

The Vacuum.Net Theory: Definition

A Theory of Everything Stated by Its Own Criterion

J. Konstapel, Leiden

© 2026 J. Konstapel, Constable Research, Leiden. All rights reserved. Quotation with attribution is permitted; reproduction of the whole requires written permission.

Version 2 — 16 October 2026

0. The frame

A theory of everything is expected to do several things:

- cover all phenomena;
- be consistent;
- relate the levels of nature;
- account for its constants;
- recover the established theories;
- predict.

These are expectations, not laws of method. Each rests on a view of knowledge. This definition states its own view first, so that the reader knows the measure.

Measurement. A measurement is not an independent judge. An experiment is designed, run and read within a theory. Its result is a theory-laden reading, not a neutral fact (Hanson, Kuhn; Duhem and Quine).

Criterion. The vacuum.net theory is therefore not measured against single outcomes. It is measured by **interpretability**. Every accepted theory, together with its measurements, can be rewritten in it. A theory T is interpretable in a theory U when a translation carries every statement of T into a statement of U (Tarski, Mostowski and Robinson, 1953).

The translation is fixed. Interpretability alone is cheap if the translation may be chosen case by case. Here it may not. One procedure (Section 6) translates every theory. It is fixed before any case is read, and it leaves no free choice. A rewriting that needs a choice the procedure does not make is a failure of the theory. This is where the theory can fail, without treating any measurement as a neutral judge.

1. Primitive notions

The theory has four primitive notions:

- **strand;**

- **touching:** the strand meeting itself;
 - **phase:** the state in which the strand returns;
 - **closure:** the return of a configuration on itself in phase.
-

2. Axioms

N1 (Strand). There is one strand. Every distinction is the strand touching itself.

N2 (Closure). What closes in phase stays. What does not close passes on as tension.

N3 (Memory). At every knot the order of the passages is defined. The first passage fixes the orientation to which later passages are related.

N4 (Context). Constants are state functions of the local net.

N5 (Scale). The same winding appears at every depth. What does not close at one depth is the material of the next.

3. Scope

The theory concerns every distinction that stays.

Whatever has received a name in any field — physics, life, mind, language, art, law, economy, history — is such a distinction. A name marks a closure. The scope is therefore not a list of domains. It follows from N1 and N2, and it has no edge.

4. Definitions

D1 (Winding). A part of the strand that returns on itself in phase.

D2 (Knot). A place the strand passes more than once. The observer is a knot: it is part of the strand and meets every passage through its place.

D3 (Mesh). An opening between strands, with a size.

D4 (Trit). An element of $\mathbb{Z}_3$, written $+1$, 0 , -1 . It records how two passages meet.

D5 (Window). Three trits. A window closes when their sum is $0 \bmod 3$.

D6 (Ladder). Every named magnitude q , taken against its natural unit, has a position $p = \log_3 q$. The ladder is the set of positions of all numbers $2^a \cdot 3^b$, with a and b integers. One step of 3 is one winding of three; one step of 2 is one winding of two.

D7 (Rest and closure depth). A pair (n, k) has rest $2^n/3^k$. The closure depths are the k at which the rest becomes smaller than at every earlier k . They are the denominators of the convergents of $\log_2 3$: 1, 2, 5, 12, 41, 53, 306, 665, ...

D8 (Origin). In the physical realisation the natural unit is fixed by hydrogen: $S_0 = 1/(2R_H) = 45.588 \text{ nm}$ and $T_0 = S_0/c = 1.5207 \times 10^{-16} \text{ s}$. Magnitudes in other physical units are first carried to a length or a duration by c and Planck's constant h . S_0 , T_0 , c and h are the inputs of the theory.

5. Theorems

T1 (Nine of twenty-seven). Exactly 9 of the 27 windows close.

Proof. The sum map $\mathbb{Z}_3^3 \rightarrow \mathbb{Z}_3$ is a surjective homomorphism; the closing windows are its kernel, of order $27/3 = 9$. ■

T2 (Two kinds of closure). A window closes if and only if its trits are all equal or all different.

Proof. All equal gives $3a \equiv 0$. All different gives $0 + 1 + 2 \equiv 0$. Two equal and one different gives $2a + b \equiv 0$, hence $b \equiv a$, a contradiction. ■

Every open window joins a pair to a different third value. A seam between two differently closed structures is therefore always open.

