X
Metaphysics of the Negligible

Heisenberg's Anschaulichkeit

In 1927, Werner Heisenberg published an article entitled *Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik*, in which he introduced the first draft of what would then become known as the "uncertainty principle."[1] From the title, it is evident that the article discusses the "content of quantum-theoretical kinematics and mechanics;" what is less obvious is nevertheless the adjective of such "content," described by Heisenberg as *anschaulich*. In the philology of the ar-

1 Werner Heisenberg: *Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik*. In: *Zeitschrift für Physik*. Vol. 43, No. 3, (Berlin: Springer, 1927), p. 172–198.

ticle's translation, this word has been translated in a variety of ways: "physical," "perceptible," and "perceptual," for instance. But *anschaulich* can also mean "intelligible," "intuitive," and "descriptive."[2] Kant adopts a similar term in the first part of the *Critique of Pure Reason*, that dedicated to transcendental aesthetics: *Anschauung* (literally "view" or "vision") is the object of a theory in which space and time are the conditions of possibility of knowledge as transcendental forms of perception.[3] To pick up a term with such a longstanding tradition, reintroducing it to the realm of physics, was initially Erwin Schrödinger in the formulation of a theory meant precisely to solve an open issue left by Heisenberg's previous article: Heisenberg's matrix mechanics correctly managed to calculate the position of atomic particles, but it did so by refusing to account or to "picture" what would happen in-between those positions, during the so-called

2 Hilgevoord, Jan and Jos Uffink, "The Uncertainty Principle," *The Stanford Encyclopedia of Philosophy* (Winter 2016 edition), Edward N. Zalta (ed.), URL: https://plato.stanford.edu/archives/win2016/entries/qt-uncertainty/ (23 Feb 2022).

3 Immanuel Kant, *Kritik der reinen Vernunft* (Hamburg: Felix Meiner, 1956). Besides Kant, the notion of *Anschauung* and of *Anschaulichkeit* has a longstanding tradition in the philosophical discourse. For further reference, see: Pirmin Stekeler-Weithofer, *Formen der Anschauung: Eine Philosophie der Mathematik* (Berlin: De Gruyter, 2008); and Klaus Thomas Volkert, *Die Krise der Anschauung: Eine Studie zu formalen und heuristischen Verfahren in der Mathematik seit 1850* (Göttingen: Vandenhoeck & Ruprecht, 1986).

quantum leaps. Matrix mechanics would therefore assume the discrete observable value as *particles*, as values that could not be harmonized in a continuous model. Schrödinger's theory of wave mechanics proposed instead a way to reconcile the discreteness of these observations with the continuity of a wave function. *Anschaulichkeit* was, for him, the advantage of this theory: the mathematical model of the wave function was proven in its validity by the fact that it could be matched by observable—the German *anschauliche*—data. By picking up the same term for his later article, Heisenberg redefined its meaning: if, for Schrödinger, *Anschaulichkeit* stood as an *ex-post* proof of the overall validity of his theory, for Heisenberg it was instead an *a priori* condition to the understanding of the theory itself, and thus a limiting one.[4] The fact that *Anschaulichkeit* was not a validation of his theory but a condition of understanding was not just demonstrated

4 Whereas Schrödinger's *Anschaulichkeit* has to be understood in the analytic frame of his wave function (and pertains, therefore, to a calculus), Heisenberg's take on it is more algebraic than analytical. At the very beginning of his article, Heisenberg writes: "We believe we understand a physical theory in an intelligible way [*anschaulich zu verstehen*] if, in all simple cases, we can grasp the experimental consequences qualitatively and see that the theory does not lead to any contradictions." Heisenberg, *Über den anschaulichen*, 172. A precious reconstruction of Heisenberg and Schrödinger's diatribe can be found in Carlo Rovelli *Helgoland: Making Sense of the Quantum Revolution*, trans. Erica Segre and Simon Carnell (New York: Riverhead Books, 2021).

by Heisenberg by levering on the interpretation of the word itself, but especially by the very content of the paper: in its embryonic form, the principle of uncertainty stated that the more precisely one tries to measure the position of a particle, the less complete this picture would be.[5] In other words, it stated that, to a quantum-theoretical understanding, observation *matters*.

Even if from different sides, both Heisenberg and Schrödinger converged on the importance of observation. However, Heisenberg added that the object of his theory seemed to be ascertained only within the very limits of observability or, in other words, *only within the exchange* it entertains with its observer. What happened beyond this exchange could not be objectified and had to be neglected. This neglect, which appeared at first to be a failure of Heisenberg's theory, was assumed by it as the very operative principle. The uncertainty principle establishes an unavoidable relation, within the observation, between the acquisition of precise meas-

5 "At the instant of time when the position is determined, that is, at the instant when the photon is scattered by the electron, the electron undergoes a discontinuous change in momentum. This change is the greater, the smaller the wavelength of the light employed, i.e., the more exact the determination of the position. At the instant at which the position of the electron is known, its momentum, therefore, can be known only up to magnitudes that correspond to that discontinuous change; thus, the more precisely the position is determined, the less precisely the momentum is known, and conversely." Heisenberg, *Über den anschaulichen*, 174–175.

