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E. B. Dagum

Time–Space in Geography

Geographers have always regarded space and time as fundamental attributes of reality. However, significant variations have existed in the meaning associated with these concepts. The independence of space and time, where each concept provides a separate frame of reference for positioning objects and events, is seen in both regional studies and in attempts to cast geography as a purely spatial science. In contrast, the merger of time and space into the singular notion of time–space has for many researchers become the ideal in concept if not in practice.

1. *Absolute vs. Relative Views of Time and Space*

Immanuel Kant (1724–1804), less noted for instruction in physical geography at the University of Königsberg than for his broader theory of knowledge, was instrumental in laying a philosophical basis for treating time and space as *a priori* separate from each other, with absolute dimensions validated through human experience. In contrast to Kant's view, the inseparability of space and time is embraced in the concept of time–space as a single definable dimension of reality, where one cannot have space without time, and vice versa. This perspective, one of the foundations of relativity theory, conceives time–space in relationship to the movement of material objects and to events. Conceptually, the coincidence of time and space is easy to grasp—any object or event embraces simultaneously positions in time and in space (e.g., tossing a ball and observing its flight).

From an operational and measurement perspective, researchers often return to the Kantian view, treating the separation of time and space as a practical necessity. Geographers have attempted to work around this difficulty in two principal ways. First, explanatory and descriptive models (e.g., Walter Christaller's central place theory) may be used to consider the human settlement system at different points in time as a means of detecting historical changes in the spatial character of the landscape. Second, researchers may abstract the time dimension of change into periods or stages, sometimes in arbitrary correspondence to the processes being investigated. An example of the later is use of census data, where changes might be assessed over a 10-year period,

such as population growth within a region between 1990 and 2000. In contrast, frequently researchers also define periods of time or stages according to the dominance of certain social circumstances (for instance, the baby-boom period) or of prevailing technologies, such as the automobile era.

2. From Spatial to Time–Spatial Perspectives

Attempts in the 1950s and 1960s to recast geography from a descriptive to a predictive science offer a clear demarcation in the progression of thinking about time–space in geography. In the traditional paradigm of regional descriptive geography, time and space were treated as separate even though attention was given to documenting landscape conditions at different points in time. Theoretical quantitative geography emerged to counter the descriptive focus of this tradition, but many researchers, nonetheless, retained the separation of time from space in what was termed the exceptionalism of the spatial paradigm. This was most pronounced in the advocacy of Schaefer (1953) and Bunge (1962) for whom geography was a theoretical science in search of spatial morphological laws. The merger of geography's theoretical thrust with practical issues of society, however, necessitated a predictive perspective.

Interest in prediction resulted in a shift of emphasis from the depiction and explanation of geographical patterns to that of process identification to understanding the dynamics of regional economies and the nature of human spatial behavior. Thus, from a fundamental focus on pure spatial form, attention turned to the movements of objects and to the passage of events through space and time. Models to simulate urban growth and other phenomena as processes of spatial diffusion (see *Diffusion: Geographical Aspects*) (represent explicit attempts to mesh the time and space dimensions in geographical research. Significant statements advancing time–space perspectives are found in Hägerstrand's (1973) conceptualizations of spatial diffusion and time-geography, Janelle's (1969) formulation of time–space convergence, and Harvey's (1990) notion of time–space compression.

At the behavioral level, Hägerstrand's time-geography model of society stands out in its attempt to capture the movement and activity participation of people through graphic representation of their simultaneous and sequential space and time locations. The concept of an individual's time–space path portrays the continuity of human existence as a line that occupies space and time simultaneously and continuously, relative to a person's activities in space through the temporal cycles of the day or a lifetime. The inherent Euclidean nature of this space is a consequence of treating time and space as homogeneous media for movement, broken up in response to social constraints that determine who has access to specific spaces at given times and under what circumstances.

