

# Gödel's holistic ontology - the foundation of science on an exact theory of metaphysics

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- 1) Characteristics of Gödel's metaphysics
- 2) Gödel's conceptual and mathematical realism
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  - 2.2) New concepts and principles of maximality
- 3) Gödel's space-time models and the non-existence of time
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- 5) Gödel's holistic ontology and the foundation of science on an exact metaphysics of absolute infinity

# 1) Characteristics of Gödel's metaphysics

## Gödel's Metaphysics and Its Foundations

- Gödel's Life's Work: Development of a comprehensive system of the sciences on a fundamental metatheory that he described as an exact theory of metaphysics
- Interdisciplinary Scope: Positioned at the intersection of philosophy, mathematics, logic, and theology.
- Influence of Leibniz: "exact theory of metaphysics, presumably in the form of a monadology." (Wang, 1997, p. 8):
  - ▶ the „theory is a monadology with a central monad (namely, God) [addition by Hao Wang]“. It is like the monadology by Leibniz in its general structure.

# 1) Characteristics of Gödel's metaphysics

- Influence of Husserl's phenomenology (Wang, 1997, p. 8):
  - supports the primacy of the mind
  - provides the connection between concepts, mathematical ideas, and their real effects
- Gödel gives a classification of worldviews divided into two fundamental orientations (Gödel, 1961, p. 374):
  - toward metaphysics and religion ⇒ idealism and optimism
  - away from metaphysics and religion ⇒ skepticism, positivism, empiricism, and thus materialism and pessimism
- Gödel's metaphysics is „rationalistic, idealistic, optimistic, and theological“.

# 1) Characteristics of Gödel's metaphysics

- In Leibniz's system: all monads are based on the *Urmonade* – God – described as **absolutely infinite** (Leibniz, 1998, pp. 33-37)
  - ▶ with his reliance on monadology, Gödel adopts **absolute infinity** as the basic ontology for his exact metaphysics
- Central role of absolute infinity underlies Gödel's
  - ▶ conceptual and mathematical realism,
  - ▶ analysis of space-time,
  - ▶ argument against the objective existence of time,
  - ▶ ontological proof of God

## 2) Gödel's conceptual and mathematical realism

- Mathematical concepts are accessed through intuition, not empirical perception (Bedürftig & Murawski, 2010, p. 16).
  - ▶ Intuition acts as an additional sense, giving access to an abstract world, independent of direct spatiotemporal realm (Gödel, 1953, version III, pp. 353–354).
  - ▶ Gödel has a form of Platonic realism, though not strict Platonism.
- Mathematics (like physics) is based on axioms with real content (Gödel, 1944, p. 132); mathematical truths are grounded in intuitive concepts, not conventions (Gödel, 1953, pp. 357-358).
- And: regarding concepts he makes the distinction between:  
“Thing/entity” vs. “whole/unity” → important for set formation and *closure principle* (Wang, 1997, p. 295).

## 2) Gödel's conceptual and mathematical realism

- Intuition has two aspects (Gödel, 1953, p. 357-360):
  - ▶ Connected to reality → laws of nature are mathematically expressible.
  - ▶ Grounds abstract, syntactic structures → needed to justify formal systems.
- Mathematical objects are transcendent: theories and axioms capture them only incompletely.
  - ▶ This is similar to Kant (conceptual structures vs. objectivity), yet Gödel rejects Kant's subject-dependence (Bedürftig & Murawski, 2010, p. 115).
- Gödel aligns more with Husserl's phenomenology – and his method of eidetic reduction – , expecting it to yield new mathematical concepts, especially in set theory (Bedürftig & Murawski, 2010, p. 116; Wang, 1997, pp. 156-157).
- Eidetic reduction: recursive intuition grasps essences by bracketing subjective presuppositions (Husserl, 2006, p. 222; 2013, p. 281) → leads to the result that we are all able to arrive at the same concepts (Gödel, 1944, and the accompanying commentary)

