UNIT 1 SPACE AND TIME

Contents

1.0 OBJECTIVES

This unit takes the students to the speculative, philosophical and scientific notions of space and time.

1.1 INTRODUCTION

Space and Time remain as one of the riddles in philosophy since ancient period. Are space and time ultimately real? Or they are real only with reference to phenomena or event is still a debatable question. Those who support the absolute theory of space and time argue that space and time are ultimately real. But those who disagree with the absolute existence of space and time argue that space and time are real only with reference to phenomena. Space and time are non-existent if they are divorced from events. Space and time act as receptacle of events. Events are meaningless without spatio-temporal characteristics. They are also thinkers who support the theory that space and time are 'empty.' Are space and time finite or infinite? There is no 'beginning' and 'end' for space and time accounting to the infinite theory of space and time. There is also no 'direction' for space and time. We do not know where is the starting point for this cosmos nor do we know the terminus of it.

1.2 PERCEPTUAL AND CONCEPTUAL SPACE AND TIME

When we perceive the external world we see in front of us the perceptual world. When we slowly turn our heads, the 'horizon' of the perceptual world changes and there is continuity in our perception. 'Far,' 'near,' 'above,' 'below,' 'by the

side of,' 'under' etc. are some of the words we use to refer to the spatial quality of our perception. Perceptual space is 'sensibly continuous.' Perceptual time is the experience of an event when it 'endures.' The duration of the event is a continuation of the past to the present and the future. Perceptual space and time are experienced by us through events. Perceptual space is finite. It can be divided into smaller units. The divided segments of the infinite space can be quantitatively measured. Perceptual space has got directions and reversible.

But perceptual time is irreversible. It can be divided into smaller units. Both percpetual space and time are limited and can be specified to particular contexts or phenomena. Conceptual space and time are infinite, unlimited, and abstract and has no directions. They are indivisible and imagined. It is possible to go to the present from the past or from the past to the present. Conceptual space is infitite in the sense that our imagination cannot limit the space. The mind can form an idea about small or big space. Once can also imagine future time. Since the space or time which are imagined are called conceptual space or time, they are not limited.

There are other theories of space and time too apart from the perceptual and conceptual theories of space and time.

1) Idealistic theory of space and time (Kant)
2) Realistic theory of space and time (Samuel Alexander)
3) Anti-Intellectualistic theory of space and time (William James and Henri Bergson)
4) Realitivistic theory of space and time (Albert Einstein)

1.3 IDEALISTIC THEORY OF SPACE AND TIME

Immanuel Kant is the exponent of Idealistic theory of space and time. His views on space and time are discussed in his *The Critique of Pure Reason.* According to him our perception (which he calls '*phenomenon'*) consists of two parts: that due to object, which he calls 'sensation,' and that due to our subjective apparatus, which, he says, causes the manifold to be ordered in certain relations. This latter part he calls the form of the phenomenon. This part is not itself sensation, and therefore not dependent upon the accident of environment; it is always the same, since we carry it about with us, and it is *a priori* in the sense that it is not dependent upon experience. A pure form of sensibility is called a 'pure intutition'; there are two such forms namely spasce and time, one for the outer sense, one for the inner. As pure forms of intuition the mind projects spatio-temporal characteristics to the objects of perception. Therefore the external objects themselves do not have space and time. They are the subjective (as forms of intuition) projections of the inner mind. Idealistic view of Kant with regard to space and time are established by him by using antinomicial concepts. Antinomical concepts are opposite concepts. In case space and time are not subjective, but objective, it is inevitable that the following possibilities will exist simultaneously:

1) That space and time are both finite and infinite
2) That space and time are both divisible and indivisible
3) That space and time are both part and whole

If space and time are assumed to be objective, realistic or empirical, the above possibilities will exist simultaneously. It is non-sensical to say that space and time are finite and infinite divisible and indivisible, and part and whole simultaneously. Therefore according, to Kant to overcome this problem it is necessary to say that space and time are Idealistic. The antinomical (opposite) concepts such as finite-infinite, divisible-indivisible, part-whole are used by Kant to prove his Idealistic theory of space and time. Kant also uses tow classes of arguments to prove that space and time are *a priori* forms of intuition: (1) metaphysical and (2) epistemological (which he calls transcendental). The metaphysical arguments are taken directly from the nature of space and time and the transcendental arguments are taken indirectly from the possibility of pure mathematics. As regards space metaphysical arguments are four in number:

1) Space is not an empirical concept, abstracted from outer experiences, for space is presupposed in referring sensations to something external, and external experience is only possible through the presentation of space.

