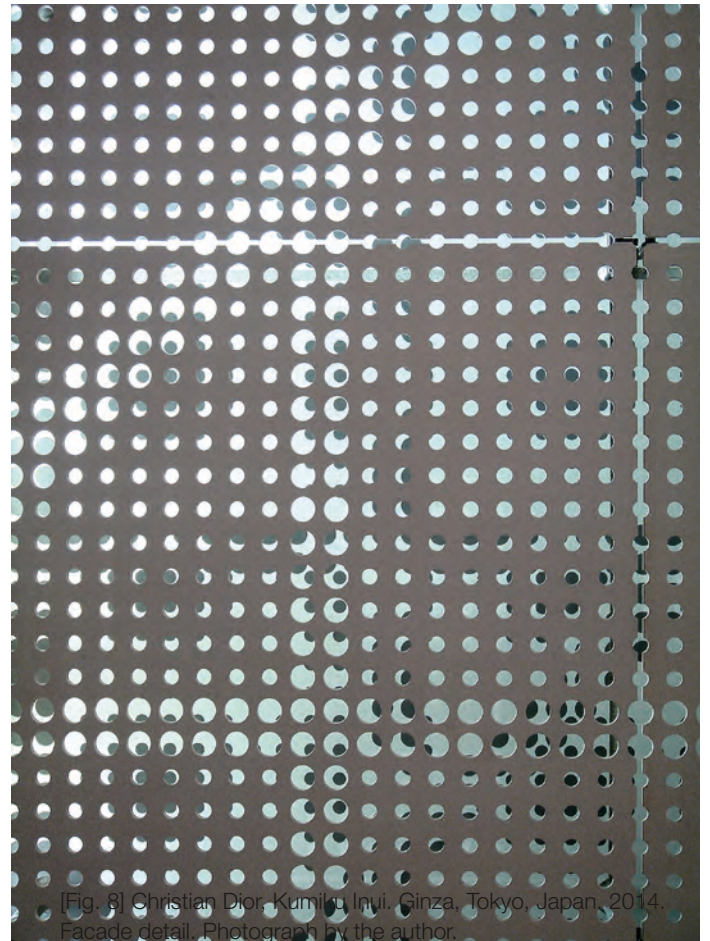
17 Moiré: French term for a strong fabric with visual wave patterns. The Moiré effect happens when two or more regular meshes with similar geometric characteristics overlap with slight shifts in their position and/or geometry. The meshes do not have to be identical and are combined to produce irregular, distorted optical effects. The Moiré effect is directly related to the rules in geometry and mathematics that deal with the scale and proportion of overlapped meshes. In his 1967 essay *Sémiologie Graphique*, French author Jacques Bertin explained, through drawings and texts, various visual effects similar to this one. See Jacques Bertin, *Sémiologie graphique. Les diagrammes, les réseaux, les cartes* (*Semiology of Graphics: Diagrams, Networks, Maps*) (with Marc Barbut et al) (Paris: Gauthier-Villars, 1967).

The blurring condition explained by Bertin in 1967 drew the interest of Le Corbusier in 1953. The Swiss master made an observation about certain stickers or *screentones* that came into the market in 1937. They were called *zip-à-tone*, and were usually used to hatch areas in a drawing:



[Fig. 7] *Zip à Tone* illustration. Le Corbusier. From *Le Modulor*. 1953.

[Fig. 8] Christian Dior, Kumiku Inui. Ginza, Tokyo, Japan. 2014. Facade detail. Photograph by the author.



[Fig. 8] Christian Dior, Kumiku Inui. Ginza, Tokyo, Japan. 2014. Facade detail. Photograph by the author.

“*Zip-à-tone* is a product recently placed at the disposal of draftsmen, photographers, and commercial artists. It consists of transparent cellophane sheets covered over by different patterns printed in black [...] To play the game (an unexpected one) which I am suggesting, it is enough to take the first fragment of *zip-à-tone* that comes to your hand, place it on top of another, and turn it very slightly from left to right or from right to left. You will see that, within less than one-quarter of one rotation, you will have determined seven different drawings of a hexagon. It happens under your very eyes: within a second you see a thrilling geometric phenomenon come to life and develop. But if, in turning your cellophane sheet, you do not stop at the right stages there will be no geometry; you will be left outside the door in a world of inconsistency. This phenomenon of interference denounces the hiatus as much as it demonstrates perfection. It all depends on you or on the circumstances in which you read, your lack of attention or a minute displacement of an object. The wealth of the world consists precisely in these infinitely fine nuances which the vulgar man forgets to see because he imagines a wealth that is spectacular, noisy, torrential... dwelling only in privileged places, inaccessible to modest folk. It is enough to observe.”¹⁸ The “thrilling geometrical phenomenon” described by Le Corbusier was nothing else than what the conventions later called Moiré effect. This geometric condition is very pertinent to addressing the structural possibilities of filters. What the Swiss master called a “phenomenon of interference” can be understood as a proper description of how architectural filters perform, emerging precisely from a refined exactitude in the observation of a spatial experience. The headquarters building for Christian Dior in Ginza, Tokyo, whose facade was designed by Kumiko Inui in 2004, explores these visual phenomena through the overlap of perforated metal panels. Inui explored the visual effects of several layers of similar perforated patterns, generating vibrating effects for the fashion house in Japan.

