# Uncertainty and Poetic Inhabitation: Or how to articulate chance

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*Chance can mingle, but it cannot unmingle, and a combination of various elements in a well-ordered edifice in which something can be distinguished can only be made deliberately* – Poincaré, *Science and Method,* 1914/1908 [1, p.18]

To think of chance with regard to architecture intuitively appears to open a space of incompossibility, of paradoxes and ambiguities. Henri Poincaré's formula, although it only engages metaphorically with architecture, indeed suggests that the act of edification is the expression of an intention, a will or firm desire. That is, an action, we can hypothesize, that implies causality and necessity, differently from the complex, matted ensembles governed solely by chance: an action in which control is exerted upon the multiple elements in order to erect well-ordered wholes.

As epitomized by Marc-Antoine Laugier's primitivist fantasy [2], the modern tradition has rooted architecture in absolute necessity. It is upon this unshakable ground that the abbot established his fixed rules, immutable laws and *"infallible means of perfection"* [3]. His general principles drew their mythical origin from the image of the spontaneous action of an uncorrupted human spirit, following his century's quest for a universal human nature, and belief in the continuous progression of man towards a scientific, objectified knowledge of the world. Laugier founded the first architectural gesture in immemorial times: The primitive hut would have been the form given to human necessity to protect and shelter from natural elements and phenomena—the sun's heat, the thick clouds that form from the meeting of *"a thousand vapours raised by chance"* [4], the frightful rain, the invading moisture, the unhealthy air… Architectural magnificence and invention were to ensue only from the original, simple model of the hut, stemming from the quintessential elements composing it and moralized through orders that ensure beauty, through invariability.

It is this primitive man's desire to *"make himself an abode which covers but not buries him*" [5] – an original desire sparking from the unpredictability of natural phenomena, and the threat and discomfort that come as corollaries—that, for Laugier, engenders architecture. Simple yet infallible means, a few branches and as many leaves, allow the primitive man to control and master his local environment, against any unforeseeable fluctuation. That Laugier flattens the understanding of architectural orders, by dislocating them from any transcendental dimension, is a fundamental point that would have to be developed elsewhere. Here, if we abide by

Latour's [6] critique of the *"constitutional guaranties"* of modernity[1], we can however retain that Laugier's gesture introduces an asymmetry: It extracts architecture from its antique transcendental nature, leaving the latter untouched, maintaining it as a distant and hostile domain, while instituting a humanly constructed and immanent realm, a domain purified from any exogenous threat, from which contingency is banned. This essentialization of the protective function not only induces a moralization of architecture, whose beauty is dialectically related to necessity, but operates as the founding separating gesture of modernity that ensures the establishment of a social realm forged by logics of control, exclusion and normalization.

Unpredictability and contingency hence embody the *other* to architecture, which is defined *ex negativo* with regard to a quantitative space that is controlled, and purified from any fluctuant intensity. They are established in a dialectical relation to architecture, appearing to be simultaneously what engenders it—that is, the conditions of possibility of what emerges as an oppositional gesture to these conditions, what gives rise to, and institutes, order—and what negates this foundational notion of order.

## Risk, Chance and Measure

Emerging from the ruins of the war as much as from those of a drained modern movement, the European architecture of the 1950s and 1960s battled what was then perceived as an extreme homogenization, induced by a blind functionalism and the application of general, willingly exhaustive strategies of forecasting. Against such ideology, planning, Team 10 member Aldo Van Eyck argued then, was to be redefined as *"the built counter form of a more complete and complex human reality"* [7] and, while it should follow quantitative strategies that can deal with the greatest number, it had to be designed to accommodate individual desire.

Twenty years later, French critic Michel Ragon [8] harshly questioned the post-war, experimental and visionary architecture he had initially been championing. Looking back at what he considered to be failed ambitions, he questioned how a 'life-like' macro-structure could ever be designed in advance, and if it could be designed at all, considering life is *"rightly made of chance and unpredictability"* [9].

