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ABSTRACT

Ten professional geography research papers presented at the Geography Section of the 1974 annual meeting of the Ohio Academy of Science are provided. Six of the papers may be considered to fall under the broad classification of human geography, two others are about physical geography, while the remaining two seek to improve the craft of modern cartography. The titles of the ten papers are (1) A Factorial Ecology of Cincinnati's Black Residential Areas; (2) Structural Bases of Sex Ratios in India; (3) Cannonical Analysis of Crime and Their Socioeconomic Indicators; (4) A Spatial Perception Study of Cincinnati: A View from Newport; (5) Black Caribs in Two Societies: Differential Acculturation Rates; (6) The Ejido System in Mexico: An Example of Agrarian Reform; (7) Some Interrelationships of Parent Materials, Soils, and Land Use in Lancaster County, Pennsylvania; (8) The Use of Factor Analysis in the Production of Soil Resource Maps for Regional Planning Studies; (9) Preliminary Investigations of the Dispersal of Air Contaminants over the Northeast District of Ohio; and (10) An Urban Atlas, or Only Computer-Mapping: Which Way Should Geographers Go? (Author/DE)

OHIO GEOGRAPHERS:

RECENT RESEARCH THEMES

Volume Number 2: 1974

Wolf Roder,
Marlyn L. Shelton, Editors

Department of Geography
University of Cincinnati

OHIO GEOGRAPHERS: RECENT RESEARCH THEMES

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PREFACE

The present second volume of Ohio Geographers is a proceedings of the Geography Section of the Ohio Academy of Science in the sense that all the papers were presented at the eighty-third annual meeting at Wooster College on April 26, 1974. Missing are those communications among scholars not intended for publication, and those prepared for publication elsewhere. The session was arranged by the section Vice-President, Gerald F. Pyle of the University of Akron.

The current research themes shared by Ohio geographers are by no means parochial. The volume indicates rather that topics, methods, and even field areas are those of geographers generally. Six of the papers may be considered to fall into the very broad classification of human geography, two others may be considered part of physical geography, while the remaining two seek to improve the ancient craft of modern cartography.

The papers provide evidence that Ohio geographers are well versed in the quantitative methods and computer routines which have revolutionized geographic research in the past two decades.

Several of the papers address themselves strictly to the advance of theory. A contribution to the theory of cultural integration is one topic (Walter and Williams) improvements in factorial ecology another (Maziarz) the social causes of crime a third (Singh) perception of the environment the fourth (Mazey), and imbalance of sex ratios a fifth (Reith).--

The increasing concern of geographers with the practical application of their scientific insights finds its reflection in several papers. These applications range from an examination of soils for use in county planning in two papers (Limbird; Nash) to the rapid production of computer maps of air pollution (Sawan). They include a careful examination

of successful land reform for lessons applicable elsewhere (Harnapp), and end with an impassioned plea for the production of useful and excellent urban atlases (Anton).

The choice of field area of these papers indicates that Ohio geographers have not abandoned the global outlook of the discipline. Three papers have chosen parts of Ohio for their experiments, two visit the neighboring states of Kentucky and Pennsylvania, while another two address themselves to the nation as a whole. Among international field areas, one paper concerns the whole of India, another the problems of Mexican land reform policy, while a third considers a problem contrasting Guatemala and Belize.

The editorial and mechanical operations of publication were performed at the University of Cincinnati. This institution also provided financial support through its Research Council and the mediation of Dean Guy Stern. We are indebted to Karen Nilson and Cheryl Sievering for preparation of the manuscript.

Wolf Roder
Marlyn Shelton

Cincinnati, Ohio
June, 1974

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A FACTORIAL ECOLOGY OF CINCINNATI'S BLACK RESIDENTIAL AREAS

Thomas J. Maziarz
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ABSTRACT: - Using census tract data from Cincinnati, Ohio for 1970, a factorial ecology of 65 census tracts with more than 400 blacks was undertaken using oblique factor analysis. The first factor loaded highly on income, education, and occupation variables. The second factor was composed of variables describing family size and age structure. These dimensions, which were only slightly correlated, are similar to those found in most factor analytic studies of entire urban areas. The spatial distribution of the factor scores was also similar to those found in studies of entire urban communities. Economic status was low near the city center and high at the periphery of the black sector. A pattern of family status scores was less clear, but somewhat zonal.

These results tend to confirm the hypothesis that the internal structure of ethnic areas may exhibit spatial patterns of residential differentiation similar to those of the entire metropolitan community. They closely resemble the results found in the study by Roseman, Christian, and Bullamore, (1972) indicating that these structural patterns may be identifiable in many urban areas.

Social geographers and human ecologists have devised two techniques which have greatly aided them in increasing their understanding of the residential structure of the city. Social area analysis was first used by sociologists but has since been a frequently applied technique in geography. With the aid of computer technology, a second but more exploratory technique called factorial ecology was developed which tended to confirm the conclusions of numerous social area analyses.

Although our comprehension of urban human ecology is far from complete, it far surpasses our understanding of the ecology of black residential areas. Most factorial ecologies and social area analyses have

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simply found that black areas appear as separate sectors, nuclei or subsystems within an urban system, but have failed to explore the ecological structure within these areas. Recently, interest in the ecology of black residential neighborhoods has increased and factorial ecologies of these areas have been done in several cities.

It is the purpose of this paper to supplement the information on black ghettos gathered by human ecologists. The results of a factorial ecology of the black residential areas of Cincinnati, Ohio, are pooled with those done by a few other researchers and generalizations about black residential structures in American cities are outlined.

METHODOLOGY

Factor analysis is most often mentioned for its value as an exploratory or index building technique, and loudly denounced as a method of hypothesis testing. Even for exploratory analysis, however, it has its shortcomings. Investigating a completely new area of study, a researcher can draw misleading conclusions from data that have been factor analyzed. In order to avoid this problem, researchers should not approach a problem without reasonable hypotheses; but instead, should, "draw on existing theory and previous research as much as possible." (Armstrong, 1967, 20) To this end, a bibliographic search was made of the literature on black residential structure. The material consulted offered evidence in support of the hypothesis that blacks segregate themselves in a manner similar to the host community. The reader is referred to the following excerpts from papers in which techniques other than factor analysis were used.

> This study indicates that a local community inhabited by a segregated racial or cultural group may develop the same pattern of zones as the larger urban community. (Frazier, 1937, 72)

> Age structure varies systematically through ghetto-space. (Sanders and Adams, 1971-72, 123)

> We found a pattern of class segregation within a number of nonwhite areas that is very familiar to all students of the American city; it can be summed up as, "The higher up the social ladder, the farther out you live," (Schnore, 1956, 133)

> The residential segregation of families by income and by stage of the family life cycle within Milwaukee's black community resembles in both pattern and degree that in the white community. (Edwards, 1970, 185)

Given the evidence from prior research and recent statements by geographers such as Johnston (1971) that stratification systems of sub-communities should parallel those of the host society, the follbwing hypothesis is made.

There are at least two dimensions to the differentiation of black residential areas. economic status and family status. These dimensions are hypothesized to be similar in structure to the two basic dimensions (bearing the same labels) normally found in factorial ecologies of North American cities. The variables chosen to test this hypothesis are given below in Table 1 along with a graphic display of the hypothesized structure of the two dimensions. Variables chosen were commonly used in other factorial ecologies and typically associated with economic or family status.

TABLE 1
(Hypothesized Structure)

	ECONOMIC STATUS	FAMILY STATUS
CLERICAL WORKERS	+	0
SERVICE WORKERS	+	0
PROFESSIONAL WORKERS	+	0
MEDIAN INCOME	+	0
MEDIAN EDUCATION	+	0
WORKING WOMEN	0	+
SINGLE FAMILY HOMES	0	+
OVER 60	0	+
UNDER 18	0	+
HOUSEHOLD SIZE	0	+

An unrotated principal components solution was rotated to an oblique solution. This method of rotation was chosen because it usually yields a solution that is easier to interpret substantively, and recently many analysis have argued that it is the conceptually more appropriate technique. For instance, "Cattell makes it clear that the orthogonal model is too restrictive to permit a fit to naturally occurring causes, which are more often than not correlated or oblique." (Semple, 1969, 1) Berry (1971) argues that the orthogonal rotation may be particularly inappropriate in

urban factorial ecologies since economic status, life cycle, and segregation dimensions are frequently correlated. To provide added assurance that results would be comparable to other studies, an orthogonal rotation was also done to examine differences from the oblique solution.

The study area includes 65 census tracts within the SMSA of Cincinnati. These tracts are all designated in the 1970 census as having nonwhite populations of 400 or more. The nonwhite population in Hamilton County is 145,333, which is 15.7 percent of the total population. The tracts observed had a population of 136,545 nonwhites. This is 93.95 percent of the county's nonwhite population.

RESULTS

The factor structures for both the orthogonal and the oblique rotations are summarized in Table 2. The two solutions shown are remarkably similar, a characteristic recently suggested as a generalization by Davies and Barrow (1973).

TABLE 2*

	(a) OBLIQUE (Pattern Matrix)		(b) ORTHOGONAL	
	ECONOMIC STATUS	FAMILY STATUS	ECONOMIC STATUS	FAMILY STATUS
CLERICAL WORKERS	.697	------	.685	------
SERVICE WORKERS	-.824	------	-.802	------
PROF. WORKERS	.889	------	.832	------
MEDIAN INCOME	.843	------	.827	------
MEDIAN EDUCATION	.886	------	.869	------
WORKING WOMEN	.730	------	.742	.485
SINGLE FAMILY HOME	.549	-.471	.580	.596
OVER 60	-.411	.680	-.467	-.772
UNDER 18	------	-.984	-----	.933
HOUSEHOLD SIZE	------	-.859	-----	.902
PERCENT OF TOTAL VARIANCE	**45	**26	44.4	31.3

*All variables were found to be normally distributed without transformation.

**These figures are only direct contributions. Jointly the two factors contributed another 16.5 percent. The correlation between factors was .33.

The oblique factor structure differs somewhat from the hypothesized structure. Three variables, WORKING WOMEN, SINGLE FAMILY HOMES, and OVER

60, have loadings on the economic status factor of .35 or greater. It was expected that these variables would be strongly correlated with family status and uncorrelated with economic status. However, WORKING WOMEN is strongly associated with economic status only; SINGLE FAMILY HOME is moderately associated with both factors, and OVER 60 is strongly associated with family status and moderately associated with economic status. Thus, it does not seem inappropriate to consider the hypothesized and observed structures similar, since all variables except WORKING WOMEN were associated with the dimensions they were expected to associate with. The differences that do exist deserve further consideration and will be discussed in the following sections.

The spatial patterns of factor scores may be examined in FIGURE 1 and FIGURE 2. The score pattern for economic status is very definitely zonal; the high scores are at the periphery, the low scores near the center. In the instance of a ghetto where residential growth is often constrained to expansion along one or two sectors, a zonal pattern of economic status scores is to be expected. For entire metropolitan communities, economic status is known to have a zonal variation within the more prominent sectoral pattern of economic status.

The pattern for family status is a little less clear, though still apparently zonal as was anticipated. Most of the high status tracts are located at the periphery, while most of the low status tracts are near the center. The tracts most obviously deviating from the general pattern are found clustered together.

COMPARISON WITH OTHER STUDIES

At this time there are five other studies of black residential areas available for comparison (Christian, 1972, Johnston, 1971; Meyer, 1971; Roseman, et al., 1972; and Todd, 1972). Including this study, the black areas of seven cities that have been factor analyzed are: Cincinnati, Milwaukee, Los Angeles, Chicago, Memphis, Detroit, and Toledo.

Chicago was analyzed using data for 1950 and 1960, and Milwaukee was analyzed by two different researchers using different data sets. A review of all these studies provides a reasonable basis for making generalizations about the black residential structure in American cities. Unfortunately, only the results for five cities could be reproduced in this

FIGURE 1

FIGURE 2

report (see Table 3). Space limitations also demanded that the results for the Roseman, et al., study be shown in abbreviated form. Only the significant factor loadings for the first two factors are given. The last two factors, segregation and in-migration, contributed only small amounts of variance and are not discussed. The complete results from Meyer's study are reproduced.

All the studies reported finding at least two dimensions which, for purposes of this paper, will be called economic status and family status. In eight of the nine factorial ecologies performed, these two factors explained the most variance. It is important to note that although the composition of both dimensions did vary from city to city, certain variables are always associated with particular factors. Income and education variables are always very strongly associated with economic status and never associated with family status. Other variables which typically associate with economic status and not with family status are house value, amount of rental payment, and proportion of professional or managerial workers.

Likewise, the variables family size and the proportion of children in the population are always very strongly associated with family status and never associated with economic status. Typically, the percentage of overcrowded dwelling units in a tract is strongly associated with family status. Christian (1972) found this variable associated with economic status for Chicago in 1950, but by 1960 it had become associated with family status. Johnston found the variable measuring overcrowding was associated with a completely different factor.

Two variables, percentage of women in the work force and percentage of homes that are owner-occupied, or single family homes, which according to the hypothesis should have been highly correlated with the family status factor, did not consistently do so. These variables have almost always been strongly associated with family status in studies of North American cities (Murdie, 1969, Rees, 1970). Studies of the black community in the city have shown that the working women and single family home variables have no clear patterns of association with the two dimensions. Percentage of women in the work force has variously loaded on: economic status, but not family status; family status but not economic status; or on both factors at once. This was also found to be the case for the proportion of

TABLE 3

	(a) CHICAGO[1]		(b) MILWAUKEE[1]		(c) LOS ANGELES[1]	
	I	II	I	II	I	II
INC=$2000-	-.73	----	-.81	----	.84	----
MEDIAN INC.	.93	----	.91	----	-.92	----
CROWDING	----	.78	----	.69	----	.83
OWNER OCCUPIED	.79	----	.86	----	-.71	----
MEDIAN EDUC.	.71	----	----	----	-.74	----
POP/HOUSEHOLD	----	.88	.78	.92	----	.94
BOTH PARENTS	.86	----	----	----	-.71	.56
UNDER 18	----	.92	----	.76	----	.93
OVER 60	----	-.61	.59	-.57	----	-.63
PROFESS., MGR.	----	----	----	----	-.76	----
CRAFTSMEN	----	----	.55	----	----	.59
LABORER	----	----	----	----	----	.53
SERVICE	----	----	----	----	.58	----
MALE UNEMPLOY.	-.57	----	----	----	.73	----
WORKING WOMEN	----	-.59	.74	----	----	-.67
INC=$8000+	.84	----	.84	----	-.87	----
INMIGRANT	----	----	----	----	----	----
MOBILITY	----	----	----	----	----	----
SOUND HOUSING	.56	----	----	----	----	----
BLACK POP.	----	----	----	----	----	----
% BLACK	----	----	----	----	----	----
% TOTAL VARIANCE	30%	17%	35%	16%	35%	23%

	(d) DETROIT[2]		(e) MEMPHIS[2]	
	I	II	I	II
FAMILY INCOME	.93	----	.83	----
EDUCATION	.90	----	.82	----
RENT	.80	----	.76	----
SOUND HOUSING	.77	----	.84	----
WORKING WOMEN	.76	----	.56	-.49
HOUSE VALUE	.66	----	----	.46
UNDER 18	----	.95	----	.94
POP/HOUSEHOLD	----	.94	----	.92
MALE AGE	----	-.91	----	-.90
SINGLE FAM. HOMES	----	.49	----	.57
% TOTAL VARIANCE	52%	40%	40%	46%

[1]Adapted from Roseman, et al.,1972, pp. 244-245.

[2]Adapted from Meyer, 1971, p. 337.

dwelling units that are single family homes.

Johnson was the only researcher who felt that his study showed that the black factor structure did not resemble the structure of the host community. Yet the two variables most highly correlated with his first factor were an education variable (-.91) and an occupation variable (-.88), as would be expected. The three variables most highly correlated with his second factor were: one measuring the percentage of males in the population (-.90), one measuring the proportion of the population under 15 years of age (.88), and one measuring the average family size (.73). It is felt that these results are not incompatible with the generalizations made above.

Not all the researchers reported the spatial distribution of factor scores, but those results reported indicate that at least economic status has a clearly zonal pattern. Higher status areas are located at the periphery, and low status areas near the center. For family status, only Roseman, Christian and Bullamore's results for Los Angeles show a definitive zonal pattern. Other results such as those shown in Figure 2 are less clear.

CONCLUSIONS

It appears that there are at least two distinct factors necessary to explain the patterns of residential differentiation within an urban black community. These two factors closely resemble the factors of economic and family status found in studies of entire urban communities. The economic status factor is oriented towards income, education, and occupation attributes while the family status factor is oriented towards family size and composition attributes. The factor structures differ, however, in that variables reflecting the participation of women in the work force and the incidence of single family homes or owner occupancy, are not clearly associated with family status in the black community as they are for entire urban communities.

REFERENCES CITED

Armstrong, J. S., "Derivation of Theory by Means of Factor Analysis or Tom Swift and His Electric Factor Analysis Machine," The American Statistician, Vol. 21 (1967), pp. 17-21.

Berry, B. J. L., "The Logic and Limitations of Comparative Factorial Ecology," Economic Geography, Vol 47 (1971), pp. 209-219.

