Ilija Barukčić

Theoriae causalitatis principia mathematica

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Image credit: National Aeronautics and Space Administration (NASA/JSC), United States of America.

Earth rising above the moon’s horizon viewed from the Apollo 11 spacecraft (Astronauts Neil A. Armstrong, commander, Edwin E. Aldrin and Michael Collins) on July 20, 1969. The lunar terrain pictured is in the area of Smyth’s Sea on the nearside.

Contents

Volume I

The general theory of causality

> "Time is not
> something objective and real,
> neither a substance, nor an accident, nor a relation. "
>
> (see Kant, 1770)
> (see also (English) Kant, 1894, p. 61)

There is no doubt. Kant's own view on space does not differ from his own view on time at all.

> "Space is not
> something objective and real,
> neither substance, nor accident, nor relation ;
> but subjective and ideal ... "
>
> (see also Kant, 1770)
> (see also (English) Kant, 1894, p. 65)

Kant's category of a fire in a human mind and the fire itself outside a human mind need to be distinguished. The category of a fire in a human mind does not possess the possibility to kill real-world people. However, in contrast to Kant's category of a fire in a human mind real-world fires sometimes kill more people each year than all natural disasters. Even a small fire can become a major fire that ravages a home and may threaten the lives of the people inside. Sometimes only minutes or even seconds are left to escape such a house fire and to rescue itself and its own life. However, following Kant, we need only to be concerned about the category of such a fire in our human mind ("... wir haben es ... nur mit unseren Vorstellungen zu thun; wie Dinge an sich selbst ... seyn mögen, ist gänzlich außer unserer Erkenntnißsphäre. "(see also Kant, 1790, p. 235)) but not about the fire itself. We just cannot recognize how the fire itself is ("wie Dinge an sich selbst ... seyn mögen, ist gänzlich außer unserer Erkenntnißsphäre. "(see also Kant, 1790, p. 235)). Any fire has the potential to burn any evidence within minutes in particular with regard to the correctness of Kant's transcendental conception of causality, the same is refuted. ■

Kant himself, in contrast to Bishop George Berkeley (1685–1753), is an advocate of a fundamental conception of idealism which concede to some extent the existence of something independent of human mind.

However, everything the humans can know about this mind-independent reality depends according to Kant himself on human mind itself and is at the end not independent of human mind. Kant, tends to reduce objective reality or of everything that exists to some kind of perception or of experience and allows at the end that everything that exists may be in some way mental while ending up at a kind of circular reasoning (circulus in probando). In last consequence, human mind would have to create the object observed or earth's moon would exist only if someone looks at the same ("... wir haben es ... nur mit unseren Vorstellungen zu thun; "(see also Kant, 1790, p. 235)). Kant's philosophical insights seduce us to develop thousands of categories of millions of trees but does not allow us to see the forest as a Ding an sich. In the end, and tome some extent contrary to Kant, view positions of Albert Einstein (1879–1955) may turn out to be right.

"We often discussed his notions on **objective reality**.
I recall that during one walk **Einstein** suddenly stopped, turned to me and **asked whether** I really believed that
the moon exists only when I look at it. "

(see also Pais, 1979, p. 907)

One is not surprised about Einstein's Anti-Kantian position.

"The elements of ... reality cannot be determined by a priori philosophical considerations, but must be found by an appeal to results of experiments and measurements. "

(see Albert Einstein et al., 1935, p. 777)

That is only one among the many points why Kant's approach to objective reality is likely to fail to withstand and to meet the challenges of change. In the light of the issue to be addressed, it seems perfectly natural that Kant's a priori demand had to be rejected once and for all (see Friedman, 2008), especially under the conditions of Einstein's theory of relativity. In general, we might confidently ask ourselves whether it is permissible at all to assume any connection between Kant's 'Thing in itself'and an expected value of a random variable or the results of measurements as obtained by Einstein's co-moving observer. Especially, are the results

