

## **CONCEPTS AND TRENDS IN GEOGRAPHY**

### **UNIT-III**

#### **FOUR TRADITIONS IN GEOGRAPHY-MAN, LAND, AREA STUDIES, SPATIAL AND EARTH SCIENCE-DUALISM AND DICHOTOMIES: DETERMINISM VS POSSIBILISM,PHYSICAL VS HUMAN –PARADIGMS IN GEOGRAPHY**

#### **FOUR TRADITIONS IN GEOGRAPHY**

Geographer William D. Pattison introduced his four traditions of geography at the annual convention of the National Council for Geographic Education in 1963. With these precepts, Pattison sought to define the discipline by establishing a common vocabulary in the geographic community at large. His goal was to create a lexicon of basic geographical concepts so that the work of academics could be easily interpreted by laymen. The four traditions are the Spatial or Locational Tradition, the Area Studies or Regional Tradition, the Man-Land Tradition, and the Earth Science Tradition. Each of these traditions is interrelated, and they are often used in conjunction with one another, rather than alone.

#### **Spatial or Locational Tradition**

The core concept behind the Spatial Tradition of geography relates to the in-depth analysis of the particulars of a place—such as the distribution of one aspect over an area—using quantitative techniques and tools that might include such things as computerized mapping and geographic information systems, spatial analysis and patterns, aerial distribution, densities, movement, and transportation. The Locational Tradition attempts to explain the course of human settlements in terms of location, growth, and in relation to other locales.

#### **Area Studies or Regional Tradition**

Unlike the Spatial Tradition, the Area Studies Tradition determines as much as it is possible to glean about a particular place in order to define, describe, and differentiate it from other regions or areas. World regional geography, along with international trends and relationships are at its center.

#### **Man-Land Tradition**

The focus of the Man-Land Tradition is the study of the relationship between human beings and the land they live on. Man-Land looks not only at the impact people

impose on their local environment but conversely, at how natural hazards can influence human life. Along with addition population geography, the tradition also takes into account the ramifications that cultural and political practices have on the given area of study as well.

## Earth Science Tradition

The Earth Science Tradition is the study of planet Earth as the home to humans and its systems. Along with the physical geography of the planet, focuses of study include such things as how the planet's location in the solar system affects its seasons (this is also known as Earth-sun interaction) and how changes in the lithosphere, hydrosphere, atmosphere, and biosphere impact human life on the planet. Offshoots of the Earth Science Tradition of geography are geology, mineralogy, paleontology, glaciology, geomorphology, and meteorology.

In response to the four traditions, in the mid-1970s, researcher J. Lewis Robinson noted that Pattison's model left out several important aspects of geography, such as the factor of time as it relates to historical geography and cartography (mapmaking). Robinson wrote that by dividing geography into these categories—while admitting consistent themes do run through all four—Pattison's precepts lacked a unifying focus. Robinson did, however, concede that Pattison had done a good job of creating a framework for the discussion of the philosophical tenets of geography.

As a result, while it's not the be all and end all, most geographic studies are likely to at least begin with Pattison's traditions. While not perfect, they have nonetheless become essential to the study of geography since first being adopted. Many of the more recent specialized areas of geographic study are, in essence, new and improved versions—reinvented and using better tools—of Pattison's original ideas.

## DETERMINISM VS POSSIBILISM,

Determinists **thought** that the natural environment determined the human response, while possibilists **thought** that the environment gave people a number of possibilities, each of which could be followed by different groups of people.

## **Dichotomy between Determinism and Possibilism of Geography!**

In the history of geographical concepts, there have been various approaches and schools of thought of study man-nature interaction.

The first approach adopted by the geographers to generalize the patterns of human occupations of the earth surface was deterministic. Their major initial source for explanations was the physical environment, and that theoretical position was established around the belief that the nature of human activity was controlled by the parameters of the physical world within which it was set.

Determinism is one of the most important philosophies which persisted up to the Second World War in one shape or the other. The point of view is that the physical environment controls the course of human action. In other words, the belief that variation in human behaviour around the world can be explained by the differences in the natural environment. The essence of the deterministic school of thought is that the history, culture, living style and stage of development of a social group or nation are exclusively or largely governed by the physical factors of environment.

The determinists generally consider man a passive agent on which the physical factors are constantly acting and thus determining his attitude and process of decision making. In brief, determinists believe that most human activity can be explained as a response to the natural environment.

The first attempt to explain the physical features and character traits of various peoples and their culture with reference to the influence of natural conditions was made by the Greek and Roman scholars. They included the physician Hippocrates, the philosopher

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Aristotle, and the historians Thucydides, Xenophon, and Herodotus. In the Greco-Roman period, regional studies were closely bound up with the study of history. Thucydides and Xenophon saw Athens's natural conditions and geographical position as the factors underlying its greatness. Strabo referred to similar phenomena when explaining the mighty and greatness of Rome. Aristotle, for example, explained the differences between Northern Europeans and Asians in terms of climatic causes.

He argued that the colder climates of Europe produced brave but unintelligent people who were able to maintain their independence but who did not have the capacity to rule others. Aristotle thought that the people inhabiting the warm climates of Asia were intelligent but lacking in spirit and therefore subject to slavery. Because humans often judge their own home as the best place, it is not surprising that Aristotle believed that the middle place, combining the best of all possible worlds, was Greece (Glacken, 1967: 93).

Moreover, according to Aristotle, the inhabitants of cold countries are courageous but "lacking in political organization and capacity to rule their neighbours" and also the people of Asia lack courage and so slavery is their natural state. The people of Greece, on the other hand, who occupy 'the middle position geographically', he sees as endowed with the finest qualities and thus destined by nature itself to rule over all.

The Greek scholars have referred to the easy-going ways of Asiatics living in favourable environmental conditions, while the penurious Europeans had to work hard for a little amelioration of their poor environment. They contrast the tall, gentle, brave folk of the most windy mountains with the lean, sinewy blonde inhabitants of

dry lowlands. Aristotle emphatically attributed the progress of certain nations to their favourable environmental conditions.

Similarly, Strabo—the Roman geographer—attempted to explain how slope, relief, climate all were the works of God, and how these phenomena govern the life-styles of people. Montesquieu pointed out that the people in cold climates are stronger physically, more courageous, frank, less suspicious and less cunning than those in the warm climates. The people of warm climates are timorous, weak in body, indolent and passive.

Geographical determinism continued to dominate the writings of the Arab geographers. They divided the habitable world into seven *kisbwas*, or terrestrial zones (climate) and highlighted the physical and cultural characteristics of races and nations of these zones. Al-Battani, Al-Masudi, Ibn-Hauqal, Al-Idrisi, and Ibn-Khaldun attempted to correlate environment with human activities and mode of life. Al-Masudi, for example, asserted that in the land like Sham (Syria) where water is abundant, the people are gay and humorous, while the people of dry and arid lands are short-tempered. The nomads who live in the open air are marked by strength and resolution, wisdom and physical fitness.