Christian, C., "Social Areas and Spatial Change in the Black Community of Chicago: 1950-1960," University of Illinois at Urbana-Champaign, Department of Geography, Paper Number 2, 1972

Davies, W. K. and G. T Barrow, "A Comparative Factorial Ecology of Three Canadian Prairie Cities," The Canadian Geographer, Vol. 17 (1973), pp. 327-353.

Edwards, O L , "Patterns of Residential Segregation within a Metropolitan Ghetto," Demography, Vol. 7 (1970), pp. 185-192.

Frazier, E. F., "Negro Harlem. An Ecological Study," American Journal of Sociology, Vol. 43 (1937), pp. 72-88.

Hughes, J and G. Carey, "Factorial Ecologies: Oblique and Orthogonal Solutions: A Case Study of the New York SMSA," Environment and Planning, Vol. 4 (1972), pp. 147-162

Johnston, R. J , Urban Residential Patterns. An Introductory Review. (New York· Praeger Publishers, 1971)

Meyer, D., "Factor Analysis Versus Correlation Analysis. Are Substantive Interpretations Congruent?", Economic Geography, Vol. 47 (1971), pp. 336-343

Murdie, R., "Factorial Ecology of Metropolitan Toronto, 1951-1961. An Essay on the Social Geography of the City," The University of Chicago, Department of Geography, Research Paper Number 116, 1969.

Rees, P H., "The Factorial Ecology of Metropolitan Chicago, 1960," in Geographic Perspectives on Urban Systems, ed. by B. J L. Berry and F W. Horton. (Englewood Cliffs: Pretice Hall, 1970), pp. 319-394.

Roseman, C., C. Christian, and H. Bullamore, "Factorial Ecologies of Urban Black Communities," in Perspectives in Geography 2, Geography of the Ghetto: Perceptions, Problems, and Alternatives, ed. by Harold Rose (DeKalb, Illinois. Northern Illinois University Press, 1972), pp. 239-256.

Sanders, R and R Adams, "Age Structure in Expanding Ghetto-Space: Cleveland, Ohio, 1940-1965," The Southeastern Geographer, Vol. 11-12 (1971-72), pp. 121-132.

Semple, R. K., "An Oblique Simple Structure Factor Analysis of Viability Measures for Southern Ontario Towns," University of Toronto, Department of Geography, Discussion Paper Number 2, 1969.

Schnore, L., "Social Class Segregation Among Nonwhites in Metropolitan Centers," Demography, Vol. 2 (1956), pp. 126-133.

Todd, W., "Factor-Analytic Black-White Polarization in Milwaukee, 1950 to 1970," abstract from paper read at Annual Meeting of West Lakes American Association of Geographers, 1972.

STRUCTURAL BASES OF SEX RATIOS IN INDIA

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ABSTRACT: - Principal components analysis of forty-six variables relating to demographic, social, environmental, and economic characteristics of the population of India has been conducted, using 330 district and other political units as observations. The forty-six variables were reduced to eleven factors that explained 75 percent of the total variance of the data. These factors, through factor scores, were then subjected to a multiple, step-wise regression analysis in which sex ratio was the dependent variable. Here approximately 75 percent of the variation in Indian sex ratios was explained. While a purely demographic factor relating to differential mortality of females emerged as the most important functional factor, other factors of social and economic import also emerged statistically significant.

An imbalance in the sexes of India's population and the concomitant attempt to explain the prevailing composition have been a concern to demographers since the first census of 1871 revealed a heavy male bias. Measured as females per 1000 males, the sex ratio has continuously declined since then, measuring 941 in 1961 and 932 in 1971. Early hypotheses included underenumeration of females and infanticide, especially of girls, as basic causes for the relative paucity of females. More recent studies have concentrated on the sex-selectivity of bio-demographic processes, especially mortality, as influencing (Visaria, 1971). The present study suggests that sex ratios are sensitive to a number of influences of differing spatial intensity, and that recognition of these intensities will not only permit a better understanding of sex ratio composition in

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the entire population structure, but also within India's spatial structure.

METHODOLOGY

For the 330 districts and other political units of India, data were collected for 46 variables of social, economic, environmental, and demographic import (Table 1). These data were subjected to a principal components analysis that explained some 75 percent of data variance by 11 factors (Table 2). These factors are identified as: I, Settlement Character; II, Age Structure; III, Matronism; IV, Rural Land Use and Tenure, V, Tribal-Christian Population; VI, Population Density; VII, Sikh Community, VIII, Hindu-Muslim Community; IX, Family Composition; X, Relocation-Frontier Areas, and XI, Labor-Occupational Structure. These factors may briefly be defined as structural groups underlying the total data assembly, each group being defined on the basis of associated variables. The importance of these factors in the study is that they are statistically independent, unlike the original variables, and that they are normally distributed, these conditions are prerequisite to the second strategy of analysis.

The factors were next subjected to multiple, step-wise regression analysis. This procedure allows for an ordering of factors according to their importance in explaining sex ratio variations in India. Here sex ratio was introduced as a dependent variable, while the previously-determined factors were the independent variables measured by factor scores. Not only may the ordered import of the factors be ascertained in the program, but their relative importance and direction of relationship with sex ratios may also be determined.

RESULTS OF STUDY

The results of the regression analysis indicate that nearly 75 percent of variation in India's sex ratios, as measured in 330 observation units, is explained by the simultaneous use of 9 of the 11 factors delineated by principal components analysis (Table 3).

As judged by order of entry and Beta weight, Matronism emerged as the most important factor to which sex ratios in India are sensitive; the

Table 1: Description of Variables employed

1 Population Density
2 % of Population Urban
3 % of Population Literate and Educated
4 % Change in Population, 1951-1961
5 % of Population Employed in Primary Industries
6 % of Population Employed in Secondary Industries
7 Housing Density
8 % of Population Employed in Tertiary Industries
9 % of Households with Married Son or Other Married Male
10 % of Households with Male as Head
11 % of Population Christian
12 % of Population Hindu
13 % of Population Muslim
14 % of Population Sikh
15 % of Population Dependent (0-14, 60+ Years)
16 % of Population Youthful (0-14 Years)
17 % of Population Old-Aged (60+ Years)
18 % of Population Speaking Regional Language(s)
19 % of Population Widows
20 % of Female Population 0-14 Years
21 % of Female Population 15-44 Years
22 % of Female Population 45+ Years
23 Ratio of Households to Houses
24 Household Density
25 % of All Industries Run by Electricity
26 % of Female Population Never Married
27 Ratio of Female Workers to Male Workers
28 % of Population Non-Workers
29 % of Population Living in Villages Under 500 Population
30 % of All Cultivating Households Pure Tenancy Holdings
31 % of All Census Houses Used as Medical Institutions
32 % of All Households engaged in Cultivation Only
33 % of Population in Scheduled Tribes
34 % of Population in Scheduled Castes
35 % of Population Spatially Immobile
36 % of Population Intra-District Migrants
37 % of Population Inter-District (Intra-State) Migrants
38 % of Population Inter-State Migrants
39 % of Migrants at Enumeration Site One Year or Less
40 % of Households Single Member
41 Index of Housing Congestion
42 % of All Workers at Cultivation Hired Workers
43 Cultivators and Agricultural Laborers per 100 Acres of Net Area Sown
44 % of All Cultivating Households Cultivating 0-5 Acres
45 Miles of Surfaced Roads per 1,000 Square Miles
46 Allopathic Doctors per 1 Million Population

Source: Author's compilation from 1961 CENSUS OF INDIA

relationship is positive. Matronism defines an older, female population, including widows. The factor thus becomes an essentially demographic index, measuring differential mortality. Mortality is especially lethal for women of childbearing ages, one suggestion being that nearly 10 percent of females die at some point in childbirth (Visaria, 1967, 343). Such a condition significantly depresses the sex ratio, and suggests that if the threshold of post-childbearing years can be attained, a more balanced sex structure will result. This factor may also indicate those areas where female infanticide has not been a problem.

The Sikh religious community is revealed as the second most important factor influencing sex ratios, with a negative relationship, i.e., the greater the Sikh ambience, the lower the sex ratio. Organization of Sikhs, whether societal or biological, is imperfectly understood regarding their sex disparity; however, it will suffice to note that the Sikh character has traditionally been martial, and this condition may lend itself to either a real or apparent male numerical advantage.

The settlement factor defines an urban-rural continum; its entry in the regression analysis is third, and negative. Thus, urban areas tend toward masculinity, while rural areas tend toward femininity. Important here is the consideration that this factor exhibits a spatial structure with regard to sex ratios in India opposite that known in the Western experience: U.S. cities, for example, are more feminine and U.S. rural areas are more masculine (Thompson and Lewis, 1965, 78). It can also be noted that analysis of residuals indicates that urban areas of South India are significantly under-estimated, thus suggesting some regional bias in this factor's relationship to sex ratios and need for further study. On the one hand, differences in the availability of housing may influence the family composition of migration streams to urban areas; on the other, family composition to such streams may be a function of religious differences in religious orthodoxy among the majority Hindu population. Another matter warranting closer attention, though not explicity a facet of this study, is the influence of differing functional bases on sex ratios in urban systems.

Fourth-ordered in relation to sex ratios is Rural Land Use and Tenure, which is functionally negative. Higher sex ratios are maintained by

Table 2: Factor Loadings and Communalities of Variables

Variable	Factor I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Communality
2	.35	.10	-.09	.21	-.02	.24	-.04	.02	.11	-.05	.15	.66
8	.78	.19	-.11	-.09	.10	.28	.03	.02	.05	-.02	.19	.80
3	.75	-.06	.07	-.26	.31	.16	-.08	.11	.03	.05	.18	.81
32	-.74	-.13	.08	.02	-.14	-.03	-.06	.06	.06	-.31	-.18	.74
46	.69	-.02	-.13	.01	-.01	.45	.15	-.04	-.00	.01	.08	.73
25	.67	-.10	-.12	.05	.07	.05	.26	-.01	.06	.00	.17	.58
37	.51	.19	-.18	.34	-.15	-.13	.14	.20	.21	.00	.11	.60
6	.50	.07	.23	.04	.03	.01	-.21	-.36	-.09	.43	.01	.66
40	.44	.30	.13	.21	-.31	-.04	.20	.18	-.28	.10	-.23	.66
15	-.10	-.91	.06	.05	.01	-.14	.08	.02	-.02	-.21	.08	.92
16	-.11	-.89	-.24	.09	.03	-.12	-.04	-.04	-.02	-.22	.08	.94
21	.07	.87	-.09	.01	.10	.04	-.13	-.10	.06	-.02	-.18	.85
20	.03	-.68	-.65	.07	.06	-.01	.13	-.07	-.06	.01	.10	.93
22	-.08	.06	.87	-.10	-.17	-.01	-.04	.16	.03	.02	.03	.84
17	-.05	-.13	.82	-.10	-.05	-.08	.35	.01	.01	-.03	.03	.84
4	.24	-.28	-.63	-.05	.00	-.08	.01	.09	-.16	.13	-.14	.62
19	-.10	.13	.55	-.03	-.13	.23	-.51	.26	-.26	-.09	.12	.82
10	-.06	.08	-.52	.35	-.18	-.02	.30	.04	.09	-.25	.06	.60
3	.45	.30	-.46	-.08	-.08	.22	.08	.13	-.02	.38	-.14	.76
44	-.14	.21	.22	-.77	.06	-.08	-.03	-.21	.04	-.07	-.15	.79
30	.08	-.09	-.07	-.60	.24	-.01	-.01	.07	-.15	.08	.05	.47
43	-.17	.22	.21	-.57	.01	-.09	.06	-.11	.03	-.06	-.54	.77
42	.14	.16	.05	-.55	.04	-.15	-.30	.12	-.03	-.18	.40	.67
41	-.06	-.12	.16	-.39	-.34	-.07	.34	-.17	.37	.17	-.08	.64
11	.07	.03	.06	-.19	.76	.00	.12	-.07	.04	-.01	-.09	.64
9	-.33	-.11	.09	.13	-.66	.07	.09	-.21	.31	.06	.03	.74
26	.37	-.30	-.32	-.22	.61	.05	.25	-.16	-.08	.09	.03	.86
33	-.29	.10	-.27	.03	.54	.05	-.02	-.02	-.03	.16	-.44	.69
34	.01	.02	.01	-.12	-.46	-.01	.27	.28	-.23	-.19	.29	.55

Table 2 (continued)

Variable	Factor I	II	III	IV	V	VI	VII	VIII	IX	X	XI	Communality
1	.34	.15	.02	.09	-.00	.89	-.04	-.03	.09	-.04	.01	.94
24	.34	.16	.02	.09	-.00	.88	-.04	-.02	.09	-.04	.01	.94
14	.17	-.15	.07	.14	.10	-.03	.76	.08	-.08	.03	.18	.71
13	-.04	.02	-.12	-.07	-.10	.01	-.10	-.86	-.02	.01	.15	.81
12	-.09	-.05	.03	.04	-.50	.03	-.38	.67	.06	-.04	-.03	.87
35	-.39	-.20	.36	-.10	.16	-.04	-.20	-.53	.13	-.34	.07	.81
36	-.42	-.10	.30	.04	-.09	-.21	-.30	.51	-.12	-.00	-.12	.70
23	.14	.08	.15	.16	-.10	.02	-.07	.02	.87	-.13	.00	.86
7	-.05	.06	-.12	-.01	-.05	.08	.11	-.05	.84	.34	.14	.90
45	.30	.06	.03	-.01	.18	.35	-.11	.10	.51	-.20	.09	.58
39	.08	.18	.01	.06	.03	-.15	.02	-.00	.05	.65	-.11	.50
31	.13	.42	-.37	-.16	.16	.18	.16	.09	.11	.58	.13	.81
28	.33	-.20	.03	-.17	-.08	.03	.18	-.15	.09	-.16	.76	.84
18	-.04	-.10	.17	.18	-.13	-.01	.03	.03	.01	.02	.73	.62
27	-.28	-.02	.24	.05	.24	-.08	-.38	.20	-.11	.01	-.64	.80
5	-.56	.01	.07	.12	.02	-.14	-.16	.21	-.13	-.20	-.61	.85
Eigen Value	8.60	5.11	4.48	3.67	2.89	2.32	1.85	1.72	1.51	1.33	1.08	
% Total Variance												
Individual	18.7	11.1	9.7	8.0	6.3	5.1	4.0	3.7	3.3	2.9	2.3	
Cumulative	18.7	29.8	39.5	47.5	53.8	58.9	62.9	66.6	69.9	72.8	75.1	
% Common Variance												
Individual	24.9	14.8	12.9	10.6	8.4	6.8	5.4	4.9	4.4	3.8	3.1	
Cumulative	24.9	39.7	52.6	63.2	71.6	78.4	83.8	88.7	93.1	96.9	100.0	

Source: Author

Table 3: Results of Regression Analysis

Step	Variable Entered	R	R^2	Contribution to R^2	Partial-b Regression Coefficient	Standard-β Regression Coefficient
1	MATHON	.497	.247	.247	38.02	.497
2	SIKHJI	.642	.413	.166	-31.20	-.407
3	SEITLE	.731	.534	.121	-26.66	-.348
4	HOUSE	.778	.605	.071	-20.39	-.266
5	COMMUN	.809	.654	.049	17.01	.222
6	TRICHR	.838	.701	.047	16.60	.217
7	AGESTR	.854	.729	.028	-12.79	-.167
8	DENSTY	.860	.740	.011	- 7.93	-.104
9	LABOCU	.863	.745	.005	- 5.59	-.073

Test for R: $F_{.05}$ (9, 320 df) = 2.41; F-Value = 103.8*

Test for b's: $t_{.05}$ (319 df) = 1.97; all b's*

MATHON = Factor III
SIKHJI = Factor VII
SEITLE = Factor I
HOUSE = Factor IV
COMMUN = Factor VIII
TRICHR = Factor V
AGESTR = Factor II
DENSTY = Factor VI
LABOCU = Factor XI

Source: Author

minimal acreages of cultivating households, little tenancy, and an absence of hired labor; these conditions seem to represent a subsistence type of agriculture. Opposite conditions depress the sex ratio.

The Hindu-Muslim Community factor is fifth, with a positive relationship: a greater Hindu proportion promotes a more balanced sex ratio, while a great Muslim proportion promotes disequilibrium. Muslims, like the Sikhs, are a minority community; apparently the prevailing sex structure is exaggerated in minority groups.

The Tribal-Christian factor enters sixth with a positive relationship. In addition to tribal and Christian population, unmarried females and an orientation toward nuclear rather than extended families are included. Behavior of this factor regarding sex ratios may indicate an exception to the notion of minority groups' having an exaggerated version of the national sex structure.

Age Structure enters the regression analysis seventh, and is negatively related. Positive factor scores here define the older end and negative scores define the younger end of the age spectrum. Thus, Indian society generally becomes more masculine as it grows older, substantiating the presence of high female mortality at perhaps all ages, and again displaying a component polar to Western expectations.

The relationship of the eighth factor entered, Density, is negative to sex ratios. High density situations, including urban areas, are predicted low sex ratio areas, i.e., having a strong masculine component.

The last factor of significance is Labor and Occupational Structure, and is negative. Non-workers and non-primary labor categories, both characteristic of urban situations, depress the sex ratio, while small village situations, including agricultural laborers, cultivators, and, again, tribal peoples, tend to generate a more balanced sex structure.