In this perspective, the terminal crisis of the modern movement may therefore be addressed as that of an architecture established upon the expulsion of uncertainty. Doesn't architecture, as also science, appear to be founded upon a—fertile—ambiguity: Is it not navigating between control and potential, aiming at mastering and producing regularities, while simultaneously remaining open to the indecisiveness of life? Can architecture ever order the world while accounting for its fundamental uncertainty?

This questioning remains profoundly topical today, specifically with regard to the manner in which chance is related to computation. It seems that the growing tendency to consider the world through the scientific, artistic, and architectural lens of complexity—over the past sixty years—has had a growing background noise as its corollary, composed by the discourses that, playing into a technocratic ideal of control, conflate the notion of chance with that of risk. As philosopher of law Antoinette Rouvroy [10] puts it:

"(…) a dominant phantasm that autonomic computing, allowing for the complex operations of datamining and precise and dynamic profiling, will render the world and its inhabitants predictable provide the ideological background of the enthusiastic support for any technology promising to help tame the chaos."

It follows that, in today's discourses, contingency takes on the form of a bicephalous figure, in a manner that conserves the operational differentiation established by Franck H. Knight [11, 12]: While an ideology of control still considers risk—which is associated with the calculable probability of an event—as that which should be pre-emptively eradicated [13], an ideology of profit exploits volatility as uncertainty in asymmetric mechanisms of value production [14]. These apparently opposite attitudes however rely on a similar understanding of the idea of chance, and of the relation it entertains with that of knowledge. In a manner that appears to conserve Laplace's determinism, both exploit chance as epistemic—or what Poincaré called the "measure of our ignorance" [15]—and, therefore, as potentially eliminable by the supposedly absolute knowledge that hyper-resolved technical apparatuses, over-abundant data, and methods to distil information from it are believed to provide.

Against such flattening, and against the modernist architectural process of 'purification', we would like to speculate upon how architecture could be fundamentally related to chance, that is, in its objective, and not epistemic nature. Chance, in Poincaré's view, is objective when the criterion upon which it is defined is relative to a given state of the world and not to this or that man, hence is true for all men [16]. But it is the biologist Jacques Monod [17] who proposed a concept of objective chance that, by destroying anthropocentrism, may be the most fertile to rethink architecture's capacity to accommodate universality and plurality in compatible manners. Monod determined the "absolute and blind liberty" of chance to be the sole source of creation and novelty in the biosphere: Captured and conserved through invariance, by means of the teleonomic nature of the reproductive process, chance is converted to 'rule' and 'necessity'. This vision of the living as being governed solely by chance and necessity, posits man as this 'strange animal', who belongs simultaneously to the realm of the biosphere—and is, in this, not different from any other living form—and to the realm of ideas, living therefore on the margins of the universe.

By embracing objective chance, architecture, we would like to argue, could be redefined as a domain within which new manners to accommodate plurality and commonality could be invented; manners that would neither induce an understanding of order as being unifying and all-inclusive, nor favour social constructivism[2], reified epistemologies or reductionist categorisations of the multiplicity of life forms and fleshes (geological, biological, cosmic, human, animal).

As the poetic meter indirectly articulated the divine transcendence through its necessity, so the architectural measure traditionally embodied transcendental (cosmologic, divine) or secularised ideas of beauty and harmony, conserved through regulated, invariable, orders. Here, we would rather like to speculate upon what an architectural measure whose necessity rather stems from contingency could be. How could such a necessary measure be invented for our hybrid, physical and digital, world, with regard to code? And could it be, in any manner, founded upon the fundamental principle of chance?

How could such a measure—that *cannot be another*[3], to paraphrase Stéphane Mallarmé [18]—however not imply a totalization? And, inversely, how could a measure that "is under no obligation to exist; but (it) has the right to" [19] still establish a common dwelling, within which to inhabit poetically? It would have to

hold on to the promises of modernity against the reality of their—political and architectural—enactment. A century after the normativity of the meter has been, subtly yet firmly, eroded by Marcel Duchamp[4], it would still have to maintain the intent to be *natural, invariable* and truly *universal*—as the initiators of the Modern metric system Talleyrand and Condorcet intended—hence not encompassing anything arbitrary [20]. It would have to be objective, that is to say, defined upon a criterion that is true to all living forms (universal), while still accommodating local and temporary stabilities (plural). In Michel Serres' words, it would have to have simultaneously "just one direction, just one sense" [21] and to be captured and deviated locally.

