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Is Structural Differentiation in Localities a Single or Multidimensional Phenomenon? Alternative Measures and Relation to Population

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IS STRUCTURAL DIFFERENTIATION IN LOCALITIES A SINGLE OR MULTIDIMENSIONAL PHENOMENON? ALTERNATIVE MEASURES AND RELATION TO POPULATION[1]

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ABSTRACT Several measures of structural differentiation for various institutionalized areas of county development are compared. Evidence regarding the hypotheses that differentiation is a system-wide, unidimensional phenomenon and that it is related to population are investigated. Scalable dimensions are found to exist among county administrative characteristics, medical specialties, commercial services, and educational institutions. Guttman scales formed from the complexity of such development are often used along with population size as operational measures of locality differentiation. The four scales and population size are analyzed together using the Guttman-Lingoes Multiple Scalogram Analysis for three different points in time. It is concluded that the alternative measures of differentiation cannot be used interchangeably as equal or nearly equal measures of the concept. Population size and the differentiation of commercial services, however, are close parallels. Their reliability as correlates of differentiation is consistent for three different points in time as indicated by the Guttman-Lingoes Multiple Scalogram Analysis. Theoretical implications are that differentiation cannot be viewed as a single phenomenon. Future research should consider separately different levels of development and rates of change depending on the type of differentiation considered. This will make the task for explanatory theory more complicated than it would have been had all measures of structural complexity proven to be tautologically related.

Introduction

Conceptualization and measurement of social differentiation often has been inconsistent in sociological research. Much of the difficulty has been in determining whether it is a single or multidimensional concept and

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whether its relationship to population size and change is one of tautology, causal dependence, or causal independence.

This paper presents four scales of county institutions as indicators of the complexity and sophistication inherent in the organizational structure of counties. Such measures are generally referred to in the sociological literature as representative of the division of labor (Durkheim's 1933 definition of differentiation which refers to the specialization of occupations). This term is also employed by Parsons (1961) in his explanation of social change and is applied to the increased specialization of functions. According to Gouldner's analysis of Parsons, it is "primarily a way in which the system adapts to and copes with prior but unexplained impairment of equilibrium" (Gouldner 1970:358).

A generic structural yet symbolic interpretation of the term for use in community theory and research has been provided by Young (1966). He argued that the observable division of labor represents an even broader phenomenon leading him to define differentiation as "the capacity of a system to process complex information types." Later, the Youngs (1973:12), using an isomorphic but more operational definition, defined differentiation as "the number of specialized social symbols maintained by a given system." The Youngs' interpretation of differentiation yields a more fundamental sociological concept. As with most abstract concepts of theoretical sociological significance, it allows for alternative substitutable structural measures. However, all measures of structural complexity are claimed by the Youngs to reflect tautologically the same underlying phenomenon within a social system (Young and Young 1973:64-69). Since differentiation is conceptualized as an emergent property, aggregated individual characteristics of a population are considered unacceptable as measures.

Population size has been used by some sociologists as an alternative indicator or at least a proxy for differentiation. For example, Clark (1973) when considering variables that influence the centralization of decision making says: "One demographic characteristic generally associated with structural differentiation is population size: the larger the number of inhabitants in a community, the greater the structural differentiation." He proceeds then to investigate the influence of population size on decision making and cites several other researchers who have previously used the same variable in similar research. Eberts and Young (1971) argue that this relationship is theoretically tenuous. They point out that whereas Durkheim (1933) argued for a link between the number of biological entities and social or moral density, population size is not social density.[2] Yet, for other social scientists, the ideas often go hand-in-hand that greater numbers of people

[2] Often unrealized also is that persons per square mile is not "social density" in Durkheim's view since his concept requires evidence of "persons in contact" (1933:262).

are associated with a wider range of individual variation and an increase in the potential differentiation within a community (Reissman 1970).

Human ecology has tried at times to justify theoretically the use of population size. As is well known, Duncan and Schnore (1959) articulated an ecological framework widely referred to as the POET model for the central import given to population, organization, ecology, and technology. While they separate out the consideration of population from the notion of differentiation (as division of labor), there is no abstract sociological concept to which population is related as an operational variable. In addition, human ecology has given the notion of the division of labor relatively extensive theoretical discussion (Hawley 1950; Simmel 1959:52-62; Smith 1963:3-17; Spencer 1921). Clemente and Sturgis (1972) point out, however, that, "The few studies which have attempted to delineate empirical components of the division of labor generally employ ad hoc operational definitions whose utility is limited to the specific research problem under consideration." An exception to this is a set of works by Gibbs and Martin (1962), Labovitz and Gibbs (1964), Gibbs and Browning (1966), and Browning and Gibbs (1971) attempting to develop measures at the national and international level. Beyond these studies is the effort by Clemente and Sturgis (1972) to focus on theoretical and empirical linkages at the community level.