3. Time–Space Convergence and Human Extensibility

Time–space convergence is a measure of change in the effort required to overcome distance. Generally, it is defined as the average rate of decline in travel time between two places over time. For example, owing to innovations that span the eras of stagecoach travel to automobiles on limited-access highways, Boston and New York have approached each other at an average annual rate of 22 min per year between the years 1800 and 2000. The parallel concept of time–space divergence provides for the tangible measurement of increases in separation between places that result from traffic congestion and failure to maintain infrastructure. Implicit in the convergence/divergence viewpoint is the recognition that physical points (places on the earth) are in relative motion with respect to one another whenever functional measures (such as travel time and cost) are used as the distance metric. Because levels of investment in transportation and communication technologies are not uniform, some places converge much more rapidly with the remainder of the settlement system than others. Some places, bypassed by modern space-adjusting technologies, will diverge, and others will converge and diverge selectively relative to various parts of the urban system. Variations in the set of rates that define convergence among all possible pairs of places create a nonhomogeneous time–space that is relative and dependent on the inferred movement of places with respect to one another. In this time–space, places are seen to compete in their quest to gain relative accessibility over other places, thereby gaining advantages for attracting economic and other opportunities.

Time–space convergence is analogous to the physical concept of velocity and purports to assess the earth-shrinking impact of technological investments to overcoming distance. As a time-rate changes over time, it fits in the domain of metaconcepts. It is not a velocity of sensation; rather it is a process identifiable and abstracted only through measurement. The structure of the resulting space, the frame of reference for human activities, is constantly in flux and is not describable in terms of Euclidean geometry. Even though this abstraction of reality may not be recognized intuitively, the time–space convergence/divergence process embraces explicit recognition of its social origins as the result of deliberative innovation through investment decisions. It is this human behavioral response to time–space convergence that reshapes the space of human geography. Yet, Forer (1974) demonstrates reciprocity in this process, whereby the existing spatial structure of society also

influences emergent patterns of investment to encourage time–space convergence.

As a complement to time–space convergence, Janelle (1973) advanced a reciprocal concept of human extensibility. Developed more fully by Adams (1995), this refers to the ability of an individual or agency to extend their influence and presence over space and through time to distant locations via media and other means of influence over human resources. Human extensibility parallels the construct of time–space distanciation as advanced in Giddens's (1984) structuration theory. Together, these concepts pose questions regarding the closure or spatial boundedness of human societies and systems. They also bring forward issues concerning the differential abilities of individuals, firms, nations, and other forms of human agency to reach beyond their physical locations to shape possibilities for human livelihood elsewhere. Such discrepancies lead Harvey (1990) to advance yet another conception of time–space, one rooted in the historical materialism of the political economy.

4. Time–Space Compression

Harvey advances the notion of time–space compression and provides a compelling rationale for imbuing time–space with social content and experiential meaning. This is brought about by attempts within Capitalism to extract as much surplus value per unit of time as possible. Though annihilation of space through time is analogous to time–space convergence, the broad implications of compression may be less amenable to direct measurement. Use of the term compression captures the general speeding up of all kinds of events that intensify the turnover of capital and that implode on human existence as substantive levels of stress. Furthermore, in Harvey's interpretation, the transcendence of global capital over local domains thrives on shortened time horizons and on the ability to eradicate distance as an inhibitor to exchange and dominance. The ability of capital to shift resources to different places easily, and often with impunity to the disruption of life at the local scale, suggests that time-space compression may denigrate the importance of place in human society. It is in the inherent mobility and speed of such possible actions that time–space compression challenges any attempts to define the time–space nature of society too rigidly.

5. Time–Space, Dynamic Cartographic Visualization, and the Humanist Challenge

One of the issues that hinders broad application of time–space perspectives in the social and behavioral sciences is the difficulty inherent in representing the underlying complexity in the human organization of space through time. This is both an issue regarding the nature of the tools at the disposal of researchers and of how questions in empirical research are linked within alternative theoretical frameworks. The integration of space-time analyses and modeling within the frameworks of dynamic mapping, cartographic visualization, and Geographic Information Systems (see *Dynamic Mapping in Geography*; *Geographic Information Systems: Critical Approaches*) holds promise that research tools finally are catching up with needs of social and behavioral scientists for assessing alternative theoretical constructs. The transfer of these technologies to the interactive realm of the Internet offers the potential for incorporating simultaneous representation of processes through space and time. Both real-time and simulated processes are possible. Driving the interest in such developments are the needs for planners, policy makers, and scholars to understand the dynamic time–space transformations that are occurring among places and regions as a consequence of continuing advances in information and communication technologies. However, these transformations pose fundamental challenges to how social and behavioral scientists interpret the meaning of place in everyday life and to how they integrate these interpretations within theoretical and decision-making frameworks (see *Place in Geography*; *Space and Social Theory in Geography*).