18 Le Corbusier, *The Modulor*. (London: Faber and Faber, 1953), 150-154.

Another factor involved in these questions of contours is the relationship between the geometry of the internal mesh and the distance between the observer and

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the filter. This range establishes a scalar relationship that differentiates some filters from others. When we get considerably close to a facade that was designed as a mesh of assembled elements or a continuous plane of perforated mass, we can see through the interstices to the other side. In this instance, we cannot see the enclosure wall as a filter but rather as a structure that is riddled with openings. If we move away from that enclosure, we can then see a vibrant pattern in which the voids and masses are no longer evident. From an even farther distance, we cannot distinguish any openings, only a continuous plane of matter. Therefore, we can observe that the perception of the filter as such is, to a large extent, due to the scalar relationships between three geometric factors: the internal contour condition or filter mesh – the transverse geometric relation –, the exterior contour condition or filter edge – the longitudinal geometric relation –, and the relative distances between the previous two conditions and the observer. The combined relationships between the internal geometric mesh, the outer edge, and the observer constitutes a critical parameter in the distinction between a filter and simple openings, such as traditional windows, in a blank wall or a wall that is practically opaque. The range of possibilities should shift away from the extremes: far from a continuous plane of matter and far from a single opening. The balance between these three conditions determines the filtering qualities and the atmosphere that such limit comprises.

Spanish architect Juan Navarro Baldeweg proposes a series of lines connecting us with our material environment. “Architecture is the meeting place for all these lines that go diagonally through and perforate the material productions that involve us.”¹⁹ Our gaze and the exterior light trace the meeting place where the filter intervenes as a connecting device. The permeable construction modifies what could have initially been a direct, literal relationship, and builds a new architectural atmosphere through the specificity of geometry and the subjectivity of the mind. Like Marcel Duchamp’s *inframince* – an inaccessible but existent edge that separates the sea and the sky –, the construction of a filter creates a closing structure that performs as a diaphragm of accumulated energy, which functions as a condenser and a diffuser at the same time. The definition of the contour conditions allows for the calibration of atmospheric effects that are generated later through the changing projections and the interpreting mind of the observer.

19 “That which architectural works ultimately put forward is that which defines them from the outside: something that has no beginning and no end, something to which distinctions between inside and outside do not apply. [...] Like the philosopher contemplating that which is tangible, the abstract realm and the distant and limited framework within which ideas move and pass like whirlwinds needs to be constructed. Therefore, I understand works of architecture as a section physically defined by a flow of fibers that extend beyond the work itself; it is a cut in the rope made with threads that link that which is loose [...] and connect our material production with the psychic perception and the capacity to represent the concrete and the abstract, the close and the remote that affect the nature of mankind.” Juan Navarro Baldeweg, Juan, “El objeto es una sección. La Geometría complementaria,” *Circo* 1995.25 (Madrid: Circo, 1995), 7.

20 Mies van der Rohe, cited in Fritz Neumeyer, *Mies van der Rohe. La palabra sin artificio. Reflexiones sobre arquitectura 1922/1968* (Madrid: El Croquis / Biblioteca de Arquitectura No. 5. 1995). Translation by Author.

21 B. H. Arnold, *Intuitive Concepts in Elementary Topology* (Englewood Cliffs, N.J.: Prentice Hall, 1962).

Geometric Rationality and Poetic Emotion

“Order is more than just order: it is organization; organization is more than just organization: it is meaning.”