CONCLUSIONS

This study suggests that some factors have import for the national sex ratio structure. Minority (non-Hindu) groups generally are associated with an imbalanced sex structure, they also display higher growth rates in India, and some Hindu opposition to birth control measures have been directed toward this consideration. Should the growth differential con-

tinue, the gap in the relative balances of the sexes may be expected to widen. Vital processes, especially mortality, are also confirmed as strongly influencing sex structure. A potential value of the study lies in the ordering of the relative importance of several factors not previously considered in combination. The study also suggests that other factors have import only in local or regional context, e.g., in urban systems where sex ratios are likely not "natural," but rather a function of sex-biased migration streams involved in city-hinterland relationships. By further analysis of the results of both principal components and multiple regression techniques, the complex population structure of India and its relationship to sex ratios may be better understood in its spatial structure as well.

REFERENCES CITED

Thompson, Warren S. and David T. Lewis, Population Problems (5th ed.; New York: McGraw-Hill Book Company, 1965).

Visaria, Pravin M., "The Sex Ratio of the Population of India and Pakistan and Regional Variations During 1901-1961,"; Patterns of Population Change in India, 1951-61, ed. by Ashish Bose (Calcutta: Allied Publishers, Private, Ltd., 1967).

_____, Census of India: 1961, Vol. I, Monograph No. 10, The Sex Ratio of the Population of India (New Delhi: Office of the Registrar General, 1971).

CANONICAL ANALYSIS OF CRIME AND THEIR SOCIO-ECONOMIC INDICATORS

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ABSTRACT: - This study describes and interprets patterns of association between crime components and their socio-economic indicators. The attempt to relate criminal incidents to socio-economic characteristics may highlight some of the social and economic variables significant in generating and promoting crime in general. This study does not construct a theoretical framework to account for the incidents of crime in a casual manner.

The crime components for 203 S.M.S.A.s for 1970 and their socio-economic attributes from the basis for the canonical analysis. The variables used in this study to explain criminal incidents can at best be considered characteristics with respect to which criminal occurrences vary. The presence of such factors does not guarantee the occurrences and the absence of these variables does not ensure their non-occurrence.

The main purpose of this study is to describe and interpret significant patterns of association between components of crime and their possible socio-economic determinants. As criminal offenses, like other social offenses, are the resultant effect of social and economic processes inherent in the society, the attempt to relate criminal incidents to socio-economic characteristics may highlight some of the social and economic variables that might be significant in generating and promoting crime in general.

CANONICAL ANALYSIS

The crime components for S.M.S.A.s for 1970 and their socio-economic attributes form the basis for the canonical analysis in this study.

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Canonical analysis is an explanatory model with great potential for geographic research, with specific reference to geography of crime.

Geographical research in the past has not made much use of canonical correlation technique. Lately, however, a number of geographic studies have been based on the canonical correlation model (Ray and Lohnes, 1970). Berry's (1966) study of interaction in India, Gauthier's analysis of the relationship between development of road networks in Brazil and regional economic development (Gauthier, 1968, 77-94), as well as Ray's (1970) study of spatial interrelationships of economic and cultural differences in Canada are some of the studies based on canonical analysis. Another recent study based on canonical correlation is that of Freeman (1973).

In some respects canonical correlation is similar to factor analysis-both are based on the construction of linear functions which consist of the elements of the original variables. The main difference, however, rests on the nature of retrieving the structural elements. Factor analysis operates on maximum variance, whereas the canonical model operates on maximum covariance between the two sets of variables under investigation (Cooley and Lohnes, 1971, 169).

Given two sets of variables, X_i and Y_j, canonical correlation computes two linear transformations:

$$P = \sum_{i=1}^{n} p_i X_i = p_1 X_1 + p_2 X_2 + \ldots p_n X_n$$

$$Q = \sum_{j=1}^{m} q_j Y_j = q_1 Y_1 + q_2 Y_2 + \ldots q_m Y_m$$

such that the correlation between P and Q is maximized (Monmonier and Finn, 1973, 140). This correlation is referred to as the canonical correlation. The coefficients p_i and q_j are the canonical variates or the weights used to indicate the relative importance of the original variables in the linear expressions. The canonical weights are similar to the beta weights (standardized beta coefficients of a multiple regression). For clarity, one set is termed the criterion set, while the other is termed the predictor set. The criterion set is composed of those variables whose spatial variations are to be explained, while the predictor set constitutes the variables whose spatial variations serve as

the basis for explanation. In this study, for instance, the components of crime serve as the criterion set, and the socio-economic attributes form the predictor set. Designating the criterion set by P and the predictor set by Q, it is possible to obtain the expected values for P and Q by evaluating the linear equations for each observation using Z-scores from the original data (Monmonier and Finn, 1973, 140). Thus, we can compute the canonical weights for variable C as:

$$P_c = \sum_{i=1}^{n} p_i X'_{ci}$$

$$Q_c = \sum_{j=1}^{m} q_j Y'_{cj}$$

where X' and Y' are the variables standardized to a mean of zero and a standard deviation of one.

In essence the canonical model extracts the significant elements of structure within the predictor set and the criterion set in a way so as to yield maximum correlation. Pairs from the predictor and the criterion sets are combined to form canonical vectors. The first of these vectors is derived in such a way that the elements of the predictor and the criterion sets have the maximum correlation; the correlation declines with subsequent vectors. The elements of the criterion and the predictor sets have a loading on the canonical vector. This loading represents the correlation of the original variable with the newly formed structural dimension (Freeman, 1973, 126). The structural relationship as represented by the canonical vector may be interpreted in terms of the magnitude and the sign of the loadings of each of the factors.

CANONICAL PATTERNS OF ASSOCIATION BETWEEN CRIME COMPONENTS AND SOCIO-ECONOMIC CHARACTERISTICS

The result of the aggregate canonical correlation is presented in the last row of Table 1. This table shows the patterns of association between socio-economic attributes and crime components. Loadings of elements of both the sets, on the first through the last canonical vectors, are presented as columns in Table 1. All loadings greater than 0.4500 (in absolute terms) have been underlined. In the interpretation

Table 1: Aggregate Canonical Analysis (1970)*

Factors	Canonical Vectors						
	I	II	III	IV	V	VI	VII
Predictor Variables							
% Non-white	0.9531	0.1003	-0.0118	0.0380	-0.1798	0.0110	-0.0759
% Children living with both parents	-0.8068	-0.2161	0.3654	-0.2348	-0.0736	-0.0872	0.0887
% Migrant	0.1566	0.0973	0.0040	-0.2432	0.1868	-0.1431	0.1327
Married women as % of labor force	0.2810	-0.0431	0.0450	0.3030	0.0089	0.0289	0.8761
% Unemployed	-0.3628	0.5057	-0.2569	0.0501	0.1124	0.2248	-0.3966
% in Manufacturing	-0.1980	-0.5745	0.5576	-0.0572	0.0274	-0.1361	-0.0497
% in White collar occupation	0.1508	0.6399	0.0464	0.2694	-0.3241	-0.2523	0.2797
% with Income less than $3,000	0.4644	-0.1350	-0.6856	0.3003	0.2116	-0.1026	-0.3366
Criterion Variables							
Homicide	0.9776	0.1108	0.0268	0.0160	0.1361	0.1007	0.0485
Forcible rape	0.4706	0.7007	0.0261	0.0183	0.0688	-0.5218	-0.0975
Robbery	0.4778	0.4332	0.6507	0.0488	-0.3406	-0.0540	-0.1982
Aggravated assault	0.6976	0.2445	-0.3135	0.1913	-0.5196	-0.2172	0.0408
Burglary	0.3646	0.8031	-0.0298	0.4033	0.0469	0.1596	-0.1757
Larceny	0.1640	0.9042	-0.0517	-0.1064	-0.1907	0.2213	0.2373
Auto theft	0.2647	0.4048	0.6146	0.5008	0.0589	-0.1191	0.3462
CANONICAL CORRELATION	0.7980	0.6760	0.5060	0.2600	0.2310	0.2120	0.1350

*Based on standardized values for 203 S.M.S.A.s. Loadings greater than 0.4500 are underlined.

of the canonical correlation output, the emphasis rests with the dominant patterns of association. In most cases, the researcher does not need to explain all the canonical vectors. To decide on the significant vectors to be interpreted, a Wilke's Lambda was calculated and a chi-square test of significance was performed. Only vectors whose contribution to the explained variance is significant at the .05 level of confidence are interpreted. Only three vectors are significant, and, therefore, only these are interpreted and discussed.

To introduce the spatial dimension into the analysis, canonical scores associated with the k significant canonical weights were mapped and discussed. The pairs of canonical scores are computed as:

$$(S_1) = (C^*) \times (M_1)$$

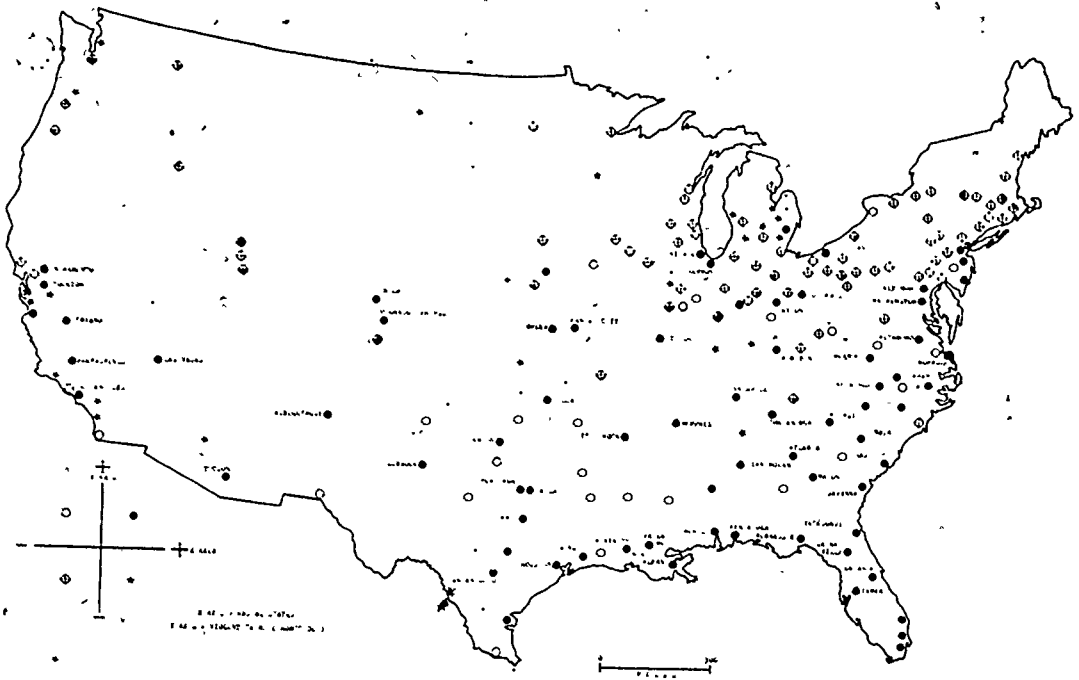
$$(S_2) = (P^*) \times (M_2)$$

where C* is an n x m_1 matrix of standardized values of the criterion set; P* is an n x m_2 matrix of standardized values of the predictor set; and S_1 and S_2 are both n x m_2 matrices of canonical scores. For mapping purposes, a fourfold category was developed. centers that score positively on both S_{1i} and S_{2i}, centers that load positively on the criterion set but negatively on the predictor set, centers with negative and positive scores on both the criterion and the predictor sets, respectively; and centers with negative scores on both sets.

ANALYSIS OF THE CANONICAL VECTORS

The first vector extracted from the canonical analysis reveals strong association between racial component, family cohesiveness and economic poverty of the predictor set with elements of violent crimes, specifically homicide and aggravated assault, of the criterion set (canonical correlation being .798). The strong association of the family cohesiveness in vector one enforces the notion that stability in the family does in many subtle ways dampen criminal offenses. The spatial pattern of violent crimes in conjunction with the socio-economic variables is depicted in Figure 1. Even a casual observation reveals a heavy concentration in the South of those centers that score positively on both axes. About 80 percent of the sample urban nodes in this region showed positive loading

Figure 1: Racial Status and Violent Crime (Homicide): 1970



on both the violent crime and the racial components. Path analysis revealed that the association of the racial component with violent crime is the manifestation of other intervening variables, the most important of which was economic poverty.

The second canonical vector highlights the relationship between occupational structure and property crime, and the spatial pattern is depicted in Figure 2. With the exception of California and Florida, the distribution shows more or less a random pattern suggesting that occupational structure alone may not adequately explain the spatial configuration of the crime components.

The third canonical vector reveals the association between economic poverty and property crime. It is apparent from Figure 3 that the highest concentration of centers that scored positively on both the axes is in the South. Most of these centers are characterized by large proportions of families with income less than $3,000 per year, poor housing, family disintegration, and relatively poor educational and social programs.

CONCLUSION

This study raises more questions than it answers. It is evident from the preceeding analysis that socio-economic variables may effectively account for the spatial variation of the crime components. But to derive more meaningful relationships between socio-economic characteristics and the criminal incidents, further research has to be done at the micro level, incorporating other pertinent variables.

ACKNOWLEDGMENTS

The contribution of Professor Milton E. Harvey of Kent State University, Geography Department, in preparing this study is most gratefully acknowledged. It was his idea to map the canonical scores so as to retrieve a meaningful spatial pattern. Indeed, without his help, this study would have never achieved its present form.

REFERENCES CITED

Berry, Brian J. L., Essays on Commodity Flows and the Spatial Structure of the Indian Economy, Chicago: Univ. of Chicago, Department of Geography Research Paper No. 111 (1966).

Figure 2: Occupational Structure and Property Crime: 1970

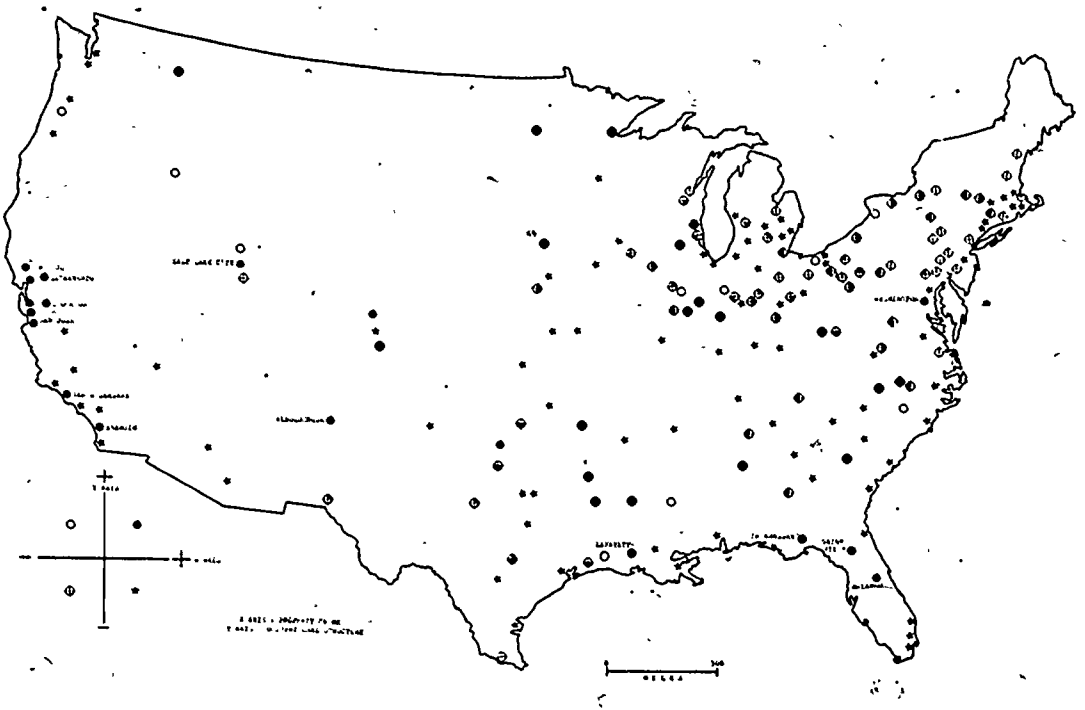
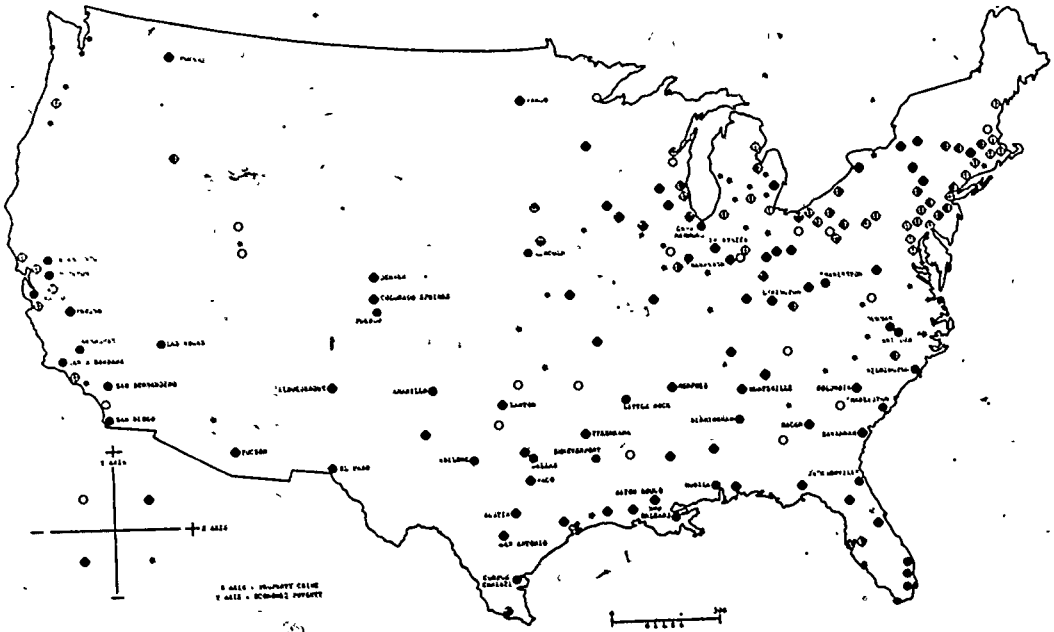


Figure 3: Economic Poverty and Property Crime: 1970



Cooley, William W. and Paul R. Lohnes, Multivariate Data Analysis, New York: John Wiley & Sons, Inc., 1971.

