UC Irvine

UC Irvine Previously Published Works

Title

Regional comparisons, replications, and historical network analysis

Permalink

<https://escholarship.org/uc/item/30v269sb>

Journal

Cross-Cultural Research, 25(1-4)

ISSN

1069-3971

Authors

Burton, ML

White, DR

Publication Date

1991

DOI

10.1177/106939719102500104

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at

<https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

REGIONAL COMPARISONS, REPLICATIONS, AND HISTORICAL NETWORK ANALYSIS

Michael L. Burton and Douglas R. White*

One of the oldest cross-cultural traditions is the use of regional samples. Despite the historical importance of regional studies, most recent cross-cultural research has used worldwide samples, and regional studies have received less attention than worldwide comparisons in the recent cross-cultural literature.

While worldwide cross-cultural studies usually involve nomothetic analysis, regional studies are often idiographic, being concerned with the classification of societies, with regional histories, or with local ecologies. And while we appreciate the value of these research traditions, we also want to emphasize the role that regional samples can play in nomothetic research, through the replication of findings.

Galton's problem (Naroll 1970) refers to statistical problems that are due to the existence of linkages among sampling units. Ordinary statistical tests are weakened if sampling units are linked either by common history or by extensive contact. Proponents of worldwide cross-cultural tests have gone to great lengths to select samples that minimize these linkages. Using regional samples increases the linkages and the need for dealing with Galton's problem. We will discuss below some new solutions to Galton's problem and their relevance for regional studies.

Regional analyses require the world's societies to be classified by region. We find little discussion in the literature of the best methods for doing so, and we will touch here on some of the issues involved in classifying the world into regions. We will first discuss comparative studies that are delimited to single regions; discuss next the advantages of regional studies, regional replication of worldwide hypotheses, and solutions to Galton's problem; and conclude with methods for partitioning the world into regions.

Regional Comparative Studies

Most cross-cultural studies have used worldwide samples. These samples have often been selected in a way that will minimize the historical connections among their units (Murdock and White 1969). Doing so results in a thin coverage of any

*Michael L. Burton is Professor of Anthropology at University of California, Irvine, California.

*Douglas R. White is Professor of Anthropology at University of California, Irvine, California.

given region, which decreases the usefulness of such samples for the study of regional processes. Most anthropologists are regional specialists and are primarily interested in the historical and causal relationships within their own regions. For this reason, regional samples appeal to many anthropologists.

There are two kinds of regional studies. Studies that use *continuous area samples* include all or most of the societies in a region. Such studies were originally associated with the work of Kroeber and Driver and with the European diffusionist scholars, and they were designed to study the relationships among cultures (Boas 1894; Kroeber 1939b). Codes for a large number of traits across different domains were used to compute measures of association between cultures, with the goals being the classification of cultures and the analysis of historical processes. The second type of regional study is concerned with a more sharply focused set of substantive questions and tends to be based on a thinner sample of societies. We will call these *focused regional studies*.

We begin now with a survey of comparative studies in three important regions—North America, Oceania, and Africa. In so doing, we will see how anthropological traditions of regional analysis have been developed within regions, with resultant differences in research problems and strategies across the region.

The most extensive regional studies have been done in North America. Beginning with the work of Kroeber and Driver, these studies have used dense samples. Driver's festschrift (Jorgensen, ed. 1974) provides an excellent survey of his North American research. Jorgensen's (1974) essay in that volume summarizes succinctly the issues involved with continuous area studies. Jorgensen used statistical terminology to contrast two modes of cross-cultural analysis. In his terms, "R-mode" refers to studies of relationships among variables, while "Q-mode" refers to studies of relationships among cultures. Jorgensen argued that R-mode analysis had been flawed by poor sampling procedures, by its inability to resolve Galton's problem, and by a tendency to use bivariate correlations to make inferences about multivariate processes. In contrast, Q-mode analysis had tended to use multivariate procedures, such as cluster analysis, to improve sampling and to make both causal and historical inferences.

In his early work, Driver was concerned with measures of similarity between cultures. Driver and Kroeber (1932) developed several of these measures and tested them, using data collected in Polynesia, North America, and Peru. Klimek (1935) extended this mode of analysis to represent simultaneously both the relationships among cultures and the relationships among variables.

The problem of simultaneously representing historical relationships and nomothetic relationships became a major focus of Driver's work. In his essay on girls' puberty ceremonies (1941), Driver drew upon Cora DuBois's dissertation research (1932) and upon Klimek's (1935) methodology to analyze 118 culture traits in 159 Western North American societies. The traits were much more numerous and diverse than the variables in most recent cross-cultural studies. They included such phenomena as "drumming on a plank at girl's puberty," "use of the gourd rattle," "seclusion of the girl outdoors or in a roofless enclosure," and "avoidance of hunters." This level of detail allows more information about cultural context than is usually found in worldwide cross-cultural studies.

In the girls' puberty paper, Driver developed a data analysis strategy that he used

throughout his later work. He clustered the tribes into 23 groups and computed intercorrelations among all of the tribes for each group. He then correlated the culture traits with geographical subregions and with language families, finding that only a small percentage of traits correlated either with geography or language. Finally he discussed possible historical inferences from the patterns of association of traits with language and geography.

In his later work, Driver went beyond Q-mode analysis to attempt simultaneous analysis of the effects of functional causes, psychology, and history on culture traits. His 1956 study analyzed the variables used in Murdock's *Social Structure* (1949), with a sample of 280 North American Indian societies. He claimed two advantages to using his approach over Murdock's. First, it allowed for closer attention to history. Second, he was able to present a complete table of correlations among variables, whereas Murdock used only a subset of the correlations. From this table, Driver was able to compute a cluster analysis and compare the clusters of variables with the subregions of North America, and also to discuss the history of each of the subregions.

Driver's paper on kin avoidances in 277 North American Indian societies (1966) continued the research strategy that he had developed in the girls' puberty paper. Driver summarized his research strategy as follows: "Culture area groupings and language family memberships are treated as variables for the first time and are correlated statistically with avoidances, in addition to forms of residence, descent, and kinship terminology" (Driver 1966: 176). Driver found strong correlations between avoidances and both language family membership and region. He also found stronger correlations between avoidance rules and kinship terminology than he found between avoidance rules and either residence or descent.

Driver's comprehensive study of North American Indians (Driver and Massey 1957; Driver 1961) was based on a sample of more than 250 societies. Driver did not accept the national boundary between the United States and Mexico as a culture area boundary; his North American region included Mesoamerica and the Caribbean. He divided the region into 17 culture areas and presented numerous maps showing the distribution of economic, social and cultural variables.

Driver and Massey did not produce codes for their North American data; they simply recorded them on maps. Driver later had the North American data coded from the maps. Some new societies were coded, increasing the sample to 273, with 279 culture traits. These data were used in a comprehensive study of relationships among region, culture, and language (Driver et al. 1972; Driver and Coffin, 1975) that marks the culmination of Driver's North American work. In the first part of the study, Driver et al. (1972) used hierarchical clustering methods to classify 273 North American societies into 35 clusters. They then compared this statistically-based classification with Kroeber's culture area classification, with Murdock's culture provinces, Driver's (1969) classification and Spencer and Jennings's (1965) classification. As a validity test, they measured the correlation between each classification and Voegelin and Voegelin's (1966) language classification, finding it to have a higher correlation with Kroeber's classification than with the other three classifications.