T3 (The ladder has no gaps). The positions $b + a \cdot \log_3 2$ lie dense on the line.

Proof. If $\log_3 2 = p/q$ were rational, then $2^q = 3^p$, which is impossible because the left side is even and the right side odd. An irrational step generates a dense set (Kronecker). ■

So between any two positions lie infinitely many others. There is no last depth.

T4 (The lever is a state function). For an observer on a knot that counts the passages it sees, the coupling lever is $\gamma = -(1 + P)/P$. Here P is the probability that the strand returns to a place it has passed.

Proof. Returns are independent with probability P , so the count of passages is geometric. Its cumulants give $\gamma = -\bar{n} \cdot \kappa_3 / \kappa_2^2 = -(1 + P)/P$. ■

γ depends on the freedom of the strand. This is N_4 in exact form.

T5 (Four is two times two). A rotation is two reflections. The rotated object returns after 2π . The rotor that describes it returns only after 4π .

Proof. $R = b \cdot a = \cos(\theta/2) - B \cdot \sin(\theta/2)$. Hence $R(2\pi) = -1$ and $R(4\pi) = +1$, while R and $-R$ move the object identically. ■

T6 (Consistency). The axioms admit a model.

Proof by construction. A single lattice path that crosses itself is one strand (N1). The time order of passages at each place is defined (N3). Its trit windows close or stay open (N2). Its lever depends on its return probability (N4, T4). The trit lattice shows the same transition at every size, which is the scale property (N5). A theory with a model is free of contradiction. ■

6. The translation procedure

The procedure takes one input: a named subject of any field, as that field describes it. It returns, without choice, the subject's place in the net. It has six steps.

Step 1 — Entries. List every magnitude the field uses to define the subject, with the uncertainty the field itself states. Each magnitude is one entry. A subject with three defining magnitudes has three entries. Nothing is selected.

Step 2 — Kind. Each entry is of exactly one kind, read from its unit:

Kind of magnitude	Unit	Role in the net
size	length	mesh
duration, period, age	time	winding (a return takes a time)
motion	length per time	strand
count	a whole number of units	knot (passages held together)
proportion	one magnitude divided by another of the same kind	window (two windings set against each other)
any other physical unit	carried to length or time by c and h (D8)	the role of that length or time

Step 3 — Natural value. Divide a length by S_0 and a duration by T_0 . A count and a proportion are already pure numbers; a proportion is taken as larger over smaller.

Step 4 — Position. $p = \log_3$ of the natural value.

Step 5 — Address. Find the integers (a, b) with $|p - (b + a \cdot \log_3 2)|$ within the field's own uncertainty, expressed as $\log_3(1 + u)$, and with $|a| + |b|$ as small as possible. Ties go to the smaller $|a|$, then to $a \geq 0$. The address is $2^a \cdot 3^b$.

Step 6 — Depth and rest. The depth is $|a| + |b|$, the number of windings of two and three in the address. The rest is the natural value divided by $2^a \cdot 3^b$.

Laws and constants. A law of a field that sets a product of powers of its magnitudes equal to a constant, $\prod q_i^{(e_i)} = C$, becomes a relation between addresses: $\sum e_i \cdot (a_i, b_i) = (a_C, b_C)$. A law states which combination of windings returns; that is a closure. A constant of a field becomes an entry like any other, and by N4 its value is read as a property of the local state.

T7 (The procedure is a function). For every subject with stated magnitudes and uncertainties, the procedure returns exactly one result.

Proof. Steps 1 to 4 are fixed computations. In Step 5 the set of admissible (a, b) is non-empty by T3, and finite for each bound on $|a| + |b|$; a smallest $|a| + |b|$ exists, and the tie rule picks one pair. Step 6 is a computation. ■

Worked cases. Computed by the procedure, with the uncertainty stated in brackets.

Subject	Field	Kind	p	Address	Depth	Rest
octave (exact)	music	proportion 2/1	0.631	2^1	1	1
fifth (exact)	music		0.369	$2^{-1} \cdot 3^1$	2	1

Subject	Field	Kind	p	Address	Depth	Rest
		proportion 3/2				
Pythagorean comma (exact)	music	proportion $3^{12}/2^{19}$	0.012	$2^{-19} \cdot 3^{12}$	31	1
group of about 150 (10%)	sociology	count	4.561	$2^1 \cdot 3^4$	5	0.926
generation of about 30 years (10%)	demography	duration	51.966	3^{52}	52	0.964
Kondratieff wave of about 50 years (10%)	economics	duration	52.431	$2^{-1} \cdot 3^{53}$	54	1.071
Bohr radius (10^{-6})	atomic physics	size	-6.152	$2^{-95350} \cdot 3^{60153}$	155,503	1.000001
year (10^{-6})	astronomy	duration	48.870	$2^{-83710} \cdot 3^{52864}$	136,574	1.0000002

Two things follow from the table.