Freeman, Donald B., International Trade, Migration and Capital Flows, Chicago: Univ. of Chicago, Department of Geography Research Paper No. 146 (1973).

Gauthier, Howard L., "Transportation and the Growth of Sao Paolo Economy," Journal of Regional Science, Vol. VIII, No. 1 (1968), pp. 77-94.

Monmonier, Mark S. and Fay Evanko Finn, "Improving the Interpretation of Geographical Canonical Correlation Models," The Professional Geographer, XXV (May, 1973), pp. 140-142. For a rigorous derivation of the model see Theodore W. Anderson, An Introduction to Multivariate Analysis. (New York: John Wiley & Sons, Inc., 1958); Harold Hotelling, "Relations Between Two Sets of Variates," Biometrika, XXVIII, pp. 321-377.

Ray, D. Michael and Paul R. Lohnes. Canonical Correlation in Geographical Analysis. Unpublished research paper, State University of New York at Buffalo, November, 1970.

_____. The Spatial Relationships of Economic and Cultural Differences: A Canonical Ecology of Canada. Unpublished research paper, University of New York at Buffalo, 1970.

A SPATIAL PERCEPTION STUDY OF CINCINNATI: A VIEW FROM NEWPORT

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ABSTRACT: - In attempting to understand human interactions and behavior within an environment, it is important to study and analyze the individuals involved in this behavior. This paper was undertaken to investigate the spatial preferences of a specific geographical group of individuals. To understand behavior, it is necessary to study the processes that initiate the behavior. In this case, the processes of concern are the action space of a group of individuals and their value judgement toward their geographical surroundings. Specifically, the group investigated consists of high school students in a community of the Cincinnati Metropolitan Area--Newport, Kentucky. The first aim of the study was to explore the students' spatial perception of the entire Cincinnati area and the second to investigate how the students perceive their Northern Kentucky surroundings.

The purpose of this paper is to investigate how a group of individuals' action space is related to their value judgement of a number of neighborhoods. Recent work in this behavioral framework has found that urban residents share "a common action space based on their perceptions of the residential quality of neighborhoods" (Johnston, 1972, 201). More specifically, action space has been defined as "the collection of all urban locations about which the individual has information and the subjective utility or preference he associates with these locations" (Horton and Reynolds, 1971a, 37). Closely related to the concept of action space is activity space which is the area in which an individual has his usual spatial behavior. Johnston has stated that evidence suggests that activity spaces should be sectoral in form (Johnston, 1972, 201).

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One of the basic questions in this investigation is how do individuals view the area in which they live. According to Adams, each individual has a mental image of the city which is sectoral in form. Although he has no empirical verification for this conclusion, he deduced that an individual's mental image of a city emphasized the portion of the urban area in which he lived and the area between his home and the CBD. This is the best known because it is frequently traveled for specific functions such as shopping, work, or recreation (Adams, 1969, 322). Empirical support for Adams' conclusions have been found by Donaldson by investigating intra-urban migration and its relation to urban mental maps. Through analysis of interview data Donaldson concluded that the respondents' mental image of their city was related to the sector in which they resided. Also, a similar bias existed in their housing search patterns and migrational destinations (Donaldson, 1973, 83).

In approaching a study of neighborhood perception, an overriding concern is territoriality and strong identity of local places. This issue provides a framework for personal and social integration. Along with the sense of identity is an emotional feeling of belonging in or to a specific area. Though communication opportunities for a person in an urban environment are widely scattered, the degree to which he takes advantage of these can be dependent on social class.

A recent study by Horton and Reynolds (1971b) closely parallels the investigation of this paper, but the major emphasis was to compare and contrast the preferences of residents in two different sections of the city. In so doing, they attempted to ascertain whether an individual's action space and residential desires were influenced by the socioeconomic status of his home neighborhood. The major conclusion of their study was that action space is more dependent upon neighborhood location of the city dweller than his income. Also, it was concluded that perception of residential quality is not a function of income, but of other factors such as ethnicity (Horton and Reynolds, 1971b, 90-102).

Using a sample survey, Johnston also investigated the preference patterns of urban dwellers. He concluded that the respondents agreed on the status of various suburbs in Christchurch, New Zealand, and also upon

the desirability of the suburbs as places to live. Since the two variables were highly correlated, Johnston concluded that the respondents assessed desirability in terms of socioeconomic status (Johnston, 1971, 68).

EMPIRICAL INVESTIGATION

The geographic area for this study was the Cincinnati Metropolitan Area and a group of high school students in Newport, Kentucky, was chosen as a study sample. Newport, itself, is an old river town that is losing or has lost much of its higher socioeconomic population to the more suburban Kentucky communities. Newport is in very close proximity to the CBD of Cincinnati and may be regarded as a zone of transition from the CBD to the suburbs. An intuitive generalization would be that Newport is primarily composed of the working class population and to a certain extent of the lower class. Also, it is believed that a large percentage of the population of Newport is composed of first and second generation migrants primarily from eastern Kentucky.

In a study which investigated the space and time preferences of a group of students, Gould found that the highest positive and negative associations were in the eastern part of the United States where the students had the most abundant information about the area because of their long residential history there (Gould, 1967, 271). If it can be assumed that this finding is applicable to a micro-level study, then it may be expected that the students of this investigation will have strong positive and negative responses toward areas about which they have the most information.

In approaching this study an attempt was made to integrate two emphases in perception studies. First, the investigation attempted to identify the action space of the study group and through this delimit the spatial extent of the behavior of the individuals. Secondly, the study endeavored to find the extent to which an individual's action space predetermined the way in which a group of individuals assess their preference space.

Spatial behavior and an individual's action space would be influenced by the social and geographical influences the individuals encounter on a day-to-day basis. Of importance in this regard is the fact that the indi-

viduals studies consisted of young people in their teen years; therefore, their action space is undoubtedly strongly influenced by their parents' action spaces. At this age the most important influence on the social situation is the educational institution which would limit their action space. The distance of necessary travel in the daily lives of these young people would be considerably less than an adult who may have quite a distance to travel to work.

Due to these factors, it is hypothesized that the group studies will possess a spatial concentration of their action space. Since the individuals share their main social institution, their information flow is both enhanced and inhibited by having much of their social contact taking place in this large group. Therefore, the action space of a group of individuals with a specific geographical location would be quite similar.

Action space was operationalized as Horton and Reynolds have done by determining how familiar or unfamiliar an individual is with a neighborhood. Because of the age of the group sampled, residential desirability was measured in terms of how the student liked or disliked the neighborhoods. It was believed that the simpliest possible constructs would be the best to utilize. Both of these constructs were measured by means of a semantic differential scale. The questionnaires consisted of the names of 72 neighborhoods in Northern Kentucky and Cincinnati. Eighty students were asked to rate each neighborhood on the two constructs by a seven-point scale. In order to counteract the influence these two questionnaires may have on each other, a predetermined sampling design was set up. In two classes the questionnaires were administered on the same day, but they were alternated as to which one was given first. In two other classes this alternation also was done, but a day lag time was interjected between the administering of the two questionnaires. With the last two classes, one questionnaire was given to each of two classes. The 72 neighborhoods were comprised of 50 Cincinnati neighborhoods and 22 Northern Kentucky neighborhoods. The names of the neighborhoods in the two areas were intermixed. The students were given separate maps of the two areas with the neighborhoods numbered on the map according to the number they were on the questionnaire.

The method of analyzing the results of the questionnaires was principal components analysis. This method was selected in order to find the general underlying structure of their cognitive image of the neighborhoods. Scores on the first unrotated principal component were utilized in analyzing this general trend of the responses. In the familiarity questionnaire the first component explained 39 percent of the variance, and in the questionnaire inquiring about the like or dislike of the neighborhoods the first unrotated component explained 15 percent of the variance.

For interpretation the scores were analyzed and mapped. From this analysis certain generalizations can be made. First, and as expected, Newport, the home community, rated the highest score indicating the greatest degree of familiarity as shown in Figure 1. Secondly, Figure 1 also shows that in general the farther a neighborhood was from Newport, the less familiar the students were with it. Thirdly, Newport students are more familiar with neighborhoods south of Newport than those west of their home community also indicated in Figure 1. Possibly the river on the western boundary of the city acts as a barrier.

From Figure 2 it is evident that all of the neighborhoods in Cincinnati fell within the low or relatively unfamiliar range of scores. In general the students were more familiar with neighborhoods in close proximity to the CBD of Cincinnati as indicated in Figure 2. These neighborhoods would also be closest to their home community. Figure 2 supports the conclusion that with regard to familiarity with the neighborhoods, the river and state boundary act as a barrier in the students' interaction with the metropolitan area.

The results of the like-dislike polarization are not as conclusive since only 15 percent of the variance was explained by the first principal component. In general, as shown in Figure 3, the students had a favorable feeling toward their home community of Newport and other nearby Kentucky neighborhoods. However, some of the Northern Kentucky neighborhoods which were familiar to [redacted] students were extremely disliked. This finding validates what was hypothesized. The rather surprising finding

