0/0 = Nullity = refuted!

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Abstract

Objectives:

The scientific knowledge appears to grow by time. However, every scientific progress involves different kind of mistakes, which may survive for a long time. Nevertheless, the abandonment of partially true or falsified theorems, theories et cetera, for positions which approach more closely to the truth, is necessary. In a critical sense, a reduction of the myth in science demands the non-ending detection of contradictions in science and the elimination the same too.

Methods:

Nullity as one aspect of the trans-real arithmetic and equally as one of today's approaches to the solution of the problem of the division of zero by zero is re-analyzed. A systematic mathematical proof is provided to prove the logical consistency of Nullity.

Results:

There is convincing evidence that Nullity is logically inconsistent. Furthermore, the about 2000 year old rule of the addition of zero's (0+0+…+0 = 0) is proved as logically inconsistent and refuted.

Conclusion: Nullity is self-contradictory and refuted.

Keywords: Indeterminate forms, Classical logic, Zero divided by zero

1. Introduction

Dividing by zero on a computer causes several problems. No wonder that computer hardware manufacturers invented the concept of "*not a number*" to define circumstances that a meaningful result or number can't be returned. Anderson et al. (Anderson et al., 2007) are defined a new arithmetic which is claimed to have no arithmetical exceptions. Following Anderson et al. (Anderson et al., 2007) the transreal numbers include all of the real numbers, plus three other mathematical constructs: infinity (∞), negative infinity (-∞) and "nullity" (∅). In point to fact, Anderson et al. (Anderson et al., 2007) are treating infinity not as something real but as something trans (non-) real. What is "nullity"? Nullity as such as a number defined by the transreal axioms is not equal to any real or infinite number while it is equally the ratio of two numerical zeros (real numbers). At the end, Anderson et al. (Anderson et al., 2007) concept of "nullity" is not completely identical with the concept of "not a number" as already known in floating point arithmetic's on computers but effectively, it is. "Nullity" is just a reformulation of the basic mathematical concept of "undefined" and equally nothing else but "*not a number*". Still, the question is, is Nullity logically and mathematically consistent?

2. Material and Methods

2.1. Definitions

DEFINITION 1. (NUMBER +0)

Let c denote the speed of light in vacuum, let ε_0 denote the electric constant and let μ_0 the magnetic constant, let i denote an imaginary number (Bombelli, 1579). The number +0 is defined as the expression

$$\begin{aligned} +0 &\equiv \left(c^2 \times \varepsilon_0 \times \mu_0\right) - \left(c^2 \times \varepsilon_0 \times \mu_0\right) \\ &\equiv +1 - 1 \\ &\equiv +i^2 - i^2 \end{aligned} \tag{1}$$

while "=" denotes the equals sign or equality sign (Robert Recorde, 1557) (Rolle, 1690) used to indicate equality and "-" (Widmann, 1489) (Pacioli, 1494) (Robert Recorde, 1557) denotes minus signs used to represent the operations of subtraction and the notions of negative as well and "+" (Widmann, 1489; Pacioli, 1494; Recorde, 1557) denotes the plus signs used to represent the operations of addition and the notions of positive as well.

DEFINITION 2. (NUMBER +1)

Let c denote the speed of light in vacuum, let ε_0 denote the electric constant and let μ_0 the magnetic constant, let i denote an imaginary number (Bombelli, 1579). The number +0 is defined as the expression

$$+1 \equiv \left(c^2 \times \varepsilon_0 \times \mu_0\right) \equiv -i^2 \tag{2}$$

DEFINITION 3. (EXPONENT RULES)

The base *b* raised to the power of *n* is equal to the multiplication of *b*, *n* times or

$$b^n \equiv \underbrace{(b \times b \times \dots b)}_{n\ times} \tag{3}$$

DEFINITION 4. (POWER RULE (POWERS TO POWERS))

To raise a power to a power it is necessary to multiply the exponents. We obtain

$$(b^n)^m \equiv (b^{n \times m}) \tag{4}$$

DEFINITION 5. (ANDERSON ET AL. DEFINITION OF NULLITY)

