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## Diffusion Research in the Context of the Naturalism Debate in Twentieth-Century Geographic Thought

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*The variety of diffusionist traditions found in geography is best understood in terms of the broad conceptual shifts that have occurred in human geography during the twentieth century. Diffusion research can be seen as having passed through four stages: environmentalism, regional synthesis, spatial analysis, and postspatial analysis. The description of each stage in terms of the naturalism debate illustrates the manner in which basic beliefs concerning the nature of geographical science infuse questions of significance, theory, and method in the study of diffusion.*

Diffusion studies have been a part of geographical research throughout the twentieth century, but the wide variety of such studies prohibits reference to a single diffusionist tradition within the discipline. The most useful framework for the discovery of order among this variety is to view diffusion studies as reflections of the major conceptual shifts in geography that have taken place during this century (Brown, 1981). These shifts have not been related to empirical anomalies nor to theoretical debate but, rather, are related to changing perspectives concerning the basic goals of a geographical science. Central to this debate is the issue of naturalism, the view that the social sciences can be modeled on the natural sciences (Bhaskar, 1979; Thomas, 1979). A consideration of the variety of interpretations given to the naturalist perspective by geographers provides an important component in a contextual understanding of twentieth-century geographic thought.

### A Historical Schema

That geographic diffusion studies reflect these larger concerns of the discipline is illustrated by the fact that differing views of diffusion can be described in terms of the relatively standard schema of twentieth-

century Anglo-American geographic thought. Within this schema, the discipline is seen as having passed through a sequence of stages from environmentalism to regional synthesis to spatial analysis and finally into the present, pluralistic stage best described as postspatial analysis. As the name indicates, the last stage is the most difficult to characterize in that the only unifying theme appears to be the negative one of a reaction against the view of geography as a positivistic spatial science. Within discussions of diffusion, the manifestation of this discontent has been a criticism of the decontextualization of the diffusion process that is seen as resulting from an exclusive concern with modeling the spatial aspects of this process and from an overriding interest in the development of empirical generalizations concerning spatial form (Agnew, 1979; Blaikie, 1978; Blaut, 1977; Gould, 1984; Gregory, 1985; Meir, 1982).

Most attempts to characterize these shifts of focus at both the disciplinary level of geography and at the subdisciplinary level of geographical diffusion studies have relied in varying degrees upon the concepts used by the historian of science Thomas Kuhn (1970) in his research on paradigms and scientific revolutions (Billinge et al., 1984; Johnston, 1979; Brown, 1981; see also Stoddart, 1981). The application of his model of scientific revolutions appears to be problematical, however. Among the difficulties are the ambiguous nature of the term *paradigm* and the question of the appropriateness of applying this term to the social sciences in disregard of Kuhn's claims concerning the "preparadigmatic" or "immature" nature of most social sciences (Barnes, 1982; Masterman, 1970; Thomas, 1979).

Despite these difficulties Kuhn's research has served the positive function of stimulating study of the history and the sociology of science, which has been instrumental in highlighting the gap between the practice of science and normative versions of the nature of science. These studies have recognized the role of such things as cultural beliefs, metaphysics, epistemology, and social norms as important in understanding scientific change. Although these different concerns were combined into the paradigm concept, Kuhn has restated his position in arguing that their interrelatedness should be noted but they can "no longer be discussed as though they are one of a piece" (1970, 182). For example, naturalism has been described as the "primal" philosophical problem of the social sciences, but the impact of attempts at its resolution extend beyond philosophical discourse to influence group norms in the practice of science (Bhaskar, 1979). Social scientists have often responded to periods of disciplinary insecurity by redefining or clarifying the relationship of their disciplines with the more prestigious natural sciences (Kuklick, 1980). The major

themes in geographic thought and, more specifically, in geographic diffusion studies have both reflected and been supported by such redefinitions.

*Environmentalism: Semple's Interpretation of Ratzel*

The diffusionist ideas of the nineteenth-century German geographer Friedrich Ratzel were introduced to U.S. social science through several sources, the most prominent of whom were the geographer Ellen Semple and the anthropologist Franz Boas and his students. The interpretation of Ratzel's work associated with the environmentalism of Semple appears quite different, however, from the interpretation found in the work of Boasian ethnographers. Carl Sauer, an intellectual descendent of both of these traditions, has explained this discrepancy in suggesting that Semple's work is essentially based upon the first volume of Ratzel's *Anthropogeographie*, a volume concerned with the environmental basis of civilization, whereas the Boasians, especially Sauer's Berkeley colleague Robert Lowie (1937), had recognized a less deterministic Ratzel in the second volume, a volume concerned with topics of migration and diffusion.

