ESSAY FOR A COSMOLOGY OF INVERSION

by Christian Waldvogel

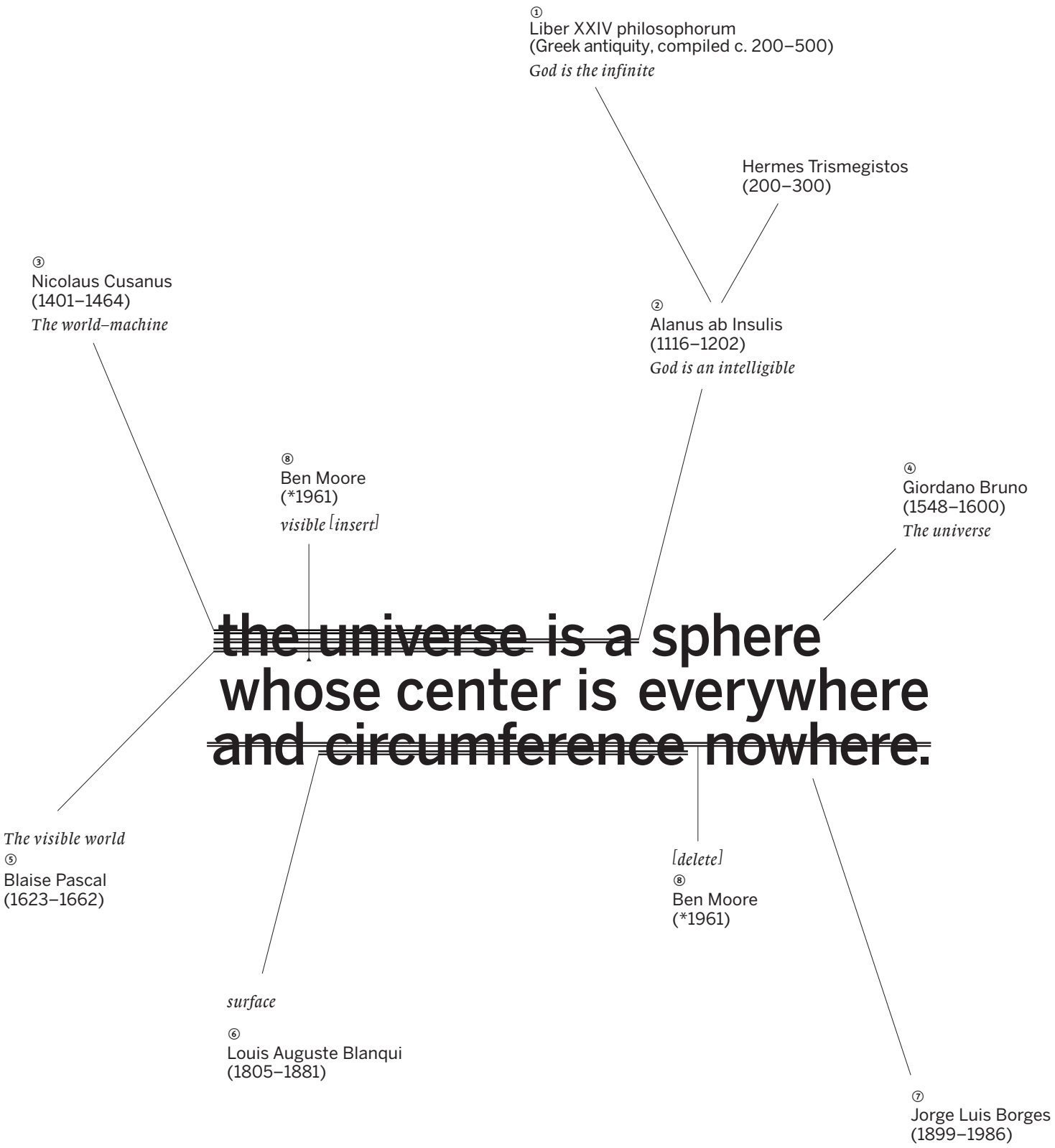
①
Liber XXIV philosophorum
(Greek antiquity, compiled c. 200–500)
God is the infinite
Hermes Trismegistos
(200–300)
③
Nicolaus Cusanus
(1401–1464)
The world–machine
②
Alanus ab Insulis
(1116–1202)
God is an intelligible
⑧
Ben Moore
(*1961)
visible [insert]
④
Giordano Bruno
(1548–1600)
The universe
~~the universe~~ ~~is a~~ sphere
whose center is everywhere
~~and circumference nowhere.~~
The visible world
⑤
Blaise Pascal
(1623–1662)
[delete]
⑧
Ben Moore
(*1961)
surface
⑥
Louis Auguste Blanqui
(1805–1881)
⑦
Jorge Luis Borges
(1899–1986)