Anderson et al. (Anderson et al., 2007) defines Nullity as

$$\frac{0}{0} \equiv Nullity \tag{5}$$

DEFINITION 6. (ANDERSON ET AL. AXIOM'S WITH RESPECT TO NULLITY)

Some of Anderson et al. (Anderson et al., 2007) axioms especially with respect to Nullity are as follows.

$$Anderson\ et\ al.\ Axiom \quad [A4]: \quad Nullity + a \quad = \quad Nullity \tag{6}$$

$$Anderson\ et\ al.\ Axiom \quad [A7]: \quad -(-a) \quad = \quad a \tag{7}$$

$$Anderson\ et\ al.\ Axiom \quad [A9]: \quad -Nullity \quad = \quad Nullity \tag{8}$$

$$Anderson\ et\ al.\ Axiom \quad [A11]: \quad +\infty - \infty \quad = \quad Nullity \tag{9}$$

$$Anderson\ et\ al.\ Axiom \quad [A15]: \quad Nullity \times a \quad = \quad Nullity \tag{10}$$

$$Anderson\ et\ al.\ Axiom \quad [A16]: \quad \infty \times 0 \quad = \quad Nullity \tag{11}$$

$$Anderson\ et\ al.\ Axiom \quad [A16]: \quad Nullity^{-1} \quad = \quad Nullity \tag{12}$$

2.2.1. Axiom I (Lex identitatis. Principium Identitatis. Identity Law)

In general, it is

$$+1 \quad \equiv \quad +1 \tag{13}$$

or the superposition of +0 and +1 as one of **the foundations of quantum computing**

$$+1 \quad \equiv \quad (1+0) \times (1+0) \times (1+0) \times (\dots) \times (1+0) \tag{14}$$

2.2.2. Axiom II (Lex contradictionis. Principium contradictionis. Contradiction Law)

Contradictions are an objective and important feature (Barukčić, 2019c) of objective reality. Still, contradictions in theorems, arguments and theories would allow us to conclude everything desired. In contrast to religion and other domains of human culture, one very important and at the end to some extent normative criteria to achieve some advances and progress in science is depended on detecting contradictions in science and eliminating the same too. The most important point is that even if we are surrounded by contradictions a co-moving observer (Barukčić, 2019c) will always find that something is *either* +1=+1 *or* +0=+0 but not both, i. e. it is not +1 = +0. The simplest form of Aristotle's law of contradiction (Barukčić, 2019a; Barukčić, 2019b; Barukčić, 2019c;) is defined as

$$+1 \quad \equiv \quad +0 \tag{15}$$

According to Popper, a philosopher of science of the 20th century, contradiction is the demarcation line between science and 'non-science'. "We see from this that if a theory contains a contradiction, then it entails everything, and therefore, indeed, nothing[...]. A theory which involves a contradiction is therefore entirely useless as a theory". (Popper, 2002, p. 429).

2.2. Methods

2.2.1. Direct Proof

Inversion (Toohey, 1948) is an inference rule or a proof method which demands that an immediate inference is made from a certain starting point, axiom or statement. The inverse of the statement P → Q ("If *P is true*, then *Q is true*") is thus far the statement ¬P → ¬Q or in spoken language: "If *P is false*, then *Q is false*". A positively formulated direct proof is based on the assumption that P → Q ("If *P is true*, then *Q is true*") while a negatively formulated direct proof is based on the assumption that ¬P → ¬ Q or "If *P is false*, then *Q is false*".

