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Review Article

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Is the Russel Paradox Valid in Case of the Collection Called 'Universe'?

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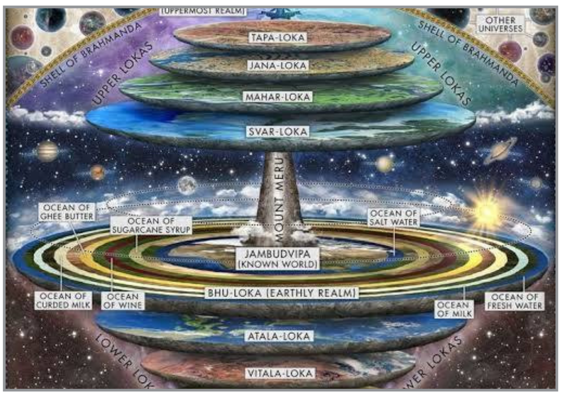
Abstract
These paper present similarities between the meaning of the natural languish words 'Universe' and 'Set of all sets that are not members of themselves'. Similarities are collected across different cultures and during time in order to establish if today similarities represent sufficient arguments for sustain that for the meaning of the natural languish word 'Universe' the Russell's paradox is valid. Comparing the understanding of the meaning of the natural languish word 'Universe' with the understanding of the natural language word "Set of all sets that do not contain themselves as elements" we find very high similarity. Therefore, the natural language word 'Universe' meaning is a Russell set for which Russell's paradox is true. Because from the principle of explosion of classical logic, any proposition can be proved from a contradiction, the presence of contradictions like Russell's paradox in an axiomatic 'Universe' theory is disastrous; since if any formula can be proved true it destroys the conventional meaning of truth and falsity. Different relevant models (mental constructions) of 'Universe 'are presented in which the presence of Russell's type paradox is ignored.

Keywords: Similarity, Universe, Russell's Paradox.

The Meaning of the Natural Languish word 'Universe' in Different Cultures During Time.

Hindu Cosmology is the description of the universe and its states of matter, cycles within time, physical structure, and effects on living entities according to Hindu texts. Hindu cosmology is also intertwined with the idea of a creator who allows the world to exist and take shape. [1] Hindu cosmology outlines the structure and cycles of the universe according to Hindu texts, emphasizing a cyclical view of time and the existence of multiple universes. It describes the universe as composed of subtle and gross matter, governed by the three qualities (gunas) of sattva, rajas, and tamas. A key concept is the cyclical nature of creation, preservation, and destruction, with each cycle known as a kalpa, and further subdivided into yugas.



In Indian culture, the term "universe" is encompassed by several concepts, most notably Loka and Brahman. Loka can refer to a world, a realm of existence, or even a mental state, and in the context of cosmology, it often refers to different planes or realms within the universe. Brahman is the ultimate reality, the source and ground of all existence, and the observed universe is often seen as a manifestation or projection of Brahman. Additionally, the concept of Ṛta represents the cosmic order and law that governs the universe.

Chinese Cosmology, a holistic worldview, views the universe as a unified organism where humans and the heavens are interconnected and influence each other. It emphasizes harmony, balance, and the interconnectedness of all things, often described through concepts like Yin and Yang and the Five Elements. Originating in Chinese philosophy, yin and yang , is the concept of opposite cosmic principles or forces that interact, interconnect, and perpetuate each other. Yin and Yang can be thought of as complementary and at the same time opposing forces that together form a dynamic system in which the whole is greater than the assembled parts and the parts are essential for the cohesion of the whole. In Chinese cosmology, the universe creates itself out of a primary chaos of primordial qi or material energy, organized into the cycles of yin and yang, force and motion leading to form and matter. "Yin" is retractive, passive, contractive and receptive in nature, while "yang" is repelling, active, expansive and repulsive in principle; this dichotomy in some form, is seen in all things in nature and their patterns of change, difference and transformations. For example, biological, psychological and cosmological seasonal cycles, the historical evolution of landscapes over days, weeks, years to eons. The original meaning of Yin was depicted as the northerly shaded side of a hill and Yang being the bright southerly aspect. When pertaining to human gender Yin is associated to more rounded feminine characteristics and Yang as sharp and masculine traits.

Wuxing (Chinese: 五行; pinyin: wǔxíng), usually translated as Five Phases or Five Agents, is a fivefold conceptual scheme used in many traditional Chinese fields of study to explain a wide array of phenomena, including terrestrial and celestial relationships, influences, and cycles, that characterize the interactions and relationships within science, medicine, politics, religion and social relationships and education within Chinese culture. The five agents are traditionally associated with the classical planets: Mars, Mercury, Jupiter, Venus, and Saturn as depicted in the etymological section below. In ancient Chinese astronomy and astrology, that spread throughout East Asia, was a reflection of the seven-day planetary order of Fire, Water, Wood, Metal, Earth.

Japanese Cosmology. In Japanese mythology, the Tenchi-kaibyaku (天地開闢; Literally "Creation of Heaven & Earth") is the story that describes the legendary birth of the celestial and creative world, the birth of the first gods, and the birth of the archipelago. This story is described at the beginning of the Kojiki, the first book written in Japan (712), and in the Nihon Shoki (720). Both form the literary basis of Japanese mythology and Shinto; however, the story differs in some aspects between these works.

