Architecture as a worldview

how can architecture empower the production of knowledge and meaning given the unintelligible nature of the universe?

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Abstract

The essay and the design project are an attempt to re-explore the fundamental purpose of architecture as mediating interactions between the human self and the external world. From the intuitive perception of an environment to the establishment of an artificial system of proportion and order, the hypothesis considers the design of buildings as a desire for re-orientation within a scale-less universe, abstracting the vastness of a greater cosmos into tangible, ordered space, a space for finding orientation and meaning.

Intro

Religion, science, and architecture, as disciplines, are meant to establish order and symmetry on the unintelligible nature of the universe either theoretically or spatially. From Stonehenge megaliths to the physics standard model, our perception of reality is framed by a series of measurements projected onto the immeasurable.

The Neolithic observatory, as a rough and solid assemblage of carved stones, oriented following cosmical directions, equals the complex technology of the CERN quantum colliders in Geneva. Both apparatuses grasp a tiny portion of the infinite to build their "own universe". These singular visions upon the vast cosmos are what make science and architecture substantial to humanity as a tool for thoughts and criticism, refutation, and contradiction. Those are disciplines where nothing is given as true or false by dogmatism but accepted or dismantled only through experimentation and construction. Quoting the Roman writer Caius Plinius in his Historia Naturalis, "the only certainty is that nothing is certain". Both buildings and scientific theories are constructions, that could potentially be destroyed or renovated.

A scientific device or an architectural design operates using, virtually or spatially, proportions, orientation, mass or voids to create fields of collisions, space of interactions and places for ontological meaning. The craft of human ontologies relies entirely on these systems, allowing the materialisation of referential point within the immensity. The immateriality of micro and macro-objects that affects the very material reality of our environment is embedded symbolically through the experience of a space, an artefact, or a computer diagram. Timothy Morton situates these ungraspable, yet influential objects in the "hyper" world, a world too large to be apprehended in its totality. The telescope that we mystify or the bedroom in which we sleep is, therefore, a meta-frame in a megauniverse.

How do those perceptual frames operate on a geographical scale? How do we design them? What meaning emanates from them? If mathematical proportions are the key to knowledge, where do those systems come from? As such, to what extent a building participates in the production of knowledge and meaning given the unintelligible nature of the universe?

Employing a variety of historical, philosophical, scientific and architectural reference, this thesis is an attempt to explore the role of architecture in positioning man within an endless cosmos.

I. The mental construction of the landscape

Following Marc-Antoine Laugier's natural history of architecture, the protective instinct against environmental condition is the initial motivation behind the craft of any building. Taking distance from the aesthetical arranging natural objects found on-site, the builder accommodates his environment to settle in a territory and isolate from the climate's harshness. This understanding magnifies the technicality of the building, its performance, and the cleverness of its builder. It connotates the principle of architecture as an intuitive, natural, and supreme discipline that allows humankind to occupy any places on earth.¹

But beyond spatial occupation, the mental ordering of a landscape offers the possibility of orientation, knowledge and meaning. Simondon, investigating the genesis of technics, identified a primitive stage of human existence preceding the segregation of object and subject, an initial relation to the world that he defines as magical unity. The sensorial environment of Man is understood as a continuous milieu structured by a network of privileged points of exchange rather than fragmented objects. Those key points allow the cognitive distinction between a figure and a ground, as a "primitive mode of structuration" of the universe. The distinction between human reality and an objective world is incompatible in such a system. The self is included in a mixed reality punctuated by privileged moments and places in which exchanges between man and the world take place. The mountain peak, or a tree

¹ Marc-Antoine Laugier, *Essai Sur l'architecture* (Paris, France: Duchesne, 1753), 10.

in a plain, embodies the quality of distinct geography that suggests a meaningful reading of the surrounding horizon, one of contemplation and communication. "The magical universe is made of a network of access points to each domain of reality: thresholds, summits and crossing points attached through their singularity and their character".² Simondon suggests that time equally possess similar limits and distinctions during which exchange happen again between "human intention and the spontaneous unfolding of events". The understanding of the repetitive pattern of celestial movements was in this sense crucial for both spatial and temporal orientation. As such, the mythical narrative may succeed not less than modern thought in establishing a coordinated spatial system; "but the system is determined not by objective measurements but by an emotional recognition of values."3

This idea of key-point theoretically explained by Simondon might have been implicitly suggested already by Claude Nicolas Ledoux's figure of *L'abri du Pauvre* (Fig.1). Initially, the engraving celebrates the new definition of space carried by the Newtonian scientific revolution, becoming a quantifiable notion. As such, the small portion of the vast universe that man inhabits is defined by the rise of a tree.⁴ The tree, as a biological construction seen through the human eyes, offers the opportunity to measure distances that separate the observer from the observed object. The tree is this tangible object sitting in an immeasurable vastness but foremost the representation of a privileged place to read the world, a key point in Simondon's term. This

> ² Gilbert Simondon, On the Mode of Existence of Technical Objects (Minneapolis, MN: Univocal Pub, 2016), 176–80.



Fig 1.Claude Nicolas Ledoux, L'abri du Pauvre, 1804



Fig 2. Le Corbusier, proportions used to measure landscape, in *Le Modulor*, 1950.

³ Richard Padovan, Towards universality: Le Corbusier, Mies and De Stijl. (London: Routledge, 2002), 169.

⁴ Cornelis van de Ven, Space in Architecture: The Evolution of a New Idea in the Theory and History of the Modern Movements, 3rd rev. ed (Assen/Maastricht, The Netherlands; Wolfeboro, N.H., U.S.A: Van Gorcum, 1987), 53.

biological figure might be used for an architectural thesis as an allegory to the primitive shelter. The innate artificial delimitation of territory would not claim for protection or governance only but also aim at refining the bonds between an unintelligible environment and a human mental projection of an ordered cosmos. To another degree, those natural singularities become for Le Corbusier, the possibilities for human vision to establish a proportional order in which the body is measured in relation to the landscape (Fig.2)

In a series of essays, published by the Architectural Review, the critic Peter Buchanan suggested the necessity of a cultural change to reach true sustainability in buildings. He emphasises the fundamental purpose of architecture as "a mean to create ourselves and our surroundings" ⁵. In modern western cultures, the compartmentalised and functional experience of reality is deployed onto our spatial use of space, which Le Corbusier crystallised considering a building as a machine to live in. In ancient cultures, where the universe is experienced as an interconnected milieu more than a distinct hyper-object, societal and urban structures were shaped by the mental internalisation of the cosmos. Symbolic representation of celestial movement, constellations or surrounding landscapes is the support for narratives and rituals that takes place in dedicated buildings, piazza or cities. In this way, the endless scale of the universe both in time and space becomes familiar enough to create a deep sense of belonging to a particular place, a place for exchange between man and the world.