Mies van der Rohe²⁰

The atmosphere that appears behind a filter embodies the formalization of certain basic topological aspects of the filter’s structural organization, such as concentration or dispersion, homogenization or differentiation, opening or closing, continuity or discontinuity, and connection or disconnection. These basic geometric operations refer to the definition of the atmospheres and the relations that emerge within them, instead of the geometric figures that they form. Professor B. H. Arnold states that “the topological properties of a figure are the most basic and fundamental of its geometric properties.”²¹ We could say that filters are configured from general topological orders that admit the coexistence of several elements. A filter can be formed spontaneously by nature itself, or artificially via the conscious actions of mankind. The former would include arboreal structures, whereas the latter would include constructed filters that enclose architectural atmospheres. Professor and author Carlos Martí referred to trees to illustrate this matter: “A tree has an order of its own, despite the different parts of which it is composed. In this case, order

means unity that dominates disparity, a system of rules that gathers together various elements, providing the whole with a new equilibrium.”²² Based on this hypothesis, if we understand a filter as an organized system, we will be able to interpret it as the material result of a specific field condition that admits improvisations that do not alter its essence. The structural configuration of a filter constitutes much more than just a question of form, but a “structural system [that] is capable of maintaining its spatial production even under microscopic variations and changes.”²³ The way the filter opens, organizes space, and arranges its parts has to be precise and rigorous, but this is not necessarily so in its external appearance, but in its essence, in the deepest conceptual levels.²⁴ The quality of the space may be modified but it does not disappear.

The discourse established between geometric rigor and poetic emotion is directly related to the research of some relevant scientists who have conducted in-depth studies on meshes and patterns, as well as on aesthetic perception. The metallurgist and scientific historian Cyril Stanley Smith (1903-1992), founding director of the Institute for the Study of Metals at the University of Chicago, closely scrutinized aspects such as the crystalline and structural geometries of different materials, as well as certain visual properties so as to determine their intrinsic aesthetic values. Smith highlighted the structural, geometric, and visual interest of the rarely-noticed imperfections found in patterns in which the interaction between regularity and irregularity was the hitherto unexplored cause of the structures’ aesthetic attractiveness. As an explorer of microscopic patterns in foams, crystalline aggregates and metals, among other materials, Smith claimed that the perception of structural organization was based upon the whole and not upon the fragments, just as the topological requirements of a spatial culmination determine the relations with the whole. The scientist wrote in one of his well-known texts: “Somehow, the brain perceives the richness of possible plays among patterns composed by simpler parts, a combination between the local and that with a longer reach, between the extension and the consolidation, between the substance and the surface, between order and disorder.”²⁵ Smith’s reflection establishes a geometry-based work strategy that suggests a duality between the technical and the experiential, that is, between the scientific and the phenomenological. Smith thus opened a pathway to an aesthetic emotion that is linked to the production of metal’s internal structure, a pathway on which one is inextricably bonded to the other, leading us to the structure of the poetic, from geometry to emotion.²⁶

Italian author and professor Massimo Piattelli-Palmarini expressed his deep interest in the juxtaposition of two models, the crystal and the flame, as two “forms of perfect beauty. [...] On the one hand, the crystal, image of invariability and regularity of specific structures; on the other hand, the flame, image of the constancy of a global exterior form, despite the incessant internal agitation.”²⁷ Piattelli-Palmarini proposed a similar dual organization of grammar to that of Claude Lévi-Strauss, who wrote: “The experience of the abstract can only be realized through the science of the concrete.”²⁸ In an analogous way, architectural filters entail a permanent balance between two components, geometry and emotion, crystal and flame, the essence of which can be found in their constant dialogue. The crystal and the flame, as two structures that are perfect in themselves, establish an opportune metaphor that illustrates, in Calvino’s terms, “two forms of growth over time, two absolutes, two categories to classify facts, ideas, styles, feelings [...] On the one hand, the reduction of aspects that are contingent to abstract schemes with which to make operations and demonstrate theorems; on the other hand, the effort of words to express with the highest possible precision the sensitive aspect of things.”²⁹ This counterposition draws attention to the dual nature of a filter, the physical and the mental, that of the implacable geometry, and that of

22 Carlos Martí Arís, “Tres paseos por las afueras,” *EAR 1* (Barcelona: UPC, 2008), 21. Translation by Author.

23 See Cristina Díaz Moreno and Efrén García Grinda, “Ocean of Air,” *El Croquis* 121/122 (Madrid: El Croquis, 2004), 28-34. The structural systems proposed by each type of filter work as “field configurations that are simply and weakly connected at a local scale, but become a highly complex system when examined as a whole.”