FIGURE 1

FAMILIARITY WITH KENTUCKY NEIGHBORHOODS

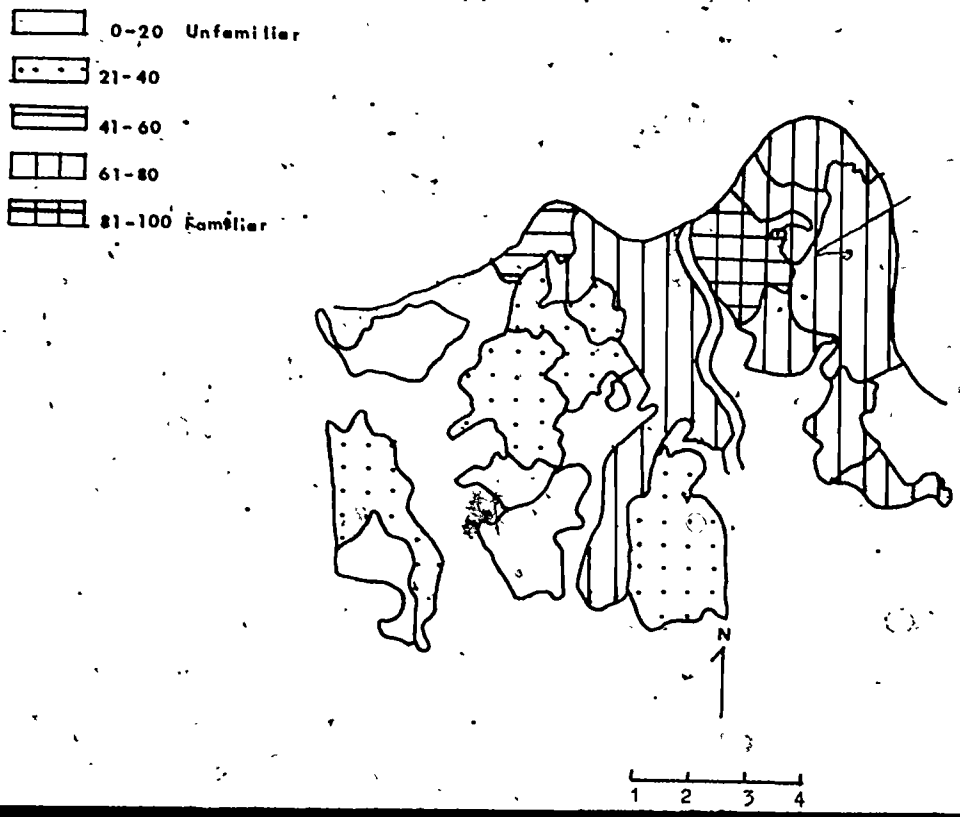


FIGURE 2
FAMILIARITY WITH CINCINNATI NEIGHBORHOODS

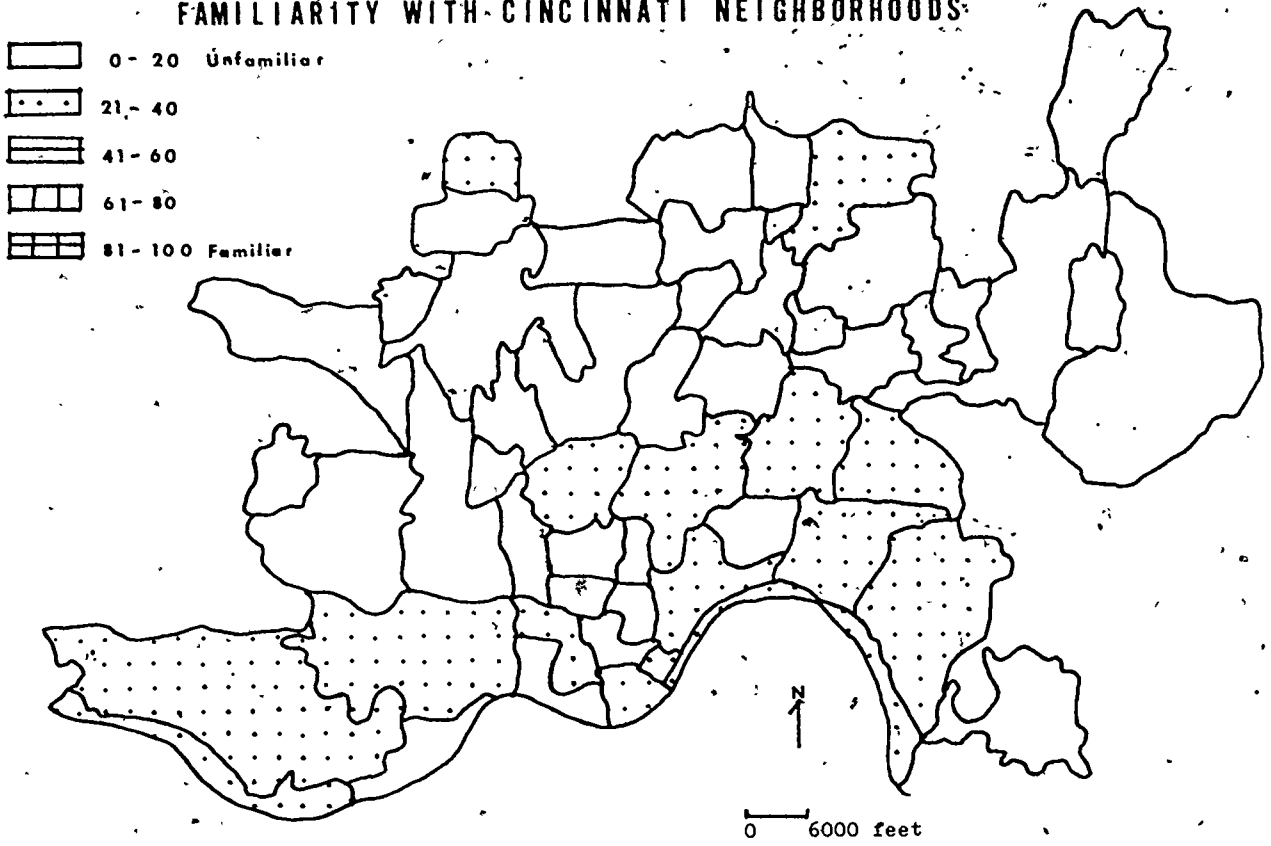


FIGURE 3
DESIRABILITY OF KENTUCKY NEIGHBORHOODS

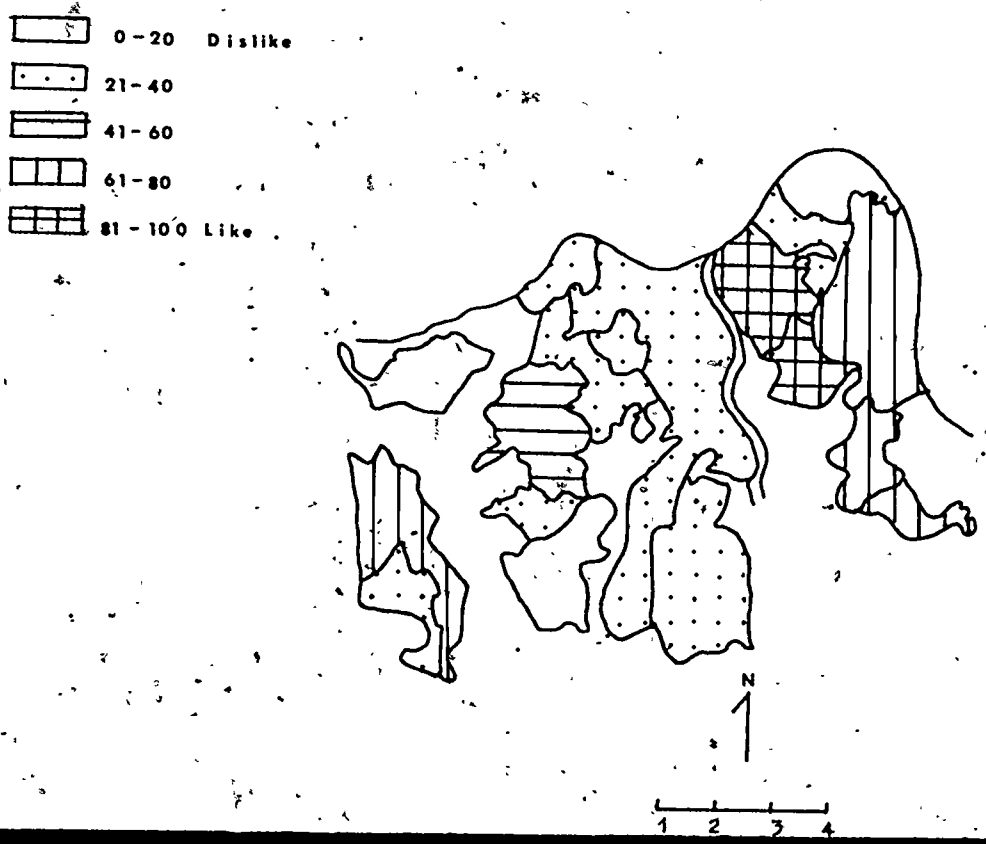
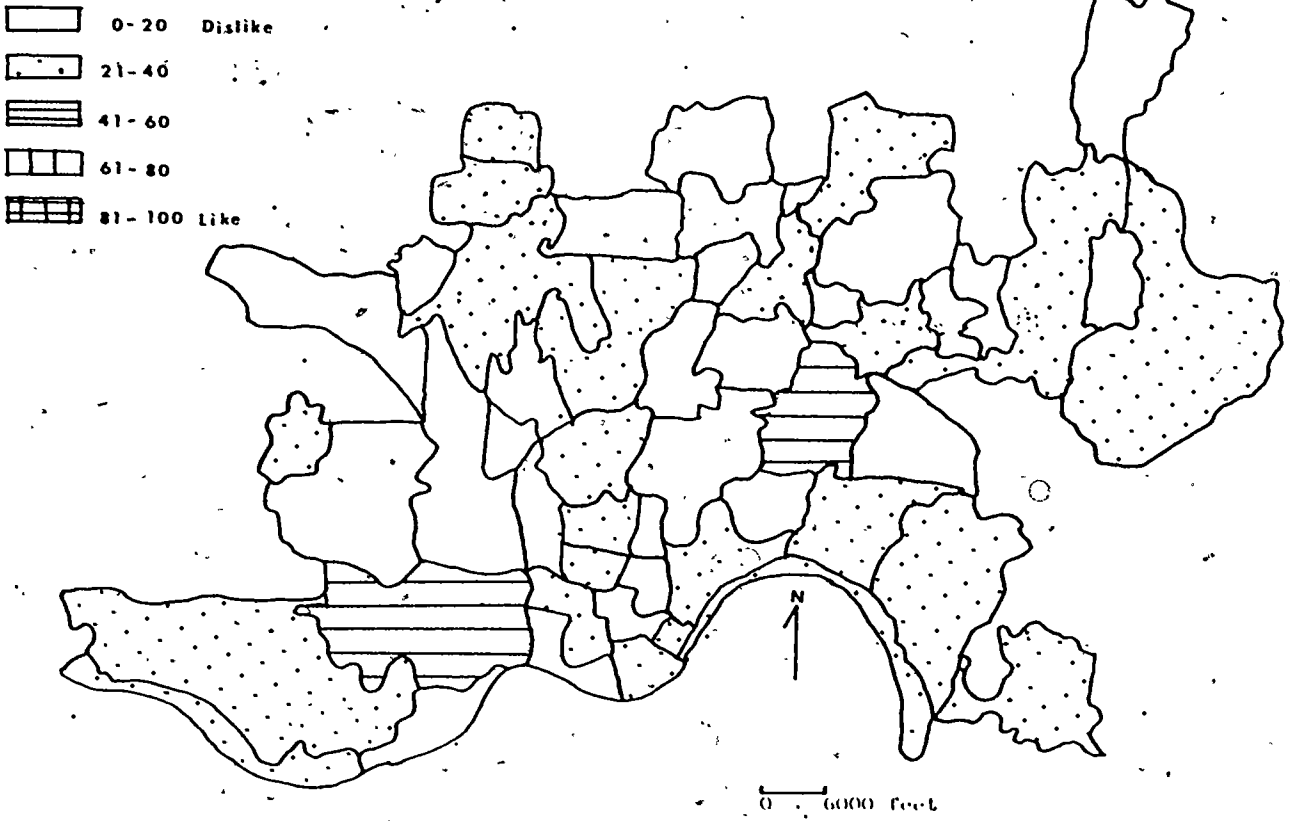


FIGURE 4
DESIRABILITY OF CINCINNATI NEIGHBORHOODS



was that even though the students were not familiar with the Cincinnati neighborhoods, they judged them as being areas they disliked as Figure 4 illustrates.

One last aspect of the analysis was to correlate the scores of the two questionnaires. The correlation coefficient was .72; therefore, approximately 50 percent of the variation was explained by a linear relationship between familiarity and the value judgement. From this, one of the hypotheses would be rejected. Instead of the students strongly liking or disliking areas with which they were most familiar, the students tended to like a neighborhood if they were familiar with it. The hypothesized conclusion would have been an U-shaped curve, whereas the final results gave a linear relationship. This confirms what has already been stated that the students were not familiar with Cincinnati and did not like it, but were familiar with most of the Northern Kentucky neighborhoods and liked them.

CONCLUSIONS

In general most of the hypothesized conclusions were confirmed through the data analysis. The students sampled seemed to have a similar action space as evidenced by the percent variance explained on the first unrotated principal component. Their action space could also be termed sectoral in form since it consisted primarily of the home community, Newport, and other neighborhoods that were in close proximity to their home. The important point to be made was that this sectoral bias consisted of Northern Kentucky neighborhoods. The action space of the group would be termed spatially concentrated since results showed that the students had minimal information about neighborhoods that were increasingly distant from Newport and also on the Ohio side of the river.

Further work could be undertaken with this type of study to compare adult and student results on the same method of analysis. Also, it would be interesting to compare the results of a study ascertaining the action space and residential desirability to the migrational patterns of Appalachians that have moved to urban areas. Understanding human behavior is such a complex phenomenon that any study concerned with it will always raise more questions and lead one to further work.

REFERENCES CITED

Adams, John S., "Directional Bias in Intra-Urban Migration," Economic Geography, Vol. 45 (October, 1969), pp. 302-323.

Donaldson, B., "An Empirical Investigation into the Concept of Sectoral Bias in the Mental Maps, Search Spaces and Migration Patterns of Intra-Urban Migrants," Geografiska Annaler, Vol. 55 (Series B, 1973), pp. 13-33.

Gould, Peter, "Structuring Information on Spacio-Temporal Preferences," Journal of Regional Science, Vol. 7 (Supplement, 1967), pp. 259-274.

Horton, Frank and David R. Reynolds, "Effects of Urban Spatial Structure on Individual Behavior," Economic Geography, Vol. 47 (January, 1971a), pp. 36-48.

Horton, Frank and David Reynolds, "Action Space Differentials in Cities," in Perspectives in Geography 1--Models of Spatial Variation, ed. by Harold McConnell and David W. Yaseen (Dekalb, Ill.: Northern Illinois University Press, 1971b), pp. 83-104.

Johnston, R. J., "Activity Spaces and Residential Preference: Some Tests of the Hypothesis of Sectoral Mental Maps," Economic Geography, Vol. 48 (April, 1972), pp. 199-211.

_____, "Mental Maps of the City: Suburban Preference Patterns," Environment and Planning, Vol. III, No. 1 (1971), pp. 63-71.

BLACK CARIBS IN TWO SOCIETIES: DIFFERENTIAL ACCULTURATION RATES

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ABSTRACT: - This study examines the social position of Black Caribs in two communities: Punta Gorda, Belize, and Livingston, Guatemala. It demonstrates that there are significant differences in attitudes to language, wage labor; and locational preference which have implications for physical, social, and economic mobility. In short, Belizean Caribs are being integrated into a national society at a more rapid rate than Guatemalan Caribs.

Of the many processes of change operating in the world, two tend to predominate. The first of these is integration. Though it may cover a large range of human relationships, in its broadest sense it refers to welding and holding a society together (Weiner, 1971:180). Undoubtedly, its most common meaning is political integration which we may define as the process of bringing together culturally, socially, and/or spatially discrete groups into a single territorial unit and of establishing a national identity. For the many newly independent countries of the world today, the success of such a process is critical to their continued existence. Leaders in these states actively attempt to foster a national society by creating a sense of territorial nationality which overshadows or eliminates parochial, regional, and/or ethnic loyalties.

The second and perhaps more fundamental process is acculturation. As with integration, the concept is multidimensional and not precise. The term is most often used for "the process of interaction between two societies by which the culture of the society in the subordinate position

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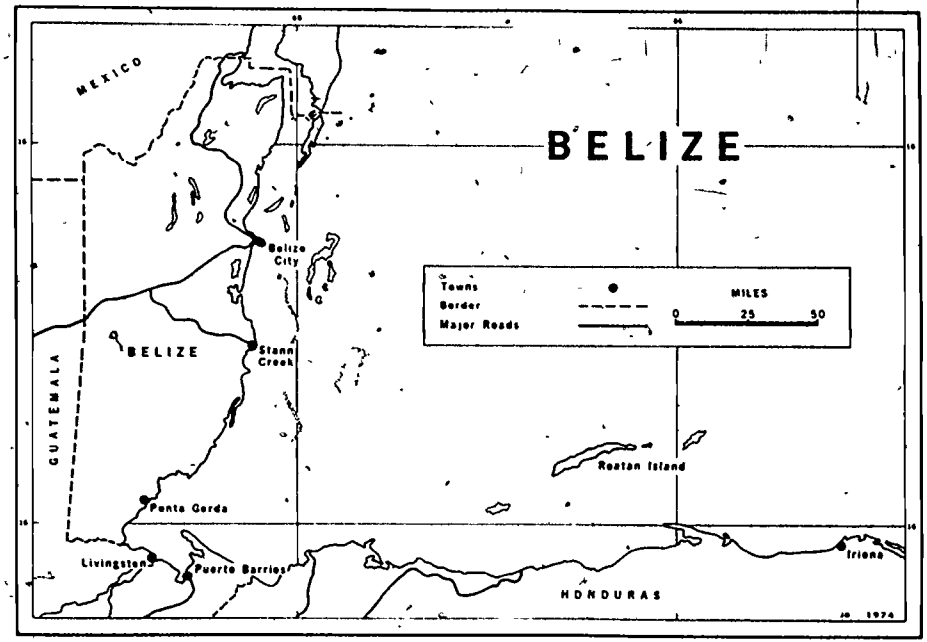
[called the recipient] is drastically modified to conform to the culture of the dominant society [called the donor]" (Hoebel, 1966:559). The process tends to be selective because the entire culture of either group is seldom available to the other and because the flow may not be unidirectional. We should stress, nevertheless, that it is the nature of the definition that the recipient society is the one undergoing the most change and that the change is in the direction of convergence with the dominant or donor society.

The significance of these two processes varies greatly over the world. In countries or states which have plural societies they may tend to reinforce and support each other, speeding the creation of a state having a single national identity which corresponds with a particular territorial unit. Most studies of integration focus on the state and attempt to analyze the way in which political cohesion is occurring. However, there are other avenues of exploration, concerned more broadly with acculturation, which may offer significant insights. In this study we will focus on one group and within it examine the indicators of change which would point to acculturation and national integration.

The general objective of our study was to examine the Black Carib people as an ethnic group found in two countries, each with different cultural, social, economic, and political characteristics. Specifically, we wanted to determine if there were differential acculturation rates between the Black Caribs in Belize and those in Guatemala, and to attempt to offer explanations for the observed differences. As representative of the Black Caribs in the two countries we chose the communities of Punta Gorda, Belize, and Livingston, Guatemala. We are using the data gathered in these communities as surrogates for the entire country, recognizing there may be exceptions.

BLACK CARIBS IN BELIZE AND GUATEMALA

The Black Caribs originated from the union of escaped African slaves and Carib Indians on the island of St. Vincent, beginning about 1625. In 1796, five thousand of them, virtually the whole population, were deported from St. Vincent to Roatan Island, off the coast of present-day Honduras, for rebelling against British colonial rule. Shortly afterwards they


BELIZE
MEXICO
GUATEMALA
HONDURAS
Belize City
BELIZE
Stann Creek
Punta Gorda
Livingston
Puerto Barrios
Roatan Island
Trionfo
Towns
Border
Major Roads
MILES
0 25 50
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moved to the mainland and began expanding northward along the coast. By 1802, they were in the colony of British Honduras (now Belize) and in 1820, Punta Gorda and Livingston were founded. Today, the extent of their settlements is from Stann Creek, Belize on the north to Iriona, Honduras on the south (Gonzalez, 1969: 17-30).

Though the Black Caribs have African physical traits, they carry the culture of the Carib Indian and speak a language that is basically Arawak. They have been primarily subsistence fishermen and farmers, with the men doing the fishing and the women cultivating bitter manioc as a staple foodstuff. Prior to the creation of the present political units, the Black Caribs (hereafter simply Caribs) constituted a single ethnic group, confined to a narrow coastal strip, practicing endogamy, and having considerable cultural cohesion (Coelho, 1955; Gonzalez, 1965 and 1969; and Taylor, 1949).

Today, after having experienced different colonial rule and divided by political boundaries, the Caribs of Belize and Guatemala are participating in the creation of national societies under different national conditions. In Belize, they are one of several identifiable ethnic groups, each having very different cultural backgrounds and tending to be spatially discrete. The main groups are Creole, Indians, Spanish, Caribs, English, Chinese, and East Indians. The Caribs comprise about seven percent of the total population (121,300) of Belize or about 9,000. They constitute the majority in the town of Punta Gorda (approximately 2,000) although Creole, Spanish, Indian, Chinese, and East Indians are present also. In Guatemala, they form a very negligible proportion of the population (.04 percent of 5,600,000) and are one of three identifiable groups--Ladino, Indian, and Carib. The Carib is spatially discrete as in Belize. Livingston is also about 2,000 in population and overwhelmingly Carib, although Spanish and Indians are present.

In economic terms, Caribs are limited in their participation in the national economies of the two countries. Only in relatively recent times have significant numbers begun to participate consciously in national development. In Livingston, most Caribs look to the nearby port of Barrios for employment (Gonzalez, 1965:273). In Punta Gorda, wage labor and the teaching profession provide major outlets for upward economic mobility.

Caribs comprise a significant number of the teaching profession and are sent to various parts of the country. In addition, significant numbers of wage laborers work in Belize City, the largest town in the country.

Language is another important difference between Caribs in Belize and those in Guatemala. The predominance of Spanish in Livingston and English in Punta Gorda, as a second language, is one of the indicators of the functional role of the international boundary that separates the two communities. The degree of importance of the national language between Caribs in Punta Gorda and Livingston should reflect a measure of their participation in the building of a national society and the degree of acculturation taking place.

TEST OF HYPOTHESES

From July through September, 1973, field research was conducted in Punta Gorda and Livingston. We considered two general hypotheses: 1) intragroup cultural variations between Belizean and Guatemalan Caribs are less pronounced than cultural variations between Belizean Caribs and the Belizean donor society (i.e., Creoles and "Spanish") or between Guatemalan Caribs and the Guatemalan donor society (i.e., Ladinos); and 2) the process of acculturation to the dominant national society has proceeded further among Belizean Caribs than among Guatemalan Caribs.

The first hypothesis is suggested by Carib homogeneity and cohesiveness as a cultural group, perhaps uniqueness, prior to the partitioning of them into distinct national units by the international boundary. Several writers have shown that Carib identity is not completely limited or confined by these borders (Ashcraft, 1973; Conzemius, 1928; Fox, 1962; Gregg, 1968; and Jones, 1970). To our knowledge, hypothesis two has not been tested empirically along the Caribbean coast. We would expect, however, a greater degree of acculturation on the Belize side because Caribs there are members of an ethnically more diverse national unit and are almost indistinguishable physically from the Creole donor society. By contrast, the Guatemalan Carib is in a national unit with a more monolithic Ladino donor society having much less diversity and is readily distinguishable physically due to black skin.