- **The exact proportions of music sit at their own addresses with rest 1.** They are closures in the strict sense.
- **The depth of a subject depends on the resolution with which its field names it.** A subject named roughly sits shallow: the generation at 3^{52} , the long wave at $2^{-1} \cdot 3^{53}$, next to the closure depth 53. A subject named to six digits sits very deep. By N4 this is expected: the address belongs to the subject together with the state in which it is named.

7. How the expectations are met

Expectation	How it is met
All phenomena	The scope clause (Section 3): every distinction that stays.
Consistency	T6: the axioms have a model.
Relation of the levels	N5: the same winding at every depth, and the remainder of one depth is the material of the next. This is neither pure reduction nor emergence without a common rule.
Self-reference	The observer is a knot on the strand (D2). The ladder has no last depth (T3). The theory

Expectation	How it is met
	includes its own observer and stays open, as a final theory must.
Constants	N4 and T4: constants are state functions. Only the origin S_0 , T_0 is an input (D8).
Established theories	One fixed translation procedure (Section 6), which is a function (T7). It makes interpretability a strong demand: no case may require a free choice.
Prediction	Replaced by fixed interpretability (Section 0). A measurement enters as part of the theory that produced it and is rewritten with it. The procedure gives the address before the case is read.

8. Open

1. **The origin.** S_0 , T_0 , c and h are taken as given. The theory does not yet derive them.
2. **The rate per mesh.** The theory fixes the energy per mesh, not how often it is released.
3. **Translations still to be written.** The forces of nature and the spectrum of particles are not yet rewritten in full; nor are quantum mechanics and general relativity.
4. **Laws of other forms.** The rule for laws in Section 6 covers products of powers. Laws of other forms, such as exponential decay, are not yet given a fixed rule.

References

Tarski, A., Mostowski, A., Robinson, R. M. (1953). *Undecidable Theories*. Amsterdam: North-Holland. *Why read?* The exact notion of one theory being interpretable in another. This is the criterion of Section 0.

Hanson, N. R. (1958). *Patterns of Discovery*. Cambridge University Press;
Kuhn, T. S. (1962). *The Structure of Scientific Revolutions*. University of Chicago Press. *Why read?* Why observation is theory-laden.

Stanford Encyclopedia of Philosophy. "Underdetermination of Scientific Theory." <https://plato.stanford.edu/entries/scientific-underdetermination/> *Why read?* The Duhem–Quine thesis: no single measurement decides between theories.

Stanford Encyclopedia of Philosophy. "The Structure of Scientific Theories." <https://plato.stanford.edu/entries/structure-scientific-theories/> *Why read?* What a formal theory statement contains: primitives, axioms, theorems, interpretation, scope.

Hawking, S. (2002). "Gödel and the End of Physics." Dirac Centennial lecture. *Why read?* Why a final theory that contains its observer stays incomplete. Compare Section 7, self-reference.

Grassmann, H. (1844). *Die lineale Ausdehnungslehre*. Leipzig: Wigand. *Why read?* The extended form as the trace of a moving element: the net as the path of motion.

Larson, D. B. *Outline of the Deductive Development of the Theory of the Universe of Motion*. *Why read?* The natural reference system and the observer as a displacement: the knot of D2.

Konstapel, J. (2026). "The Mathematics of Closure." constable.blog, 15 October. <https://constable.blog/wp-content/uploads/the-mathematics-of-closure.pdf> *Why read?* The convergents of $\log_2 3$ and the rests $2^n - 3^k$ behind D7.

Konstapel, J. (2026). "The Vacuum.Net Theory: A Formal Statement." Version 5. Constable Research, Leiden. *Why read?* Full proofs of T1-T5 and the computations behind T4 and T6.

Dunbar, R. I. M. (1992). "Neocortex size as a constraint on group size in primates." *Journal of Human Evolution* 22, 469-493. *Why read?* The group of about 150 used as a worked case in Section 6.