fig. 1 **(0)**

(1)

In *La esfera de Pascal*, the Argentinean writer Jorge Luis Borges sketches «a chapter in a universal history [which is perhaps] the history of a few metaphors.»⑦ Writing near the end of a two-decades-long process of slowly turning blind, he examined the recurrence of an image he had repeatedly encountered in the scientific and philosophical canons of antiquity and the Renaissance:[1] the image of an impossible sphere used to describe the shape of the Universe.

Borges' work centered on the fundamental[2] questions: on humanity itself, its world, and its culture. He deliberated on the nature of time, on dreams, reality, imagination, religion, the sciences, encyclopedias and other means of storing and accessing knowledge, on love, anger, hate, (not) being a parent, on language, oral and written traditions, storytelling, the truth, phantasy, legends and history, on rules, laws, crime, violence and ethics.

(2)

A lifelong reader, I took Borges' baton and tracked the progression of *The Universe is a sphere [...]* along a relay spanning almost two Millennia. Using the universal access to facsimile documents granted by today's electronic libraries, I was able not only to verify Borges' quotes and sources, but to find additional instances, and to add yet another layer to this palimpsest.

Since its first documented occurrence in the second century AD, this statement has been repeatedly adjusted to reflect the philosophy and cosmological model of the time while maintaining its provenance in geometry. *God* became *the world-machine*, then *the Universe*, intermittently *the visible world*, before turning into *the Universe* again in Borges' writing. (see fig. 1)

Upon my request, astrophysicist Ben Moore⑧ followed the model of all those who had used the image of the impossible sphere to describe the shape of the Universe—according to his state of knowledge. He was the only scientist to introduce a physically significant change, specifying that the image describes only a part of the Universe, the *visible Universe*, and that therefore much more must exist. (see fig. 1, ⑧)

If the impossible sphere describes only a part of the Universe, then the image of a sphere—a dedicatedly finite shape—does not seem to be ideal, even when altered to a sphere whose center is everywhere and circumference nowhere. And yet it is as close to what we see and know as we have got over the past two thousand years and more.

(3)

The diagram (fig. 1) can be read as a *version history* of the image that also reflects the development of the sciences: from religious philosophy and geometry to mathematics, physics, astronomy, and cosmology. At the same time, and maybe more importantly, the concurrent dilution of the role and rule of religion becomes evident: from providing the guidelines for ethics, society and health, a meaning to life and death as well as soothing knowledge about the workings of the Universe, religion progresses towards being a hermetic structure built on belief and doctrine, disconnected from reality, which is increasingly governed by the insights provided by science. This process is mirrored in the succession of scholars who

1 —— During his tenure as a librarian at Argentina's National Public Library, Borges read and memorized vast parts of the library's inventory before losing his eyesight to an inherited genetic condition. Ironically, he returned to the library to become its director when he was fully blind.