As a part of the field research project, questionnaires were administered to 207 students in Punta Gorda and Livingston. Of these 138 were Carib students, 92 and 44 from Punta Gorda and Livingston, respectively, and 71 were Creoles or Ladinos, 46 and 25 from Punta Gorda and Livingston, respectively. The forty-eight item questionnaire was designed to determine actual and perceived patterns of physical, social, and occupational mobility. Specific hypotheses and results are listed in Table 1.

1) The use of the national language, English in Belize and Spanish in Guatemala, when speaking with family and friends, is more common among the dominant culture groups than among Caribs; however, Belizean Caribs use their respective national language more than do Guatemalan Caribs.

Hypothesis 1 is verified by the sample data. As expected, almost all Creoles and Ladinos use their appropriate national language in the home. Carib is the most important language in the home in both Carib communities; however, a significantly greater percentage of Belizean Caribs have acculturated the national language as their principal language with family and friends.

2) The Creole and Ladino dominant culture groups have greater occupational mobility than do Caribs; however, Belizean Caribs have greater occupational mobility than do Guatemalan Caribs.

Hypothesis 2 is, in general, not verified by the indicators used in the sample study. We felt that fishing, as an important element in supplementing family income, would be indicative of traditional Carib culture and would therefore be significantly more pronounced among Caribs and especially among Guatemalan Caribs. The data do indicate variations in the expected directions, but the differences between the two Carib groups prove not to be significant. We viewed farming, an economic activity when practiced above the subsistence-gardening level of traditional Carib society, and preference for wage labor over the more traditional subsistence fishing and gardening as indicators of occupational mobility. The data do indicate that Punta Gorda Caribs have greater occupational mobility than do Livingston Caribs, though in the case of variations in the importance of farming, the differences may well reflect random sampling errors. However, the preference for wage labor and farming among Punta Gorda Caribs apparently exceeds that of the dominant Creole and Ladino

TABLE 1

ADOPTION OF BEHAVIORAL TRAITS HYPOTHESIZED TO INDICATE ACCULTURATION BY SAMPLE POPULATIONS IN PUNTA GORDA AND LIVINGSTON (IN PERCENT)

Ethnic Group		Language	Occupational Mobility			Physical Mobility	
		Uses National Language[a] With Family and Friends	Has Strong Preference For Wages over Self-employment	Fishing is Important For Livelihood (Above Subsistence Level)	Farming is Important For Livelihood (Above Subsistence Level)	Perceived: Hopes to Migrate Outside Local Community	Actual: Has Sibling Living in National Capital
Dominant Culture Groups							
Creoles and Ladinos		96	26	13	20	66	32
Punta Gorda Caribs		47	37	21	24	75	28
Livingston Caribs		16	14	31	16	91	24
Significant Variation at the .05 Level	Dominant Groups vs. Caribs	Yes	No	Yes	No	Yes[c]	No[b]
	Punta Gorda Caribs vs. Livingston Caribs	Yes	Yes	No[b]	No[b]	Yes[c]	No[b]

a. National language is assumed to be English (or Creole) in Punta Gorda and Spanish in Livingston.
b. Variation is not significant at .05 level, but is in expected direction.
c. Difference between groups is opposite that expected.

(Source: Field Survey)

ethnic groups.

3) The Creole and Ladino dominant ethnic groups have greater physical mobility than do Caribs; however, Punta Gorda Caribs have greater physical mobility than do Livingston Caribs.

Hypothesis 3 is also not verified by the data. Taking the number of students from each ethnic group that have siblings living in the respective national capital as an indicator of past physical mobility, the variations do occur in the expected directions. However, the variations are not significantly different. By contrast, perceived mobility, as measured by the percentage of students who hope (or plan) to migrate outside the local community, is inverse that hypothesized and that indicated by the data on actual past mobility.

CONCLUSION

Is there sufficient evidence to conclude that differential acculturation rates occur, that Punta Gorda Caribs are acculturating more rapidly than Livingston Caribs? We believe the question can be tentatively answered yes. Language is a strong cultural indicator, is closely linked to ethnicity, and is critical in the integration of groups into national communities (Deutsch, 1964). As shown in the test of hypothesis one, while most Caribs retain the use of the Carib language in the home, Punta Gorda Caribs are acculturating in this regard much more rapidly than are Livingston Caribs. Corroborating evidence for this comes from Gonzalez (1965:274) when she states that Livingston Caribs ". . . valued less the Ladino culture of both city or the country" than either their own or the North American one. Likewise, the retention of the traditional occupation of fishing among Caribs indicates a degree of cultural cohesiveness, while the slightly higher probability of fishing among Guatemalan Caribs may indicate lower rates of acculturation than among Punta Gorda Caribs.

Other variations noted in the study cannot be fully explained at this time. Indeed, they may reflect distinct economic, spatial, and social constraints between Guatemala and Belize. For example, the high percentage of Livingston Caribs who plan to migrate to another community may reflect a severe shortage of suitable employment for young people in that community, rather than acculturation. It must also be noted that, in the

long run, the two general hypotheses presented in this paper are contradictory. Caribs cannot remain a culturally distinct ethnic group and continue to experience rapid acculturation. As Gonzalez (1965:272) states: ". . . the price of this adaptation is the rejection of Carib culture . . ." The cultural and spatial distinctiveness of Punta Gorda and Livingston Caribs is likely to begin to break down with the passage of time, if indeed, there is not already significant mixing into the Creole donor society of Belize.

Nonetheless, questions remain. Are there other factors which might measure the acculturation rate, and the difference across the international boundary, better than those we used? Conzemius (1928) suggests one variable that could--diet. Gonzalez (1965) indicates another that has possible relevance--preference for place. Does the particular type of migration affect acculturation rates? Gonzalez (1961) defines the predominant type among the Caribs as recurrent; is there a significant difference between Belizean and Guatemalan Caribs in type? Our data do not answer the question since we did not differentiate by type of migration.

Our brief study has raised as many or more questions than it answered. Though it provides some indication of differential acculturation rates, the data are less persuasive than we would like. We need to go again.

ACKNOWLEDGMENTS

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REFERENCES CITED

Ashcraft, Norman, Colonialism and Underdevelopment: Processes of Political Economic Change in British Honduras (New York: Columbia University Press, Teacher's College, 1973).

Coelho, R. G. de, "The Black Carib of Honduras. A Study of Acculturation" (unpublished PH.D. dissertation, Northwestern University, 1955).

Conzemius, Eduard, "Ethnological Notes on the Black Carib (Garif)," American Anthropologist, Vol. 30 (1928), pp. 183-205.

Deutsch, Karl W., "Communications Theory and Political Integration," in The Integration of Political Communities, ed. by P. E. Jacob and J. V. Toscano (New York: J. P. Lippincott, 1964), pp. 46-74.

Fox, David J., "Recent Work on British Honduras," Geographical Review, Vol. 52 (1962), pp. 112-117.

Gonzalez, Nancie L. Solien, "Family Organization in Five Types of Migratory Wage Labor," American Anthropologist, Vol. 63 (1961), pp. 1264-1280.

_____, "Black Carib Adaptation to a Latin Urban Milieu," Social and Economic Studies, Vol. 14 (1965), pp. 272-278.

_____, Black Carib Household Structure: A Study of Migration and Modernization (Seattle: University of Washington Press, 1969).

Gregg, A. R., British Honduras (London: Her Majesty's Stationery Office, 1968).

Hoebel, E. Adamson, Anthropology (New York: McGraw-Hill, 1966).

Jones, David R. W., "The Caribbean Coast of Central America: A Case of Multiple Fragmentation," The Professional Geographer, Vol. 22 (1970), pp. 260-266.

Steward, Julian H., Theory of Culture Change (Urban, Illinois: University of Illinois Press, 1963).

Taylor, D. M., The Black Carib of British Honduras (New York: Viking Fund Publications in Anthropology No. 17, 1949).

Weiner, Myron, "Political Integration and Political Development," in Political Modernization, ed. by Claude E. Welch, Jr. (Belmont, California: Wadsworth, 1971), pp. 180-196.

THE EJIDO SYSTEM IN MEXICO: AN EXAMPLE OF AGRARIAN REFORM

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ABSTRACT: - The problem of land tenure is everywhere a basic variable in considerations of land use systems, and at the present time, many governments in the less industrialized nations of Africa, Asia, and, especially, Latin America, are experiencing demands for land from large agrarian populations. In this time of upheaval it is suggested that an evaluation of Mexico's experience, accomplishment, and also failures through a half century of very active agrarian reform could be instructive and could serve as a guide to help avoid basic errors in planning and implementing agrarian reforms elsewhere. This paper reviews results of one aspect of agrarian reform in Mexico, the ejido croplands, quantities, the magnitude of this change, and points out problems within this system.

A problem which has long faced many developing nations with respect to development of the agricultural sector of the economy is that of land tenure, specifically, the holding of large tracts of land by a relatively few elite landowners. The large majority of the agrarian population on the other hand owns very little of the land. This disparity in land ownership has acted as a brake on agricultural development and has often led to political unrest, upheaval, and in some cases, outright revolt. Such was the situation in Mexico where, on the eve of the 1910 Revolution, it was estimated that 90 percent of the heads of rural households were landless. (Wolf and Mansen, 1972, 148).

For approximately a decade following the initial outbreak of hostilities in 1910, revolt raged throughout the country. However, out of the chaos came a social and economic revolution that is still in progress. A fundamental change made was the ejido system, the beginning of land

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reform -- dissolution of the large private estates and church holdings and the reapportionment of the land in collectivized units or in small parcels among the poor rural population.

The Constitution of 1917 in its Agrarian Code set forth the principles under which land would be taken from the Church and the wealthy, sometimes with payment made by the government and sometimes not, and redistributed to the peasants under a plan known as ejido. Ejido, originally in Spanish, referred to communal grazing lands outside the village. But in Mexico it refers to the holding of use-rights to land by individual peasants and not specifically to land held in common, even though some of the land is used communally.

Any pueblo, or village, with a number of eligible citizens, usually at least 20 heads of households, may petition the government to be endowed with lands taken from private owners. If there is private land available within 7 kilometers of such a village it could be expropriated with the owner being allowed to keep a certified portion of his choosing. If no private land is available within 7 kilometers of a petitioning village, then land may be taken elsewhere and petitioning peasants will be relocated where the land is made available. Thus, throughout the country numerous new ejido settlements have been established.

The amount of land that the individual owner may retain varies from state to state and according to physical conditions of land and climate. Of first class irrigated land 100 hectares may be retained; of land with ample rainfall, 200 hectares; of good quality pasture, 400 hectares; of arid pasture or monte, 800 hectares. An area of ambiguity remains in the statements of inaffectability (that land which the owner may retain) regarding land devoted to ranching. For stockraising the amount of land necessary to maintain up to 500 head of cattle or their equivalent in other animals according to the forage capacity of the land may be retained by the owner. Only recently have attempts been made to define forage capacities on a regional basis which would remove some of the ambiguity. Special consideration is given to raising of certain crops like bananas, henequen, coffee, sugar cane, and others where the limit is 300 hectares that might be retained by the private owner. Beyond these limits the remainder of the land can be expropriated. (Constitucion, Art. 27)

The remainder of the land would then be reassigned by the federal government to an individual ejido unit which would in turn apportion land to individual ejidatarios. The ejido council which is composed of a president, treasurer, and secretary as its council officers will then make individual assignments of use-rights. If any ejidatario does not cultivate his land for two consecutive years his right to till it may be taken away and reassigned to someone else. The term "use-right" means just that because the government ultimately owns all lands and all minerals in the country. (Article 27, 1917). Under the ejido plan the government merely grants rights to cultivate the land. Under this law, therefore, ejidatarios may not sell or rent the land, nor borrow money on their use-right. The implications of this limitation are quite far-reaching in regard to capital investment and other aspects of agricultural advancement.

Ejido formation began slowly with the Carranza administration of 1915-1920 when less than 1 million hectares were reapportioned. From that point on reapportionment continued apace until a peak was reached in the late 1930's when during the 6 year term of Lazaro Cardenas approximately 17 million hectares were allotted to ejidos. Since Cardenas, the administration of Lopez Mateos from 1958-1964 was the next champion of the ejido movement with over 16 million hectares reapportioned. Immediately after that, during the Diaz Ordaz term, somewhat over 15 million hectares were added to ejido lands and it yet remains to be seen how much land will be expropriated during the Echeverria years. At one time it was proposed that expropriation for ejidos be completed by 1970, the end of the Ordaz term. However, with the present regime of President Luis Echeverria expropriation has continued, though not at the same pace as that during the Ordaz term of office. (Jensen, 1968, 7).

Since the beginning of agrarian reform in 1917 the magnitude of change that has taken place has been truly significant when one considers the amount of land that has passed from latifundia to the control of ejidos. The most recent figures available, those from the 1960 census, show that in that year 56 percent of all properties were in ejidos, while 44 percent of the cropland, and 41 percent of the irrigated land was in ejido holdings.

As of 1960 donations of lands to ejidos and benefited over 2 million heads of families or about 10.7 million people, representing 35 percent of the total population and 65 percent of the rural population of all Mexico. Ejidatarios now account for over 38 percent of Mexico's agricultural labor force -- an increase from 29 percent in 1950. Census data for 1970 will undoubtedly show higher percentages. (Anuario Estadistica . . . 1960).

Under present laws those states with over 40 percent of croplands in ejidos are approaching completion of distribution of existing cropland. Since most of these states are in the densely populated zone of Mexico and experiencing rapid population increase, it appears that there will not be enough land for all -- not even for those now holding unsatisfied ejido land rights. It has been noted in the small state of Tlaxcala that with complete distribution of all available lands there would still be 15,000 petitioning peasants in the state not provided with land. The ejido system clearly has not supplied all those who desire land even though it has aided a very large number of people.

A recent trend has been to establish new centers of ejido population away from the heavily populated central zone. The state of Chihuahua, with over 1 million hectares in new ejido grants, received a number of large-scale grazing ejidos replacing negated grazing rights of private corporations. The state of Sinaloa is another area that has large numbers of new ejido grants and new centers of population in irrigated areas along the coast. Since 1959 the 235 new centers of population have provided 2.4 million hectares of land with a relocation of 34,000 families totaling 168,000 people. On any scale this is a major undertaking in relocating of families with unsatisfied land rights. It is also verification of the land hunger of the people who are willing to be resettled in areas often far from familiar home grounds. (Jensen, 1965, 6).

EJIDO SIZE AND MANAGEMENT

The majority of individual ejido parcels are quite small in size. For the nation as a whole, 7 percent of the ejido parcels have less than 1 hectare, 34 percent from 1 to 4 hectares, 42 percent from 4 to 10 hectares, and only 16 percent have over 10 hectares per holding. The agrarian

Land reform as it has been carried out in the past 50 some years has virtually wiped out the old system of latifundia but has replaced it with a new minifundia. The objective of giving land to a previously landless peasantry has been to a large degree achieved. But the question might be legitimately asked, Is the new system more productive than the one it has replaced? And, is it as productive as those lands that remain in private ownership?

One approach to evaluation of ejidos is in terms of crop production as a basis for ascertaining whether this system is better or worse than other systems within the country. The 1960 census indicated that ejidatarios accounted for 41 percent of the value of crops on a national scale. This 41 percent also indicates that ejido lands are probably contributing less than their share of crop value since they accounted for 48 percent of the cultivated land in the country. (Census Agricola--Ganadero Y Ejidal, 1960). In fairness, it should be pointed out that lands granted to ejidos were not always the best land available. Ejido croplands produce the bulk of the nation's tobacco, henequen, and rice; and are major producers of beans, sugar, and corn while private lands account for the dominant share in alfalfa, tomatoes, wheat, strawberries, and cotton.

In terms of four staples of the Mexican diet, maize, beans, squash, and wheat, ejido lands are not producing these crops in abundance while private lands must make up for the deficit. A possible explanation for total ejido crop production being lower in percentage than the share of cropland is the fact that ejidos reported 60 percent less expenditures for fertilizers and insecticides than did the private lands over 5 hectares in size. Furthermore, in the case of intensive cultivation of horticultural crops where the private sector is highly specialized and has large inputs of fertilizer, hybrid seeds, and the latest farming techniques, the ejido cannot compete and produce on an equal basis. (Jensen, 1958, 12).

The evidence pointing to lower productivity on ejidos compared with private holdings is one of the major shortcomings, to this point, of the ejido system. It is precisely this point to which the government is addressing itself in attempting to increase yields on ejido lands. In

recent years aid has been forthcoming for ejidos in terms of loans for purchase of machinery which may be pooled for use by a number of ejidatarios, for insecticides, fertilizer, and hybrid seeds and also technical aid which will accelerate the adoption of farming methods which will raise overall output. However, the results of these initial efforts are yet to be seen and, to be sure, more of this type of help must be continued.

A new emphasis in the past few years has been put on integrated ejidos with large inputs of financial and technical aid and the encouragement of establishing industries within the ejido communities. And a small start has been made toward cooperative ejidos -- one has been established as a tourist enterprise, another a cooperative fishing enterprise, and a third a commercial poultry business. The Ejidal Bank has increased aid to ejidos and a definite effort has been put forth to educate the ejidatarios and their families as is evidenced by the building of many new schools in rural areas in the 1960's.