## Invention

In order to speculate about how such a measure could be invented, we will follow, albeit too briefly, a line of thought which roots the necessity of architectural articulations (in our computational age) in the principle of chance, by addressing the notion of invention with regard to poetry, music and computational processing—all domains that rely on a "matrix group of seeds" or "unities of some kind" [22], in the words of Michel Serres. To do so, we would like to turn to *Science et Méthode*, a collection of philosophical reflections by French mathematician Henri Poincaré, on the methods and nature of scientific knowledge. To reflect upon architectural invention, we will operate by analogy, learning from Poincaré's definition of *mathematical invention*[5], whose mechanism, he specifies, presents no appreciable difference with that of invention in general. Moreover, turning to this mathematical approach opens paths through the compact fog into which architecture appears to have condensed, in our computational era characterized by the inflation of the levels of discretization and, subsequently, of data.

Writing at the turn of the century, Poincaré [23] addresses some of the revolutions occurring in the mathematics and sciences of the period. In a time of profound transformation, he refuses to embrace *a priori* the many novelties (e.g. in mechanics) and approaches then considered most successful (e.g. the reduction of mathematics to the rules of formal logics), choosing none of the "comfortable solutions that dispense with the necessity of reflection" [24] that are doubting and believing everything.

The mathematician's description of his art shares affinities with that of Vitruvius's: Poincaré's exploration of mathematical methods—founded upon observation, experimentation and, above all, the necessity of choice—indeed appears to be guided by the same triad of principles as the Roman architect's treaty. Let's rapidly address *firmitas* (stability) and *venustas* (beauty), the latter of which we will return hereafter. Poincaré considers the foundation of mathematical education, hence the manner in which this knowledge is initially transmitted and secured, must be "good and sound logic"[6] [25]. He also indexes invention to beauty, the harmonious arrangement of elements, which generates an aesthetic emotion and guides the mind in the process of discovery.

More importantly, Poincaré dedicates much attention to the notion of utility. His conception of this quality, he writes, is neither indexed to the industrial ideal of progress nor solely to that of moral judgment. The former, which he rejects as a principle reigning over a "narrow and greedy plutocracy" [26], aligns with the contemporary conception that—in architecture as elsewhere[7]—indexes invention to

the production of novelty. Innovation, today, is widely thought of as encompassing and surpassing invention, by giving it a *realist* or practical dimension by means of application or implementation [27], leading to the "triumphs of industry" that, prolonging Poincaré's reading, enrich "many practical men" at the expense of the few "disinterested fools" [28] who are the real inventors. Invention, as we will see hereafter, has a very different kind of utility as principle, which stems from the fertilization of instinct by thought, and is deeply connected to beauty.

As we read Poincaré, we will however not subscribe to the totality of his hypothesis, not following him along the stream that links invention to the unconscious. While it will follow the sequences of his description, our reading will be informed by the atomist model and its interpretation by Michel Serres, with regard to code. We feel invited and comforted in this attempt by Poincaré's own invocation of Epicurus's physics. As a first step, we will connect his vivid description of the mechanisms of invention, and their intimate relation to intuition, with the model inherited from ancient rhetoric. In particular, we will learn from the capacity to abstract from any a priori certainty and emphasize situatedness, following rhetorical principles.

## To fortify and to hunt – with rhetoric

We can identify three steps, or degrees, in Poincaré's exploration of the meanders of invention. After having rejected memory and refined attention to the world as qualities sufficient to foster it, he proceeds to establish repetition of "pre-existing reasoning" as its first principle. This repetition is already a form of invention, or rather, of reinvention, Poincaré claims. In a manner reminiscent of the medieval aphorism of the dwarfs and the giants[8], he hence posits knowledge as a prerequisite to discovery. This physically and intellectually elevated position appears in the form of an architectural metaphor in Lucretius:

"But nothing is more welcome than to hold the lofty and serene positions well fortified by the learning of the wise, from which you may look down upon others and see them wandering all abroad and going astray in their search for the path of life, see the contest among them of intellect, the rivalry of birth, the striving night and day with surpassing effort to struggle up to the summit of power and be masters of the world." [29]

In this image, the "lofty and serene positions" that result from a collective process of edification appear to be occupied only by some, whose literacy in the arts and sciences allow inhabiting knowledge, and raising to the level, or mode, of cognition presupposed by invention.