An example of work on contemporary urban ecology by Berry and Kasarda (1977:305-337) includes a factor analysis of the "latent structure" of 1,762 places with 10,000 or more population. They state that human ecology has had "...many attempts to reduce the socioeconomic complexity of urban places to classifications based on the economic specialities of cities." But, as they indicate, the critical question is classification or factorial dimensions for what? They find 14 dimensions in their factor analysis which "...was prepared in the belief that some rethinking of the city-classification problem would provide a framework within which the consumer might be induced to address the issue of theoretical relevance more directly." A common characteristic of this and several other recent ecological factor analyses utilizing the concept of "division of labor" or "differentiation" is the utilization of individual characteristics which requires them to infer the nature and pattern of the industrial, commercial, retail, wholesale, government or service institutional structures (Hadden and Borgatta 1965). Such studies using factor analytic approaches have also selected with minimal theoretical explanation a large number of population characteristics and other variables such as economic, geographic, and locational features (King 1966).

When viewed as autonomous variables, population and differentiation have been used to describe each other causally. On the other hand, population size has been viewed more often than not as a single, isomorphic indicator

or as one of multiple indicators of social differentiation. Discrepancies in past research findings may be related to how social differentiation has been conceptualized and measured and how its relationship to population size has been proposed. Further careful analysis of the relationship between these variables is needed.

Some researchers have followed parsons' interpretation of Durkheim to validate the use of population size as a causal variable of structural change in the differentiation of social systems. Kasarda (1974), for example, cites Parsons' view of Durkheim and assumes it is system size that is causal in his study of three levels of social organization: the institutional, the communal, and the societal. Accordingly, he asserts that large size has a substantial influence on the internal organization of social systems at each level (Kasarda 1974:19).

Another view is that differentiation is in fact a causal variable, but only one of several influences contributing to population growth (Gibbs and Martin 1962). The rationale for causal status is that as communities become more differentiated they are capable of attracting and sustaining larger populations. Luloff and Stokes (1977) employ a cross-lagged panel analysis of population size and differentiation but find no significant differences in their abilities to predict each other. They also discuss several other studies in which low correlations between population size and some measure of differentiation have been reported (e.g., Johansen and Fuguitt 1973). In the ecological analysis of "the division of labor" (as indexed by industrial diversification) by Clemente and Sturgis (1972), population size, "physical density," and "social density" were hypothesized as independent variables. Only "social density" was found to exert a significant impact.

There are, then published reports supporting a close causal relationship between population size and differentiation and others undermining this position. It appears the connection is not a direct one, if indeed these two variables are related, or possibly the discrepancy in these findings is related to the choice of measures of differentiation.

In an attempt to answer the question of the sociological significance of the differentiation of locality structures, the Youngs (1973:12) have argued that differentiation is fundamentally an emergent property represented by the number of specialized social symbols that a system maintains. This perspective, therefore, rejects the use of population size as a measure of differentiation because it lacks meaning as a sociological concept.

The underlying premise in the theoretical perspective represented by the Youngs is that differentiation is a single structural dimension and that indicators of such a concept are interchangeable emergent institutionalized properties. MacCannell (1979) and numerous sociologists whom he cites follow this view. The premise assumes that knowledge of one structural indicator of differentiation serves as a basis for predicting an infinite array of other

structural indicators. This line of thought is also stated by Eberts and Young (1971:123), in an outline of sociological variables of development, when they hypothesize that "...the diversity of specialties in one institutional sector is equivalent to the range of variation in any other." Elsewhere, in an attempt to order communities on a cumulative scale of differentiation, Young and Fujimoto (1965:349) state that "...If differentiation is a general dimension that applies equally to all institutional sectors, any relationship between the differentiation within two given sectors should be tautological."

Several empirical tests of the tautological nature of community differentiation scales which tend to support this hypothesis have been conducted (Kaplan 1974; Spencer 1973; Stuby 1979; Young and Young 1973). Young and Young (1973:35-37) review several others. All of these, except Young and Young (1973), are based on only one point in time.