It would appear that a modification of the ejido plan might be wise in order to correct faults within the system. The problem of the ejido presently is also a problem of people. The solution must in large part come from outside the agrarian sector -- for if the standard of living is to be raised then more people must be employed outside the agrarian sector. There is an increased need for industrialization along with consolidation of ejido lands into larger viable cropland units. Agricultural extension services coupled with increased financial aid are a must if improved techniques are to be implemented. In any new definition of the ejido there must be a combination of land, people, and capital, realistically related to the physical environment and to markets, that can provide the possibility and thus the incentive for a family to earn an income suitable to a growing, developing nation.

The ejido system has helped to promote political stability and has improved the lot of the peasantry over previously poorer conditions. If Mexico can make needed adjustments as conditions dictate, then a continued growth in the agrarian sector can be assured.

REFERENCES CITED

Anuario Estadistica de Los Estados Unidos Mexicanos, Mexico City, 1960.

Census Agricola-Ganadero Y Ejidal, 1960.

Constitucion de Los Estados Unidos Mexicanos, Article 27, 1917.

Constitucion de Los Estados Unidos Mexicanos, Article 27, 1970.

Jensen, J. Granville., "The Ejido in Mexico: An Agrarian Problem," Yearbook, Association of Pacific Coast Geographers, 1958.

_____, "Notes on Ejido Development During the Presidency of Lopez Mateos," Yearbook, Association of Pacific Coast Geographers, 1965.

_____, Underemployment: A Problem of Ejido Farming (Corvallis: Oregon State University Press, 1968).

Wolf, Eric R. and Edward C. Hansen, The Human Condition in Latin America (New York: Oxford University Press, 1972).

SOME INTERRELATIONSHIPS OF PARENT MATERIAL, SOILS, AND LAND USE IN LANCASTER COUNTY, PENNSYLVANIA

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ABSTRACT: - Lancaster County, Pennsylvania, is one of the most productive non-irrigated agricultural counties in the United States. Agricultural land use centers on the major fertile valley of the county. Peripheral agricultural sectors are found in the county where land use seems to be closely related to soil capabilities and the soils in turn related closely to parent materials. One example of the agricultural periphery illustrates interrelationships of parent materials, soils, and land use. Analysis of variance indicates that significant differences in land use and soils exist between two parent material areas. Conclusions are that parent materials influence resultant soils; variations in soil capabilities influence variations in land use; and soils can be utilized to analyze land use patterns and project land use trends.

Lancaster County, located in southeastern Pennsylvania (Figure 1), is one of the most productive non-irrigated agricultural counties in the United States. Agricultural land use centers on the Lancaster-Frederick Lowland, the major fertile valley of the county. This valley constitutes the center of the Pennsylvania Dutch culture and is the agricultural core of the region. The high productivity of limestone derived soils of the Lowland greatly contribute to Lancaster County's fame as "Garden Spot of America." Peripheral agricultural sectors are found in the county where land use seems to be related closely to soil capabilities and limitations and the soils in turn related closely to the underlying parent materials.

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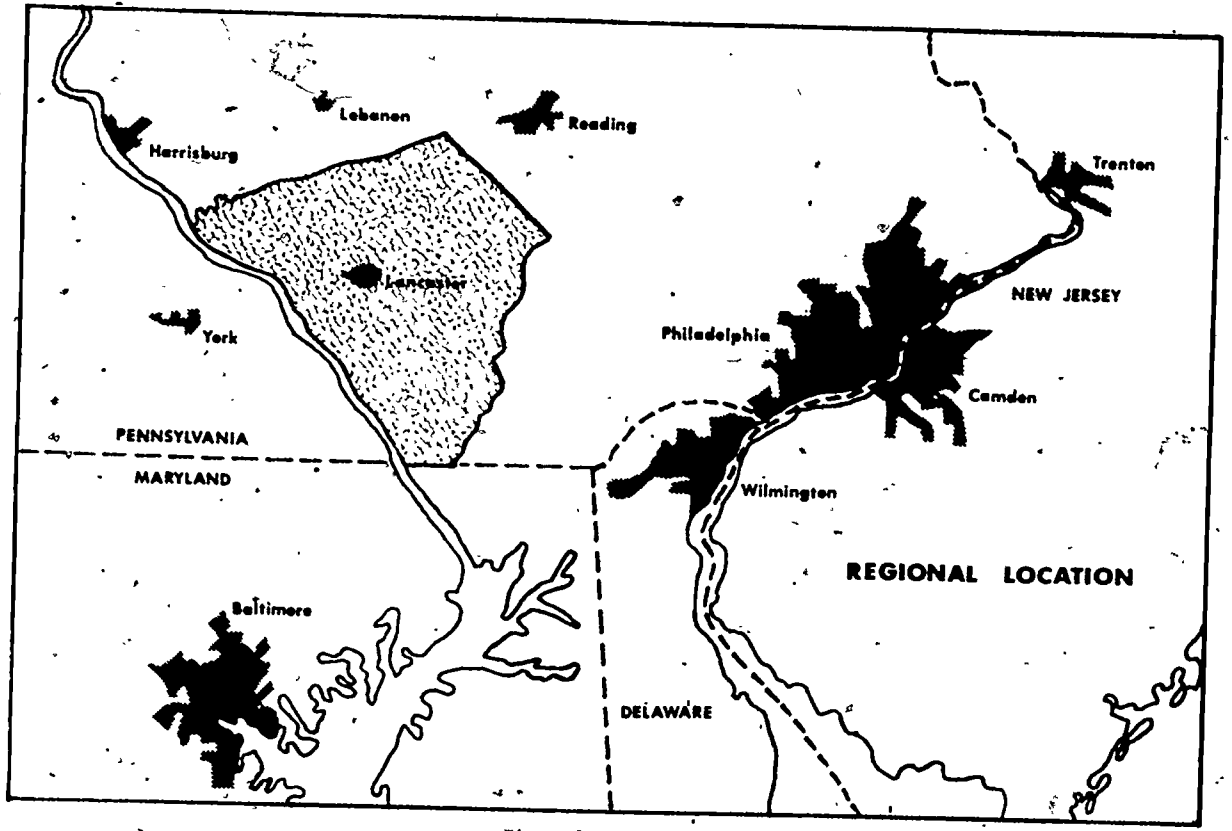


Figure 1

SETTING OF STUDY

Agricultural production truly is outstanding in the County. Lancaster County ranks first in Pennsylvania in the production of corn for grain, corn for silage, wheat, barley, hay, and tobacco (Pennsylvania Statistical Abstract, 1969). According to the Sketch Plan of the county, "within the national framework Lancaster (County) still ranks higher than all other non-irrigated counties in value of its agricultural productivity. (This rank) can be attributed in large measure to the fertile, limestone based soil and to the mild climate. . .with its liberal growing season" (Planning Commission, 1970, 50). However, local changes in topography and especially in bedrock have been major influences in creating a variety of soils within the county. (Planning Commission, 1970, 125).

The planning of future development within the county must consider the spatial aspects of the soils of the county and the range in productivity of specific soil types if prime quality agricultural land is to be maintained (Planning Commission, 1970, 127). Closely distinguished areas of best agriculture and poorer grades of agriculture should be delineated. One need not concentrate on the agricultural core because it has a known agricultural value. Rather, a part of the agricultural periphery must be more closely examined to determine the interrelationships of parent materials, soils, and land use in the contest of grades of agriculture.

GEOLOGY OF STUDY AREA

The segment of the agricultural periphery chosen for this study is in northwestern Lancaster County (Figure 2). Here two contrasting parent materials seem to result in considerably different soils which in turn seem to influence variations in land use between the two sectors. The two sectors parallel one another in an arc-like band from near Elizabethtown in the west to near Lititz in the east. The more northerly sector contains soils developed from Triassic age sandstones and the more southerly sector contains soils developed from the Ordovician age shale.

Both formations are part of the Piedmont Province of the Appalachian Highlands Physiographic division. These formations are classified as lowlands despite the rolling topography. The general character of the

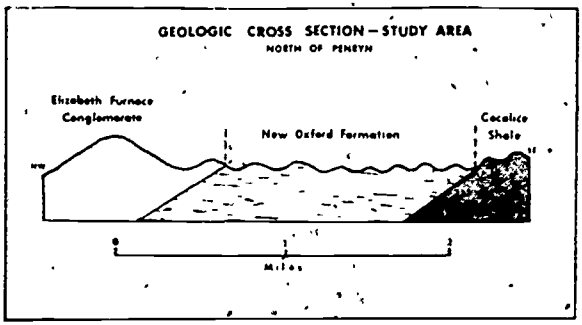
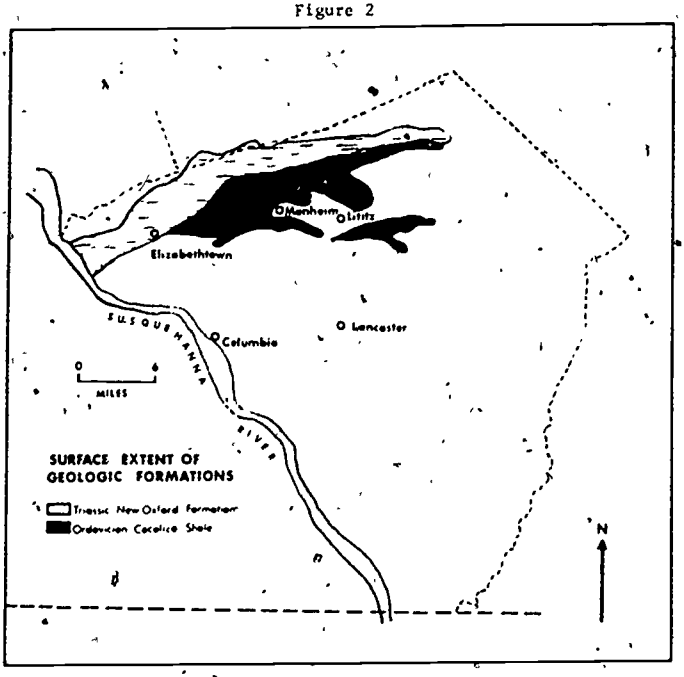


Figure 3

Figure 2



rocks of the Triassic Formations are red sandstones and shales interbedded with light gray and yellow sandstones (Carey, 1959, 2). In Lancaster County, the Triassic New Oxford Formation lies unconformably over Ordovician shales (Figure 3). The formation consists of light gray to grayish yellow crumbly sandstone with some thin beds of red shales. This area is so different from the rest of the Piedmont Province that it might well be considered a separate physiographic division (Hall, 1934, 8). The New Oxford Formation is a monoclinal belt which dips to the northwest. The arkosic sandstones tend to form more resistant ridges while the shale beds and softer sandstones develop into small valleys. The rhythmic occurrence of red shales and sandstones and grayish sandstones suggests seasonal deposition (Jonas and Stose, 1930). This color banding is very noticeable in some plowed fields.

The Ordovician formation comprises a lowland between the Triassic lowlands to the north and the Lancaster-Frederick Lowland to the south. The Ordovician Cocalico Shale appears as elevated ridges when viewed from the adjacent Lancaster-Frederick limestone lowlands. The argillaceous Cocalico Shale is very dark in color, ranging from a dark grey to bluish-black. It weathers easily and rapidly into relatively thin, light brown soil containing many buff shale slivers. This formation centers on the Penryn Anticline and dips generally northwest and southeast.

SOILS OF STUDY AREA

The Lansdale-Steinsburg soil association consists of soils developed from yellow and brown sandstones and shales of the New Oxford Formation. The topography is rolling. General type farms with dairy cattle as the main livestock seem to be most prevalent. The soils are mostly deep and well drained with a low natural fertility level. They are moderately to strongly acid as influenced by the sandstone parent rock. Most soils contain a fairly high percentage of sand and gravel and have a moderate to low moisture holding capacity because of the coarseness of the material. Internal drainage is moderately rapid so droughtiness is a considerable handicap especially on sloping areas. Erosion is a further handicap for use of these soils for crop production. Intensive management practices are needed to conserve moisture, prevent erosion, make up

for the low natural fertility, and the lack of organic matter.

The Bedington-Berks soil association consists of soils developed from the Cocalico Shale. The topography is mostly rolling with well rounded, short smooth slopes. General types of farms with dairy cattle as the main livestock seem to prevail here as in the Triassic area, but tobacco and vegetables seem to become an important part of crop rotations. The soils are moderate to deep, well drained, and have a low to moderate natural fertility level. The Bedington soils are deeper and more fertile than the Berks soils. The soils are moderately to strongly acid as influenced by the acid shale parent rock. The shale bedrock weathers to silt and clay, producing a finer textured soil. The Berks soils have a moderately low water holding capacity and slow to very slow runoff. These soils have little or no erosion hazard except on steeper slopes. Most areas of this soil are used for crops; it is considered to be a good soil for crops because it has no serious management problems (Carey, 1959, 20). The Bedington soils have a high to moderate water holding capacity. Most areas of this soil are used for crops because of its relatively high natural fertility and lack of serious management problems.

ANALYSIS OF DIFFERENCES

It is evident that the two parent materials helped to produce two different groups of soils. In order to more fully understand the degree of differences between the two groups of soils, and land use on the two groups of soils, sample cells were chosen within the boundaries of the Triassic and Ordovician formations. Five one-quarter square mile cells were selected within each formation sector. Each cell was selected at random, except that the selection was altered enough so that one side of each square bounded a road. The boundary along the road was deemed necessary to obtain access to the cell to collect data on soils, slope, and land use. Data were collected from each cell using aerial photographs, soil survey maps, and on site observations. The data gathered were summarized to produce average textures of A_1, B_2, and C horizons, pH, and cation exchange capacity for the soils of each cell. Percentages of land devoted to four basic uses - woodland, pasture, idle land and cropland - contributed the foundation for analyzing differences in land use. The

cropland percentage figure was subdivided into major types of crops to further determine differences in land use between the two soil regions. The land use percentages and average data on the soils were statistically analyzed using a simple analysis of variance test set at a .05 level of significance.

In the analysis of the soils, there proved to be a statistically significant difference between the two soil sectors in the average texture of the A_1 or surface horizon, the average texture of the B_2 or subsoil horizon, and in the weathered bedrock C horizon. The average textures for the Cocalico shale derived soils are silt loam, silty clay, and shaly silt loam compared to coarse loam, gritty silt loam, and sandy loam for the New Oxford derived soils. This textural difference may be significant in water holding capacity, water availability to plants, and nutrient availability to plants. In fact, droughtiness and low fertility are mentioned as two important disadvantages to the New Oxford Formation derived soils (Carey, 1959, 48).

The average pH levels of the two soil sectors are not significantly different. However, the trend seems to indicate that the Cocalico Shale derived soils are more responsive to lime applications and fertilizers than the New Oxford derived soils. Variations in pH between the two soil areas seem to be attributed partly to pH of the bedrock and partly to farming practices on individual farms.

The cation exchange showed a significant difference between the two soil sectors. The average cation exchange capacities for the surface, subsurface, and weathered bedrock horizons of the Cocalico shale soils are 26.4, 23.8 and 16.4 compared to averages of 13.2, 10.4 and 8.6 for the New Oxford soils. The significant variations in cation exchange capacity can be attributed to the higher percentages of silt and especially clay in the soils formed from the Cocalico shale. The implication of such a variation in cation exchange capacity is that the soils of the Cocalico shale sector act as a better reservor for plant nutrients and perhaps can respond more readily to the application of fertilizers.

In the analysis of land use in the two sectors, a significant difference is exhibited in the percentage of woodlands, the percentage of idle land, and the percentage of cropland. The woodlands comprise only

6.8 percent of the land on the Cocalico Shale compared to 19 percent on the New Oxford Formation. The idle lands comprise only 6.4 percent of the land on the Cocalico Shale compared to 13.2 percent on the New Oxford Formation. The cropland comprises 72 percent of the land on the Cocalico Shale compared to only 45.4 percent on the New Oxford Formation. It seems that soils are greatly influential in this pattern. Pastures do not show a significant variation between the two soil sectors because livestock, especially dairy cattle, are important in both sectors.

Looking more closely at the cropland use, other significant variations are revealed. On the Cocalico Shale derived soils, hay occupies 10.8 percent compared to 30.8 percent on the New Oxford derived soils. This seems to be well correlated with the need for long rotations and fallow periods to conserve moisture and fertility on the Lansdale soils derived from the New Oxford Formation (Carey, 1959, 48). An even more significant aspect of the cropland areas of the two sectors is the percentage of cropland devoted to tobacco (7.5%) and to vegetables (7.8%) on the Cocalico Shale soils compared to virtually no tobacco or vegetables on the New Oxford soils. The tobacco seems to be concentrated on the Bedington silt loam soil which generally has a higher natural fertility and higher cation exchange capacity than other soils studies. The significant increase in vegetables and tobacco can probably be attributed to the better moisture availability, the better response to fertilizer applications, and the higher cation exchange capacity in the Cocalico derived soils relative to the New Oxford derived soils.

CONCLUSIONS

This study seems to show that inherent features of parent materials are closely reflected in the characteristics of the derived soils. Variations in soil characteristics, especially soil capabilities, influence significant variations in land use. These variations seem to indicate that the areas underlain by the New Oxford Formation could be sacrificed to land uses other than agriculture. The interrelationships of parent materials, soils, and land use can be applied to many areas such as Lancaster County to analyze the land use patterns, project future land use trends, and most importantly to help develop sound regional planning

so that prime agricultural land is not lost entirely to other uses.