In a more extensive analysis, Driver and Coffin (1975) classified North American Indians into culture areas, using hierarchical clustering. They then correlated this classification with culture area classifications by a number of other scholars, finding

their classification to have high correlations with classifications by Kroeber (1939a), Spencer and Jennings (1965), and Sturtevant (1975), but a low correlation with Murdock's (1967) classification. They then correlated Voegelin and Voegelin's (1966) language classification with the various regional classifications, finding the highest correlation (.61) with Kroeber's areas, and the lowest correlation (.32) with their own classification. This correlation was followed by computation of correlations within language families between percentages of cognates shared and sharing of culture traits.

Driver and Coffin (1975) followed these Q-mode analyses with a hierarchical clustering of the culture traits into 55 clusters, and discussed each cluster of traits in terms of (1) culture history, (2) functional relationships among the traits, and (3) the regions where each cluster of traits occurs. Compared to most cross-cultural research, Driver and Coffin analyzed traits from very diverse domains. An example of their substantive diversity can be seen in the cluster of traits associated with horticulture. This cluster included, among other traits, "maize dominant," "pottery the dominant noncooking container," "cotton clothing," "cigar or cigarette," "turkeys," "apartment house cluster," "curved throwing club," and "irrigation ditches." Several of these traits are more particular in their formulation than would be the case in many cross-cultural studies, where "apartment house cluster" would be an instance of a more general variable, such as "presence of villages," and "irrigation ditches" would be an instance of "irrigation present."

A similar approach to Driver's classification of ethnic units can be seen in the dissertation written by Kenny (1974), who clustered 1,213 societies from the *Ethnographic Atlas* (Murdock 1967), with respect to 284 culture traits. Kenny did seven classifications, one for each of Murdock's six major regions, and one for a 20 percent world sample. Within each region, he correlated his classification with Murdock's sampling provinces (Murdock 1968), with a classification by language family, and with subsistence types, finding all of these correlations to vary across regions. For example, the correlation between Kenny's classification and a language family classification varies from a low of .10 (Africa) to a high of .40 (Circum-Mediterranean). Kenny's world classification correlated .40 with Murdock's provinces, .43 with language family membership, and .25 with subsistence types, providing support for the validity of Murdock's provinces, as well as evidence for the relationship between regions and language families. Although Kenny could have used his data to check the validity of Murdock's six major regions, he did not do so, instead limiting his comparisons to variability within those regions.

Jorgensen's work has built on the continuous area tradition of Driver's research, while improving upon the statistical methodology. In *Salish Language and Culture* (1969), Jorgensen used nonmetric, multidimensional scaling to study interrelationships among language, cultural variables, and environmental variables. His 1969 study was the first use of advanced multivariate methods to study the problems of integrating Q-mode and R-mode analysis.

In *Western Indians* (1980), Jorgensen continued to emphasize advanced multivariate analyses, coding data for 441 variables and 172 societies. Like Driver, Jorgensen has shown a major interest in the relationships of culture traits with language and geography. Jorgensen organized his data into eight domains—technology and material culture; subsistence economy; economic organization; settlement pattern,

demography, and community organization; social and kinship organization; political organization, sodalities, and warfare; ceremonialism; and spirit quest, shamanism, causes of illness, and magic. In accordance with his concern that culture areas should be identified empirically, Jorgensen used multidimensional scaling and hierarchical clustering techniques to classify the 172 societies into seven regions—Pueblos, Southwest, Great Basin, Southern California, Northern and Central California, Plateau, and Northwest Coast (1980: 89). This analysis was followed by an analysis of the eight domains. Computing correlations among these domains (p. 97), he found the strongest correlations to be among economic organization, technology, and subsistence economy. He then did a cluster analysis within each domain, to produce a separate classification of cultures within each of the domains with a detailed discussion of each domain. Jorgensen's 1980 work is the most comprehensive study made to date using the continuous area approach. In Jorgensen's (1983) article on the Southwest, he continued to apply his methodology in a smaller region, showing the utility of the method for resolving classification issues in an area that has been the topic of much comparative research (Steward 1937; Eggan 1950; Ortiz 1972).

Comparative research in Oceania dates to Sahlins's *Social Stratification in Polynesia* (1958), a comparison of 13 societies with respect to food production, degree of social stratification, social organizational type, and productivity. Sahlins's study followed the logic of cross-cultural research in coding each of a sample of societies for each of several variables. However, Sahlins did not say *how* he selected the sample, nor did he compute statistical tests for the hypotheses that he tested.

Goldman's *Ancient Polynesian Society* (1970) assembled comparative data on 18 Polynesian societies. Goldman discussed the same variables for each society—genealogical traditions, primogeniture, seniority of descent, the male line, genealogical depth, sanctity, wealth, political hegemony, the structure of status, genealogical rank, commoners, achieved status, status rivalry, and descent group organization—hence following the logic of the cross-cultural method. However, he did not provide systematic codes, other than the ones used for kinship terminologies, although such codes could be constructed from the information in his book.

Brown's (1978) *Highland Peoples of New Guinea*, and a related article (Brown and Podolefsky 1976), tested Boserup's (1965) hypothesis about relationships among population density, agricultural intensity, and land tenure, using a sample of 17 Highland New Guinea societies. These studies found evidence for a reciprocal causal relationship between population density and agricultural intensity, as well as for a causal relationship between agricultural intensity and form of land tenure. However, the evidence is weakened by lack of attention to sampling. We are simply told that a number of ethnographies were consulted and that those samples were included for which there was adequate ethnographic coverage. In sum, although Oceania offers great promise for comparative research, the level of sophistication of the existing work is low.

Africa has provided a rich arena for comparative research, beginning with Baumann (1928). Murdock's *Africa* (1959) classified more than 850 African societies into 11 major clusters and 48 subclusters. Murdock produced the major clusters on the basis of language, geographic proximity, and subsistence economy.

Examples are African Hunters, Sudanic Agricultural Civilization, North African Agricultural Civilization, and East African Pastoralism. The classification was not done statistically, but according to ad hoc criteria.

The subject matter of Africa was weighted toward categories that Murdock had coded in *Social Structure* (1949)—“food-producing activities, the division of labor by sex, housing and settlement patterns, kinship and marriage, the forms of social and political organization” (p. viii). Murdock’s approach to the study of Africa was sharply different from his worldwide cross-cultural research. Although he collected extensive systematic data on Africa, he did not publish African codes or use the data for nomothetic analyses.

Schneider’s *Livestock and Equality in East Africa* (1979) is a good example of a focused regional study. Schneider was concerned with the relationships between pastoral economy and social structure. He used data from a number of sources, including the *Ethnographic Atlas* (Murdock 1967). Maps were presented for 43 contiguous societies for such variables as level of political organization, kinship terminology, descent, cattle/person ratios, and presence of the tsetse fly. Although Schneider’s study was oriented toward hypotheses about the relationships between livestock economies and social structure, it contained only two statistical tests—the first one showing a negative correlation between the importance of agriculture and the livestock/person ratio and the second showing no correlation between age-sets and the livestock/person ratio, each for a small subsample. The conclusions from this important work would have been strengthened by more systematic comparative coding and data analysis.

