

**EVOLUTION OF GEOGRAPHICAL
THOUGHT**

Subject: Geography CBCS HONOURS

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Semester: VI

CC: 13T

POINT: 7.

Behavioural Revolution:

It may be seen as a developing criticism from within the Quantitative Revolution. Behavioural geography treats man as a responder to stimuli. It seeks to identify how different individuals respond to particular stimuli (and also how the same individual responds to the same stimuli in different situations) to isolate the correlates of those varying responses to build models that can predict the probable impact of certain stimuli.

In the 1920s, the Finnish geographer Johannes Gabriel Grano and his Estonian student Edgar Kant were attempting a behavioural approach. It was Gilbert White whose thesis on human adjustments to floods was published in 1945. His associates at the University of Chicago developed a behaviourist approach for studying reactions to the natural hazards basing this on Herbert Simon's theories of decision-making.

White found it more important to map the personal perception of the decision-maker than to describe the factual physical and economic conditions of the environment, since the decision maker would act upon his own perception and not on the environmental factors themselves.

Kates, a major exponent of the behaviourist approach, states that the way men view the risks and opportunities of this uncertain environment plays a significant role in their management as in resource management.

Julian Wolpert, while studying the patterns of migrations, found the gravity model an inadequate representation. He stated that each individual has an action space—the set of place utilities which the individual perceives and to which he responds—whose contents may deviate considerably from that portion of the real world which it purports to represent. Wolpert's papers heralded the development of Behavioural Geography.

The aim in behavioural geography has been to derive alternative theories to those based on the economic man. These theories are more concerned with understanding why certain activities take place rather than what patterns they provide in space.

Here, the researcher uses the real world from the perspective of those individuals whose decisions affect locational or distributional pattern. The study of behavioural processes led to an increase in the geographers' understanding of how spatial patterns evolve, thereby complementing their ability to describe such patterns.

One aspect of behavioural geography has been the concept of the mental map. Mental maps are an amalgam of information and interpretation reflecting not only what an agent knows about places but also how he or she feels about them.

Mental maps are important to the geographer not only as a means of examining an individual's areas of spatial preference but also as an insight into the process whereby decisions are made, opportunities perceived and goals determined and satisfied. The behaviourist approach is an inductive one, with the aim being to build general statements out of observations of ongoing processes.

Pred presented an alternative to theory building based on economic man and proposed the use of a behavioural matrix to provide a framework in which locational decision-making could be analysed. Axis of behavioural matrix are quantity and quality of information available and the ability to use that information. In it, the economic man is located at the bottom right hand corner. Harvey criticised this model, finding it ambiguous, unoperational, and an oversimplification of the complex nature of behaviour.

According to Gold, the behavioural approach is based on four major assumptions:

1. The environment in which the individuals act is that which they perceive and not the real world.
2. Individuals interact with their environments, responding to them and reshaping them.

3. The focus of the study is the individual and not the group.

4. Behavioural geography is multi-disciplinary.

The behaviourist approach appears to consist of two approaches. The first is based on the study of overt behaviour using the traditional positivist formation of dependent variables, influenced by independent variables. It involves widespread application of statistical techniques. The second approach is based on the attempts to identify the mental construction that lies behind overt behaviour. Little achievement has been made in the second approach.

Behaviouralism: It's Objectives, Salient Features and Historical Perspective!

Dissatisfaction with the models and theories developed by the positivists, using the statistical techniques which were based on the 'economic rationality' of man led to the development of behavioural approach in geography.

It was increasingly realized by the geographers that the models propounded and tested with the help of quantitative techniques, provided poor descriptions of geographic reality and man and environment relationship. Consequently, progress towards the development of geographical theory was painfully slow and its predictive powers were weak.

Theories such as Central Place Theory, based on statistical and mathematical techniques, were found inadequate to explain the spatial organization of society. The economic rationality of decision-making was also criticized as it does not explain the behaviour of floodplain dweller, who does not leave his place despite the risk of flood.

It was a psychological turn in human geography which emphasized the role of cognitive (subjective) and decision-making variables as mediating the relationship between environment and spatial behaviour. The axiom of 'economic person' who always tries to maximize his profit was challenged by Wolpert. In an important paper, Wolpert (1964) showed that, for a sample of

Swedish farmers, optimal farming practices were not attainable. He concluded that the farmers were not optimizers but, in Simon's term, satisficers.

