

At the Shore of Relations In the Middle of Nature there is a Clock

By Vera Bühlmann

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At the Shore of Relations

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Note On Alignment

Some coincidences are handled locally; others only become perceptible when they can be carried across situations. Astronomers observed the alignment of celestial bodies. Navigators aligned instruments with the horizon. Builders oriented structures according to the movement of the Sun—sometimes as simply as a shadow cast by a rod marking the passage of the day. Alignment, in this broader sense, depends on subtle supports—arrangements that do not impose order but allow relations to hold across different situations.

The word *alignment* has become a defining term in contemporary discussions of artificial intelligence. In technical discourse it refers to a specific engineering challenge: how to ensure that increasingly capable computational systems behave in accordance with human intentions, values, or regulatory constraints. This formulation addresses an urgent practical problem. Systems of unprecedented computational power are entering domains of scientific research, economic organization, and political decision-making. Ensuring that such systems remain intelligible and accountable is an important task. Yet the prevailing optics of the debate also carry a certain risk. When alignment is framed exclusively as a problem of governance—how to discipline machines into compliance with predefined objectives—the concept begins to narrow. It ceases to be a question of understanding. A discourse intended to secure coexistence with artificial intelligence may then inadvertently evoke its opposite: a world organized entirely around control. But AI can participate in fields of articulated relations: If alignment is understood not as the imposition of intention but as the coordination of relations across contexts, then what becomes relevant is not so much a model of consciousness, but a field of attention distributed across instruments, practices, and observers. Such distributed forms of attention may begin to resemble constellations—configurations of auxiliary relations that support one another without converging into a single center. In this sense, they may be understood as adjoint: not identical, but mutually enabling.

The reflections that follow hence approach the term from a different direction. Long before it entered the vocabulary of machine learning, alignment belonged to practices through which occurrences in the world became legible. In

these situations alignment did not mean obedience to a command. It meant the recognition that movements occurring in different places could form a pattern. The present essay attempts to reactivate this broader sense. Rather than addressing the engineering task of aligning machines with human instructions, it explores the conditions under which relations between phenomena become aligned in ways that allow geometry, measurement, and knowledge to emerge. Alignment belongs not only to calculation, but also to handling.

Topicality—A Relational Conception of Place

The text will unfold through a series of scenes: traces left on a shoreline, instruments that hold relations between movements, networks of observation woven into larger structures, and finally the quiet attentiveness of Penelope at her loom. Alongside the loom, one might imagine a ledger—not of accounts, but of occurrences. A surface on which relations are not explained, but simply noted as having taken place. The ledger is not writing as memory, but writing as light inscription that does not demand retention, a surface that allows traces to be noted and released. The scenes may be approached through an image that joins several philosophical traditions: Aristotle once suggested that place resembles an amphora. A place, thus the idea, gathers what it contains not by producing it but by establishing the boundary within which movements may settle. Such a place does not ground relations; it supports them, allowing them to hold without fixing them in advance. The metaphor of the amphora therefore expresses something essential about place: it is not an empty container but a configuration that holds coincidences together. The mathematician René Thom revisited Aristotle's theory of place through the lens of topology and ethology.¹ For Thom, a *topos* is not merely a geometric location. It is the domain of a living being—a territory organized around a center inhabited by what he calls the “master of the place.”² Such a domain is structured by outer and inner bounds which the inhabitant rarely crosses, he calls them the *eschata*.³ These limits are not simply edges in the geometric sense, rather they function as orienting structures within a lived environment, through which the inhabitant can situate itself. Thom illustrates this through the maritime technique of amers—alignments between distant landmarks such as lighthouses. The alignment of landmarks does not produce a map; it provides an auxiliary structure through which parallel occurrences between positions can be maintained. The alignment of landmarks does not operate within a single site; it relates positions across different viewpoints. By observing the relative ordering of such landmarks along the horizon, a navigator can determine her position without measuring distances. One might say: it functions locally, but becomes intelligible only when

¹ René Thom, “Aristote Topologue” in *Revue de synthese*: 4, 1999, p. 39-47.

² Ibid., 41.

³ Ibid.

it is taken across positions. The alignment of these external markers produces a qualitative map of the domain: orientation arises not from coordinates but from relations between boundaries.

This relational conception of place resonates with another philosophical intuition, articulated by Henri Bergson. For Bergson, time is not composed of discrete instants but unfolds as duration, a continuous interpenetration of moments. If Aristotle's *amphora* provides an image for place, Bergson's duration provides an image for the flow of events within that vessel. Together they suggest that the world may be understood as a field in which coincidences gather within places while unfolding through durations. Duration becomes perceptible not in itself but in small articulations: a shadow shifting, a drop falling at intervals, a vibration repeating beyond perception.

A poetic intuition from ancient atomism captures this union of place and time in a single image: It suggests that somewhere in the middle of nature, time upsurges. Not a single mechanism, but a field of rhythms—shadows, flows, oscillations. There is not an origin that could be related to immediately. Assumed is instead “a clock” of which this intuition maintains that “it is the whole of it (nature)”.⁴ The phrase should not be understood as referring to a mechanical device hidden within matter. Rather, it evokes the possibility that natural processes articulate rhythms that might enter into articulation. These rhythms do not align without remainder; they shift, overlap, and displace one another—like breaths that never fully coincide.” It is the idea of a “liquid history” that posits a chaotic, non-deterministic, and complex view of time, full of eddies, currents, and whirlpools—nonlinear spirals rather than a direct line. If clocks are related to geometry, philosophy has not paid enough attention to the gnomonic art of bringing things into alignment with one another through this relation.

Our Motif: Clocks and Organs

The shadow of a sundial, the interval of falling drops, the oscillation of atoms—each offers a way in which relations articulate themselves as time. Each clock settles a relation within a situation. Yet these relations become comparable only when they can be carried across different contexts. These articulations belong to what might be called an objective vernacular: ways of handling phenomena without being abstracted from their situations. A vernacular grammar in action. Each of these situations reveals a clock-like articulation of relations. They do not impose time upon the world; they provide auxiliary conditions through which temporal coincidences can be compared and held together. These clocks are not independent mechanisms, rather they resemble “organs” within a larger “organism”. This formulation does not evoke a mere metaphor, it furnishes a mechanics for studying clocks like Thom picks up Aristotle's notion of place as an

⁴ Michel Serres, *The Birth of Physics*, trans. Bill Ross and David Webb (Bloomsbury, London 2018), 191: “the clock in the middle of nature is the whole of it—invent liquid history and the ages of water!”

amphora, such as to study places anthropologically and mathematically. Decisive is simply this: An organ cannot be understood in isolation from the body to which it belongs. Its function arises from the tunings it maintains with other organs and with the environment. The organism therefore represents a kind of whole that cannot be reconstructed through the simple aggregation of parts.

The analytic part-whole relation assumes that the whole is nothing more than the sum of its components. An organism shows the opposite: the parts themselves derive their meaning from the relational configuration of the whole. The clock imagined at the heart of nature by this old intuition resembles such an organ: It articulates rhythms within a relational field rather than operating as an external mechanism imposed upon the world. Through this, it renders relations perceptible – it does not *make* these occurrences, it has no grasp on what it “holds”, it merely renders it intelligible.

Four Eschatologically Clocked “Moments” – *Traces, Shore, Schemata and Pulse*

The first moment is the trace, surfaces that receive and lose inscriptions. A trace is the minimal mark through which a movement begins to register. A shadow cast by a rod, a ripple crossing water, a line drawn by the retreat of a wave in the sand—each records the passage of a relation between forces, a supported appearance. At the shore the world presents itself primarily through traces. The trace marks not an instant, but a moment in which movements briefly coincide. Movements continually leave marks that appear and disappear again. What takes place here does not gather into a stable present; it appears as a fleeting coincidence of movements. Like this, the trace belongs to the domain that Henri Bergson called duration: a field in which events unfold through continuous transformation rather than discrete instants. The geometer who attends to traces with the poetic sensibility of a natural philosopher begins to perceive the world not as a collection of objects, but as a field of movements leaving signals.

The second moment is the schema, bounded articulations. Traces become intelligible when relations between them stabilize into minimal articulations. These articulations are relational and operational, hence we can call them *schematic logoi*. They are objective words or relations (logos) but they are not impartial – they are articulate because they are *objectively in tune* with a larger whole: sundial aligns shadow and sunlight into a recognizable schema, a loom organizes threads into crossings, a spoon condenses relations between hand, material, and nourishment. The tip of the needle concentrates spatial attention upon a limit. Each artifact functions as a small device through which coincidences acquire form, turn into consistent articulations. In philosophical language, the schema mediates between phenomena and intelligibility. It is neither a mere image nor an abstract concept, it is a relational articulation through which the world becomes legible.