2) Space is a necessary presentation *a priori,* which underlies all external perceptions; for we can not imagine that there should be no space, although we can imagine that there should be nothing in space.

3) Space is not a discursive or general concept of the relations of things in general, for there is only one space, of which we call 'spaces' are parts, not instances.

4) Space is presented as an infinite given magnitude, which holds within itself all the parts of space; this relation is different from that of a concept to its instances and therefore space is not a concept.

The transcendental argument concerning space is derived from geometry. Kant holds that Euclidean geometry is known *a priori,* although it is synthetic, i.e., not deducible form logic alone. Geometrical proofs depend upon the figures. The objects of sense must obey geometry, because geometry is concerned with our ways of perceiving, and therefore we can not perceive otherwise. This explains why geometry, through synthetic, is *apriori* and *apodeitic*. The arguments with regard to time are essentially the same, except that arithmetic replaces geometry with the contention that counting takes time.

1.4 REALISTIC THEORY OF SPACE AND TIME

Samuel Alexander is the exponent of the realistic theory of space and time. The basic elements of Alexander's system can be traced to the great philosophers of the past, and the scientific thinkers of his time but his greatness lies in synthesizing them into an original form all his own. Like Lloyd Morgan, Alexander was a naturalist and an empiricist. But whereas Morgan starts from physical events related in space and time and tries to show how, out of these, all inorganic material substance, life and mind can be conceived to emerge, Alexander pushes the idea of emergence still further and shows how the entire universe including all physical events, life, mind and even deity can be conceived to evolve out of Space-Time emerges out of the matrix of Space-Time. Space-Time is the basic of a 'Pyramid' structure of emergent evolution and out of it emerges the higher levels, matter, life, mind and deity. Deity forms the apex of the pyramid, and there is *anisus* toward the deity inherent in the process of evolution. This explains the upward

direction of the process. For Alexander epistemology is not the necessary preliminary to metaphysics and mind is a natural phenomenon. Every experience may be analysed into two district elements and their relation to one another. The two elements which are the terms of the relation are, on the one hand the act of mind or the awareness and on the other the object of which it is aware; the relation between them is that they are together or compresent in the world which is thus so far experienced. I am aware of my awareness and my awareness and my being aware of it are identical. But I am aware of an object, as something distinct from awareness and present before it. To keep the distinction between subjective and objective knowledge clear, Alexander calls the former enjoyment, and the latter contemplation. The mind enjoys itself; but the mind contemplates a true (in perception), an image (in memory) etc. While for Berkeley 'reality is ideas,' for Alexander 'ideas are reality.' Since he keeps the identity between the object contemplated and the object existing he is an epistemological monist or a neo-realist.

1.5 SPACE-TIME: THE ULTIMATE STUFF OR MATRIX

Space-Time, conceived as 'a system of motion' is hypothetically posited by Alexander as the stuff or matrix (or matrices) out of which things or events emerge. All finite beings are in some sense complexes of space and time. His procedure is not deductive, but, like that of science, empirical. He starts with the hypothesis of space-time and shows gradually that it can account for all observable phenomena, and thus the hypothesis becomes verified and justified. Unlike Spinoza and Kant, for Alexander space and time are inseparable system of motion. In this regard he agrees with Einstein's space-time continuum. Our experience of the finite space and time are parts of the imagined space and time. Therefore there is no reason to say that infinite space and time are unreal. Space and Time are ordinarily regarded as separate and independent. But their separation is the result of abstraction. For Alexander space and time are interdependent so that there neither is space without Time nor Time without space; that space is in its very nature temporal and Time spatial. Time, apart from space, would be nothing more than a mere succession of discrete instants, and there would be nothing to unite these discrete members into a continuous whole. If, therefore, the past instant is not to be lost as it otherwise would be, or rather since this is not the case in fact, there needs must be some continuum other than Time which can secure and sustain the togetherness of past and present, of earlier and later. This other form of being is space; that is space supplies us with the second continuum needed to save Time from being a mere 'now.' As Time in so far as it was temporal became a mere 'now,' so space as merely spatial becomes a blank. It would be without distinguishable elements. But a continuum without elements is not a continuum at all. Time distinguishes and separates the parts of space. Thus Space and Time depend each upon the other. Without space there would be no connection in Time. Without Time there would be no points to connect. There are no such things as points or instants by themselves. There are only point-instants or pure events. In fact there is no instant of time without a position in space and no point of space without an instant of time. A point occurs at an instant and an instant occupies a point. We can not think of the existence of a portionof space without thinking of it as existing at a particular date or time; and similarly we can not think of a particular time without thinking of it as the time of objects existing in