At the beginning the universe was immersed in a beaten kind of matter (chaos) in the shape of an egg, sunk in silence. Later there were sounds indicating the movement of particles. With this movement, the light and the lightest particles rose but the particles were not as fast as the light and could not go higher. Thus, the light was at the top of the Universe, and below it, the particles formed first the clouds and then Heaven, which was to be called Takamagahara (高天原; "High Plain of Heaven"). The rest of the particles that had not risen formed a huge mass, dense and dark, to be called Earth.

When Takamagahara was formed, a small plant was formed and from this small plant the first three gods appeared:

- Amenominakanushi (天之御中主神, Ame-no-Minakanushi)
- Takamimusubi (高御産巣日神, Taka-mi-musuhi-no-kami) and
- Kamimusubi (神産巣日神, Kami-musuhi-no-kami).

Then these gods:

- Umashi-ashi-kabi-hikoji (宇摩志阿斯訶備比古遅神, Umashi-ashi-kabi-hikoji-no-kami) and
- Ame-no-toko-tachi (天之常立神, Ame-no-toko-tachi-no-kami)

These five deities, known as Kotoamatsukami, appeared spontaneously, did not have a definite sex, did not have partners (hitorigami) and went into hiding after their emergence. These gods are not mentioned in the rest of the mythology.

Izanagi and Izanami giving birth to Japan

Then two other gods arose:

Kuni-no-Tokotachi (国之常立神, Kuni-no-tokotachi-no-kami) and

Toyo-kumono [ja] (豊雲野神, Toyo-kumono-no-kami)

These gods also emerged spontaneously, did not have a defined sex, did not have a partner, and hid at birth.

Then, five pairs of gods were born (for a total of ten deities), each pair consisting of a male deity and a female deity:

- Uhijini [ja] (宇比地邇神) and his younger sister (and wife) Suhijini [ja] (須比智邇神),
- Tsunuguhi (角杙神) and his younger sister (and wife) Ikuguhi (活杙神),
- Ōtonoji_(意富斗能地神) and his younger sister (and wife) Ōtonobe_(大斗乃弁神),
- Omodaru (於母陀流神) and his younger sister (and wife) Aya-kashiko-ne (阿夜訶志古泥神) and
- Izanagi (伊邪那岐神) and his younger sister (and wife) Izanami (伊邪那美神)

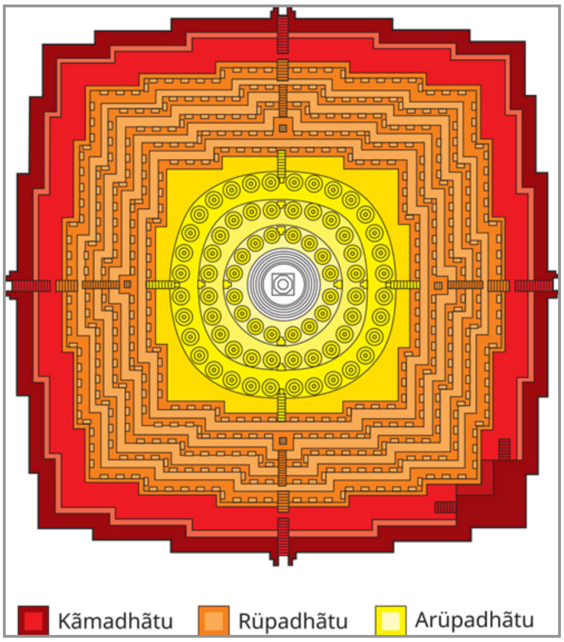
All deities from Kuni-no-koto-tachi to Izanami are collectively called Kamiyonanayo (神世七代; "Seven Divine Generations"). Following the creation of Heaven and Earth and the appearance of these primordial gods, Izanagi and Izanami went on to create the Japanese archipelago (Kuniumi) by stirring the ocean with a spear, then the matter that dripped off of the spear solidified and became an island, and they also gave birth to a large number of gods (Kamiumi). One of these gods being Amaterasu (the sun goddess of the Shinto religion).

Japanese Depiction of the Ten Realms

Buddhist Cosmology is the description of the shape and evolution of the Universe according to Buddhist scriptures and commentaries. It consists of a temporal and a spatial cosmology. The temporal cosmology describes the timespan of the creation and dissolvement of alternate universes in different aeons. The spatial cosmology consists of a vertical cosmology, the various planes of beings, into which beings are reborn due to their merits and development; and a horizontal cosmology, the distribution of these world-systems into an infinite sheet of existential dimensions included in the cycle of samsara. The entire universe is said to be made up of five basic elements of Earth, Water, Fire, Air and Space. Buddhist cosmology is also intwined with the belief of Karma. As a result, some ages are filled with prosperity and peace due to common goodness, whereas other eras are filled with suffering, dishonesty and short lifespans.