In this view, knowledge is acquired, and invention rendered possible by means of a process of identical repetition— the production of *fac simile*—that is not a commentary of the existing body, but a *re-articulation.* "It seems to me, then," Poincaré writes, "as I repeat an argument I have learnt, that I could have discovered it. This is often an illusion; but even if I am not clever enough to create for myself, I rediscover it myself as I repeat it" [30]. The repetition of the "canonical corpus of authoritative knowledge" [31] consists in the learning from, and getting literate in, the codes, measures and rhythms that have conserved and maintained the initial conditions of the moment of invention, which—in his reading of Lucretius—Serres [32] models as a bifurcation from the universal, entropic flow of history.

What is at stake in a physical conception of history is the possibility of a collective memory, as that which stems from the repetition—that is, the keeping *vivid*—of that which has emerged from, by locally deviating from, universality. Evanescent, the physically encrypted information—i.e. through code or measure—"escape[s], for the time of [its] existence, that is to say for as long as the code is memorized, the irreversible flux of dissolution" [33]. To posit repetition of the processes of reasoning (or creating) as the condition of knowledge and, following Poincaré, as that of invention, is to index individual invention to collective memory.

In repeating, one does therefore not invent, but participates in a dual movement: that of raising the local (temporal and spatial) constructs to *collective* matters and that of learning to inhabit them, individually [34]. It is the animation and actualization of these constructs that, for Poincaré, spark the intuition of order. In the manner of the practice of rhetoric, this process of repetition opens the imaginative horizon of whom who undertakes it, enriching the library of forms, topics or intellectual artefacts from which to learn, and draw.

This view recalls the metaphorical conception of invention as *venatic* thinking, in which discovery has hunting as a correlate [35]. One of the systems of invention of ancient rhetoric was that of topics (from the Greek *topos*, places) and common places (from the Latin *locis communis*), understood either as intellectual sources or regions harboring a proof that could be inserted in discourse, or as formal or structural inventive strategies. The skilled student of rhetoric would, in the manner of a hunter, learn to survey "the secret places where arguments reside, and from which they must be drawn forth" as exposed by Quintillian [36]. Learning to inhabit the canonical corpus in an individual manner thus presupposes an approach to knowledge that proceeds territorially or geographically: It consists in getting acquainted with the regions of our hunt—those harboring a rhetorical argument (topic) or a mathematical element.

As rhetoric has to seize the situational nature of discourse, so architecture has to discriminate based on the moment and locus of its development and, in order to do so, to rely on a process of learning and repetition that is neither undefined, nor unlimited, but founded upon discrimination and discernment. Indeed, not all regions are worth the survey. To Poincaré, only the mathematical facts that, through analogy, conduct to the knowledge of a mathematical law are worth studying; that is, those whose study permits to raise to a higher level of generality, from which to look down, in Lucretius's words, not upon our peers but upon the many facts and elements amongst which, from our elevated position, we might discover unsuspected relations.

## Solution spaces – with combinatorics

It is therefore neither facts nor elements that are the subjects of our inventive effort, but the connections amongst them, the tying together in manners yet unthought-of. In this sense, Poincaré appears to revive the Leibnizian *ars inveniendi,* indissociable in its character from the *arte combinatoria,* and programmatically and intellectually distinct from the *ars demonstrandi* [37].

Combinatorial, in which the symbolic code that articulates our contemporary computational procedures finds its origin, is rooted in arithmetic: It consists in

finding the number of possible combinations, or ensembles, for elements in given conditions. Its applicability, however, is not constrained to mathematics, as epitomized in Raymond Queneau's [38] 1961 work *Cent mille milliards de poèmes*[9]. Written with the help of mathematician François Le Lionnais[10], in a manner of an exercise of combinatorial logic, this poem comprises $10^{14}$ different sonnets, which readers can compose randomly by combining verses written on autonomous paper straps (attached to commutator bars). The individual reshuffling of the poem is allowed by the extreme regularity of the work, which—beyond all permutations—is ensured by the respect of the poetic meter throughout: Each of the fourteen verses that compose the ten sonnets indeed follow the same scansion (rhythmic) and a similar series of rhymes.