⁵ Peter Buchanan, 'The Big Rethink Part 4: The Purposes of Architecture', *Architectural Review* (blog), 27 March 2012, 43, https://www.architectural-review.com/archive/campaigns/the-bigrethink/the-big-rethink-part-4-the-purposes-of-architecture.

As a combination of reading and writing the attempts to confront those findings with small design experiments, before the final design project, offered me inspiration to bring to the graduation project a site and a design.

Measuring Landscape from scrap

I started with a sculptural intervention on a nearby hill composed of concrete aggregate, bricks and other construction material. Sitting at the angle of a road and a highway, nobody ever paid attention to it. Inspired by the Neolithic observatories punctuating the Celtic regions of Europe I decided to climb on top and lift a couple of bricks and concrete blocks vertically following the line of the peak. If the intervention was purely intuitive, I managed to relate this banal act of lifting stones with the idea of landmark that Simondon was explaining in his magical unity theory. The vertical elements that disturb the horizontality of the landscape - a stone, a tree, a mountain... - are key points that allow the cognitive distinction between a figure and a ground, as a "primitive mode of structuration" of the universe. If the ambition of this intervention does not go as far as "structuring the universe" it nonetheless provided me with a deeper comprehension of the idea behind verticality, which was explicitly translated in the design project afterwards. Just as the lifted bricks suggested to look differently at the mountain, the turrets sitting around the refuge are the vertical elements that give the possibility to the hiker to look out at specific landscape singularities but also look within the self once sitting inside the turrets.



Fig. 3 Measuring landscape from scrap, sculpture made by the author, 2020



Fig. 4 Measuring landscape from scrap, sculpture made by the author, 2020

The Camera obscura and the city.

Finally, as part of the workshop organised by students in the Explore Lab studio, I associated my research topic on architecture as a device to read the world with one of my studio mates, concerned on his side with the right to the city by Lefebvre, to design a human-size camera obscura. This workshop managed to foster our respective interest into a collective architectural intervention. The tiny movable darkroom that we design and built back in December allowed the explore lab group to experience the effect of seeing an image of the city that was projected upside down in the box through a tiny little hole. Then we asked each student to individually underline the contour of this flipped image onto a white piece of paper. If the optical image corresponds exactly to the outside world, the individual drawing of the student is the physical translation of a personal experience inside the box, sitting alone and contemplating a mirrored projection of the outside world, like the myth of the cave by Plato. This intervention is the literal materialisation of the idea that architecture gives the possibility to re-read the outside world.



Fig. 5 The camera obscura and the city, installation made by the author and Lorenzo Bondavalli, 2020



Fig. 6 The camera obscura and the city, interior view of the camera where the image of the outside is projected onto a white sheet of paper, installation made by the author and Lorenzo Bondavalli, 2020

II. The architecture of the inbetween

To refine the spatial understanding of such a place, the architectural definition of intervals or threshold is introduced as an occasion to articulate two worlds both spatially and visually.

One contemporary architect that attempted to work on the explicit relation between architecture and cosmology was Aldo Van Eyck, focusing on the evocative power of a threshold between two fields of influence, two spaces or two persons. It is particularly interesting to confront his idea of the space "inbetween" with our previous understanding of architecture as a place for communication between man and the world. Informed by a multidisciplinary investigation in art, ethnology and philosophy, Van Eyck was concerned by the design of collective spaces, bringing together a maximum range of associations in the most elementary forms possible⁶. He identifies the definition of a threshold with the ambivalent quality of the human mind located between emotion and intellect. spirit and desire while being able to process both simultaneously. "It must not be unequivocally open or closed, space or mass, but must paradoxically be both at once [...] it should be the built mirror of human nature in which man can recognize himself."7 The threshold condenses scales of different objects into an intense spatial experience. Architecture is defined as an assemblage of "dual phenomena in which polarities are

⁶ Francis Strauven, Aldo van Eyck: The Shape of Relativity (Amsterdam: Architectura & Natura, 1998), 356.

⁷ Strauven, 357.

mutually reconciled; small-large, part-whole, openclosed and inside-outside".

From the city to the house, thresholds are microcosms in themselves smoothing the transition from one scale to another. In this way, the house is not a whole but rather an ensemble of transitioning elements from the intimate sphere of the bedroom to the public space of the city or the wilderness of the landscape. A window, a door are the points of a house through which the communication between an external and internal world are established. The door is not a separating closed surface but rather a place "whose very form evokes welcoming and seeing off, a place that invites one to pause". It is the complex articulation of inside and outside expressively illustrated by Van Eyck himself picturing an entrance of a house in the city of Djenné, in Mali, surrounded by a low mud wall where the domestic use of the place intersects with the public space of the street (Fig.3). A boy sits on the wall, on the border between sun and shadow, the house, and the city, in a space which is neither domestic, nor public, but independent on its own. Similarly, the window, articulates two viewpoints at once, where the other side becomes visible, they are "the eyes through which the house looks out on the external world which gives expression to its interior"8. In the orphanage that Van Eyck built in 1960 in Amsterdam, similitudes with Dogon's architecture can be found in this understanding of windows and doors as ambivalent spaces where the intersection between two scales or two worlds creates a third one. A girl is playing on a small circular concrete stair sitting on the exact separation between outdoor and indoor space (Fig.4).



Fig. 7 Aldo Van Eyck, boy sitting in front of a house in Djenné, 1960, in *The Shape of Relativity*, Francis Strauven



Fig. 8 Aldo Van Eyck, a girl sitting on a window threshold at the Amsterdam Orphanage, 1960

⁸ Strauven, 358.

While the threshold is an articulated space that belongs equally to the inside or the outside, it is nonetheless a place that allows human cognition to delimitate, frame and observe creating meaningful points of views. As Rietveld pointed out facing De Stijl quest of spatial continuity between in and out, an entirely unbounded space could not be perceived: "Delimitation is not an impoverishment, but on the contrary, the necessary and the most human means to experience reality"⁹.