George Tathan—a leading historian of the 18th century—also explained the differences between peoples with reference to the differences between the lands in which they lived. Kant was also a determinist, who stated that the people of New-Holland (East Indies) have half-closed eyes and cannot see to any distance without bending their heads back until they touch their backs. This is due to the innumerable flies which are always flying in their eyes. Kant further stressed the point that all the

inhabitants of hot lands are exceptionally lazy and timid. Timidity engenders superstition and in lands ruled by kings it leads to slavery.

In support of his hypothesis of the influence of climate, he stated that animals and men which migrate to other countries gradually get affected by their environment. For example, the brown squirrels which migrate to Siberia turn grey and the colour of white cows in winters turns greyish.

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The environmental causation continued throughout the 19th century when geographers themselves used to regard geography above all as natural science. Carl Ritter—the leading German geographer— adopted an anthropocentric approach and introduced geographical determinism in the early 19th century. Ritter attempted to establish the cause variations in the physical constitution of body, physique and health of men living in different physical environmental conditions.

He stated that the narrow eyelids of Turkoman people were an obvious effect of the desert upon the human organism. Many of his pupils considered geography “as the study of relationship between the density of a people and the nature of their land”. Many geographers of his school declared that their main task was to identify the influence exerted by geographical conditions on material culture and the political destinies of the inhabitants of a given region, both in the past and present.

Alexander von Humboldt, one of the founders of ‘modern geography’ and a contemporary of Ritter also asserted that the mode of life of the inhabitants of a mountainous country differs from that of the people of the plains.

The scientific milieu in the latter half of the 19th century and early decades of the 20th century was dominated by Darwin's idea, deductive approaches and an acceptance of the Newtonian cause and effect relationships. The origin of the scientific determinism lie in the work of Charles Darwin, whose seminal book *Origin of Species* (1859) influenced many geographers.

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Fitting well into this intellectual environment, the theory of environmental determinism, developed mostly by geographers, was the prevailing view in American geography at the turn of the 20th century. Darwin's notions regarding evolution were taken up by William Morris Davis, in his cycle of erosion model of landforms development. The concern was with documenting the control or influence of environment upon human society.

The founder of the 'new' determinism was Friedrich Ratzel. He supplemented 'classical' geographical determinism with elements of 'Social Darwinism' and developed a theory of the state as an organism which owed its life to the earth and which was ever striving to seize more and more territory. In the opinion of Ratzel, "similar locations lead to similar mode of life". He cited the example of British Isles and Japan and asserted that both these countries have insular locations, which provide natural defence against the invaders. Consequently, the people of these countries have been making rapid progress.

Ratzel—a follower of Darwin—believed in the survival of the fittest and saw 'man' as the end-product of evolution—an evolution in which the mainspring was the natural selection of types according to their capacity to adjust themselves to physical environment. He was convinced that the course of history, the mode of life of a

people and the stage of its development are closely influenced by the physical features and location of a place in relation to mountains and plains. In his deterministic approach, he gave more weight to location in relation to topographic features.

#### Historical Perspective of Scientific Determinism:

The theological school of thought advocated the idea of a designed earth: one especially fitted for the human species. To a great extent, this is part of the wider concept 'teleology', i.e., the concept of an overall creation with a particular purpose which was usually divine. The deterministic school of thought is that of environmental influence on culture. This derives initially from the contrast between nature and custom in different places and came to be used in interpreting the great array of human cultural and biological differences.

Thomas Malthus who was a scientific determinist (1766-1834), emphasized not only the influence of different environments but also the limitations which the earth imposed on social development. The father of this generation of offspring seems to have been Carl Ritter (1779-1859) whose theme was that the physical environment was capable of determining the course of human development. His ideas were strengthened by the publication of Charles Darwin's *Origin of Species* in 1859, with its emphasis on the close relationship of organism and their habitats and the notion of the pressures of natural selection. Thus arose a 'scientific' type of environmental determinism which accounted for such features as migrations and the national characteristics of particular people.



The names of Friedrich Ratzel (1844-1904) and Ellen Churchill Semple (1863-1932) are associated with the most outspoken expression of the idea of environmental determinism. This approach was slightly modified by Ellsworth Huntington and Griffith Taylor. Huntington tried to seek out objective evidence of the effect of physical environment, and in particular climate which he regarded as an important influence on human behaviour. Taylor (1880-1963) was even more careful to gather accurate data about environment and to relate these to his idea of human habitability, especially in Australia. He tended to play down socio-economic factor. He believed that environment sets the limit of human development. His determinism was likened to a traffic control system which determined the rate but not the direction of progress, and so it became known as 'stop-and-go determinism'.

#### Environmental Determinism:

As stated earlier, the origin of environmental determinism lies in the work of Charles Darwin, whose seminal book *Origin of Species* (1859) influenced many scientists.

The belief that variations in human behaviour around the world can be explained by differences in the natural environment is known as environmental determinism.

At the beginning of the 20th century 'environmentalism' became particularly widespread in the United States, where its leading proponents were W.M. Davis (in his cycle of erosion model of landform development), Ellen Churchill Semple and Ellsworth Huntington. Semple was the direct descendant of Ratzel. She preached the philosophy of her master and thus was a staunch supporter of determinism. Her books *American History and its Geographic Conditions* (1905) and *Influences of Geographic Environment* (1911), established environmentalism in America in the early decades of the 20th century.

**Influences of Geographical Environment (1911) begins with the following paragraph:**

Man is a product of the earth's surface. This means not merely that he is a child of the earth, dust of her dust, but the earth has mothered him, set him task, directed his thought, confronted him with difficulties, that have strengthened his body and sharpened his wits, gave him his problems of navigation or irrigation and at the same time whispered hints for their solution. She has entered into his bones and tissues, into his mind and soul. On the mountain she has given him leg muscles of iron to climb the slope, along the coast she has left these weak and flabby, but given him instead vigorous development of chest and arm to handle his paddle or oar.

In river valley, she attaches him to fertile soil... Simple, in her book, distinguishes the attitudinal characteristics of the people living in different physical settings and points out that the dwellers of mountains are essentially conservative. There is little in their environment to stimulate them to change and little reaches them from the outside world. Hence, innovation is repugnant to them. As a matter of fact, the process of diffusion of new ideas and innovations in the hilly tracts of isolation and relative isolation is slow as compared to the well-connected plains of the world. This relative isolation of the hill dwellers leads to orthodoxy, conservatism and suspicious attitude towards strangers. They are extremely sensitive to their traditions and do not like criticism.

They have strong religious feelings and an intense love for family. The bitter struggle for existence makes the hill men industrious, frugal, provident and honest. Contrary to this, the people of plain parts of Europe are energetic, serious, thoughtful rather than emotional, and cautious rather than impulsive. The people of the Mediterranean

region where the climate is temperate and mild are gay, humorous, sporting and imaginative as life is easy.

Elsworth Huntington—the American geographer—who wrote the monumental book, *The Principles of Human Geography* in 1945, was a protagonist of environmental determinism. Huntington's writings on climate and civilization displayed his predilection for racial typecasting and environmentalist explanations. He, however, constantly reiterated the importance of genetic constitution and threw his weight behind various genetic enterprises (Spate, 1968). He took the most decisive step since the time of Hippocrates towards something new and conclusive in environmental causation thinking. Over many years he was engaged in developing the idea of climate's leading role in the advancement of civilization. He advanced theories relating to course of civilization to climatic change.