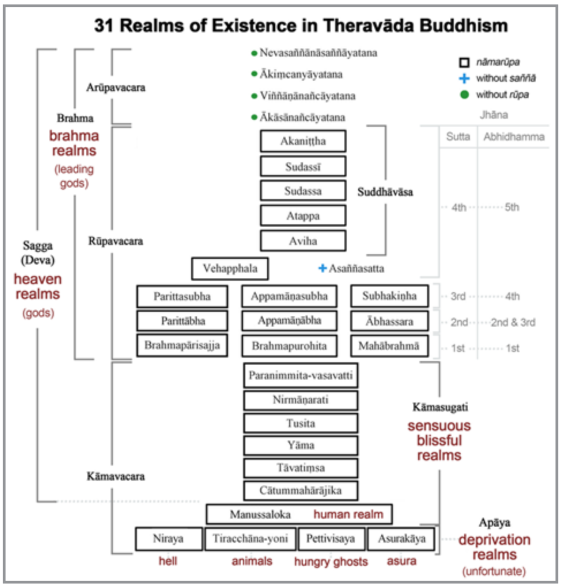
Wat Arun in Bangkok has five pagodas, which were built to Simulate Buddhist Cosmology

Buddhist mandala with Mount Meru shown in the center depicting the terrestrial universe divided into four quadrants each containing oceans and continents with the known world of humans, Jambudvīpa, located in the south alongside three other continents named Pūrvavideha, Aparagodānīya and Uttarakuru.



The plan of the Borobudur temple complex in Java mirrors the three main levels of Buddhist cosmology. The highest point in the center symbolizes Buddhahood.

Aerial view of Borobudur



The thirty-one planes of existence and the Jhānic-relation according to Theravāda Buddhism

Buddhist Cosmological Image of Alternate World Systems.

In Taoist Cosmology, the Tao is the ultimate, unnamable source and principle of all existence. It's a void, a state of potential from which everything arises. From the Tao emerges the two complementary forces, Yin and Yang, which interact and give form to the universe, including humans. This process is cyclical and interconnected, emphasizing the flow and transformation of all things.

Taoism is a philosophical and religious tradition indigenous to China, emphasizing harmony with the Tao □ (pinyin: dào; Wade–Giles: tao). With a range of meaning in Chinese philosophy, translations of Tao include 'way', 'road', 'path', or 'technique', generally understood in the Taoist sense as an enigmatic process of transformation ultimately underlying reality. Taoist thought has informed the development of various practices within the Taoist tradition, ideation of mathematics and beyond, including forms of meditation, astrology, qigong, feng shui, and internal alchemy. A common goal of Taoist practice is self-cultivation, a deeper appreciation of the Tao, and more harmonious existence. Taoist ethics vary, but generally emphasize such virtues as effortless action, naturalness, simplicity, and the three treasures of compassion, frugality, and humility.

The core of Taoist thought crystallized during the early Warring States period (c. 450 – c. 300 BCE), during which the epigrammatic Tao Te Ching and the anecdotal Zhuangzi—widely regarded as the fundamental texts of Taoist philosophy—were largely composed. They form the core of a body of Taoist writings accrued over the following centuries, which was assembled by monks into the Daozang canon starting in the 5th century CE. Early Taoism drew upon diverse influences, including the Shang and Zhou state religions, Naturalism, Mohism, Confucianism, various Legalist theories, as well as the I Ching and Spring and Autumn Annals.

The Chinese character 道, which represents Tao and is often translated as 'way', 'path', 'technique', or 'doctrine'

The bagua, a symbol commonly used to represent the Tao and its pursuit

A temple in the Wudangshan, a sacred space in Taoism

Taoist clergy of Baxian Temple [zh], Xi'an, 1910–1911.

Wong Tai Sin Temple, one of the most important Taoist temples in Hong Kong

Taoist ceremony at Xiao Ancestral Temple in Chaoyang, Shantou, Guangdong

The Cosmology of the Ancient Near East refers to beliefs about where the universe came from, how it developed, and its physical layout, in the ancient Near East, an area that corresponds with the Middle East today (including Mesopotamia, Egypt, Persia, the Levant, Anatolia, and the Arabian Peninsula). The basic understanding of the world in this region from premodern times included a flat earth, a solid layer or barrier above the sky (the firmament), a cosmic ocean located above the firmament, a region above the cosmic ocean where the gods lived, and a netherworld located at the furthest region in the direction down. Creation myths explained where the universe came from, including which gods created it (and how), as well as how humanity was created. These beliefs are attested as early as the fourth millennium BC and dominated until the modern era, with the only major competing system being the Hellenistic cosmology that developed in Ancient Greece in the mid-1st millennium BC. Geographically, these views are known from the Mesopotamian cosmologies from Babylonia, Sumer, and Akkad; the Levantine or West Semitic cosmologies from Ugarit and ancient Israel and Judah (the biblical cosmology); the Egyptian cosmology from Ancient Egypt; and the Anatolian cosmologies from the Hittites. This system of cosmology went on to have a profound influence on views in early Greek cosmology, later Jewish cosmology, patristic cosmology, and Islamic cosmology (including Quranic cosmology).

The Cosmology of the Ancient Greek. A term for universe among the ancient Greek philosophers from Pythagoras onwards was ‘τὸ πᾶν’ (tò pân) 'the all', defined as all matter and all space, and ‘τὸ ὅλον’ (tò hólon) 'all things', which did not necessarily include the void. Another synonym was ‘ὁ κόσμος’ (ho kósmos) meaning 'the world, the cosmos’[2 - 4].

