Refutation of flow theory

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Abstract: We evaluate two theorems, one postulate, and nine examples of ZFC axioms as not tautologous. This refutes flow theory. These results form a non tautologous fragment of the universal logic VL4.

We assume the method and apparatus of Meth8/VŁ4 with Tautology as the designated proof value, F as contradiction, N as truthity (non-contingency), and C as falsity (contingency). The 16-valued truth table is row-major and horizontal, or repeating fragments of 128-tables, sometimes with table counts, for more variables. (See ersatz-systems.com.)

LET ~ Not, ¬ ; + Or, ∨, ∪ ; - Not Or; & And, ∧, ∩, · ; \ Not And;
> Imply, greater than, →, ⇒, ⊃, ⊢ ; < Not Imply, less than, ∈, ⊂, ⊆, ⊇, ⊕;
= Equivalent, ≡, ⇔, ↔, ≈, ≃; @ Not Equivalent, ≠, ⊬;
% possibility, for one or some, ∃, ∀, ◊; # necessity, for every or all, ∇, □, L;
(z=z) T as tautology, ⊤, ordinal 3; (z≠z) F as contradiction, Ø, Null, ⊥, zero;
(%z>≠#z) N as non-contingency, ∆, ordinal 1; (%z<≠#z) C as contingency, ∪, ordinal 2;
~(~ y < x) ( x ≤ y), ( x ⊆ y), ( x ∈ y); (A=B) (A¬B).
Note for clarity, we usually distribute quantifiers onto each designated variable.

From: Sant'Anna, A.S.; et al. (2019). Follow the flow: sets, relations, and categories as special cases of functions with no domain. Draft 2.6. arxiv.org/pdf/1912.00801.pdf adonai@ufpr.br

Abstract We introduce, develop, and apply a new approach for dealing with the intuitive notion of function, called Flow Theory. Within our framework all functions are monadic and none of them has any domain. Sets, proper classes, categories, functors, and even relations are special cases of functions. In this sense, functions in Flow are not equivalent to functions in ZFC. Nevertheless, we prove both ZFC and Category Theory are naturally immersed within Flow. Besides, our framework provides major advantages as a language for axiomatization of standard mathematical and physical theories. Russell’s paradox is avoided without any equivalent to the Separation Scheme. Hierarchies of sets are obtained without any equivalent to the Power Set Axiom. And a clear principle of duality emerges from Flow, in a way which was not anticipated neither by Category Theory nor by standard set theories. Besides, there seems to be within Flow an identification not only with the common practice of doing mathematics (which is usually quite different from the ways proposed by logicians), but even with the common practice of teaching this formal science.

2 Flow theory, 2.1 Functions
Theorem 1 $\forall f \forall g (f=g \Rightarrow \forall x (f(x)=g(x)))$. (1.1.1)

LET p, q, r, s: f, g, x, h.

(#p=#q)=((#p & #r)=(#q & #r)) ; TVCT TTTT TVCT TTCT (1.1.2)

Theorem 5 1 is the only function which is flexible with 1.
Proof: Thee statement above is equivalent to say that $\forall x(x \neq 1 \Rightarrow x(1) \neq 1)$. In other words, $\forall x(x(1)=1 \Rightarrow x=1)$. But we already know that 1(x) = x. Therefore, if we have $x(1)=1 \land 1(x)=x$, according to P1, we have x = 1. (5.1.1)

$(((%p & #r)=#r) & ((%p & #q)=(s=s)) & (((p & #r)=#r) & ((%q & #r)=#r))$ $((#p & #q)=#q) & ((#q & #p)=#p) ;$ TVCT TCTT TVCT TCTT (5.1.2)
The last two theorems do not say what are the images \( x(0) \) or \( x(1) \) (when \( x \neq 1 \), in the last case). Nevertheless, such values prove to be rather important for future applications of Flow Theory. But before discussing that, we introduce another axiom.

**P5** – Composition \( \forall f \forall g \exists ! h (h \neq 0 \land h \neq \perp \land \forall x ((x \neq f \land x \neq g) \Rightarrow (x \neq h \Rightarrow h(x) = f(g(x)))) \land (g \neq h \Rightarrow h(g) = 0) \land (f \neq h \Rightarrow h(f) = 0)). \) \hspace{1cm} (P5.1)

**Remark P5.2:** If Eq. P5.1 is mapped using 1 as \((s=s)\), instead of ordinal 1 as \((%s>%s)\), the table result values become all \( F \)'s for contradiction instead of \( C \) for falsity.

**3 ZFC is immersed in Flow**
**3.1 ZFC Axioms**

... The axioms of ZFC are the following:

**ZF1** – Extensionality \( \forall x \forall y (\forall z (z \in x \Leftrightarrow z \in y) \Rightarrow x = y) \) \hspace{1cm} (ZF1.1)

**ZF2** - Empty set \( \exists x \forall y (\neg (y \in x)) \) \hspace{1cm} (ZF2.1)

**ZF3** – Pair \( \forall x \forall y \exists z \forall t (t \in z \Leftrightarrow t = x \lor t = y) \) \hspace{1cm} (ZF3.1)

**ZF4** - Power set \( \forall x \exists y \exists z (z \in y \Leftrightarrow z \subseteq x) \) \hspace{1cm} (ZF4.1)

**ZF5**α - Separation Scheme \( \forall z \exists y \forall x (x \in y \Leftrightarrow x \in z \land F(x)) \) \hspace{1cm} (ZF5.1)

**ZF6**α - Replacement Scheme \( \forall x \exists y \forall a (x, y) \Rightarrow \exists z \forall w \forall t (t \in w \Leftrightarrow \exists s (s \in z \land a(s, t))) \) \hspace{1cm} (ZF6.1)

**ZF7** - Union set \( \forall x \exists y \forall z (z \in y \Leftrightarrow \exists t (z \in t \land t \in x)) \) \hspace{1cm} (ZF7.1)
As is well known, most if not all classical mathematics can be reformulated in ZFC. As a result, ZFC provides a rich framework for the formulation of physical theories—although perhaps not the most economical. As an alternative, we will now consider a different version of set theory, and explore its use in the foundations of physics.

Two theorems (Eqs. 1.1.2 and 2.1.2) and one postulate (P5.2) are not tautologous. Nine examples as ZFC axioms (ZF1.2-9.) as rendered are not tautologous. These results refute flow theory.