2.2.2. Proof by contradiction (Reductio ad absurdum)

In point of fact, it is difficult for scientists prove a theorem, a theory et cetera to be true for ever. Regardless of how many positive examples appear to support a theorem or a theory, one single counter-example or one single contradictory instance to a theory is sufficient enough to falsify the general validity of a theorem or of a theory et cetera. A proof by contradiction is such a scientific proof method which is able to proof the general the falsity or the truth of a statement, an equality, a principle (P) et cetera. "The proof ... *reductio ad absurdum*, which Euclid loved so much, is one of the mathematician's finest weapons" (Hardy, 1992, p. 94). If the *goal* of a proof by contradiction is to prove that *P is not true*, then *assume* first that *P is true*. In the following, based on the assumption that P is true, it is necessary to be able to conclude or to derive something which is impossible or which is a contradiction. Under the conditions, that the logic of the proof by contradiction is sound (i.e. no technical errors et cetera), the only option is that the assumption that P is true is incorrect. Therefore, we must conclude that P is not true, which completes the proof. Something impossible or incorrect cannot be derived from something correct as long as there are nor technical or other errors inside a proof.

3. Results

THEOREM 3.1. (REFUTATION OF ANDERSON ET AL. NULLITY)

CLAIM.

Anderson et al. (Anderson et al., 2007) approach to the division by zero is based on the logical contradiction

$$+1 \quad = \quad +0 \tag{16}$$

PROOF.

In general, taking axiom 1as not to be true, it is

$$\mathbf{+1} \quad = \quad \mathbf{+0} \tag{17}$$

which as such is absolutely and obviously erroneous. This is equally the simplest mathematical form of Aristotle's law of contradiction (Barukčić, 2019). Anderson et al. (Anderson et al., 2007) are claiming that the transreal arithmetic as total arithmetic contains the real arithmetic without any arithmetical exceptions. In particular, Anderson et al. (Anderson et al., 2007) are pointing out by axiom 7 (Eq. 7) that **principium identitatis** is respected. In other words, Nullity as a mathematical construct of transreal arithmetic is not grounded on a logical contradiction. Thus far, Nullity taken as logical consistent cannot allow us nor is it possible to deduce something correct from such an incorrect and fallacious starting point. Multiplying the starting point of this proof by Anderson et al. (Anderson et al., 2007) Nullity we obtain

$$+1 \times (Nullity) \quad = \quad +0 \times (Nullity) \tag{18}$$

According to Anderson et al. (Anderson et al., 2007) axiom 15 (Eq. 10) we obtain without any technical errors the result that

$$\boldsymbol{Nullity} \quad = \quad \boldsymbol{Nullity} \tag{19}$$

QUOD ERAT DEMONSTRANDUM.

THEOREM 3.2. (REFUTATION OF TODAY'S RULE OF THE ADDITION OF ZERO'S)

Nicomachus of Gerasa (ca. 60 – ca. 120 AD), was born in Gerasa, a former Roman province of Syria, and is best known for his book *Introduction to Arithmetic*. Nicomachus (Nicomachus, pp. 48, 120, 237-238) claimed that the sum of nothing added to nothing was nothing or in other words it is 0+0+0 + …+ 0 = 0.

CLAIM.

The rule of the addition of zero's (+0 + 0 + … +0 = +0) is self-contradictory and based on a logical contradiction.

PROOF.

In general, taking axiom 1 not to be true, it is

$$(\mathbf{1}) + (\mathbf{1}) + \cdots + (\mathbf{1}) \quad = \quad +(\mathbf{1}) \tag{20}$$

which is a non-acceptable contradiction. Multiplying this equation by 0, we obtain according to our today's rules of mathematics that

$$\begin{gathered} (1 + 1 + \cdots + 1) \times 0 \quad = \quad +(1 \times 0) \\ or \\ (n\ times) \times 0 \quad = \quad +(1 \times 0) \end{gathered} \tag{21}$$

or that

$$(1 \times 0) + (1 \times 0) + \cdots + (1 \times 0) \quad = \quad +(0) \tag{22}$$

or today's rule of the addition of zero's as

$$(\mathbf{0}) + (\mathbf{0}) + \cdots + (\mathbf{0}) \quad = \quad +(\mathbf{0}) \tag{23}$$

QUOD ERAT DEMONSTRANDUM.