African societies are well known for their emphasis on age organizations and on rites of passage involving initiation. Several comparative studies of age-class systems have focused on Africa (Bernardi 1985; Prins 1953; Foner and Kertzer 1978; Kertzer and Madison 1981; Stewart 1977).

Ericksen (1989b) coded 113 African societies for more than a dozen variables pertaining to male and female age organizations and secret societies. Her work added valuable complexity to the previous work and is important for its emphasis on both male and female organizations. Ericksen’s analyses dispel some common misconceptions. She found, for example, that age organizations are more common in West Africa than in East Africa (p. 248) and that female age organizations are found in half of the societies that have male age organizations.

In another paper, Ericksen (1989a) coded female circumcision, virginity tests, female initiations, and premarital sex norms for 115 African societies and tested hypotheses about relationships between these two variables and fraternal interest groups.

Ericksen’s two studies provide a model for focused regional studies. With careful attention to sampling and to the coding of variables that are well motivated in terms of general social theory as well as regionally focused writing, the two studies contribute both to nomothetic hypothesis testing and to a better understanding of the culture histories of Africa. The variables in these two datasets can easily be combined with other *Ethnographic Atlas* variables (Murdock 1967), for further tests of hypotheses about male and female age organizations, female circumcision, or secret societies.

Advantages of Regional Studies

The arguments for world samples are well known. Provided the sampling is done properly, such samples allow for generalization to the universe of all human societies, and they minimize the problems of statistical estimation that are due to Galton's problem. In spite of these arguments, we think that regional analyses are an equally essential component of cross-cultural research. We have identified six possible advantages to the use of regional samples. The first of these advantages has been discussed by Jorgensen (1979), who argued that existing world samples were taken on an ad hoc basis. Jorgensen claimed that no principled method had been developed for the stratification of world cultures by language or region, and that work designed to develop such criteria was essential. Jorgensen argued that more attention should be paid to the empirically-based classification of cultures based on regional samples. He advocated beginning with continuous area samples, using Q-mode analyses to classify the ethnic units in those samples, then following up with sampling from these empirically-derived clusters of ethnic units.

A second advantage, discussed both by White (1975: 300) and by Jorgensen (1979), is that regional samples provide more data about ethnographic context, i.e., "the regional approach allows the researchers to employ ethnographic knowledge to a considerably greater extent than is possible in worldwide comparisons" (Jorgensen 1979: 325). The local ethnographic contexts to which they refer include ecology, relationships with neighboring societies, and language relations. Jorgensen's *Western Indians* (1980), for example, has more than 100 variables concerning the presence of various species of plants and animals. It would not be possible to code the biological environment at this level of complexity for a world sample.

A third advantage pertains to interactions between societies (White 1975: 301-303). Regional samples allow for coding a high density of data about linkages between societies, such as trade, warfare, and intermarriage. While one can code societies in a world sample for relationships with their neighbors, a denser regional sample will allow for a more complete representation of the network of those relationships.

A fourth advantage of regional samples is that they can be used in understanding the kinds of social and culture phenomena that occur infrequently in a world sample but frequently within some regions. These kinds of phenomena would occur too infrequently in a worldwide sample to be studied at that level. Examples of such phenomena include female husband marriage (O'Brien 1977); ritualized homosexuality (Herdt 1981); patrilateral parallel cousin marriage (Murphy and Kasdan 1959); the berdache (Whitehead 1981); and female circumcision (Erickson 1989a). We think that the best way to understand these kinds of phenomena is to do nomothetic analyses of their variation within the regions where they occur frequently.

Explaining regional phenomena through the use of local variables might seem to be an exercise in historical particularism. However, we believe that the variables that explain these local cultural forms can often be seen as local manifestations of more general processes. One of the biggest problems in statistical estimation is mis-specification of models. Regional models, by forcing us to be more careful about

specification of local variables, can help to overcome a possible bias toward use of overly global, packaged variables.

A fifth strength of regional analyses is their value as a stage in building global hypotheses. Beginning at the regional level can cause the analyst to consider variables that might be ignored when working at the world level. We followed this strategy in our work on the sexual division of labor. We began the analysis with an African sample (White, Burton and Dow 1981). Trying to understand the prevalence of male farming systems in the more arid regions of West Africa caused us first to posit a relationship between the length of the dry season and the sexual division of labor. However, in the African sample, slavery was a stronger predictor of the division of labor than was the length of the dry season. It was only when we moved upward to a model for the Old World (Burton, White, and Dow 1983) that we found that length of the dry season was the more replicable variable.

The sixth advantage of regional samples is their use in replicating cross-cultural findings, a strategy advocated by Przeworski and Teune (1970: 32-34) and White (1975: 308-309).

Regional Replication

From the perspective of worldwide comparisons, regional replications are an important stage of hypothesis testing. Replication can occur either by first constructing a regional model and then attempting to replicate it within other regions or by first constructing a worldwide model and then testing whether it replicates within regions.

Three replication studies were based on factor analysis. Two of these followed the same strategy, with one (Sawyer and LeVine 1966) using data from the "World Ethnographic Sample" (Murdock 1957) and the other (Smith and Crano 1977) using data from the *Ethnographic Atlas* (Murdock 1967). In both of these studies, regional replication was done by comparing correlations between variables and factors across regions. Both studies found regional replication of many factors. However, comparison of variables with factors produces a bias toward high correlations, since the factors are originally constructed from the variables. In spite of the method bias toward replication, however, a close reading of the two articles shows a number of relationships that do not replicate. Sawyer and LeVine themselves discuss the low replication of two correlations pertaining to patrilineality. Their patrilineal factor has a low correlation with patrilineal exogamy in the Circum-Mediterranean, and the correlation between bride-price and patrilineality varies across regions. They also note large differences across regions in the relationship between animal husbandry and the importance of cereal agriculture. The latter differences can also be seen in Smith and Crano's (1977) analysis.

In a third replication study, Driver and Schuessler (1967) also factor analyzed data from the "World Ethnographic Sample," but came to different conclusions, because they examined replication at the level of the original correlations and used a group significance strategy. They computed a matrix of 435 correlations among 30 variables for each of Murdock's six regions. For each of the 435 sets of six correlations, they did a statistical test as to whether the differences among them could

have occurred by chance. Driver and Schuessler found significant differences for 69 of the 435 sets of correlations. Using a group significance test, they concluded that "there are other than random factors operating to produce differences among the correlations for the areas" (1967: 337). Correlations with low replication across regions included patrilineality with bride-price, patrilocal residence with patrilineal descent, marriage to FaBrDa forbidden with marriage to MoSiDa forbidden, cereal grains dominant with agriculture dominant, and animal husbandry with nuclear family households.

An important finding by Driver and Schuessler (1967) was that relationships among matrilineal institutions showed stronger replication between the Old World and New World than did relationships among patrilineal institutions. Driver and Schuessler interpreted this finding in terms of the absence from the New World of technologies, such as the plow and domesticated animals, that correlate with Old World patrilineal institutions. While these institutions existed in the New World, they had less time depth and were not as fully elaborated.