2.1.6 Georg Wilhelm Friedrich Hegel (1770-1831) – both

Kant's respond to Hume's scepticism resulted in a much greater sceptical conclusion of Kant himself. Kant's theory understood as correct does not exclude that a world in itself or a 'Thing-in-itself'(Ding an sich) may exist. Regrettably and without any logical need, Kant demands ex cathedra that the humans can know nothing about the world in itself or about the 'Thing-in-itself'(Ding an sich). Kant denies any possibility of epistemological progress **from the known to the unknown**. Therefore, the only option left open for human knowledge is the following:

> "... das, was der Erscheinung der Materie,
> als **Ding an sich** selbst, zum Grunde liegt
> ... bleibt ... ohne allen Zweifel ...
> außer dem Felde aller menschlichen Erkenntniß ... "
>
> (see also Kant, 1790, p. 428)

In simple words of an agnosticist par excellence. "What matter may be as **a thing in itself** ... is **completely unknown to us** ... "(see Kant, 1929, Critique of pure Reason, p. 344). Georg Wilhelm Friedrich Hegel (1770-1831) rejected Kant's far-reaching and fundamentally sceptical conclusion. In attacking Kant, the 19th Century German post-Kantian idealistic philosopher **Georg** (see Hegel, 1812) **Wilhelm** (see Hegel, 1813) **Friedrich** (see Hegel, 1816) **Hegel**(1770-1831) provided an own(see Hegel, 1998, p. 558-571), very abstract and purely idealistic philosophical account of **the nature of causality** (see also Hegel, 1813, pp. 261-282) while relying on the dialectical method. However, it is of the utmost importance that Hegel himself started his theory from a purportedly logical point of view. It did not take a very long period of time in the further process of the development of science, and Hegel himself has been taken over by Karl Marx (1818-1883). In short, Marx(see Marx, 1867) himself as a truly convinced post-Hegelian turned Hegel's dialectical idealistic philosophy upside down in putting the same on its feet by inverting Hegel's dialectical idealistic philosophy into a dialectical materialist theory.

Hegel's statement before translated into English. "Therefore, though the cause has an effect and is at the same time itself effect , and the effect not only has a cause but is also itself cause, yet the effect which the cause has, and the effect which the cause is, are different, as are also the cause which the effect has, and the cause which the effect is."(see also Hegel, 1998, p. 565/566). Hegel formulates the relationship between a cause and an effect in his typical way. However, figure 4 may illustrate in more detail what Hegel is talking about.

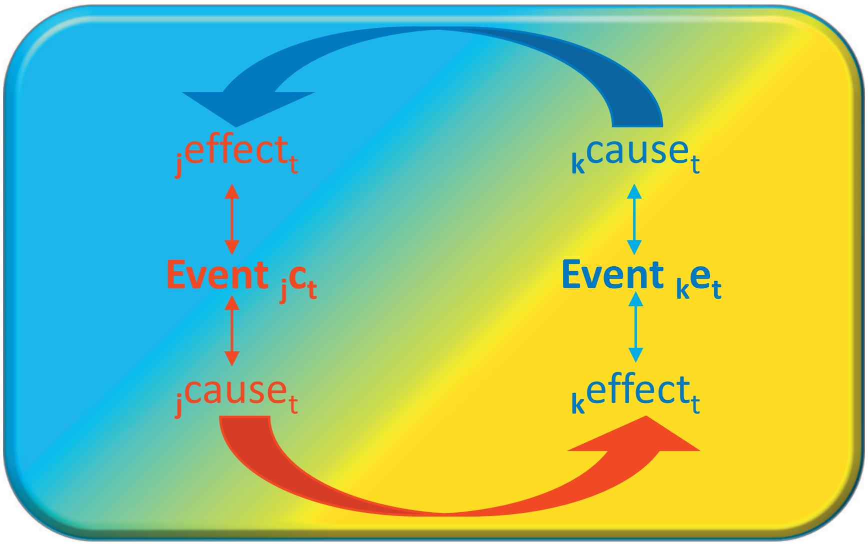

Fig. 4 Every event is determined at the same time t as the unity of a cause and an effect (see Hegel, 1813, p. 273).

German idealism effectively ended shortly after Hegel's death, especially due to view anti-idealist authors like Ludwig Andreas Feuerbach (1804-1872), Karl Marx (1818-1883) and of course other too. However, according to Hegel himself, this is not a pity, '**ne regrette rien**'.