The basic philosophy of Huntington was that the supreme achievements of civilization in any region were always bound up with a particular type of climate and variation in climate led to 'pulsations' in the history of culture. He suggested that the 'best' climates for work were those in which there was variety and in which the temperatures fell within a certain range, and wrote of the correlation between a stimulating climate and high civilization based on in the U.K. and New England (U.S.A.). He associated with the climatic cycles the 'Golden Age' in ancient Greece, the Renaissance in Western Europe, and cyclical fluctuations in iron production or the price of share.

Huntington divided the world in the mild and harsh climatic zones and established that the ancient civilizations (Egyptian, Mesopotamian, Chinese, Indus) flourished in the fertile river valleys of mild climates. He also established the hypothesis of invasion and tribal warfare. The great outpouring of nomadic people from Central

Asia which led to Mongols' conquest of Iran, Iraq, Turan, Turkistan, Central Asia, China and India and the raids in Eastern Europe in the 13th century could be explained by the dying of pastures on which the nomads were dependent.

According to Huntington, religion and racial character are the products of climate. A temperature of about 20°C and variable atmospheric conditions (temperate cyclonic weather) are the ideal climatic conditions for high mental and physical efficiencies. Such a climatic condition is found in the North-East U.S.A. and countries of North-West Europe. The advancement of Americans/ Europeans in the fields of science and technology has thus been attributed to cyclonic weather and temperate climatic conditions by Huntington.

The underdevelopment of the tropics, he explains, is owing to the humid, hot, oppressive weather which makes the people lethargic, lazy, inefficient, suspicious and timid. Huntington thus believed that out of all the factors of natural environment, climate was the fundamental factor in the rise of civilization (1939). He concluded that his homeland, which was the north-eastern part of U.S.A., had the best environment.

He even produced a map, based primarily on the opinions of other North Americans and Europeans, which showed that temperate climates had the highest level of 'health and energy' and civilization. It is obvious that this map is highly subjective and its logic differs little from Aristotle's, except that Huntington perceived the world from a different home location.

Environmental determinism is regarded by many people as overly simplistic because it neglects the cultural factors that affect human behaviour. Two societies that inhabit areas having similar climates and landforms may be very dissimilar. How could two

contrasting societies like Bakarwals and Kashmiris of Jammu & Kashmir, Nepalis and Khasis of Meghalaya, Assamese and Bengalis of the Brahmaputra Valley, Tharus and Sikhs of the Tarai region of Uttar Pradesh, for example, exist in a similar environment and have different modes of life and cultural ethos, if climate dictated patterns of life?

Subsequent geographers like Mackinder, Chisholm, Davies, Bowman, Robert Mill, Geddes, Sauer, Herbertson, Taylor, etc., interpreted the progress of societies with a deterministic approach. Many scholars made it vividly clear that climate influenced physical properties of the soil which ultimately determined the cropping patterns, on which depend the dietary habits, physique and attitudes of the inhabitants. Mac Carrison demonstrated conclusively that the greater stature, strong constitution and superior physical resistance of the Sikhs of Northern India as compared to those of the Tamils of South India are a direct result of the superior Sikh diet, particularly its greater richness in protein. The Khasis of the plateau of Meghalaya have in general a poor physique because the protein intake in their diet is significantly low and the humid weather throughout the year creates breathing problems to the inhabitants of this plateau.

Lord Boyd Orr and Gilkhs observed a similar phenomenon in East Africa, where they studied the Kikuyu and the Mesai tribes of Kenya. The Kikuyus are farmers living on a diet of cereals, tubers and legumes; and the Mesais on the other hand, are cattle raisers, whose diet includes meat, milk and ox-blood, which they take from the animals. These two human groups living side by side in the same environment differ profoundly in their physical measurements.

This difference is the direct result of their fundamentally different diets. Similarly, there is no doubt that the low stature and poor physique of most of the tribals, the rural masses and the slum-dwellers of India are the result of starvation, undernourishment and malnutrition. The poor physique of the Somalians, Nepalis, Bangladeshis and Vietnamese may also be explained against the background of their poor diet and undernourishment.

How closely soil and vegetation influence the health and stature of peoples and animals has been explained by Karl Mackey. In the opinion of soil scientists, “the history of civilization is the history of soil”. Roosevelt once remarked: “If soil is gone, men must go and the process does not take long.” Thus, soil is the basis of all living organism. He cites the case of Shetland ponies:

On the Shetland Island, at the northern extremity of the British Isles (60°N), are found the smallest horses in the world, only about 3 feet in height. Traditionally, it used to be thought that these Shetland ponies constituted a separate race of horses, stabilized by inbreeding—until some businessmen decided to supply the American market by raising these ponies in U.S.A. To their great disappointment, the ponies born under the new conditions got bigger and bigger generation after generation until they were the same size as horses of other ‘races’.

The fact is, there are no separate races of ponies. Even after hundreds of generations when the ponies were taken to areas with richer soil they regained the characteristics of their ancestors.

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A similar example can be found among the Chinese and the Japanese who migrated to Europe and America. Their weight and height increased after a period of time.

The Pygmies also lose their characteristics when transplanted to plain regions where agriculture and cattle-raising provide much more varied food. Thus, the short-statured races became tall-statured tones.

Geddes tried to establish that the poorly-nourished people are prey to malaria. In support of his hypothesis, he stated that the meat-eating Muslims in India are much less subject to malaria than are the Hindus with their vegetarian diet.

The influence of physical factors on food habits and the consequent effect on the rate of birth in different regions can be seen in the fact that the high birth rates (above 30) are all confined to tropical countries. The geo-ecological and socio-economic conditions of these countries are all ill-adapted to either the production or consumption of proteins of animal origin. If we compare the birth rate with the intake of animal proteins throughout the world, we find a clear correlation between the two factors, i.e., fertility going down as consumption of such proteins rises.

For example, the daily intake of animal protein in Sweden and Denmark is 63 grams and 60 grams respectively and the birth rate is 15 and 18 per thousand respectively. In India and Malaysia, only about 7 grams and 8 grams of animal protein is consumed respectively and the corresponding birth rate in these countries is 35 and 33 per thousand respectively.

These may be overgeneralizations as many other factors like standard of living and socio-cultural attributes also contribute to birth rate, yet there is no denying the fact that the quality of diet has much bearing on the increase, decrease and longevity of the population of a region.

There is evidence showing that terrain, topography, temperature, rainfall, humidity, vegetation and soil, individually and collectively, affect social and economic

institutions and thereby the mode of life of people, yet the role of man as a transforming agent of his physical surroundings is quite significant.

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In fact, acts of man reveal many facts for which environmental forces alone can give no satisfactory explanation. For example, similar environment does not always invoke the same response. Eskimos differ markedly from the Tundra tribes of Siberia. Pygmy hunters share the equatorial forests of Central Africa with agricultural Negroes in a remarkable symbiosis. The Khasis, Garos and Jaintias of Meghalaya and the Lushais of Mizoram, living under almost a similar climatic and environmental conditions, have marked variations in physical traits, physique, dietary habits, standard of literacy and attitude towards life. In fact, no two cultures and various ethnic groups within a physical environment evaluate and use the resources of an environment in exactly the same way. This variation in the evaluation of resources is one of the main causes of differences in the lifestyle and stage of development of various ethnic groups and nations.