The objectives of behavioural approach were:

1. To develop models for humanity which were alternative to the spatial location theories developed through quantitative revolution;
2. To define the cognitive (subjective) environment this determines the decision-making process of man;
3. To unfold the spatial dimensions of psychological and social theories of human decision-making and behaviour;
4. To explain the spatial dimensions of psychological, social and other theories of human decision-making and behaviour;
5. To change in emphasis from aggregate populations to the disaggregate scale of individuals and small groups;
6. To search for methods other than the mathematical and statistical that could uncover the latent structure in data and decision-making;
7. To emphasize on procession rather than structural explanations of human activity and physical environment;
8. To generate primary data about human behaviour and not to rely heavily on the published data; and
9. To adopt an interdisciplinary approach for theory-building and problem-solving.

The fundamental arguments of the behavioural geography to achieve these objectives are that:

- (i) People have environmental images;
- (ii) Those images can be identified accurately by researchers; and

(iii) There is a strong relationship between environmental image and actual behaviour or the decision-making process of man.

The behavioural approach in geography was introduced in the 1960s. Its origin can be traced to the frustration that was widely felt with normative and mechanistic models developed with the help of quantitative techniques.

These normative and mechanistic models are mainly based on such unreal behavioural postulates as 'rational economic man' and isotropic earth surface. In normative models, there are always several assumptions, and generally the centre of attention is a set of omniscient (having infinite knowledge) fully rational actors (men) operating freely in a competitive manner on isotropic plane (homogeneous land surface).

Many normative models are thus grossly unrealistic as they ignore the complexities of real world situations and instead concentrate on idealized behavioural postulate such as rational economic man. People behave rationally, but within constraints—the cultures in which they have been socialized to make decisions.

Behavioural geography banks heavily on 'behaviouralism'. Behaviouralism is an important approach adopted mainly by psychologists and philosophers to analyze the man-environment relationship. The behaviouristic approach is largely inductive, aiming to build general statements out of observations of ongoing processes. The essence of behavioural approach in geography lies in the fact that the way in which people behave is mediated by their understanding of the environment in which they live or by the environment itself with which they are confronted.

In behavioural geography, an explanation for man-environment problem is founded upon the premise that environmental cognition and behaviour are intimately related. In other words, behavioural approach has taken the view that a deeper understanding of man-environment

interaction can be achieved by looking at the various psychological processes through which man comes to know environment in which he lives, and by examining the way in which these processes influence the nature of resultant behaviour.

The basic philosophy of behaviouralism may be summed up as under:

The behavioural geographer recognizes that man shapes as well as responds to his environment and that man and environment are dynamically interrelated. Man is viewed as a motivated social being, whose decisions and actions are mediated by his cognition of the spatial environment.

Salient Features:

The salient features of behavioural geography are as under:

1. The behavioural geographers argued that environmental cognition (perception) upon which people act may well differ markedly from the true nature of the real environment of the real world.

Space (environment) thus can be said to have a dual character:

(i) As an objective environment—the world of actuality—which may be gauged by some direct means (senses); and

(ii) As a behavioural environment—the world of the mind— which can be studied only by indirect means.

No matter how partial or selective the behavioural environment may be, it is this milieu which is the basis of decision-making and action of man. By behavioural environment it is meant: reality as is perceived by individuals. In other words, people make choices and the choices are made on the basis of knowledge.

Thus, the view of behaviour was rooted in the world as perceived rather than in the world of actuality. The nature of the difference between these two environments and their implications for behaviour was neatly made by Koffka (1935-36) in an allusion to a medieval Swiss tale about a winter travel:

On a winter evening amidst a driving snow-storm a man on a horse-back arrived at an inn, happy to have reached after hours of riding over the winter-swept plain on which the blanket of snow had covered all paths and landmarks. The landlord who came to the door viewed the stranger with surprise and asked from whence he came? The man pointed in a direction away from the inn, whereupon the landlord in a tone of awe and wonder said: "Do you know that you have ridden across the Great Lake of Constance?" At which the rider dropped stone dead at his feet.

This example vividly shows the difference between the 'objective environment' of the ice-covered lake Constance and the rider's subjective or 'behavioural environment' of a wind-swept plain. The rider reacted to the situation by travelling across the lake as if it were dryland—we may safely surmise that he would have acted otherwise had he but known!