Semple's interpretation is the most clearly presented in her 1911 work titled *Influences of the Geographic Environment*, with the subtitle, *On the Basis of Ratzel's System of Anthropogeography*. In this volume Semple addressed the spread and development of civilization through the movement of peoples driven largely by the forces of nature. Diffusion of ideas and innovations was thus seen in terms of these migrations. The scientific worldview associated with this conceptualization is evident in Semple's claim that the essential point of the Copernican revolution was the view of "a world in motion instead of a world at rest." Anthropogeography concerned itself with the "whole complex relation of unresting man to the earth" (Semple, 1911, 79-80).

The specific model for such a science was for both Semple and Ratzel the life sciences, especially ideas of evolutionary biology and zoology: "Just as an understanding of animal and plant geography requires a previous knowledge of the various means of dispersal, active and passive, possessed by these lower forms of life, so anthropogeography must start with a study of the movements of mankind" (Semple, 1911, 80). Following the lead of Ratzel, Semple identified the goal of anthropogeography as the discovery of natural laws. She credited Ratzel with "placing anthropogeography on a secure scientific basis" when he "first investigated the subject from the modern scientific point of view, constructed his system according to principles of evolution, and based his conclusions on worldwide inductions . . ." (Semple, 1911, v). She recognized the immaturity of the scientific study of humankind compared to other sciences but

argued that the laws of anthropogeography were nonetheless "well founded" (Semple, 1911, vii).

Like the discussions of other social scientists who played important roles in the early stages of academic specialization, Semple's discussions of the scientific nature of geography had among their goals the establishment of the scientific credentials of anthropogeography and the delimitation of its conceptual independence through the "carving out" of a distinctive subject matter. Both of these functions were served by the identification of a single causal relationship between nature and humankind. According to Semple, such a relationship was infinitely more complex than plant-environment relationships and thus was deserving of independent status from the biological sciences. Also, an anthropogeography based upon this relationship would be a unifying force among the human sciences, which she believed offered only "piecemeal and partial" explanations: "All these sciences, together with history so far as history undertakes to explain causes of events, fail to reach a satisfactory solution of their problems largely because the geographic factor which enters into them all has not been thoroughly analyzed" (Semple, 1911, 2). The "evolutionary environmentalism" associated with Ratzel and Semple was an extrapolation of evolutionary biology applied to the understanding of cultural differentiation (Campbell and Livingston, 1983). Anthropogeographers sought mechanisms in the form of natural laws in which causes of cultural variations were found in the surrounding environmental conditions. Model mixed with metaphor in the application of Semple's science of anthropogeography to the Mediterranean as she described her evolutionary scheme in which diffusion played a vital function:

Whatever flower of culture each small region developed in its own garden plot was disseminated over the whole basin by the multitudinous paths of the sea. So varied were the local conditions of temperature, rainfall, soil, relief, area, coastline and vicinal grouping, that each district commanded some peculiar combination of natural advantages in the production of its distinctive contribution to the civilization as the whole. These cultural achievements in turn, transplanted to distant shores, took on new aspects in response to a changed environment or were remodeled by the genius or needs of new masters [Semple, 1931, 9-10].

Causal regularities associated with the laws of migration and geographical isolation proposed by Ratzel's teacher Moritz Wagner as well as the neo-Lamarckian doctrines of the inheritance of acquired traits were employed to provide the appearance of a scientific foundation for the study of cultural and regional differentiation.

*Regional Geography: Sauer and Kniffen*

Carl Sauer's cultural geography represented an attempt to carry on the traditions of Ratzel's anthropogeography and its concerns with cultural origins, migration, and diffusion but at the same time to eliminate what he saw to be the a priori assumptions of his teacher Semple. He condemned the monocausal theories of the previous generations of human geographers and presented instead the argument that human geography was a science that did not seek natural laws (Sauer, 1925, 1927, 1936, 1941). Sauer was antipositivist in that he condemned the idea of a human science based upon the model of physics that sought explanations in terms of universal laws, but he was not antinaturalist. He stated that "if the social scientists are naively positivistic, that means only that they have learned badly from natural science" (Sauer, 1947).