It has also been observed that the same physical conditions of land could have quite different meanings for people with different attitudes towards their environment, different objectives in making use of it and different levels of technological skill. The Gujjars and Bakarwals of Jammu & Kashmir like to settle on slopes and to utilize these slopes for pastures while the Kashmiris like to settle in levelled areas and to utilize their arable land for paddy and orchard cultivation. The former are nomads while the latter are cultivators.

In agricultural areas, it is clear that slope had one meaning for the man with a hoe and quite another for a man with a tractor-drawn plough. It might be that the



introduction of machinery would reduce the arable area of a country or change the kind of soil considered desirable. People of one kind of culture might concentrate in the valleys (Mesais and Kikuyus of East Africa) whereas another kind of people in the same area might concentrate their settlements on fertile uplands. Water-power sites that were useful for the location of industries before the advent of steam engine lost that attraction when power came from other sources.

Environment undoubtedly influences man, man in turn changes his environment and the interaction is so intricate that it is difficult to know when one influence ceases and the other begins. Many landscapes that appear natural to us are in truth the work of man. Wheat, barley, olive, and vine, which dominate the Mediterranean countries, are entirely the products of human effort. Apple and almond orchards of Kashmir and Himachal Pradesh and Kumaun division of Uttar Pradesh are the creations of man.

Similarly, cultivation of basmati rice (a high water requiring variety) in only 50 cm rainfall areas of the Punjab and Haryana is the direct and conspicuous result of human efforts. Wheat cultivation in West Bengal, Orissa and Dimapur of Nagaland is the outcome of the use being made of the innovation of high yielding varieties (HYV). Countless such examples from the developed and the developing countries can be cited. Thus, man and environment are intrinsically interdependent and it is difficult to say which becomes more influential and when.

After the Second World War, the philosophy of environmentalism was attacked. Many geographers in the United States, Britain, Canada and other countries drew attention to the one-sided approach adopted by the environmentalists in their interpretation of historical reality, to their exaggeration of nature's active role and to the fact that they only acknowledge man as capable of passive attempts at adaptation.

Actions of man reveal many facts for which environmental forces alone can give no satisfactory explanation.

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Spate criticized the fanatic approach of environmental determinists. He, for example, states that “environment taken by itself is a meaningless phrase; without man environment does not exist”. Equally important is his indication of the need to consider the psycho-physiological influence of the geographical environment via the social structure. In the final analysis, Spate concluded that geographical environment is only one of the factors of territorial differentiation and “it acts through society; cultural tradition has a certain autonomous influence”. Recently, an Australian writer— Wolfgang Hartake—argued that while the role of physical factors might well be relatively unimportant in the fringe zone of Frankfurt, “it is hard to imagine the extreme climatic conditions not playing a direct role in any human activity which occurs in the Sahara”. Similar argument is put forward by Hartshorne.

He rejected environmentalism purely on the grounds that it separates nature from man and thus is “disruptive of fundamental unity of the field”, i.e., contradicts the concept of geography as an integrated science.

The environmentalist movement started in the 1960s has however, shown quite distinctly that there is an overall limit to certain kinds of human economic activity in terms of biophysical persistence and resilience of the planet’s systems. In brief, at the very largest scale we can be determinists, where as at the more local scales we can see the virtue of possibilism or cultural and social determinism.

Possibilism:

Possibilism in geography developed as a reaction to extreme generalizations of environmental determinists that led to a counter thesis, of possibilism, which presented the man as an active rather than a passive agent.

This philosophy attempts to explain man and environment relationship in a different way, taking man as an active agent in environment. This is a belief which asserts that natural environment provides options, the number of which increases as the knowledge and technology of a cultural group develop.

Led by French geographers, the followers of historian Lucien Febvre, possibilists presented a model of people perceiving the range of alternative uses to which they could put an environment and selecting that which best fitted their cultural dispositions. This point of view was named 'possibilism' by Lucien Febvre, who writes: "The true and only geographical problem is that of utilization of possibilities. There are no necessities, but everywhere possibilities.

The natural data (factors) are much more the material than the cause of human development. The 'essential cause' is less nature, with its resources and its obstacles, than man himself and his own nature."

According to Febvre, a possibilist, "man is a geographic agent and not the least. He everywhere contributes his share towards investing the physiognomy of the earth with those changing expressions which is the special charge of geography to study."

Vidal refuted the concept of physical determinism and advocated possibilism. "Nature sets limits and offers possibilities for human settlement, but the way man reacts or adjusts to these conditions depends on his own traditional way of life."

But, the possibilists recognize the limitations imposed by physical environment. Fabvre echoes this view: “Men can never entirely rid themselves whatever they do of the hold their environment has on them.” In the similar manner, Brunhes remarks: “The power and means which man has at his disposal are limited and he meets in nature bounds which he cannot cross. Human activity can within certain limits varies its play and its environment, but it cannot do away with its environment, it can only modify it but it can never surpass it, and will always be conditioned by it.” Brunhes further writes: “Nature is not mandatory but permissive.”

Similarly, Lablache says: “There is no question of geographical determinism, nevertheless, geography is a key that cannot be dispensed with.”

Possibilism is also associated with the French School of Geography founded by Vidal de Lablache (1845-1918). The French geographers saw in the physical environment a series of possibilities for human development, but argued that the actual ways in which development took place were related to the culture of the people concerned, except perhaps in regions of extremes like deserts and tundra.

The historian Lucien Febvre (1878-1956) set out to demolish the environmental deterministic argument by asserting the initiative and mobility of man as against the passivity of the environment, and regarded other humans as part of environment, of any group because they contributed to the formation of the next group’s cultural surroundings, or milieu. Among those influenced by this type of thinking was H.J. Fleure (1877-1969) who tried to formulate world regions based on human characteristic rather than the traditional climatic—biotic regions. So he brought forth a scheme which included ‘regions of effort’, ‘regions of hunger’ and ‘industrialized regions’, to name a few.

Possibilism has also been influential in the rise of the school of cultural geography associated with the name of Carl Ortwin Sauer and the University of California at Berkeley, and with the development of the idea of human ecology. The founder of this latter notion (human ecology) was H.H. Barrows (1877-1960) of the University of Chicago.

The possibilists cited numerous examples in support of their argument. There are distinct zones which are distributed symmetrically on each side of the equator, great climato-botanic frames, unequally rich in possibilities, unequally favourable to the different human races, and unequally fitted for human development; but the impossibility is never absolute—even for the races least ‘adapted’ to them—and all probabilities are often found to be upset by the persistent and supple will of man. The ‘environmental determinist’ thesis has it that these frames constitute “a group of forces which act directly on man with sovereign and decisive power”, and which govern “every manifestation of his activity from the simplest to the most important and most complicated”.

What really happens in all these frames, especially in those which are the richest in possibilities, is that these possibilities are awakened one after the other, then lie dormant, to reawaken suddenly according to the nature and initiative of the occupier. “These possibilities of action do not constitute any sort of connected system; they do not represent in each region an inseparable whole; if they are graspable, they are not grasped by men all at once, with the same force, and at the same time.” The same regions, through the changes in value of their elements, have the most varied destinies. And it is human activity which “governs the game”.