For the purposes of this paper, we accept Young's (1966) definition of differentiation, mentioned earlier, and the preferred approach to measurement using social institutions. We proceed, then, to test the extent of the validity of the "tautology hypothesis" regarding the substitutability of alternative measures of structural differentiation. We also wish to test the frequent assumption that population can be used as a proxy for structural differentiation. If differentiation is multidimensional and each dimension (including population) responds distinctively, then its treatment as a dependent variable (e.g., as the object of attempts to explain change in differentiation) becomes a great deal more complex and so, therefore, must the theory to explain it.

Sample and scale analysis

The 100 counties of North Carolina constitute the units of study.[3] Following the Youngs' (1973) definition, the phenomenon to be studied is conceived as a cumulative development process. For our purpose, which includes the exploration of this developmental concept and its potential use for analytic models and policy purposes, the Guttman scale technique is appropriate.[4] We wish to explore

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[3] Bonjean et al. (1969) present a convincing case that there is more to be gained in the use of counties as units of analysis, relative to other ecological units. Clay et al. (1975) make a lengthy argument supporting the use of the county as a viable unit of analysis, especially when studying institutionalized services.

[4] The concept, operations, and rationale for using Guttman scaling with ordinal data in such instances is discussed at length in Young and Young (1973). One point sometimes overlooked is that the use of a factor analysis on dichotomous items forming a guttman scale would necessarily yield multiple factors rather than one (Schuessler 1966:462). The two procedures answer different questions concerning data patterns.

variability in subcategories of the differentiation concept, and we need a fairly straightforward technique that will search the data systematically for the cumulative unidimensional patterns of institutional complexity expected. The determination of scalability or nonscalability of several conceptual areas of locality development and analytical comparisons among the scales derived are the objectives of the analysis.[5]

Social scientists too seldom have made use of direct measures of group level organizational structure while, all too often, studying individual characteristics which are then aggregated to infer (sometimes erroneously) system characteristics of larger socio-political units. For this reason, the present research emphasizes locality structures rather than measures derived from aggregations of individual level data. Measures of differentiation for this study were selected from the areas of administration, commerce, medical specialties, and education, which correspond to four important traditional institutional areas of interest in the field of sociology: government, economics, medical services, and education. Because these measures of differentiation were originally developed for a monograph involving a time series analysis of change over time (Tomazic 1981), the set of items for each measure had to reflect acceptable scalability levels for three time periods. In this study, however, they provide, in effect, three subsequent tests of the hypotheses.

Administrative office scale

The first measure of differentiation focuses on the complexity and cumulative development of administrative services.[6] Guidelines for item selection were aimed at obtaining an assessment of the widest degree of diversity in county services as shown by the number of individuals in single roles or offices of county government. Specifications for coding were that the offices existed in

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[5] The logic of a Guttman scale is that it assumes that items come from a single dimension representing a conceptually cumulative developmental pattern of response (Edwards 1957; Guttman 1944). A supplementary coefficient is employed which adjusts for extreme marginals and must reach .60 (Menzel 1953). The method of least errors (Wimberley 1976) was used in determining errors and scale scores. Although, theoretically, any institutional categories would be acceptable, these were chosen because they contain items similar to previous research (see review in Young and Young, 1973) and they were the only categories with North Carolina data in readily available form and existing back as far as the 1950s.

[6] Data coded from the **North Carolina Manual** (North Carolina Secretary of State, 1951, 1961, and 1971).

Table 1: Guttman Scales of County Administrative Offices in North Carolina Counties for 1951, 1961, and 1971.

Year and Step No.	Offices		No. Counties in Steps
1951			
8	County Manager		4
7	Treasurer		13
6	Auditor or Accountant		10
5	Health Officer		16
4	All Treasury, Audit & Tax Functions		22
3	Tax Supervisor or Tax Collector		20
2	Coronor		14
1	Basic Services		1
	Coefficient of Reproducibility	= .91	
	Minimum Marginal Reproducibility	= .77	
	Percent Improvement	= .14	
	Coefficient of Scalability	= .60	
1961			
8	County Manager		5
7	Treasurer		14
6	Auditor or Accountant		13
5	Health Director		16
4	All Treasury, Audit & Tax Functions		24
3	Tax Supervisor or Tax Collector		14
2	Coronor		13
1	Basic Services		1
	Coefficient of Reproducibility	= .91	
	Minimum Marginal Reproducibility	= .77	
	Percent Improvement	= .14	
	Coefficient of Scalability	= .61	
1971			
8	County Manager		14
7	Treasurer		12
6	Auditor or Accountant		10
5	Health Director		20
4	All Treasury, Audit & Tax Functions		21
3	Tax Supervisor or Tax Collector		17
2	Coronor or Medical Examiner		5
1	Basic Services		1
	Coefficient of Reproducibility	= .91	
	Minimum Marginal Reproducibility	= .76	
	Percent Improvement	= .15	
	Coefficient of Scalability	= .62	

each county and that they were occupied by actual specialists who performed that function and no other for the county government. An office was considered present if both these conditions were met. The resulting scales should present an accurate picture of the diversity of such services in the county. The items and details of the scale assessment are shown in Table 1.