## 2) Gödel's conceptual and mathematical realism

- This view aligns with contemp. psychological perspective: concept formation occurs through figure–ground differentiation at all levels → concepts differ by content, not structure (Mühlenbeck & Jacobsen, 2020; Mühlenbeck, 2022b).
    - Implies: mathematical concepts (sets, classes) also arise on different levels of abstraction
  - Husserl's distinction (Husserl, 1900, chap. 2):
    - Pure logic → a priori laws; independent of empirical consciousness
    - Applied logic → mental content
    - The connection between them: Intentionality → linkage of concepts with worldly content (Husserl, 1900, p. 101; 1988)
- Corresponds to Gödel's realist view of mathematical objectivity.
- Intuition + intentionality → allow access to multiple levels of abstraction:
    - From (concrete) empirical objects → to normative structures → to fundamental conditions underlying mathematical and conceptual reality.

## 2.1) Concepts of sets, points, and the continuum

### Set Theory and the Continuum Problem

- Gödel (1939) and Cohen (1963) proved that the Continuum Hypothesis (CH) is independent of ZFC.
- Gödel (1939): used the inner model  $L$  and axiom of constructibility  $V=L \rightarrow$  showed GCH holds in  $L$  and ZFC+CH is consistent (assuming that ZFC is)
- Cohen (1963): constructed with *forcing* a larger model where CH is false
  - CH is undecidable in ZFC.
- In the current system:
  - no final ordering of infinities
  - an infinite hierarchy of infinities that cannot be fully described by current axioms

## 2.1) Concepts of sets, points, and the continuum

- Gödel (1947):  $L$  not meant as an alternative theory; only to show compatibility of ZF, AC, and GCH (Bedürftig & Murawski, 2010, p. 228).
- rejected restricting set theory to definable sets; argued for extensions by large cardinals, strong axioms of infinity, esp. Mahlo-type axioms as natural extensions (Gödel, 1947, p. 520).
- Believed CH-problem would eventually be solved by new axioms (Gödel, 1947, p. 524).
- „Independence of CH acceptable only for intuitionists; a realist must assume CH is either true or false, and ZFC is incomplete“ (Gödel, 1947, p. 520).
- Continuous conceptual growth: flexible notions of “sets” and “properties of a set” will generate new axioms affecting CH (Gödel, 1947, p. 520 fn. 17).

## 2.1) Concepts of sets, points, and the continuum

### Concepts of sets and classes

- Russell's paradox → led to distinction: sets vs. proper classes →  $V$  must be a proper class
  - NBG set theory (Bernays 1937, 1976; Gödel 1940; Neumann 1925, 1928):
    - Large sets preserved,
    - Classes resolve antinomies, enabling open structures.
- Gödel: the universal class  $V$  follows a principle of maximality (Wang, 1997, p. 262).
  - Consequence:
    - Set-theoretic universe is open both outward (large cardinals) and inward (infinitesimals) (Bedürftig & Murawski, 2010, p. 187).
    - Early indication of internal and external unboundedness of the continuum.

## 2.1) Concepts of sets, points, and the continuum

### Continuum: different concepts

- Homogeneous continuum:
  - ▶ Indefinite, inexhaustible, infinitely divisible → absolute infinity (Bedürftig & Murawski, 2010, pp. 157, 174–175, 186).
  - ▶ Corresponds conceptually to the universal class, cannot be captured by large cardinals or infinitesimals
- Discrete point-continuum (sets):
  - ▶ Formed through operations within the homogeneous continuum, depending on it as constituting background.
  - ▶ Real numbers  $\mathbb{R}$  have no intrinsic continuity: are treated as discrete points (Bedürftig & Murawski, 2010, p. 186).
- Gödel argued for principle of maximality: „the set-theoretic universe behaves unified, does not fundamentally change when moving from smaller to larger sets“ (Wang, 1997, p. 281) → mutual correspondence.