Early Greek cosmology refers to beliefs about the origins, development, and structure of the universe in Ancient Greece that existed before the development of Ancient Greek astronomy. The basic elements of this early cosmology included a flat earth, heaven, a cosmic ocean, the afterworld (Hades), and the netherworld (Tartarus). The first three were represented by the gods Gaia, Uranus, and Oceanus (or sometimes Pontus). Ancient Greek cosmology was related to ancient Near Eastern cosmology, and was ultimately replaced by a more systematic and demythologized approach found in ancient Greek astronomy. Its main sources are the poetry of Homer (the Iliad and the Odyssey), Hesiod (the Theogony and the Works and Days), and surviving fragments from Mimnermus.

Beginning in the 5th century BC, elements of the traditional Greek cosmos began to be modified and challenged. One of the earliest of these challenges came from the emergence of the view that the cosmos as a whole was spherical (advocated by Xenophanes, Parmenides, Empedocles, and others). The rotation of the spherical cosmos was said to explain the visible rotation of the stars (an idea called "vortex"). Soon, a spherical model of the earth itself was proposed, which gradually gained acceptance, although the flat earth view never entirely disappeared during either classical antiquity or late antiquity, continuing to receive support from geographers and others like Ctesias, Ephorus, Strabo, Tacitus, and the Epicureans. The last Greek advocate of the traditional cosmology was Cosmas Indicopleustes.

All models of early Greek cosmology shared the following five elements:

- A solid sky (firmament)
- High ridges at the rim of the (flat) earth
- The sun being close to the earth when it sets and rises
- The sun feeds on vapors from the earth
- The sun and moon are both small compared to the earth

Another important element of early Greek cosmology that would distinguish it from the ancient Greek astronomy that would come to dominate in later centuries was the emphasis on the role of the gods in the past and ongoing history of man and the mythological nature of the surrounding world.

Early Greek cosmology is similar and related to cosmology in the ancient Near East. The famous trio of gods Zeus (king of the gods), Poseidon (god of the sea), and Hades (god of the netherworld) have been described as a "perfect" equivalent to trios of gods in ancient Near Eastern cosmologies, such as Baal, Yam, and Mot in the cosomology of Ugarit, a city that once existed in modern-day West Syria. Hesiod's Theogony is potentially directly textually related to an earlier Hittite cosmology called the Song of Kumarbi. More broadly, early Greek cosmogonies could derive from an even earlier, Indo-European cosmogony.

In early Greek cosmology, the earth is a finite plain with outer edges. Fantastical creatures, monsters, and quasi-humans were believed to inhabit the edges of the earth. Past the earth's edges, it was believed that there was a cosmic ocean, whose name was Oceanus. Oceanus is also said to be overlaid by the rim of a shield, originally fashioned for Achilles by Hephaistos. Oceanus had a sister and wife named Tethys, the god of freshwater, rivers, and springs. The two intermingle and mate to generate succeeding generations of gods: this intermingling between the salt- and fresh-water gods mimics earlier Mesopotamian cosmologies, like in the division between Tiamat and Abzu, and later Greek cosmologies, including one reported in Plato (Timaeus 40e). The idea of salt and freshwater blending, personified by deities, may stem from hydrological observations; the name of the island-country Bahrain means "Two Seas", in reference to the meeting and mingling of fresh and salt water seas.

West European Cosmology. Western European cosmology, throughout history, has evolved from ancient Greek models to medieval and early modern perspectives, significantly shaped by religious and philosophical thought. Early models, like the geocentric view, placed Earth at the center of the universe, with the Sun, Moon, and planets orbiting in concentric spheres. This was later challenged by the heliocentric model, which positioned the Sun at the center, and eventually by modern understandings of a galaxy-centered universe with expanding galaxies.

Synonyms are also found in Latin authors (totum, mundus, natura) and survive in modern languages, e.g., the German words Das All, Welt all, and Nature, for universe. The same synonyms are found in English, such as everything (as in the theory of everything), the cosmos (as in cosmology), the world (as in the many-worlds interpretation), and nature (as in natural laws or natural philosophy) [5 - 6].

The Meaning of the Natural Languish Expression ‘Universe’ In Our Day. According to the universe is all of space and time and their contents. It comprises all of existence, any fundamental interaction, physical process and physical constant, and therefore all forms of matter and energy, and the structures they form, from subatomic particles to entire galactic filaments.

The physical universe is defined as all of space and time (collectively referred to as spacetime) and their contents. Such contents comprise all of energy in its various forms, including electromagnetic radiation and matter, and therefore planets, moons, stars, galaxies, and the contents of intergalactic space. The universe also includes the physical laws that influence energy and matter, such as conservation laws, classical mechanics, and relativity.

The universe is often defined as "the totality of existence", or everything that exists, everything that has existed, and everything that will exist. In fact, some philosophers and scientists support the inclusion of ideas and abstract concepts—such as mathematics and logic—in the definition of the universe. The word universe may also refer to concepts such as the cosmos, the world, and nature [7 – 17].

From the above presented understanding of the natural languish word ‘Universe’, it follows that the interpretation of the word "universe" as ‘all of space and time and their contents or everything that exists, everything that has existed, and everything that will exist , is widely accepted’.