From a set of 22 items, 11 turned out to be very basic services in all counties and thus were combined into one item. Five items were dropped from the scale. "Surveyor," "librarian," and "veteran's service officer" were deleted because they would have been redundant items, neither adding nor detracting from the measure. "Judge" and "solicitor" were dropped because judicial system reorganization made it impossible to determine exact equivalents for all time periods. The above process of elimination left eight items (Table 1). Note that the frequencies to the right of the table indicate the frequencies of the counties fitting the pattern for that scale step number (listed to the left of the item which demarcates the scale step) and not the frequency of occurrence of the item listed. These items meet the minimal requirements of reproducibility and scalability set by Guttman (1944) and Menzel (1953). What is more, the items meet these scale test criteria on three separate occasions spaced 10 years apart, which greatly reduces the probability that this scale had been generated by random data, a problem discussed at length by Chilton (1969).

Commercial services scale

The measure of economic differentiation was based on the availability of commercial services in 1956, 1964, and 1974. The data came from the retail trade section of the U.S. Bureau of the Census' County Business Patterns (1956, 1964, 1974).[7] From the many items listed in this section, 10 items hypothesized to tap high, medium, or low commercial differentiation were chosen (Table 2). The coefficients of reproducibility and scalability were well above the minimum requirements.

Some items shifted positions at different times. This is not unusual in measurement construction and is somewhat similar to changes in factor loadings. of greater importance, however, is that the items continued to exhibit a compatible pattern such that they fit the particular dimension. Due to changes in the rest of the economic and social structure, a particular item may take on different weights.

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[7] With the use of data from County Business Patterns, it should be noted that the absence of an item for a county means only that there are fewer than 10 such units in the county or that there are fewer than 50 employees.

Table 2: Guttman Scales of Commercial Services in North Carolina Counties for 1956, 1964, and 1974.

Year and Step No.	Commercial Services		No. Counties in Steps
1956			
10	Bookkeeping Service		7
9	Jewelry Store		4
8	Amusement Center		3
7	Credit Service		7
6	Legal Service		10
5	Drug Store		8
4	Furniture Store		6
3	Gas Station		19
2	General Merchandise		8
1	Grocery Store		10
0	None of the above items		18
	Coefficient of Reproducibility	= .98	
	Minimum Marginal Reproducibility	= .78	
	Percent Improvement	= .20	
	Coefficient of Scalability	= .91	
1964			
10	Bookkeeping Service		8
9	Jewelry Store		3
8	Amusement Center		8
7	Credit Service		13
6	Legal Service		8
5	Drug Store		5
4	Furniture Store		3
3	General Merchandise		17
2	Gas Station		14
1	Grocery Store		8
0	None of the above items		13
	Coefficient of Reproducibility	= .97	
	Minimum Marginal Reproducibility	= .78	
	Percent Improvement	= .19	
	Coefficient of Scalability	= .86	
1974			
10	Jewelry Store		10
9	Bookkeeping Service		3
8	Legal Service		9
7	Amusement Center		13
6	Credit Service		10
5	Furniture Store		5
4	Gas Station		4
3	Drug Store		6
2	General Merchandise		10
1	Grocery Store		17
0	None of the above items		13
	Coefficient of Reproducibility	= .98	
	Minimum Marginal Reproducibility	= .79	
	Percent Improvement	= .19	
	Coefficient of Scalability	= .91	

Medical specialties scale

An assessment of the degree of differentiation in the medical sphere is provided by data on the variety of medical specialists available in a county. Data for 1950, 1960, and 1970 were scaled. Twenty-two different types of medical specialists were coded; however, so few counties had any of these specialists in 1950 that only seven types were usable. Over half the counties in 1950 did not have a resident physician, and by 1970 there were still 18 counties with no physician. Nevertheless, the scales attain high levels of scalability and yield eight levels of medical sophistication for counties (Table 3).[8]

While some large facilities could be considered regional institutions and are often controlled by state and federal constraints, the location of medical specialties reflects the much greater autonomy that physicians have maintained as a profession. Items that seldom occur in counties because of larger regional patterns of mandatory location unrelated to previous levels of differentiation would not scale. From 1950 to 1970 there were, of course, a variety of state, federal, and local efforts to entice physicians to rural county positions. Also, a great deal of specialization was developing within the profession, thus making more specialists available (Elliott 1970). While these factors may have contributed to the changes in the nature of the scale and, perhaps, even to county ranks, the explanation of the changes goes beyond the scope of this research.