"What is necessary cannot be otherwise ... "

(see also Hegel, 1998, p. 549)

2.2.1 Co-relation is not causation

In spite of the adverse circumstances, one of the first documented and detailed mathematical trials to mathematize the relationship between cause and effect can be attributed to the concept of co-relation, a mathematically evolutionary pre-stage of causation. Decades of experience has taught us that numerous hands make light work. This is like ever of vital importance with respect to every scientific issue to which attention should be drawn. Of particular note is that the French physicist Auguste Bravais (1811-1863) discussed the issue of co-relation(see also Bravais, 1846) already in 1846. Francis(see also Galton, 1877) Galton (1822 - 1911), the 1909 knighted English Victorian statistician and anthropologist, was the first to measure the"... the index of co-relation ..."(see Galton, 1888) while the term 'coefficient of correlation'has been coined by Francis Ysidro Edgeworth (1845-1926) in 1892(see Edgeworth, 1892). In the following, Karl Pearson (1857 - 1936) himself made another important contribution(see also K. Pearson, 1896, p. 261) to the theory of co-relation. John Burdon Sanderson Haldane (1892-1964) is writing that Pearson

> "... spent about a year in the universities of Heidelberg and Berlin ... At about this time he began to spell his Christian name with a K instead of a C. ... a special homage to Karl Marx, for we know that he later lectured on Marx, and ... when in Germany the police once searched his rooms ... one of Marx's books was the most subversive of the documents which they found there ... "
>
> (see also Haldane, 1957, p. 304)

In fact, following Pearson(see also K. Pearson, 1896) Pearson (1857 - 1936), it is of crucial importance to recognize that Bravais developed a complete theory of co-relation for the first time in history.

> "*The fundamental theorems of co-relation were for the first time and almost exhaustively discussed by B r a v a i s ('Analyse mathematique sur les probabilities des erreurs de situation d'un point.' Memoires par divers Savans, T. IX., Paris, 1846, pp. 255-332) nearly half a century ago.*"
>
> (see also K. Pearson, 1896, p. 261)

Theorem 16 (The coefficient of co-relation) *Let Y denote a quantity (i.e. effect or outcome variable), let p(Y) denote the probability of this quantity. Let* $E(Y) \equiv Y \times p(Y)$ *denote the expectation value of Y. Let X denote another quantity (i.e. cause or input variable), let p(X) denote the probability of this quantity. Let* $E(X) \equiv X \times p(X)$ *denote the expectation value of X. The co-relation coefficient is based on a quantity dominated, mechanical understanding of the relationship between two factors like X and Y.*

Proof **If** the premise

$$\underbrace{+1 = +1}_{(Premise)} \tag{11}$$

is true, **then** the conclusion

$$\begin{aligned} \rho(Y, X) &\equiv \frac{E((Y - E(Y)) \times (X - E(X)))}{E(Y - E(Y)) \times E(X - E(X))} \\ &\equiv \frac{\sigma(Y, X)}{\sigma(Y) \times \sigma(X)} \equiv +1 \end{aligned} \tag{12}$$

is also true, the absence of any technical errors presupposed. The premise

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

is true. Multiplying this premise (i.e. axiom) by Y, it is

$$Y \equiv Y \tag{14}$$

Bravais (1811-1863) (see Bravais, 1846) - Pearson's (1857-1936) "*product-moment coefficient of co-relation*"((see Galton, 1877; K. Pearson, 1896)) in contrast to the causal relationship k ((see I. Barukčić, 1989, 1997, 2005, 2016e, 2017b, 2017c)) is based on the demand that **Y = X**. Based on this fundamental assumption, equation 12 can be rearranged as

$$Y \equiv X \tag{15}$$

Two which are different are as well identical with each other. This basic relationship between Y and X is illustrated symbolically fig. 5.

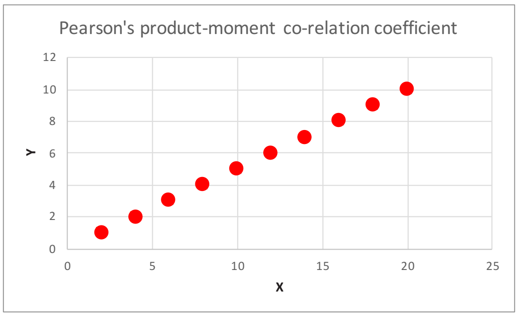

Fig. 5 Pearson's product moment coefficient of co-relation and the mechanical relationship between Y and X.