White, Pesner, and Reitz (1983) developed an exact interaction test, a generalization of Fisher's Exact Test, for replication of correlations across regions. This test allows for a more precise approach to the problem addressed by Driver and Schuessler (1967). White and Pesner (1983) used this test to study replication of three sets of variables across regions. They found regional replication for Murdock and Provost's (1973) variables on the sexual division of labor and for an unpublished dataset on avoidance behavior, but significant lack of replication for 37 social structure variables from the *Ethnographic Atlas*, suggesting a high degree of interaction of social structure relationships with regional contexts. This finding parallels the findings of Driver and Schuessler, in that the variables that Driver and Schuessler found *not* to replicate were social structure variables having to do with patrilineal institutions.

Two papers on polygyny have extended regional replication to the multivariate level. Burton and Reitz (1981) examined the relationships among polygyny, the sexual division of labor in agriculture, and the presence of the plow, using a log-linear model. A worldwide model had significant relationships between each pair of these three variables. However, when regional replication was tested by incorporating region as a control variable, region had a significant relationship with all three variables, and there was no longer a significant relationship between the plow and the division of labor.

White and Burton (1988) constructed a more comprehensive model to explain general polygyny, with five independent variables that replicated across regions—fraternal interest groups, marriage of captives, war for plunder, absence of the plow, and low dependence on fishing for subsistence. This model explained more of the variance for the Old World than for the New World, a difference that may be related to Driver and Schuessler's (1967) findings discussed above, since polygyny and fraternal interest groups are strongly linked with patrilineal institutions.

Work by Burton, White, and Dow on the sexual division of labor illustrates the strategy of building upward from a regional study. In a study restricted to Africa (White, Burton, and Dow 1981), cereal crops and slavery were the best predictors of male farming. Moving to larger regions required considerable respecification of the model. Slavery did not replicate, and three new variables were required to under-

stand variation within the Old World—number of dry months, dependence on animals for subsistence, and presence of the plow (Burton, White, and Dow 1983). The final stage was to replicate the Old World model in the New World and the Pacific (Burton and White 1984). As with the polygyny study, the model explained much more variance in the Old World than in the New World or the Pacific.

A new strategy for regional replication has been made possible by the use of optimal scaling (Gittens 1984; Greenacre 1984; Nishisato 1980; Weller and Romney 1990), a model that represents societies and traits in the same space, thus providing a more sophisticated technology for Driver's enterprise. Two recent papers illustrate the value of the method.

Murdock, Wilson, and Frederick (1978) found strong regional clusterings of beliefs about disease. They hypothesized that this was due to sharing of beliefs about disease within language families. Moore (1988) reanalyzed these data, using optimal scaling. Her analysis allows for more detailed statements about variation by region and by language family. Moore found a dimension that clustered Africa with the Circum-Mediterranean, with high emphasis on witchcraft and infection—in contrast with East Eurasia, the Insular Pacific, and the Americas, which tend to emphasize soul loss, organic deterioration, contagion, and fate. Analysis of variation across language families also showed Indo-European, Afro-Asiatic, and Nilo-Saharan to be similar in having emphasis on witchcraft and infection—in contrast with such language families as Sino-Tibetan, Athapaskan, and Austronesian, which emphasize soul loss, organic deterioration, contagion, and fate.

Bradley et al. (1990) used optimal scaling to represent regional differences in subsistence changes that are caused by the world system and found strong temporal and regional clustering in patterns of subsistence change. Changes that occurred before 1920 tended to involve major or total loss, intensification of nonagricultural production, and change in settlement pattern, and they were clustered in Northeast Asia, North America, and Oceania. Changes that took place after 1920 tended to involve agricultural intensification, increase in wage labor or trade, and expansion, and they were clustered in Africa and Eurasia.

An overall summary of replication studies offers a mixed picture. Some nomothetic relationships show strong regional replication, while others vary across regions. The factor analytical studies and the work done by White and Pesner (1983) provide evidence that some social structural relationships vary with the regional context. Driver and Schuessler's analysis (1967) of regional differences in the complex of patrilineal institutions seems to us to be headed in the right direction. Their finding is consistent with the stronger replication of models of polygyny and of sexual division of labor in the Old World, because those models invoke variables (fraternal interest groups, polygyny, the plow, and use of domesticated animals) that are associated with Driver and Schuessler's complex.

New Solutions to Galton's Problem

One of the major objections to the use of regional samples has been that these samples are especially subject to Galton's problem. While even the best worldwide

sample will not be free of linkages among its societies (Murdock and White 1969), regional samples will contain many more interdependencies.

A new approach to Galton's problem, network autocorrelation analysis (Dow, Burton, and White 1982; Dow et al. 1984), estimates multivariate models in samples that contain interdependencies. Rather than requiring a sample that is free of interdependencies, network autocorrelation analysis explicitly models those intersocietal linkages and estimates nomothetic relationships, while controlling for the effects of linkages between societies.

Network autocorrelation analysis is a straightforward generalization of spatial autocorrelation analysis, first proposed by Loftin (1972), as a solution to Galton's problem. Spatial autocorrelation analysis is widely used in geography to model interdependencies among social units, measured in terms of spatial distances (Cliff and Ord 1973). It requires two kinds of data: (1) codes for all social units on each variable and (2) measures of distances among all of the social units. The distance measures are used to compute an asymmetrical matrix, W , that measures the relative physical proximity of each social unit to each other social unit. Spatial autocorrelation analysis estimates the degree of spatial autocorrelation in the data and controls statistically for the effects of this autocorrelation, when estimating regression models.

Network autocorrelation analysis is designed to represent more accurately than is otherwise possible the historical and social linkages between human societies. These linkages may have weak correlations with spatial proximity, and may be poorly represented by spatial autocorrelation analysis, but they may be better represented by other kinds of measures of intersocietal linkages.

The network autocorrelation model requires the researcher to specify the kinds of historical or social linkages that account for autocorrelation. Hence, as Jorgensen says (1979: 318), an analysis of autocorrelation is a causal model, based on a theory about linkages among societies. Possible linkages include membership in the same language family, historical relationships within the same imperial system (White and Burton 1984), shared religion, and trade. The measures of linkage between societies could be dichotomous measures of presence or absence of a link; measures of distance on a taxonomy of languages (White, Burton, and Dow 1981); or interval scale measures, such as trade volume.

There are two different spatial autocorrelation models, the spatial effects model and the spatial disturbances model (Doreian 1980). In the generalization to network autocorrelation, these are called network effects and network disturbances (Dow, White, and Burton 1982). In the effects model, only the dependent variable is autocorrelated. In the disturbances model, the error terms are autocorrelated. This is equivalent to a model in which the autocorrelation analysis is used to "subtract out of each variable score that portion due to the influence of contiguous or related units" (Dow, White, and Burton 1982: 233). We think that in most cases, it will be the entire system of variables that is autocorrelated, rather than just the dependent variable, so that the disturbances model will be more appropriate.¹

Although the network autocorrelation model is a regression model and assumes an interval scale dependent variable, Reitz and Dow (1989) and Dow (1990) have developed a nominal analogue to network autocorrelation analysis.

Regional replications should use controls for autocorrelation, because regional samples have a great degree of internal clustering of similar societies. As with the design effect in cluster sampling, such clustering has the effect of leading to underestimates of subsample variances and confidence intervals. Consequently, without controls for autocorrelation, tests of replication will be biased toward nonreplication, because confidence intervals around each regional result have been underestimated. In this situation, results may often appear *not* to replicate when a proper estimation of standard errors would show replication.