It was assumed that the medical specialties scale would reflect a facet of county differentiation similar to that of the commercial differentiation scale. Whereas the scale of commercial services presents a generalized picture of the diversity of consumer services in a county, the medical specialties scale presents a more specific picture of a particular type of available service. Also, the scale is preferable to many of the more often used measures such as "physicians per capita" or "hospital beds per capita" which do not provide a realistic picture of the diversity of health care services. Certain of these specialties -- such as surgery, radiology, and urology -- imply the existence of special physical facilities as well.

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[8] In several scales it will be noted that the top scale step (row totals) contains a greater number of counties than some lower scale steps. This is because this is the frequency for the scale step and includes the error pattern and does not reflect actual item (column) frequency. In all of the scales, the items are arranged in descending order of frequency. For example, the item frequencies (number of counties having the item) for 1970 in Table 3 from the top down are 23, 29, 40, 46, 62, 63, and 82 (physician).

Table 3: Guttman Scales of Medical Specialties in North Carolina Counties for 1950, 1960, and 1970.

Year and Step No.	Medical Specialties		No. Counties in Steps
1950			
7	Orthopedic Surgery		5
6	Urology		2
5	Obstetrics & Gynecology		3
4	Internal Medicine		2
3	Radiology		4
2	Surgery		11
1	Physician		19
0	None of the above items		54
	Coefficient of Reproducibility	= .97	
	Minimum Marginal Reproducibility	= .88	
	Percent Improvement	= .09	
	Coefficient of Scalability	= .75	
1960			
7	Orthopedic Surgery		12
6	Urology		7
5	Obstetrics & Gynecology		9
4	Internal Medicine		9
3	Radiology		12
2	Surgery		8
1	Physician		12
0	None of the above items		32
	Coefficient of Reproducibility	= .97	
	Minimum Marginal Reproducibility	= .80	
	Percent Improvement	= .17	
	Coefficient of Scalability	= .84	
1970			
7	Orthopedic Surgery		20
6	Urology		8
5	Obstetrics & Gynecology		9
4	Internal Medicine		6
3	Radiology		14
2	Surgery		9
1	Physician		16
0	None of the above items		18
	Coefficient of Reproducibility	= .96	
	Minimum Marginal Reproducibility	= .80	
	Percent Improvement	= .16	
	Coefficient of Scalability	= .78	

Educational institutions scale

A measure of the differentiation level of education in the counties is developed through a scale of educational institutions (Table 4).[9] It is assumed that access to a wide range of information and skills is available at these different types of educational institutions. The measure also reflects the diversity of alternative educational and informational sources that local people may tap for various purposes, including, but not limited to, career education. The presence of an educational institution can well serve to stimulate individual use of that institution, and its absence may discourage anyone predisposed to use it.

The first and most basic of the six items -- that all public high schools in the county were accredited by the North Carolina Board of Education -- is significant, since accreditation very often reflects the quality of education and credentials for advancement to higher levels of education. Also, one would assume that the state would strive to ensure such accreditation, as would the counties themselves. However, 43 counties did not have this item in 1953-54, although 70 counties achieved this (Step 1) or a higher scale step. Twenty counties failed to meet this accreditation criterion at the two later points in time.

The second item -- that at least one high school in the county was accredited by a regional association -- was chosen because accreditation by a regional association indicates the likelihood of an educational program of higher quality. These first two items represent the basic "preconditions" in an educational career for students because admissions to institutions of higher learning often are influenced by the accreditation status of the high school from which a student graduates.

The other four items in the scale represent postsecondary educational institutions: Business or vocational training school; junior college, community college, or technical institute; senior college or university; and a graduate program.

These six items form the educational institutions scales. The scales meet the required levels of reproducibility and scalability.

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[9] The data for the educational institutions came from three sources: (1) **The Statistical Abstract of Higher Education in North Carolina** (North Carolina Department of Public Institution 1954a, 1964b, 1971c); (2) **The North Carolina Board of Education Biennial Report** (North Carolina Department of Public Instruction 1954a, 1964b, 1971c); (3) **The North Carolina Education Directory** (North Carolina Department of Public Instruction 1954a, 1964b, 1974c).

