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The Evaluation of Laws of Geography

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ABSTRACT: Geography is, by definition, a scientific discipline since it seeks the truth by analysing data in order to create normative claims. There shouldn't be any restrictions on when or when a law applies. One interpretation is that it is a universal truth applicable everywhere. This highlights a key difference between the various legal codes. Important to this topic is the idea that legal norms shouldn't be adopted based on their plausibility but rather must be independently confirmed via objective mechanisms. Researchers must state their hypotheses as "a claim whose truth or untruth is capable of being validated" so that they may be checked against reality, since only a good rule can predict specific patterns. Laws of equilibrium, dynamics, and statistics play important roles in human geography. Research into geographical events and spatial patterns is aided greatly by positivist geography's heavy reliance on laws. There are two methods that may be used to construct a scientific rule: induction and deduction. There was an effort in the 1960s to transform geography into a nomothetic science, and one of the foundational ideas behind this shift was that "everything is connected to everything else, but close things are more related than distant things" (Tobler's First Law; TFL). Space exploration, much alone supporting life, would be very challenging. The first law of Tobler is well accepted: "the phenomena exterior to an area of concern affects what goes on within." The second law is less widely known. Ecology, Cognition, Political Behavior, and Finance scholars have all presented their own distinct interpretations of this idea. Improvements in geomatics and the codification of spatial law have made it possible to apply the scientific method to the problem of giving a convincing account of observable occurrences. The whole body of study known as geostatistics is predicated on..

KEYWORDS: Quantitative Revolution; Spatial Science; Scientific Methods;

I. BACKGROUND

It was in the pre-Classical centuries of North Africa and Southwest Asia, as well as the Classical times of Greece and Rome, that geography first emerged as a distinct discipline. Martin (2005). (2005). (2005). The European colonial endeavour was intricately linked to the development of geographical philosophy in the period between the fifteenth and sixteenth century. Three prominent Enlightenment figures—Immanuel Kant, Alexander von Humboldt, and Carl Ritter—owe a great lot to the development of contemporary colleges, especially in the United States (Hartshorne, 1959). Students at American colleges showed increased enthusiasm for geography and law in the first part of the twentieth century, yet these two disciplines ended up holding quite different levels of clout. Not only does geography play a part in the growing divide between social and empirical sciences, but it has also made conceptual decisions that put it on the outside of both. Some of the most influential American geographers of the early twentieth century advocated for environmental determinism, the theory that environmental factors are the ultimate causal factor in the development of human society (Semple, 1911). After facing criticism in the 1920s and 1930s, environmental scientists turned their focus to regional and morphological strategies, but by the middle of the 20th century, these methods had fallen out of favour in the United States. This persisted for another twenty years, even after the postmodern movement had found a foothold in American universities (for more on Murphy, click here) (2006). According to Smith, a "perceived poor degree of geographical research" and a "lack of coherent intellectual landscape and set of objectives" put geography at danger of being lost at Harvard and other universities (1987).

The quantitative revolution ushered forth a new, more scientific approach to the study of geography, which marked a significant theoretical change. Since regional geography failed to adequately represent global spatial change, this new subject was developed to do so. Supporters of the quantitative revolution argue that it replaced the previous descriptive (idiographic) approach with an era of empirical lawmaking (nomothetic) geography. Because of the quantitative revolution of the '50s and '60s, geography has evolved from a focus on regions to one on space (Gregory et al., 2009).

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Along with environmental determinism, regional geography, and critical geography, the quantitative revolution is one of the four key paradigm breakthroughs that shaped the field of modern geography. Before history's time came around, the quantitative revolution had already taken place in economics, psychology, politics, and other social sciences.

II. THE QUANTITATIVE REVOLUTION

To counteract the prevailing paradigm of regional geography, the quantitative revolution arose. In the United States, where regional geography was the main philosophical school, heated debates erupted. It became apparent in the early 1950s that the dominant framework for geographical study was inadequate to explain the spatial organisation, ecological relationship, and temporal evidence of physical, economic, social, and political activities. More and more geographers began to voice their discontent with the discipline's long-held paradigm and its emphasis on regional geography, which they saw as too descriptive, piecemeal, and unable to be generalised. Early critics like Ackerman (1945) advised systematising the field to overcome these issues. There followed a flurry of discussion on the best way to pursue geographical research. The Schaefer–Hartshorne argument from 1953 is often seen as an early example of this. It's been a while since the publication of *Exceptionalism in Geography: A Methodological Examination*. Schaefer argued in this book against Hartshorne's exceptionalist views of geography as a field with the area as its primary focus. In contrast, Schaefer envisioned the major goal of the field to be the formation of morphological rules via scientific investigation, i.e. the incorporation of laws and methodologies from other social science fields that lay more emphasis on processes.