The logical consequence of Eq. 15 is that

$$E\,(Y) \equiv E\,(X) \tag{16}$$

Equation 15 demands too that

$$Y^2 \equiv X^2 \tag{17}$$

Equation 17 demands that

$$E\left(Y^2\right) \equiv E\left(X^2\right) \tag{18}$$

Equation 15 can be rearranged as

$$Y - E\,(Y) \equiv X - E\,(Y) \tag{19}$$

According to equation 16, equation 19 changes to

$$Y - E\,(Y) \equiv X - E\,(X) \tag{20}$$

In other words, we must accept the equality of

$$E\,(Y - E\,(Y)) \equiv E\,(X - E\,(X)) \tag{21}$$

By squaring equation 21, it is

$$E\,(Y - E\,(Y))^2 \equiv E\,(X - E\,(X))^2 \tag{22}$$

or

$$E\,(Y - E\,(Y)) \times E\,(Y - E\,(Y)) \equiv E\,(X - E\,(X)) \times E\,(X - E\,(X)) \tag{23}$$

Based on equation 21, equation 23 can be rearranged as

$$E\left(Y - E\left(Y\right)\right) \times E\left(X - E\left(X\right)\right) \equiv E\left(\left(X - E\left(X\right)\right) \times \left(X - E\left(X\right)\right)\right) \quad (24)$$

Based on equation 15 and equation 16, equation 24 can be rearranged as

$$E\left(Y - E\left(Y\right)\right) \times E\left(X - E\left(X\right)\right) \equiv E\left(\left(Y - E\left(Y\right)\right) \times \left(X - E\left(X\right)\right)\right) \quad (25)$$

Equation 25 can be simplified (see Sachs, 1992, p. 496) as (see also Kolmogoroff, 1950, p. 60)

$$E\left(\left(Y - E\left(Y\right)\right) \times \left(X - E\left(X\right)\right)\right) \equiv E\left(Y - E\left(Y\right)\right) \times E\left(X - E\left(X\right)\right) \quad (26)$$

Rearranging equation 26, Bravais (see Bravais, 1846) (1811-1863) - Pearson's (1857-1936) "*product-moment coefficient of co-relation*"(see Galton, 1877; K. Pearson, 1896) follows (see Sachs, 1992, pp. 496-497) as

$$\begin{aligned} \rho\left(Y, X\right) &\equiv \frac{E\left(\left(Y - E\left(Y\right)\right) \times \left(X - E\left(X\right)\right)\right)}{E\left(Y - E\left(Y\right)\right) \times E\left(X - E\left(X\right)\right)} \\ &\equiv E\left(\left(\frac{Y - E(Y)}{\sigma(Y)}\right) \times \left(\frac{X - E(X)}{\sigma(X)}\right)\right) \\ &\equiv \frac{\sigma\left(Y, X\right)}{\sigma\left(Y\right) \times \sigma\left(X\right)} \\ &\equiv +1 \end{aligned} \quad (27)$$

■

Bravais (see Bravais, 1846) (1811-1863) - Pearson's (1857-1936) "*product-moment coefficient of co-relation*"(see Galton, 1877; K. Pearson, 1896) is based on the assumption that **a quantity Y is equivalent to a quantity X**. Under this assumption, it is possible (see theorem 16, EQ. 27) to derive Pearson's product-moment coefficient of co-relation in a technically correct way. However, this implies too, that the product-moment coefficient of co-relation is not identical with causation. A cause effect relationship cannot be reduced under any circumstances to a mechanical relationship between two quantities. However, Pearson's product-moment coefficient of co-relation demands us precisely to accept such a simple and mechanical relationship between two quantities as being identical with causation. No wonder that Karl Pearson (1857-1936) himself “rejected causal thinking.”(see Blalock, 1964, p. 39). Pearson’s product-moment coefficient of co-relation does not account for sure for causation, as demonstrated by theorem 16. In this context, it is relatively easy to get convinced that co-relation and causation are not identical in order to draw reliable conclusions (from observational data). Many times, mathematical examples or proofs are able to illustrate the truth of a statement. However and conversely, one single counterexample, experiment et cetera is enough and posses the theoretical potential to demonstrate the falsity of a theory, of a theorem et cetera. But the question remains, what makes the logical-mathematical difference between causation and co-relation? Theorem 17 should be able to shed light on the matter.