The Meaning of the Natural Languish Word ‘Set’

By an “aggregate” we are to understand any collection into a whole M of definite and separate objects m of our intuition or our thought. These objects are called the “elements” of M. [18]. pg.85. The German word for a set is Menge, which is the reason Cantor denotes a set by M and its elements by m. In Menge is translated as an aggregate, but it has since become common to use the word set instead. Examples of sets are to be found everywhere around us. For example, we can speak of the set of all living human beings, the set of all cities in the US, the set of all sentences of some language, the set of all prime numbers, and so on. Each living human being is an element of the set of all living human beings. Similarly, each prime number is an element of the set of all prime numbers, and so on.

If S is a set and s is an element of S, then we write $s \in S$. If it so happens that s is not an element of S, then we write $s \notin S$. If S is the set whose elements are s, t, and u, then we write $S = \{s, t, u\}$. The left brace and right brace visually indicate the “bounds” of the set, while what is written within the bounds indicates the elements of the set. For example, if $S = \{1, 2, 3\}$, then $2 \in S$, but $4 \notin S$. Sets are determined by their elements. The order in which the elements of a given set are listed does not matter. For example, $\{1, 2, 3\}$ and $\{3, 1, 2\}$ are the same set. It also does not matter whether some elements of a given set are listed more than once. For instance, $\{1, 2, 2, 2, 3, 3\}$ is still the set $\{1, 2, 3\}$. Many sets are given a shorthand notation in mathematics because they are used so frequently. A few elementary examples are the set of natural numbers, $\{0,1,2,...\}$, denoted by the symbol N, the set of integers, $\{..., 2, 1, 0, 1, 2,... \}$, denoted by the symbol Z, the set of rational numbers, denoted by the symbol Q, and the set of real numbers, denoted by the symbol R.

A set may be defined by a property. For instance, the set of all planets in the solar system, the set of all even integers, the set of all polynomials with real coefficients, and so on. For a property P and an element s of a set S, we write P(s) to indicate that s has the property P. Then the notation $A = \{s \in S : P(s)\}$ indicates that the set A consists of all elements s of S having the property P. The colon: is commonly read as “such that,” and is also written as “|.” So $\{s \in S \mid P(s)\}$ is an alternative notation for $\{s \in S : P(s)\}$. For a concrete example, consider $A = \{x \in R : x^2=1\}$. Here the property P is “$x^2=1$.” Thus, A is the set of all real numbers whose square is one.

For two sets, we may speak of whether or not one set is contained in the other. Here is how Dedekind defines this relation between sets. Note that Dedekind calls sets systems.

A system A is said to be part of a system S when every element of A is also an element of S. Since this relation between a system A and a system S will occur continually in what follows, we shall express it briefly by the symbol $A \prec S$. [19, pg. 46]

Modern notation for $A \prec S$ is $A \subseteq S$, and we say that A is a subset of S. Thus, $A \subseteq S$ if, and only if, for all x, if $x \in A$, then $x \in S$. When A is not a subset of S, we write $A \not\subseteq S$.

A system A is said to be a proper part of S, when A is part of S, but...S is not a part of A, i.e., there is in S an element which is not an element of A. [19, p. 46]. Nowadays we say that A is a proper subset of S, and write $A \subset S$. If A is not a proper subset of S, then we write $A \subset S$.

We already discussed the membership and subset relations between sets. But when are two sets equal? Dedekind addresses this issue as follows. ...a system S...is completely determined when with respect to everything it is determined whether it is an element of S or not. The system S is hence the same as the system T, in symbols $S \equiv T$, when every element of S is also element of T, and every element of T is also element of S. [19, pg. 45]

Thus, two sets A and B are equal, in notation $A \equiv B$, when they consist of the same elements; that is, $A \equiv B$ if, and only if, for all x, $x \in A$ if, and only if, $x \in B$.

So far we have clarified the meanings: membership, subset, and equality relations between sets. But we can also define operations on sets that are somewhat similar to the operations of addition, multiplication, and subtraction of numbers. The sum of a collection of sets is obtained by combining the elements of the sets. Nowadays we call this operation union. This is how Dedekind defines it.

By the system compounded out of any systems A, B, C, . . . to be denoted M(A, B, C, . . .) we mean that system whose elements are determined by the following prescription: a thing is considered as element of M(A, B, C, . . .) when and only when it is element of some one of the systems A, B, C, . . . , i.e., when it is element of A, or B, or C, . . . [19, pp. 46–47]

In the particular case of two sets A and B, the union of A and B is the set consisting of the elements that belong to either A or B. Modern notation for M(A, B) is $A \cap B$. Thus, $A \cap B = \{x : x \in A \text{ or } x \in B\}$. Here the meaning of “or” is inclusive; that is, if it so happens that an element x belongs to both A and B, then x belongs to the union $A \cup B$. Another useful operation on sets is taking their common part. Nowadays this operation is known as intersection. This is how Dedekind defines it.

A thing g is said to be common element of the systems A, B, C, . . ., if it is contained in each of these systems (that is in A and in B and in C...). Likewise, a system T is said to be a common part of A, B, C, . . . when T is part of each of these systems; and by the community of the systems A, B, C, . . . we understand the perfectly determinate system G (A, B, C, . . .) which consists of all the common elements g of A, B, C, . . . and hence is likewise a common part of those systems. [19, pp. 48–49]

In the particular case of two sets A and B, the intersection of A and B is the set consisting of the elements of both A and B. Modern notation for G(A, B) is $A \cap B$. Thus, $A \cap B = \{x : x \in A \text{ and } x \notin B\}$.