2 —— Having lost his visual connection to the world and left without the ability to either read or write, Borges dictated most of his essays, short stories, musings, and poems. Using the vast fund of knowledge he retained in his mind, he established an almost entirely internal or 'virtual' *modus operandi* that was reduced to the three possibly most fundamental fundamentals: *memory*, *the mind*, and *thought*.

quoted and re-interpreted *The Universe is a sphere […]*: from priests, gods (Hermes Trismegistos), and philosophers to heretics, natural philosophers, intellectuals, and cosmologists.
Ultimately, the diagram reveals how the sciences, philosophy, religion, and technology have shaped our ways of living through the ages. By initiating discussions and providing fundamental knowledge, these disciplines informed (and continue to inform) everyone's everyday life.
The diagram also shows how the formation of natural science is intricately linked with our drive to comprehend the shape and nature of the Universe, and how geometry was the science deemed adequate to describe what was thought to be the realm of the gods.

(4)
Geometry originated in the study of idealized forms[3] like straight lines and circles, forms that could be found in nature—in the maritime horizon, a piece of tensioned yarn, or a drop of blood.
Abstract shapes were drawn, the investigation of their inter-relations led to discoveries like the Pythagorean theorem or an approximation of Pi. Patterns were generalized. The straightness of a ray of light or the curvedness of an orange were investigated and parametrized. Fundamental shapes like plane, cube and sphere were isolated or found, followed by more complex ones like the Platonic polyhedra or solids of revolution.

(5)
Geometric configurations are quantified using parameters like length, angle, radius, or circumference. Proportion describes the relation between two compatible parameters, and the search for 'ideal' or 'beautiful' proportions was one of the fundamental aims of the early geometers. It might be noteworthy that the discovery of both the golden ratio and the Platonic solids roughly coincides with the source texts in the *Book of the XXIV Philosophers* and its postulate *The Universe is a sphere […]*. (see fig. 1, ① and source texts in the annex)

(6)
Proportion is a property of everything geometric, but geometry is not limited to what is visible. Electric fields can be described in geometric terms, as can gravity and everything that is wave-like, for example the disturbances in air we perceive as sound. If the frequencies of such waves are organized according to a system of proportions[4] we may talk about *music*, which in turn is one of the fundamental achievements of humankind: art.

(7)
While music—in its more traditional, non-avant-garde form—is based on a system of proportions, all other kinds of art make use of proportion in one way or another as well: abstract painting in an obvious, geometric manner, figurative painting and portrait photography in a more disguised one, and literature, theater, film, and performance in terms of timing and spacing, to name only a few examples.
Using the musical systematization of proportions and sometimes breaking its rules[5] an artist can convey what cannot be expressed using other media, and what would be impossible to grasp for an audience.

3 —— The strategy of simplifying and generalizing things, of reducing problems to less complex, more elementary problems, of looking for abstraction to gain insight and overview is common not only to all sciences, but to all of human behavior. Geometry is therefore a natural science that is natural to human beings.

4 —— A fundamental concept of western music is the *well tempered tuning*, in which the notes' frequencies are proportionally spaced by function of the 12th root of 2.

5 —— The *blue note* is tuned between the major and minor third of well tempered tuning. Its tonal resemblance to the into-

Every art form and every medium has its advantages and shortcomings, as do the different branches of science.
Visual art in turn may use matter that reflects light waves in a specific manner (paint on canvas) to provide a colorful visual sensation. The way we perceive colors—their wavelength range being defined by the wave-lengths our optical organs are able to compute—is a result of our evolution in the vicinity of a star with certain characteristics.[6] Similarly, the range of pressure fluctuations that our auditive organs compute to create aural sensations is a function of the composition of our atmosphere and earth's gravity.

(8)
Just as we are able to perceive art in the form of matter (painting, sculpture, theater) or waves (sound, light), we describe the Universe as a system consisting of matter (Relativity) or waves (Quantum Mechanics). And just as these two approaches have (yet) to be unified with each other, it is extremely rare to find a piece of visual art informed by music (or a musical composition inspired by a piece of visual art) that is better or more successful than the work by which it was informed.
The translation from one system to another, possibly incompatible system poses extraordinary and sometimes insurmountable difficulties, like trying to express a dream by means of architecture or forming a sphere from a sheet of paper.