Theorem 17 (Co-relation is not causation) *Let Y denote a quantity (i.e. outcome), let p(Y) denote the probability of this quantity. According to Kolmogorov, who applies “the theory of probability to the actual world of experiments ... ”(see Kolmogoroff, 1950, p. 3) it is* $E(Y) \equiv Y \times p(Y)$ *(see Kolmogoroff, 1933) denoted the expectation value of Y. Let X denote another quantity, let p(X) denote the probability of this quantity. Let* $E(X) \equiv X \times p(X)$ *denote the expectation value of X. The co-relation coefficient is based on a quantity dominated, mechanical understanding of the relationship between two factors like X and Y. Pearson’s product-moment coefficient of co-relation is grounded on the mathematical starting point that,*

$$p(Y) \equiv p(X) \tag{28}$$

which is not generally given. Pearson’s product-moment coefficient of co-relation, even if mathematically correct, is refuted.

Proof **If** the premise

$$\underbrace{+1 = +1}_{(Premise)} \tag{29}$$

is true, **then** the conclusion

$$p(Y) \equiv p(X) \tag{30}$$

is also true, the absence of any technical errors presupposed. The premise

$$+1 \equiv +1 \tag{31}$$

is true. Multiplying this premise (i.e. axiom) by $E(Y)$, it is

$$E(Y) \equiv E(Y) \tag{32}$$

According to EQ. 16, EQ. 32 changes to

$$E(Y) \equiv E(X) \tag{33}$$

The expectation value of Y is defined as $E(Y) \equiv Y \times p(Y)$ while the expectation value of X is known to be defined as $E(X) \equiv X \times p(X)$. EQ. 32 can be rearranged as

$$Y \times p(Y) \equiv X \times p(X) \tag{34}$$

According to EQ. 15 it is $Y \equiv X$. Rearranging EQ. 34, we obtain

$$Y \times p(Y) \equiv Y \times p(X) \tag{35}$$

Dividing EQ. 35 by Y yields

$$p(Y) \equiv p(X) \tag{36}$$

■

Meanwhile, there are more than enough other(Sober, 2001) counterexamples which were able to provide evidence that causation is not identical with causation, co-relation is not enough for causal inference. Thus far, let us assume again that Y may denote something like an effect while X may denote something like a cause. Pearson's product-moment coefficient of co-relation demands us to accept under any circumstances a mechanical and fixed relationship between the probabilities of a cause and an effect (see theorem 17, Eq. 36). It is hard to deny that such circumstances may exist. But this condition is not universally applicable. Causality and a mathematical formula describing the same is and need to be generally valid. The theorem 17 demonstrates exactly one of the reasons why Pearson's product-moment coefficient of co-relation collapses mathematically on the field of causality more or less entirety.

13.4 Anti Zadeh - Refutation of Fuzzy logic

An extreme advantage but equally a disadvantage of Boolean logic too is that the truth value is always either +0 or +1. The need and the desire to develop a logical reasoning which is nearer to objective reality with allows vague or imprecise statements, a so-called multi-valued logic or dialectical logic, lead to the development of fuzzy logic by the Azerbaijani scientist Lotfi Aliasker Zadeh (1921 –2017). Fuzzy logic (see also Lee & Zadeh, 1969; Zadeh, 1965, 1968, 1971, 1984, 1996, 1997) is more or less a special form of logic which belongs to a family of many-valued logics(see also Gödel, 1932; Łukasiewicz, 1920; Post, 1920) in which the truth value is any real number between +0 and +1. However, Jan Łukasiewicz (1878–1956) and Alfred Tarski (1901–1983) published an early example of a many-valued logic (see also Łukasiewicz & Tarski, 1930) long before the inception of the theory of fuzzy sets as proposed by Zadeh himself. Lotfi Aliasker Zadeh proposed the following operators of Fuzzy logic.