The third moment is the weave, as something to be followed rather than imposed. Once schematic logoi appear, they can be coordinated into larger

relational structures. The loom provides the guiding image: Threads stretched between two boundaries cross repeatedly. Through these crossings a fabric gradually emerges. Penelope's loom illustrates a form of knowledge grounded in attention to relations. The pattern of the fabric appears not through the imposition of a design but through the sustained coordination of threads, coordinated across contexts. Mathematical diagrams perform a similar operation. Tunings between domains are articulated through networks of transformations, diagrams functions like a woven structure in which occurrences hold across contexts. The weave therefore represents the architectonic dimension of relational thought. Penelope's practice suggests a form of attention that does not originate in a single act of consciousness and is not bound to a single observer, but emerges across an objective field of attentiveness.

The fourth moment is the pulse, a rhythmic spacing maintained through time, like breath. At this stage relations reveal the rhythms through which larger structures maintain coherence over time. The clock that is assumed to sit "in the middle of nature" – effectively turning a place into an active *milieu* for interminglings that reach beyond the boundaries of the place – it appears in many instances whenever occurrences articulate periodic rhythms: the shadow of a sundial, the falling of drops in a water clock, the oscillations of atoms in modern timekeeping. But also a heart beating within a body, a tidal rhythm within the sea, a planetary orbit within the cosmos—each expresses a pulse through which coincidences stabilize without becoming static. The pulse therefore marks the point where relational structures become living rhythms.

Clocks, according to this stoic intuition, are not independent mechanisms, they resemble organs within a living whole. But how to operationalize it such as become mobile, trans-latable, such that it can speak more eloquently of our topic of interest, namely the actuality of a contemporary notion of alignment?

The Double Bounds of Place

The four moments of our motif correspond closely to the relational architecture described by René Thom in his reinterpretation of Aristotle's theory of place. Thom describes place as structured by two boundaries: the external horizon of landmarks and the internal boundary of accustomed perception. Between these limits extend rays of relation through which the inhabitant situates itself in the world. These rays form a collar linking the two borders. Within this field: traces appear along the horizon, schemata stabilize relations between landmarks, relations weave the territory into a coherent domain, and the rhythms of movement generate pulses through which the domain becomes habitable and visitable. Place, adjoined with the operationalisation of the ancient intuition that in the middle of nature there is a clock whose accountable temporality is coextensive to nature at large, and hence gives us a precise and "liquid" notion of history, resembles both an amphora that gathers relations and a loom on which the world's alignments are woven.

Cosmic Modesty – the Essay as Instrument

The fourfold motif also describes the intention of the essay itself, namely to offer a topicality capable of accommodating them in a “common” philosophical “place”. The chapters of the edited volume may be approached as movements within a larger composition—a *partiture* (score) exploring the relational emergence of geometry. The present text offers a modest instrument with which the reader may play upon that score. Its purpose is not to dictate interpretations but to cultivate a form of attention capable of following the four operations through which intelligibility emerges: noticing traces, recognizing schemata, weaving constellations, listening to pulses.

To practice these operations is to exercise what the essay calls *cosmic modesty*: the willingness to allow the structures of the world to reveal themselves through constellations rather than imposing them from above. And through such attention the signals produced by the world’s flows, currents, drifts, tides, oscillations, pulsations, eddies and ripples, surges may gradually become readable as *news of the world*. Seen in this light, the amphora of place, the phasing of the duration of time, and the clock in the middle of nature converge into a single image: Places gather relations. Durations allow traces to unfold. Schematic logoi articulate those couplings into intelligible forms. And somewhere within this field — perhaps at its living center — the rhythms of the world continue to sound like the ticking of an organ within a larger whole of natural complexity. To attend to those rhythms is to practice the art of reading the news of the world.

Displaced. *From the Cave to the Shore*

A rarely emphasized detail in Plato’s allegory of the cave deserves renewed attention: What the cave stages is not merely illusion, but an auxiliary arrangement, a configuration that allows constellations between light, object, and surface to hold long enough to become readable. The shadows that the prisoners see on the wall are not cast directly by natural bodies illuminated by the sun. They are cast by artifacts—objects carried along a parapet behind the prisoners, illuminated by firelight. The cave is therefore not merely a metaphor for ignorance or illusion. It is also a carefully staged theatre of artifacts, in which technical objects intervene between phenomena and perception. The cave produces local articulations—relations that hold within a fixed arrangement.

This detail alters the epistemological structure of the allegory. What the prisoners observe are not simply deceptive appearances but articulations mediated by artifacts. The shadows become legible because objects have been arranged in a particular configuration: a light source, a screen, and a set of figures whose outlines are projected as silhouettes. The cave is already a site of framing: light, object, and surface form a minimal parergon within which interplays appear. The cave thus already contains an implicit instrument—a

primitive apparatus for producing traces. What appears on the wall does not accumulate as a stable image but as successive inscriptions—each shadow overwriting the previous. In such a setting the shadows involve an element of chance, but they do not appear randomly. They exhibit intervals that can be recognized, compared, and perhaps even anticipated. To read these shadows is already to practice a minimal philology. They function, one might say, as schematic logoi: minimal articulations through which relations between artifacts and movements announce themselves. Minimal, because they arise within a bounded field: A source and a surface, a movement and its trace—two limits between which a relation becomes visible. What appears is not a thing but an *alignment* across these limits. The shadow does not represent an object; it articulates a relation. Such articulations are minimal in a precise sense: they are the smallest configurations in which a relation becomes intelligible. They require no abstraction beyond the setup itself. They are already *operative* schemata. In this sense, the cave does not merely produce images. It produces the first elements of a relational language whose words (logoi) are configurations that operate, bounded from two sides: one processual, a plenum-source (like the sun, gravity, oscillation) interacting with a receiving surface (like ground, vessel, detector). This double boundary is instrumentally produced, its framing occurs “naturally” and yet mediately, rendered through artifice, in a readable form—in its minimal conditions it requires a tripartite setup. In the case of the cave: light plus object plus wall; in the case of the sundial, rod plus sun plus ground; and in the case of a waterclock, vessel plus drip plus gravity. A “minimal articulation” is a schematic word because the articulation is made possible, not simply found.

Plato’s narrative ultimately directs attention away from this apparatus aspect of the allegory’s setup itself. The minimal articulation do function as schematic words, but the schematism is not accentuated. The philosophical drama culminates in the ascent from the cave toward the direct light of the sun. The mediating devices disappear from view. The present reflection proposes a small substitution in this directionality: Can we displace the allegory from the cave into another apparatus set-up, the *shore*? The shore extends this auxiliary condition into an open field, where supports are no longer fixed but continuously reconfigured. The shore offers a scene structurally similar to the cave but without the enclosing architecture. Here, too, traces appear upon a surface. Shadows move across the ground as the sun changes its position. Waves draw temporary lines in the sand. Objects carried by the sea accumulate briefly before dispersing again. But unlike the cave, where artifacts are arranged in advance to produce shadows, the shore presents a more open environment in which artifacts, organized embodiments of natural movements, and attentive observation interact continuously. Here too, a rod planted in the sand becomes a sundial, a vessel placed beneath a drip becomes a water clock, a thread stretched between two stakes becomes a line for measurement. In each case, here too, the artifact does not simply produce an object of perception: It establishes a situation in which movements become complex and articulated. But at the shore, unlike to the cave, these articulations no longer remain confined to a

single setup; they can be followed across shifting situations. These articulations are precisely what we call *schematic logoi*. They are not patterns imposed from outside (or mysteriously and purely allegorically from within the set-up, as is the case in cave), nor are they plain regularities discovered in nature. They are relational schemata through which phenomena become intelligible within a given configuration of observation.

Let us approach this indirectly. Let us not begin with formal constructions, but rather examine clocks as situations in which movements leave traces as minimal articulations: A shadow cast by a rod, a sequence of drops falling from a vessel, the oscillation of atoms within a clock, each of these situations transforms movement into a trace that can be recorded, and hence rendered intelligible beyond the singularity of it as a situation (hence not only perceptible but also recordable). Such traces are commonly called *data*. Yet if data are understood simply as informational units extracted from the world, something essential disappears from view: A *datum* does not arise in isolation. It emerges only within a configuration that allows a relation to come into view and become articulable. A shadow appears only where light, object, and surface are aligned. A drop becomes countable only where a flow is constrained into intervals. An oscillation becomes measurable only where it takes form within an apparatus. Each datum is therefore not a thing, but an “atom” of a minimal articulation of a relation.

Data may be understood as partitioning schematic logoi in their most elementary form. They are the smallest configurations in which relations between movements become legible: patterns begin to emerge within flows, correspondences between currents come into view, interactions between oscillations become legible, a constellation of shifts begins to show, these movements leave traces that can be followed and alignments between trajectories begin to register, a weave of interactions becomes visible and coincidences between rhythms begin to appear. These flows articulate themselves into discernible patterns. What is “given” in a datum is not an object but an *alignment*—an articulation bounded by the conditions that make it recordable. To understand data, therefore, is not merely to collect or process information. It is to investigate the conditions under which such atomicity arises. From this perspective, knowledge does not begin with isolated data points, nor with abstract structures imposed upon them. It begins with the recognition that each datum already belongs to a relational field—a field in which traces, once articulated, can be compared, repeated, and coordinated: Such alignment arises in relational-operable conditions of displacement, its conditions of possibility are “helped” by an auxiliary component whose situativeness we can best imagine with the stoic intuition of a clock in the middle of nature.