Sauer's scientific philosophy was an interesting combination of ideas derived from his training in the natural sciences, especially with geologist Rollin Salisbury, and his intellectual contacts with the Boasian ethnographers Robert Lowie and Alfred Kroeber. From the natural scientists Sauer gained an appreciation for, and training in, natural history, and from the ethnographers he gained an appreciation for the culture history of Ratzel and Eduard Hahn and the Neo-Kantian interpretation of historical science. He referred to his approach to the social sciences as culture history, and it was this approach that characterized his diffusion research and that of his student Fred Kniffen.

Sauer avoided the use of the term *anthropogeography* to describe his research because of its association with environmentalism and used instead the concept of cultural geography. His cultural diffusion was much like the approach found in Semple's writings in that his model was drawn from the life sciences and his concern was for understanding the origin and dispersion of cultural artifacts as a basis for understanding areal and cultural differentiation. Unlike Semple, however, he did not see the purpose of such studies as the discovery of natural laws of such differentiation. Also, Sauer removed the study of diffusion and of areal variation of culture from evolutionary environmentalism by detaching cultural origins from the causal mechanisms of environmental adaptation.

The relationship between the life sciences and Sauer's cultural history can be better understood through brief reference to the scientific philosophy of Sauer's Berkeley colleague Alfred Kroeber. Kroeber initially distanced anthropology from biology to establish more firmly the logical independence of the science of culture, but after having accomplished this goal, he once again noted the logical similarities between the two fields (Stocking, 1968). Many of the similarities were rooted in the neo-Kantianism of

the German philosophers Heinrich Rickert and Wilhelm Windelband and their elaboration of the distinction between idiographic and nomothetic concept formation. Kroeber's views on this distinction changed from originally conceiving it as a basis for dividing cultural science from natural science to more appropriately recognizing it as a description of two types of concept formation found in varying degrees in all sciences (Bidney, 1953).

Contrary to the lore that surrounds the terms *idiographic* and *nomothetic* in geography and in other social sciences, these terms did not refer to distinctions between nature and culture, unique objects and general objects, or between description and explanation; they instead corresponded to a distinction made concerning the goals of concept formation. Each could be applied to the same aspects of reality but with differing results. In one case "value is ascribed to knowledge of the general properties of reality," and in the second case "value is ascribed to knowledge of its concrete and unique properties" (Oakes, 1980). Causality was a component of each mode of concept formation, in the form of causal laws in the nomothetic mode and in the form of causal sequences of events in the idiographic mode (Windelband, 1980; Burger, 1976).

The sciences in which the idiographic mode was most evident according to Kroeber were the historical sciences, such as cultural anthropology, geology, and biology. He criticized other social scientists including his mentor Boas for not recognizing that it was the idiographic mode of concept formation rather than an essential concern for the temporal that characterized the historical sciences. He states: "I am convinced that the essence of the process of historical thought will continue to fail of being grasped as long as time is considered most important in that essence. This essence is the characterizing delineation of groups of phenomena in context, into which both time and space factors enter" (Kroeber, 1952, 102). The nomothetic mode of concept formation destroys context in seeking as its goal universal generalizations (Kroeber, 1952, 101).

Kroeber utilized a conception of cause as "formal cause," in which one studies relations such as antecedence, similarity, and contrast among cultural forms (Kroeber, 1952, 107). The primary epistemological concerns in discussing cultural forms became those of appropriate description, classification, and the tracing of origins of these cultural forms (Wolf, 1981). This method was similar to what Sauer (1941) referred to as the geographic method of seeking clues to origins and dispersions from the study of distributions. Although Sauer did not concern himself with the specifics of neo-Kantian philosophy, many of the ideas of idiographic concept formation are evident in his work. The goal of cultural geography was the understanding of the origin and dispersion of cultural artifacts

in their phenomenal context of period and place. Theory and generalization were viewed in purely instrumental terms as steps in the process of accumulation of facts about specific cultural forms.

Sauer's student Fred Kniffen has been the most significant contributor to diffusion studies in this culture history tradition. Kniffen describes his work as systematic geography, which, similar to systematics in evolutionary biology, has as its immediate goals accurate description and classification. Systematic geography was seen as a necessary step for the more general goal of regional synthesis. For example, in establishing the significance of his studies of the diffusion of the covered bridge, Kniffen wrote: "Besides its romantic and antiquarian appeal, to the student of man and his works the covered bridge is a conspicuous detail of the cultural scene. By its presence or absence in a complex of traits it aids the recognition of regions. Knowledge of the origin and diffusion of the covered bridge contributes to an understanding of cultural differentiation" (Kniffen, 1951, 114).