2. Secondly, behavioural geographers give more weight to an individual rather than to groups, or organizations or society. In other words, the focus of study is the individual, not the group or community. They assert that research must recognize the fact that the individual shapes and responds to his physical and social environment. In fact, it is necessary to recognize that the actions of each and every person have an impact upon the environment, however, slight or inadvertent that impact may be. Man is a goal-directed animal who influences the environment and in turn is influenced by it. In brief, an individual rather than a group of people or social group is more important in man-nature relationship.

3. Behavioural approach in geography postulated a mutually interacting relationship between man and his environment, whereby man shaped the environment and was subsequently shaped by it (Gold, 1980:4).

4. The fourth important feature of behavioural geography is its multidisciplinary outlook. A behavioural geographer takes the help of ideas, paradigms, and theories produced by psychologists, philosophers, historians, sociologists, anthropologists, ethnologists and planners. However, the lack of theories of its own is coming in the way of rapid development of behavioural geography.

Historical Perspective:

In geography, behaviouralism has a long history. Consciously or unconsciously, the behavioural approach has been adopted since the time of Immanuel Kant. In the last decades of the 19th century, Reclus, the French geographer, emphasized the point that in man- environment relationship man is not a passive agent. The landscape school in American geography focused on man as a morphological agent. Similarly, advocates of human geography—as a type of human ecology—owed much to the possibilist philosophical position (French School) that stressed the significance of choice in human behaviour.

Sauer, the leading American historical geographer, also recognized fully the important role played by man in shaping his socio-cultural environment by transforming and utilizing his physical surroundings. In 1947, Wright put emphasis on behavioural approach for the interpretation of man-nature interaction. He proposed that a profitable direction for geography would be to study geographical knowledge in all its forms, whether contained in formal geographical inquiries or in the vast range of informal sources, such as travel books, magazines, newspapers, fiction, poetry and painting. The works of Sauer, White and many others demonstrate that people act according to habits and experience not as rational persons.

Wolpert (1964) concluded in his doctoral thesis that farmers face an uncertain environment—both physical and economic—when making land use decisions, which in aggregate produce a land use map. Wolpert decided that the farmers were satisficers and not economic men. They behave on the available information and their image about the environment and the resource. Subsequently, Kirk (1952-1963) supplied one of the first behavioural models. In his model, he asserted that in space and time the same information would have different meanings for people of different socio-economic, cultural and ethnic backgrounds living in a similar geographical environment. Each individual of a society reacts differently to a piece of information about the resource, space and environment. This point may be explained by citing an example.

The highly productive Indo-Gangetic plains have different meanings for different individuals belonging to various caste, creed and religion. Jats, Gujjars, Ahirs, Sainis, Jhojas and Gadas living in the same village perceive their environment differently. A Jat farmer may like to sow sugarcane in his field, a Gada and a Jhoja may devote his land to sugarcane, wheat and rice, an Ahir may like to grow fodder crops for the milch animals, and a Saini is invariably interested in intensive cultivation, especially that of vegetables. For a Saini (vegetable grower), even five acres of arable land may be a large holding, while a Jat who uses a tractor considers even 25 acres a small holding. The perceived environment of each of these farmers living in the same environment thus differs from each other both in space and time.

The followers of behavioural geography do not recognize man as a rational person or an ‘economic man’ who always tries to optimize his profits. Man always does not take into consideration the profit aspect while performing an economic function. Most of his decisions are based on behavioural environment (mental map) rather than on the ‘objective or real environment’.

The fundamental arguments of behavioural geography are that:

1. People have environmental images;

2 Those images can be identified accurately by researchers; and

3. There is a strong relationship between environmental images and actual behaviour.

Figure 12.1 A Conventional Model of Man-Environment Relationship, after Boulding 1956