In the middle of nature means not at a center point but within such configurational fields. Here, schematic logoi engage in a participative play, they begin to weave together. And the world, through their alignment on conditions of given displacement, gradually becomes readable. To understand data,

therefore, is to investigate the conditions under which relations become observable. They may be understood as following a simple sequence of operations. Yet these operations do not form a rigid method. They resemble rather the movements of a musical motif recurring throughout a composition.

Schematic logoi hence are operational correlated to how they trace a motif. The generic form of a motif may be expressed through our four phases: *trace*, *schema*, *weave*, *pulse*. Together they describe how constellations between phenomena show up and gradually settle into structures. The notion of schematic logoi is not just another word for pattern: while a pattern, in the ordinary sense, suggests a motif that appears again and again, a schematic logos, by contrast, designates an intelligible articulation through which connections between phenomena become intelligible.

Approached architectonically, such schematic logoi emerge wherever relations are found form through practices of attentive handling. Instruments, observational procedures, and media environments establish situations in which movements leave traces that can be compared and coordinated. Within these situations, orientations do not simply accumulate: *they acquire form through schemata that allow them to be recognized and communicated.*

Artifacts Casting Shadows

This perspective invites a reconsideration of what might be called the *vernacular* language of relations. The vernacular invoked here is not the anthropological domain of inherited customs or culturally specific traditions. It refers instead to the objective languages that arise from ways of handling phenomena. A loom, a sundial, a measuring device—or a computational model, they each introduce an environment in which correspondences between movements become articulable. The resulting schemata constitute a kind of vernacular grammar. Forgetting then is not loss, but a condition of continued articulation. The grammar holds without preserving everything. Schematic logoi here function as operative articulations rather than as mere descriptions. Such artifacts have been present from the beginning: wherever a surface is prepared, a relation framed, a trace made readable. They mediate between observation and structure, between the fleeting traces of events and the more stable architectures of geometry, design, or theory. In contemporary mathematical language one might say that they resemble relational schemata through which local observations can be coordinated into larger structures. What appears at first as a dispersed field of traces becomes intelligible when such schemata allow intervals to align across contexts.

Seen in this way, schematic logoi provide a vocabulary for the architectonic dimension of knowledge. They are neither purely subjective interpretations nor immutable laws of nature. Rather, they belong to the relational domain in which phenomena, instruments, and attentive practices converge. To attend to schematic logoi is inseparable from cultivating a

particular form of attention: the ability to recognize how constellations articulate themselves across heterogeneous domains. It is through such attention that the fleeting signals of the world become intelligible as the news of the world.

Many historical artifacts may be understood in this way. Consider the famous spoon described by Nicholas of Cusa. In one of his reflections on craftsmanship, Cusanus points to the simple act of carving a spoon from a piece of wood. The form of the spoon does not arise from imitation of a particular natural object. Instead it emerges from the relation between the material, the hand of the craftsman, and the intended gesture of use. The spoon thus embodies a small but precise articulation of aligned intervals: concavity capable of holding liquid, a handle shaped to be grasped, proportions that allow the object to mediate between hand and mouth. Its form is not arbitrary. It condenses a set of practical couplings into a stable schema. In this sense the spoon may be understood as a schematic *logos* of nourishment: a minimal articulation through which the relations between body, material, and sustenance become operable.

A different example appears in the scholastic fascination with the tip of the needle. Medieval theologians are often remembered for the playful question of how many angels could stand on such a point. Yet beneath the anecdote lies a subtle epistemological function. The tip of the needle provides an artifact that concentrates spatial attention into an extreme limit. By invoking such a point, thinkers were able to explore questions concerning divisibility, presence, and the relation between the finite and the infinite. The needle's point therefore becomes more than a physical object. It functions as a schematic *logos* of limit: a minimal articulation through which the structure of space can be interrogated. Like the spoon, the needle tip condenses a relational problem into an artifact that allows thought to operate upon it.

Artifacts are not merely tools or products of craftsmanship, they are sites where schematic *logoi* become tangible. A loom articulates relations between threads. A sundial articulates relations between sunlight and planetary rotation. A needle tip articulates relations between extension and limit. A spoon articulates relations between hand, material, and nourishment. Each artifact introduces a situation in which relations can be handled, repeated, and explored.

This observation helps to clarify our train of thought about an *ethological* notion of vernacular language. The schematic *logoi* embodied in such artifacts do not belong primarily to abstract theory, they arise from practices of handling materials and signals in ways that allow configurations to announce themselves. They form *objective vernaculars*, they are languages not of words but of operations: ways of shaping situations so that constellations may appear. The craft of carving a spoon, the practice of aligning a rod with the sun, the gesture of placing a needle upon a surface—all participate in this vernacular articulation of the world. Through such practices, fleeting traces acquire schematic form. And through these schemata, the world begins to speak its news.

Ta Mathemata

Ta mathemata (Greek: τὰ μαθήματα) literally means “that which is learned” or “the subjects of study.” It derives from *manthano* (“I learn, I understand”) and, in ancient Greece—particularly in Plato’s writings—referred to the mathematical sciences (arithmetic, geometry, astronomy, harmonics) as subjects of study, that is, as topics that can be studied in their own right. It is the origin of the word “mathematics” and draws a lineage quite cross with the current and mostly applied view upon mathematics. Let us see what the objective vernaculars of schematic logoi can show us with respect to an adequate appreciation of today’s mathematics actuality of a difficult and constitutive notion at work in studying and learning, namely that of abstraction.

With the notion of schematic logoi we can find a particularly vivid image in the loom of Penelope as a *topos* (place). A loom organizes threads so that relations between them become visible: vertical threads remain stretched in tension while horizontal threads move across them. Each crossing produces a small articulation. None of these crossings, taken individually, reveals the structure of the fabric, only through the gradual accumulation of many such relations does a coherent pattern appear. The weaver does not simply observe threads, she follows the alignments that emerge from their intersections. In this sense the loom operates as an instrument of relational articulation: It provides a situation in which schematic logoi—minimal articulations of relation—become noticeable through repeated crossings. Penelope’s practice illustrates a distinctive epistemic posture. Rather than imposing a design from above, the weaver allows the structure of the fabric to emerge from the coordination of many local relations. Attention moves across the field of threads, following the alignments that gradually stabilize into a form. The loom thus provides a small model of relational knowledge. This image resonates with certain developments in modern mathematical thought. In category theory, structures are defined not primarily by the intrinsic properties of objects but by the relations that connect them. Morphisms establish transformations between objects, and the coherence of these transformations reveals the structure of the system. Diagrams serve as the instruments through which such relations become visible. Each arrow represents a transformation; each commuting square expresses a condition of coherence. The diagram as a whole functions as a relational schema.

One might therefore interpret such diagrams as *formalized* schematic logoi: articulations that allow orientations between domains to become intelligible. Just as the loom organizes threads into crossings that reveal a fabric, the categorical diagram organizes morphisms into arrangements that reveal structure. Elias Zafiris’ metaphor of weaving here acquires particular significance when relations between different domains must be coordinated. In many situations observations arise locally: a measurement performed in one context, a signal recorded in another, a structure constructed within a particular mathematical framework. To understand how these local articulations relate to

one another requires a mechanism of translation. Category theory describes such situations through adjoint relations and functorial correspondences between domains. Without entering the technical details, one might say that these structures allow configurations articulated in one domain to be “woven together” with configurations articulated in another. The weave thus becomes an apt image for the emergence of larger structures from local articulations.

Seen in this light, Penelope’s loom offers a striking epistemological analogy. Each thread corresponds to a local articulation—an observation, an artifact, a measurement. The loom establishes the conditions under which these articulations can intersect. As the weaver follows the crossings, relations begin to align. Gradually the structure of the fabric appears. What the loom achieves through material threads, mathematical frameworks achieve through relational schemata. Both practices reveal how structures emerge from the coordination of orientations. The concept of schematic logoi therefore provides a bridge between several domains: In craft traditions they appear as operative schemata embodied in artifacts, in philosophy they mediate between concepts and experience, and in mathematics they become relational diagrams coordinating structures across domains. Penelope’s loom stands at the intersection of these traditions. It illustrates how local articulations may be woven into a coherent fabric through sustained attention to arrangements. To cultivate such attention is to practice a form of *alignment* in the deeper sense: not the imposition of control upon a system, but the recognition of correspondences through which structures emerge. The loom, the diagram, and the artifact all function as *instruments* through which the world becomes intelligible. One might imagine, alongside the loom, another surface: not for weaving but for noting. A kind of ledger—not of accounts, but of occurrences. Not governing what happens, but registering that something has taken place. The surface on which this grammar leaves marks inscribes entries as grammatical units of noticing. Schematic logoi are not just patterns—they are the “words” of this vernacular grammar. The subject becomes the one who sustains attention within this grammar.