The frame and the interval to re-read geographies

In Earth Moves, the French architect Bernard Cache proposed to conceptualise the architectural mechanisms that allow delimitation to happen by understanding a building as the interlocking of frames in every dimension, plan, section, elevations. Frame, as in a painting, delimitates a field of possible actions which are fixed and represented into a stable image. What Cache propose instead is the production of frame in terms of cinematic quality. Influenced widely by the teaching of Deleuze, it implies a dynamic conception of spaces allowing the possibility to escape the frame and evolves through a multi-dimensional space: "We would pass from the canvas on the painting to the fresco on the wall, to the mosaic on the ground and finally to the stained glass in the window frame"¹⁰. What this implies is to understand those frames as intervals of probabilities, a cinematographic set, built to articulate human life with a wider geographic scale. Architecture thus escapes its traditional role of housing and grounding to provide a more intimate relation to the outside world by a constant interlocking of frame and

⁹ Padovan, *Towards universality : Le Corbusier, Mies and De Stijl.*, 16.

¹⁰ Bernard Cache, *Earth Moves: The Furnishing of Territories*, ed. Michael Speaks, trans. Anne Boyman, Writing Architecture (Cambridge, Mass: MIT Press, 1995), 22.

intervals. Deleuze, in this way, suggests that the frames and their joins "hold the compounds of sensation, hold up figures and intermingle with their upholding their own appearance."¹¹

To clarify, Cache identified three functions to the frame each one associated with a functional architectural element.

At first, the wall delimits the interval of probabilities that allow life to develop itself, initially incompatible with its surrounding milieu. So far, the arguments exposed were concern about the continuous relation between man and the world through a harmonious understanding of space. Cache nuances this harmony considering that the wall, the partitioning of a territory, is the necessary condition to establish a connection with this same landscape. "Architecture builds its space of compatibility on a mode of discontinuity". To determine order within scaleless geography, narrowing down the operation to a limited area becomes necessary.

Once isolated, the window is the second function of the frame that select bites of information from the vastness. Geographical objects are visually associated together and become meaningful to the human eye as soon as the surrounding landscape is abstracted. The discontinuity built up by the surrounding wall is identifiable as such when we realise, looking outside through the opening, that continuity has been broken. As Van Eyck noticed, a window looks out on the external world to give expression to an internal space. The true relevance of a window is its capacity to give a space its singularity. By imposing a unique, stable point of view, the vision is conditioned to frame a particular place and moment.

¹¹ foreword by Michael Speaks in Cache, XIX.

The floor is the third elementary component of an interval. If the wall delimitates and the window selects, human development depends on the fundamental notion of balance in reaction to gravity. The inhabited surface respects a certain range of inclination that intersects horizontally the gravitational axis of the earth: "it is the flatness of the stage that makes choreography probable, just as it is the flatness of the stadium that increase the probability of aesthetics."¹²

If the roof remains the last element to close the box, Cache cannot consider it as a frame on its own since it is nothing more than a horizontal wall that equally protects and delimit. While the moderns deeply integrated this aspect to such an extent that the roof disappeared completely from their architectural repertoire, the initial value of this element is found in its formal quality: the prism, the dome, the pyramid etc. In the same way, the window determines the singularity of space by pointing out external objects, the sloped roof defines the "singular becoming of a place", turning the place into an eminence or a landmark.

To illustrate how this interlocking of frames and intervals might work tangibly, I attempted to draw a plan of my living room after noticing how the windows of this simple space are correctly aligned with celestial movement at a specific moment of the year, precisely on November 23th 2020. Indeed, the banal Dutch farmhouse becomes highly evocative as soon as the sun and the moon simultaneously set down and rise in the two-opposing window of the room. The Deleuzian definition of the frame involves the capacity of unframing, the possibility to escape the fixed image of the frame and relate it to other phenomenon happening in this same space given by other frames. The accumulation of point of views is ordered in an

¹² Cache, 26.

intelligible way so knowledge and meaning are associated with the experience. This is made possible by the capacity of the house to make abstraction of the surrounding landscape and select only the limited region where the sunset, and the moonrise at a given day in the year. Rather than considering the opening left by the window as the ultimate element to appreciate such a moment, one needs to consider the interlocking of vertical and horizontal frames as a whole. The image of the sunset is made possible by the opaque materiality of the wall abstracting the surrounding landscape to emphasise the uniqueness of the transparent frame. The floor stretched in between the walls is the stabilised horizontal surface on which the chair and the table stand, allowing the observer to rest and focus his attention on the outside. At last, the ceiling and the roof enclose the room for two reasons: to protect from the cold and the rain but in this situation also prevent the light to disturb the spectacle happening in the limited frame of the window.

If this successive description of architectural elements might seem evident, it is nonetheless effective to understand the complex articulation of frame as described by Cache (Fig.9). In the preface of his book, Anne Boyman formulates an interesting consideration that resonates particularly with this experience: "A territory is not the immobile closed space of the context to which a building must be mimetically adjusted [...] Rather, architecture is the art of the frame, and the architectural in things is how they are framed"¹³. This Dutch farmhouse was never intended to be oriented in a particular cosmic direction until one observer, looking through the window from a specific position in the room realised that the width of the frame was able to capture

¹³ Cache, X.

simultaneously the sunset and the moonrise for just a few days in a year.

The point of view, crafted by the image given in the frame, is an idea extensively explained by Deleuze in his lectures at la Sorbonne in the '80s, that Cache attended in his youth. If the philo-mathematical definition of the concept goes largely beyond the analytical scope of the thesis, it is nevertheless useful to remember that the fundamental aspect of the point of view is the construction of an order relative to the observer.¹⁴ Designing a frame is to suggest an order, a singular perception of the cosmos.

¹⁴ Gilles Deleuze, *Le Point de Vue*, Lecture, Leibniz et Le Baroque (Paris, France: Université de Vincennes, 1986),

https://www.youtube.com/watch?v=yEg4Tc40rWM. At 01:07:00



Fig 9. Plan of a living room between sunset and moonrise, CAD drawing of the author, 2020

III. The empathic and the abstract frame towards the world

To design a frame, from the scale of the furniture to the scale of the city, is the possibility to reduce a greater order into a tangible formal object and space. The evocative power of a building is to relate both the limited cognitive capacity of man with a greater unintelligible world by re-constructing a miniaturised cosmos. To reformulate Van der Laan position, the thing we craft or build is the thing we know within an unknown universe. This complex mental and technical manipulation implies the transition from perception to measurement resulting in the establishment of proportional systems. The harmonious transition between the landscape to the chair, the successive interlocking of the frame, is driven by an arithmetic logic. If this logic is the product of scientific reasoning, it is often inherited from a cosmological narrative, a position that defines how man interacts with the world.