(9)
In *The Large, the Small, and the Human Mind*,[9] Roger Penrose argues that the key to the reconciliation of Relativity and Quantum Mechanics is the human mind—just as it is in the analogous problem from the art world discussed above. As artificial intelligences and 'learned machines' make rapid progress, the creation of such a *Grand Unified Theory* seems in reach. Computer networks have gained and continue to gain an (almost) all-encompassing knowledge from having immediate access to (almost) all of humankind's scientific and cultural output from antiquity to the present. Computers are able to instantly iterate through vast possibility matrices.[7]
So is an idea simply the recognition of an unexpectedly appropriate ('original') set of parameters in a possibility matrix? If that is so, then computers will one day be as smart and creative and visionary as the best of us.[8] If not—if the detection of a superior parameter combination isn't a part of the actual idea, but only part of the *communication* about this idea—then the creation of new concepts and new understanding will remain exclusive to the realm of the human mind, which in that case may indeed be the most fundamental of all fundamentals. (see note 3, Borges' modus operandi)

(10)
If it weren't for language: Ludwig Wittgenstein famously described the boundary of one's world as being set by the extent of one's language.[10] We think *in language*, be it a mother tongue, a second language, symbols, numbers, music, images, scents, tastes—all of which are organized in systems of their own. Besides

---

nation of someone speaking of sad things is owed to the origin of Blues music — to which it is characteristic — in American slavery.

6 — This idea was brought to my attention by astrophysicist Ben Moore (see ⑧).

7 — See Google's AlphaGo software-based Go player, and what happened when it started playing against a copy of itself (nature.com/news/self-taught-ai-is-best-yet-at-strategy-game-go-1.22858).

8 — This is the position of thinkers like Ray Kurzweil, Noam Chomsky, and Marvin Minsky. Other authorities in the field, like Stephen Hawking, Bill Gates, and Elon Musk, do not have to determine whether AI can be truly intelligent, but warn of the possible implications of AI going haywire (futureoflife.org/ai-open-letter). An AI with a mission poses a threat unless it is able to have ideas. A computer scientist who doubts the possibility of purely software-driven artificial intelligence is Rolf Pfeifer, who argues that the body, and its interaction with the physical world, is essential to true intelligence.

being our primary means of interaction, a language is a vehicle for information storage based on a system of meanings, sound, (design) rules, and their notation. When we study, ponder, daydream or dwell in a semi-somnolent state, our subconscious transposes electro-chemical processes into one of the notational systems in which our individual consciousness is proficient.[9] Out of the pool of available systems, both the conscious or the subconscious may select the notational system in which we 'visualize' a thought or an idea. This is how and why we may wake up from sleep hearing a melody we hadn't known before.
A composer like Johann Sebastian Bach probably envisioned (or *'enaudited'*, or *'encalculated'*) his music both in terms of notes creating sound and a specific mood as well as in terms of frequency proportions, geometric structures, and text. All of the notational or linguistic systems in which our thoughts can become 'palpable' have their inherent advantages and limitations, and they are different for each individual. This is why different art forms and media exist, why interdisciplinary teams often find unexpected solutions, and maybe why Esperanto never took off.