urement and its irreversible loss. Such irreversibility implies that this relation is accountable in economic terms only contingently: its economy can never be considered total but must always account for what exceeds it (as a loss, an expenditure, a *Verlust*). These contingent economies allow for the exchange between observed and observer, "creditor" and "debtor," but only upon an unaccountable reserve—one similar to Blumenberg's *Vorbehalt*—of what stands *beyond* observation and measurement. Such a "beyond" is not quantifiable, but can only be *quantized*, addressed in proportional terms—as a quantum, not as a "how many" but an "as much." Therefore, the relation is not only between observer and observed but also between observable and *un*observable. The quantum-physical observation comes, thus, close to that double duplication enacted by the image, and observation can be described as a kind of balance or equilibrium that rests upon a circle of some "non-knowledge," a residue of intellection that is in no way directly accountable.[6]

6 The notion of non-knowledge might instead find an interesting theological development in a classic of the 14th Century, such as *The Cloud of Unknowing*. More recently, Carlo Rovelli provided a quantum-physical account of entropy in terms of *blur*. "Boltzmann has shown that entropy exists because we describe the world in a blurred fashion. He has demonstrated that entropy is precisely the quantity that counts *how many* configurations our blurred vision cannot distinguish. Heat, entropy, and the lower entropy of the past are notions that belong to an approximate, statistical description of nature. [...] But something further is also true: the blurring itself determines a

The image can be seen, under these terms, as the expression of an ontological difference, of an irreducible and substantial discontinuity between the *ontic* realm of being and the one of *ontological* intellection, in a way in which none of the two comes before the other since both are co-ordinated and co-constituted by the image as their transcendental projectual.[7] Intellection rises in the form of analogy, of an architectonic proportion: as an image—a "bridge"—upon the negligible, as acutely recognized by Simone Weil:

> Essential contradiction in our conception of science: the fiction of the closed vessel (the foundation of every experimental science) is contrary to the scientific conception of the world. Two experiences should never give identical results. We overcome it through the notion of the negligible. But the negligible is the world...

particular variable—time." Carlo Rovelli, *The Order of Time* (London: Penguin Books, 2019). In this perspective, the things of the world are not ontologically set, but they "emerge" from time as a blur: they are *categorically* addressable, rather than ontologically. A similar "fertility" is described by Elias Zafiris in his relation between a quantum spin-foam to the notion of information as *anadyomene*—an epithet of Aphrodite, meaning "emerging from the foam." See: "Circumventing Complexity: Motif of Information as Anadyomene," in Elias Zafiris, *Natural Communication: The Obstacle-Embracing Art of Abstract Gnomonics* (Basel: Birkhäuser, 2020).

7 See also Chapter 7.2. Rereading Heidegger's ontological difference precisely in such mathematical terms would be interesting. See: Martin Heidegger, "Die Grundprobleme der Phänomenologie," in *Gesamtausgabe. II. Abteilung: Vorlesungen 1923-1944* (Frankfurt am Main: Vittorio Klostermann, 1989).

So it is with the simplest technique. It is *chosen* as a model.

The notion of the analogy of identical ratios is central for the Greeks. A bridge between the finite and the infinite.[8]

Currency

Today, such an "economic" understanding of the image and observation has found a precise formulation in the notion of information. In his 1956 book *Science and Information Theory*, Leon Brillouin describes information in terms of entropy and negentropy:

Every physical system is incompletely defined. We only know the values of some macroscopic variables, and we are unable to specify the exact positions and velocities of all the molecules contained in a system. [...] Entropy measures the lack of information; it gives us the total amount of missing information on the ultramicroscopic structure

8 Here translated from the French: "Contradiction essentielle dans notre conception de la science : la fiction du vase clos (fondement de toute science expérimentale) est contraire à la conception scientifique du monde. Deux expériences ne devraient jamais donner de résultats identiques. On s'en tire par la notion de négligeable. Or le négligeable, c'est le monde... / Il en est ainsi de la plus simple technique. On la *choisit* pour modèle. / La notion d'analogie, de rapports identiques, est centrale chez les Grecs. Pont entre le fini et l'infini." Simone Weil, *Cahiers*, in *Œuvres complètes* VI, Vol. II, (Paris: Gallimard, 1997), 547.

> of the system. [...] any observation or experiment made on a physical system automatically results in an increase of the entropy of the laboratory. It is then possible to compare the loss of negentropy (increase of entropy) with the amount of information obtained.[9]

Building upon Leo Szilard's and Claude Shannon's work, Brillouin starts from the constitutive discreteness of Heisenberg's *Anschaulichkeit* and borrows the thermodynamic notion of entropy to account for the exchange of information. In his theory, a *gain* of information corresponds to a *loss* of negentropy, and such an exchange happens on the basis of the understanding of entropy as the measure for the *lack* of information. Despite borrowing the concepts from life sciences, according to which negentropy signaled the possibility of defining the living in precise scientific terms, Brillouin's phrasing—lack, obtainment, loss—paves the way for a relatively economical and quite "materialist" understanding of information. In these terms, entropy can be considered a "debt" that becomes constitutive for an economy where the exchanges are accounted for through negentropy.[10] Gains

9 Léon Brillouin, *Science and Information Theory* (Mineola, NY: Dover Publications, Inc, 2013), xii.

10 On the constitutive role of debt for the establishment of an economy of exchange, see: David Graeber, *Debt: The First 5,000 Years* (Brooklyn, NY: Melville House, 2011).