The model of the relationship of systematic studies, such as diffusion studies, and regional geography was that of biological ecology: "Initially he [the geographer] studies these two groups of phenomena [natural and human] after the manner of taxonomy. Eventually, as a regional geographer properly grounded in systematic knowledge, he scrutinizes the man-land relations of a specific segment of the world, a procedure analogic to biologic ecology" (Kniffen, 1978, 199). Unlike the problems of the biologist or the ecologist, however, the problems of description and taxonomy often stretch the geographer's concept of objectivity, for, as Kniffen suggests, cultural mixing poses problems not found in the biological sciences in that the biologist is not concerned with the possibility of encountering "a tail of a lion grafted to the body of a cow" (Kniffen, 1936, 180; see also Runciman, 1983).

This overriding concern with description and classification was part of the impetus behind the spatial analysts' reaction against the regional theme in geography, and they found in the work of the Swedish geographer Torsten Hagerstrand a concrete example of what they perceived to be diffusion studies in the mode appropriate for a modern social science of geography.

#### *Spatial Analysis: Interpretations of Hagerstrand*

The diffusion model of Hagerstrand, similar to that of Sauer, can be seen as both a continuation of and a significant break from past traditions. The heritage of his research traces back to Ratzel and to his own interest in ethnographic research (Hagerstrand, 1983; Pred, 1967). In his autobiographical statement Hagerstrand (1983) has noted the support that he

found in what he saw to be the parallel research of Fred Kniffen. Also, Hagerstrand has had a lifelong interest in natural history, biology, and ecology, a fact that I think is important for understanding the trajectory of his research interests, especially his current concern with time-geography. Recognition of these interests allows us to see the shifts of his research interests away from explicitly diffusion studies as an increase in the depth and breadth of an ongoing research program rather than as a radical shift (Hagerstrand, 1974).

This human ecological aspect of Hagerstrand's research has not been well understood in Anglo-American geography. Instead, greatest attention has been paid to the physicalist, reductionist, and quantitative nature of his studies of the spatial structure of diffusion, an emphasis that was due in part to the introduction of his work into the polarized debate in Anglo-American geography during the 1950s and the 1960s between the quantitative spatial analytic tradition and the qualitative regionalist tradition. The spatial analysts placed emphasis on the differences rather than the similarities between Hagerstrand's work and that of the cultural tradition because of their view of Sauer as a mandarin of the prescientific traditionalism of regional geography. Also, Sauer's intransigent view of mathematical model builders as the most recent example of academic evangelists who have plagued twentieth-century American geography with programs that imposed a rationalist orthodoxy on the field did little to encourage a sense of unity of purpose between the two groups (Entrikin, 1984).

The Anglo-American spatial analytic tradition, which provided both an intellectual influence and a receptive audience for Hagerstrand's research, was perceived by its proponents as the vanguard of a modern social science of geography. The explicit philosophical justification for this approach was couched in the language of logical empiricism, in which the goal of all scientific inquiry was explanation involving scientific laws in the form of true, empirical generalizations. Explanation was seen as logically equivalent to prediction, and thus the "pragmatic criterion of predictive success" became the sole criterion of evaluation for such explanations (Hesse, 1980, 190). The predictive success of physics made it the model science against which all others were judged. The reductive, quantitative, and theoretical mode of the physicist was the model employed by the spatial analysts seeking empirical generalizations, explanations, and predictions. It is within this intellectual context that Hagerstrand's approach to diffusion flourished.

Hagerstrand, like other spatial analysts, attempted to construct mathematical models that would provide the means for predicting or retrodicting the spatial spread of innovations. To accomplish this task, he made



simplifying assumptions. The rationality of the decision maker was assumed; the heterogeneity of places was transformed to the homogeneity of space; and the community became a set of discrete individuals linked by a communication system. Access to information was the primary variable, and thus space itself becomes of fundamental importance (Hagerstrand, 1967, 6).

In spite of and, perhaps, because of his ties to earlier diffusionist traditions, Hagerstrand sought to apply the reductionist and mathematical strategies that he found to be so attractive in the philosophy of physicist Arthur Eddington. Also of interest to him was the social physics of the sociologist George Lundberg. Of Lundberg's influence, Hagerstrand wrote:

By looking at the sentences I underlined in his book, I can easily reconstruct what I picked up with approval from him. Here is one example: 'The ends of science are the same in all fields namely, to arrive at verifiable generalizations as to the sequences of events.' . . . Today Lundberg's physicalism, behaviorism, positivism, or what you care to call it, may seem naive. But given the cackling in geography this new song sounded lovely in my ear [Hagerstrand, 1983, 247-8].