## 2.1) Concepts of sets, points, and the continuum

### The Need for New Concepts

- Unresolved problems (e.g., CH) require new axioms grounded in a deeper understanding of logical–mathematical concepts (Gödel, 1947, pp. 520–521).
- Goal: concept unifying both set formation and its meta-level conditions → moving toward system completeness.
  - ▶ Gödel’s note: “class (= absolute)”; Wang (1997, p. 315) identified this with the universal class, linked to idea of Cantor.
  - ▶ Points arise from the homogeneous continuum; without it, discrete points would have no independent existence (Bedürftig & Murawski, 2010, p. 157).
- Consequence:
  - ▶ Each point must itself reflect absolute infinity → otherwise the overall infinity would not be absolute.
  - ▶ Gödel’s maximality ideas express this intrinsic–extrinsic infinity relation.

## 2.2) New concepts and principles of maximality

New concept must be comprehensive in capturing (Gödel, 1946, p. 151):

- ▶ the universal class as absolute infinity,
- ▶ strong axioms of infinity,
- ▶ existing set-theoretic axioms.

→ This principle of maximality is: Ackermann Principle & Reflection Principle

- Ackermann principle:  $V$  (the universe of all sets) is fundamentally undefinable—“The Absolute is unknowable.” (Wang, 1997, p. 283) → generalization of the Reflection principle
  - ▶ Ackermann-principle should be the foundation of all set-theoretic axioms (Wang, 1997, pp. 282–283).
- Reflection principle: „the central principle“ (Wang, 1997, p. 283):
  - ▶ Properties of  $V$  are always reflected in smaller substructures.
  - ▶  $V$  can never be fully captured by any structural description, regardless of the logic used (Wang, 1997, pp. 280–281).

## 2.2) New concepts and principles of maximality

### Closure, Non-Closure, and Absolute Infinity

- Closure principle: any set closed under certain operations leads to the existence of a larger, similarly closed set → inaccessible and Mahlo cardinals arise (Wang, 1997, p. 280).
- This implies non-closure of  $V$ :  $V$  is never final or complete.
- Gödel illustrates this through the continuum of points and intervals on a line:
  - ▶ Any line is “coverable by infinitely many intervals of any given length” (Gödel, 1947, p. 523),
  - ▶ cannot be fully captured by points, because “summing up all the points, we still do not get the line; rather, the points form some kind of scaffold on the line.” (Rucker, 2019, p. 82; quoted in: Wang, 1974, p. 86).
- The Ackermann principle thus reflects absolute infinity: even each individual point must be absolutely infinite, otherwise the Absolute becomes definable/restricted.

## 2.2) New concepts and principles of maximality

One axiom of Infinity (Gödel, 1946, p. 151)

- Every formal system gives rise to an unending process of axiom-extensions → into the transfinite
- Gödel proposed:
  - this infinite series of extensions could be captured by one formally decidable and true axiom of infinity (not by a formalism, Gödel, 1951, pp. 308–309) - concerning the magnitude of the universe of all sets
  - could ground all proofs in one extended system, enabling a completeness theorem that would make all set-theoretic statements decidable by tying them to the size of the universe of all sets.
- Gödel believed CH had a definite truth value ( $|\mathbb{R}| \leq \aleph_2$ ) and that GCH is false (Gödel, 1995a; Wang, 1997, p. 252).

## 2.2) New concepts and principles of maximality

From a cognitive perspective:

**Absolute infinity** is captured through one *open concept* and *axiom* – not formalized

- different levels of abstraction: formalization of concrete objects vs. concept of meta-level condition

### 3) Gödel's space-time models and the non-existence of a universal lapse of time

#### Mathematics and Infinity applied to Space-Time

- Gödel links mathematical concepts directly to reality: mathematical structures possess real existence (Bedürftig & Murawski, 2010, p. 114).
- Indispensability principle: because physics presupposes mathematics, mathematical objects must be real in some sense (ibid.).
- Consequence:
  - ▶ the absolute, open infinity of  $V$  must apply to physical reality as well.
  - ▶ With this: Gödel's Platonic realism implies a non-relativity of truth (Wang, 1997, p. 167) and a corresponding form of determinism (Rucker, 2019, p. 168).
  - ▶ But: this determinism remains open due to the unbounded, undefinable Absolute.