We may also define the difference of two sets A and B as the set consisting of those elements of A that do not belong to B. This operation is called set complement and is denoted by. Thus, A- B = {x : x∈ A and x ∉ B}.

The set operations may yield a set containing no elements. We call the set containing no elements the empty set (or null set) and denote it by $\emptyset$.

The notations for the set operations that we use today were first introduced by Giuseppe Peano (1858–1932).

Usually the sets that we work with are subsets of some ambient set. For instance, even numbers, odd numbers, and prime numbers are all subsets of the set of integers Z . Such an ambient set is referred to as a universal set (or a set of discourse) and is denoted by U. In other words, a universal set is the underlying set that all the sets under examination are subsets of. We may thus speak of the set difference U- A, which is the set of those elements of U that do not belong to A. The set difference U- A is usually denoted by A^c. Thus, A^c= U- A = {x ∈ U : x ∉ A}.

Russell's Paradox

We conclude this section by the celebrated Russell's paradox. As we saw earlier, different properties give rise to different sets. If every set was determined by some property, then the whole of set theory would be derivable from the general principles of logic. Since all of mathematics is based on set theory, it would follow that the whole of mathematics is derivable from the general principles of logic. This was the grand plan, known as logicism, of the great German mathematician, philosopher, and one of the founders of modern logic, Gottlob Frege (1848–1925). Unfortunately, soon after Frege published his program, the famous British philosopher, mathematician, and antiwar activist Bertrand Russell (1872–1970) found a fatal flaw in Frege's arguments. This became known as Russell's paradox. For the history of Russell's paradox, including the excerpt from his 1902 letter to Frege, we refer to, where different versions of the paradox, as well as paradoxes of a similar nature can also be found. Below we give one of the most popular version of Russell's paradox, which is perfectly suited for our purposes. It is taken from [20 - 21, pp. 1–2].

By a set, we mean any collection of objects — for example, the set of all even integers or the set of all saxophone players in Brooklyn. The objects that make up a set are called its members or elements. Sets may themselves be members of sets; for example, the set of all sets of integers has sets as its members. Most sets are not members of themselves; the set of cats, for example, is not a member of itself because the set of cats is not a cat. However, there may be sets that do belong to themselves — for example, the set of all sets. Now, consider the set A of all those sets X such that X is not a member of X. For A there are two possibilities ('tertium non datur'=' law of excluded middle): to contain it as an element or not to contain it as an element. Assuming that A is a member of A, then it follows that A is not a member of A; and assuming that A is not a member of A, then it follows that A is a member of A.

Implications of russell's paradox concerning the meaning of the natural word set.

Prior to Russell's paradox (and to other similar paradoxes discovered around the time, such as the Burali Forti paradox), a common conception of the idea of set was the "extensional concept of set", as recounted by von Neumann and Morgenstern: A set is an arbitrary collection of objects, absolutely no restriction being placed on the nature and number of these objects, the elements of the set in question. The elements constitute and determine the set as such, without any ordering or relationship of any kind between them. In particular, there was no distinction between sets and proper classes as collections of objects. Additionally, the existence of each of the elements of a collection was seen as sufficient for the existence of the set of said elements. However, paradoxes such as Russell's and Burali-Forti's showed the impossibility of this conception of set, by examples of collections of objects that do not form sets, despite all said objects being existent.

From the principle of explosion of classical logic, any proposition can be proved from a contradiction. Therefore, the presence of contradictions like Russell's paradox in an axiomatic set theory is disastrous; since if any formula can be proved true it destroys the conventional meaning of truth and falsity. Further, since set theory was seen as the basis for an axiomatic development of all other branches of mathematics, Russell's paradox threatened the foundations of mathematics as a whole. This motivated a great deal of research around the turn of the 20th century to develop a consistent (contradiction-free) set theory. In 1908, Ernst Zermelo proposed an axiomatization of set theory that avoided the paradoxes of naive set theory by replacing arbitrary set comprehension with weaker existence axioms, such as his axiom of separation (Aussonderung). (Avoiding paradox was not Zermelo's original intention, but instead to document which assumptions he used in proving the well-ordering theorem.) Modifications to this axiomatic theory proposed in the 1920s by Abraham Fraenkel, Thoralf Skolem, and by Zermelo himself resulted in the axiomatic set theory called ZFC. This theory became widely accepted once Zermelo's axiom of choice ceased to be controversial, and ZFC has remained the canonical axiomatic set theory down to the present day. ZFC does not assume that, for every property, there is a set of all things satisfying that property. Rather, it asserts that given any set X, any subset of X definable using first-order logic exists. The object R defined by Russell's paradox above cannot be constructed as a subset of any set X, and is therefore not a set in ZFC. In some extensions of ZFC, notably in von Neumann–Bernays–Gödel set theory, objects like R are called proper classes. ZFC is silent about types, although the cumulative hierarchy has a notion of layers that resemble types. Zermelo himself never accepted Skolem's formulation of ZFC using the language of first-order logic. As José Ferreirós notes, Zermelo insisted instead that "propositional functions (conditions or predicates) used for separating off subsets, as well as the replacement functions, can be 'entirely arbitrary' [ganz beliebig]"; the modern interpretation given to this statement is that Zermelo wanted to include higher order quantification in order to avoid Skolem's paradox. Around 1930, Zermelo also introduced (apparently independently of von Neumann), the axiom of foundation, thus—as Ferreirós observes—"by forbidding 'circular' and 'ungrounded' sets, it [ZFC] incorporated one of the crucial motivations of TT [type theory]—the principle of the types of arguments". This 2nd order ZFC preferred by Zermelo, including axiom of foundation, allowed a rich cumulative hierarchy. Ferreirós writes that "Zermelo's 'layers' are essentially the same as the types in the contemporary versions of simple TT [type theory] offered by Gödel and Tarski. One can describe the cumulative hierarchy into which Zermelo developed his models as the universe of a cumulative TT in which transfinite types are allowed. (Once we have adopted an impredicative standpoint, abandoning the idea that classes are constructed, it is not unnatural to accept transfinite types.) Thus, simple TT and ZFC could now be regarded as systems that 'talk' essentially about the same intended objects. The main difference is that TT relies on a strong higher-order logic, while Zermelo employed second-order logic, and ZFC can also be given a first-order formulation. The first-order 'description' of the cumulative hierarchy is much weaker, as is shown by the existence of countable models (Skolem's paradox), but it enjoys some important advantages."