When a regression model is not well specified, regional clustering of residuals may be examined as a possible clue to what variables have not been properly specified in the model. In this way, the combination of autocorrelation analysis and regional analysis may be very useful in the specification of causal models.

Dow (1986, 1987) provides tests of the homogeneity of regression coefficients across subsamples for the network disturbances models that can be used with regional replication. He also provides a measure of goodness-of-fit that is useful for distinguishing among alternative substantive models.

Findings of Network Autocorrelation Studies

The studies of polygyny and the sexual division of labor, discussed above, used the network autocorrelation model. The African study (White, Burton, and Dow 1981) tested a model of polygyny with two predictors—patrilocal residence and female contributions to agriculture. This model showed significant spatial autocorrelation, with more polygyny in the Sahelian region and less polygyny in North Africa than was predicted by the model. In a more comprehensive world model, which was better specified, there was no significant autocorrelation. This experience illustrates one principle of autocorrelation research—i.e., that autocorrelation may be due to misspecification of a causal model.

In the African model of sexual division of labor (White, Burton, and Dow 1981), both spatial autocorrelation and language family autocorrelation were present. The authors hypothesized that the language autocorrelation was due to especially high levels of female farming among Bantu societies. After controlling for Bantu language family membership, spatial autocorrelation was no longer significant, and language autocorrelation was diminished.

In studies of the sexual division of labor involving the Old World and the entire world (Burton, White, and Dow 1983; Burton and White 1984), language autocorrelation remained, but could be controlled for by the Bantu language family membership. This effect could be due either to genetic relationships among the cultures or to more recent social history—for example, the effects of widespread male labor migration among Bantu societies. Like the polygyny study, this study showed that it is possible to go beyond detecting autocorrelation to testing hypotheses about its causes.

Dow et al (1984) tested the autocorrelation model with data that Pryor (1976) had tested, using his “diffusion possibility matrix.” Data on presence of gambling showed considerable spatial autocorrelation, which could be accounted for by a much higher level of gambling in North America. With controls for autocorrelation,

socioeconomic inequality has a significant positive effect on gambling, a relationship that was not detected in the model without consideration of autocorrelation.

Several cross-species studies have used network autocorrelation analysis to ascertain whether traits that vary across species are due to phylogenetic inertia or to adaptive functional relations. Felsenstein (1985) attacked this problem using a contrast model for controlling for phylogeny in cross-species comparative analysis. Cheverud, Dow, and Leutenegger (1986) reexamined the strong correlation between degree of polygyny and sexual dimorphism, which has been discussed in "The Role of Cross-Species Studies in Cross-Cultural Research" by Gaulin (elsewhere in this volume). These researchers found the strongest predictors of sexual dimorphism among primates to be phylogenetic inertia (measured by autocorrelation), and size. When size and phylogeny are controlled, there is no relationship between polygyny and sexual dimorphism. If this finding is replicated across other orders of mammals, it will challenge one of the classical arguments of evolutionary biology.

Cheverud and Dow (1985) examined the hypothesis that the degree of diversity of distributed populations will correlate with the time elapsed since their divergence from a common ancestral population. Analyzing the fission patterns of groups of Cayo Santiago Rhesus Macaques, they found that fission occurs along lines of genetic dissimilarity and that most of the variation between groups can be explained by the fission pattern, rather than by time since divergence.

Dow and Cheverud (1985) and Dow, Cheverud, and Friedlaender (1987) provide methods for separating different kinds of network autocorrelation effects and discuss the potential of those methods for determining evolutionary and cultural effects. As noted by Cheverud, Dow, and Leutenegger (1986: 918): "A fundamental methodological problem in comparative analysis is thus formally identical in the biological and cultural sciences."

Strategies for Selecting Regions

Partitioning of the world into regions is used as the basis for region-specific models, as the basis for regional replication of causal models, and as the basis for sampling units. For all three purposes, it is important that the regionalization be done well. Given this fact, it is striking to find little discussion of the criteria to be used for the partitioning. We have identified several issues that need to be resolved in selecting regions.

Regions should be spatially contiguous and culturally homogeneous. Ultimately, any regionalization should be validated statistically. The work of Driver, Kenny, and Jorgensen, discussed above, provides a beginning of the statistical work that is needed to validate regions. These criteria have yet to be applied at the world level. In the absence of this empirical basis, we see many unsolved problems. For example, should the Austronesian cultures of Indonesia and Southeast Asia be classified with the Austronesian cultures of the Pacific, or with East Eurasia? Should the cultures of Madagascar be included in Africa, or in the Indonesian region, to which they have strong and relatively recent historical connections? Should the Circum-Caribbean be a separate region? If not, should it be included with North America or South

America? Should there be a separate Circum-Polar region? Where should the dividing line be drawn between Europe and Asia? Should the cultures of North Africa and of the Arabian Peninsula be placed in the same region?

Problems with the definition of Africa illustrate the difficulties that are involved in deciding upon appropriate regions. Many cross-culturalists have used Murdock's (1967) classification of regions. Murdock used a minimalist definition of Africa. He placed Madagascar in an East Eurasian region, and he put the Afrikaaners in the Circum-Mediterranean. He put all of North Africa, Northeast Africa (Amhara, Galla, and Somali), and a number of West African societies in the Circum-Mediterranean, along with all of Europe. West African societies that were placed in the Circum-Mediterranean include the Wolof, Tukulor Fulani, Songhai, Kanuri, and Hausa; West African societies that were placed in Africa include the Serer (adjacent to the Wolof), Futajalonke Fulani, Mende, Bambara, Tallensi, and Azande. These are all south of the Sahara, and all in close proximity. Murdock appears to have used religion (Islam or Christianity) as the criterion for placing Sub-Saharan African societies in the Circum-Mediterranean. To many scholars, classifying Africans according to whether they had been converted to monotheism would be seen as colonial in spirit.

Murdock's boundary between the Circum-Mediterranean and East Eurasia separates the Arabic world from Iran, then runs north through the Caspian Sea and the Ural Mountains. However, Murdock includes the Kalmyk (West of the Caspian Sea) in East Eurasia, probably on linguistic grounds, while their near neighbors (Armenians, Circassians, etc.) are in the Circum-Mediterranean.

In the East, Murdock places all Indonesians in the Insular Pacific region, including the Sumatran Malays, while including the Malay proper in East Eurasia. The effect of this placement and the previous decision to put Madagascar in East Eurasia is to classify Madagascar with the Malay, but not with Indonesia.

A better approach would seem to be to divide the world by continents. This would place all of Africa in a single region, but it would create a very large Eurasian region. It would also leave unresolved the questions of whether the islands of Indonesia and the Philippines are part of Eurasia or part of Oceania, and whether the islands of the Caribbean are part of North America or South America.

The problem of the boundary between Europe and Asia appears to have been resolved in cross-cultural samples by neglecting the societies of Central Eurasia. In the vast region of the Soviet Union, Mongolia, and China, between 60 degrees and 110 degrees longitude, the Standard Cross-Cultural Sample (Murdock and White 1969) has only two societies—the Kazak and the Khalka. In the same region, the *Ethnographic Atlas* (Murdock 1967) has only ten societies. This is a striking level of undersampling, which may have been due to the deleterious effects on scholarship of the cold war.