### 3) Gödel's space-time models and the non-existence of a universal lapse of time

- Ontological and mathematical identity: the existential relation between entity and being parallels the relation between point sets and the homogeneous continuum.
  - ▶ Being functions as an inexhaustible, non-discrete existential background (Mühlenbeck, 2021; Rucker, 2019, pp. x–xiii).
  - ▶ just as  $V$  “maps” into any interval, each space-time interval contains the same absolute infinity.
- Reason:
  - ▶ Gödel's holism: the connection between logic, mathematics, and empirical science implies that all mathematical structures possess reality (Gödel, 1944, pp. 120–121).
  - ▶ Also: limiting the mathematical description of nature creates a closed system whose own consistency cannot be proven (Gödel, 1931).

### 3) Gödel's space-time models and the non-existence of a universal lapse of time

#### Gödel's Rotating Space-Time Models

- One of Gödel's arguments against universal time lapse: in relativistic cosmology the problem of simultaneity arises (Gödel, 1949a, p. 202).
- Gödel's models integrate empirical findings and his philosophical commitments (Gödel, 1949, 1949a, 1952; Yourgrau, 2023).
- Variants differ in rotation rate and possibility of time travel, but share the same global structure (Ellis & Hawking, 1973; Hawking, 1990).
- Contrary to some summaries, Gödel's universes are not closed in volume:
  - They contain open, infinite world-lines (Gödel, 1949, p. 447; 1952).
- Global rotation gives rise to closed time-like curves, eliminating universal time while maintaining an unbounded universe.

### 3) Gödel's space-time models and the non-existence of a universal lapse of time

→ Due to global rotation, closed time-like curves, and infinite space:

- The superposition of all temporal modalities implies that possibility and contingency exist at every point (see also: Kovač, 2012, p. 331; Yourgrau, 1999, 2005).
  - ▶ Therefore, no absolute or universal time can exist: an infinite plurality of times = no single time.
  - ▶ Space and time belong together - form a single continuum containing all spatial and temporal modalities superimposed.
  - ▶ Absolute infinity of  $V \leftrightarrow$  absolutely infinite space-time; no formalism can fully structure it (Gödel, 1951, p. 309).

### 3) Gödel's space-time models and the non-existence of a universal lapse of time

- Gödel's universe is maximal in structure and possibility:
  - No restrictions in topology and times
  - leads to modal collapse: one maximal world, the possible = the necessary (e.g. Gödel, 1970; Sobel, 2004).
- Collapse is often interpreted as restricted determinism, eliminating free will (Sobel, 2004).
- But: within absolute infinity, all spatial and temporal configurations already exist → freedom is embedded in possibility.

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

### Gödel's Ontological Proof - Absolute Maximality

- Stays in the tradition of Anselm of Canterbury, Descartes, Leibniz → Gödel: Ontological argument infers actual existence from logical necessity (Canterbury 1994, Chs. 2–4; Sala 1990, p. 45).
- God is understood as the maximum “than which nothing greater can be conceived”  
⇒ Goal of the proof: to find **the maximum!**
- Gödel defines God as the maximum of all positive properties (Wang 1997, pp. 114–115).
- Maximality can be considered from set theoretic perspective

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

### Positive Properties, Existence, and the Causal Background

- Positive properties (Gödel, 1995a, pp. 404, 434): „moral aesthetic“ and as „perfective“ and „Being is a perfective“ → „perfective“ not composed attribution
- Gödel's fundamental ontological category: causal relatedness (Kovač 2015; 2020).
  - ▶ Can be understood as „existential relation“
- We remember: all spatiotemporal structures coexist and interpenetrate; no unified space-time frame (Kovač 2012; Yourgrau 1999; 2005).
- Existence is the basic positive property, underlying all others (Wang 1997, p. 116).
- For the maximum of positive properties → the maximum of Being has to be found (Being = synthesis of essence and existence)