and losses arise here in the "negotiation" between observer and observed, in which information is converted into energy and vice-versa. Even if still implicitly, Brillouin prepared the ground for the introduction of a "third" element that, like the image, would allow for this conversion and, consequently, for such an economy of exchange—something that would "step in" the gaps left by Heisenberg's particles, without falling into the trap of Schrödinger's calculus. Even if discussed by him still in terms of "life," this third element could already be borrowed as something more autonomous and "intelligent" than a vitalist understanding might have suggested. Discussing Brillouin's notion of negentropy, Vera Bühlmann identifies this element as *code*:

> Brillouin foregrounded the role of 'code' in such 'intelligent' computation: he thereby applied a *double* notion of negentropy and entropy—one to energy, one to information. Entropy applied to *energy* follows a physicalist view (universal nature), negentropy applied to *energy* follows a biologist view (pluralist natures, fragile balances of import/export relations in metabolisms); entropy applied to *information* follows a biologist view (attends now to specific balances of pluralist natures, whereby local balances are being 'generalized' into global 'ontologies'), negentropy applied to *information* follows a physicalist view (universal nature, can now attend to that nature's 'givenness' in greatest local

> diversity ('givenness' as 'datedness'). The fourfold energy and information orders assume that both are linked and convertible to each other by code.[11]

Energy and information, universality, and pluralism "touch" in the notion of code, as *unica mens* and individual minds touched in the image. Code and image unfold in such double duplication: light can be converted into mass, photons into electrons, potency into act, and vice versa. The distinction between a "physicalist" and a "biologist view" could be compared to the two positions outlined by Clément concerning the environment as something towards which both "equality" and "superiority" are possible stances. If the Averroistic notion of the image stood for what Coccia described as a "physics of the sensible," the notion of code in information theory could perhaps be described as a *metaphysics of the negligible*.[12] Averroes's material intellect and the medieval "speculations" on the statute of the image come quite close to the form of mediality that is experienced with the digital: the coextensiveness of matter (of hardware) and agency (of software); the multiplication of images as a set of indeterminate exact copies; their reduction to a "punctual" and

11 Vera Bühlmann, *Mathematics and Information in the Philosophy of Michel Serres* (London: Bloomsbury Academic, 2020), 39.

12 Emanuele Coccia, "Physique du sensible. Penser l'image au Moyen Age," in *Penser l'image*, ed. Emmanuel Alloa (Dijon: Les Presses du Réel, 2010).

intensive form that does not take any "physical" room; and, ultimately, the consequent understanding of the intellect not as a transcendent "supreme entity," but immanently as "the thinnest of all matters"[13]—as some "intra-material software" (*logiciel intra-materiel*), to use the words of Michel Serres.[14]

What Brillouin's theory introduces additionally is that the negligible becomes here an explicitly operative principle: the exchange between energy and information would not be there without the asymmetry of entropy, without thus what Brillouin calls a "lack of information."[15] This asymmetry becomes a *currency*—and, in this case, information—only if accepted as such, as a constitutive "grain" of reality: this implies that the observer *must* relinquish the expectation of gaining information on the microscopic states of the system, on the "infinitely small" (and thus operationally negligible). "[T]he measurement of extremely small distances is physically

13 Coccia, *La Trasparenza delle immagini*, 115.

14 "On peut dire du gnomon : 'il connaît' comme on dit qu'il pleut. Le gnomon a l'air d'un style, mais nul ne le tient en main. Des choses du monde se donnent à voir à un objet qui les montre : entièrement objective, la théorie se passe de sujet. Une chose, le gnomon, intervient dans le monde et celui-ci lit sur soi l'écriture qu'il trace. Ce type de logiciel intramatériel conditionne nos performances cognitives, comme une sorte de transcendantal objectif." Michel Serres, *L'Incandescent* (Paris: Le Pommier, 2003), 58. See also: "A Logos Genuine to the World: 'Le logiciél intra-matériel,'" in Bühlmann, *Mathematics and Information in the Philosophy of Michel Serres*, 66–72.

15 Brillouin, xii.

impossible," Brillouin writes. "The mathematician," he continues, "defines the infinitely small, but the physicist is absolutely unable to measure it, and it represents a pure abstraction with no physical meaning:"[16] such "ultramicroscopic" structures can only be conceived as abstractions in the exchange between the mathematical and the physical as the image rises within the exchange between the intelligible and the sensible. As a currency established through code, information itself must utterly abstract from the "value" of what it deals with; it must therefore relinquish any claim to understand its meaning. Code and information act here similarly to Name and language: the sign only works after the "possession" and the "absorption" of the alterity of the Name and its consequent release of an "allegoric space." Brillouin's theory works only upon the "elimination" from it of what he calls "the human element."[17] Code and image are the *loci* where this

16 "An interesting outcome of this discussion is the conclusion that the measurement of extremely small distances is physically impossible. The mathematician defines the infinitely small, but the physicist is absolutely unable to measure it, and it represents a pure abstraction with no physical meaning. If we adopt the operational viewpoint, we should decide to eliminate the infinitely small from physical theories, but, unfortunately, we have no idea how to achieve such a program." Brillouin, *Science and Information Theory*, xii.