Do the meanings of space and the meanings of time mean anything aside from their relationship to one another as time–space? The theoretical grounding of answers to this question rest, in part, on the ability of researchers to use the emerging tools of analytical representation in their descriptions and analyses. At the same time, answers rest fundamentally on being able to recognize humanist qualities in the nature of time–space (e.g., temporality and spatiality, as discussed in Kellerman (1989)). The humanization of time–space acknowledges its relativity to different value systems, recognizes its manifold possible metrics, and is able to relate these to human thought processes and experiences. Casting time–space in this manner draws on past formulations and opens the realm of possible investigations to include analytical time–space prediction as well as research formulations grounded in the approaches of critical science and postmodernism.

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D. G. Janelle

Time-use and Gender

Men and women have to make decisions on how to use their time, as a day has only 24 hours, or rather time is limited. Activities men and women make decisions about can be divided into paid work, domestic work and childcare, personal obligations, and leisure. Time has become an increasingly scarce good; newspapers and other media abound with stories suggesting that time pressure is becoming a real epidemic. The article discusses how time use is measured and the patterns of time use of men and women and provides explanations of gender differences.

1. The Measurement of Time-use

To understand time use of men and women, it can be categorized in several ways. If one is interested in paid work and leisure, a distinction is made between work vs. nonwork activities. With respect to the division of labor between husbands and wives, the most frequently used division is between paid work, domestic work and childcare. It is evident what is meant by paid work, and most authors use more or less the same description. However, household labor can be defined in a variety of ways. Naturally, cooking and cleaning are domestic tasks, but it isn't clear how to classify activities that are part leisure and part work, such as vegetable gardening, gourmet cooking, or playing with the children. Leisure is a broad category, including indoor activities like reading books and watching television, outdoor activities like sporting, but also social contacts and going out for dinner. Personal obligations often form a kind of residual category, including activities like sleeping and eating at home.

The most accurate and reliable way to measure the time use of people is the time diary method (Andorka 1987, Juster and Stafford 1991, Harvey 1993). In this approach, respondents are asked to keep records of what they were doing at all times for a day or more. In some studies the main activity is noted in fixed interval units (e.g., in quarters of an hour) while in others intervals are left free (i.e., starting and finishing times are indicated). The period of time when the diary is kept also differs. In some cases respondents are only required to keep a diary for a single day, while in others they are asked to do so for a whole week. The time diary method prevents respondents from exaggerating the durations of their favorite activities while neglecting the time devoted to day-to-day concerns and trivialities. Thus, the actual subject being studied is not overstated, which sometimes happens when specialized questionnaires are used. A serious limitation of time diaries is the difficulty in dealing with more than one activity performed simultaneously (Warner 1986). For example, people may cook dinner while supervising children, or sew while watching television. Another method to measure patterns of time use is asking direct questions that require men and women to estimate their usual time spent on a list of activities. In order to help the respondent, in these questionnaires often domestic work is distinguished into some clear categories like cooking, cleaning, doing the laundry, and shopping. Those few studies that compare time-diary to direct-question data find that direct questions typically produce higher time estimations than time-diary questions (Juster and Stafford 1991), especially for activities that occur frequently (Marini and Shelton 1993). Both husband and wife overestimate their time devoted to domestic duties.

2. Time-use Patterns

There has been a traditional gender division of time consuming activities within western societies: women used to do most of the household work and childcare, whereas men worked for pay the whole day and were responsible for providing family income. This has changed substantially in recent decades. In the western world, women's paid work has increased vastly. Now a majority of women in many nations are employed for pay, something that would have been hard to imagine just after the Second World War. Despite the overall increase in levels of women's employment large differences exist between countries in the northern continents. Nordic countries, such as Sweden and Denmark, have had higher levels of female labor force participation than other western countries for a long time. The Anglo-Saxon countries, such as the USA and the UK were runners up, while in Italy, Spain and Greece still less than half of the active female population has a paid job. For Eastern Europe, the picture is different. The communist ideology, established after the Second World War in Eastern Europe with the exception of Russia, forced many women to enter the labor market. In the 1960s already three quarters of the women had a paid job. Despite the

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