space. Ideas of space and time are, therefore, mutually interdependent. Space-Time presents a very complex system which can be grasped by the idea of motion. Even a particle and its motion is a made of Space-Time, Mind is made of Space-Time. Mental acts are really identical with neural processes, so that awareness of enjoyment of an act of mind is nothing but the enjoyment of a neural process with its own time and space. Therefore mind also is made of the stuff of Space-Time.

1.6 CATEGORIES, QUALITIES AND VALUES

Space-Time matrix gives rise to all existents by its internal differentiation. All objects have two different kinds of characters, pervasive and variable. The pervasive characters follow from the spatio-temporal nature common to all objects. These are called categories. The variable characters are those which are generated by special kinds of grouping of Space-Time and are found in special classes of existents. These are called qualities. The categories are the essential and universal constituents of whatever is experienced and they are common to the mental and non-mental. They are *a priori,* whereas qualities are empirical. The categories are *a priori,* not in the sense that they are not experienced; but in the sense of being pervasive and universal like the a priori categories of Kant. Alexander gives the natures of the different groups of categories such as; (1) Identity, diversity and existence (2) Universal, particular and individual (3)relation (4) order (5) substance, causality, reciprocity (6) quantity and intensity (7) whole and parts and number (8) motion. These categories are derived from the different aspects of the Space-Time system. Space-Time relationship is analogous to mind-body relationship. As the mind intitiates, guides and organizes the activities of the body, so also does Time with regard to space. The first thing to emerge out of space-time (or motion) by the activity of Time on space is finite motion. By a further grouping and complexity there emerges the next quality: Matter with primary qualities. Similarly in the course of further complexities and motions, the qualities such as matter with secondary qualities, life, mind and deity emerge. According to Alexander even deity is a product of emergent evolution from Space-Time (motion). For Bergson *Elan Vital* or reality pushes from behind the species and therefore evolution is creative. But deity according to Alexander is neither transcendental nor a force pushing from behind as the cause of evolution. Just like matter life and mind even deity is a product or quality emerging out of Space-Time matrix. However it must be admitted that Deity is the finest quality to be evolved from Space-Time.

As far Alexander's realistic conception of Space and Time, it must be stated that Space and Time have independent existence of their own. For Kant, Space and Time have no objective or independent existence. They are subjective or *a priori* forms of intuition. Such an idealistic view of space and time is refuted by Samuel Alexander by accepting space and time to be objectively real. On the contrary even the mind is a by product of Space-Time matrix. The values such as truth, goodness and beauty though dependent on mind are not the qualities of Reality. They are the products of interaction between mind and Reality. They arise out of mind's interpretation, utilization and appreciation, or in a word valuation of Reality. They should be called, therefore, values rather than qualities (of Reality). Reality in itself is neither true, nor, good nor beautiful. What is more important to remember here is that even values are product of Space-Time.