13.4.1 Fuzzy logic - The negation operator

Bernoulli trial t	${}_{R}U_{t}$	$\neg {}_{R}U_{t}$	Boolean NOT $\neg {}_{R}U_{t}$	Fuzzy NOT $1 - {}_{R}U_{t}$
1	1	0	0	0
2	1	0	0	0
3	0	1	1	1
4	0	1	1	1
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

Table 45 Boolean NOT operator and Fuzzy logic NOT operator are identical.

13.4.2 Fuzzy logic - The conjunction operator

Bernoulli trial t	${}_{R}U_{t}$	${}_{R}W_{t}$	Boolean AND $({}_{R}U_{t} \cap {}_{R}W_{t})$	Fuzzy AND $Minimum({}_{R}U_{t}, {}_{R}W_{t})$
1	1	1	1	1
2	1	0	0	0
3	0	1	0	0
4	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

Table 46 Boolean logic AND operator and Fuzzy logic AND operator.

13.4.3 Fuzzy logic - The disjunction operator

Bernoulli trial t	${}_{R}U_{t}$	${}_{R}W_{t}$	Boolean OR $({}_{R}U_{t} \cup {}_{R}W_{t})$	Fuzzy OR $Maximum({}_{R}U_{t}, {}_{R}W_{t})$
1	1	1	1	1
2	1	0	1	1
3	0	1	1	1
4	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

Table 47 Boolean logic OR operator and Fuzzy logic OR operator.

13.4.4 Refutation of Fuzzy logic

Counterexample 72 (Refutation of Fuzzy logic by a counterexample)

Let $p({}_{R}U_{t})$ denote the probability of an event ${}_{R}U_{t}$ at a certain Bernoulli trial / point in (space-) time t. Let $p({}_{R}W_{t})$ denote the probability of an event ${}_{R}W_{t}$ at the same Bernoulli trial / point in (space-) time t. Let $p({}_{R}U_{t}, {}_{R}W_{t})$ denote the joint-probability of events ${}_{R}U_{t}$ and ${}_{R}W_{t}$ at the same Bernoulli trial / point in (space-) time t. Fuzzy logic demands that

$$+0 \equiv +1 \tag{650}$$

Proof (by counterexample)

Axiom I or

$$+1 \equiv +1 \tag{651}$$

as our starting point of this proof by counterexample is true. Rearranging Eq. 651, it is

$$p\left({}_{R}U_{t} \cap {}_{R}W_{t}\right) \equiv p\left({}_{R}U_{t} \cap {}_{R}W_{t}\right) \tag{652}$$

In **the case of independence** of both events ${}_{R}U_{t}$ and ${}_{R}W_{t}$ Fuzzy logic must yield contradictory free results. In this case, we must accept as true that

$$p\left({}_{R}U_{t} \cap {}_{R}W_{t}\right) \equiv p\left({}_{R}U_{t}\right) \times p\left({}_{R}W_{t}\right) \equiv Minimum\left(p\left({}_{R}U_{t}\right), p\left({}_{R}W_{t}\right)\right) \tag{653}$$

Under circumstances of independence where $p\left({}_{R}U_{t}\right) = 0.5$ and $p\left({}_{R}W_{t}\right) = 0.4$, Eq. 653 yields the following results.

$$p\left({}_{R}U_{t} \cap {}_{R}W_{t}\right) \equiv 0.5 \times 0.4 \equiv Minimum\left((0.5), (0.4)\right) \tag{654}$$