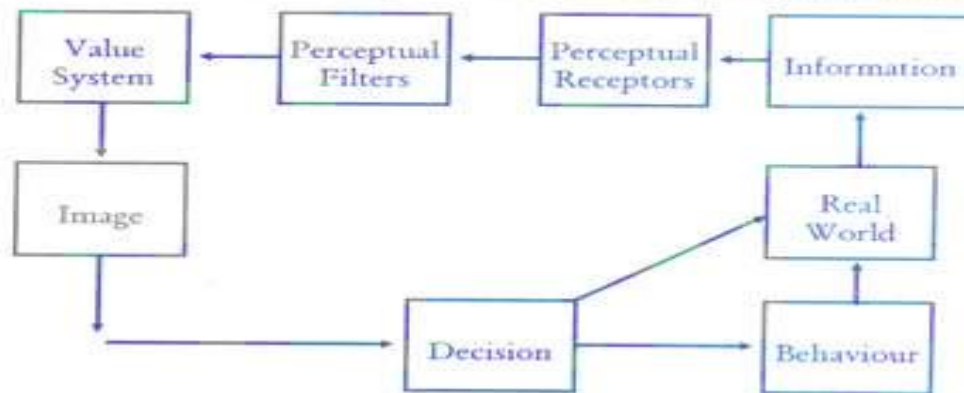


The behavioural paradigm has been shown in Figure 12.1. In this paradigm, man has been depicted as a thinking individual whose transactions with the environment are mediated by mental processes and cognitive representation of external environment. In geographical circles, this concept is derived primarily from the work of Boulding (1956) who suggested that over time individuals' developmental impressions of the world (images) are formed through their everyday contacts with the environment and that these images act as the basis of their behaviour.

The conceptual framework provided by Downs has been illustrated in Figure 12.2. This framework proposes that information from environment (real world) is filtered as a result of personality, culture, beliefs, and cognitive variables to form image in the mind of man who utilizes the environment. On the basis of the image formed in the mind of the utilizer about the environment he takes a decision and uses the resources to fulfil his basic and higher needs. Downs' framework also suggests that there exist an 'objective' and a 'behavioural' environment.

Figure 12.2 *Environmental Perception and Behaviour, after Downs (1970a:85)*

A



similar but slightly more complex classification came from Porteous (1977) who recognized the existence of:

- (i) The phenomenal environment (physical objects);
- (ii) The personal environment (perceived images of phenomenal of real environment); and
- (iii) Contextual environment (culture, religion, beliefs and expectations that influence behaviour).

Sonnenfeld (1972) went even further and proposed four levels at which the environment should be studied.

The four-fold environment, advocated by Sonnenfeld, has been given as below:

- (a) The geographical environment (the world);
- (b) The operational environment (those parts of the world that impinge upon a man, whether or not he is aware of them);
- (c) The perceptual (the parts of the world that man is aware of as a result of direct and indirect experience); and
- (d) The behavioural (that part of the perceptual environment that elicits a behavioural response).

The behavioural approach in geography is a fruitful one and it helps in establishing a scientific relationship between man and his physical environment. The broad scope of behavioural geography is remarkable even by the standards of human geography. There are, however, overall, biases in content towards urban topics and towards developed countries. One of the main weaknesses of behavioural geography is that it lacks in synthesis of empirical findings, poor communication, inadvertent duplication, and conflicting terminology.

In behavioural geography, the terminology and concepts remain loosely defined and poorly integrated, primarily owing to the lack of systematically-organized theoretical basis.

Another shortcoming of behavioural geography lies in the fact that most of its data are generated in laboratory experiments on animals and the findings are applied direct to human behaviour. Koestler (1975: 17) pointed to the danger of this strategy, in that behaviouralism “has replaced the anthropomorphic fallacy—ascribing to animals human faculties and sentiments—with the opposite fallacy; denying man faculties not found in lower animals; it has substituted for the erstwhile anthropomorphic view of rat, a ratomorphic view of man”. In short, behaviouralist theories are elegant but unhelpful when it comes to understanding the real world man-environment interaction.

Behavioural geography has too often put too much emphasis on ego-centred interpretations of the environment. Specifically, scholars are critical of two assumptions on which a great deal of behavioural research in geography is based. The first assumption is that there exist identifiable environmental images that can be accurately measured. It is not clear whether an environmental image can be extracted without distortion from the totality of mental imagery. Moreover, not enough effort has gone into checking and validating the methods by which images are elicited.

The second critical assumption is that there exists a strong relationship between revealed images or references and actual or real world behaviour. The main objection to this assumption is that it

is an unfounded assumption because extremely little research has been undertaken to examine the congruence between image and behaviour.

A more serious criticism of behavioural approach in geography is that it frequently views man as homo-psychologicus and tends to treat environmental behaviour as a non-dimensional phenomenon to the extent that the economic, social and political considerations that act concomitantly with environmental influences are frequently overlooked.

Another significant deficiency in behavioural geography has been the gap between theory and practice. This has been most noticeable over the question of public policy. In fact, behavioural geographers remain observers rather than participants. There is a serious lack of knowledge of planning theories and methods amongst behavioural geographers, which is an impediment to more active involvement.

It is a barrier that can be removed only by developing the requisite understanding of the planning processes; it cannot be camouflaged by noble sentiments and moral tone. For instance, it will be only rarely that a small survey carried out upon a sample of students will supply the basis for far-reaching policy recommendations, yet the final paragraphs of many such works contain this seemingly obligatory element.