At the Shore of Relations

Such a ledger would not explain the pattern. It would remain with the crossings, allowing them to stand. The entry preserves the event only lightly—enough for it to remain available, not enough to fix it in place.. Let us explore these conditions through a series of scenes. Each of them assumes there is a clock in the middle of nature. First, a sun clock at the shore, where traces appear and disappear within a field of movements. Second, the water clock and the shore, an instrument which settles relations between movements and renders them comparable. Third, an atomic clock amidst the shore, considered as global placeness of mathematical thinking. The scenery displayed with it at its heart shows us the weave as a metaphor for the relational structures through which

disparate observations become coordinated into geometry. Taken together, these scenes furnish a joint and complex vision: that geometry may arise from the coordination of orientations between observations rather from a pre-given spatial substrate. The critical angle shifts to *how do relations become stabilized in a form that geometry can inhabit?*

The shore offers a peculiar environment for observing the emergence of form. Here movements continuously leave traces. Waves advance and retreat across the sand. Shadows shift as the Earth rotates relative to the Sun. Fragments carried by water gather briefly before dispersing again. Such moments gather movements into a brief coincidence, they do not form a stable present. Most of these traces appear only for a moment: A footprint dissolves under the next wave, a line drawn in the sand vanishes as the surface shifts, a shadow changes its length as the Sun moves across the sky. Yet even in their transience, these traces reveal something important: form appears when alignments between movements stabilize, even if only briefly.

Like this, the shore may be invoked as a small *laboratory* of relations—a place for labour where oratory mingles in, where speech and doing do not belong to separate spheres but augment one another. Let us thus consider: A vertical rod placed in the sand produces a shadow that slowly rotates across the ground. The movement of the shadow articulates the relation between the rotation of the Earth and the position of the Sun. A vessel placed nearby releases water drop by drop. Each falling drop articulates the relation between gravity, viscosity, and the geometry of the container. Further away, in laboratories far from the beach, atoms oscillate between energy states, producing frequencies of remarkable stability. Despite their differences in scale, these phenomena share a common structure: Each transforms movement into a trace, each trace records a relation between movements.

At this point the meaning of the word *data* begins to ripple. In contemporary discourse, data are often treated as discrete informational units extracted from the world, but historically the word *datum* referred simply to that which is given within a situation. What becomes given in the examples above is not an isolated object—what becomes given is a relation articulated through time, a relation that appears when different movements coincide within a situation: The shadow registers a relation between celestial motions, the falling drop registers a relation between gravity and flow, the atomic oscillation registers a relation within the structure of matter itself. Data do not exist independently of the situations that allow such occurrences to become visible. They emerge when relations between movements are stabilized in a form that can be observed, repeated, and compared.

This perspective invites a shift in emphasis. Instead of asking what data are, one may ask: *Under what conditions do relations become observable as traces?* The answer involves the presence of an instrument.

Instruments of Relation

Instruments occupy an ambiguous position between nature and construction. Rather than producing a present moment, Instruments create situations in which relations can coincide. It may first appear to function within a given situation, yet its significance emerges when the intervals it articulates can be carried across contexts. In this sense, instruments often operate less like functions than like functors: they preserve relations across transformations, they do not merely produce values. A rod planted in the ground, a vessel releasing water, a resonant cavity stabilizing atomic oscillations: each device introduces an arrangement through which movements can be compared. While what these devices produce are traces, the movements themselves do not originate within the instrument (the Earth rotates whether or not a sundial is present, water falls under gravity regardless of whether a vessel captures its flow and atoms oscillate independently of the clocks built to observe them). What the instrument introduces is not the movement itself. It introduces a configuration in which the relation between movements *shows up*. What these examples suggest is the presence of what may be called an auxiliary architectonics: a set of supporting arrangements through which relations become stable enough to be observed, compared, and coordinated. Auxiliary architectonics allows relations to hold across shifting situations in which they come into coincidence, it does not stabilize a single present.

Consider how the sundial intercepts the passing of time: The movement of the shadow does not originate in the rod, it arises from the relation between the rotation of the Earth and the position of the Sun. Without the rod and the surface on which the shadow falls, this relation would remain invisible. The instrument transforms a celestial relation into a visible trace. Likewise for a water clock, it performs a similar operation. Water flows continuously under gravity, yet when this flow passes through a narrow opening and falls drop by drop, the continuous movement becomes articulated as a sequence of intervals. In both cases, the instrument converts a continuous movement into discrete temporal relations. Likewise modern atomic clocks, even if at a different scale. Transitions between energy states within atoms generate oscillations that can be held and amplified. These oscillations become frequencies that serve as global standards of time. Here again the instrument holds a relation within matter and translates that relation into a trace that can circulate across technical networks.

Placed side by side, these examples suggest a general formulation: Rather than producing data, instruments give form to the occurrences through which data *show up*. Or more precisely: An instrument is a medium for the articulation of relations that exist independently of the instrument. Within such media, movements leave traces that can be compared across locations and observers. From these comparisons larger relational structures begin to emerge. It is through this process that geometry gradually becomes thinkable. A next step therefore asks: If constellations between movements can be stabilized through instruments and traces, how do these relations become coordinated into the structures we recognize as geometry?

Architectonics in the Auxiliary

The traces of the discussed clocks described so far appear in many different places and scales. And taken individually, they remain local. A shadow on one surface reveals little about the larger configuration in which it participates, just as a single oscillation within a laboratory clock tells us nothing about the geometry of the world. Geometry begins to emerge only when such traces become coordinated. Auxiliary architectonics depends on this capacity: relations must not only be established locally, they must be maintained across different situations. What is at stake is not only function, but functoriality. The problem therefore shifts: How do relations observed in different situations become linked in a way that produces a coherent spatial structure? Auxiliary names the condition under which coincidences can appear without being reduced to a fixed ground, it does not mean subordinate.

Let us follow Zafiris in picturing this process as a kind of weaving. Individual observations function like threads. Each thread carries a relation: a shadow recording celestial motion, a drop marking gravitational flow, a frequency expressing an oscillation within matter. On their own, these threads remain isolated, a fabric appears only when they intersect. The crossings between threads form patterns, and patterns stabilize into structures. What we call geometry may be understood as gradually emerging from auxiliary fabrics of such crossings that are, at the same time, fabricated auxiliaries. Such a notion of the *auxiliary*, a support that supplements and a supplement that supports in simply adjoint manner. Adjoined, that is without having to fix something, without restoring or rightening an odd, this resonates strongly with the architectonic perspective developed in this volume: namely that the emergence of physical geometry is best investigated through functorial relations linking domains of observation and mathematical structure. Here too, the underlying idea is that geometry emerges from the active coordination of relational descriptions across different contexts of observation. The weaving metaphor offers a way of visualizing this coordination: Each observation establishes a local articulation of crossings. When these articulations are compared and translated across contexts, a network of correspondences begins to form, and the network gradually acquires a stability that allows observers to treat it as a spatial structure. Geometry appears when relations between observations hold together consistently.

Historical examples make this process that involves an architectonic in the auxiliary visible. One of the most famous is the measurement of the Earth's circumference attributed to Eratosthenes. The measurement does not rely on a single instrument but on an auxiliary architecture linking observations across distance. Two observations were made at different locations in Egypt. At Syene the Sun stood directly overhead at noon during the summer solstice, casting no shadow. At Alexandria, at the same moment, a vertical rod produced a measurable shadow. Neither observation alone revealed anything about the size

of the Earth. But when the two traces were compared, a relation appeared. The angle between the shadow in Alexandria and the vertical corresponded to the curvature of the Earth's surface between the two locations. From this relation the circumference of the Earth could be inferred. Each observation functions locally. The measurement emerges only when the relation between them is carried across sites. The procedure is not merely functional; it is functorial.

What served as the instrument in this situation? Not a single device. Rather, a configuration linking two observations, such that the physical geometry of the Earth emerged from the coordination of local traces and comparisons that establish relations between them, as well as across contexts. Consistent occurrences across multiple observations reveal larger structures that hold, by continuous testing on auxiliary architectonics: Geometry arises through a process of relational inference, for which it seems opportune to say: *space is being abducted from time*. By means of such architectonics—involving both, empirical precision and speculative ratiocination—physical geometry may be understood as emerging by inferring from the ongoing coordination of temporal events, as movements leave traces in time and coincidences between traces reveal patterns. The patterns stabilize in tune with experience into structures interpreted retroactively as spatial.