or

$$0.2 \equiv 0.4 \tag{655}$$

Simplifying Eq. 655, it is

$$+0 \equiv 0.2 \tag{656}$$

and at the end

$$+0 \equiv +1 \tag{657}$$

This counterexample has refuted the Fuzzy logic. √

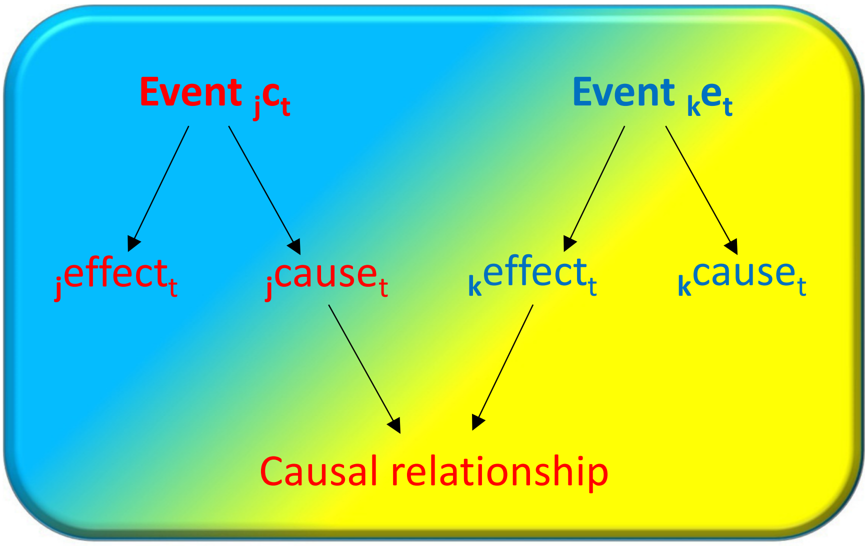

Fig. 16 The unity and the struggle between a cause and an effect (see Hegel, 1813, p. 273).

Hegel's position outlined just before translated into English. "Therefore, though the cause has an effect and is at the same time itself effect, and the effect not only has a cause but is also itself cause, yet the effect which the cause has, and the effect which the cause is, are different, as are also the cause which the effect has, and the cause which the effect is."(see also Hegel, 1998, p. 565/566). Hegel formulates the relationship between a cause and an effect in his typical way. The cause has within itself those properties in which the determinateness of the cause has to be found and vice versa. The effect is not an effect as contrasted with another, but possesses within itself the determinateness whereby it is an effect. The cause itself is determined with reference to an otherness, the effect, but in such a manner that its nature is to negate this its own otherness. However, the other of the cause itself, the effect, is itself negating the cause and excluding this its own non-being from itself, it negates its relationship to its own other, the cause. In other words, both, cause and effect, are negating each other. However, can a cause be a cause in itself, apart from any relation to the effect and vice versa? Can an effect be an effect in itself, apart from any relation to the cause?

Under conditions of Einstein's general theory of relativity, the causal relationship k (**Einstein's Weltformel**), denoted as $k\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right)$, is given by

$$\begin{aligned}
&k\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right)\\
&\equiv \frac{\sigma\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right)}{\sqrt[2]{{}^{2}\sigma\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap {}^{2}\sigma\left({}_{R}W_{kl\mu\nu\ldots}\right)}}\\
&\equiv \frac{\sigma\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right)}{\sigma\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap \sigma\left({}_{R}W_{kl\mu\nu\ldots}\right)}\\
&\equiv \frac{\left({}_{R}U_{kl\mu\nu\ldots} \cap {}_{R}W_{kl\mu\nu\ldots}\right) \cap \left(p\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right) - \left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)}{\sqrt[2]{\left(\left({}_{R}U_{kl\mu\nu\ldots}{}^{2}\right) \cap \left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}U_{kl\mu\nu\ldots}\right)\right)\right) \cap \left({}_{R}W_{kl\mu\nu\ldots}{}^{2}\right) \cap \left(p\left({}_{R}W_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)\right)}}\\
&\equiv \frac{\left({}_{R}U_{kl\mu\nu\ldots} \cap {}_{R}W_{kl\mu\nu\ldots}\right) \cap \left(p\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right) - \left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)}{\left({}_{R}U_{kl\mu\nu\ldots} \cap {}_{R}W_{kl\mu\nu\ldots}\right) \cap \sqrt[2]{\left(\left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}U_{kl\mu\nu\ldots}\right)\right)\right) \cap \left(p\left({}_{R}W_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)\right)}}\\
&\equiv \frac{\left(p\left({}_{R}U_{kl\mu\nu\ldots}, {}_{R}W_{kl\mu\nu\ldots}\right) - \left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)}{\sqrt[2]{\left(\left(p\left({}_{R}U_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}U_{kl\mu\nu\ldots}\right)\right)\right) \cap \left(p\left({}_{R}W_{kl\mu\nu\ldots}\right) \cap \left(1_{kl\mu\nu\ldots} - p\left({}_{R}W_{kl\mu\nu\ldots}\right)\right)\right)\right)}}
\end{aligned} \tag{809}$$