In other words, generalization on the basis of small sample studies should not be made the basis of wider and important policy decision-making. It is, therefore, necessary to conduct research on problems that specifically deal with policy questions, that are well-versed in planning theory and methodology, and communicate the results intelligently to the interested parties.

There are signs that such an approach is developing, but the gap is still wide. The future of behavioural geography would be bright only if it could improve its standing in the subject while maintaining its multidisciplinary links.

Despite several constraints and methodological limitations, behavioural geography is now widely accepted within the positivist orientation. It seeks to account for spatial patterns by establishing generalizations about people-environment interrelationship, which may then be used to stimulate change through environmental planning activities that modify the stimuli which affect the spatial behaviour of ourselves and others.

The research methods of behavioural geography vary substantially but the general orientation—inductive generalization leading to planning for environmental change—remains. Eventually, it is hoped, a ‘powerful new theory’ will emerge. Golledge argued that substantial advances in understanding spatial behaviour have already been made by studying ‘individual preferences, opinions, attitudes, cognitions, cognitive maps, perception, and so on—what he terms processes variables.

QUANTITATIVE REVOLUTION IN GEOGRAPHY

1. Introduction

In the 1950s and 1960s, a revolutionary change described as "*quantitative revolution*" occurred in the discipline of geography. It replaced the 'idiographic' approach based on areal differentiation by 'nomothetic' one, which had its roots in the search for models of spatial structure and phenomenon. The *quantitative revolution* led the basis of geography as a spatial science that dealt with the spatial analysis of phenomena that existed on the earth surface. In simpler words, it gave geography a scientific vision through the application of methodology rooted in statistical methods. Some of the elements of positivism, which had previously been not accepted at some point in time, were now accepted open-handedly. In the words of Burton (1963) this school had set out to discover universals, to build models and to establish methods and theoretical bases on which geographical realities could be erected.

Traditionally, geography was a discipline that studied and described the surface of the Earth, but in due course of time, its definition and nature have changed. It was now related to providing accurate, systematic, rational descriptions and explanations of the variations in the geographical phenomenon that occurred over the Earth's surface. The most obvious change has occurred due to the *quantitative revolution* that brought changes in the methods and techniques used to explain the geographical phenomenon in a spatial framework.

The movement that led to the occurrence of quantitative revolution in geography was initiated by natural scientists specifically physicists and mathematicians. It expanded and led to change physical sciences followed by biological sciences. By the late 1960s, it became a feature of most of the social sciences. These include economics, psychology, and sociology; though had faint impressions in the disciplines of anthropology or political science, has not occurred in history.

The main objectives of this paradigm in geography were first, to change the narrative character of the subject (geo + graphics) and make it a scientific discipline. The second objective was to explain and interpret the spatial patterns of geographic phenomena in a logical and objective pattern way. The third objective deals with the use of mathematical and statistical

techniques; fourthly, to make accurate statements (generalization) about location order; fifthly, to prepare estimates, principles and laws for testing estimates and estimates and forecasts and lastly to provide a sound philosophical and theoretical base to geography, and to make it a scientific discipline.

These objectives lead a number of dichotomies within the discipline apart from the quality dichotomy. Now, these included measurement by instruments versus direct sense-data; rational analysis versus intuitive perception; cold scientific constructs developed in the laboratories versus rich daily sensed – experience from the real world itself; constantly changing phenomena versus discrete cases; nomothetic versus idiographic, to mention a few. If one tries to seek answers to these dichotomies he gets trapped within them and is unable to understand the movement towards quantification in geography. Thus, to avoid this we shall concentrate on how this movement became part of the discipline and slowly engulfed it in such a manner that it led to the spread and growth of scientific method in geography.

2. Quantitative Revolution in Geography

Traditionally, Geography has been a "following" discipline; the main streams of ideas had their roots in other disciplines. The doctrine of environmental determinism was represented in the writings of Semple, Huntington, G. Taylor, and Ratzel (if he can be considered a determinist). They were busy with the idea of a causal relationship and were regularly demanding and looking for "laws". A similar mechanical flavor existed in the works by "Quantifiers". It seems as if geography is re-emerging after it got soaked in ideographic approach, which created a distance between geography and environmental determinism. It seems in some way or other; the quantitative revolution took geography closer to environmental determinism especially as this revolution occurred simultaneously with the upsurge of neo – determinism. The Quantitative Revolution, but natural, was strongly opposed and the dominance of environmental determinism delayed the process of establishment of the scientific basis that the quantifiers wanted to provide. It was vehemently opposed in the United States as determinism had its strongest base there. Still, new techniques were been used and others were being developed as part of the prevailing probabilistic trend in contemporary science. In the words of Bronowski (1959) in simpler terms, statistics replace the notion of inevitable effect by probable trends. As the revolution progressed

the use and purpose of use of statistical techniques that are quantification became more and more indeterministic.