Mathematical frameworks developed in the twentieth century have increasingly explored perspectives compatible with this relational intuition. In category theory, objects are characterized more by the morphisms that relate them to other objects than not by intrinsic properties primarily. Structures emerge from the network of transformations connecting them. Similarly, in sheaf-theoretic approaches to geometry, local observations are organized across overlapping domains. Where these domains intersect, the relations between local descriptions must agree. Geometry appears through the coherence of these relations. Instead of beginning with space and placing coincidences within it, one begins with picking up relations and aligning them in between contexts that need to be “bridged” or “glued” as instrumental adjoinings. They too do not *make* the movements that allow to show up if well placed and tuned. But they lend themselves to investigate structures not plainly visible, by rendering them apparent from instrumenting their coordination. In this sense, both traces and instruments can be understood as local articulations within a larger weave.⁵

Instruments and traces are like functors and function: what acts as a function in one context may well adopt a functorial role in another. Likewise, what acts as a trace in one context may well adopt the role of a functor in another. When threads are compared across instruments and observers, new relations become visible. Frequencies measured in distant laboratories can be synchronized. Shadows observed at different locations can be compared, and measurements obtained at different times can be related through transformations. Gradually more and more complex network of relations form

⁵ A sundial produces a trace linking Earth and Sun, a water clock produces intervals linking gravity and flow, an atomic clock produces frequencies linking energy states within matter: each device establishes a thread in the fabric.

and auxiliary patterns of consistency that can be trusted more than others begin to appear. These patterns allow observers to treat the network itself as a physical geometry.

The weave therefore has two aspects. First, it is constructed through the coordination of observations. Second, it remains visible beneath the geometry it produces. If the relations between observations change, the resulting geometry may also change. New instruments introduce new threads into the fabric. New threads reveal previously unseen structures. Geometry thus appears less as an immutable container and more as a relational structure that acquires its coherence through practice.

This interpretation invites a further reflection. If geometry emerges from a weave of relations, then the work of the observer begins to resemble that of a weaver. Observations must be gathered, interlinkages between them must be recognized, patterns must be followed as they extend across different domains. The activity required is neither purely technical nor purely theoretical. It is a form of attention. One must learn to notice how traces connect, how relations stabilize, and how patterns emerge across the weave. The emergence of geometry is not only a mathematical problem, it is inseparable from an epistemic *practice*: to ideate geometry is to learn how to attend to and follow relations across a field of traces until a coherent structure offers itself by appearing.

The Shore—a Place for Overspilling Amphora

The metaphor of weaving emphasizes how relations between observations become coordinated within an auxiliary architectonics. Yet weaving alone explains not how relations gather in the first place. Threads must first be brought together before they can be woven. The question therefore becomes more concrete: Where do relations accumulate in a way that allows them to become legible? And how to think of contexts that align *and* overlap, and more: that swap over, one into another? One answer lies in the idea of place as functionally contained as amphora, and the shore as a the idea of place as functorially containing places that overlap one another.

In the ancient Mediterranean world, vessels were among the most common technical objects. Amphorae carried wine, oil, and water across the sea. Their shapes varied according to the materials they contained and the journeys they were meant to endure. At first sight the function of such vessels appears simple. They hold liquids. Yet this simplicity conceals something more subtle. A liquid has no stable form of its own. It flows, disperses, and adapts to the shape of whatever contains it. The amphora interrupts this flow by introducing a boundary. Within that boundary the movement of the liquid becomes temporarily stabilized. The vessel therefore does not produce the liquid, it creates the conditions under which the liquid can gather. This observation invites a shift in perspective. Instead of asking what a container holds, one might

ask: What kinds of motions become noticeable because the container exists? A vessel gathers flows that would otherwise remain dispersed. Within the cavity of the amphora, currents settle into patterns. Surfaces appear where none existed before. The container thus functions less as a passive receptacle than as a mediator between movements.

The shore can be understood in similar terms. At first glance the shore appears simply as the boundary between land and sea. Yet this boundary is neither fixed nor purely linear. It is a region where different flows intersect: waves, wind, sediment, and light continually interact. Fragments carried by the sea accumulate there for a time. Stones, shells, and pieces of wood gather before dispersing again. Footprints appear in wet sand. Lines form where waves retreat. Objects arrange themselves into temporary constellations. Each trace records a relation between movements. Most of these traces disappear quickly. But the surface on which they appear remains receptive to new inscriptions. The shore behaves like a vast and porous vessel: It gathers movements that arrive from different directions and allows them to leave traces. These traces accumulate long enough to become observable before they dissolve again into the flux of events. The shore therefore resembles an amphora whose walls are continually reshaped. Rather than containing a stable substance, it contains relations in the process of forming and dissolving.

Seen from the auxiliary architectonics perspective, the instruments discussed earlier may also be understood as vessels of relation. A sundial gathers the movement of sunlight and the rotation of the Earth into a visible configuration. A water clock gathers gravitational flow into discrete intervals. An atomic clock gathers oscillations within matter into stable frequencies. In each case the device creates a small environment in which a relation can settle long enough to become observable. The instrument functions as a container for movement. Not a container that holds the phenomenon itself, but one that gathers the relation between movements into a form that can be traced. Such containers do more than produce traces. They also shape the environments in which relations can be compared. Consider again the simple example of falling water. When a vessel releases water through a narrow opening, the continuous flow becomes a sequence of drops. Each drop marks an interval. If another vessel produces a similar sequence under comparable conditions, the two rhythms can be compared. Through such comparisons relations between different flows become measurable. The container thus participates in the formation of a relational field. This field may extend far beyond any single instrument. A network of clocks synchronized across distant locations forms a temporal infrastructure that allows measurements made in one place to be related to measurements made elsewhere. Astronomical observations gathered from different points on the Earth can be coordinated into a celestial map. In each case local traces are collected within specific environments and then connected through relations of comparison. The vessel becomes part of a larger relational architecture. Just as the shape of a vessel arises from the need to gather and stabilize flows, spatial structures may arise from the need to coordinate relations

between observations. The vessel does not precede the flows entirely. Its form evolves in response to them. Similarly, the geometry through which we describe the world may evolve in response to the relational patterns revealed by observation. In the terms of an auxiliary architectonics, physical geometry becomes a vessel capable of gathering relations and acting as media – like places, physical-geometric structures are marked by double boundaries, points that render functions coherent and the coherence of stable functions that act as functorial bridges. Such double boundaries are captured well in the image of a shore of relations where movements intersect, traces appear, patterns accumulate before dispersing again.; but in another resolution, they are perhaps best captured in the format notions of the palimpsest and the parerga. The shore already presented such a surface; the cave already staged such a frame. A surface may register traces locally, but its significance lies in how these traces can be related across layers.

Palimpsest and the Parerga – Atonal Thinking and Media Agency

The shore receives these traces without preserving them permanently. Yet the repeated encounter between movements gradually produces stable surfaces: beaches, sediment layers, coastlines. These surfaces are the result of countless interactions, they are the sediment of relations. Instruments perform a similar operation at smaller scales. In finer resolutions, hence, such double boundaries are perhaps best captured in the format notions of the palimpsest and the parerga.

This is because another transformation becomes necessary when relations begin to circulate through extended systems of mediation. At that point the problem is no longer merely how relations become observable. The problem becomes one of orientation within relational fields. For a long time, many systems of organization relied on a center. In classical geometry the center of a circle provided a reference from which all distances could be measured. In this auxiliary architectonics view, a circle's centre point does not belong to the scope of the circle properly, it is what gave rise to the drawing of its compass. In political and cosmological thought the center too functioned as the point from which order radiated outward. But there is one field of artistic practice in particular, where metrical relations are physical and sonic, and where the decoupling of centre point and circle has been explored in helpful terms: Atonal music.

In music the tonal system organized relations between notes around a privileged point: the tonic. Within such systems orientation is straightforward. Every relation can be interpreted through its distance from the center. But the twentieth century gradually witnessed the emergence of structures that no longer depended on a central point of reference. In tonal harmony, compositions are organized around a central tone. Tension and resolution

unfold through departures from and returns to this tonal center. At the beginning of the twentieth century, composers such as Arnold Schoenberg began experimenting with compositions in which no tone occupied this privileged position. Instead of orienting musical relations toward a single center, the structure of the composition emerged from the relations among the tones themselves. In the twelve-tone technique, a sequence of notes is arranged so that none dominates the others. Transformations—such as inversion, retrograde, and transposition—generate variations while preserving the relational structure of the sequence.

To listeners accustomed to tonal orientation, this music initially appeared disorienting. Without a tonal center, the ear could no longer rely on familiar expectations of resolution. Yet the music was far from chaotic. A different kind of order emerged—one distributed across the entire field of relations. This shift offers a suggestive analogy for the relational structures encountered in contemporary scientific and technical environments. Large datasets, distributed sensing systems, and algorithmic media increasingly produce fields in which meaning resides distributively in constellations that involve many point. Instead, patterns emerge from correlations distributed across many observations.