1.7 ANTI-INTELLECTUALISTIC INTERPRETATION OF SPACE AND TIME

The anti-intellectualistic trend in philosophy was advocated by philosophers like William James and Henri Bergson. Their attitudes revolted against Absolute Idealism. The study of Biology left a permanent impression on Bergson, and moulded his metaphysical outlook. While the materialist tries to interpret the whole world-matter, life and mind-in terms of matter alone, and the idealist in terms of mind alone, Bergson attempts to understand everything in terms of life. The fundamental idea of Bergson's thought is the life-force which we feel throbbing within us. The world of matter lying extended before us and ideas appearing within our mind are understood as products of the same life-impetus which Bergson calls as *Elan Vital.* The vital force, *elan vital,* is in a flux or change. Due to change there is evolution which is creative. Man, plants and animals are the three dimensional changes brought about by the vital impetus. The metaphysics of Bergson is based on the philosophy of change. His philosophy of change is based on his philosophy of time. He calls time as *duree* (duration). Time is popularly understood as the succession of homogeneous moments which do not differ from one another in respect of character of quality. Motion, too is conceived, according to this idea of time, as the occupation of different positions in space at successive instants of time and it becomes thus a source of endless puzzles and paradoxes as Zero points out. This popular conception of time is mechanical and mathematical which is static. Bergson does not agree with the mathematical and mechanical conception of time. According to him time is duration, *duree,* which is the basis for all changes or for events to take place. Events take place in time in the internal world as well as in the external world. The states of consciousness succeed one another in our mind and things which are perceived are simultaneous, extended in space, outside one another. They are present all together. There is thus neither past nor future in space, and therefore, no succession. The external world is the simultaneous togetherness of many objects existing side by side. The so called successive states of the external world are nothing but different simultaneous presentations of the world arranged successively by the mind. If we deduct mental activity there would be nothing left but simultaneity and the external world would be devoid of time or succession. There are two aspects of our mental life a superficial one, and a deeper one. In its superficial aspect it consists of sensations, emotion, thoughts etc., which are separated, isolated, named and arranged one after another. Succession belongs only to this superficial aspect. But in its deeper aspect the different experiences of the mind are inseparably intermingled, they interpenetrate and form one concrete whole, in which no element is outside another and the elements, are not, therefore, arranged in any order of succession. In every intense experience we have an undistinquished multiplicity of elements blending into a moving whole whose intensity is due to the cumulative force of the interpenetrating elements. If we accept the view that time can be measured like space, the most fatal consequence of spatialisation, is that we come to believe that the past is left behind, and is dead and gone, and the future lies ahead and therefore the present is all that is left, and is of any consequence. But for Bergson real time is an unbroken concrete unity or whole which are not abstract or independent units. The spatialised and abstract conception of time can not grasp the Reality which is unceasing action or change. Motion or change can be understood only through

a time which is dynamic and not static. There must be something continuing and developing through the different states to unify them into one process of change, or rather there would be only a discrete and discontinuous multiplicity. Therefore for Bergson time does not mean succession, and change does not mean mere succession of states – the replacement of one state by another. But time is duration which is the nature of real change itself. "Duration is the continuous progress of the past which gnaws into the future and which swells as it advances. And as the past grows without ceasing, so also there is no limit to its presentation." Every present experience is felt as duration. It is as James says, like a 'saddle back,' and not like a 'needle point' or a 'knife edge.' The past, present and future interpenetrate into a dynamic whole which is analysed by the intellect into successive static ideas. The different aspects of Bergson's philosophy centre round this conception of Time or change. Time, change and consciousness are related to each other. Bergson tries to show through his philosophy the dialectical nature of *Elan Vital* by using the opposites such as matter-memory, space-time, intellect-intuition, closed morality-open morality and static religion-dynamic religion. The forward movement of *Elan Vital* overcomes the obstacles created by matter, space, intellect, closed morality and static religion.

1.8 RELATIVISTIC THEORY OF SPACE AND TIME

The classical physics of Newton was not challenged by the scientists till the beginning of the 20th century. However some of the new discoveries in science during the 20th century could not be explained by the Newtonian concepts adequately. The Newtonian mechanics and his absolute theory of space and time were criticised by scientists like Albert Einstein. Newtonian theory of classical mechanics considered the ether as the medium of motion and space. Time and motion were independent of each other. The three dimensional space and one dimensional time were separable with each other. The invention of electro magnetic field, sub atomic particles and quantum mechanics challenged the Newtonian classical mechanics. Newton's proofs of absolute space were proved to be fallacious by the modern science. His first proof that absolute motion proves absolute space and the former is proved by force, is a vicious circle, for the forces are only postulated to explain motion. His second proof is derived from circular motion such as what produces the concavity of the surface of a rotating pail of water, but this is now thought to be due not to empty space but to them matter filling it. Newton's third proof that relative motions are differences of absolute ones is not tenable for an absolute motion or translation of a body from one part of absolute space to another cannot be known because these parts are indistinguishable. A body can move not with reference to absolute space but to other bodies. The ideas of absolute space were finally abandoned after the experiments of Michelson-Morley who did not find any difference in the velocity of light when measured once in the direction of and then perpendicular to earth's movement. Such a difference ought to have there if light were electromagnetic vibrations in a medium, called ether, pervading all space. By absolute space Newton understood the empty and motionless space of the universe. He used the term 'absolute' to characterise the invariance of lengths and time intervals. In classical mechanics the concept of absolute time found its expression in the recognition of absolute simultaneity; if any two events occurred simultaneously in one inertial system of reference, they were also found to occur simultaneously in another. The conclusion ensuing from the principle of the constancy of velocity

of light was entirely different: Two events which took place simultaneously in one system of reference could not be simultaneous in another. In other words, simultaneity according to this principle is relative.