In geography, the revolution began in the late 1940's and culminated in the period from 1957 to 1960; finally, over in 1963, the year Burton wrote his paper. In between these years, it did gain momentum especially after Ackerman and Schaefer favoured in making geography more theoretical and systematic in nature. Ackerman commented, "although the simplified forms of statistical assistance have been part of geographic distribution analysis in the past; discipline is beginning to move towards more complex statistical methods-a completely logical development'. Burton further commented that both Hartshorne and Spate also agreed on the usage of these techniques in geographical thinking.

The reference of Hartshorne (1959) is being made to his statement, which says, "To raise ... thinking above the scientific knowledge level, it is important to establish generic concepts, which can be implemented with maximum objectivity and accuracy through quantitative measurements which can be subjected to comparisons through the mathematical logic".

Spate (1960) in his paper on "Quantity and Quality in Geography"; published in the *Annals of the American Geographers* seems somewhat skeptical about quantification in geography. The report of a National Academy of Sciences – National Research Council Committee on 'The Science of Geography' (1965) also discussed the influence of quantitative revolution in geography. They stated that geographers believe that correlation of spatial distributions, considered both statistically and dynamically, maybe the keys to understanding the development of living systems, social structures and environmental changes that occur over the earth surface. In the past progress was slow and gradual as the number of geographers was less while the problems were numerous. Moreover, the methods of analyzing these multi-variate problems were rigorous. It was only recently that systematic concepts and approaches have been adopted to analyze these multifaceted problems.

3. The Path of the Quantitative Revolution in the Discipline of Geography

The roots of the revolution were in the following publications, which had their significant influence on the incidence and growth of quantification in geography. These are – Neuman and Morgenstern's *Theory of Games and Economic Behavior* (1944); Weiner's volume on *Cybernetics* (1948); *Human Behaviour and the Principle of Least Effort* by Zipf (1949) and **3**

Stewart's paper entitled *Empirical Mathematical rules Concerning Distribution and Equilibrium of population* (1947). Stewart's paper needs special mention as he put forward a new way to raise the old geographic questions.

The effect of quantification began to be felt immediately in geography. Rather its rise has been startling in its suddenness. Quantification did increase in geography and one should accept it as it had a valuable role to play. For example, in 1936, John Ker Rose argued in his paper on corn cultivation and climatic conditions that "the methods of relational analysis would be particularly promising tools for geographical investigation." This call was largely ignored. Strahler initiated an excellent petition when he attacked Davis's explanatory and descriptive explanation of geomorphology and supported G. K. Gilbert's dynamic-quantitative systems.

a) Quantitative Revolution in the branches of Geomorphology and Climatology

Strahler claimed that Gilbert's paper was more apter than Davis's work; then what was the reason that it was not accepted as a sign post in geomorphology for future work; rather it has been forgotten and neglected for nearly thirty years. The answer is with Strahler himself who opines that thinks that geomorphology was a part of geography. The physical geographers did not adopt these ideas rather they followed Davis. Some of the prominent followers of Davis include *Douglas Johnson*, *C A. Cotton*, *N. M Fenneman*, and *A.K. Lobeck*. Strahler finally states these geographers made "excellent contribution to descriptive and regional geomorphology" and has provided a solid foundation for study in "human geography", but did not lay the basis for scientific study within the geographical thinking. This does not mean that prior to Strahler; geographers were not using quantitative techniques in geomorphology. Quam and Woolridge vehemently criticized his views. Quam (1950) states that mathematical formulae and statistical analysis in geomorphology may result in showing an unrealistic picture of reality that might not be accurate and objective. Similarly, Woolridge (1959) critics Strahler's views and states that although there is the prevalence of a 'new' quasi-mathematical geomorphology; it is inadvisable to use mathematics at a higher level as these are not apt in explaining the geomorphologic phenomenon. He further states that whatever the case may be they will continue to regard W. M. Davis as their founder and would criticize all those who do not agree with the methodology of Davis's interpretations of a different phenomenon occurring over the earth surface.