In Queneau's words[11], invention appears gifted with a machinic dimension, which serves his intellectual program of a systematic exploration of the potential of literature, through calculability. Would a *computational* invention identify with such a machinic combination of existing elements; that is to say, does *ars inveniendi* cultivate an identity relation with *arte combinatoria*? In Leibniz's philosophy of knowledge, the former was posited as an application of the latter, which in its turn was described as a method for the former [39].

Invention, therefore, cannot be fully willed and reduced to the activity of making new combinations with entities that are already known: indeed, as Poincaré notes, "that can be done by anyone, and the combinations that could be so formed would be infinite in number, and the greater part of them would be absolutely devoid of interest" [40]. This uselessness appears to be ironically implied in the "manual" devised *ad absurdum* by Queneau for his poem:

"Assuming that it takes 45 seconds to read one sonnet and 15 seconds to adjust the commutator bars, 8 hours a day, 200 days a year, then you can read on for one million millenniums; if you read 365 days a year non-stop, it's 190,258,751 years, without counting leap years and other odds" [41].

As a "customer" who would be presented with a number of samples so big that a lifetime wouldn't suffice to examine them all, the reader of Queneau's poem proceeds to a purely quantitative treatment of the poetic elements. Playful and deceiving, this process does not require any specific intuition to be carried out, nor the "delicate feeling" described by Poincaré. The crafting of Queneau's poem "by everyone, not by a single person"[12] [42] does away with the qualitative articulation characteristic of rhetorical invention, as, in this case, the individual arrangements of the sonnets is not subjected to individual imagination or skills, but to randomness.[13]

Despite the conservation of the necessary nature of the poetic meter, enforced throughout all permutations, none of the numerous options is endowed with a necessity equal to that of Mallarmé's number; floating in a space of pure equivalence, no sonnet appears more meaningful, hence valuable, than any other. The economical metaphor adopted in both the manual and the afterword by Le Lionnais suggests that the "increase in productivity" [43] of the poetic generator, or machine, is such that, as a corollary, the "cost price" of each sonnet is reduced.[14] Queneau's poem is a game that produces excess, or saturation. To put it in mathematical terms, the solution space of the poem is so vast that the value of each solution appears to dissolve in the entropic process of meaningless accumulation[15]; in other words, it opposes Serres' understanding of meaning as "a filtered rarity" [44], entering in a symmetry play similar to that of data and information.

## Of galaxies and islands—with code and probabilities

Against the contingency, and uselessness, of the outputs of such combinatorial process, Poincaré affirms that invention operates as discernment and selection. "Discovery consists precisely in not constructing useless combinations, but in constructing those that are useful, which are an infinitely small minority" [45]. This process of "filtration", in Serres' [46] words, is indeed necessary with regard to the process of aggregation of the elementary 'atomic' stock with which one operates in numbers, words, sounds and symbols. "Once we have arrived at this point the question arises: monster or not, realisable or not, meaningless or not, viable or not. Hence the schema: the alphabetical ensemble, permutations, filtration" [47].

This atomist understanding of invention as aggregation, and further as coding and decoding, is at the center of Poincaré's text.[16] "If I may be permitted a crude comparison" he writes, "let us represent the future elements of our combinations as something resembling Epicurus's hooked atoms" [48]. Borrowing from the atomist conception of life as emerging from the local (spatial and temporal) aggregation of a multiplicity of atoms, spontaneously deviated from their infinite vertical spilling—the *clinamen*—the mathematician onceives of invention as a dynamic process, in which new combinations emerge from the mutual collision, the interlocking, the mingling of elements. Here, Poincaré's approach resonates with Serres' understanding of Lucretius's atoms *as* letters (and vice versa). In all its possible forms, invention, in this view, operates by means of a process of aggregation in which not all interconnections are acceptable—hence *filtration*. Differently from numbers (*chiffres*), unities *as letters* produce only certain sequences, certain meaningful manners to encode information. In this "antinomy of applied knowledge" [49], Poicaré [50] had explicitly chosen not to reduce mathematics to the rules of formal logic, and refused that the finite is explained by the infinite.

