

Non-linear diffusion: Bison on the hoof and on the rail in the United States

David Lulka

Department of Geography, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-4493, United States

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Abstract

This paper puts forth a non-linear, post-structural conception of geographical diffusion by utilizing the example of American bison. In doing so, this approach stands in contrast to canonical theories of diffusion (notably neoclassical economics and political economy), which portray diffusion as a steady progression of development. In reviewing the history of bison diffusion during the 20th century, the impact of several factors is evident. These include environmental, cultural, economic, governmental, health and material factors. Each of these variables has taken several distinct forms, thereby enlarging the number of actors involved in the species' redistribution. The impact of each variable has waxed and waned over the years. Consequently, a series of heterogeneous networks has formed, which have simultaneously undercut the importance of certain variables and formed the basis for new channels of bison diffusion. The non-linear nature of diffusion emerges from the different temporalities of these networks. In an alternating fashion, this process of network-building has guided bison onto public, private, and tribal lands.

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1. Introduction

By the late 1970s, research on geographical diffusion had receded due to the emergence of theoretical perspectives that critiqued neoclassical approaches. In place of “adoption” and “diffusion”, “globalization” emerged as the phenomenon that characterized the spatial extension of worldviews and material practices. As a result, the technical specifications that typified research on geographical diffusion fell into disuse (if not disrepute). Even though the newer emphasis on relationalism has pointed out the vacuousness of “globalization”, interest in diffusion has not re-emerged. This is ironic given that adoption, diffusion, and globalization may all be subsumed under the category of relations. The ongoing distinction between these fields of research seems to be based upon the a priori imposition of theoretical priorities that distinguish between types of

relations (thus inverting their actual relationship) or prevailing misconceptions of scale that view scale as the determinant of relations (rather than the other way round). In countering these suppositions, the present paper seeks to reinvigorate research on diffusion by reaffirming the fundamental role of relations (in all of their heterogeneous neutrality) in a way that reasserts the multifaceted nature of geographic phenomena.

This paper outlines a non-linear, post-structural conception of geographical diffusion by utilizing the example of the American bison. Over the last century, bison have been redistributed onto public, private, and tribal lands. The mechanisms by which this process has occurred has varied from place to place, often involving a number of variables that have been ignored by traditional theories of geographical diffusion. This paper accentuates the importance of these overlooked factors in order to establish a more comprehensive depiction of diffusion. Bison offer an ideal subject for this examination because their distribution was severely diminished by the end of the 19th century (Hornaday,

E-mail address: dlulka@rohan.sdsu.edu

1890). Those scattered remnant populations, which held approximately 1000 animals, provide an ideal starting point for examining diffusion since bison now reside in all 50 states and number more than 200,000 in the United States. It is also ideal because Latour (1996) identified domestication as the central point in human–non-human relations. Information for this theoretical examination was gathered from historical documents, contemporary publications, and 80 in-depth interviews with individuals involved with bison or bison meat sales on public, private, and tribal land.

2. Canonical theories regarding diffusion

Diffusion is a traditional topic of interest within the discipline of geography. In the mid-20th century, Sauer (1952) examined the early dispersal of agricultural crops, using historical data from varied sources. More recent examples of this cultural approach include Kniffen (1965) and Jordan (1993), who, respectively, utilized visual and documentary data to support their conclusions. According to Mikesell (1978), however, diffusion was not a main emphasis of cultural geographers because they preferred to focus upon the material artifacts of culture rather than intangible processes. This suggests these early geographers did not grasp the importance of the material mechanisms that facilitated diffusion (which later became the subject of analysis in actor-network theory). Although the empirical details in these works are important contributions, their impact on the trajectory of geographic research is questionable. As Yapa (1996, p. 233, original italics) notes, “Most studies of diffusion in geography usually begin with a brief reference acknowledging the work of cultural geographers, particularly Sauer’s *Agricultural Origins and Dispersal* (1952), and quickly move on to the themes engaged by Hägerstrand: simulation, modeling, hierarchical effects and so on” (for example, see Brown, 1981).

For his part, Hägerstrand (1952, p. 4) affirmed the cultural aspects of diffusion by stating that diffusion takes place in two dimensions, “the spatial and the social”. The social aspect was implicitly acknowledged in his prioritization of face-to-face contact. Yet, for the purpose of theory-building, Hägerstrand chose to highlight the spatial aspect of diffusion, a decision that greatly influenced the trajectory of future geographic research. Hägerstrand borrowed substantially from the early literature on agricultural sociology. This sociological literature established a framework for subsequent geographical thought. Many researchers of the time sought to identify the factors that encouraged or hindered the adoption of agricultural practices. Accordingly, in many studies, the primary objective was to determine the appropriate “unit of adoption”. Symptomatic of the era, most of these investigations focused on the individual household or farm, yet some also examined the neighborhood as a possible significant unit (Hoffer and Stangland, 1958; Katz, 1962; Coughenour, 1964; Lionberger, 1954; Marsh and Coleman, 1954; Ramsey et al., 1959; Young and Coleman, 1959). In many regards, these

analyses portrayed farmers as isolated units who engaged in the activity of production, yet were largely separate from the influence of any “industry”, consumer mandate, or governmental legislation. The general state of technology during this time, which effectively “localized” production, impaired government oversight, and minimized the role of mass communication, may in part explain this analytical focus. In other studies, the role of different information sources was emphasized, yet in a rather apolitical or objective stance (Ryan and Gross, 1943; Copp et al., 1958; Coughenour, 1960). In some cases, the process of adoption and diffusion was theorized in stages, in many respects similar to Hägerstrand’s notion of innovation waves (Beal et al., 1957; Hassinger, 1959). This approach led to the unfortunate designation of “early adopters” and “resistors”, which commonly portrayed the latter group as backward or irrational in light of economic realities.

Hägerstrand’s theories included many of these components, but of particular interest was his utilization of the Monte Carlo method. Above all, this involved the construction of a square matrix comprised of smaller boxes (Hägerstrand, 1965). The square matrix was designed as a theoretical approximation of the circular environment that surrounds each individual in his or her daily life. In the center box of the matrix stood the individual actor who created an innovation. With this theoretical model in mind, Hägerstrand designated each outlying box with a statistical figure that represented the likelihood the innovation would be adopted by a person residing at that location. According to this model, the likelihood that an individual will adopt an innovation decreases with greater distance. In this regard, then, Hägerstrand’s theory is a gravity model that prioritizes the impact of space. Although the matrix is an abstraction, it is meant to accurately represent the diffusion and distribution of actual phenomena in the real world.

Although Hägerstrand appeared to retain a keen awareness of the social life of the individual (as exhibited in his time geography – Gren, 2001), followers of his statistical approach seemed to lose touch with these variables. In subsequent decades, the process of diffusion was more precisely calibrated by means of new mathematical and statistical approaches. Berry (1972) used such techniques to describe hierarchical diffusion. Cliff et al. (1981) studied the diffusion of measles in Iceland because they believed the phenomenon was replicable, stable, observable, and isolated, all features amenable to the scientific method and predictions that are universally applicable. Morrill et al. (1988) outlined this technique in more general terms.

The quantification of diffusion also fit well with progressive notions of diffusion and the focus on modern innovations. The emphasis on innovations has plagued research on diffusion and is problematic because it does not account for counter-cultural movements that are innovative by virtue of their embeddedness in a modern environment. Such counter-cultural movements often look to the past for guidance in making ethical decisions, thus conflicting

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