17 "The methods of this theory can be successfully applied to all technical problems concerning information: coding, telecommunication, mechanical computers, etc. In all of these problems, we are actually processing information or transmitting it from one place to another, and the present theory is extremely useful in setting up

elimination occurs, a place of projectual detachment from the "presupposed." The introduction of code renders this elimination not necessary but contingent: the "human element" is no longer something fixed from which to depart, but rather an image from which one can depart as much as that can be reached—the image of a "hominescence" rather than a *humanismus*.[18]

If the image could be considered as the expression of this asymmetry as an ontological difference, with information, such expression is symbolized, encased, and turned into a general equivalence. The image, the likeness of something, can be quantized via code and information theory to act as a currency: it turns into a copy only of itself and, at the same time, of nothing in particular. This is possible thanks to the probabilistic nature of information theory and thus to the transformation of *likeness* into *likelihood* (or of *quanta* into *quantities*). It proceeds by modeling an initial "inertial" condition in which "no special information" is possessed

rules and stating exact limits for what can and cannot be done. But we are in no position to investigate the process of thought, and we cannot, for the moment, introduce into our theory any element involving the human value of the information. This elimination of the human element is a very serious limitation, but this is the price we have so far had to pay for being able to set up this body of scientific knowledge." Brillouin, *Science and Information Theory*, x.

18 Michel Serres, *Hominescence*, trans. Randolph Burks (Bloomsbury: Bloomsbury Academic, 2019).

about the system in consideration,[19] a condition that corresponds to a situation in which a number of different possibilities might happen. Still, these other possibilities—these "cases"—are set *a priori* all as *equally probable*. Such an a priori condition of uncertainty determines the maximum uncertainty of the problem related to the context and, thus, the maximum amount of information required to make a selection.[20] Setting such an equivalence, and thus modeling this as a subsequent "inertial" condition, is an act of coding that transcribes the indeterminacy of chance into determinate cases.

However, it would be a mistake to consider coding merely as a *descriptive* act. Taken seriously, *Anschaulichkeit* implies that the negligible is not simply what cannot be "passively" accounted for; it is what has to be *actively* neglected. Furthermore, the probabilistic set-up developed by Brillouin (and by James Maxwell and Claude Shannon before him), which develops one of Heisenberg's on a more abstract level, makes it clear that the coding

19 "Concerning the basic law of motion, the law of inertia, the question arises whether this law is not to be subordinated under a more general one, i.e., the law of the conservation of energy which is now determined in accordance with its expenditure and consumption, as work-names for new basic representations which now enter into the study of nature and betray a notable accord with economics, with the 'calculation' of success." Martin Heidegger, "Modern Science, Metaphysics, and Mathematics," in *Basic Writings*, ed. D. F. Krell (London: Routledge & Kegan Paul, 1978), 270.

20 Brillouin, *Science and Information Theory*, 1.

happens *a priori* and is thus closer to an artificial construct than a natural constant. As Emanuele Severino pointed out, probability theory is introduced by Daniel Bernoulli as the *Ars conjectandi*, an art of predicting "events that, like those occurring in games of chance, do not allow themselves to be reached by the *epistéme* and whose prediction is, therefore, the work of an *ars*, that is, of an activity guided by rules that are not intended to be valid as incontrovertible truths."[21] The probabilistic view seems to be transversal to the one of the project: the prediction is here not a throwing-forward, but a "throwing-with." Conjecture, from *cum-jacio*, implies "being provided with an equipment that allows one to reach what is ahead."[22] This does not mean that the coding of information is entirely arbitrary and subjective but that it deals with chance in terms that are not univocally set.

Both quantum physics and information theory seem to converge towards a notion of the image that is *autonomous* both from the subject as well

21 "Nel suo titolo stesso, l'*Ars conjectandi* di Bernoulli si propone esplicitamente come previsione (*conjectura*, da *cum-jacio*, getto innanzi essendo provvisto di un'attrezzatura che consente di raggiungere ciò che sta innanzi): come previsione di eventi che, come quelli verificantisi nei giochi d'azzardo, non si lasciano raggiungere dall'*epistéme* e la cui previsione è quindi opera di un'*ars*, cioè di un'attività guidata da regole che non intendono valere come verità incontrovertibili." Emanuele Severino, *Legge e caso* (Milan: Adelphi, 2002), § XIV. Translated from the Italian.

22 Severino, § XIV.

as from the object: on the one hand, it removes itself from the "human element" and the attribution of values and meanings; on the other, it is not "naturalistic," it does not stand as a depiction of an implicit truth—it is not a verisimilitude (epistemological) but a likeness (architectonic), it is what art historian Ananda Coomarswamy describes as "an image akin (*sungenēs*) and 'equal' (*isos*) to its model; in other words, a natural and 'adequate' symbol of its referent."[23] Model and image do not exclude each other but rather establish a virtuous cycle through which knowledge can be accessed in an architectonic matter.