In ZFC, given a set A, it is possible to define a set B that consists of exactly the sets in A that are not members of themselves. B cannot be in A by the same reasoning in Russell's Paradox. This variation of Russell's paradox shows that no set contains everything. Through the work of Zermelo and others, especially John von Neumann, the structure of what some see as the "natural" objects described by ZFC eventually became clear: they are the elements of the von Neumann universe, V, built up from the empty set by transfinitely iterating the power set operation. It is thus now possible again to reason about sets in a non-axiomatic fashion without running afoul of Russell's paradox, namely by reasoning about the elements of V. Whether it is appropriate to think of sets in this way is a point of contention among the rival points of view on the philosophy of mathematics. Other solutions to Russell's paradox, with an underlying strategy closer to that of type theory, include Quine's New Foundations and Scott–Potter set theory. Yet another approach is to define multiple membership relation with appropriately modified comprehension scheme, as in the Double extension set theory.

Similarity between the meaning of the natural languish words 'Universe' and 'Set of all sets that are not members of themselves'

Remember:

1. The 'Universe' is all of space and time and their contents. It comprises all of existence, any fundamental interaction, physical process and physical constant, and therefore all forms of matter and energy, and the structures they form, from subatomic particles to entire galactic filaments.
2. The physical 'Universe' is defined as all of space and time (collectively referred to as space-time) and their contents. Such contents comprise all of energy in its various forms, including electromagnetic radiation and matter, and therefore planets, moons, stars, galaxies, and the contents of intergalactic space. The 'Universe' also includes the physical laws that influence energy and matter, such as conservation laws, classical mechanics, and relativity.
3. The 'Universe' is often defined as "the totality of existence", or everything that exists, everything that has existed, and everything that will exist. In fact, some philosophers and scientists support the inclusion of ideas and abstract concepts—such as mathematics and logic—in the definition of the 'Universe'. The word 'Universe' may also refer to concepts such as the cosmos, the world, and nature.
4. By a "Set" we are to understand any collection into a whole M of definite and separate objects m of our intuition or our thought. The objects that make up a Set are called its members or elements. Sets may themselves be members of sets. Most sets are not members of themselves. However, there may be sets that do belong to themselves — for example, the Set of all sets.

Reading the meaning of the natural language word 'Universe' we understand that the 'Universe' is the collection of everything. Comparing this understanding with the understanding of the natural language word "Set of all sets that do not contain themselves as elements" results very high similarity. Therefore, the natural language word 'Universe' meaning is a Russell set for which Russell's paradox is true. We saw the logical complications arising from Russell's paradox in section 3. Also there we saw different axiomatic approaches to set theory intended to resolve the logical complications. Among these axiomatic approaches, we underline that the theory of types, in axiomatic set theory, resembles to the stratification of the understanding of the natural language word 'Universe' in Hindu cosmology.

We do not know exactly what Einstein meant by the natural word 'Universe' when he developed the theory of general relativity. If he had in mind a theory avoiding the Russell paradox? From his publications we only know that Einstein had at least the following three different understandings of the natural word 'Universe'.

-Einstein's static universe, aka the Einstein universe or the Einstein static eternal universe, is a relativistic model of the universe proposed by Albert Einstein in 1917. Shortly after completing the general theory of relativity, Einstein applied his new theory of gravity to the universe as a whole. Assuming a universe that was static in time, and possessed of a uniform distribution of matter on the largest scales, Einstein was led to a finite, static universe of spherical spatial curvature. To achieve a consistent solution to the Einstein field equations, for the case of a static universe with a nonzero density of matter, Einstein found it necessary to introduce a new term to the field equations, the cosmological constant. In the resulting model, the radius R and density of matter ρ of the universe were related to the cosmological constant Λ according to Λ = 1/R 2 = κρ/2, where κ is the Einstein gravitational constant. [22 – 26].