2.1. Epistemological Underpinnings

The novel approach provided overarching principles about spatial features in many cultural and biological contexts. Nomothetic science describes the current state of geography, whereby generalisations may take the shape of hypotheses, models, or theories that have been tested via empirical study, and where the quality of research is evaluated according to objective standards of scientific rigour. Although it was first published in 1969, David Harvey's *Explanation in Geography* remains a seminal work in the effort to recast geography as a spatial science. Harvey presented a two-pronged approach to explaining geographical phenomena: inductive reasoning, where broad generalisations are drawn from specific examples; and deductive reasoning, where specific examples are used to form testable models and hypothesis, which are then verified through empirical observation and solidified into scientific laws. H. (1969). (1969). (1969). In his opinion, the best (2). Critical rationalism was developed by Karl Popper (1963, 1969) in response to positivism. Popper argued that hypotheses can only be refuted, not confirmed.

III. POST-REVOLUTION GEOGRAPHY

With its impact spreading positivist (post-positivist) thought and counter-positivist replies, the quantitative revolution greatly influenced the development of the field of geography into its present form (Johnston and Sideway, 2016). Tobler developed the first rule of geography as a result of the growing awareness of distance as an important consideration in making sense of the spatial organisation of phenomena that emerged with the revolutionary period (1970). Geographical study would not be possible without the theoretical groundwork provided by the continued advancement of theoretical geography, and the growth of spatial analysis in geography led to an increase in the number of planning applications (Gregory et al., 2009). There have been several advances in geomatics as a result of geographers' increased use of computers, including the invention of the geography information system (GIS) and its subsequent widespread use. These advancements finally let geographers evaluate complicated models on a full-scale model, taking into account the passage of time, the distance between points in space, and the interconnection of different kinds of terrain. The advancement of geomatics has contributed to the blurring of the lines between physical and human geography by making it possible to evaluate the complexity of both the built and natural environments using computational models (Johnston and Sideway, 2016).

All that time spent on statistical models will later prove to be the revolution's downfall. A growing number of geographers worried that these methods lacked theoretical grounding despite their sophisticated veneer. Others claimed that it was a step backward for a field that had previously taken pride in its inclusive approach to researching both

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humans and the natural environment. Upon the arrival of the 1970s, the quantitative revolution was met with open opposition. The counter-positivist movement arose as geographers demonstrated the limitations of statistics in explaining and addressing inequalities of race, class, gender, and conflict (Gregory et al., 2009). David Harvey, in this way, abandoned his prior publications in which he supported the quantitative revolution in favour of a Marxist theoretical stance (Harvey 1972, 1973). New subfields in human geography, such as critical geography and feminist geography, would soon arise to provide a new language for talking about these problems.

The word "scientific method" refers to the systematic approach used in the pursuit of reliable information. In order to do its job, the scientific method must first provide explanations for observed events. Defending the scientific status of geography is unnecessary. Simply said, geography is a science since it is a truth-seeking field that uses empirical observations as its primary source material. None of the authors advocate for a change in geography's epistemology. Theory (and fact), law, logic, and reduction are often cited as the five pillars upon which the scientific process rests. Nonetheless, the scientific practise and process in geography and allied disciplines is also sustained and provided the necessary input by another component, namely, hypothesis.

IV. ON GEOGRAPHY LAWS

Second, "law" is a fundamental concept in scientific thought. Statements concerning constant relationships are an integral part of every well-developed scientific theory. It is possible that these rules are obvious at the level of ordinary experience, or that they are only apparent at the level of scientific research, such as via controlled experimentation or microscopic examination. Like with theories, scientists have a tendency to look for rules that apply to a wide variety of occurrences. Deterministic rules, which state that if A and B are present, then C must follow, are also popular in the scientific community. However, it is acknowledged that certain laws have a probabilistic form, even if they reflect a temporary stage in the growth of the field and will be superseded by deterministic laws as the discipline advances. It was Schaefer (1953) who first argued that geographers should attempt to make claims with the force of law. A science, in his view, is defined by the explanations it offers, and such explanations need the existence of rules. Phenomena may be explained if their occurrence is always recognised as an application of laws. Major regularities reported in geography often include spatial patterns. Therefore, geography must be regarded of as the discipline concerned with the creation of rules determining the spatial distribution of particular characteristics on the surface of the Earth.

A law ought to be applicable everywhere and at any time. Thus, it may be said to be a "universal statement" with no limits on its applicability. This hints to one potential way to identify a unique regulation. Braithwaite's (1953) examination of scientific explanation focuses in large part on the question of how rules connect to a larger theoretical framework. The truth or falsehood of the generalisation included in a statement cannot be used to evaluate whether or not the statement is a law. An important consideration in deciding whether a claim is a law is how it fits into the larger body of claims that make up a theory. If this is the standard, then we need to revise our thinking about the steps of verification that must be taken before a scientific hypothesis can be elevated to the status of a scientific law. Directly referencing an empirical topic is sufficient to prove the truth or falsity of a generalisation. An empirical law's veracity must be demonstrated in the same way, but it also needs backing from other laws, including theoretical laws (which cannot be directly tested), and lower-level empirical laws (which enable it make predictions).