Table 4: Guttman Scales of Educational Institutions in North Carolina Counties for 1953-54, 1963-64, and 1970-71.

Year and Step No.	Educational Institutions	No. Counties in Steps
1953-54		
6	University with a Graduate Program	5
5	Senior College or University	8
4	Junior College, Community College or Technical Institute	5
3	Business College or Trade School	13
2	High School Accredited by a Regional Association	11
1	All High Schools Accredited by NC	28
0	None of the above items	30
	Coefficient of Reproducibility = .92	
	Minimum Marginal Reproducibility = .78	
	Percent Improvement = .14	
	Coefficient of Scalability = .63	
1963-64		
6	University with a Graduate Program	6
5	Senior College or University	13
4	Junior College, Community College or Technical Institute	9
3	Business College or Trade School	3
2	High School Accredited by a Regional Association	22
1	All High Schools Accredited by NC	32
0	None of the above items	15
	Coefficient of Reproducibility = .95	
	Minimum Marginal Reproducibility = .77	
	Percent Improvement = .18	
	Coefficient of Scalability = .79	
1970-71		
6	University with a Graduate Program	7
5	Senior College or University	8
4	Business College or Trade School	5
3	Junior College, Community College or Technical Institute	37
2	High School Accredited by a Regional Association	17
1	All High Schools Accredited by NC	18
0	None of the above items	8
	Coefficient of Reproducibility = .93	
	Minimum Marginal Reproducibility = .75	
	Percent Improvement = .18	
	Coefficient of Scalability = .72	

Analysis of Interrelationships of scales and population

Table 5 presents three intercorrelation matrices of the four scales and population size for 1950, 1960, and 1970. Three of the scales (commercial, medical, and educational) and population demonstrate what would be high correlations for sociological research, except that these are assumed to be tautological measures of one concept, social differentiation. Such an assumption would require high correlations to be viewed as valid interchangeable measures. The office scale has lower average correlations with the other three scales and with population for all three time periods.

Table 5: Correlation Matrices for 1950, 1960, and 1970 Data.

	Com. Scale	Med. Scale	Educ. Scale	Office Scale	Pop. Scale
A. 1950					
Commercial Scale	1.00				
Medical Scale	.74	1.00			
Education Scale	.67	.61	1.00		
Office Scale	.36	.41	.28	1.00	
Population Scale	.84	.78	.66	.41	1.00
B. 1960					
Commercial Scale	1.00				
Medical Scale	.81	1.00			
Education Scale	.77	.76	1.00		
Office Scale	.62	.48	.43	1.00	
Population Scale	.79	.69	.70	.47	1.00
C. 1970					
Commercial Scale	1.00				
Medical Scale	.87	1.00			
Education Scale	.67	.61	1.00		
Office Scale	.34	.28	.36	1.00	
Population Scale	.73	.65	.67	.46	1.00

Measurement error probably was not the major reason for the pattern of outcomes in Table 5, given the low percentages of scale error and the number of weak correlations among differentiation measures that have been observed in the literature. Moreover, as previously indicated, scales in this study have demonstrated over-time reliability in that the same items were shown to form a cumulative scale at three points in time with acceptable levels of reproducibility and scalability. There is, however, another possible reason for lower than expected correlations other than technical measurement problems. Theoretically, some institutions or institutional sectors may develop more slowly or more rapidly than others (Gibbs and Poston 1975). Another possibility is that localities have developed specialty areas (Stuby 1979).

In other research on differentiation and population size, the units of analysis have been cities where population size is affected by annexation as well as by natural increase and migration (Luloff and Stokes 1977; Fuguitt and Kasarda 1981). Thus great variation may be obtained.[10] Counties, however, are units with stable land areas during this time period, and thus population size can be affected only by migration or natural increase.

As a further test of the assumed tautological nature of the measures, the four scales and population size were submitted to a Guttman-Lingoes Multiple Scalogram Analysis (Lingoes 1963; 1973).[11] The use of such an analysis follows the suggestion of using principal components to bypass the problem of multicolinearity (Maddala 1977:190-194). Multiple scalogram analysis effectively results in principal components where the dimensions tapped are orthogonal to one another, thus allowing for the determination of scalable subsets without relying on a priori decisions as to the universe of content.

If the scales and population are, in fact, tapping a single dimension of differentiation, they should form a consistent overall scale pattern using the Guttman-Lingoes

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[10] In the research by Luloff and Stokes (1977), which deals with differentiation in cities in North Carolina, the population variable approaches a correlation of 1.00, with a beta of 0.996.