A major concern with Driver's work on regionalization was the question of correspondence between language families and regions. Language family seems also to have played a role in Murdock's regionalization. Whiting, Sodergren, and Stigler (1982) provide strong evidence for the role of language family membership in migration patterns. They found that societies within a given language family have rarely crossed the isotherm of 10 degrees mean winter temperature. With this kind of evidence, it seems to us that one criterion for regions should be that they subsume language families, rather than splitting them.

Using language family membership as a criterion sheds new light on the question

of boundaries within Africa. Three language families—Nilo-Saharan, Niger-Congo, and Khoisan—are restricted to the African continent. A fourth—Afroasiatic—extends into the Middle East. This grouping suggests the possibility of a maximalist view of the African region that would include the Arabian Peninsula and the present-day countries of Israel, Jordan, Iraq, Syria, and Lebanon.

Similarly, using the Austronesian language family as a criterion would create a single Oceanic region that included the Pacific, Malaya, Indonesia, and Madagascar.² While these proposals for revising the African and Oceanic regions may seem strange to people who are used to the older categories, we think that they are just as logical as the regions in current usage. More empirical research of the type done by Driver would be required, to determine which regional groupings were best fitted to the regions.

A different kind of problem with regionalizations can be seen in the definition of the New World. Here the problem is that cross-cultural samples have been limited primarily to American Indian societies. For example, the Standard Cross-Cultural Sample (Murdock and White 1969) contains 65 New World societies, of which only 2 (Saramacca, Haitians) are not American Indian societies. The *Ethnographic Atlas* (Murdock 1967) includes 366 New World societies, of which only 5 (Black Carib, Saramacca, French Canadians, New Englanders, and Brazilians) are not American Indian societies. Murdock placed the latter 3 of these societies in the Circum-Mediterranean, rather than the Americas.

Contemporary American nations are populated by ethnic groups from all regions of the world. The principles that Murdock and others have used to exclude most of these from the American samples are applied inconsistently. If the guiding principle was to exclude all societies that had been drastically transformed since Columbus, then many American Indian societies should also be excluded. If the principle was to exclude societies that had migrated into their present locations within the past 500 years, then many societies in Africa and Eurasia should have been excluded from the samples. Murdock's principle seems to have been that societies that migrated *within* their original regions were included in the sample, but that societies that migrated across major regions were either excluded from the sample or classified within their original regions. Such a procedure will result in a selection bias within cross-cultural samples against highly migratory peoples.

Improving Regional Studies

We have described the contributions made both by continuous area studies in North America and by focused regional studies in Africa. Given the value of those studies, it is clear that cross-cultural research could benefit from more of both kinds of studies, especially in regions other than Africa and North America.

Possibly the most important agenda for regional studies is to improve the definition of regions. We have discussed the problems with Murdock's definition of Africa, with the undersampling of societies in Central Eurasia, and with the omission from cross-cultural samples of most of the Post-Columbian societies of the New World. Driver's and Jorgensen's efforts to base regionalizations upon empirical data provide an important basis for work that is yet to be done to test empirically the validity of major world regions. Such work will not address the equally important problem of

omissions due to research bias. We need to develop and test hypotheses about the sources of bias, in selecting samples, similar to the work that has been done on bias in cross-cultural coding.

While we recognize that most regional studies should be based on a spatially contiguous region, we also think that there would be value in regional studies defined by language family or by common history. Samples for such studies would include all societies that had participated in some important historical process, and they could include samples of societies in the African-American diaspora—Austronesian societies or Arabic-speaking societies. Crosscultural coding within a language family on social and cultural variables would provide a valuable supplement to the linguistic and archaeological data that are now used to make inferences about language history.

Since a major use for regional samples is in the replication of studies done on worldwide samples, more regional samples should be coded with the existing worldwide samples as a reference point, so that it would be possible to make use of samples at both levels for hypothesis testing. For example, a purely African sample might have data on female circumcision, female husband marriage, age-set organizations, divine kingship, and the presence of millet, sorghum, and dwarf cattle, but it should also have many of the variables that have been found to be most valuable in world samples.

If better regional samples were available, we could use a multilevel approach to look at interactions between the local and the larger-scale phenomena in regional and world systems. We could also use a multilevel strategy to model nonreplication between regions—that is, to account for regional differences in terms of systemic processes (see Dow's chapter on "Statistical Inference in Comparative Research," elsewhere in this volume).

We have described the history of attempts to develop samples that were free of interdependencies, as well as a new method for compensating statistically for linkages among societies. For many kinds of studies, the linkages themselves are of interest. We saw an interest in inferences about historical linkages in Driver's work. We think it would be valuable for regional studies to code explicitly for linkages among societies in their samples, so that there would be two kinds of data coded: (1) data on variables across societies and (2) data on the linkages of each society with each other society.

One arena where linkages are especially important is the study of regional economic and ecological systems. We need more regional economic samples like Schneider's (1979). These studies could code local economies, political economy, linkages with the world system, local ecologies, and economic relationships such as trade linkages. Such samples would enable us to examine the effects of ecology and economy upon local cultural systems and could be used as supplements to analyses of regional market systems (Skinner 1964; Smith 1976).

Conclusion

Regional replications, even more than worldwide studies, require autocorrelation methods for proper tests of causal models. Regional studies are important in their

own right, but they are particularly important in relation to worldwide comparative studies. Worldwide studies require for their validity, where possible, replication across different regions. Just as regional studies can specify more precise causal factors of local importance, often as specific manifestations of more global processes, autocorrelation models can also provide for rich modeling of intersocietal relationships in local regions.

Autocorrelation methods, combined with regional or multiregional analysis, provide a powerful means for distinguishing the effects of common ecology, common origin, cultural diffusion, or intersocietal linkages, such as trade, warfare, or conquest. Cross-species comparative studies have shown massive autocorrelation effects of common evolutionary history, as, for example, in the relation between sexual dimorphism and polygyny. Such effects might also be expected to be found in certain cultural domains. There are, for example, major regional clusterings in the distribution of types of human polygyny (White 1988a). It has not been clearly demonstrated, however, whether these clusterings are due to regional ecological similarities in the adaptive context or to the cultural inertia of common historical origin.

The kind of specificity that is possible in the testing of different explanatory models in regional and worldwide studies represents a return to the issues that were of great concern to anthropologists early in this century, issues that have been labeled "particularistic" or idiographic. We have tried to show that such particularism is a tremendous aid to scientific investigation, in that it consists (a) of building detailed matrix representations of intersocietal relationships as potential sources of autocorrelation and (b) of then testing causal-functional models directly alongside ecological-historical-evolutionary ones, with considerable specificity. Yet another way has thus been provided in which concerns with history and idiographic particularism are fused with rigorous scientific methods and the testing of multiple alternative or complementary hypotheses.

Notes

¹Programs for network autocorrelation analyses can be obtained through *World Cultures* (Reitz, Dow, and White 1988).

²This grouping represents the definition of the Oceanic region that is used by the journal *Oceania*.

REFERENCES

Baumann, Hermann

1928 The Division of Work According to Sex in African Hoe Culture. *Africa* 1: 289-319.

Bernardi, Bernardo

1985 *Age-Class Systems*. Cambridge: Cambridge University Press.