Leibniz's symbolic logic, which he had made the principle of his *ars inveniendi* for mathematics, but not only, was similarly not based on numbers, but on characters (*operatio per characteres*). Their interpretation would "range from algebra to geometry, through logic, music and cryptography" [51]. Hence, symbolic logic, underlain by, yet not limited to, numeration, applies to thought in general. And if characters used can signify or represent algebraic signs, music tones or logical concepts, then the art of invention through combination goes beyond a simple arithmetic; it opens up to the possibility of a translatability between domains, through ciphering and deciphering. Computational code, as a conventional system of symbolic characters, articulated through combinatorial rules, supposes a symbolic understanding of the nature of number [52,53]. The *ciphering* thus inscribes a substitution game at the heart of code, which implies the possibility of a calculation of characters that can be indifferently numbers, signs or letters. The rise of code and computation in architecture therefore opens its domain to all others that—thought of in an elementarist key—can tie invention to combinations and probabilities.

After poetry, let us then move to music, or rather to the "poetic process of music" [54] to further this reflection. Poincaré's atoms share familiarities with Greek composer and architect Iannis Xenakis's sound grains, upon which he founded his formal conception of music, in the 1960s:

"Every sound is an integration of grains, of elementary sound particles, of sound quanta (…) Each sound, every sonic variation, even continuous, is conceived as an

assemblage of elementary grains, sufficiently numerous and disposed in time in an adequate manner" [55].

First analogically then digitally, Xenakis developed a series of musical pieces based on the representation of the continuous magnitude of sound through these symbolically expressed, discrete, generic, units, and their articulation in sequences of varying degrees of order (different values of negentropy), by means of probability calculus.[17] Probabilities operated as the mathematical tool that, by describing the reign of average, opened up the possibility to extract from it, to liberate music (as well as history, and all other art forms) from determinism and causality. The formalization and axiomatization of music, organizing the local articulation of the continuous magnitude of sounds by sound grains, not only allows the musician to move closer to the astrophysicist who investigates galaxies, Xenakis noted, but to "producing his own, expressing the fundamental abstraction of the universe" [56]. Thought of in such key, the art of sound could be elevated closer to stars, numbers and human intelligence, and open up the possibility of translation towards domains of light and space, hence towards architecture. Xenakis envisioned this approach as a renewal of the "necessity to be understood" [57] that artists and creators exercised through the search of proportion and the recourse to the musical scale, which he described as a shared manner to "edify within the enclosure" of the field of virtualities [58].

Similarly for Poincaré, the beauty and harmony of discoveries are not determined a priori by the 'atoms', but are the fruits of their "unexpected couplings" [59], contingently produced by a code that is performative. In the mathematician's words, it is among the couplings that may emerge "from the disorder born of chance" [60], fruits of unpredictability, that the 'useful' and beautiful ones are to be found. What makes those fertile in Poincaré's view, what therefore makes them worth pursuing and materializing, is their *harmonious* nature. Harmonics (*harmos*, union) corresponds to the combination of rhythmic and metrics, two key components of music (as rhythm and bar) and poetry (as scansion and poetic meter). Considered as 'obscure and complicated' by Vitruvius, who invited architects to know music in order to understand the rules of the harmonic scale, it has been a ruling concept at the heart of classical architecture, where it was understood as the condition for beauty: Alberti, for instance, defined his aesthetical ideal upon the proportional harmony that ensues from the geometrical-mathematical ratios in music.