There are no doubts among human groups similarities—or, at least, analogies—of life which are the result of the exploitation of similar possibilities. But there is

nothing fixed or rigid about them. We must avoid confusing once more necessity with possibility.

The possibilists show with great precision that society interposes practices, beliefs, and rule of life between nature and man; that man's utilization of possibilities and his exploitation of his environment are thereby hampered, so as, for example, to render his food singularly monotonous. "Nowhere is food eaten by savages without care in the choice. There are prohibitions, restrictions, taboos on sides.

But this social constraint was, no doubt, not exercised at first in its full vigour. There was great homogeneity in primitive human groups, but there were necessarily differences (age and sex) and individual contingencies, however slight. In small societies the organization was not rigid enough at the beginning to stifle initiative. It is thanks to differentiation, to the individual alone, that life has been ameliorated and that society itself has been organized.

The possibilists also argued that it is impossible to explain the difference in human society and the history of that society with reference to the influence of physical environment. They hold that man himself brings his influence to bear on that environment and changes it.

The philosophy of possibilism—the belief that people are not just the products of their environment or just pawns of natural environment—became very much popular after the First World War. For the possibilists, the works of man, not the earth and its influence, are the starting points, the most important is the freedom of man to choose.

Although the philosophy of possibilism became very much popular after the First World War, it was Vidal de Lablache who advocated and preached the philosophy

of possibilism. Lablache was such a staunch supporter of this philosophy that he developed the 'school of possibilism'. Vidal in his studies minimized the influence of environment on the activities of man. Central to Vidal's work were the lifestyles (*genres de vie*) that develop in different geographical environments.

In his opinion, lifestyles (*genres de vie*) are the products and reflections of a civilization, representing the integrated result of physical, historical and social influences surrounding man's relation to milieu in a particular place. He believed that whereas society and nature were usually represented as "two adversaries in a duel", the human being was in fact "part of living creation" and "its most active collaborator". And it was this dialectic which he subsumed in the concept of the *genre de vie*. He tried to explain differences between groups in the same or similar environment, and pointed out that these differences are not due to the dictates of physical environment but are the outcome of variations in attitudes, values and habits. Variations in attitudes and habits create numerous possibilities for human communities. It is this concept which became the basic philosophy of the school of possibilism.

The possibilists emphasize the point that it is impossible to explain the difference in human society and the history of that society with reference to the influence of environment; they hold that man himself brings his influence to bear on that environment and changes it.

After Vidal, possibilism continued to grow and spread on both sides of the Atlantic. In France, Jean Brunhes was a strong supporter of possibilism. Brunhes enunciated the first explicit formulation of human geography as a systematic approach to the study of human geography.

Outside France, the possibilist ideas were accepted by a large number of geographers and anthropologists. Barrows—the prominent ecologist—gave greater importance to man than to environment. A more acceptable view of possibilism was presented by Sauer. He asserted that geographer's role is to investigate and understand the nature of the transition from the natural to the cultural landscape.

From such an exercise the geographer would identify the major changes that had occurred in an area as a result of occupancy by succession of human groups. Its importance is often greater in regions where it has been acclimatized than in those where it originated and domesticated. For example, wheat does not have the largest yields in regions where it was first domesticated (South-West Asia). Cultivation of rice is now done largely in U.S.A., Canada, Australia, Pakistan and India—places where it was taken up later.

According to the possibilists, nature is never more than an adviser. There are no necessities but everywhere possibilities. This, by the reversal with it, involves man in the first place, man and no longer the earth, nor the influence of climate nor the determinant conditions of localities. The range of possibilities in every region is limited more by the price man is willing to pay for what he wants than by the dictates of environment. For example, man through his technical skill can grow banana, rice and rubber in Antarctica but he has to take into consideration the input cost. The prohibitive cost of production of these crops will compel man not to grow these crops in the tundra region.

Men can never entirely rid themselves, whatever they do, of the hold their physical environment has on them. Taking this into consideration they utilize their geographical circumstances more or less according to what they are, and take advantage more or less completely of their geographical possibilities.



But here, as elsewhere, there is no action of necessity. The limits set by nature to man's action vary from one historical period to another. In marginal environments, such as the hot and cold deserts and tundra, and at low stages of culture man's choice may be extremely restricted. In the more favourable areas of the warm and cool temperate zones, and in periods when man's techniques are highly developed, the possibilities are more numerous. But notwithstanding the many skills man may acquire, he can never free himself entirely from nature's control. Bowman asserted: "While the physical laws to which mankind responds are available in their application and degree of effect, yet this is also true that all men everywhere are affected to some degree by physical conditions."

In spite of the fact that man has numerous possibilities in a given physical setting, he cannot go against the directions laid by the physical environment. The possibilistic approach has been criticized by many contemporary thinkers. Griffith Taylor, while criticizing possibilism, opined that society as a whole should make a choice, and since only an advisory role is assigned to geographer, his function "is not that of interpreting nature's plan". Taylor was largely right when he wrote that the task of geography is to study the natural environment and its effect on man, not all problems connected with man or the 'cultural landscape'.<sup>28</sup> Moreover, possibilism does not encourage study of physical environment and it promotes over anthropocentrism in geography.

Geographical determinism at least obliges the geographer to turn his attention to nature, and if the question is asked as to who is setting out to destroy geography, then blame should be placed above all at the possibilists' door. Possibilism thus tended to exaggerate the role of culture and to neglect the importance of natural environment. In brief, the approach of possibilism may be as ludicrous as determinism, but possibilistic generally recognised the limits to action which

environment set, and avoid the great generalizations which characterised their antagonists.

Neo-Determinism:

The concept of 'neo-determinism' was put forward by Griffith Taylor—a leading Australian geographer. He argued that possibilists had developed their ideas in temperate environments such as north-western Europe, which offer several viable alternative forms of human occupation. But such environments are rare: in most of the world as in Australia the environment is much more extreme and its control over human activity is enormous. He coined the term 'stop-and-go determinism' to describe his views.

In the short term, people might attempt whatever they wished with regard to their environment, but in the long term, nature's plan would ensure that the environment won the battle and forced a compromise out of its human occupants. He, in the 1920s, argued that the limits of agricultural settlement in Australia had been set by factors in the physical environment such as the distribution of rainfall. Taylor's view was initially most unpopular in Australia, but it has been generally accepted since then.

**In his book on Australia published in 1948, Taylor reaffirmed his basic position:**

The best economic programme for a country to follow has in large part been determined by nature (environment), and it is the geographer's duty to interpret this programme. Man is able to accelerate, slow or stop the progress of a country's (region's) development. But he should not, if he is wise, depart from directions as indicated by the natural environment. He (man) is like the traffic controller in a large city who alters the rate but not the direction of progress.

Neo-determinism is also known as 'stop-and-go determinism' and Griffith Taylor's philosophy can be very vividly explained by the role of a traffic controller.

Man follows nature's programme only if he is wise, presuming he can act foolishly, which admits the possible contention that within broad limits set by environment man can choose, at the very least. Taylor concedes him the choice between WI .At is wise and what is foolish. But wisdom and folly are human concepts. The natural environment knows nothing of them. In nature there is only the 'possible' and 'impossible'. Finer categories are man-made.