24 Le Ricolais understood form as something open and not closed, and spoke of the notion of form as a “more fluid concept, often linked to the parameter of time, thus indicating movement.” Robert Le Ricolais, “Introduction to the Notion of Form” (1966), *Data: Directions in Art, Theory and Aesthetics* (Greenwich, CT.: New York Graphic Society Ltd., 1968), 48.

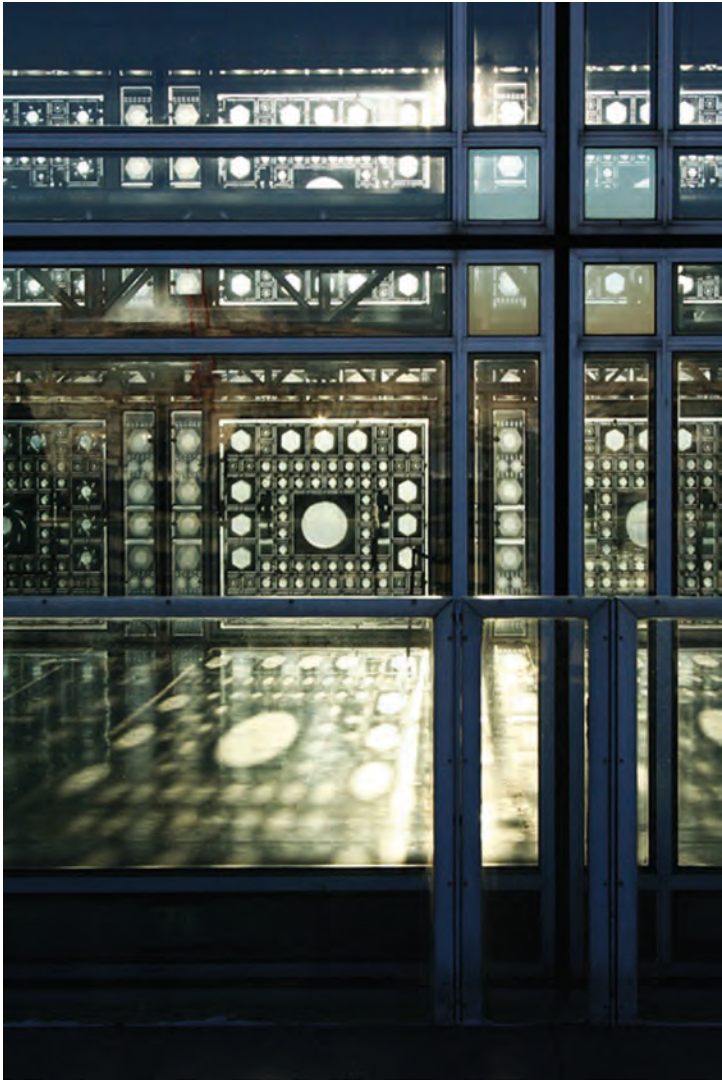
25 Cyril Stanley Smith, “Structure, Substructure, Superstructure,” *Structure in Art and Science* (New York: George Braziller, 1964), 36, 40. Habraken speculates about the intermediate point between the objective and the subjective, between essence and experience: “What really matters is the relationship between the parts and not a particular configuration.” He continues: “Could it be that a pattern’s aesthetic pleasure comes from the configuration of a sort of moiré halfway between a new recent experience and the accumulation of previous experiences, halfway between the different parts of a pattern perceived in an oriented space with scale and time variations due to the marvelous properties of the brain?” N. J. Habraken, *The Structure of the Ordinary* (Jonathan Teicher, ed.) (Cambridge: MIT Press, 2000), 249.

26 The work on phenoma and perception by Gernot Böhme and Christian Borch is particularly relevant.

27 In the introduction to the volume containing the discussion between Jean Piaget and Noam Chomsky at the Centre Royaumont at the homonymous abbey in Asnières sur Oise in 1980. Noam Chomsky and Jean Piaget, *Théories du langage – Théories de l’apprentissage. (Theories of Language – Theories of Learning)* (Paris: Du Seuil, 1980).