A single measurement rarely reveals anything significant on its own. The significance appears only when coincidences among measurements are traced across the field. Temperature readings gathered across the globe reveal climate patterns only when compared with one another. Signals transmitted through communication networks acquire meaning through their position within sequences of other signals. Orientation in such environments no longer proceeds from a center. It proceeds through the recognition of patterns within relational fields. Media systems play a crucial role in shaping these fields. An instrument such as a sundial or a water clock already mediates between movements by translating them into traces. Modern media infrastructures extend this process by connecting traces across vast networks of devices, observers, and computational processes. Sensors distributed across landscapes record atmospheric conditions. Satellites transmit signals linking distant locations. Algorithms process enormous collections of measurements, identifying correlations that would otherwise remain invisible. Rather than merely transmitting information, these systems create environments in which relations between signals become detectable. In such environments the task of interpretation changes. Instead of searching for a single explanatory center, observers must learn to navigate a distributed field of occurrences. Clusters, gradients, and networks replace linear chains of causation as the primary structures of orientation.

One might describe this shift as a movement toward atonal thinking. Just as atonal music organizes sound through transformations within a relational field rather than through reference to a tonal center, contemporary media environments often organize information through distributed patterns rather than centralized hierarchies. The analogy should not be taken too literally, yet it

captures something essential about the transformation of perception required in such environments: Orientation becomes relational. Mathematical frameworks explored by contributors to this volume reflect a similar movement. Category theory, for example, characterizes structures through the relations that connect them rather than through intrinsic properties alone. Objects acquire meaning through the morphisms that relate them to other objects. Similarly, sheaf-theoretic perspectives organize local observations across overlapping contexts. Where these contexts intersect, the interlinkages between local descriptions must agree. Geometry emerges from the coherence of these relations. In such frameworks, no single observation functions as a privileged center. Instead, structure arises from the consistency of coincidences across the entire network. The traces and instruments appear as local articulations within the depth of a larger relational field: A shadow on the ground is meaningful only in relation to other shadows observed elsewhere. A frequency measured in one laboratory acquires significance when compared with frequencies measured in others. Each trace becomes a point within a distributed pattern. The role of media systems is to connect these points. This transformation has consequences for how attention operates, for in a system organized around a center, attention can remain focused on a single point of reference. In a relational field, attention must move across multiple intervals simultaneously. Patterns must be followed as they unfold across the field. The skill required is measurement *cum* attentive navigation within relational structures.

At this point the metaphor of weaving returns in a new light. For the weaver it is not a central thread that determine the pattern of the fabric. Instead, the pattern emerges through the orientations between threads as they cross one another on the loom. The structure of the cloth appears gradually as the crossings accumulate. Thus weaving provides a small model of relational orientation. Threads interact without subordinating themselves to a single dominant axis. Patterns emerge through the coordination of many local crossings.

Penelope's Epistemology

Let us return to a figure who embodies this form of relational attention. While others explore distant territories, she remains near the loom, following the slow emergence of patterns through the crossings of threads. Her work consists in observing not by traveling through space but by remaining attentive and active on the spot to how relations accumulate into structure. Her name is Penelope.

In Homer's *Odyssey*, Penelope remains in Ithaca while Odysseus travels across distant seas. The hero's journey unfolds through encounters with unfamiliar places: islands, storms, monsters, and kingdoms. Penelope's activity appears far more modest. She weaves. During the day she works on a large shroud. During the night she secretly unravels the threads she has woven, delaying the moment when the garment will be finished. The episode is usually interpreted as a gesture of fidelity, a strategy through which she postpones the

demands of her suitors. Yet another dimension of the scene deserves attention. Penelope's activity is directed toward the articulation of immanent and intrinsic relations rather than toward the exploration of spatially far away places.

A loom holds threads under tension. Vertical threads remain fixed while horizontal threads move across them. Each crossing produces a small intersection. Thousands of such crossings gradually form a pattern. The weaver does not simply observe individual threads, she follows the relations between them. A change in tension alters the pattern of the fabric, a shift in rhythm modifies the arrangement of crossings. The surface of the cloth emerges from the coordination of many small relations. The loom therefore functions as a relational instrument. It organizes threads in such a way that patterns emerge. Seen from this perspective, Penelope's activity acquires an epistemic dimension. Her work requires sustained attention to a field of relations. The emerging pattern cannot be grasped from any single crossing. It appears only through the gradual accumulation of many intersections: The weaver must learn to recognize how these intervals interact. Penelope's gesture of unraveling the fabric at night adds another layer to this practice. By undoing the pattern she restores the field of relations to a previous state, allowing the process to begin again. The pattern emerges and dissolves repeatedly. Through this repetition the structure of the weave becomes increasingly intelligible.

Penelope's loom offers a small model of relational knowledge, insofar as knowledge arises from the carefully attentive interlinking of distributed observations into constellation. It emerges from the coordination of many relations across time. Each observation corresponds to a thread. Each comparison between observations forms a crossing. The resulting pattern gradually becomes visible. Coupled with this epistemic practice, the loom resembles in the relational infrastructures described earlier. Instruments gather traces of movement and media systems connect traces across distances. Mathematical frameworks organize these relations into coherent structures. Penelope's weaving embodies the same principle in miniature.

The contrast with Odysseus clarifies the nature of this epistemic practice. Odysseus navigates a geography of places lined out next to one another. His knowledge arises from encounters with distant territories. Penelope remains in a single location. Her knowledge develops through attention to the arrangements unfolding within a field of threads. The adventure of the traveler is spatial. The adventure of the weaver is relational. This distinction reflects two different orientations toward the world. One seeks knowledge through movement across space, the other seeks knowledge through the recognition of patterns within relations. Modern scientific practice has been dominantly in the mode of spatial adventure. It increasingly requires the second form of attention, that of Penelope. Contemporary observational systems produce enormous fields of traces. Sensors distributed across the planet record atmospheric data, laboratories measure signals at scales far beyond ordinary perception. Computational systems process these traces, revealing correlations that extend across vast datasets. Understanding such systems requires the ability to follow

relations across the field. It is in this sense, that the observer begins to resemble the weaver.

Penelope's loom therefore offers more than a literary image. It illustrates a practice of attention suited to relational environments. The weaver does not impose a pattern from outside. She follows the interactions between threads until a pattern becomes visible. Likewise, the interpretation of relational data requires learning how to follow relations as they accumulate into patterns. Knowledge emerges gradually as a fabric from this process.

Seen in this light, Penelope's gesture may be interpreted as a quiet form of exploration. While Odysseus travels through geographical space, Penelope explores the domain of immanence: the abducted space of relations intrinsic to contexts. Her loom becomes a device for investigating how structures emerge from the coordination of many local interactions. The patterns she observes are modest compared with the vast geometries studied in mathematics and physics. Yet the underlying epistemic principle remains the same: relations must be woven together before structures appear.

This insight prepares the final question of the essay. If knowledge arises from the attentive coordination of relations, what role might humanistic practices play in a world increasingly organized through data? Let us turn now to this question and ask, how the cultivation of attention—once associated with the interpretation of texts, images, and music might extend to the interpretation of relational data fields. In other words: What does it mean to read data through observation and measurements (weaving), and also through a disciplined attention and philological interpretation (placing the threads, knotting and untying the cloth)? What was practiced at the shore, in the cave, and in the handling of artifacts, appears here under another name. Philological attention does not remain within a single articulation; it follows constellations across contexts. In this sense, it operates functorially.

A Philological Art of Articulating Data

We have followed a path through several scenes: the shore, the objective vernaculars of instrumenting constellations and arrangements of relations, the training of attention necessary to render phenomena not only visible but also intelligible, observations woven together in the place-making and careful terms of an auxiliary architectonics, and Penelope's loom, which offers a small model of relational attention. Taken together, these scenes suggest a shift to a different optics according to which knowledge does not begin with stable objects. This observation becomes especially relevant in an age increasingly described as the age of liquid time but also as the age of data. Data stream and circulate today through infrastructures of remarkable scale. Sensors distributed across landscapes measure atmospheric conditions. Satellites observe planetary movements. Digital systems register countless interactions between devices and users. In such environments the volume of traces often exceeds the capacity of

any individual observer. Yet the problem is not merely quantitative. A single datum rarely reveals anything on its own. Philological attention operates within an auxiliary architecture: it does not so much construct as following and maintaining their coincidences across a field of traces. The challenge lies precisely in recognizing relations within and across *palimpsests* and *parergas*—within vast and deep fields of traces. A temperature reading, a frequency measurement, a transaction record—taken in isolation, each appears insignificant. Meaning emerges only when constellations between many such traces become synoptically, comprehensively, visible and intelligible: patterns of correlation, repetition, and transformation reveal structures that would otherwise remain hidden.

This situation recalls a practice long cultivated within the humanistic traditions. The study of literature, art, or music has never consisted in mainly collecting isolated facts about texts or images. Instead, it involves learning how elements participate in larger patterns: A word acquires meaning through its relation to other words within a phrase, a paragraph, a book; a motif in music gains significance through its recurrence across a composition; a brushstroke in a painting belongs to a broader arrangement of forms. There is a philological art of reading these relations that expands beyond text as a specific format of writing in language. This is relevant, beyond the so called linguistic turn in philosophy, precisely because it names a reading practice that does not primarily extract information but maintains it in constellations. And it is also relevant beyond the new materialists attention to matter, which in their emphasis of embodied practices tends to eclipse the constitutive relation between code, metrics, and material elementarity. The philological art of reading these relations is the recognition of patterns in the coded textures of an auxiliary architectonics.