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

- ▶ Gödel models the maximum of positive properties with an ultrafilter construction (Benzmüller & Fuenmayor 2020) on all *perfectives of Being* (the continuum of Being).
- ▶ Ultrafilter = maximal filter (Burris & Sankappanavar 2012)
- ▶ Because all possibilities and space-time forms remain open, the ultrafilter is unrestricted.
- ▶ Result:
  - ▶ Maximum of positive properties = absolute infinity, leads to the maximum "than which nothing greater can be conceived."

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

### Modal Collapse & Attempts to Avoid It

- Gödel's axioms are so strong that modal collapse follows → only one possible world exists (Benzmüller & Paleo 2014; Kovač 2012, pp. 327–328).
- Evidence Gödel intended collapse (Kovač, 2012, p. 327):
  - Deterministic comments on time, predictability, and free will (Rucker 2019, p. 168).
  - E.g.: free will compatible with foreknowledge ("one does not deliberately do the opposite of what one wants").
  - In absolute infinity: free will is included in possibilities/times etc.
- Collapse is not presupposed as a premise – it results from the ontological proof (Kovač 2012, p. 328).
- But: attempts to avoid collapse because of the assumption that it restricts free will (e.g. Anderson, Fitting):
  - Modifications target: Definition and domain of positive properties; strength of axioms governing positivity and necessity.

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

Some Modified Proofs, Their Limitations and Why None Preserve Gödel's Absolute Maximum (Mühlenbeck, 2024):

- Anderson's Modification (Anderson, 1990; Anderson & Gettings 1996)
  - ▶ Positive properties remain intensional, but some axioms are weakened
  - ▶ Requires changes to divinity and essence definitions
  - ▶ Avoids collapse, but the weakened filter loses maximality → God no longer the maximum
- Fitting's Modification (Fitting 2002)
  - ▶ Treats positive properties as rigid extensions—properties are only counted, if they hold in all possible worlds
  - ▶ This removes cross-world variability → ultrafilter becomes smaller
  - ▶ Result: no absolute maximum; God becomes extensionally restricted.

## 4) Ontological proof of God: 'The maximum than which nothing greater can be conceived'

### Gödel's Unique Result: The Absolute Maximum

- Attempts to avoid collapse generate restricted worlds with fewer positive properties.
  - any restriction contradicts the concept of God as the maximum.
- Therefore: modal collapse is a necessary outcome of maximality; Gödel's desired result
- Gödel implicitly uses an open, homogeneous concept of set/class—the “new concept” he sought beyond classical discreteness.
- Only Gödel's original proof preserves the absolute maximum—and thereby establishes the absolute infinity of reality (space-time).
- Conclusion: In Gödel's metaphysics, set theory, logic, and ontology converge, fulfilling his project of a formal metaphysics in the form of Leibniz's monadology.

## 5) Gödel's holistic ontology and the foundation of science on an exact metaphysics of absolute infinity

### Gödel's Holistic Ontology: Science Grounded in an Exact Metaphysics of Absolute Infinity

- Unifying Principle: All domains—set theory, mathematics, space-time, ontology—share the same structure:
  - Absolute infinity as foundational ground → unrestricted, evolving infinities built within it.
- Mathematics: Called for a non-discrete, open concept of universal class = absolute infinity.
- Reality & Space-Time: Mathematical structures reflect real ones; Gödel's cosmological models imply an infinitely open, continuous space-time without universal time.
- Ontological Proof: God = maximum of all positive properties, structurally mirroring the maximality of the universal class and the continuum of being (→ space-time)
- Resulting Worldview: A maximally open, relational continuum, grounded in absolute infinity, where mathematics and world stand in mutual correspondence of conceptual intuition and spatiotemporal realization of absolute infinity.