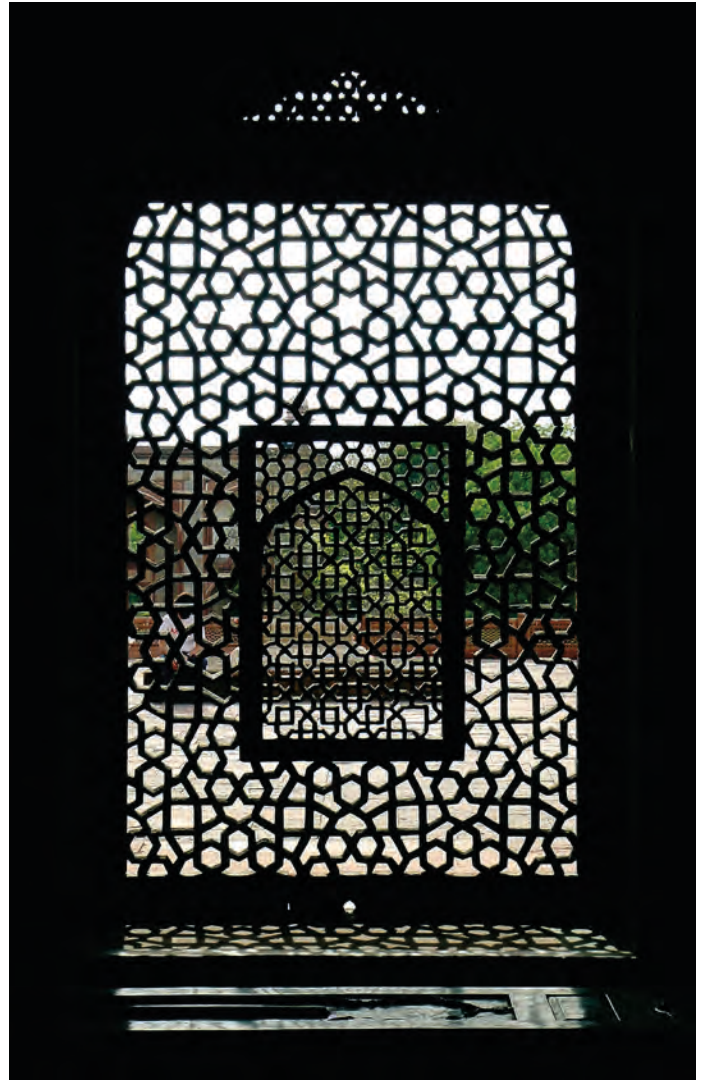
28 Claude Lévi-Strauss, *La pensée sauvage (The Savage Mind)* (Paris: Plon, 1962).

29 Italo Calvino, *Six Memos for the Next Millennium* (Milan: Einaudi, 1985), 80.



[Fig. 9] Institut du Monde Arabe. Jean Nouvel. Paris, France. 1987. Facade detail. Photograph by the author.

[Fig. 10] Humayun's Tomb. Mirak Mirza Ghiyath. New Delhi, India. 1565. Window detail. Photograph by the author.



the poetic and multi-referential spirit of emotion. The metaphor parallels a similar approach to that of Jorge Wagensberg, when the author opposes uncertainty in the production of forms.³⁰ The stone trellises or *jalis* in Humayun's tomb, in New Delhi, India, completed in 1565 by Mirak Mirza Ghiyath, exemplify the dual functioning of the filter: the precise and virtuous stone carving execution, and the vibrant, visual transverse connection. At a contemporary level, Jean Nouvel completed the Institute du Monde Arab in Paris between 1981 and 1987, where he overlapped glass reflections to the active diaphragms in the facade that interacted with the amount of natural light in the exterior.

Conclusions: Filtering Architectural Atmospheres: Phenomena of Interference

We can conclude that a filter exposes organizational systems that synthesize geometric relations with the capacity to cause emotional architectural atmospheres. Filters perform under a dual function that combines the precision of a crystal and the unpredictable agitation of a flame. A filter is initially built using clear structural and constructive schemes within specific organizational and mechanical constraints, and is later activated phenomenologically through the intervention of light and the gaze. The parallelism between a filter and a poem allows us to illustrate the access to the architectural emotion of the new atmosphere through rigorously scientific and exact operations that involve matter and air. The measurable construction and the intangible experience result in a continuous equilibrium between a technical and a non-technical dimension.

30 Jorge Wagensberg. *La Rebelión de las Formas* (Barcelona: Tusquets, 2004).

No poetry can take place with no intrinsic order. The precision embodied in a filter depends upon the series of distances and proportions that necessarily condition the final atmosphere. Without the initial technical precision, there is no control over the resulting atmosphere in intimate connection with the material structure. The poetic dimension of filters originates from its capacity to transform the precise geometry of its contour condition into an unexpected atmosphere, once light and the gaze become involved. This capacity to translate the controllable into the uncontrollable, the physical into the emotional, the objective into the subjective, the measurable into the incommensurable, characterizes every atmospheric architecture through the geometry of filters.

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