[11] In 35 previous studies of differentiation using the same perspective, Guttman scales were developed. Past attempts to include all items in a single scale have resulted in the loss of a number of items, and, therefore, the development subscales and the analysis of their interrelatedness have become the general pattern in this line of research. Substantial intercorrelations are a common finding with a few exceptions. See young and Young (1973:34-38) for a review of the justification of this approach, the most pertinent supportive research findings, and anomalies among previous studies.

analysis. Since the data are available for three time periods, one should obtain the same overall scale pattern for each period, containing all four scales utilized as items plus the population measure as an item. If, however, these five items do not form a single scale, or if they form different scales, then one cannot conclude that the way the units of analysis are ordered or ranked on one measure is useful in predicting order on any other measure. Thus the measures would not be interchangeable. The problem then is, as Coombs (1976:230) states, "one of testing whether the continuum defined by each of several items is the same one."

The following is a summary of the analysis. Z-scores are calculated for the scale steps of each of the four Guttman scales and population. These scores are then recoded (1 through 8) for each county using the standard deviations as cutting points. The Lingoes program then determines the dividing point and plots the scores as 1's and 0's. The process is then one of attempting to chain the items (scales and population) together, using a chi square criterion of 10.827 and a phi criterion of .80. Once a scale is created, the next phase is to attempt to continue to form a scale from the remaining items. Table 6 shows the scales that form at each time period and the scale assessment. Those items that do not fit into a scale can be interpreted as tapping additional dimensions. The program, in effect, separates items with orderly interlocking from those with disorderly interlocking (Coombs 1976).[12]

Using the four 1950s differentiation scales and rank on population size (see Table 6), we found that only the medical, population, and commercial measures form a scale. The education measure and the office measure, however, will not scale nor form an additional scale and thus do not appear in the 1950s section of Table 6. Thus in 1950 three different dimensions are being tapped by the five items. With the data for 1960, only the office measure did not scale, indicating the presence of at least two dimensions. In 1970, three dimensions reappear, but not with the same items. In this case the population size, commercial, and education measures form one scale, whereas the medical and office measures will not scale nor form an additional scale. In all cases, the scales meet acceptable standards of reproducibility with a high percent improvement.

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[12] The Guttman-Lingoes procedure takes all items (the four scales and population, in this case) and initially attempts to form one scale. Those items that do not fit the initial scale are then utilized in an attempt to form a second scale, which is orthogonal to the first. In like manner, a third scale, a fourth scale, and so forth are attempted. Items left over that will not chain together with any other items are then viewed as tapping separate dimensions.

Table 6: Guttman-Lingoes Multiple Scalogram Analysis for Differentiation Scales and Population Size in North Carolina Counties for 1950s, 1960s, and 1970s.

Years and Step No.	Measures in 1950s		No. Counties in Steps
1950s			
3	Medical Scale		22
2	Population Size		16
1	Commercial Scale		13
0	None of the above		49
	Coefficient of Reproducibility	= .95	
	Minimum Marginal Reproducibility	= .63	
	Percent Improvement	= .32	
1960s			
4	Education Scale		23
3	Population Size		13
2	Commercial Scale		9
1	Medical Scale		10
0	None of the above		45
	Coefficient of Reproducibility	= .94	
	Minimum Marginal Reproducibility	= .60	
	Percent Improvement	= .34	
1970s			
3	Population Size		32
2	Commercial Scale		13
1	Education Scale		19
0	None of the above		36
	Coefficient of Reproducibility	= .95	
	Minimum Marginal Reproducibility	= .58	
	Percent Improvement	= .37	

Of note then is that these measures do indeed tap a dimension or dimensions indicative of some facet of differentiation. However, the items (scales) which form these Guttman-Lingoes scales, except for commercial services and population size, are not consistent over time. One item, the office measure, never appears in the scales, whereas population and commercial services appear in each. It is interesting that these two should consistently appear together, since they are the most widely used indicators of differentiation.

The office scale is the only scale that consistently remains separate from the other items. This finding would seem to be in line with the zero-order correlations in Table 5. This facet of county governmental differentiation appears to be consistently independent of other aspects of differentiation, perhaps measuring a dimension very different from the others.