The possibilists admit that the opportunities offered by any environment are not all equal. Some demand little for man, others continual struggle; some yield large, other meagre returns. The ratio between effort and return can be looked upon as the price nature exacts from man for the particular choice he makes; but recognition of this inequality of opportunities gives no clue as to what nature prefers, for the wise man to follow suit.

Once possibility of alternative action is conceded, then it is difficult to see how 'stop-and-go determinism' can claim that man is not a free agent, that his liberty is curtailed. In no environment are the possibilities limitless and for every choice price must be paid, proponents of possibilism admit this, but within these limits freedom to choose exists. Man makes his choice, and man himself judges its relative wisdom or folly by reference to goals he himself has established.

Limits to man's freedom beyond those generally recognized by possibilists are, according to Taylor's definition, those imposed by man's conception of wisdom. There is nothing indeed that contradicts the assertion of Febvre (founder of possibilism) that there are no necessities but everywhere possibilities and man as a

master of these possibilities is the judge of their use. Thus, man chooses, but only from the range which nature presents him.

In brief, people might attempt whatever they wished with regard to their environment, but in the long term, nature's plan would ensure that the environment won the battle and forced a compromise out of its human occupants.

**Probabilism:**

The concept of probabilism was put forward by O.H.K. Spate (1957). The view that although the physical environment does not uniquely determine human actions, it does nevertheless make some response more than others. The term was proposed as a mid-way between a stark environmental determinism of Ratzel and a radical possibilism of Febvre, Lablache and Sauer. While the environmental determinists, influenced by the cause and effect relationship of Darwin, asserted that human activities are controlled by the physical environment, the possibilists opined that physical environment provides the opportunity for a range of possible human responses and the people have considerable discretion to choose between them.

According to Spate, "human action was represented as not so much a matter of all-or-nothing choice or compulsion, but a balance of probabilities". For example, there is a probability that the land use intensity in the Sutlej-Ganga plain decreases away from the market centres; the population density decreases away from metropolitan centres in all directions; crop yields diminish beyond a certain walking distance from the village settlement.

There may be, however, exceptions to each of these generalizations, and in many cases, there are also limits to the range of territory which they hold true. The exceptions and the limits demand explanation. After this concept, the probability

theory came to be regarded as an essential component of geographical analysis since it provided “a common mode of discourse” for “scientific study of the landscape”.

This view, in fact, is perfectly compatible with the original Vidalian conception. The geographers started to use the probability theory to determine the man and environment relationship and also to make a scientific study of the landscape.

The probability theory was criticized on several grounds. For example, a complete knowledge about the environment (resources) may not be available; the data available about the resources and their utilization may not be reliable; the perception about resources (environment) differs from man to man, community to community, region to region and country to country. The application of probability model, owing to these constraints, may be difficult and the results thus obtained may not be authentic, close to the ground reality.

#### Cultural or Social Determinism:

Cultural or social determinism emphasizes the human element: “Our thoughts determine our acts, and our acts determine the previous nature of the world” (James, 1932: 318). Since human interest, desires, prejudices and group values vary across space, there is a consequent variation in the cultural landscape and levels of socio-economic development. The modification of an environment largely depends on our perceptions, ideas and decision-making processes.

This philosophy, advocated by American scholars, can be summed up as the principle according to which the “significance to man of the physical and biotic features of his habitat is a function of the attitudes, objectives and technical skills of man himself”. For example, a country that is richly endowed from the point of view of the hunters, might appear poor to an agricultural people; the importance of coal is

not identical to those who can and those who cannot make use of it. All these truths are self-evident. What is also true is that as technology develops, the importance of the environment does not decrease but changes and becomes more complex.

The philosophy of cultural determinism is fairly widespread among American geographers. Eduard Ullman, for example, wrote that “the environment is essentially neutral, its role being dependent on the stage of technology, type of culture and other characteristics of a changing society”. The assessment of a mountain pass, for example, will differ for those who possess horses, automobiles, aeroplanes; the assessment of soil fertility will not be identical from the point of view of a Japanese farmer, on the one hand, or an Amazonian Indian, on the other. Similar natural conditions may call forth different reactions on the part of man, and within similar sets of conditions, different cultures can take place. George Carter singles out three fundamental factors in human geography. He has laid greater stress on cultural forces and writes that “ideas remain as the primary cause of change..., it is these ideas that determine the human use of physical world”. He also emphasized the point that human will is the decisive factor.

After the Second World War, the school of social determinism became quite popular in Austria, Holland and Sweden. Social geography deals with the spatial distribution of societies. It, however, does not enable us to achieve a profound understanding of social relations or landscape. Social groups can be distinguished with reference to ethnic, religious, professional and certain other features, while social changes are only noted but rarely linked with any fundamental economic causes or the class structure of society.

The study of the influence exerted by these groups on landscape is reduced to the definition of purely external factors of the cultural landscape (type and deployment

of houses, land use, field patterns, etc.) right down to the morphological and functional changes within the confines of a single street. Infinitely painstaking 'micro-territorial' research of this type is usually purely empirical in character and cannot provide the basis for scientific conclusions of any real significance. Social or cultural determinism thus does not adequately assess the environmental factors, i.e., the influence of natural environment upon 'cultural geographical differences'. Social determinism is thus also rigid like environmental determinism and therefore cannot be accepted in its crude form.

The debate among geographers about whether people are free agents in their use of earth (environment) or whether there is a 'nature's plan' slowly dissolved as the antagonists realised the merits in each case.

## **PHYSICAL VS HUMAN**

The Greeks were probably the first who stated and started **dichotomy** of **physical** and **human geography**. Hecataeus gave more emphasis to **physical geography**. Similarly Eratosthenes and Ptolemy gave more importance to **physical geography** while Strabo and his disciples were in favour of **human geography**.

## **PARADIGMS IN GEOGRAPHY**

Geographers are dividing themselves in the category of positivists, pragmatists, phenomenologists, existentialists, idealists, realists and dialectical materialists. This is a crisis phase with revolution which shall lead to new **paradigm** phase.

A **paradigm shift**, a concept identified by the American physicist and philosopher Thomas Kuhn, is a fundamental change in the basic concepts and experimental practices of a scientific discipline. Even though Kuhn restricted the use of the term to the natural sciences, the concept of a paradigm shift has also been used in numerous non-scientific contexts to describe a profound change in a fundamental model or perception of events.

Kuhn presented his notion of a paradigm shift in his influential book *The Structure of Scientific Revolutions* (1962).