Among all the fascinating history of proportion, the Modulor and the Plastic number developed by Le Corbusier and Dom Hans Van der Laan in the 20th century are highly significant regarding their spirituality and their cosmic view. Richard Padovan, based on the work of the German art historian Willem Worringer in 1907, associates these systems to, respectively, an empathic and an abstract position in the world¹⁵. Worringer indeed proposes that human attitudes to the external world can be identified in two ways. Empathy, from the German word, *Einfuhlung*, "in-feeling", is a naturalist approach that presumes nature as a

¹⁵ Richard. Padovan, *Proportion : science, philosophy, architecture* (London [etc.]: Spon, 1999), 19.

harmonious mathematical ordering, intelligible to human arithmetic reasoning. In contrast, abstraction, *abstrahere* "to draw away from", assumes the "overwhelming formlessness" of the external world. Our limited cognitive stimulus is receptive to a fragment of the immensity that surrounds us. The idea of an absolute nature is rejected to consider man's own delimitation and product as the salvation against a "deep spiritual distress".¹⁶

Once identified, the comparison between Le Corbusier, and Van der Laan system of proportion personify the theoretical explanation of those two terms.

Le Corbusier idea that architecture is "the first manifestation of man creating his own universe, creating it in the image of nature"¹⁷ resonates with an empathic position. The Modulor is founded on the measures of the body as the literal embodiment of nature's fundamental proportion: the golden section. The humanistic vision of Le Corbusier assumes a mathematically ordered universe, harmonious and ideal, inherited from Platonic cosmology. The mathematical vision of Plato indeed suggests a coherent composition of spatial units that can be described in arithmetical terms. All material objects are translated into regular solids: fire as a pyramid (four planes), air as octahedron (eight planes), earth as a cube (six planes), cosmos as a dodecahedron (twelve planes) and water as icosahedron (twenty planes). By systemizing the components of nature into substantial objects, man alienation with the invisible and mysterious universal space is abolished.¹⁸ The universe

¹⁶ Padovan, 27.

 ¹⁷ Le Corbusier, *Towards a New Architecture* (New York: Dover Publications, 1986), 69; Padovan, *Proportion : science, philosophy, architecture*, 13.

¹⁸ Ven, *Space in Architecture*, 13.

and human mind are aligned to a fictive axis that dictates mathematical rule of harmony and proportion as the ultimate access to beauty, from the shape of a plane to the monumentality of the Parthenon.¹⁹ Primary masses such as pyramids, cubes, cones, cylinders are the most recognizable forms both within nature and the mind. Egyptian, Greek or Roman architecture, as the harmonious and monumental composition of those elementary elements, remains the fundamental basis on which Le Corbusier stands to develop his "New Architecture". Escaping from the academic teaching of the Beaux-art, the industrial aesthetic of grain silos and factories is the contemporary translation of this antique beauty that for him, has been forgotten for too long. Without being driven by an architectural idea, but simply by the results of calculation, "The engineer makes use of the primary elements, and by co-ordinating them in accordance with the rules, provoke in us architectural emotions and thus make the work of man ring in unison with universal order."20 Similarly, the Purist movement launched in 1918 by Le Corbusier and the art historian Amédée Ozenfant stands against the abstraction offered by Cubists, considered so far as a "decorative formalism". Purism rather brings the classical representation of tangible objects to a new aesthetical experience. Assuming that geometry and mathematics are inherent to our universe and recognizing our capacity to translate it into concrete forms, stresses the unity existing between man and the external world. This is the core of the empathic argument proposed by Worringer in his paper.

For Van Der Laan, instead, artistic form as well as proportional system are not derived from nature but

¹⁹ Le Corbusier, *Towards a New Architecture*, 208.

²⁰ Le Corbusier, 31.

imposed upon it. Architecture, rather than being the spatial manifestation of elementary cosmic forms, is an "abstraction imposed on nature: a frame projected on the natural continuum in order to make it measurable and intelligible"21. As a monk, Van der Laan asks a complex epistemological problem, How can we know the absolute objective Truth, the Things as they are?²². He reminds us that in the catholic tradition, God is an external divine entity placed outside men, identified as the "Other". He stands against the humanists, considering the definition of order and proportion as relative to human cognition rather than an intrinsic natural harmony to be found outside. Measurement and counting are the man-made mechanisms to define a perimeter of certainty in an uncertain infinite cosmos. The house facilitates this process of counting in the most effective way. As Van Der Laan noticed in a lecture given in 1985: "The sheer fact that we refer to natural space using negative terms like immeasurable, invisible and boundless indicates that it lacks something for us. Architecture then is nothing else but that which must be added to natural space to make it inhabitable, visible and measurable."23 While studying theology and Greek philosophy he realised that the mind is not just a passive receptacle of stimuli but participates actively in the development of a self-created environment. Therefore, in the work of art, the geometrical proportion has the capacity to abstract the initial sensory impression into a pure object of thought.24

To resume, empathy is a projection outward into nature, while abstraction is oriented inward from nature²⁵. The diagram presented is an attempt to

²¹ Padovan, *Proportion : science, philosophy, architecture*, 33.

²² Caroline Voet et al., Dom Hans van Der Laan: A House for the Mind: A Design Manual on Roosenberg Abbey (Antwerp: Flanders Architecture Institute, 2017), 11.

²³ Padovan, Proportion : science, philosophy, architecture, 35.

²⁴ Padovan, 36.

²⁵ Padovan, 36.

visually understand those two categories of thoughts (Fig.10). Two circles associated with each of the terms regroup a series of words that are related either to one or the other. While the nature of those groups diverges radically, it is evident that the two systems agree on the use of mathematics and proportions as the fundamental basis to establish order and meaning. If Le Corbusier stresses the unity of man and nature and Van der Laan their duality, those two ideas are nevertheless the manifestation of profound concern to elevate architecture as a cosmic discipline. As Van der Laan stated:

"If I compare a house with a human body or a tree or the universe with all its stars and planets, I can only say that the house is like the work of a child. But when I consider our artefacts, from another point of view, they appear as the glory of creation, for here something has happened within creation, towards which the whole creation leads."²⁶

If the architectural practice of Van der Laan is deeply rooted in the catholic tradition, it is nonetheless a theological affirmation of the principle of relativity, mainly developed in science but equally impacting philosophy, which assumes the subjectivity of the artificial order established by man cognition. The plastic number is the product of a world view that accepts the impossibility of absolute knowledge, objective and complete.

²⁶ H. van der Laan lecture, december 1967 as cited in Padovan, 39.