23 "The imitation or 're-presentation' of a model (even a 'presented' model) involves, indeed, a likeness (*homoia*, Latin *similitudo*, Skr. *sādṛśya*), but hardly what we usually mean by 'verisimilitude' (*homoiotēs*). What is traditionally meant by 'likeness' is not a copy but an image akin (*sungenēs*) and 'equal' (*isos*) to its model; in other words, a natural and 'adequate' symbol of its referent." Ananda K. Coomaraswamy, "A Figure of Speech, or a Figure of Thought?," in *Figures of Speech or Figures of Thought? The Traditional View of Art*, ed. William Wroth (Bloomington, Ind: World Wisdom, 2007), 9. Aristotle's writings seem to play, in one way or the other, a crucial role in this distinction within the history of Western thought. Whereas Averroes's Commentary on his writings seems useful to reintroduce an architectonic understanding, Karl Popper previously identified Aristotle as the fore-bringer of epistemology at large. See: Karl R. Popper, "Introduction: Aristotle's Invention of Induction and the Eclipse of Presocratic Cosmology," in *The World of Parmenides: Essays on the Presocratic Enlightenment*, ed. Arne F. Petersen (London, New York: Routledge, 1992), 1–6.

Nomothesis

These considerations are all tied to the postulation of an autonomous statute of images. In informational terms, this autonomy corresponds to the treatment of natural invariances through the mediacy of code on the one side and the "elimination of the human element," i.e., to the evacuation of any claim over meaning on the other. Such autonomy outlines what could be referred to as the *theological-political* character of the image: as a medium with a domain of its own, the image is not quite just a representation of something; its "existence" is not univocally linked to the one of an external reference. The representation process is, therefore, in the case of the informational image, an intransitive one, so to speak: rather than a representation (of something), the image has to be understood as *a representative* in itself—and for this reason, the one of the images is a *statute* and not a *state*, as it is not to be epistemologically or analytically legitimized. Like in the case of the image, the notion of representativeness is particularly evasive to a logical understanding because it exceeds contradiction and can thus appear as a paradox. The representative moves *within* antitheses and articulates them; it is molded as what Schmitt defined as a *complexio oppositorum*: not a coincidence (*ad infinitum*) of the

opposites (as in Cusa's *coincidental*) but their immanent "folding together" (*cum-plexio*).[24] The political character resides precisely in the fact that these antinomies do not annihilate each other but instead find a possibility of mutual confrontation in the representative. The dialectic play of contradictions is here organized into a "space" or a "domain—and is, therefore, the outcome of an architectonic ability rather than a logical one.

But how does this sort of translation from the logic and the dialectic to the architectonic and the "spatial" occur? And how do they relate to the polit-

24 The relation between logics and representativeness is perhaps best grasped in Schmitt's discussion of the statute of rhetorics in the modern age: "The lack of understanding of the significance of rhetoric is but one manifestation of the polar dualism of the age, expressed here, on the one side, by a rapturously overpowering music; on the other, by a mute practicality. It seeks to make 'true' art into something Romantic, excessively musical and irrational. It is well-known, largely owing to Taine's gifted discernment and depiction, that there is a close relation between rhetoric and the *esprit Classique*. But Taine destroyed the living idea of classicism by making it the antithesis of Romanticism. Without actually believing it himself, he endeavored to identify the classical with the rhetorical and thereby with artificiality, empty symmetry, and fabricated lifelessness. A whole assortment of antitheses to play with! In this comparison of rationalism and something 'irrational,' the classical is allotted to the rational, the Romantic, to the irrational. Rhetoric comes under the heading of the classical and rational. Most decisive, however, is rhetoric in the sense of what one might call representative discourse rather than discussion and debate. It moves in antitheses. But these are not contradictions; they are the various and sundry elements molded into a *complexio* and thus give life to discourse." Carl Schmitt and G. L. Ulmen, *Roman Catholicism and Political Form* (Westport, Connecticut: Greenwood Press, 1996), 23.

ical? In the *Nicomachean Ethics*, Aristotle describes the political precisely as *arkhitektonikē*, an "architectonic science or faculty."[25] Both the political and architectonics are by him related to *phronēsis*, "prudence," a form of practical wisdom able to confront the natural unpredictability of chance and its particular cases. If, on the one hand, the exercise of politics is concerned with deliberation over specific occurrences, and the ones who practice it are compared by Aristotle to "manual workers" (*kheirotekhnai*), on the other hand, the architectonic faculty instead consists in what he defines as a "legislative" activity—*nomothetikē*.[26] He appears here to discuss what today is referred to as the principle of the separation of powers: the executive, legislative, and judiciary. But whereas in the modern state, the

25 "Now it would seem that this supreme End must be the object of the most authoritative of the sciences or faculties [*epistēmōn ē dunameōn*]—some science or faculty which is pre-eminently a master-craft [*arkhitektonikēs*]. But such is manifestly the science of Politics." Aristotle, *The Nicomachean Ethics*, trans. H. Rackham, 1094a 1–25.

26 "Prudence [*phronēsis*] is indeed the same quality of mind as Political Science [*hē politikē*], though their essence is different. Of Prudence, as regards the state, one kind, as supreme and directive [*arkhitektonikē*], is called Legislative Science [*nomothetikē*]; the other, dealing with particular occurrences, has the name Political Science [*politikē*], that really belongs to both kinds. The latter is concerned with action and deliberation (for a parliamentary enactment is a thing to be done, being the last step in a deliberative process), and this is why it is only those persons who deal with particular facts that are spoken of as 'taking part in politics,' because it is only they who perform actions, like the workmen in an industry." Aristotle, *Nicomachean Ethics*, 1141b, 8–29.

legislative power is political insofar as it is *within* politics (and often overlaps with the executive), in Aristotle's configuration, the legislative is *beside* it.[27] The architectonic character of politics is, in fact, not quite legislative but *nomothetical*: it is not a matter of "law-making" but of the "placing" of a *nomos*.

