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Author
Agarwal, Pragya

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Walter Christaller: Hierarchical Patterns of Urbanization
By Pragya Agarwal

Background

The size distribution of urban locations has been a significant question in urban science. Walter Christaller, a German geographer, originally proposed the Central Place Theory (CPT) in 1933 (trans. 1966). Christaller was studying the urban settlements in Southern Germany and advanced this theory as a means of understanding how urban settlements evolve and are spaced out in relation to each other. The question Christaller posed in his landmark book was "Are there rules that determine the size, number and distribution of towns?" He attempted to answer this question through a theory of central places that incorporated nodes and links in an idealistic situation.

The model in CPT is explained using geometric shapes, such as hexagons and triangles. Similar to other location theories by Weber and Von Thunen, the locations are assumed to be located in a Euclidean, isotropic plane with similar purchasing power in all directions. The assumption of universality in the transport network was also established and all parts of the plain were served by the central place. A Central Place is a settlement or a nodal point that serves the area around with goods and services (Mayhew, 1997). Christaller's model also was based on the premise that all goods and services were purchased by consumers from the nearest central place, that the demands placed on all central places in the plain were similar, and that none of the central places made any excessive profit.

Innovation

Christaller's CPT was evolved from the concept of centralization as an ordering principle. Chirstaller proposed that if the centralization of mass around a nucleus is an elementary form of order, then the same centralistic principle can be equated in urban settlements. The Christaller model proposed a hierarchical arrangement of settlements and conceptualized the model with hexagonal arrangements. The hexagon best equated a circle for maximum coverage and some of the problems of overlap within circular arrangements were removed from hexagonal arrangements. The population size and importance of a

settlement were not necessarily synonymous, but the centrality of the place was conceptualized in terms of its importance in the region around it.

The theory consisted of the basic concepts of centrality, threshold, and range. *Centrality* is the draw to a particular place. The *threshold* is the minimum market that is needed to bring a new firm or service provider or city into existence and keep it running, and *range* is the average minimum distance that people will travel to buy these services or goods. This is the marketing principle in Christaller's model. The variations in Christaller's central place theory were based on transportation (mid-point) and administration (strong centralization and central market). The **marketing principle** is better known as the k=3 system, where a hexagonal space is envisaged with the central places serving two lower-order places each or one-third of the lower-order neighbors surrounding them. So, including the central place itself, a total of three places are served. The goal in the marketing principle was to serve a maximum number of consumers from a minimum number of centers. The hierarchy in the marketing model follows the rule of 3s (1, 3, 9, 27, 81 . . .), where a consumer equidistant from three higher order places A1, A2 and A3 would purchase 1/3 from A1, 1/3 from A2 and 1/3 from A3. In the **transportation model**, the goal was to minimize the network length and maximize the connectivity of centers being served. To minimize transportation costs, a different model of k=4 is proposed, where the hexagon is shifted so that the settlements are located at the center point of each side, and each central place serves a half-share of the surrounding hexagon; thus, the number of places served is four. In the **administrative model**, the goal was to provide a hierarchy of controls where the lower level centers are completely controlled/administered by the higher order places. The administrative model is where k=7, and all the six lower-order places in the hexagon are served by the central place. Christaller envisaged these models as hierarchical, with all higher order places in the hexagon surrounded by other higher-order places to explain not only local but regional economics and spatialization of urban centers.

Extensions and modifications to Christaller's CPT have been proposed. The foremost contribution was from August Losch, a German Economist, who proposed in the 1940s a consumer model based on administrative and manufacturing structure as opposed to service centres in Christaller's model. Losch started from the "bottom" of the model by considering one "equivalent customer" or one unit of consumption and build up from there. In the Losch model, the ten smallest market areas, each with a different k-value are plotted with each network surrounding a central place. These networks were then laid over each other and positioned to produce the largest number of places for each k-value. This model produced wedges of city-rich and city-poor areas spread out around a major central place. Examples of this for Toledo and Indiannapolis are shown in Figure 2, below.

Despite the inapplicability of the model in realistic situations, CPT was a breakthrough in predicting and understanding the hierarchical development of settlements, where each level of the hierarchy provides different and distinctive services. This hierarchical arrangement has been applied in regional and urban economies, in describing the location of trade and service activity, and for describing consumer market- oriented manufacturing. This hierarchical arrangement also results in a distinctive social network as the economic activities and movement of people are modified according to the hierarchical level of services provided. CPT has acted as a foundation for a large body of work on "systems of cities." The best analogy has been made to the planetary system, where individual units are kept in place by gravitational forces between them (Heilbrun, 1987). Similarly, the CPT attempts to show that each urban settlement is held in place within a system of cities and any changes in these are determined by a place's position within the system (Heilbrun, 1987).

Toledo   Indianapolis
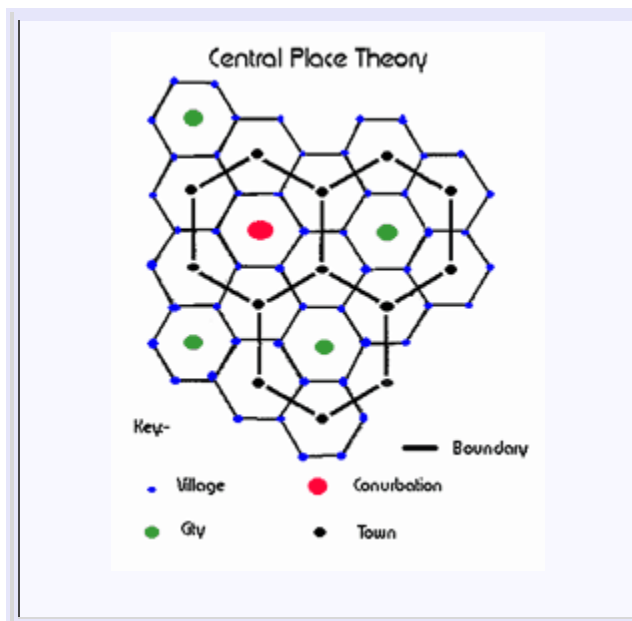
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