It is not that geomorphologists did not adopt quantification; Strahler did find his support in L. King (1962) who writes that statistical methods are useful for bulk studies and can be well appreciated if used to study complex phenomenon and processes that constitute a large number of variables or indicators. Although few studies in the branch of geomorphology can apply them, they should be used with great precision so that results are not superficial in nature. Many geomorphologists in addition to Strahler like Chorley, Dury, Mackay and Wolfman, used quantitative methods and it seemed that the practice would spread.

In the case of climatology, there is little dispute about the use of quantification. This branch of geography whole-heartedly embraced these new statistical techniques to interpret various climatic phenomena. Examples can be cited from the works of Thornthwaite, Mather and Green, Bryson who have successfully implemented quantitative techniques to seek answers for climate problems; thus silencing their critics.

b) Quantitative Revolution in the branches of Human and Economic Geography

So far, the biggest struggle for approval of quantification has been in human and economic geography. It is not surprising that in view of the possibilist tradition; it is here that the revolution runs against the ideas of independence and the uncertainty of human behavior. Here comparisons with physical sciences are useful. Physicists who work at a microscopic level, with quanta and energy, face similar problems that social scientists face with people. Such parallels when recognized are a reason for happiness and not for disappointment. In order to make a reputable place in human society, social science must get direct results in the form of a prediction science that does not need any kind of control, restriction or regiment the person. A social science that distinguishes random behaviour at the micro-level and is even able to foresee results at this level is nothing but the consequence of quantitative revolution.

Several works can be cited which used statistical techniques in a positive manner. Most interestingly large number of debates took place between scholars that appeared in the literature (Burton, 1963). Some of these are worth mentioning – Garrison's and Nelson debate on Service classification of cities; Reynolds – Garrison's deliberation on the modest use of quantification in geography. The Spate – Berry argument in *Economic Geography* that ends on the agreement that statistics are half of a filled glass, the other half is understanding and interpretations. The list is endless but some of the other debates that need to be mentioned include the contest between

Zobler and Mackay on the use of chi-square in regional geography and the dispute of Lukermann and Berry on 'geographic' economic geography.

The deliberations were done through professional magazines, which got them the much-needed attention. The result was the establishment of the Regional Science Association in 1956 that promoted quantification in geography. Moreover, it made quantifiers an essential part of the geographical thinking and giving them appreciation and approving their work part of the geographical academia.

Although most of the literature cites that, the revolution is over, it has remained active in several sub-branches of geography particularly transport, economic, and urban geography. This is evident from the fact that writings with quantitative methods have been regularly published in acclaimed journals in geography, including *Annals of the Association of American Geographers*, *Geographical Analysis*, *Environment*, and *Planning A*, *The Professional Geographer*, *Journal of Geographical Systems*, *Urban Geography*, and many others (Kwan and Schwanen, 2009). Although quantitative geography is generally "perceived as a relatively static research area," it is actually "a vibrant, intellectually exciting, area in which many new developments are taking place" {Fotheringham, Brunson, and Charlton (2000); Clark (2008); Golledge (2008)}.

Interestingly, quantification in geography has changed its course in due course of time. It now an ally of critical geographies - for example, the emphasis has shifted from global generalizations to local levels dealing with local relationships in a spatial framework. It has also become sensitive to variables like gender, race, ethnicity, sexuality, and age; and even pays attention to processes which shape individual's spatial behaviour (Kwan and Weber 2003; Poon 2003; Fotheringham 2006).

Quantitative research is still dominant in the fields of transport, economic, and urban geography in the writings of McLafferty and Preston (1997), Rigby and Essletzbichler (1997), Plummer and Taylor (2001), Schwanen, Kwan, and Ren (2008) and Bergmann, Sheppard, and Plummer (2009). In this regard, Kwan and Schwanen (2009) are of opinion that knowledge in statistical methods is essential for decoding and challenging regressive political agendas; often supported by numbers and quantitative analysis. Quantitative geography, when incorporated with a critical sensibility and used suitably, can be a powerful device for encouraging progressive social and political change.