Differently from the law, the *nomos* is not something deliberated in the political arena; Hannah Arendt notes that the *nomothetes*, the "law-giver," could even be a foreigner, engaged "much like a sculptor or architect commissioned to supply what the city required."[28] But the most concise and precise definition of *nomos* has been given by Schmitt, who in his work long indulged on such a notion: according to him, *nomos* is the word "best suited to describe the fundamental process involved in the relation between order [*Ordnung*] and orientation [*Ortung*]."[29] The nomos weaves together two domains: the geometrical one of order and the

27 "Prudence also is commonly understood to mean especially that kind of wisdom which is concerned with oneself, the individual; and this is given the name, Prudence, which really belongs to all the kinds, while the others are distinguished as Domestic Economy [*oikonomia*], Legislature [*nomothesia*], and Political Science [*politikē*], the latter being subdivided into Deliberative Science [*bouleutikē*] and Judicial Science [*dikastikē*]." Aristotle, 1141b, 29–32.

28 Hannah Arendt, "Introduction *into* Politics," in *The Promise of Politics*, trans. Jerome Kohn (New York: Schocken Books, 2005), 179.

29 Carl Schmitt, *The Nomos of the Earth in the International Law of the Jus Publicum Europaeum*, trans. G. L. Ulmen (Candor, NY: Telos Press, 2006), 67.

angular one of orientation. Schmitt then defines law (*Recht*) as "the *unity* of order and orientation:"[30] What in the *nomos* is a pre-specific relation, the law assumes as a *unity*; if the law is *one code*, nomos is the "coding" itself.

Heisenberg's matrixes could be read precisely in these terms: as an account of discrete geometric values (an order) that is inextricable from a determinate angular momentum (an orientation). But the terms of this relation are not given, this is why the relation is *Unschärfe*, "un-sharp," as Heisenberg himself called it, and it can be valid as *a principle*—it defines what in juridical terms is a "state of law," a *Rechtstaat*, and in physical ones a mechanics—only through its "quantization" into a unity. It is precisely this quantization that the object of the architectonic faculty and, conversely, its architectonic nature resides in the fact that, as a quantum, the unity cannot be determined in a univocal manner. In other words, it cannot be the object of Newtonian mechanics. The nomos binds the polis, the city as a place of the many, as a *politeia*. Unity is here always yet to be achieved and never properly "sealed," not yet "quantized"; the polis is always on the verge of *stasis*, of civil war. The nomos allows us to conceive of a unity without forgetting its "unstable" and "indeterminate" nature as quantum; it preserves the

30 Schmitt, *The Nomos of the Earth*, 42.

negligible by not claiming to speak in its name. As Arendt highlights, the nomos "is not valid outside the polis," and its "binding power applies only to the space that it encloses and delimits."[31] The coding that the nomos enact is similar to an *Entwurf*, a "project" in which, recalling Cacciari, one still "feels the pull of the throw."[32]

Once the relation resolves in unity, the nomos leaves the stage to law, to a *Rechtstaat*. Its order is not just oriented but directional: it has a *sense*, it is guided. It operates within a "logic" process, able to "linearly" solve contradictions: a contract whose validity stands in time rather than in space and is "tied to proposals and counterproposals,"[33] hence unthinkable without the infrastructural role of language and speech, of a *logos*. In this context, the representative character of the image cannot but

31 Arendt, "Introduction *into* Politics," 181.

32 "If we analyze, for example, the German term *Entwurf*, then the root of the project reemerges with force. In the *ent-*, the anticipation, the before (*Avanti*) do not resound; what resounds, rather, is the way-from, the separation-from, the departing—not so much the constructive-productive in its advance, as much as the destructive or the overcoming. In *Entwurf*, one perceives the 'pull' (*strappo*)of the 'throw' (*lancio*), not its eventual prefiguring, predictive force. Thus, in terms such as *Entwicklung* or *Entfaltung*, the *techné* of unfolding, of unwinding, of developing is portrayed with its eyes turned backward: to the 'already developed' that must be newly unfolded, to the refolded, to the 'congealed' that must be disentangled, unraveled, analyzed." Massimo Cacciari, "Project," in *The Unpolitical: On the Radical Critique of Political Reason*, ed. Alessandro Carrera (New York: Fordham University Press, 2009), 123.

33 Arendt, "Introduction *into* Politics," 179.

appear as absurd: the image cannot be but *a representation* of something; it is reduced to an epistemological "meanwhile," to being a mere logical explication of its idea, as much as a line is the "evolution of a point." The *Entwurf* becomes here fully *projected*, something "thrown in front," in which the "pull of the throw" is not to be felt anymore. And yet, as a "mere meanwhile"—as a *frattempo*, a time in-between time itself—the image can be understood as the point in which the "thinnest of all matters" becomes the "thinnest of all times," i.e., as the point of conversion between matter and time.