With harmony in mind, let us return to our initial enquiry, that is, the possibility or impossibility to produce a 'life like' structure, in as much as life is made of chance and unpredictability, or, in other words, the possibility to invent and articulate a measure that draws its necessity from contingency. To do so, we would like to cite once more architect Aldo Van Eyck, who proposed to address the "menace of quantity (the terrific problem of habitat for the greater number)" by the extension of our aesthetic sensibility to numbers [61]. "Quantity cannot be humanized without sensitive articulation of number", he claimed, encouraging architects to "uncover the still hidden laws of what (I) have called Harmony in Motion—the aesthetics of number." Van Eyck's call for an 'articulation of number' to rule over magnitudes[18] in a humanized manner, as the condition for the accommodation of human desires into quantitative logics, takes a new signification today, that breaks with structuralism in favor of a probabilistic understanding of the world.

Bernouilli's law of large numbers indeed teaches us that, considered within a large sequence, events tend to appear convergent and constant. History, when addressed in this perspective, can be understood as an entropic repetition of equivalent states Serres describes, where events are reduced to values of frequency. What the sciences

and arts of the 20th century have taught us is that probabilistic analysis opens up a critique or negation of causality, therefore liberating history from any determinism [62]. And while architecture may have been slower at learning this lesson, it seems it can, through computational code, transform the relation between chance and invention into a fertile one. That is to say, architecture can see the contingency of events as the foundation of their transformability [63] – through the invention of specific codes and measures—as an invitation to "edify within the enclosure" of virtualities, in Xenakis' words, or to draw the "outline of an island on the sea of large numbers", in Serres' [64].

## Conclusion

Following Poincaré's text on mathematical invention, I have argued that its architectural counterpart's relation to chance should be one of fertilization, rather than expulsion: the 'mingling' can thus be understood neither as menace nor as negation, but rather as architecture's fundamental source, and the "unmingling" as a principle of preservation through codification. The reading of his text in a physical, atomist, key allowed addressing invention with regard to the possibility of a double belonging: to the universal, on the one hand, and to the necessarily plural forms of inhabiting the world, on the other.

Despite the promises of big data and other purely correlational processes, architectural invention cannot, and should not, be reduced to a pure combinatorial, nor dissolved in an entropic, supposedly exhaustive, process of production. The complexity of our world, we argue, cannot be addressed through brute force; the excess or saturation of possible solutions produced only tantamount an annihilation of meaning, its dispersion in an ethics-less accumulation.

Against such view, I rather argued that invention consists in locally suspending the entropic flow of the universal, and that this can be tackled by considering the aleatory nature of events as its source. Invention, indeed, is negentropic: It seizes chance and conserves it—by encoding its effects—it locally deviates the infinite flow of events to give it direction. Through teleonomy, chance is converted to 'rule' and 'necessity', it is transformed and translated into rhythm, measure, verse, sentence... For these aleatory events and conditions to be more than what they are, that is, to be transformed into possibilities to make new worlds come to be, the inventor has to be he or she who creates gestures, manners, languages and writings that encode, that entwine, from a set of elements, imitating nature in producing local (temporal and physical) combinations. And because coding operates as a "mnemonic preserver" of the initial conditions [13, p.149], that which transforms chance into necessity, the inventor must learn her craft by reversing to those conditions, that is, through the repetition and exploration of the achievements of the past.

As the magnitudes that constitute our world exceed the possible experience of man; as the multitudes surpass every possible measurement; as the large numbers remain ungraspable, and require to be made thinkable and sensible; to 'humanize' them, as Van Eyck wished, therefore consists in inventing manners to rationalize them. This process of reasoning is fundamentally a rationalization of a certain model of the world, rendered operable by means of (architectonic) measure[19]. Measure, conceived as natural, invariant and universal through its articulation to objective chance, can therefore never depart from the prior articulation of such world model, itself founded upon an ethics, not morals. To inhabit poetically, we may conclude,

implies—following Monod—to acknowledge the aleatory character of our own existence, and the necessity of choice it imposes upon us.