This concern with verifiable generalizations of sequences of events underlines the solidly empiricist quality of this work, which often moved from large-scale data collection and analysis to abstracting general relationships. Its search for explanation involved the Humean conception of cause as the constant conjunction of events and in which the truth of a scientific explanation is dependent upon the existence of such constant conjunctions or laws.

#### *Postspatial Analysis: Responses to the Hagerstrand Model*

It has been suggested that all recent research in geographical diffusion can be interpreted as responses to the Hagerstrand model (Brown, 1981). The nature of these responses has varied significantly, however. Many critics have sought to increase the complexity of the original model by expanding the number of variables studied and by removing many of the simplifying assumptions, without contradicting the basic empiricist philosophy underlying the model. Others have attacked this philosophical basis. Both groups share a common discontent with the extreme versions of spatial analysis that characterized the Hagerstrand model, in which most social, economic, political, and environmental factors were assumed away for the purpose of considering the spatial patterns of information flows and of innovation adoption. They also share an interest in reemphasizing the contextual elements of the diffusion process (e.g. Blaikie,

1978; Blaut, 1977; Brown, 1981; Carlstein, 1982; Gregory, 1985; Meir, 1982).

These concerns are expressed in the words of Peter Gould, one of the pioneers of quantitative diffusion studies in the spatial analytic tradition, who states that the "traditional geographical analogy between particle physics and innovation diffusion has to be discarded" (1984, 23). He illustrates this point through an example:

When Portuguese farmers live in small villages, and exchange information over a glass of wine in the evening, we can see how the restricted and unreflective tradition of functional thinking that leads to a least squares estimation of a mean information field actually crushes down, and totally misrepresents, the multidimensional complexity. We also see that innovations, considered as transmitted traffic, must have some structure, some backcloth of face to face communication upon which they can move, and that this geometry of connections will severely shape the actual course of diffusion [Gould, 1984, 23].

The social structure that Gould refers to is somewhat ambiguous, however, in that the term has been given two quite distinct meanings in geographical research, one as a set of empirical constraints on action and the other as a causally efficacious object. The first view has been evident in the empiricist tradition that works to expand and apply the Hagerstrand model. The second view is part of a nascent realist critique of this empiricist tradition (Bhaskar, 1979; Sayer, 1984).

Thus far the realist contribution to diffusion studies has been largely programmatic, critical of the goals of previous, empiricist diffusion studies (Agnew, 1977; Gregory, 1985). Realists have argued that empiricism presents an incorrect description of the nature of science. They argue that scientific explanation is causal explanation, yet cause is not to be viewed in the Humean sense of the constant conjunction of empirical events but rather as residing in the nature of the object itself, as the causal power of the object to produce change. Within this view of science a causal explanation does not require universal generalizations or laws, and need not allow one to predict the occurrence of future events. Thus, criticism of Hagerstrand's diffusion studies is directed at the overemphasis upon the search for universal generalizations concerning spatial form, and at the neglect of the more causally significant aspects of the interplay between human agency and social structure (Gregory, 1985). The call is for a greater contextualization of diffusion processes, but the framework used for the argument is once again the issue of naturalism.

### Conclusion

This brief overview of twentieth-century geographical diffusion studies has illustrated the relationships among the philosophy of science, human geography, and diffusion theory. It has questioned the accuracy of viewing such diffusion studies as part of a progressive, twentieth-century march from a prescientific past to a scientific present. Also, it has contradicted those arguments that have characterized diffusion studies as moving between the two poles of a scientific and a humanistic geography. Rather, members of the various diffusionist traditions in human geography have sought to present their research in accordance with the prevailing norms concerning the nature of social science. Changes in the diffusionist tradition reflect changes in these norms.

Such an epistemological history provides a coherence to a seemingly disorderly tradition but it does not address questions concerning the mechanisms of change and persistence. Why do the norms guiding research in the social sciences seem to change with greater rapidity than do similar norms in the natural sciences? Why do these norms take on the particular form that they do? Why have the questions concerning diffusion persisted throughout the century as important research questions? How closely can this continued significance be linked to issues of practical utility associated with concerns of colonialism, nationalism, and the expansion of markets (Blaut, 1984)? Answers to such questions would contribute further to a contextual interpretation of diffusionism. To make sense of the history of diffusionism in geography and of the plurality of diffusionist traditions that currently coexist, one must recognize the manner in which basic cultural beliefs, such as those concerning the nature of science, infuse questions of significance, theory, and method.

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