(11)
In *La Biblioteca de Babel*,[11] Borges describes an infinite library containing an infinite number of books, all of which are equal in size, page count, and the number of characters per page. Since the letters appear to be set in a random fashion—representing all possible permutations of characters on pages in books—most of the books don't convey any understandable information to their readers. Rarely patterns are found, maybe the readers fail to recognize the language of a text. But since—metaphorically speaking—every thinkable text can be written using the twenty-six characters of the Latin alphabet, the infinite library inevitably contains every text ever written, every text that ever will be written, and countless almost identical copies of each (think of typos taht we skip without noticing). Consequently, one may also find the theory unifying Relativity and Quantum Mechanics, although possibly written in an as yet undiscovered language. And there will be at least one book whose conclusion is 42.[10]

(12)
Borges' fictitious library is, of course, a metaphor for the infinite Universe; it contains everything immaterial. Since questions and problems are immaterial as well, a solution must exist to every problem and an answer to every question. Finding them is *'just'* a question of making connections in a possibility matrix and in the right order, and detecting the parameter set that represents the solution(s). In addition, one needs to understand the language in which the problem is presented, and possibly other languages in which the solution might be found.

(13)
Unfortunately, it is not that simple, not all problems are soluble. A simple question one asks a child—«Are you a naysayer?»—does not present the child with a satisfactory answer. Linguistic-logical constructions like the raven paradox pose similar problems, as does the question how space could have sprung into existence at every point in space at the same time, without previously having occupied any space at all. To make things worse, the term 'previously' doesn't even make sense in this question—it would be like asking «What happened before the Big Bang?»: the system to which 'before' and 'previously' refer–time–was

9 —— Examples for such notational systems are languages, facial expressions, eye contact, music, mathematics, logic etc.

10 —— 42 is the «Answer to the Ultimate Question of Life, the Universe and Everything», according to Douglas Adams' Hitchhiker's Guide to the Galaxy. Incidentally, according to Clement of Alexandria (c. 150–215), 42 is also the number of books contained in the Greek god Hermes Trismegistos' library of all things, in which we also find *The Universe is a sphere [...]*. (see fig. 1)

created in/at/with/during/by the Big Bang itself. A paradox again, a loop of some sort, an inversion, an impossible sphere.

(14)
String theory, Multiverses, and Quantum Mechanics may prove a solution space to paradoxes involving multiple simultaneously co-existing outcomes. The seeming indifference a quantum exhibits when passing through a setup of slits and detectors hints (in my mind) at the possibility that the way we perceive our world—as a system with a determined past and a single realized or implemented future outcome—is incomplete. Maybe the *naysayer paradox* could be solved if we had mastered human-scale quantum behavior.

(15)
Another paradox resonates between logic, philosophy, and mathematics: in the concepts of *infinity* and *zero*, which occupy both ends of the scale containing all positive numbers.

– Zero has both a symbol (0) and a numerical quantity value, which is the 'numerical quantity value of nothing'.[11] Zero is the distinct contrary of the presence of a quantified numerical quantity value.
– Infinity has a symbol assigned to it (∞), but no numerical quantity value. It cannot be represented using numerical quantity values, its quantity value is the ontological absence of a numerical quantity. Therefore, infinity is the contrary of a number, it stands for the impossibility of a numerical solution space. Impossibility is the same as zero probability, and zero probability results in absence.
– The absence of a numerical solution space prevents any numerical quantity from being specified (∞)—and this is the same as the contrary of the presence of a numerical quantity value (0).

From a logical point of view, zero and infinity are the same, as argued above. From a philosophical point of view they are too: points that can be transmutated into one another by an inversion of some kind. From a mathematical point of view, however, they are not the same, they are the maximum and nothing. But they have a similar function: both are substitution variables used to circumvent the failure of certain calculations caused by system-inherent paradoxes such as those presented in *The Universe is a sphere whose center is everywhere and circumference nowhere*. But 'everywhere' means 'the maximum', and 'nowhere' means 'the minimum'–and the question that is addressed is a philosophical one.

(16)
The philosophers of Greek antiquity described the nature of the Universe using an impossible geometric shape that resulted from a mysterious transformation, a transformation that probably could best be understood by imagining an inversion[12] of some kind. We can picture how the center of the sphere was split up and distributed evenly in space, and how the circumference was projected into an invisible infinite, or into the dimensionless point at the location of the former center. But we don't have a name for the resulting geometric object, nor can we describe its shape *(yet)*.