Kuhn contrasts paradigm shifts, which characterize a scientific revolution, to the activity of normal science, which he describes as scientific work done within a prevailing framework or paradigm. Paradigm shifts arise when the dominant paradigm under which normal science operates is rendered incompatible with new phenomena, facilitating the adoption of a new theory or paradigm.<sup>[1]</sup>

As one commentator summarizes:

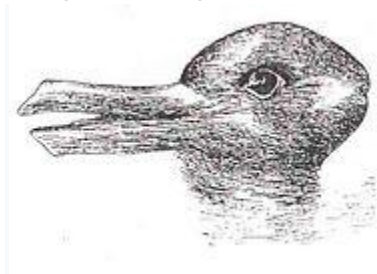
Kuhn acknowledges having used the term "paradigm" in two different meanings. In the first one, "paradigm" designates what the members of a certain scientific community have in common, that is to say, the whole of techniques, patents and values shared by the members of the community. In the second sense, the paradigm is a single element of a whole, say for instance Newton's Principia, which, acting as a common model or an example... stands for the explicit rules and thus defines a coherent tradition of investigation. Thus the question is for Kuhn to investigate by means of the paradigm what makes possible the constitution of what he calls "normal science". That is to say, the science which can decide if a certain problem will be considered scientific or not. Normal science does not mean at all a science guided by a coherent system of rules, on the contrary, the rules can be derived from the paradigms, but the paradigms can guide the investigation also in the absence of rules. This is precisely the second meaning of the term "paradigm", which Kuhn considered the most new and profound, though it is in truth the oldest.<sup>[2]</sup>

## History

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The nature of scientific revolutions has been studied by modern philosophy since Immanuel Kant used the phrase in the preface to the second edition of his Critique of Pure Reason (1787). Kant used the phrase "revolution of the way of thinking" (*Revolution der Denkart*) to refer to Greek mathematics and Newtonian physics. In the 20th century, new developments in the basic concepts of mathematics, physics, and biology revitalized interest in the question among scholars.

## Original usage





Kuhn used the duck-rabbit optical illusion, made famous by Wittgenstein, to demonstrate the way in which a paradigm shift could cause one to see the same information in an entirely different way.<sup>[3]</sup>

In his 1962 book *The Structure of Scientific Revolutions*, Kuhn explains the development of paradigm shifts in science into four stages:

- **Normal science** – In this stage, which Kuhn sees as most prominent in science, a dominant paradigm is active. This paradigm is characterized by a set of theories and ideas that define what is possible and rational to do, giving scientists a clear set of tools to approach certain problems. Some examples of dominant paradigms that Kuhn gives are: Newtonian physics, caloric theory, and the theory of electromagnetism.<sup>[4]</sup> Insofar as paradigms are useful, they expand both the scope and the tools with which scientists do research. Kuhn stresses that, rather than being monolithic, the paradigms that define normal science can be particular to different people. A chemist and a physicist might operate with different paradigms of what a helium atom is.<sup>[5]</sup> Under normal science, scientists encounter anomalies that cannot be explained by the universally accepted paradigm within which scientific progress has thereto been made.
- **Extraordinary research** – When enough significant anomalies have accrued against a current paradigm, the scientific discipline is thrown into a state of crisis. To address the crisis, scientists push the boundaries of normal science in what Kuhn calls “extraordinary research”, which is characterized by its exploratory nature.<sup>[6]</sup> Without the structures of the dominant paradigm to depend on, scientists engaging in extraordinary research must produce new theories, thought experiments, and experiments to explain the anomalies. Kuhn sees the practice of this stage – “the proliferation of competing articulations, the willingness to try anything, the expression of explicit discontent, the recourse to philosophy and to debate over fundamentals” – as even more important to science than paradigm shifts.<sup>[7]</sup>
- **Adoption of a new paradigm** – Eventually a new paradigm is formed, which gains its own new followers. For Kuhn, this stage entails both resistance to the new paradigm, and reasons for why individual scientists adopt it. According to Max Planck, “a new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.”<sup>[8]</sup> Because scientists are committed to the dominant paradigm, and paradigm shifts involve gestalt-like changes, Kuhn stresses that paradigms are difficult to change. However, paradigms can gain influence by explaining or predicting phenomena much better than before (i.e., Bohr's model of the atom) or by being more

subjectively pleasing. During this phase, proponents for competing paradigms address what Kuhn considers the core of a paradigm debate: whether a given paradigm will be a good guide for *future* problems – things that neither the proposed paradigm nor the dominant paradigm are capable of solving currently.<sup>[9]</sup>

- **Aftermath of the scientific revolution** – In the long run, the new paradigm becomes institutionalized as the dominant one. Textbooks are written, obscuring the revolutionary process.

## Features

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### Paradigm shifts and progress

A common misinterpretation of paradigms is the belief that the discovery of paradigm shifts and the dynamic nature of science (with its many opportunities for subjective judgments by scientists) are a case for relativism:<sup>[10]</sup> the view that all kinds of belief systems are equal. Kuhn vehemently denies this interpretation<sup>[11]</sup> and states that when a scientific paradigm is replaced by a new one, albeit through a complex social process, the new one is *always better*, not just different.

### Incommensurability

These claims of relativism are, however, tied to another claim that Kuhn does at least somewhat endorse: that the language and theories of different paradigms cannot be translated into one another or rationally evaluated against one another—that they are *incommensurable*. This gave rise to much talk of different peoples and cultures having radically different worldviews or conceptual schemes—so different that whether or not one was better, they could not be understood by one another. However, the philosopher Donald Davidson published the highly regarded essay "On the Very Idea of a Conceptual Scheme" (*Proceedings and Addresses of the American Philosophical Association*, Vol. 47, (1973–1974), pp. 5–20) in 1974 arguing that the notion that any languages or theories could be incommensurable with one another was itself incoherent. If this is correct, Kuhn's claims must be taken in a weaker sense than they often are. Furthermore, the hold of the Kuhnian analysis on social science has long been tenuous, with the wide application of multi-paradigmatic approaches in order to understand complex human behaviour (see for example John Hassard, *Sociology and Organization Theory: Positivism, Paradigm and Postmodernity*. Cambridge University Press, 1993, ISBN 0521350344).

### Gradualism vs. sudden change

Paradigm shifts tend to be most dramatic in sciences that appear to be stable and mature, as in physics at the end of the 19th century. At that time, physics seemed to be a discipline filling in the last few details of a largely worked-out system.

In *The Structure of Scientific Revolutions*, Kuhn wrote, "Successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science" (p. 12). Kuhn's idea was itself revolutionary in its time as it caused a major change in the way that academics talk about science. Thus, it could be argued that it caused or was itself part of a "paradigm shift" in the history and sociology of science. However, Kuhn would not recognise such a paradigm shift. In the social sciences, people can still use earlier ideas to discuss the history of science.

Philosophers and historians of science, including Kuhn himself, ultimately accepted a modified version of Kuhn's model, which synthesizes his original view with the gradualist model that preceded it.<sup>[citation needed]</sup>

## Examples

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### Natural sciences

Some of the "classical cases" of Kuhnian paradigm shifts in science are:

- 1543 – The transition in cosmology from a Ptolemaic cosmology to a Copernican one.<sup>[12]</sup>
- 1543 – The acceptance of the work of Andreas Vesalius, whose work *De humani corporis fabrica* corrected the numerous errors in the previously-held system created by Galen.<sup>[13]</sup>
- 1687 – The transition in mechanics from Aristotelian mechanics to classical mechanics.<sup>[14]</sup>
- 1783 – The acceptance of Lavoisier's theory of chemical reactions and combustion in place of phlogiston theory, known as the chemical revolution.<sup>[15][16]</sup>
- The transition in optics from geometrical optics to physical optics with Augustin-Jean Fresnel's wave theory.<sup>[17]</sup>
- 1826 – The discovery of hyperbolic geometry.<sup>[18]</sup>
- 1859 – The revolution in evolution from goal-directed change to Charles Darwin's natural selection.<sup>[19]</sup>
- 1880 - The germ theory of disease began overtaking Galen's miasma theory.
- 1905 – The development of quantum mechanics, which replaced classical mechanics at microscopic scales.<sup>[20]</sup>
- 1887 to 1905 – The transition from the luminiferous aether present in space to electromagnetic radiation in spacetime.<sup>[21]</sup>
- 1919 – The transition between the worldview of Newtonian gravity and general relativity.