- Boas, Franz
1894 *Indianische Sagen von der Nord-Pacifischen Kuste Amerikas*. Berlin: Asher.
- Boserup, Ester
1965 *The Conditions of Agricultural Growth*. New York: Aldine Publishing Co.
- Bradley, Candice, Carmella C. Moore, Michael L. Burton and Douglas R. White
1990 A Cross-Cultural Historical Analysis of Subsistence Change. *American Anthropologist* 92: 447-457.
- Brown, Paula
1978 *Highland Peoples of New Guinea*. Cambridge: Cambridge University Press.
- Brown, Paula, and Aaron Podolefsky
1976 Population Density, Agricultural Intensity, Land Tenure, and Group Size in the New Guinea Highlands. *Ethnology* 15: 211-238.
- Burton, Michael L., and Karl P. Reitz
1981 The Plow, Female Contributions to Agricultural Subsistence, and Polygyny. *Behavior Science Research* 16: 275-305.
- Burton, Michael L., and Douglas R. White
1984 Sexual Division of Labor in Agriculture. *American Anthropologist* 86: 568-583.
- Burton, Michael L., Douglas R. White, and Malcolm M. Dow
1983 *Sexual Division of Labor in Old World Agriculture*. East Lansing, Michigan: Michigan State Publications in Women and Development.
- Cheverud, James M., and Malcolm M. Dow
1985 An Autocorrelation Analysis of Fission in Social Groups of Rhesus Macaques. *American Anthropologist* 88: 916-922.
- Cheverud, James M., Malcolm M. Dow, and W. Leutenegger
1986 A Phylogenetic Autocorrelation Analysis of Sexual Dimorphism in Primates. *American Anthropologist* 88: 916-922.
- Cliff, A. D., and J. K. Ord
1973 *Spatial Autocorrelation*. London: Pion.
- Doreian, Patrick
1980 Linear Models with Spatially Distributed Data: Spatial Disturbances versus Spatial Effects? *Sociological Methods and Research* 9: 29-60.
- Dow, Malcolm M.
1986 Model Selection Procedures for Network Autocorrelation Disturbances Models. *Sociological Methods and Research* 14: 403-422.
1987 Subsample Replication in Cross-Cultural Surveys. *American Anthropologist* 89: 125-133.
1990 Categorical Analysis of Cross-Cultural Survey Data. Effects of Clustering on Chi-Square Tests. *Journal of Quantitative Anthropology* 1: 335-352.

- Dow, Malcolm M., Michael L. Burton, and Douglas R. White
 1982 Network Autocorrelation: A Simulation Study of a Foundational Problem in Regression and Survey Research. *Social Networks* 4: 169-200.
- Dow, Malcolm M., Michael L. Burton, Douglas R. White, and Karl Reitz
 1984 Galton's Problem as Network Autocorrelation. *American Ethnologist* 11: 754-770.
- Dow, Malcolm M., and James M. Cheverud
 1985 Comparison of Distance Matrices in Studies of Population Structure and Genetic Microdifferentiation: Quadratic Assignment. *American Journal of Physical Anthropology* 68: 367-373.
- Dow, Malcolm M., James M. Cheverud, and Jonathan S. Friedlaender
 1987 Partial Correlation of Distance Matrices in Studies of Population Structure. *American Journal of Physical Anthropology* 72: 345-352.
- Dow, Malcolm M., Douglas R. White, and Michael L. Burton
 1982 Multivariate Modeling with Interdependent Network Data. *Behavior Science Research* 17: 216-245.
- Driver, Harold E.
 1941 Culture Element Distributions: XVI: Girls' Puberty Rites in Western North America. *University of California Anthropological Records* 6: 21-90.
- 1956 An Integration of Functional, Evolutionary, and Historical Theory by Means of Correlations. *Indiana University Publications in Anthropology and Linguistics* 12 :1-28. (Reprinted in 1967 in C. S. Ford, ed. *Cross-Cultural Approaches*. New Haven: HRAF Press.)
- 1961 *Indians of North America*. Chicago: University of Chicago Press.
- 1966 Geographical-Historical versus Psycho-Functional Explanations of Kin Avoidances. *Current Anthropology* 7: 131-148.
- Driver, Harold E., and James L. Coffin
 1975 Classification and Development of North American Indian Cultures: A Statistical Analysis of the Driver-Massey Sample. *Transactions of the American Philosophical Society* n.s. 65(3): 1-120.
- Driver, Harold E., James A. Kenny, Herschel C. Hudson, and Ora M. Engle
 1972 Statistical Classification of North American Indian Ethnic Units. *Ethnology* 11: 311-339.
- Driver, Harold E. and Alfred L. Kroeber
 1932 Quantitative Expression of Cultural Relationships. *University of California Publications in American Archaeology and Ethnology* 31: 211-256.
- Driver, Harold E., and William C. Massey
 1957 Comparative Studies of North American Indians. *Transactions of the American Philosophical Society* n.s. 47: 165-456.
- Driver, Harold E., and Karl F. Schuessler
 1967 Correlational Analysis of Murdock's 1957 Ethnographic Sample. *American Anthropologist* 69: 332-352.

DuBois, Cora

1932 *Girls' Adolescence Observances in North America*. Doctoral dissertation. University of California, Berkeley.

Eggan, Fred

1950 *Social Organization of the Western Pueblos*. Chicago: University of Chicago Press.

Ericksen, Karen P.

1989a Female Genital Mutilations in Africa. *Behavior Science Research* 23: 182-204.

1989b Male and Female Age Organizations and Secret Societies in Africa. *Behavior Science Research* 23: 234-264.

Felsenstein, J.

1985 Phylogenies and the Comparative Method. *American Naturalist* 125: 1-15.

Foner, Anne, and David I. Kertzer

1978 Transitions over the Life Course: Lessons from Age-Set Societies. *American Journal of Sociology* 83: 1081-1104.

Gittens, Robert

1984 *Canonical Analysis: A Review with Applications in Ecology*. Berlin: Springer-Verlag.

Goldman, Irving

1970 *Ancient Polynesian Society*. Chicago: University of Chicago Press.

Greenacre, Michael J.

1984 *Theory and Applications of Correspondence Analysis*. London and New York: Academic Press.

Herd, Gilbert H.

1981 *Guardians of the Flutes: Idioms of Masculinity*. New York: Columbia University Press.

Jorgensen, Joseph G.

1969 *Salish Language and Culture: A Statistical Analysis of Internal Relationships, History, and Evolution*. Indiana University Language Science Monograph 3. Bloomington: Indiana University Press.

1974 On Continuous Area and Worldwide Studies in Formal Comparative Ethnology. *In his Comparative Studies by Harold E. Driver and Essays in His Honor*. pp. 195-203. New Haven: HRAF Press.

1979 Cross-Cultural Comparisons. *Annual Review of Anthropology* 8: 309-331.

1980 *Western Indians*. San Francisco: W. H. Freeman.

1983 Comparative Traditional Economics and Ecological Adaptations. *In Handbook of North American Indians Volume 10: Southwest*. Alfonso Ortiz, ed. pp. 684-710. Washington D.C.: Smithsonian Institution.

Jorgensen, Joseph G., ed.