1.9 EINSTEIN'S RELATIVITY THEORY

To overcome the difficulties faced by the scientists due to Newton's absolute theory of space and time, Einstein gave his historical theory of Relativity. Einstein did not agree with Newtonian conception of the independent existence of space, time and motion. For him all three are interdependent to each other. It is space-time and not space and time. In other words space-time continuum with energy (matter) was well received by the world of science. According to Einstein the position of the observer and the gravitational force play an important role in the relativity of the units of measurement in science. For example if one's weight is 60 kg. on earth, his weight on the moon will be only 12 kg., since the gravitational force of moon is only $1/5^{th}$ of that of earth. Hence the weight of an individual is relative to his position (with reference to particular location and time). Position of the observer as 'relative' factor is discussed in Einstein's *Special Theory of Relativity.* His *General Theory of Relativity* discusses the influence of gravitation as a factor of relativity in science. There are no simultaneities in the occurrence of events since the time of occurrence of an event and the time of observation of the same are not simultaneous. The stars we see on the sky would be the effect of the light caused by the stars during the period of Emperor Asoka. The light would have taken more than two thousand years to reach our eyes yesterday. Therefore our observation of celestial phenomena is misleading if we assume that there is simultaneity of the occurrence of an event and our observation of the same. Moreover there is bending of light due to gravitation and therefore the location of the star we observe is shifted to some other place.

Gravitation influences not only space but also time. The velocity of light will change depending upon the gravitational pulls of the celestial bodies. The velocity of the spin of earth and the distance between stars and planets are not absolute. We take for granted that these measured units will not change. What we measure in everyday life is relative to so many other factors mentioned above. Euclids' geometry is also not acceptable to Einstein. According to Euclid the sum of the three angles of a triangle must be 180 degree. But if this rule is applied to Matter and Motion, it is not correct. The classical physics of Newton and the assumption that matter should occupy space has been disproved by the modern interpretation of matter as 'energy.' Einstein's theory of relativity showed variant character of space and time. It is correct in the sense that the theory revealed new links and relationships which had not been taken into account by classical physics and thus gave a broader and more profound picture of the dialectics of time-space relations.

1.10 INFINITY OF SPACE AND TIME

Can we fix the starting point or beginning and the terminus for space and time? We can be conscious of space and time as long as we live. Does it mean that there was no space and time before our births and there will be no space and time after our deaths? If we travel upwards can we reach the end of the sky? These are some of the perplexing questions which evoke curiosity in the human mind.

There are millions of galaxies in the universe. The Milky Way, our galaxy is only a fraction of the whole universe. Therefore we are not at the centre of the universe. We don't know the beginning and the end of this vast universe. Space and time have no privileged axis. There is no arrow of time so that we can indicate the direction of the movement of our galaxy. Milky way is one the connecting chains of the continuity of the universe. The cosmic phenomena involving infinite quantities of matter and space are still a mystery. Man is completely lost in the infinity of space and time.

1.11 LET US SUM UP

We have given representation of different traditions of human thought and discovery on reality of space and time.

1.12 KEY WORDS

General Theory of Relativity **:** General Theory of Relativity discusses the influence of gravitation as a factor of relativity in science.

1.13 FURTHER READINGS AND REFERENCES

Heller, M, Woodin WH. *Infinity: New Research Frontiers*. Cambridge: Cambridge University Press, 2011.

Engelbert, P. *Astronomy & Space: From the Big Bang to the Big Crunch*. Detroit: UXL, 1997.

Riniolo, Todd C and Lee Nisbet. "The Myth of Consistent Skepticism – The Cautionary Case of Albert Einstein." *Sceptical Inquirer.* May/June 2007. 49-53.

Armstrong, D. *What is a Law of Nature?* Cambridge: Cambridge University Press, 1983.