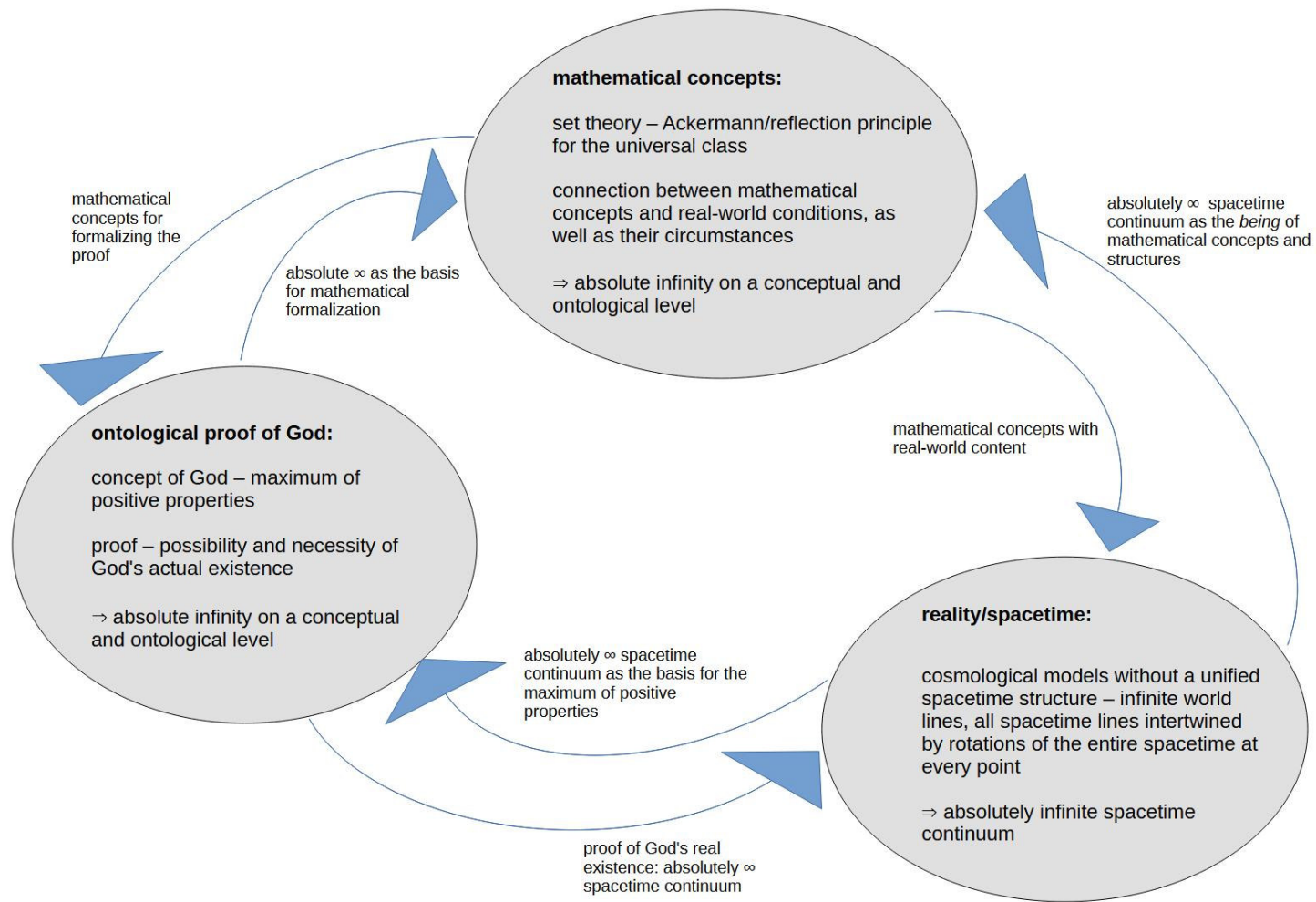


Fig.1: Gödel's holistic ontology based on absolute infinity

Thank you for your attention!

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