1974 *Comparative Studies by Harold E. Driver and Essays in His Honor*. New Haven: HRAF Press.

Kenny, James A.

1974 *A Numerical Taxonomy of Ethnic Units Using Murdock's 1967 World Sample*. Doctoral dissertation, Department of Anthropology, Indiana University.

Kertzer, David I. and Oker B. B. Madison

1981 *Women's Age-Set Systems in Africa: The Latuka of Southern Sudan*. In *Aging, Culture, and Health*. Christine L. Fry, ed. pp. 109-113. New York: Praeger.

Klimek, S.

1935 *Culture Element Distributions I: The Structure of California Indian Society*. University of California Publications in American Archaeology and Ethnology 37: 1-70.

Kroeber, Alfred L.

1939a *Cultural and Natural Areas of North America*. Berkeley: University of California Publications in American Archaeology and Anthropology, vol. 38.

1939b *Local Ethnographic and Methodological Inferences*. In *Culture Element Distributions X: Northwest California*. pp. 425-430. *Anthropological Records* 1: 6. Berkeley: University of California Press.

Loftin, Colin

1972 *Galton's Problem as Spatial Autocorrelation: Comments on Ember's Empirical Test*. *Ethnology* 11: 425-435.

Moore, Carmella C.

1988 *An Optimal Scaling of Murdock's Theories of Illness Data—An Approach to the Problem of Interdependence*. *Behavior Science Research* 22: 161-179.

Murdock, George P.

1949 *Social Structure*. New York: MacMillan.

1957 *World Ethnographic Sample*. *American Anthropologist* 59: 664-687.

1959 *Africa: Its Peoples and Their Culture History*. New York: McGraw-Hill.

1967 *Ethnographic Atlas*. Pittsburgh: University of Pittsburgh Press.

1968 *World Sampling Provinces*. *Ethnology* 7: 305-326.

Murdock, George P., and Caterina Provost

1973 *Factors in the Division of Labor by Sex*. *Ethnology* 12: 203-225.

Murdock, George P., and Douglas R. White

1969 *Standard Cross-Cultural Sample*. *Ethnology* 8: 329-369.

Murdock, George P., Suzanne F. Wilson, and Violetta Frederick

1978 *World Distribution of Theories of Illness*. *Ethnology* 17: 449-470.

- Murphy, Robert, and Leonard Kasdan
1959 The Structure of Parallel Cousin Marriage. *American Anthropology* 61: 17-29.
- Naroll, Raoul
1970 Galton's Problem. In *A Handbook of Method in Cultural Anthropology*. R. Naroll and R. Cohen, eds. pp. 974-989. Garden City: Natural History Press. (Reprinted in 1973, New York: Columbia University Press.)
- Nishisato, Shizuhiko
1980 Analysis of Categorical Data: Dual Scaling and Its Applications. Toronto: University of Toronto Press.
- O'Brien, Denise
1977 Female Husbands in Southern Bantu Societies. In *Sexual Stratification*. A. Schlegel, ed. pp. 109-126. New York: Columbia University Press.
- Ortiz, Alfonso
1972 New Perspectives on the Pueblos. Albuquerque: University of New Mexico Press.
- Prins, A. H.J.
1953 East African Age-Class Systems. Groningen: J. B. Wolters.
- Pryor, Frederic
1976 The Diffusion Possibility Method: A More General and Simpler Solution to Galton's Problem. *American Ethnologist* 4: 731-749.
- Przeworski, A., and H. Teune
1970 The Logic of Comparative Social Inquiry. New York: John Wiley.
- Reitz, Karl P., and Malcolm M. Dow
1988 Network Interdependence of Sample Units in Contingency Tables. *Journal of Mathematical Sociology* 14: 85-96.
- Reitz, Karl P., Malcolm M. Dow, and Douglas R. White
1989 AUTCOR: A Network Autocorrelation Regression Program. *World Cultures* 5: 1.
- Sahlins, Marshall
1958 Social Stratification in Polynesia. Seattle: University of Washington Press.
- Sawyer, Jack, and Robert A. LeVine
1966 Cultural Dimensions: A Factor Analysis of the World Ethnographic Sample. *American Anthropologist* 68: 708-731.
- Schneider, Harold K.
1979 Livestock and Equality in East Africa: The Economic Basis for Social Structure. Bloomington: Indiana University Press.
- Skinner, G. William
1964 Marketing and Social Structure in Rural China. *Journal of Asian Studies* 24: 3-43, 195-228, 363-399.

- Smith, Carol A.
1976 *Regional Analysis*, vols. 1 and 2. New York: Academic Press.
- Smith, Frank J., and William D. Crano
1977 *Cultural Dimensions Reconsidered: Global and Regional Analyses of the Ethnographic Atlas*. *American Anthropologist* 79: 364-387.
- Spencer, Robert F., and Jesse Jennings
1965 *The Native Americans: Prehistory and Ethnology of the North American Indians*. New York: Harper and Row.
- Steward, Julian
1937 *Ecological Aspects of Southwestern Society*. *Anthropos* 32: 87-104.
- Stewart, Frank H.
1977 *Fundamentals of Age-Group Systems*. New York: Academic Press.
- Sturtevant, William C., ed.
1975 *Handbook of North American Indians*. Washington, D.C.: Smithsonian Institution.
- Voegelin, Carl F., and Florence M. Voegelin
1966 *Map of North American Indian Languages*. Seattle: American Ethnological Society.
- Weller, Susan C., and A. Kimball Romney
1990 *Metric Scaling: Correspondence Analysis*. *Quantitative Applications in the Social Sciences #75*. Newbury Park, CA: Sage Press.
- White, Douglas R.
1975 *Process, Statistics and Anthropological Theory: An Appreciation of Harold E. Driver*. *Reviews in Anthropology* 2: 295-314.
1988 *Rethinking Polygyny: Co-Wives, Codes, and Cultural Systems*. *Current Anthropology* 29: 529-572.
- White, Douglas R., and Michael L. Burton
1984 *World Systems and Ethnological Theory: Standard Sample Codes and Hypothesis*. Proposal Funded by the National Science Foundation, Anthropology Program.
1988 *Causes of Polygyny: Ecology, Economy, Kinship and Warfare*. *American Anthropologist* 90: 871-887.
- White, Douglas R., Michael L. Burton, and Malcolm M. Dow
1981 *Sexual Division of Labor in African Agriculture: A Network Autocorrelation Analysis*. *American Anthropologist* 83: 824-849.
- White, Douglas R., and Robert Pesner
1983 *Internal Replication, the System Concept, and Sources of Validity in Non-experimental Research*. *Behavior Science Research* 18: 26-44.
- White, Douglas R., Robert Pesner, and Karl P. Reitz
1983 *An Exact Significance Test for Three-Way Interaction Effects*. *Behavior Science Research* 18: 103-122.

Whitehead, Harriet

- 1981 The Bow and the Burden Strap: A New Look at Institutionalized Homosexuality in Native North America. *In Sexual Meanings*. S. B. Ortner and H. Whitehead, eds. pp. 80-115. Cambridge: Cambridge University Press.

Whiting, John W. M., John A. Sodergren, and Stephen M. Stigler

- 1982 Winter Temperature as a Constraint to the Migration of Preindustrial Peoples. *American Anthropologist* 84: 279-298.