The image somehow counters the arrow of time: as Brillouin stated, entropy—the only equation of state in which, according to thermodynamics, time flows irreversibly—in informational physics is always to be set relative to a negentropy. And yet, in the image, this countering does not happen just linearly, as a play of positive and negative, but rather "spatially," architectonically—*nomothetically*: as the relation between order and orientation, two domains that can indeed be quantized on a line, but in which the quantization must be "remembered" in its metaphysical neglect. The one offered by the image is not just a "counter-arrow" to the flowing of time: this would correspond to a *tragic* immobility, a total symmetry. The relation between order and orientation implies that time cannot be stopped

but that it can assume an "angle," a momentum—it can be materialized as a "declination," as a case—beyond its apparently inevitable direction (conversely, matter can have different orders, it can be organized through different "tenses"). The time of the image is neither entropic nor negentropic, but *ek-tropic*: it exceeds the "programmatic" accounting of entropy and negentropy and articulates the two as that fourfold economy of exchange; credit and debit of energy and information. If entropy constitutes a "lack of information" implicit in any system, as Brillouin wrote, ektropy is the turning of this lack and this constitutive debt into a gratuitous credit and of lack into abundance. The ektropic coincides here with the political, as something that "[b]y claiming to be something more than the economic [...] is obliged to base itself on categories other than production and consumption."[34] *Anschaulichkeit* becomes, through the image, "a matter of *compossible* interpretations, of *orders* of interpretation."[35] To be "encoded" in the image is

34 Schmitt, *Roman Catholicism and Political Form*, 17.

35 "What seemed to be an absolutely inexorable law becomes a principle that can only be interpreted statistically; from Necessity it is transformed into a possible order. *Which* entropy is increasing? Which system does it quantitatively characterize as the 'degradation' of our system? But how can we say that it lives in isolation? How can we extrapolate from the fact of the increase in the measure of entropy within it, if considered in isolation, to the 'death of the sun'? Isolated systems present an irreversibility of fact, moving from conditions of lower entropy towards conditions of maximum entropy but

not just chance: even the past is un-secured: the one of the "ek-tropic instant," as Cacciari calls it, is a time in which "an 'eternal' image of the past, an image of the past as a perfect state, does not appear conceivable."[36] The past is a "state" (a has-been) only

not a nomological one. No Nomos states that things can only go like this. We can imagine cases in which entropy decreases or does not change. On the basis of the 'normal' situation, and only on the basis of this situation, we can establish the fundamental asymmetry of time, the distinction between a before and an after, but this will not indicate its *direction*. Nothing informs us that time *flows* ('irreversibly') from a before to a present to an after. We can simply define different measures of entropy, distinguish the *two* directions of time, not its flowing in *one* sense. It seems that the idea of a direction of time is closely related to a communicative model, in which it is implied that the answer *must* follow the question or that we ask questions *only because* we expect answers containing more information. But, even apart from the extraordinary 'naivety' of this idea (the whole of Kafka, for example, is a refutation of it), it does not imply any irreversibility. The communicative model could 'logically' be combined with any image of renewal; its duration does not in itself express any idea of consumption or death. There is no necessary sequence here, as there was in the entropic model. It is a matter of *compossible* interpretations, of *orders* of interpretation. But order can also be, then, the ek-tropic possibility (not mechanical, not constrained in the system of 'mechanical reversibility') revealed by the mundus imaginalis, the 'Dionysian' moment of the perfect simultaneity of the directions of time; the folding of its arrow; the 'question' that the color of the icon can address to its Gold, precisely because this is always given, before any 'question' (just as, in the dream, time seems to 'flow' towards its present, towards its 'origin' or 'cause,' towards what is already an answer to its questioning)." Massimo Cacciari, *Icone della legge* (Milan: Adelphi, 2002), 207–208. Translated from the Italian.

36 "In the Angel's name, the *idea* that it is possible to make this 'argument' 'leap,' to squirt out of the homogeneous and empty time of the continuum, to give life to days that stand, to *Fest-stage*, capable of stopping the flow and recreating it at a time, becomes self-transparent. To entropy, to irreversible consumption, his name opposes the *ek-tropic* instant. In this time, an 'eternal' image of the past, an image

as a *project*, i.e., as an *Entwurf* in which the "static" insecurity and uncertainty of its pull have been forgotten (and the project, Cacciari writes, is always a *project of State*). It stops being a "dimension" of time. It acquires instead a *depth*, as described by Merleau-Ponty concerning the pictorial gaze, as "the experience of the reversibility of dimensions, of a global 'locality' in which everything is at the same time."[37] This uncertainty of the past and the status quo can perhaps already be grasped in the fact that, when digital, the image is always also *digitable*:[38] Besides its exact, indeterminate reproduc-

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of the past as a perfect state, does not appear conceivable. The past itself is still *insecure; it* can glow with hope, and it can demand *justice*. Never, in this time, is the past *defeated*; never is the present merely the field of the victors, from which, as Simone Weil repeated, justice is always forced to flee." Massimo Cacciari, *L'Angelo Necessario* (Milan: Adelphi, 2008), 86-87. Translated from the Italian.

37 "Once depth is understood in this way, we can no longer call it a third dimension. In the first place, if it were a dimension, it would be the first one; there are forms and definite planes only if it is stipulated how far from me their different parts are. But a first dimension and one that contains all the others is no longer a dimension, at least in the ordinary sense of a *certain relationship* according to which we make measurements. Depth thus understood is, rather, the experience of the reversibility of dimensions, of a global 'locality' in which everything is at the same time, a locality from which height, width, and distance are abstracted, the experience of a voluminosity we express in a word when we say that a thing is there." Maurice Merleau-Ponty, "The Eye and the Mind," 369.