(17)
The 'world' in which the geometry of the Greek scholars took place is what today we call Euclidean geometry, it is based on the two-dimensional plane and embedded in three-dimensional Euclidean space.

11 —— The distinctly marked presence of a quantity value representing 'absence of a quantity' is similar to the fact that the vacuum of interstellar space is not nothing, but just (ideally) devoid of everything.

12 —— The geometric inversion of a three-dimensional shape is achieved by radially mirroring all its vertices about a *horizon*: a sphere whose radius ideally is half the polar radius of the bounding volume of the shape. In a regular inversion, the shape and the horizon are center-aligned, and the volume of the resulting shape are negative.

The fundamental shape of Euclidean geometry is the two-dimensional plane. It describes the spatial orientation of a surface in space, defined by two parallel or intersecting lines. As the name says, it is flat, and it has no boundaries. It extends towards infinity on all circumferential sides, but it has zero height. It does not occupy any of the infinite space in which it is embedded.

(18)

The sphere, too, is a basic two-dimensional shape, but contrary to the plane it defines a volume. This means that when embedded in Euclidean space, the sphere is a three-dimensional object, whereas its local geometry (the 'world' being the surface of the sphere) is two-dimensional. But because this surface is curved rather than flat, its local two-dimensional geometry is *non-Euclidean*, and called *spherical geometry*.
The sphere results from bending the plane downwards on all circumferential sides until the plane's infinite circumference becomes sufficiently compressed to form the south pole of the sphere:

- the origin of the plane becomes the north pole of the sphere
- the lower half of infinite space will be compressed to become the interior of the sphere
- infinity towards below will be compressed to become the center of the sphere
- the upper half of infinite space will be pulled and stretched around to encompass the sphere
- the resulting sphere will have a constant positive curvature and an unspecified radius of half the distance between zero and infinity.

Ultimately, this means that the plane is already a sphere even before being transformed—albeit a sphere with an infinite radius. And that the geometry of an infinitesimally small area on the sphere is nevertheless Euclidean geometry.

(19)

If one bends the plane the other way, applying negative (convex) curvature, the local (Euclidean) geometry will be transformed into hyperbolic geometry. This transformation is best imagined by inverting all aspects of the transformation of the plane into the sphere while keeping in mind the mechanics of geometric inversion (see note 12).
The resulting shape, which is the contrary, or opposite, or inversion of the sphere, and consequently fundamental to hyperbolic geometry, shall be called the *spherene*:[13]

- the plane's infinite circumference defines the undefinable radius of the horizon of the geometric inversion (see note 12)
- the origin of the plane remains in place as the origin of the *spherene*
- the lower half of infinite space will be stretched around to encompass the former infinite circumference
- infinity towards below will be stretched around all sides to become infinity towards all sides
- the upper half of infinite space will be contained in the former lower half of infinite space
- infinity towards above will be the infinite boundary of the former upper half of infinite space, now contained in the former lower half of infinite space
- the *spherene* will have constant negative curvature.

13 —— «*Spherene*» is a coinage that alludes to *sphere* (the antipode of which it is), and to *serene* (a «tranquil and untroubled expanse of clear sky or calm sea»).

Such an arrangement of different infinities encompassing one another appears sufficiently plausible if you imagine these infinities as interweaving in some way: they share infinite space while remaining separated from each other. This allows for further conjectures:

– the *spherene* fills infinite space
– it is infinite periodic
– it bisects space into two equal parts.

(20)

– The plane is the fundamental shape of Euclidean geometry, it is flat and bisects space into equal upper and lower halves.
– The sphere is the fundamental shape of spherical geometry, it is convex (positive curvature), and it bisects space into inner and outer parts of equal volume.
– The *spherene* is the fundamental shape of hyperbolic geometry, it is concave (negative curvature), and it bisects space into two separate, interwoven, congruent spaces ('labyrinths'[14]), or 'left' and 'right'.