Discussion

Young and Young (1973:91) use smallest space analysis to demonstrate that six differentiation indices are measuring the same underlying variable. It should be kept in mind that the relationship they found could be the result of the causal effects rather than tautological relatedness. For their diachronic causal model, they presumably selected the best two measures of differentiation (Young and Young 1973:99). A surprising but unexplained result is that their two measures of differentiation behave rather differently. Their 1950 commercial differentiation scale does not predict their 1966 community settlement pattern complexity scale. It is true that the 1950 settlement pattern complexity scale predicts the commercial scale with a partial beta of .20, but this is not a strong result. Finally, neither of the scales predicts the same variable or variables in the model, which is contrary to the hypothesized outcome. Such results are similar to those found in the data of this study, which show unexpected dissimilarity in the behavior of differentiation measures. This should raise serious questions for those interested in using a single measure of differentiation (such as a scale of commercial firms) to represent "total" or "over-all" community differentiation in causal modeling.

As for the unidimensional concept of differentiation, the present analysis suggests that measures of different institutional categories do not constitute alternative measures and that these should not be used interchangeably. Researchers studying similar institutional scales in contexts other than the United States have discovered the same phenomena but have not adequately come to grips with the implications of the discrepancy in measurement (Kaplan 1974; Young and Young 1973).[13] Yet the claim that differentiation is a single dimension cutting across all institutional sectors is, in its most general sense, understandable. One simply does not find a single sophisticated community institution such as a modern hospital or college in the midst of an otherwise peasant community. On the other hand, the existence of communities with areas of special development is not unusual. There are various types such as resort communities, retirement communities, industrial and manufacturing centers, and educational centers (e.g., college towns). However, such extreme specialization may be rare; the vast majority of

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[13] As with any measurement instrument or standardized test (e.g., SAT or GRE) constructed from a particular type of sample, there is no guarantee that the same scale measures would result and behave the same way with a different type of community sample with respect to item order, proportion discriminated, item content, or scalability level. Similar differentiation scales, however, have been derivable in more than 35 studies (Young and Young 1973:35).

communities may fit the regularized patterns of central place theory, and more research on this is needed.

While we are not ready to draw conclusions generalizing a pattern of institutional change in localities to the level of society, there is a long tradition in sociology not to be dismissed lightly (although the theory was not developed specifically for communities). it suggests that some institutional sectors are likely to reflect differentiation (or "development," or "growth" involving differentiation) before others. Perhaps the dominant historical theme has been that primacy resides in the economic sector. The works of Marx and Engels focusing on the means of production are examples. For Parsons (1961), the adaptive function was the important response to disequalibrium and the economic institution was the primary instrument. The main point here is that for some theorists a few institutional sectors change, develop, or respond before others. These early changes have consequences for all subsequent changes in a society. For Parsons (1961) and his students, these theoretical ideas were generic to social systems and thus applicable to societies or communities.

Theorists who have emphasized one particular institutional sphere over another have generally maintained an implicit static priority hypothesis. For example, it is often implicitly suggested that for all societies it is the economic activities (e.g., technological innovation or economic institutions) or "adaptive functions" that change first, leading to change in others. Research based on empirical change-over-time causal models utilizing such measures as we have developed in this paper would now seem appropriate. The behavior of various measures of differentiation in such models would yield a much greater understanding of their interrelations.

At this stage we can say that an underlying pattern of differentiation exists that is not reducible by the use of present methods or that different institutional sectors develop independently because changing structural conditions impinge upon them. But to simply assume away these differences as inconsequential because they reflect a more abstract phenomenon does not prevent drastically different outcomes in empirical analyses utilizing alternative differentiation measures. Such measures may pertain to the same conceptual category in a broad sense, but we have found differentiation reflects a multidimensional pattern in measurement construction. Most of these measures, in turn, appear uniquely related to other system variables, especially when examined over time. Given these facts, it makes little sense to us to utilize measures of differentiation as a unidimensional concept. Single so-called "global" measures of differentiation will serve only to obscure efforts toward precise causal explanation.

It does appear, however, that population size and commercial services could be used without undue distortion.

This is congruent with the work of Howard and Heise (1981) in their study of 35 North Carolina cities of 10,000 or more population. Using a nonmetric multidimensional scaling analysis they found that population size and median family income were the two best predictors of a city's relative position in the "service space" (as defined by entries in phone book yellow pages).

Future research may reveal other subdimensions that are related tautologically to one of the dimensions studied here or to population size. Such research is needed and would aid in reducing the number of subdimensions of differentiation that must be treated as dependent variables in causal explanation. In the meantime it appears that theories explaining the process of differentiation must address the different levels and rates of change for distinct subcategories as represented by the scales in this study.

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