Fig.10 Diagramatic understanding of the difference between empathy and abstraction, drawing of the author, 2020

IV. The relative point of view.

The distinction between absolute and relative space was synthesized to a certain degree by Isaac Newton. He affirmed the scientific probability of an infinite and homogeneous universe inducing therefore the impossibility to measure space by the senses. The relative space is by contrast the definition of a coordinate system that allows measurement of the absolute space to take place²⁷. While the centre of the universe has been displaced from the earth since Copernicus, the absolute idea of space does not deny the existence of a centre as such. In Newtonian terms indeed, the mechanical property of gravity relies on the existence of central masses that attracts lighter objects in an orbital trajectory. According to Max Jammer, the astronomical location of a universal centre of gravity was a major concern for Newton since it would provide the referential point to determine this absolute space²⁸. If no experimental methodology were in place to scientifically position this centre, the omnipresence of space and the potential existence of an absolute referential point correlates with the theological proof of God existence. "God is not eternity and infinity, but he is eternal and infinite. Eternal and omnipresent, God constitutes duration and space."29

Leibniz, on the other hand, rejects categorically the idea of absolute space and instead postulates, in very simplified terms, that the relation of situation is a sufficient condition for the idea of space³⁰. In a lecture given in 1986, Deleuze defines the idea of the point of

²⁷ Max Jammer, Concepts of Space: The History of Theories of Space in Physics, 3rd enl. ed (New York: Dover Publications, 1993), 32.

²⁸ Jammer, 103.

²⁹ Newton, Principles, p.544 as cited in Jammer, 113.

³⁰ Jammer, 117.

view in Leibnizian terms. An extract that he reads from The Discourse on metaphysics illustrates brilliantly the position of God within the universe in relativistic terms:

> "God turns in every direction and in every way, the general system of phenomena which he finds good to produce to manifest his glory. The result of each view of the universe as seen from a certain place is a substance which expresses the universe in accordance with this view and looking at all sides of the world in all possible ways. The result of each view of the universe as seen from a certain place is a substance [the observer] which expresses the universe in accordance with this view".³¹

Michel Serres reformulates: "It is no longer the point of view that refers to a centre; it is any centre that refers to a point of view" ³². Reality is here defined as a system of relationship between coexisting objects rather than an absolute truth that exists externally. As Deleuze pointed out, the baroque world provokes the death of the centre that is no longer identifiable in an infinite universe. The concept of centrality is transformed and become dependent of the subjective standpoint but does not entail that the various perspective is subjective. "The role of the subject in relativity theory is thus limited to objective observation from various standpoints"³³.

This is illustrated by the development of quantum physics in which, as explained by Heisenberg, the observer point of view determines the nature of what is being studied. In the experimental observation of

³¹ Deleuze, *Le Point de Vue*, 35:00.

³² Michel Serres, Le système de Leibniz et ses modèles mathématiques: Etoiles, schémas, points, 3. éd, Épiméthée (Paris: Presses Univ. de France, 1990), 29–30.

³³ Strauven, *Aldo van Eyck*, 429.

subatomic particles, an interaction takes place between the phenomena under consideration and the measuring apparatus³⁴. It is this interaction that influenced the observed phenomenon itself. To give a succinct scientific example, this implies the impossibility of predicting the position and the velocity of an electron before being observed by the measuring apparatus. The status of a quantum object is defined by a set of probabilities rather than a given condition. Schrodinger famously illustrates this quantic singularity using the metaphor of a cat in the box in which the oxygen has been partially removed. Before opening the box, one cannot know for sure if the cat is dead or alive. In this situation, the object -the cat- has two possible states which are unveiled by the observer action of opening the box. This is what Heisenberg also defines as the "uncertainty principle" from which he draws epistemological conclusions:

> "Science, we find, is now focused on the network of relationships between man and nature, on the framework which makes us as living beings' dependent parts of nature, and which we as human beings have simultaneously made the object of our thoughts and actions. Science no longer confronts nature as an objective observer but sees itself as an actor in this interplay between man and nature. The scientific method of analysing, explaining, and classifying has become conscious of its limitations, which arise out of the fact that by its intervention science alters and refashions the object of investigation. In other words, method and object can no longer be separated. The

³⁴ Strauven, 428.

scientific worldview has ceased to be a scientific view in the true sense of the word."³⁵

Starting to question the Newtonian absolute concept of space we ended up considering the whole scientific methodology as a mere translator of information between, human consciousness and the external world. The uncertainty principle can be conceptually extended to the situation of contemporary cosmology where scientific principles are made up just as they can be dismantled depending on technological progress. In the conclusion of his analysis of the Etruscan's urban grid, in The idea of a town, Joseph Rykwert, proposes a shift in the perspective of our own condition towards the cosmos. "It is no longer likely that we should find [a] ground in the world which the cosmologists are constantly reshaping around us and so we must look for it inside ourselves: in the constitution and structure of the human person.³⁶" The relativistic cosmos, therefore, suggests a vision close to the concept of abstraction of Worringer mentioned earlier. Worringer himself assumed that abstraction is the 'outcome of man's immense spiritual dread of space', facing an extended, disconnected bewildering world of phenomena³⁷. The last part of the thesis focuses on the work of Mondrian and Van der Laan as two different attempts, one artistic and the other architectural, to solve the ontological issue of disorientation and uncertainty among an unintelligible infinite universe.

³⁵ Werner Heisenberg, *The Physicist's Conception of Nature*. (New York: Harcourt, Brace, 1958), 29.

³⁶ Joseph Rykwert, The Idea of a Town: The Anthropology of Urban Form in Rome, Italy and the Ancient World, Faber Finds (London: Faber and Faber, 2010), 245.

³⁷ Jammer, Concepts of Space, 100.

V. The dual reading of abstraction through the dutch relativists

A. Mondrian's quest for universalism

What motivates the formation of the Dutch De Stijl school in 1917, is the abolition of all conventional boundaries whether in painting, architecture or life in general³⁸. The new conception of space seen earlier with the theory of relativity influenced indirectly the artistic and spiritual practice of the group. To accept a universe without a centre is to escape the representation of the individual-natural, towards the universal-abstract. The new reality is indeed the era of determines relations, the pure aesthetic of relations³⁹. Mondrian in this way had moved from the expression of matter towards the expression of a spatial idea.⁴⁰ From there, the world is seen as a continuum of endless opposites and reciprocal interaction of elementary cosmic opposites, matter-mind, exterior interior, negative positive, subjective objective, relative absolute.⁴¹ In painting, and obviously in the work of Mondrian, the frame is a fragment of a boundless continuity rather than the limit of a singular composition.