4. Discussion

According to theorem 3.2, today's rule of the addition of zero's is logically inconsistent and refuted. We started with something which is not true or (+1 +1 + … + 1) = +1, something which is an apparent contradiction. Technical errors within the proof cannot be identified. Thus far, **if** (+1 +1 + … + 1) = +1 is false, **then** (+0+0+…+0) = +0 is false too, which completes our proof.

According to the theorem 3.1, Anderson's et al. (Anderson et al., 2007) Nullity is self-contradictory and refuted. The proof is starting with a contradiction (+1=+0). According to the rules of trans-real arithmetic's, we obtain that Nullity = Nullity, which is correct. In other words, Nullity assures and demands that from something incorrect (+1=+0) follows something which is correct (Nullity = Nullity), which is a contradiction. The axioms of trans-real arithmetic's are self-contradictory. How does a trans-real mathematical construct passes over into a real number?

5. Conclusion

Anderson's et al. (Anderson et al., 2007) Nullity is logically inconsistent and refuted.

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References

Anderson, J. A. D. W., Völker, N., & Adams, A. A. (2007). Perspex Machine VIII: axioms of transreal arithmetic. In L. J. Latecki, D. M. Mount, & A. Y. Wu (Eds.) (p. 649902). Presented at the Electronic Imaging 2007, San Jose, CA, USA. doi: https://doi.org/10.1117/12.698153

Barukčić, I. 2019a. Classical Logic and the Division of Zero by Zero. ViXra, 11(3). Retrieved from http://vixra.org/abs/1903.0343

Barukčić, I. 2019b. 1/0 = 0/0 = Refuted! ViXra, 13(3). Retrieved from http://vixra.org/abs/1903.0464

Barukčić, I. 2019c. Aristotle's law of contradiction and Einstein's special theory of relativity. J. Drug Deliv. Ther. 9: 125–143. https://doi.org/10.22270/jddt.v9i2.2389

Barukčić, J.P., Barukčić, I. 2016. Anti Aristotle—The Division of Zero by Zero. J. Appl. Math. Phys. 04: 749–761. **https://doi.org/10.4236/jamp.2016.44085**

Bombelli, R. 1579. L' algebra : opera di Rafael Bombelli da Bologna, divisa in tre libri : con la quale ciascuno da se potrà venire in perfetta cognitione della teorica dell'Aritmetica : con una tavola copiosa delle materie, che in essa si contengono. per Giovanni Rossi, Bolgna (Italy).

Hardy, G. H. (1992). A mathematician's apology (Canto ed). Cambridge [England] ; New York: Cambridge University Press.

Nicomachus of Gerasa, (Syria ca. 60 – ca. 120 AD). (1926). Introduction to Arithmetic. Translated into English by Mathin Luther D'Ooge. New York: The Macmillan Company. Retrieved from https://ia600701.us.archive.org/15/items/NicomachusIntroToArithmetic/nicomachus_introduction_arithmetic.pdf

Pacioli, L. 1494. Summa de arithmetica, geometria, proportioni et proportionalità. Venice.

Popper, K. 2002. Conjectures and Refutations: The Growth of Scientific Knowledge, Überarb. A. ed. Routledge, London ; New York.

Robert Recorde. 1557. The Whetstone of Witte, whiche is the seconde parte of Arithmetike: containing the extraction of rootes: The cossike practise, with the rule of Equation: and the workes of Surde Nombers, Robert Recorde, The Whetstone of Witte London, England: John Kyngstone, 1557. ed. John Kyngstone, London (England).

Rolle, M. [1652-1719]. 1690. Traité d'algèbre ou principes généraux pour résoudre les questions... chez Estienne Michallet, Paris (France).

Toohey, J. J. (1948). An elementary handbook of logic. New York, Appleton-Century-Crofts. Retrieved from http://archive.org/details/anelementaryhan00toohgoog

Widmann, J. 1489. Behende und hubsche Rechenung auff allen Kauffmanschaft. Conrad Kachelofen, Leipzig (Holy Roman Empire).

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