## Endnotes

1. Here, only the first of the four constitutional guarantees defined by Latour is considered. Latour identifies the reversal between immanence and transcendence inherent to these guarantees and the paradoxes that result from them, the asymmetries of which constitute the edifice of modern constitution. This constitution, he claims, is what has rendered invisible the population of hybrids, between nature and culture.
2. The post-modern claim for extreme relativism flourishes today in the form of identity politics, that split up the social domain – implying differences are such that there can exist no criteria upon which to establish a common engagement.
3. In Mallarmé's poem, the Master sailor hopes to achieve "l'Unique nombre qui ne peut pas être un autre" (the unique number that cannot be another) by throwing two dices.
4. Marcel Duchamp created the work *3 stoppages étalon* between 1913 and 1953. In his *Boîte verte,* he referred to it as "Du hasard en conserve" (to put chance in a can).
5. The 1914 translation by Francis Maitland, with a preface by Bertrand Russell, does not keep the French term of "invention" originally used by Poincaré and substitutes it with that of "discovery". We will privilege the author's original text here, referring to "mathematical invention". We will discuss in particular the section "Mathematical Discovery" in the chapter "The scientist and science", Henri Poincaré (1914), *Science and Method*. London, Edinburgh, Dublin, New York: Thomas Nelson & Sons, p.46-63.
6. "(…) une bonne et solide logique" in French.
7. A rapid research in the past ten years of the issues of *Architectural Design* magazine (Wiley) gives a good panorama of the regularity of this substitution. See Volume 83, Issue 1, January 2013: Antoine Picon, "Architecture, Innovation and Tradition"; Veronika Valk, "Architecture as Initiative (A Manifesto)"; Mark Burry, "Design and Society: Innovation Through Appropriation and Adaptation". Also Mitchell Joachim, A Century of Ecological Innovation, Volume 85, Issue 4, July 2015; Patrik Schumacher, "Transgression, Innovation, Politics, Volume 83, Issue 6, November 2013; Patrik Schumacher, "Tectonism in Architecture, Design and Fashion: Innovations in Digital Fabrication as Stylistic Drivers", Volume 87, Issue 6, November 2017.
8. For the history of the aphorism, originally attributed to Bernard de Chartres, see the short and precise article by Umberto Eco for the *Enciclomedia*: "Nani sulle spalle dei gigantic, Storia di un aforisma". https://library.weschool.com/lezione/nani-sulle-spalle-dei-giganti-storia-di-un-aforisma-20772.html.
9. Raymond Queneau, *Cent mille milliards de poèmes* (Paris, Gallimard, 1961). Queneau was the founder of the experimental literary group *Oulipo*.

10. Le Lionnais also signed the afterword of the book. A co-founder of the Oulipo, he was a close friend of Marcel Duchamp, whom he met through a common passion for chess, and to whom he bought one of the copies of the *Boîte verte.*
11. Queneau uses as an epigraph a citation he attributes to Alan Turing: "Only a machine can appreciate a sonnet written by another machine."
12. A formula Queneau borrows from the 19th century French poet Lautréamont.
13. Without elaborating on it, it should be mentioned how this point connects to the six decades long line of experiments of participatory processes of architectural production, and to its contemporary re-enactment, which Mario Carpo frames as "post-authorial strategies" and "devolution of agency" strategies, implemented, in a social dimension, through open-source and crowd-sourcing design processes and, in a disciplinary one, through the exploration of open-ended, non-causal or self-organizational processes. See Mario Carpo, "Digital Indeterminism: The new digital commons and the dissolution of architectural authorship" in Pablo Lorenzo-Eiroa, Aaron Sprecher (ed.), *Architecture in Formation: On the Nature of Information in Digital Architecture* (London, Routledge, 2013): 48-52.
14. A radical analysis of the "mass customisation" paradigm currently dominant in digital design, and the corresponding mechanisms of value production, could be derived from the symbolical, and political, reading of such a conflation of invention with a pure combinatorial process.
15. We shall underline how this entropic dissolution of sense might be consciously embraced by Queneau, whose play on words and registers confers an absurd quality to the text, further enhanced by the combinatorial game.
16. This is however where our reading will depart from Poincaré's; we will not abide by his insistence on the role of the unconscious in the emergence and selection of a useful combination.
17. The first anagogical pieces were *Metastasis* (1953-54) and *Pithoprakta* (1955-56).
18. For a discussion on quantity and of differences between magnitudes and multitudes, see (61).
19. While it would go beyond the scope of this article to elaborate on it, let us mention that we believe that the articulation and encoding of a *sensorium* is as necessary as that of a measure.

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