Abstract art has the capacity to reveals the opposites and bring them into dynamic harmony. Dualities can be represented by the primary relation of horizontal with vertical. As such, universal opposites find the purest expression of their reciprocity. Horizontal remains horizontal, vertical, vertical but the intersection of those two reveal their interdependence. Opposite

³⁸ Padovan, Towards universality : Le Corbusier, Mies and De Stijl., 2.

³⁹ Strauven, Aldo van Eyck, 410.

⁴⁰ Jammer, Concepts of Space, 193.

⁴¹ Strauven, *Aldo van Eyck*, 448.

reach the purest possible equilibrium when intersected. What remains to be decided by the artist is the possibility for composition, balance and harmony, deciding the length, the density of those intersections but as well the colouring of the painting. It is the "greatest freedom of subjectivity" that Mondrian's neoplasticism offers, the representation of the universal from an individual point of view.

Mondrian artistic transition from the singular object to an abstracted universality is rooted in a strong conviction to transform man relation to religion after the first world war.⁴² He distinguishes the old consciousness, directed towards the individual, from a new spirituality aiming at escaping the bond of materialistic representation. The Neoplastic revolution, later interpreted in the fourth dimensionality of architecture with Van Doesburg or Rietveld, appears as the ultimate mean to reach this "supra-natural" spiritual level of human consciousness. Mondrian as a theosophist opposes abstraction to the natural and this opposition allows man to reach the essence of his own consciousness and spirit. In this way, "art becomes truly religious"⁴³.

Rather than escaping reality, abstraction provides a metaphysical reading of reality. It becomes a mean for the artist to overcome his subjective perception of the external world and access instead of the objectivity of geometry of lines and surfaces. Assuming the subjective point of view of the artist is to accept the limited cognitive condition of a human being, unable to fully integrate the vastness of a boundless world. To solve this issue, the frame of the canvas is taken as a fragment of infinite continuity. Moreover, a true De Stijl painting abolishes the notion of

⁴² Padovan, Towards universality : Le Corbusier, Mies and De Stijl., 6.

⁴³ Mondrian, de Nieuwe beelding as cited by Padovan, 6.

centre, focal or vanishing point. Otherwise, if the centre is placed outside the canvas, it remains the canvas of a larger painting.⁴⁴ His artistic methodology consists of reducing painting to arbitrary fragments of an imaginary greater whole.

Padovan refers to the art historian Meyer Schapiro in his brief description of the *Painting 1: Lozenge composition* made in 1926 (Fig.11). 45 degrees tilted canvas frame part of a square formed by four black lines of different thickness, oriented horizontally and vertically to the observer. What suggests the continuity of a greater universe extending beyond the canvas is the decision to show one of the four intersections that compose a square. As such, the painting is not the representation of a solitary geometrical figure but suggest instead the existence of an "indefinitely extended grid".⁴⁵

Mondrian's heritage is a profound pictural quest to eliminate the representation of appearances through successive steps that he clearly describes himself:

"I came to the destruction of volume by the use by the use of the plane. This I accomplished by means of lines cutting the planes. But still, the plane remained too intact. So I came to making only lines and brought the colour within the lines. Now the only problem was to destroy the lines also through mutual oppositions."⁴⁶

At the end of his life, he saw his whole development as a series of destruction trying to reach the true essence of abstract art: the dynamic rhythm as opposed to natural appearance.



⁴⁵ Padovan, 33.



Fig.11 Piet Mondrian, Tableau I: Lozenge with Four Lines and Gray, 1926, Moma collection [©] Katherine S. Dreier Bequest

⁴⁶ Mondrian, in "Eleven Europeans in America", in Bulletin of the Museum of Modern art as cited in Padovan, 34.

B. Van der Laan's plastic number

If the pictural aesthetic and the theoretical approach of Mondrian - and its repercussion later on in sculpture and architecture - is concerned with the representation of the universal by the means of decomposition, openness and destruction, Van der Laan has the opposite attitude towards the position of man within a relative universe. The enclosure of the house and the definition of a coherent proportioned space is a fundamental necessity for man own orientation within a scaleless, unbounded cosmos. Again, architecture has the role to create an order, a measurable and intelligible inside within an unknowable outside.⁴⁷ "By measuring out our house we give measure to the surrounding space"⁴⁸.

Nonetheless, as seen in the previous chapters, Padovan suggested that the definition of a geometrical system of measurement base on the human capacity to dissociates shape and sizes still belong to an abstract position as defined by Worringer. Human thought relies on the possibility to divide the continuum of our world into discrete element to nominate and manipulate. The notion of manipulation induces the possibility to take distance from the singular representation of objects and access to a man-made, abstracted system of composition. As a reminder, Le Corbusier, instead, developed the Modulor on its ability to "geometrise" objects and patterns found in the external world, including the human body itself. The Plastic Number is the product of pure arithmetic logic in which the initial ratio is deduced from a cognitive experience of interpretation and denomination.

⁴⁷ Voet et al., *Dom Hans van Der Laan*.

⁴⁸ Padovan, *Proportion : science, philosophy, architecture*, 362.

Indeed, the fundamental act to read space and find a position is the possibility to count and measure. When confronted with two measures of the same size, one counts. In the case of unequal parts, one measure or compares⁴⁹. For space to be clearly readable, architecture makes measuring as straightforward as counting. What interest Van der Laan is not our ability to discern proportion but our inability to do so⁵⁰. He poses the question: at what point does one distinguish unequal parts? The visual limit from which the human eye can formally differentiate the size of two objects would give the proportional ratio of the system. To demonstrate how to find this ratio, Van der Laan proposes an experiment during which volunteers would have to sort a pile of 36 pebbles in different groups of size. The largest pebbles are taken out first until one of them appears no longer to belong to that group but to another smaller group and so on until no pebbles left. It has been observed that 5 groups of 7 pebbles each have been formed intuitively, leaving one stone apart that clearly differ in size from the rest of the groups. The pebbles on the border between two groups differ from each other at a ratio of 3:4 or more exactly 1:1.325, constituting the basic ratio of the Plastic number. ⁵¹ The necessary margin to distinguish two sizes is therefore equal or superior to 1:4. By repetition of this ground ratio, the entire proportional system is developed. "The difference between 3 and 4 is the minimum difference to compare and nominate two objects."

Padovan and the Belgium architect Caroline Voet provided a fascinating analysis on the whole philosophy and mathematic developed by Van der Laan through

⁴⁹ '3:4', Dom Hans van Der Laan (blog), accessed 8 May 2021, https://domhansvanderlaan.nl/theory-practice/theory/the-plasticnumber-ratio/.