4. The Criticism of Quantification in Geography

The quantitative revolution was initially propounded to make the discipline of geography a scientific discipline where the validity of the knowledge that was generated was justified according to the principles of positivism. Although many geographers like Plummer and Sheppard (2001); Kwan (2004); Fotheringham (2006) have argued that quantitative geography does not necessarily have to be based on the epistemological premises of positivism. Whatever the case may be it is to be understood that when positivist epistemology was adopted, the purpose of the geographic research was to seek universally applicable generalizations. The criticisms became more prominent as critical geographers started questioning the relevance and value of spatial science in the early 1970s. Now quantitative geography was labeled as positivist and empiricist because it was based on the principles of scientific objectivity, value neutrality, and the search for universally applicable generalizations. One of the groups that criticized quantification was the group of feminist geographers that was critical of the tendency to draw conclusions based on the principle of universal causality from inferential statistics (Kwan and Schwanen, 2009). Quantification was also criticized for other reasons. For instance, there were those who thought that this method would mislead geography towards a futile course. Some like Stamp argued that quantifiers were too busy in sharpening their instruments that they forgot the real purpose of the revolution. Few opponents also commented on the suitability of statistical techniques for all kinds of geography. They opine that these techniques were appropriate for some branches and not the entire geographic paraphernalia. Another group condemned this revolution on a note that there was a confusion of ends and means. In the words of Spate (1960), 'it is important to count what can be counted'. Another dichotomy lies in classifying and understanding; classification should never be mistaken for comprehension. Goodall's (1952) point is worth pondering where he states that quantitative methods or statistical techniques are only adjunct to elucidations or descriptions; they can neither provide explanations nor replace them. Therefore, these methods should be observed only as useful tools and not keys to universal knowledge (Spate, 1960).

These criticisms clearly point out that the quantitative methods have some severe limitations, especially when applied to the study of certain kinds of phenomena—for example when the purpose is to uncover the complex gendered, racialized or sexualized experiences of individuals or the socio-spatial construction of identities. However, this does not imply that

quantification is not in a position to make valuable contributions in the field of geography. The difference lies in the time period if we talk of the 1950s or 1960s maybe this was not possible but in contemporary geographic research, it is possible to reconnect the critical geographies with quantification. Another point of deliberation is that within the discipline of geography several subfields, like transport geography, are historically more quantitative in nature than others; this happened because of the influence of allied fields such as civil engineering and neoclassical economics (Kwan and Schwanen, 2009).

It can be said that the revolution had an early demise; it means that the purpose of the revolution was achieved or not. If seen from the point of view of Burton (1960) its basic purpose was to make geography more scientific and to develop a body of theory. Discontent with the idiographic approach in geography is the root of quantitative revolution; the development of theoretical and model-building geography with a nomothetic approach was the expected result. The basic rationale was to develop scientific method; to develop the theory and to test the theory with the prediction for which the logic of mathematics is the best tool available.

5. Conclusions

The use of statistical or quantitative techniques is one of the most suitable methods for the development of theory in geography. The revolution can never be over until it is able to seek answers and aid the theoretical development of the discipline. Moreover, theory development and its testing are the only ways of creating new knowledge and subsequently verifying it. Models have just formalized ways of descriptions that an author has visualized and represented through his arguments and justifications. In geography, quantification brought this revolution where the ideographic base was replaced by theory building in a nomothetic approach.

Geographers started developing theories and created 'new' geography that focused on the philosophy as well as methods. These scholars were of the view that mere description, mere quantification, and mere abstraction were valid to a certain extent; but repeated use of these methods makes one an obscurantist. *Theoretical geography* got its philosophical base in Bunge's monograph published in 1962, which identified geometry as the mathematics of space and hence made spatial science the language of new geography. Harvey's *Explanation in Geography* (1969) provided a more inclusive channel for the methods and philosophy of new geography. Apart from these scholars, the Department of Geography at Lund University, Sweden became a

centre for quantitative and theoretical geography under the leadership of Hagerstrand and Morill. Hagerstrand although based in Seattle provided an academic support to the geographers working in this field at the Lund University. To conclude, whichever method one, the purpose of geography is to seek answers to questions pertaining to problems of quantity and value. Most of our experiences are qualitative in nature and when everything is, reduce to numbers; some essential attributes are lost (Huxley, 1951). Thus one needs to maintain balance as still new worlds are to be conquered and new contributions to be made.

Selected References:

- Adhikari, S. (2010) Fundamentals of Geographical Thought, Chaitanya Publishing House, Allahabad
- Dikshit, R. D (2011) Geographical Thought: A Contextual History of Ideas, PHI Learning Private Ltd, New Delhi
- Martin, G. F and James, P. E. (1972) All Possible Worlds: A History of Geographical Ideas, John Wiley and Sons, New York.

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