(21: 50% of 42)[15]

Since the plane is already an infinite-radius sphere even before the Euclidean-to-spherical transformation (see (18)), the plane is a *spherene* too, even before the Euclidean-to-hyperbolic transformation. Accordingly, the geometry of an infinitesimally small area on the *spherene* is Euclidean geometry.
The *spherene* fills infinite space, it is therefore infinitely large. Analogous to the undefinable radius of the fundamental shape of spherical geometry, the cross section of a corridor in the spherene can't be specified. The ratio between infinite space and the finite size of Earth and her surroundings (the solar system for example) is infinite—the same is true for the ratio between the cross section of a corridor in the *spherene* and the size of the solar system. In this ratio, the finite dividend that represents our reality can assume any numerical quantity value without altering the ratio. The smaller the dividend, the *'less hyperbolic'* its local geometry. Being finite, and thus having a numerical quantity value, it can never become infinitesimally small.[16] Local geometry in the dimension of Earth compared to the dimension of infinite space can't be truly Euclidean—neither on the sphere nor in the *spherene*—but almost.
But still we can imagine the Universe as an infinitely large *spherene*, so large that on the scale of the Earth the hyperbolic properties of the *spherene* are sufficiently diluted to appear Euclidean.

(22)

To go from a sphere whose center is at the center and whose circumference is at the periphery to a sphere whose center is everywhere and circumference nowhere is like going from the fundamental shape of spherical geometry to the fundamental shape of hyperbolic geometry.

---

14 —— Borges would have been thrilled to learn that the impossible sphere—the *spherene*—actually is a pair of labyrinths: «I imagined a labyrinth of labyrinths, a maze of mazes, a twisting, turning, ever-widening labyrinth that contained both past and future and somehow implied the stars.» in *The Garden of Forking Paths*, 1941.

15 —— By postulating the *spherene* as the shape of the Universe, (21) quite fittingly provides the first half of the «Answer to the Ultimate Question of Life, the Universe and Everything» (see also note 10). The material concerning the second half of the answer—the parametric description of its geometric form—is what clutters the author's other desk.

16 —— A finite operand has a numerical quantity value, which can't be transformed into the «ontological absence of a numerical quantity» (see 15). Therefore, it can never become infinitesimally small, which is infinity towards zero (but never reaching it), and which therefore follows the same logic as infinity.

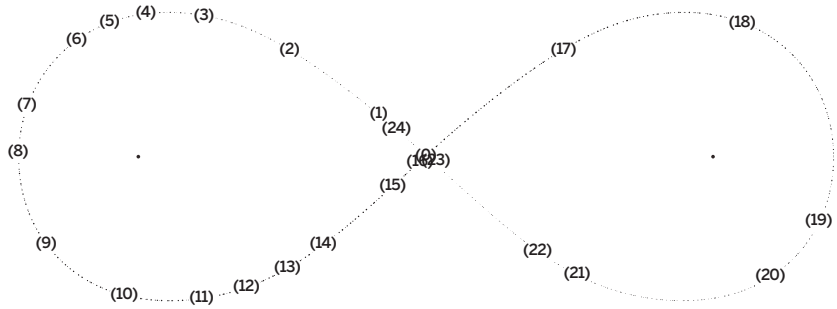

fig. 2
The argumentative structure of this text assumes the form lemniscate loop.

(23)

If the *spherene* can be found, and turns out to be the shape of the Universe, then Trismegistos, ab Insulis, Bruno, Cusanus, Pascal, Borges, and Moore may all have been right—for two-thousand years. The fundamental question about the shape of the Universe would have been solved based on imagining a dream-like, paradoxical form—and by philosophers and scientists alike.