⁵⁰ Padovan, *Proportion : science, philosophy, architecture*, 364.

⁵¹ Voet et al., *Dom Hans van Der Laan*, 24.

the application of the Plastic number in his architecture. The harmonious development of such a ratio allows establishing a chain of relationship by which the whole architectonic environment, from a brick to a whole town can be connected and made intelligible and humane.

> "from being part of a measureless continuum, a certain part of the space of nature has become a delimited territory, marked off in clearly recognizable graded intervals. A piece of the unknown has become known: and precisely by exploiting the fact that we cannot know it." ⁵²

Graded intervals guarantee indeed a continuous relationship between the intimacy of the room and the urbanity of the city. Architectonic space is categorised accordingly to the different threshold in human experience that allow the transition from the external world to the internal sphere of the habitat. Thus, the plastic number, or the initial ratio that rules it, is projected onto three orders of size: the cell, the court, the terrain. In the example of the Roosenberg abbey that Van der Laan started to design in 1972 the conception of the cell of the sister is the preliminary exercise that defines the measurement of the court and in return becomes the yardstick for the domain⁵³. Voet, beautifully summed up the quest of Van der Laan's with the project of the abbey: "to formulate a deep-level structure that on the one hand unravels the process of abstraction while on the other it is rooted in spatial experience."54

To envision the beauty of the project, one needs to consider the entire chain of harmonious relationship

⁵² Padovan, Proportion : science, philosophy, architecture, 364.

⁵³ Voet et al., *Dom Hans van Der Laan*, 45.

⁵⁴ Voet et al., 11.

established between the different spaces of the abbey. If the cell defined the underlying grid of the building, it has nothing to do with a modular architecture that successively stacks singular closed entities together⁵⁵. Instead, the building provides a profound experience of successive spatial rhythms that rely on a dynamic superposition of modules. The intertwined spatial demarcation of spaces allows a gradual transition through the different scale of the building and "causes spaces to be experienced as a whole and not as the sum of its part" (fig 12.).

The project of the abbey allows Van der Laan to push the plastic number to its extreme providing a project that is thought in its totality, from the position of the building in the forest to the tile's arrangement of the cell and to the very robes of the sister that he fashion following the ratio of 3:4.

After comparing the radical approach of Mondrian and Van der Laan in the realm of the abstract standpoint on the world, we can assume that the frame, both in painting and architecture, becomes the fundamental tool to develop the appropriate experience for thought. If Mondrian was obsessed with the abolition of the limit, his entire artistic exploration still relies on the very limit of the canvas. When Rietveld attempted to develop the idea of a boundless architecture in line with the two-dimensional research of Mondrian, he found himself in trouble, admitting that an entirely unbounded space could not be perceived. Delimitation appears as a necessity, "the most human means to experience reality"56. Openness is evident when by contrast it is inserted in an enclosed system just as light exists because of shadow.



Fig.12 Dom Hans Van Der Laan, Roosenberg Abbey, view from the entrance to the courtyard, 1971 © Photo Jeroen Verrecht

⁵⁵ Voet et al., 94.

⁵⁶ Padovan, *Towards universality : Le Corbusier, Mies and De Stijl.*, 16.

Conclusion

Architecture is equally the spatial product of a worldview on one side and the spatial interval to define this worldview on the other side, offering spaces for thoughts, speculation, and storytelling. In the case of Van der Laan, the proportional system of the plastic number is developed following a spiritual conviction inherited from a religious worldview that he managed to translate into buildings - mainly monasteries and churches - that in return, provide spaces for the community to pray and contemplate their own significance in the world. If the research and the design were not meant to deliver a complete analysis and reinterpretation of the work of Van der Laan, his philosophy, his architecture, and his spirituality had a major influence during the development of the project: assuming the small condition of humankind within a universe that is way too vast to comprehend. Thus, architecture is an "abstraction imposed on nature: a frame projected on the natural continuum in order to make it measurable and intelligible". The capacity for human to translate the complexity of a cognitive stimulus into an ordered point of view relies on its innate ability to frame and delimitate patterns and shape, to filter or abstract the overwhelming greatness into tangible manipulable objects. The telescope, the frame, the floor, the wall, the roof, or the stick offers the necessary delimitation to extract the individual from its initial condition and therefore re-read its reality from another perspective.

This research was driven by an honest intention to question the fundamental ethic of our understanding of the external world. Why do we measure objects and spaces? Why do we delimit, discretise, frame, select and classify fragments of our reality? How did we end up distinguishing the human self from an external world? If technology certainly helped humanity to shift the anthropocentric condition, how could we hope to reach one day an absolute objective truth?

What I have learned in the writing of this thesis is that architecture, just as science and art, offers the possibility to reconstruct the world so we can make sense of it. The mathematical application of proportion defines from the experience of the individual facing the external world, is what determinate the singularity of the point of view.

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Bibliography

Explicitly mentioned in the paper

Dom Hans van der Laan. '3:4'. Accessed 8 May 2021. https://domhansvanderlaan.nl/theorypractice/theory/the-plastic-number-ratio/.

Buchanan, Peter. 'The Big Rethink Part 4: The Purposes of Architecture'. *Architectural Review* (blog), 27 March 2012. https://www.architectural-review.com/archive/campaigns/the-big-rethink/the-big-rethink-part-4-the-purposes-of-architecture.

Cache, Bernard. *Earth Moves: The Furnishing of Territories*. Edited by Michael Speaks. Translated by Anne Boyman. Writing Architecture. Cambridge, Mass: MIT Press, 1995.

Deleuze, Gilles. *Le Point de Vue*. Lecture. Leibniz et Le Baroque. Paris, France: Université de Vincennes, 1986. https://www.youtube.com/watch?v=yEg4Tc40rWM.

Heisenberg, Werner. The Physicist's Conception of Nature. New York: Harcourt, Brace, 1958.

Jammer, Max. *Concepts of Space: The History of Theories of Space in Physics*. 3rd enl. ed. New York: Dover Publications, 1993.

Laugier, Marc-Antoine. Essai Sur l'architecture. Paris, France: Duchesne, 1753.

Le Corbusier. Towards a New Architecture. New York: Dover Publications, 1986.

Padovan, Richard. Proportion : science, philosophy, architecture. London [etc.]: Spon, 1999.

Padovan, Richard. *Towards universality : Le Corbusier, Mies and De Stijl.* London: Routledge, 2002.