-The Friedmann–Einstein universe is a model of the 'Universe' published by Albert Einstein in 1931.The model is of historic significance as the first scientific publication in which Einstein embraced the possibility of a cosmos of time-varying radius. Interpreting Edwin Hubble's discovery of a linear relation between the redshifts of the galaxies and their radial distance as evidence for an expanding universe, Einstein abandoned his earlier static model of the universe and embraced the dynamic cosmology of Alexander Friedmann. Removing the cosmological constant term from the Friedmann equations on the grounds that it was both unsatisfactory and unnecessary, Einstein arrived at a model of a universe that expands and then contracts, a model that was later denoted the Friedmann–Einstein model of the universe. In the model, Einstein derived simple expressions relating the density of matter, the radius of the universe and the timespan of the expansion to the Hubble constant. With the use of the contemporaneous value of 500 km·s−1Mpc−1 for the Hubble constant, he calculated values of 10−26 cm−3, 108 light-years and 1010 years for the density of matter, the radius of the universe and the timespan of the expansion respectively. It has recently been shown that these calculations contain a slight systematic error. [27 - 31].

-The Einstein–de Sitter universe is a model of the 'Universe' proposed by Albert Einstein and Willem de Sitter in 1932. On first learning of Edwin Hubble's discovery of a linear relation between the redshift of the galaxies and their distance, Einstein set the cosmological constant to zero in the Friedmann equations, resulting in a model of the expanding universe known as the Friedmann–Einstein universe. In 1932, Einstein and De Sitter proposed an even simpler cosmic model by assuming a vanishing spatial curvature as well as a vanishing cosmological constant. In modern parlance, the Einstein–de Sitter universe can be described as a cosmological model for a flat matter-only Friedmann– Lemaître–Robertson–Walker metric (FLRW) Universe. In the model, Einstein and de Sitter derived a simple relation between the average density of matter in the universe and its expansion according to H0 2 = κρ/3, where H0 is the Hubble constant, ρ is the average density of matter and κ is the Einstein gravitational constant. The size of the Einstein–de Sitter universe evolves with time as, making its current age 2/3 times the Hubble time. The Einstein–de Sitter universe became a standard model of the 'Universe' for many years because of its simplicity and because of a lack of empirical evidence for either spatial curvature or a cosmological constant. It also represented an important theoretical case of a 'Universe' of critical matter density poised just at the limit of eventually contracting. However, Einstein's later reviews of cosmology make it clear that he saw the model as only one of several possibilities for the expanding 'Universe'. The Einstein–de Sitter universe was particularly popular in the 1980s, after the theory of cosmic inflation predicted that the curvature of the 'Universe' should be very close to zero. This case with zero cosmological constant implies the Einstein–de Sitter model, and the theory of cold dark matter was developed, initially with a cosmic matter budget around 95% cold dark matter and 5% baryons. However, in the 1990s various observations including galaxy clustering and measurements of the Hubble constant led to increasingly serious problems for this model. Following the discovery of the accelerating 'Universe' in 1998, and observations of the cosmic microwave background and galaxy redshift surveys in 2000–2003, it is now generally accepted that dark energy makes up around 70 percent of the present energy density while cold dark matter contributes around 25 percent, as in the modern Lambda-CDM model. The Einstein–de Sitter model remains a good approximation to our 'Universe' in the past at redshifts between around 300 and 2, i.e. well after the radiation-dominated era but before dark energy became important.[32 – 39].

Hawking's scientific works included a collaboration with Roger Penrose on gravitational singularity theorems in the framework of general relativity, and the theoretical prediction that black holes emit radiation, often called Hawking radiation. Initially, Hawking radiation was controversial. By the late 1970s, and following the publication of further research, the discovery was widely accepted as a major breakthrough in theoretical physics. Hawking was the first to set out a theory of cosmology explained by a union of the general theory of relativity and quantum mechanics. Hawking was a vigorous supporter of the many-worlds interpretation of quantum mechanics. He also introduced the notion of a micro black hole.[40 - 42].

We mention that in none of these models of 'Universe' is there any reference to the possible existence or non-existence of a Russell-type paradox.

Conclusions

The meaning of the natural languish word 'Universe' is an "extensional concept of 'Universe'". The 'Universe' concept is an arbitrary collection of objects, absolutely no restriction being placed on the nature and number of these objects, the elements of the 'Universe'. The elements constitute and determine the 'Universe' as such, without any ordering or relationship of any kind between them. Additionally, the existence of each of the elements of 'Universe 'is seen as sufficient for the existence of the 'Universe 'of said elements. However, paradoxes such as Russell's and Burali-Forti's showed the impossibility of this conception of 'Universe', by examples of collections of objects that do not form 'Universe', despite all said objects being existent.

From the principle of explosion of classical logic, any proposition can be proved from a contradiction. The presence of contradictions like Russell's paradox in an axiomatic 'Universe' theory is disastrous; since if any formula can be proved true it destroys the conventional meaning of truth and falsity. Further, since 'Universe' theory was seen as the basis for an axiomatic development of all other branches of physics, Russell's paradox threatened the foundations of physics as a whole.

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The authors declare no conflicts of interest.

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