Crucial to this idea is the idea that laws can't be accepted on the basis of their plausibility alone but must be demonstrated via objective processes. According to Bunge (1962), you can't judge a theory by how plausible it seems or how true it seems to your intuition. After developing a theory to explain observed phenomena, researchers must next turn that theory into a hypothesis that can be tested to see whether or not their predictions hold true in the real world. The hypothesis is put to the test by creating an experiment, gathering data, and determining whether or not the prediction was accurate. Since a "rule is expected to be universal," replication on different data sets is required after an initial successful test.

One may make the case that the substantive principles of human geography need a "spatialness" since both types are necessary for resolving geographical issues. Positive geographers may examine geographical phenomena and spatial patterns with more precision and efficiency thanks to the generalizability of the principles they use. Since this view of

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Vol. 5, Issue 6, June 2016

geography as a law-seeking discipline postulates a three-tiered hierarchy of scientific claims, starting with factual statements or systematised descriptions and advancing to "empirical generalisations or laws," the term of law acquires a far greater importance here. Harvey states that one may adopt one of two routes when developing a scientific rule: (1969). The first, "induction," entails working backwards from a generalisation to particular situations, while the second, "deduction," works in the other direction, from a generalisation to specific cases.

V. DEFINITION OF LAW AND TOBLER'S FIRST LAW OF GEOGRAPHY

Richard Feynman, a physicist, defines a law in his own words (1967). In his work "The Character of Physical Law," he details the process for developing a novel physical rule. He stresses that the first guessing stage is the most challenging (Feynman 1967, 156). The next step is to "calculate the implications of the estimate to determine what might be inferred... We next compare the result to our own experiments, experiences, and observations to see whether it stands up to examination. If the hypothesis cannot be replicated in the lab, it must be wrong. Thus, you were incorrect. In addition, he emphasises deviating from the standard in order to discover new norms. Therefore, the strategy used by those who uncovered earlier legal principles cannot succeed. When it comes to determining the existence of laws, Feynman claims there is no one certain method. Zipf's (1949) rules on spatial interaction and word frequencies (both based on the principle of least effort) and "Pareto's law" are both examples of so-called "laws" in the social sciences (economics).

Roger Shephard, a psychologist and the creator of nonmetric scaling at Stanford, is often cited for the following rule on multidimensional scaling: "if a solution exists, definitely it exists in two dimensions." (Coxon 1982, 87). A French engineer named Lalanne came up with "la loi de l'équilateralité" and its guiding principles in the year 1875.

VI. THE VALUE OF TFL IN GEOGRAPHICAL INFORMATION SCIENCE (GI SCIENCE)

Over the last decade, TFL's expansion has followed that of GIScience. Because of the increased interest in and use of geographic information systems, quantitative geography and spatial statistics have had a renaissance in recent years (GIS). One common need in developing digital representations is the discovery, expansion, and formalisation of trends and facts that are so widespread and ubiquitous that they are frequently neglected in daily life. Let's examine spatial interpolation, a method for computing extrapolated values of variables in areas where they were not directly measured. Every weather map relies on interpolation to fill in the gaps between points where vital meteorological data, like temperature and pressure, have been measured. These points are used to generate surfaces, which are then seen as isolines. An apparently easy and generally recognised practise, estimating a location's temperature using the closest available data, is really an application of TFL that implicitly depends on the validity and universality of the rule.

Potential applications for this method of estimation include groundwater basins, the total amount of ore to be mined, and mining operations. The concept may be formalised as a measure of spatial autocorrelation or covariance, or as a function called a variogram or covariogram, depending on the context. TFL is the theoretical cornerstone upon which geostatistics and related fields rest (Burrough and MacDonnell, 1998; Cressie, 1991; Goovaerts, 1997). It is now feasible to put this exciting analytical approach into practise because to developments in geographical analytic tools like Geographically Weighted Regression (Fotheringham, Brunson, & Charlton, 2002). These assertions motivate research on the viability and usefulness of TFL in the field of geographic information science. It's conceivable to make either a structural or a methodological criticism (presuming that "related" implies "similar") (interpreting related mechanistically).

VII. CONCLUSION

All things are linked, although nearby things are more related than distant things; this was initially stated by Tobler (TFL). "nearby items are more similar than distant ones" is a better way to explain TFL than "related," which suggests a causative tie when none exists. Spatial interpolation, the mathematical process that allows for the gaps introduced by geographic sampling to be filled, relies on TFL as its base. Half a decade later, geographers might look back on the 1950s and be struck by how cohesive the discipline was. There was pushback after the quantitative revolution that those

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Vol. 5, Issue 6, June 2016

debates had ignited. The discipline is thriving now, at least in the United States, as a polyglot of many different methods. The 2004 Annals Forum is only one illustration of how far the discipline has gone in terms of allowing or at least acknowledging differences of opinion. Top-down linearization (TFL) is a fundamental principle of representation and a key to unlocking analytical insights for many GIS professionals, yet the very idea of laws in geography may be problematic for those working in other areas of the field.

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Vol. 5, Issue 6, June 2016

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