(24)

The chain of associations in this essay,[17] which progresses from one fundamental aspect to the next, and ultimately takes the shape of a *lemniscate loop*, allows for the conclusion that each fundamental rests (or builds) on another, and that in all but exotic cases fundamentals cannot exist without other fundamentals. Our minds, our perception, and our knowledge are interdependent systems that at some point flip back onto themselves, like inversions, rings, and *spherene*s. We work with errors, think in blurry allusions, iterating towards clarity, only to find the next question behind the latest answer. cwa, 01/22/2018

fig. 3
The way we think, (c)2015

17 —— The infinite loop of fundamentals presupposing other fundamentals presented here is just one of many that are imaginable, and it can be started anywhere:

— insight needs science needs art needs language needs code systems needs the human mind needs ideas needs (artificial?) intelligence needs time needs zero needs infinity needs a Universe needs geometry needs insight and so on.

Or:

— humanity needs evolution needs mutable DNA needs time needs reproduction needs love needs trust needs honesty. needs unambiguity needs ethics needs logic needs a mind needs a human needs humanity and so on.

References

①

Ο Θεός είναι μια κατανοητή σφαίρα του οποίου το κέντρο είναι παντού και του οποίου η περιφέρεια είναι πουθενά.

2nd definition of God, in: *Liber XXIV philosophorum*, compiled ca. 200–500.

While the contents of the book bear likelyhood to the writings of *Pseudo–Dionysius Areopagita*, *Aristoteles*, *Plotin*, *Proclus*, *Augustinus*, *Macrobius* and *Eriugena*, no authorship has been confirmed. Its attribution to *Hermes Trismegistos* is most likely a product of fiction.

②

Deus est sphaera intelligibilis cuius centrum est ubique et circumferentia nusquam.

Alanus ab Insulis: *Le sermon sur la sphère intelligible*, c. 1177

③

Vnde erit machina mündi quasi habens ubique centrü, & nullibi circumferentiam: quoniam circumferentia & centrum deus est.

Nicolaus Cusanus: *De docta ignorantia*, Book II–12, p39, 1440

④

Sicuramente possiamo affirmare che l'universo è tutto centro, o che il centro de l'universo è per tutto, e che la circonferenza non è in parte alcuna, [...]

Giordano Bruno: *De la Causa, Principio, et uno*, Dialogo 5°, p241, 1584

⑤

Quoted from Borges' *Other Inquisitions 1937–1952*, 1952:

[Le monde visible] est une sphère infinie dont le centre est partout et la circonférence nulle part.

Blaise Pascal: *Pensées sur la religion et sur quelques autres sujets*, Section XII, p66, 1671

⑥

L'univers est une sphère dont le centre est partout et la surface nulle part.

Louis Auguste Blanqui, *L'éternité par les Astres*, p5, 1872

⑦

Jorge Luis Borges, *La esfera de Pascal*, in *Otras inquisiciones*, 1952.

It is the German translation of this text that has inspired the work you are reading.

⑧

Prof. Ben Moore, in a discussion with the artist, 2014
www.ctac.uzh.ch/research/groups/moore.html

⑨

Roger Penrose, *The Large, the Small and the Human Mind*, Cambridge University Press, 1997.

⑩

[German] «Die Grenzen meiner Sprache bedeuten die Grenzen meiner Welt», in Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, 1918

⑪

Jorge Luis Borges, *La biblioteca de Babel*, in *Ficciones*, 1944

Figures

fig. 1:
The Universe is a Sphere whose Center is Everywhere and Circumference Nowhere

(c)2014 Christian Waldvogel/ProLitteris

fig. 2:
Lemniscate loop

(c)2018 Christian Waldvogel/ProLitteris

fig. 3:
this is why you can understand this [...]

(c)2015 Christian Waldvogel/ProLitteris

Credits

Text, figures, layout and typesetting:
Christian Waldvogel

Copyreading:
Nina Hausmann (Tradukas)

Contact:
Christian Waldvogel

+4178 621 1824
hochnebel@waldvogel.com