- 1964 - The discovery of cosmic microwave background radiation leads to the big bang theory being accepted over the steady state theory in cosmology.
- 1965 - The acceptance of plate tectonics as the explanation for large-scale geologic changes.
- 1974 - The November Revolution, with the discovery of the J/psi meson, and the acceptance of the existence of quarks and the Standard Model of particle physics.
- 1960 to 1985 - The acceptance of the ubiquity of nonlinear dynamical systems as promoted by chaos theory, instead of a laplacian world-view of deterministic predictability.<sup>[22]</sup>

## Social sciences

In Kuhn's view, the existence of a single reigning paradigm is characteristic of the natural sciences, while philosophy and much of social science were characterized by a "tradition of claims, counterclaims, and debates over fundamentals."<sup>[23]</sup> Others have applied Kuhn's concept of paradigm shift to the social sciences.

- The movement known as the cognitive revolution moved away from behaviourist approaches to psychological study and the acceptance of cognition as central to studying human behaviour.
- The Keynesian revolution is typically viewed as a major shift in macroeconomics.<sup>[24]</sup> According to John Kenneth Galbraith, Say's Law dominated economic thought prior to Keynes for over a century, and the shift to Keynesianism was difficult. Economists who contradicted the law, which implied that underemployment and underinvestment (coupled with oversaving) were virtually impossible, risked losing their careers.<sup>[25]</sup> In his magnum opus, Keynes cited one of his predecessors, John A. Hobson,<sup>[26]</sup> who was repeatedly denied positions at universities for his heretical theory.
- Later, the movement for monetarism over Keynesianism marked a second divisive shift. Monetarists held that fiscal policy was not effective for stabilizing inflation, that it was solely a monetary phenomenon, in contrast to the Keynesian view of the time was that both fiscal and monetary policy were important. Keynesians later adopted much of the monetarists' view of the quantity theory of money and shifting Phillips curve, theories they initially rejected.<sup>[27]</sup>
- First proposed by Ferdinand de Saussure in 1879, the laryngeal theory in Indo-European linguistics postulated the existence of "laryngeal" consonants in the Proto-Indo-European language (PIE), a theory that was confirmed by the discovery of the Hittite language in the early 20th century. The theory has since been accepted by the vast majority of linguists, paving the way for the internal reconstruction of the syntax and grammatical rules of PIE and is considered one

of the most significant developments in linguistics since the initial discovery of the Indo-European language family.<sup>[28]</sup>

- The adoption of radiocarbon dating by archaeologists has been proposed as a paradigm shift because of how it greatly increased the time depth the archaeologists could reliably date objects from. Similarly the use of LIDAR for remote geospatial imaging of cultural landscapes, and the shift from processual to post-processual archaeology have both been claimed as paradigm shifts by archaeologists.<sup>[29]</sup>

### Applied sciences

More recently, paradigm shifts are also recognisable in applied sciences:

- In medicine, the transition from "clinical judgment" to evidence-based medicine
- In software engineering, the transition from the Rational Paradigm to the Empirical Paradigm<sup>[30]</sup>

### Other uses

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The term "paradigm shift" has found uses in other contexts, representing the notion of a major change in a certain thought pattern—a radical change in personal beliefs, complex systems or organizations, replacing the former way of thinking or organizing with a radically different way of thinking or organizing:

- M. L. Handa, a professor of sociology in education at O.I.S.E. University of Toronto, Canada, developed the concept of a paradigm within the context of social sciences. He defines what he means by "paradigm" and introduces the idea of a "social paradigm". In addition, he identifies the basic component of any social paradigm. Like Kuhn, he addresses the issue of changing paradigms, the process popularly known as "paradigm shift". In this respect, he focuses on the social circumstances that precipitate such a shift. Relatedly, he addresses how that shift affects social institutions, including the institution of education.<sup>[31]</sup>
- The concept has been developed for technology and economics in the identification of new techno-economic paradigms as changes in technological systems that have a major influence on the behaviour of the entire economy (Carlota Perez; earlier work only on technological paradigms by Giovanni Dosi). This concept is linked to Joseph Schumpeter's idea of creative destruction. Examples include the move to mass production and the introduction of microelectronics.<sup>[32]</sup>
- Two photographs of the Earth from space, "Earthrise" (1968) and "The Blue Marble" (1972), are thought<sup>[by whom?]</sup> to have helped to usher in

the environmentalist movement, which gained great prominence in the years immediately following distribution of those images.<sup>[33][34]</sup>

- Hans Küng applies Thomas Kuhn's theory of paradigm change to the entire history of Christian thought and theology. He identifies six historical "macromodels": 1) the apocalyptic paradigm of primitive Christianity, 2) the Hellenistic paradigm of the patristic period, 3) the medieval Roman Catholic paradigm, 4) the Protestant (Reformation) paradigm, 5) the modern Enlightenment paradigm, and 6) the emerging ecumenical paradigm. He also discusses five analogies between natural science and theology in relation to paradigm shifts. Küng addresses paradigm change in his books, *Paradigm Change in Theology*<sup>[35]</sup> and *Theology for the Third Millennium: An Ecumenical View*.<sup>[36]</sup>
- In the later part of the 1990s, 'paradigm shift' emerged as a buzzword, popularized as marketing speak and appearing more frequently in print and publication.<sup>[37]</sup> In his book *Mind The Gaffe*, author Larry Trask advises readers to refrain from using it, and to use caution when reading anything that contains the phrase. It is referred to in several articles and books<sup>[38][39]</sup> as abused and overused to the point of becoming meaningless.
- The concept of technological paradigms has been advanced, particularly by Giovanni Dosi.

## Criticism

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In a 2015 retrospective on Kuhn,<sup>[40]</sup> the philosopher Martin Cohen describes the notion of the paradigm shift as a kind of intellectual virus – spreading from hard science to social science and on to the arts and even everyday political rhetoric today. Cohen claims that Kuhn had only a very hazy idea of what it might mean and, in line with the American philosopher of science Paul Feyerabend, accuses Kuhn of retreating from the more radical implications of his theory, which are that scientific facts are never really more than opinions whose popularity is transitory and far from conclusive. Cohen says scientific knowledge is less certain than it is usually portrayed, and that science and knowledge generally is not the 'very sensible and reassuringly solid sort of affair' that Kuhn describes, in which progress involves periodic paradigm shifts in which much of the old certainties are abandoned in order to open up new approaches to understanding that scientists would never have considered valid before. He argues that information cascades can distort rational, scientific debate. He has focused on health issues, including the example of highly mediatised 'pandemic' alarms, and why they have turned out eventually to be little more than scares.