Rykwert, Joseph. *The Idea of a Town: The Anthropology of Urban Form in Rome, Italy and the Ancient World*. Faber Finds. London: Faber and Faber, 2010.

Serres, Michel. Le système de Leibniz et ses modèles mathématiques: Etoiles, schémas, points. 3. éd. Épiméthée. Paris: Presses Univ. de France, 1990.

Simondon, Gilbert. *On the Mode of Existence of Technical Objects*. Minneapolis, MN: Univocal Pub, 2016.

Strauven, Francis. *Aldo van Eyck: The Shape of Relativity*. Amsterdam: Architectura & Natura, 1998.

Ven, Cornelis van de. *Space in Architecture: The Evolution of a New Idea in the Theory and History of the Modern Movements.* 3rd rev. ed. Assen/Maastricht, The Netherlands; Wolfeboro, N.H., U.S.A: Van Gorcum, 1987.

Voet, Caroline, Bart Decroos, Hans van der Laan, and Friederike von Rauch. *Dom Hans van Der Laan: A House for the Mind: A Design Manual on Roosenberg Abbey*. Antwerp: Flanders Architecture Institute, 2017.

Studied in the research phase

Architecture

Dom Hans van der Laan. '3:4'. Accessed 8 May 2021. <u>https://domhansvanderlaan.nl/theory-practice/theory/the-plastic-number-ratio/</u>.

Ayoub, Mounir. 'Les territoires du cercle | Espazium', 20 February 2019. https://www.espazium.ch/fr/actualites/les-territoires-du-cercle.

Berlage, The. The 1970s and the Beginning of OMA., 2019. https://vimeo.com/377509180.

Bradley, Richard. *The Idea of Order: The Circular Archetype in Prehistoric Europe*. 1st ed. Oxford: Oxford University Press, 2012.

Buchanan, Peter. 'The Big Rethink Part 3: Integral Theory'. *Architectural Review* (blog), 29 February 2012. <u>http://www.architectural.review.com/archive/campaigns/the-big-rethink/the-big-rethink-part-3-integral-theory</u>.

Lethaby, W. R. Architecture, Nature & Magic. New York: G. Braziller, 1956.

McConville, David. 'Cosmological Cinema: Pedagogy, Propaganda, and Perturbation in Early Dome Theaters'. *Technoetic Arts* 5, no. 2 (2007): 69–85.

Sandberg, Sigri. 'An Ode to Darkness', no. 1470 (April 2020).

Storrar, Greg. 'Experiment Architecture and the Observer Disposition'. The Bartlett School of Architecture - University College London, 2015.

Whitehead, Alfred North. *The Concept of NatureThe Tarner Lectures Delivered in Trinity College, November* 1919, 2006. <u>http://www.gutenberg.org/ebooks/18835</u>.

Wohlschlag, Jérôme. 'Les débuts du CERN, ville scientifique | Espazium', 21 February 2019. https://www.espazium.ch/fr/actualites/les-debuts-du-cern-ville-scientifique.

Philosophy

Arendt, Hannah. The Life of the Mind. One-Volume ed. A Harvest Book. San Diego: Harcourt, Inc, 1981.

Barad, Karen. *Meeting the Universe Halfway: Realism and Social Constructivism without Contradiction*. Edited by Lynn Hankinson Nelson and Jack Nelson. Dordrecht: Springer Netherlands, 1996.

Bryant, Levi R. Onto-Cartography: An Ontology of Machines and Media. Speculative Realism. Edinburgh: Edinburgh University Press, 2014.

Daston, Lorraine, and Peter Galison. *Objectivity*. New York : Cambridge, Mass: Zone Books ; Distributed by the MIT Press, 2007.

Hui, Yuk. 'One Hundred Years of Crisis'. Accessed 28 October 2020. <u>https://www.e-flux.com/journal/108/326411/one-hundred-years-of-crisis/</u>.

Kant, Immanuel, Paul Guyer, Allen W. Wood, and Immanuel Kant. *Critique of Pure Reason*. The Cambridge Edition of the Works of Immanuel Kant. Cambridge; New York: Cambridge University Press, 1998.

Kousoulas, Stavros. 'Drift, Naturally: A Transaffective Unfolding'. *Journal of Posthuman Studies* 4, no. 1 (2020): 76. <u>https://doi.org/10.5325/jpoststud.4.1.0076</u>.

———. 'Shattering the Black Box: Technicities of Architectural Manipulation'. International Journal of Architectural Computing 16, no. 4 (December 2018): 295–305. https://doi.org/10.1177/1478077118801937.

Marston, Sallie A., John Paul Jones, and Keith Woodward. 'Human Geography without Scale'. *Transactions of the Institute of British Geographers* 30, no. 4 (2005): 416–32.

Mattéi, Jean-François. *L'ordre Du Monde: Platon, Nietzsche, Heidegger*. 1. éd. Paris: Presses universitaires de France, 1989.

Popova, Maria. 'The Life of the Mind: Hannah Arendt on Thinking vs. Knowing and the Crucial Difference Between Truth and Meaning'. *Brain Pickings* (blog), 16 September 2014. https://www.brainpickings.org/2014/09/16/hannah-arendt-the-life-of-the-mind/.

Ross, Daniel. The Neganthropocene, 2018. https://www.doabooks.org/doab?func=fulltext&rid=26652.

Sauvagnargues, Anne. *Artmachines: Deleuze, Guattari, Simondon*. Translated by Suzanne Verderber and Eugene W. Holland. Edinburgh: Edinburgh University Press, 2016.

Smith, Daniel. 'Raymond Ruyer and the Metaphysics of Absolute Forms'. Translated by Alyosha Edlebi. *Parrhesia*, no. 27 (January 2017): 116–28.

Stengers, Isabelle. *Thinking with Whitehead: A Free and Wild Creation of Concepts*. Translated by Michael Chase. Cambridge, Mass: Harvard University Press, 2011.

Whitehead, Alfred North, and Lucien Price. *Dialogues of Alfred North Whitehead*. Boston: David R. Godine, 2001.

Worringer, Wilhelm. *Abstraction and Empathy: A Contribution to the Psychology of Style*. 1st Elephant pbk. ed. Chicago: Ivan R. Dee, 1997.

Worringer, Wilhelm, and Herbert Read. Form in Gothic. London: Tiranti, 1964.

Yusoff, Kathryn. 'Anthropogenesis: Origins and Endings in the Anthropocene'. *Theory, Culture & Society* 33, no. 2 (March 2016): 3–28. <u>https://doi.org/10.1177/0263276415581021</u>.