When the concept of data is reconsidered in this light, an unexpected continuity appears: Sensors, instruments, and computational systems generate enormous collections of traces. These traces record orientations between movements occurring across different scales: atmospheric currents, molecular oscillations, economic exchanges, social interactions. The task is not merely to store these traces. The task is to recognise relations across and within them: Which traces correspond to one another? Which patterns recur across different contexts? Which correlations reveal structures that were previously invisible? Such questions require attention to subtleties and interpretation. They require attention capable of navigating relational fields. Humanistic education has traditionally, that is immanent and transversal to the positive discursive-epistemological regimes, cultivated precisely this capacity. To study a text closely is to follow relations across a complexity of tangent—contingent—structures. To interpret a piece of music is to recognise patterns unfolding across time. To analyse an image is to trace how forms interact within a visual field. These practices train attention. They teach observers to perceive structures and structural invariances that emerge only through sustained engagement with relations.

There is hence a philological art of articulating even quantitative information in relation to which the humanist scholar stands no less outside the world of data than the mathematician scholar. On the contrary, the humanist's practice may offer an important model for engaging with relational milieus, environments. When navigating contemporary data fields, learning to read patterns rather than isolated elements is a skill that becomes necessary in any empirical practice. Large datasets reveal their significance through clusters, gradients, and networks, as they replace—*displace and align*—isolated facts as the primary objects of interpretation.

With this in mind, can we perhaps distinguish tools from instruments in both, a pairing procedure and an analogical proportioning. We can perhaps distinguish them like we distinguish the functorial role of a place's double *eschata* (in its discussion by René Thom) from its functional role? The domain of an auxiliary architectonics involves tools as well as instruments, praxis as well as ratiocination. Tools are helpful (auxiliary) too, they augment our productivity. But instruments are helpful (auxiliary) in a more silent and involutive manner. They perform a kind of education in attention that involves contemplation without exhausting itself in it. This goes not only for musical or artistic instruments: A sundial teaches the observer a contemplative attention, namely to follow the relation between sunlight and planetary rotation. A water clock teaches the recognition of gravitational rhythm. An atomic clock stabilizes oscillations that would otherwise remain imperceptible. Metrical instruments at large measure phenomena and they train the perception of attending to them. A contemporary philological art of interpretation may be understood as a continuation of this training. It teaches to notice coincidences through sustained attention, phenomena that others might overlook. Subtle correspondences between elements gradually become visible—and, if their observation is sustainable, can be demonstrated to show up with a certain regularity. This capacity becomes increasingly valuable as scientific and technological systems produce ever more extensive relational fields, as algorithms can detect correlations within large datasets. Yet the interpretation of these correlations still requires human judgment. Which intervals matter? Which patterns deserve attention? Such questions cannot be resolved by computation alone. They require cultivated forms of *literacy—quantum literacy*.

From this vantage point, humanism may be described in a simple way: with philology as an art, it is not primarily the preservation of an authoritative canon of texts, more profoundly it is the education of attention. What appears as data is not the preservation of a state, but the result of a selective forgetting through which relations become comparable. It cultivates the ability to perceive relations within complex fields of correlated “*eschata*” points, points “last, furthest, uttermost, extreme, most remote” in the auxiliary architectonics of time, space, proportion and degree. In an age of data, this capacity becomes newly relevant. To read data “actively” (observation is weaving) and philologically (weaving involves gathering, holding and attending to) is to follow the relations through which traces become meaningful. That is to say: when traces begin to

speak—as the News of the World. Philological attention does not only follow relations; it also notes them. Not in order to fix their meaning, but to let them remain available—as entries in a kind of ledger of occurrences.

News of the World

René Thom's rereading of Aristotle introduces a structural feature that illuminates the relational architecture described throughout this text: the double boundary of place. For Thom, a place is not simply defined by an outer perimeter. It possesses two distinct yet related limits. There is, first, the external boundary of the domain—the horizon of landmarks that delimit the territory of the inhabitant. And there is a second boundary located within the living body itself: the minimal boundary of the organ through which perception occurs. Thom imagines the inhabitant of a place directing its gaze toward a distant boundary. The ray of vision extends outward toward a landmark. Yet this ray also returns inward to the organ of perception—the eye beneath the eyelid. The external boundary and the internal boundary thus become connected by a field of rays. Through this relation the two borders form what Thom calls a “collar”,⁶ a “necklace” linking the two boundaries. Place, in this sense, is neither purely external nor purely internal to an individual. It is constituted by the relational field that connects the two, and what connects the two is a sort of *diaphragm* between them. A band or bundle of fibrous tissue in a body that has the ability to contract, a pulsating activity of breathing that produces movement across body and environment, an act necessary to maintain its elements in well tuned position.⁷ Relations become noticeable not only when they function within a situation, but when they can be carried across situations without losing their coherence—coincidences show up when they can *travel*. The saying does not connect elements through causal sequence; it brings them into articulation in a moment of coincidence.

Articulating the Breath of Data

This text has often used the notion of pattern. But patterns need to be “displaced” in order to be “aligned”, that is to say, they need topical alignment that involves “Versatz”. The present appears less as a point in time than as a field of con-tingency: a touching together of relations that do not fully align. Auxiliary architectonics appears here as a rhythmic spacing—a breathing of relations that allows them to shift without dissolving. While the English notion of alignment connotes harmonious fittings of sorts, the German word for it emphasising more an irreducible “stumbling” that is involved. What distinguishes a *forced*

⁶ Thom *ibid.*, 46: “un collier regulier pour cette difference globalisable”.

⁷ Diaphragm, from Greek *diaphragma*, for “partition, barrier, muscle which divides the thorax from the abdomen,” from *diaphrassein* “to barricade,” from *dia* “across” and *phrassein* “to fence or hedge in”.

alignment from a *fitting* one? With Thom's view on the relational architecture of place, we can see now that the question is how to *articulate* patterns—how to vocalize, how to prompt, how to accommodate patterns *in the saying*, not only in *writing*. Bearing this in mind, the word pattern relates more intuitively now to the more precise expression of *schematic logoi*. The shift is not merely terminological. The evocation of speech and its “presentism” is not merely a call for return to metaphysics as we knew it. It signals an attempt to describe relational articulations in a way that avoids reducing them to decorative repetition or empirical regularity. What is at stake here is not a return to speech as a privileged site of presence. The saying invoked throughout these pages does not coincide with the immediacy of voice. It names rather the moment in which relations come into articulation: when a trace appears, a pattern begins to hold, a correspondence becomes perceptible. Such saying does not endure as a fixed presence. It passes, like breath, through the field of relations. Alongside it, a complementary surface—a ledger, not of accounts, but of occurrences. Here, what has taken place may be noted without being bound to memory or obligation. The entry does not preserve the event as a permanent record; it allows it to remain available without preventing its disappearance. In this way, articulation is neither confined to speech nor captured by writing. It unfolds within a vernacular grammar in which relations are said as they occur, and inscribed only lightly—so that forgetting remains possible. For it is through such forgetting that the field remains open to further articulation. The saying invoked here bears a distant resemblance to what German expresses in *der Sage nach*: a mode of articulation without a fixed speaker. Yet it does not refer to transmitted accounts, not in the sense of “according to tradition”. It names instead the moment in which something becomes sayable within a field of relations. Schematic logoi are the means for such articulations of data in patterns, that is to say: the articulation of data into “alignments” that involve a poetics of “Versatz”. Let us see now how the evocation of the loom as a *metaphora*, in the mathematical sense Zafiris emphasises—a sense that comes close to “Vollzug” in German, as a kind of *enactment*, embodied practice, brings precision to this.

In a loom, vertical threads remain stretched between two edges of the frame while horizontal threads pass between them. Each crossing binds the two edges together through a network of relations. The external horizon of landmarks corresponds to one edge of the loom. The perceptual organs of the inhabitant correspond to the other. Between them extends a field of rays, traces, and signals that cross the domain like threads. Each crossing produces a schematic logos: a minimal articulation through which the inhabitant recognizes its position within the territory. The maritime technique of *amers* described by Thom provides a vivid example. Navigators determine their location by observing the relative alignment of distant landmarks along the horizon, this involves more than measuring distances. The ordering of these landmarks changes as the observer moves along the coast. Each ordering corresponds to a distinct region within the territory. The navigator therefore

reads a relational configuration of boundaries. The alignment of landmarks forms a schema through which place becomes intelligible. Like this, the horizon functions as a loom on which the schematic logoi of navigation are woven.

This double structure of boundaries also illuminates the image invoked earlier: the clock in the middle of nature. The rhythms of the world—solar cycles, tides, oscillations, and biological pulses—become noticeable only when relations connect external processes with internal organs of perception. The shadow of a sundial becomes legible only to an observer whose eye connects the rotating Earth with the mark on the ground. The clocks of nature therefore operate less so as isolated mechanisms than as organs within relational fields. They tick along the threads that connect the outer world with the inner boundary of perception.