38 "An enormous mental upheaval, which no one would be able to contain, was caused—and continues to be caused—by the confluence of *digital* and *digitable*. Knowledge assumes the form of a single encyclopedia in perpetual proliferation and, generally speaking, digitable. An encyclopedia that juxtaposes impeccably reliable in-

tion, it contains within itself the possibility of its indeterminate alteration, even up to the point of turning into its contingent opposite—a veritable realization of the *complexio oppositorum*. Through its entropy, the image becomes constitutive of a space of *liberal arbitrium*, of free will.

Architect sive Demiurge

This freedom is not absolute but always deals with an "other" which is undetermined and therefore open to a plenitude of potential determinations. The image is what can potentially make sense of it: make it *anschaulich*, sensible and intelligible, and physically so. But this act of sensing or sense-mak-

formation with baseless information, equally accessible and on the same level. What is digitable belongs to what is familiar and can so be used with fond indifference. Knowledge loses prestige and appears as though made up of items—in the sense of headings in an encyclopedia and incontrollable, drifting rumors or *boats*, as they say in Portuguese. The most fascinating—and potentially fruitful—aspect of this total encyclopedia is the *algorithmic chaos*, so that once the most probable connections have been reached, they become increasingly arbitrary and misleading, as is supposed to happen in a neural network." Roberto Calasso, *The Unnamable Present*, trans. Richard Dixon (London: Penguin, 2020), 70. As digitable, the digital could be compared to what Agamben describes as a "writing of potency." "The writing of potency—writes Agamben in the introduction to Coccia's book on the transparency of the images—is, in this sense, an absolute and generalized form of compilation, in which pure receptivity and pure writability coincide and in which thought, the *magnus compilator* plunders and compiles itself, endlessly adding alienity to alienity." Giorgio Agamben, "Introduzione," in *La Trasparenza delle immagini: Averroè e l'averroismo* (Turin: Bruno Mondadori, 2005), xi.

ing exceeds a physical understanding—for which it is instead *meta*-physical, something that any "physical" *Anschaulichkeit* must actively neglect. Such neglect is the product of an "architectonic ability;" as Aristotle called it, it casts a bridge between a physics of the sensible and a metaphysics of the negligible.

As previously pointed out, this architectonic understanding of the image implies at the same time its operative character: the image is not just a representation of something but is intransitively representative, and in being so, it must actively dispose the intelligible upon the negligible or, in informational terms, negentropy upon entropy. If, at its dawn, entropy has been understood as a measure for energy unable to produce work—as a kind of "resistance" to work, as a form of energetic friction—then negentropy could conversely be paraphrased as a form of intellectual work.[39] A separation and, simultaneously, a connection with something absolutely other—an *esse extraneous*—the "work" that the image "performs" opens a field

39 This would be consistent with what was suggested in Chapter III (footnote 3), i.e., to see quantum physics as a "physics of (self-) determination," as a point of conjunction between information theory and "natural will." On the development of such a notion at the border between a materialist-thermodynamic notion of work and a "new materialist" and informational one, a crucial contribution has been given by Tafuri in his seminal essay on intellectual work and capitalist development. See: Manfredo Tafuri, "Lavoro intellettuale e sviluppo capitalistico," *Contropiano*, No. 2 (1970): 241–81.

of communication—a *templum*—with such otherness. Doing so, the architectonic ability of the image opens a door (or a window) towards it (and it is perhaps in the necessary presence of a wall as what instead forecloses that the role of the negligible can be better understood), a threshold that constitutes an opening as much as a lieu of commonality. In this sense, perhaps, we can appreciate the architectonic character of the image as something "demiurgic": the work that the image performs as a public *ergon*, both *öffentlich* and common.

Architecture and architecture theory can help reshape the understanding and the role of the image in the age of information. "Age" is here not a historically determined matter: like the image, it is instead a "key" that is determined as much as determining, historical as much as historiographical—the encounter between contingency and non-contingency.[40] At the same time, this understanding of the image can help reshape the role of architecture and the architect in a broader sense beyond a mere *Baukunst*.[41] Despite the contemporary mis-

40 According to such an understanding, every age is "axial"—to quote a term coined by Karl Jaspers and recently discussed by Michel Serres—since, as a way to understand and categorize time, every age establishes an axis (a key) around which a horizon of events unfold. See: Karl Jaspers, "Vom Ursprung und Ziel der Geschichte," in *Gesamtausgabe: I. Werke*, Vol. 1, 10 vols. (Basel: Schwabe, 2017); and Michel Serres, *Relire le relié* (Paris: Le Pommier, 2019).

41 Roberto Bottazzi recently suggested that architecture was born

trust towards this association, the architect can be adequately conceived as a demiurge—not only in terms of public work, as already discussed, but even as far as a world ideator: not a transcendent-immanent *Deus sive Natura*, but a caster of transcendental forms that immanently articulate such a divide.

almost as the opposite of *Baukunst*. If the latter would deal with the "materiality" of the practice, architecture is instead concerned with coding upon it. In the scope of the present work, this must nevertheless be understood not just as a separation *but also* as a connection with what it separates from. See Roberto Bottazzi, "Omnia per Omnia: Anything by Anything" (Essays on the Architectonic Body, School of Materialist Research, 15 February 2022).