Volume III

The laws of nature

the mathematician if the laws of mathematics referred to objects of our mere imagination, and not to objects of reality. '

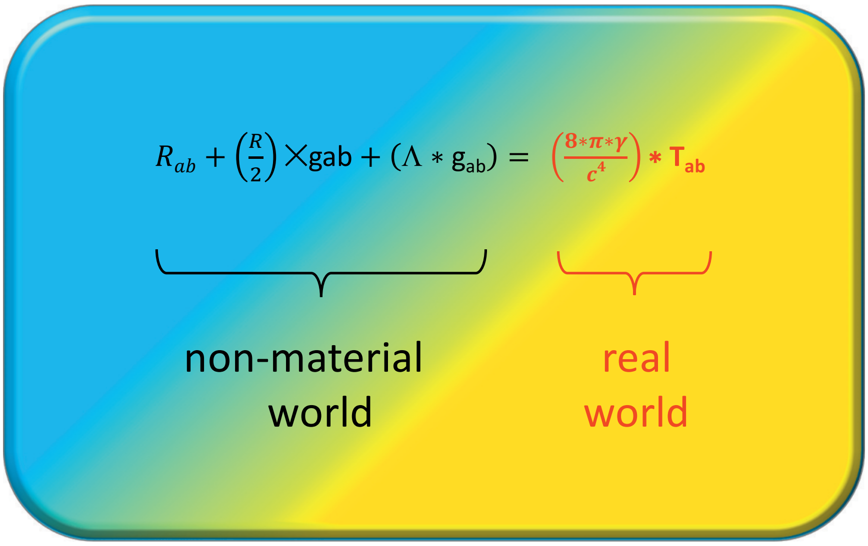

Fig. 19 Einstein's field equation and the existence of God.

Einstein himself in his original(see also Albert Einstein, 1921, p. 3) German words.

> "Die Mathematik genießt vor allen anderen Wissenschaften aus einem Grunde ein besonderes Ansehen; ihre Sätze sind absolut sicher und unbestreitbar, während die aller andern Wissenschaften bis zu einem gewissen Grad umstritten und stets in Gefahr sind, durch neuentdeckte Tatsachen umgestoßen zu werden. Trotzdem brauchte der auf einem anderen Gebiete Forschende den Mathematiker noch nicht zu beneiden, wenn sich seine Sätze nicht auf Gegenstände der Wirklichkeit, sondern nur auf solche unserer bloßen Einbildung bezögen. "
>
> (see Albert Einstein, 1921, p. 3)

Unfortunately, it is unavoidable to put forward view slight, critical remarks regarding Einstein's position on mathematics. The most definitions, rules or laws of mathematics are referred to objects of mere human mind and human imagination and exactly because of this not absolutely certain and not indisputable. Such mathematical definitions, rules or laws et cetera are debatable and in constant danger of being overthrown. To carry it to the extreme: while the Christian Bible simply insists on the doctrine: God created the world, mathematicians just define ex cathedra mathematical rules, facts et cetera i.e. like 0! = 1 (see I. Barukčić, 2018d, 2019g, 2019h, 2020b; I. Barukčić & Ufuoma, 2020; J. P. Barukčić & Barukčić, 2016) as individually and personally desired (**parte mea, regulae meae**). Clearly, one should be allowed to ask the question of

where is
the methodological difference between
religion and today's mathematics?

Taking account of all the relevant arguments mentioned before, the disregard of elementary rules of science in today's mathematics while considering Einstein's offhand remark when discussing the definitions, the rules et cetera of mathematics in a café conversation with engineer Gustave Ferrière (see also Brian, 1996, p. 76) nothing else remains to be done but to join Einstein in his radical stance on **today's** mathematics and to acknowledge publicly that

"I don't believe in mathematics."

(see also Brian, 1996, p. 76)

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