The metaphors gathered throughout this essay begin to converge as *metaphoras* is this mathematical sense. The amphora gathers relations into place. The loom weaves relations into structure. The clock articulates relations in time. Together they describe a single relational architecture: Place provides the vessel, duration provides the flow, schematic logoi provide the articulations through which occurrences become intelligible. And the inhabitant—the *maître du lieu* in Thom's phrase—moves within this woven field, reading the alignments that emerge between the boundaries of the world and the boundaries of perception. To cultivate such reading is to practice the instrument of attention proposed throughout these pages. It is to follow the threads through which the world composes the news of itself.

The shore remains, then, a fitting place to conclude. What appears at the shore is not a stable present, but a field in which relations come into contact—a great *con-tingency* from which forms briefly emerge.⁸ Here movements continually leave traces upon the surface of the sand. Waves draw temporary lines. Shadows lengthen and shorten as the Earth rotates. Wind rearranges grains into new patterns. Each trace records a relation between movements. Most of these traces pass unnoticed, yet occasionally a relation becomes visible. A shadow aligns with a mark on the ground. A sequence of drops falls with unexpected regularity. A pattern appears across distant observations. Such moments reveal something subtle about the nature of knowledge. The world continuously produces signals. These signals are not messages in the linguistic sense. They are patterns emerging from the interactions of movements. A shadow records the relation between Earth and Sun, a drop records the rhythm of gravity, a frequency records oscillations within matter. Each signal becomes perceptible only when a configuration allows the relation to appear. A datum, in this sense, resembles an entry—not a unit extracted from the world, but a trace that has been noted without exhausting what it relates. The ledger becomes the

⁸ Cf. how Michel Serres discusses the terms soft and hard as both referring to one and the same thing: the contingency that the “initial conditions” of the universe are capable of “organizing.” Serres’s notion for such contingency is *la grande circonstance*, and it names in spatial terms contemporaneity as the nascent space, where necessity results from contingency, and where they coextend in reality without ever actually coinciding. I have elaborated on this in Vera Bühlmann, *Mathematics and Information in the Philosophy of Michel Serres* (Bloomsbury, London 2020), 68ff.

place where con-tingency is inscribed without ever being fully resolved. What this introduces is a non-causal epistemology of inscription, the careful noting of how relations come into contact. What emerges from these practices is not a unified consciousness, but a form of attention distributed across relations. It does not belong to a subject alone. It takes shape wherever traces are followed, compared, and articulated across contexts. One might think of it as a constellation of auxiliary supports—adjoint without coinciding, sustaining the coherence of relations without reducing them to a single point of view. In such a perspective, alignment would no longer refer to the conformity of a system to an intention, but to the capacity to participate in such fields of articulated attention.

Instruments create such configurations. These devices do not invent the signals they record. They create environments in which the signals become visible and audible. One might think of instruments as listening devices—attuned to relations—while tools tend toward shaping and producing forms. The introverted orientation of instruments allows observers to hear the relations through which the world articulates itself. The scenes assembled in this essay—the shore, the instrument, the weave, the vessel, the relational field, Penelope’s loom—each describe a situation in which relations show up. Taken together they suggest a simple proposition: The world need not be understood as first composed of objects that later enter into relations. It may instead be approached as a field in which relational orientations give rise to forms. Geometry, measurement, and knowledge arise when these relations hold long enough to be recognized. To attend to such coincidences requires patience. Traces must be observed as they appear and disappear. Patterns must be followed across multiple contexts, with some of them spilling over into each other. Relations must be woven together until a coherent structure becomes visible. But the practice behind it resembles listening. Not listening to speech, but to the signals produced by the movements of the world.

The pages of this essay may therefore be understood as a small instrument. Their aim is not to produce a final theory. Their aim is to cultivate a certain form of attention. For to read data humanistically, and to articulate it philologically, is not simply to analyze numbers. It is to learn how to listen to the occurrences through which the world speaks.

Cosmic Modesty— A Philology of the News from the World

The notion of schematic *logoi* draws upon a long and varied tradition of philosophical reflection concerned with a single question: how relations between phenomena become articulable. One of the earliest articulations of this question appears in Aristotle’s use of the word *schema*. In Greek, *schema* does not merely designate a shape. It refers to a situation that becomes perceptible through posture, arrangement, or gesture. The schema of a body, the schema of a

tool, or the schema of a geometrical figure names ways in which constellations stabilize into recognizable form.

In Aristotle's reflections on craft this stabilization occurs through practice. The artisan does not impose an abstract design upon inert matter. Form emerges through the interaction between material, instrument, and the trained gesture of the hand. The schema condenses this interaction into a situation that can be repeated and transmitted. Artifacts embody schemata through which these relations become operable. Such schemata belong to a domain where observation and handling converge—they make relations *tangible*.

A second philosophical articulation appears in Kant's doctrine of schematism. In the *Critique of Pure Reason*, Kant recognized that concepts alone cannot account for the connection between thought and experience. Between abstract categories and the manifold of intuition there must exist a mediating operation. This operation is the schema. A schema is neither a pure concept nor a concrete image. It is a rule through which a concept becomes applicable to phenomena. The schema of number lies in the successive synthesis of units in time; the schema of causality lies in the rule that organizes sequences of events. In this way schematism identifies the crucial operation through which relations become recognizable within experience. Where Kant described this mediation in transcendental terms, artifacts and instruments make it visible in practice. A sundial articulates temporal relations through the movement of shadows. The tip of a needle concentrates spatial attention upon a limit. Each establishes a schema through which relations can be grasped.

A third articulation emerges in modern mathematics, particularly within the relational perspective developed in category theory. Here structures are no longer defined primarily by intrinsic properties but by the relations—morphisms—that connect them. Objects acquire meaning through the network of transformations in which they participate. Diagrams play a central role in this perspective. A diagram articulates the relations that define structure, it does not merely illustrate it. Its coherence ensures that transformations across domains remain consistent. Seen in this light, categorical diagrams may be understood as formalized schematic logoi. They provide relational schemata through which local constructions can be coordinated into larger structures. Just as a loom organizes threads into crossings that gradually reveal a fabric, the categorical diagram organizes morphisms into arrangements through which structure becomes visible.

Across these different historical strata—craft, philosophy, and mathematics—schematic logoi appear as recurring articulations through which relations become intelligible. In craft they arise through the handling of materials and tools. In philosophy they mediate between concept and experience. In mathematics they take the form of relational diagrams coordinating structures. Each articulation addresses the same task: making relations present, configurations of coincidences announce themselves. The spoon, the needle tip, the loom, and the diagram all belong to this lineage. They are not merely objects or representations. They are artifacts through which

relational attention becomes possible. Seen in this way, schematic logoi allow us to reconsider a distinction that has long shaped modern thought: the opposition between the arts and technology. When artifacts are understood only as technical instruments, their participation in the articulation of meaning disappears. When art is separated from the domain of instruments and operations, its relation to the structures of the world becomes obscure.

Schematic logoi suggest another possibility. Artifacts may be understood as *parerga*—framing operations that stand neither wholly inside nor outside the domain they articulate. Like the margins of a manuscript or the frame of a painting, they establish the conditions under which relations become visible without coinciding with them.

The world revealed through such operations is therefore not one in which knowledge and reality simply coincide. Nor is it adequately described by the contemporary opposition between the “real” and the “virtual.” It resembles rather a palimpsest, a surface upon which successive articulations leave traces without fully erasing the previous ones. Within this layered field, artifacts cast shadows—modest projections through which relations become legible. These shadows are not illusions to be overcome. They are the operative traces through which schematic logoi appear. Such modesty is cosmic rather than merely technical. It recognizes that knowledge emerges not from the domination of phenomena but from the patient articulation of constellations and coincidences across the spectrum of experience—from the rational constructions of thought to the empirical traces left by events.

Between these poles—ratiocination and empirical praxis—the world unfolds as a field of *Versatz*, a poetics of displacement, alignment, and substitution in which relations are continually rearranged and reinscribed. Artifacts participate in this poetics by establishing the schemata through which traces become readable. Schematic logoi offer a language through which the world’s relations can be interpreted. They bring philology and mathematics into a shared practice: the attentive reading of the layered traces through which the world continually announces itself. One might call this practice a philology of the news of the world. *At the shore of relations*, then, names a present that is not given, but happens—where relations touch without necessity.

One might speak, in this sense, of a vernacular grammar—not of words, but of operations through which relations become sayable. Such a grammar does not begin with subjects and actions, nor with causes and effects. It begins with traces: with what appears, is noted, and can be followed. Its units are not propositions but articulations—schematic logoi that allow relations to be recognized, compared, and carried across contexts. The loom and the ledger name two complementary registers of this grammar: one in which relations are woven through continuous attention, another in which they are inscribed as occurrences that can be revisited. Within such a grammar, agency no longer resides in the imposition of meaning, but in the capacity to notice, to sustain attention, and to let relations stand.