REFERENCES CITED

Carey, Jonn B., Soil Survey of Lancaster County, Pennsylvania (Washington, D.C.: United States Department of Agriculture, Soil Conservation Service, 1959).

Department of Commerce, Pennsylvania Statistical Abstract 1969 (Harrisburg: Commonwealth of Pennsylvania, 1969).

Hall, George M., Ground Water in Southeastern Pennsylvania, Ground Water Report W-2, Pennsylvania Geological Survey, Harrisburg, 1934, reprint of 1967.

Jonas, Anna I. and George W. Stose, Topographic and Geologic Atlas of Pennsylvania, no 168, Lancaster Quadrangle, Pennsylvania Geological Survey, 4th series, Harrisburg, 1930.

Planning Commission, Sketch Plan, Lancaster County, Pennsylvania, 1970.

THE USE OF FACTOR ANALYSIS IN THE PRODUCTION OF SOIL RESOURCE MAPS FOR REGIONAL PLANNING STUDIES

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ABSTRACT: - One major problem associated with the spatial application of soil resource information has been that either the soil resource information has been too general; or, too detailed for regional and metropolitan planning purposes. When using the detailed data the researcher is confronted with basically unknown interdependencies and masses of qualitative and quantitative soil variables. This situation requires the use of multivariate statistical approaches. The results of principal components analysis have produced 22 refined groupings of the detailed soil variables. The mapping of the factor scores indicates the geographic location of each of the major soil resource components and provides materials for regional planning analysis.

As a basis for a planning study, a land use allocation process is generally composed of four parts: 1) the generation of goals or policies which relate to needs, problems, and planning principles, 2) the analysis of the internal resources of the study area; 3) the synthesis of those resources with respect to the regional social, economic, and political demands; and 4) an evaluation of the impact that new development may exert on the study area. This paper concentrates on point two, the analysis of a study area's resources, in particular soil resources because the most effective land use plan is enhanced by the efficient use of soils. The actual planning process would include all other physical and cultural considerations in the analysis stage, e.g., existing land use, central water and sewer facilities, availability of land for development, etc. Since the regional or metropolitan planner must deal with large

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tracts of land, he must be able to view soil resources in terms of major physical constraints to development, e.g., flood hazards, steep slopes, organic soils, poorly drained conditions. Furthermore, the planner must have comprehensive interpretation which relates to a soil use suitability classification that shows the interrelationships and environmental impacts of various soils with the land uses in question.

One major problem associated with the spatial application of soil resource information has been that either the soil resource information has been too general, or, too detailed for regional and metropolitan planning purposes. For example, the soil survey of Stark County, Ohio involves at the general soil map level, eleven soil association groups and almost 200 soil types and phases at the field mapping level. At the first level, the general soil map has cartographic units which normally consist of one or more major soil series and at least one minor soil. Such cartographic units are empirically derived and named for the major or dominant soils in that respective grouping. At the second level, the original field soil maps (aerial photographs) provide 287 observational units which contain detailed soil information. When using the detailed data the researcher is confronted with basically unknown interdependencies and masses of qualitative and quantitative soil variables. This situation suggests the use of multivariate statistical approaches. Principal components analysis (a form of factor analysis) is considered ideal and pertinent for such a study, i.e., this algorithm disentangles complex interrelationships into their major and regional clusters. The results of the principal components analysis have produced 22 refined groupings of the detailed soil variables. The mapping of the factor scores indicates the geographic location of each of the major soil resource components and provides materials for interpretations for regional planning analysis.

Stark County has been chosen as the study area for this paper for a variety of reasons, e.g., detailed soil resource data are available and the County contains complex geologic parent materials for soils, i.e., bedrock, glacial tills, outwash plains valley trains, alluvium and organic bogs. The soils formed under the influence of these parent materials

exhibit significant textural and topographical characteristics which influence land use.

DATA HANDLING AND RESULTS OF THE ANALYSIS

Initially, this study demanded the development of an attribute matrix of the order of 287 (n) by 65 soil variables (m). The n-places are the 287 aerial photographs used in the field mapping of the County. The m-attributes consist of soil variables at the Series level of soil classification which infers various combinations of characteristics such as profile depth, depth to bedrock, ranges in depths, natural drainage, texture, erosion, etc. Major slope categories were also included as variables. Data input consisted of the actual number of acres of each soil variable by observation cell. This attribute matrix was used to perform the principal components analysis which statistically describes the combination of soil variables in terms of their regional structure.

Principal components analysis can be used to test the number of common factors or components underlying a set of variables. This technique has been used in geographic research for over a decade and is of proven utility. However, I am not aware of its use to present a locational interpretation of soil resources which could eventually uncover patterns of spatial variation in soils which may prove to be significant for regional planning activities.

The results of the Principal components analysis can aid in the geographic study of the variance of soil resources that is seen as involving some common association (or communality) between all the soil variables being considered. Thirteen of the 22 basic dimensions or components account for over 70 per cent of the total variance in the soil data for Stark County. At this stage of the study, there could be a detailed description of the statistical distribution produced. However, the geographic interpretation of the principal soil components is a more important and significant problem in a planning analysis. This interpretation was aided by the review of the factor loadings and the computer mapping of the factor scores. Such an interpretation was carried out essentially with reference to the factor loadings, the philosophy being that soil variables having high correlations or loadings will function to

identify a particular soil component. It is noted, however, that on any component some soil variables will have low loadings and consequently will be ignored in the process of giving "an interpretation" to the component. On particular soil variables, some observations almost certainly have high values in the original data matrix, however, because their occurrence is widespread in Stark County, their loadings are weighted as relatively unimportant variables. In this study, the moderately well-drained glacial till Canfield soils (variable 37) are found in almost 19 percent of Stark County and do not load positively on any soil component. This soil variable does have high negative loadings on components which are in the unglaciated sections of the study area.

The interpretation of the components has been qualified further through the examination of the original data matrix and review of the soil field maps from observation cells which have high factor scores. This examination has permitted the writer to develop cross sectional drawings which indicate the relationships of land positions and topographic sequences of the soil variables in each component. The combination of the factor score maps and accompanying cross sections facilitates the discussion of the soil components. Due to limitations of space only one soil component interpretation will be discussed in this short paper.

COMPONENT I: FINE-TEXTURED BEDROCK SOILS

Component I is concentrated in the southeastern part of the county. (Figure 1 shows the most significant factor scores above 1.50 in solid black). This part of the study area is unglaciated and has significant local relief. This component, accounting for almost 12 percent of the total variance, is basically an unglaciated fine-textured bedrock parent material factor and the most complex of all the components. Component I consists of four parts: 1) strip mine spoils comprised of fragmented shale, acid clay shale, and limestone materials (variable 56); 2) shallow light colored bedrock soils that are moderately to well drained materials formed mainly from clay shale, siltstone, and fine-grained sandstone, variables 24 (Muskingum), 26 (Keene), 27 (Latham) and 49 (Gilpin); 3) moderately steep to very steep sloping land ranging between 12 and 25 percent, variables 63 (12 to 18 percent) and 64 (18 to 25 percent);

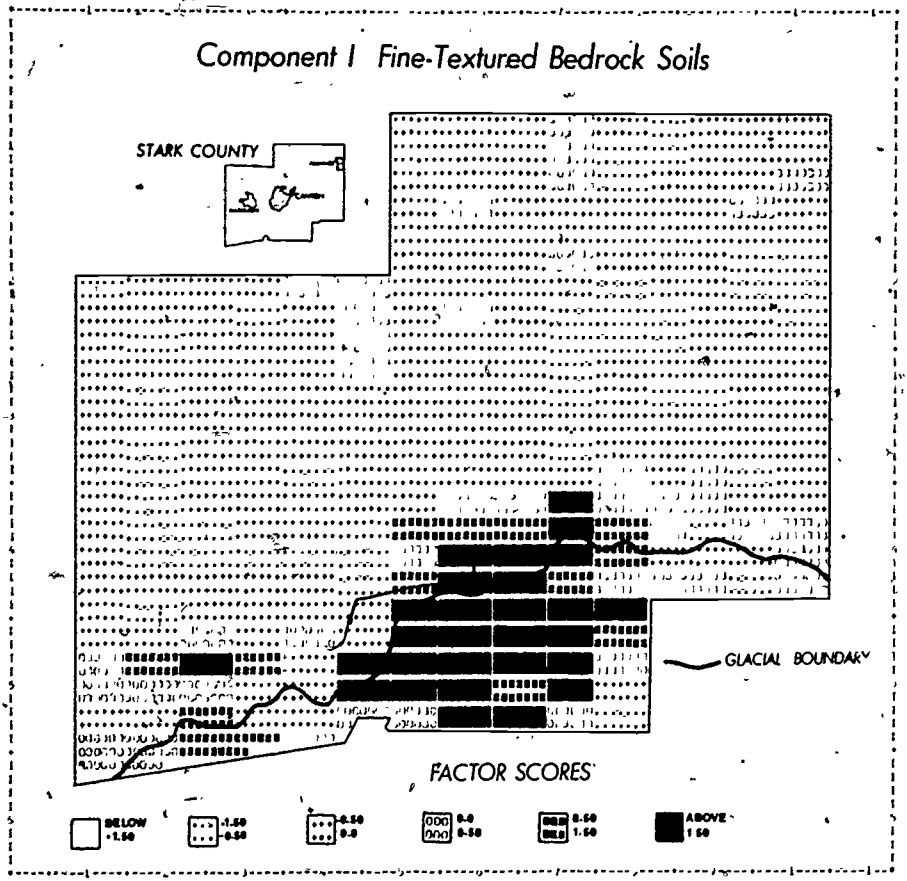
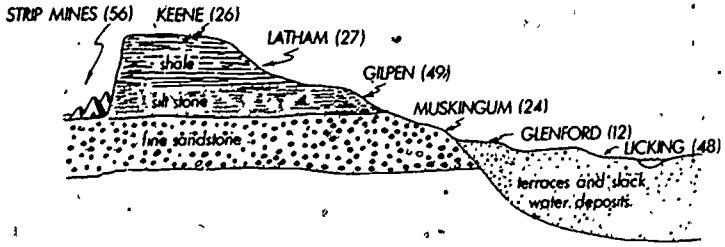

Component I Fine-Textured Bedrock Soils
STARK COUNTY
GLACIAL BOUNDARY
FACTOR SCORES
BELOW -1.50
-1.50 -0.50
-0.50 0.0
0.0 0.50
0.50 1.50
ABOVE 1.50

Figure 1


STRIP MINES (56)
KEENE (26)
LATHAM (27)
shale
GILPEN (49)
salt stone
MUSKINGUM (24)
GLENFORD (12)
LICKING (48)
fine sandstone
terraces and stock water deposits

and 4) glacial terrace and slack water deposits which were deposited beyond the glacial boundary, variable 48 (Licking). The topographic sequence of soils associated with Component I, shown in Figure 1, indicates that there are moderately well drained, gently sloping to steep soils formed in residuum weathered from shale and thin beds of siltstone (variable 26, Keene) located upslope of soils formed from acid shales which range from gently sloping to very steep areas (variable 27, Latham). Review of the detailed field soil maps on aerial photographs indicate these two soil variables are commonly upslope from variable 49 (Gilpin) a well drained, gently sloping to very steep soil formed on thin beds of acid siltstone, shale and fine-grained sandstone. Also included in this sequence is variable 24 (Muskingum) which is formed from fine sandstone. Strip mine spoil (variable 56) associated with this component consists of soil material which has been piled up during mining operations. Much of the land affected by strip mining operations in the County are found in this section of the study area.

The remaining portions of this soil component are made up of two kinds of water laid glacial materials. Figure 1 shows that these glacial soil areas are beyond the glacial boundary indicating that variables 12 (Glenford) and 48 (Licking) were associated with glacial water action rather than direct ice contact. Viewing Figure 1, one can see that variable 12 (Glenford) due to its higher topographic position is likely to be more silty and less clayey in its subsoil and underlying parent material than variable 48 (Licking).

Of all the soil components produced by this analysis, Component I is the most complex having nine (9) soil variables included in its dimensions. Furthermore, it is the only component which includes two of the major Soil Conservation Service slope classes, i.e., D slopes (12-18 percent) moderately sloping and E slopes (18-25 percent) or steep slopes. The statistical assignment of these slope variables to this soil component, is indicative of unglaciated southeast part of Stark County and its very hilly conditions with significant relative relief.

SUMMARY OF THE INTERPRETATION OF THE PRINCIPAL SOIL COMPONENTS

It is significant to note that the soil components tended to be associated with various types of geologic environments which provide the parent materials for the soil variables. Some of the major associations noted were:

1) unglaciated areas - Component I: fine-textured bedrock soils; and Component II: steep, coarse-textured bedrock soils;
2) glacial till areas - Component III: nearly level silty clay till soils with poor drainage; Component VII: silt loam and loam till soils; Component VIII: nearly level to sloping, moderately well-drained soils; Component IX: silty clay loam till soils with fair drainage; Component XII: shallow glacial till soils and silty stream terraces; Component XIII: level to nearly level shallow soils; Component V: organic soils; and
3) glacial outwash areas - Component IV: silt loam and gravelly kamic and morainic soils; Component VI: sandy outwash soils; Component X: silt loam and silty clay loam outwash soils; and Component XI: coarse gravel outwash soils; and
4) glacial boundary locations - Components VII and XII.

The results of the principal components analysis has produced refined groupings of soil variables which facilitates geographic analysis that can be used effectively in planning studies. The analysis have aided the reduction of the detailed soil resource data into a manageable number of types with descriptive terms which can be meaningful for regional planning purposes (especially in dealing with the general public, i.e., it avoids use of soil series names like Canfield). The use of principal components analysis permits a regional soil resource consideration which is more detailed and informative than the general soil map and more synthesized than the 287 detailed field soil maps. One major limitation should be understood -- while the use of principal components analysis can measure a large number of phenomena, it requires the use of an electronic computer which may not be available to the regional planner and soil resource researcher.

Factor analysis could be incorporated into procedures for making general soil maps using hierarchial grouping techniques. In addition, the results of the principal components analysis of the soil resources may be an input into further academic research activities such as redefinition of glacial features, in particular the redrawing of the glacial boundary.

PRELIMINARY INVESTIGATIONS OF THE DISPERSAL OF AIR CONTAMINANTS OVER THE NORTHEAST DISTRICT OF OHIO

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ABSTRACT: - This study investigates principally distribution and temporal changes that exist for air pollutants over the Northeast District of Ohio (as defined by the Ohio Environmental Protection Agency). The contaminants studied are: sulfur dioxide, nitrogen dioxide, and total suspended particulates.

This preliminary study indicates the location of factors which explain the air pollution problem and indicates "patterns" in air quality relationships by the use of graphic techniques. It facilitates the interpretation of large amounts of air quality data and gives the proper perspective to immediate problems in air pollution control and abatement.

INTRODUCTION

It has become increasingly more important for man to better understand the environment that surrounds him, for it affects his general welfare and property as well as his health. Factors such as climate, topography, geographic location, adversely affect the environment, either directly or indirectly. It is imperative that these factors be understood so that man may make educated decisions regarding the future of our environment. It is necessary that existing correlations be established in the environmental sciences, since the elucidation of these data will provide vital information to planners.

An important environmental problem that has only recently been widely recognized is air pollution and its effects. In order to better understand the problem and prescribe the proper treatment, the United States Environmental Protection Agency (U.S. EPA) has conducted numerous research

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activities. Some state environmental protection agencies have independently investigated the air pollution problem in their specific localities in attempts to understand the air pollution problem. In Ohio, the Environmental Protection Agency (EPA) has established contractural agreements with 13 local agencies, whereby air quality can be efficiently monitored, and proper direction established for achieving air quality standards (Ohio EPA Newsleaf, 1973). To better understand the air pollution problem, the Akron Regional Air Pollution Control Agency (APCA) has undertaken a study of the air quality over the Northeast District of Ohio.

Figure 1 depicts the Northeast District as defined by the Ohio EPA prior to January 1, 1974. The Northeast District is composed of 22 counties which include the Cleveland, Painesville, Akron, Canton, Youngstown, Lorain and Steubenville metropolitan areas. The project was initiated by the Akron Regional APCA in cooperation with the Ohio EPA and the University of Akron's Laboratory for Cartographic and Spatial Analysis. The pilot program is being funded by the Ohio EPA.

STUDY GOALS

The goals established for this pilot project were to implement and modify existing computer programs prepared by the U.S. EPA to be used to handle all air quality data originating from the Northeast District; to coordinate the efforts of the seven local air pollution control agencies in the district in their accurate and timely submittal of air quality data reports, to report this processed data to state and federal officials, and to develop new graphical techniques for the presentation of air quality data.

A considerable amount of interdisciplinary and inter-agency work is required to accomplish these objectives (American Chemical Society Report, 1969). Air pollution study requires personnel with backgrounds in computer science, chemistry, mathematics and geography. And although this study has only begun recently, the coordination of local agencies and the computer processing of data into unique graphical representations of air quality have already been achieved.

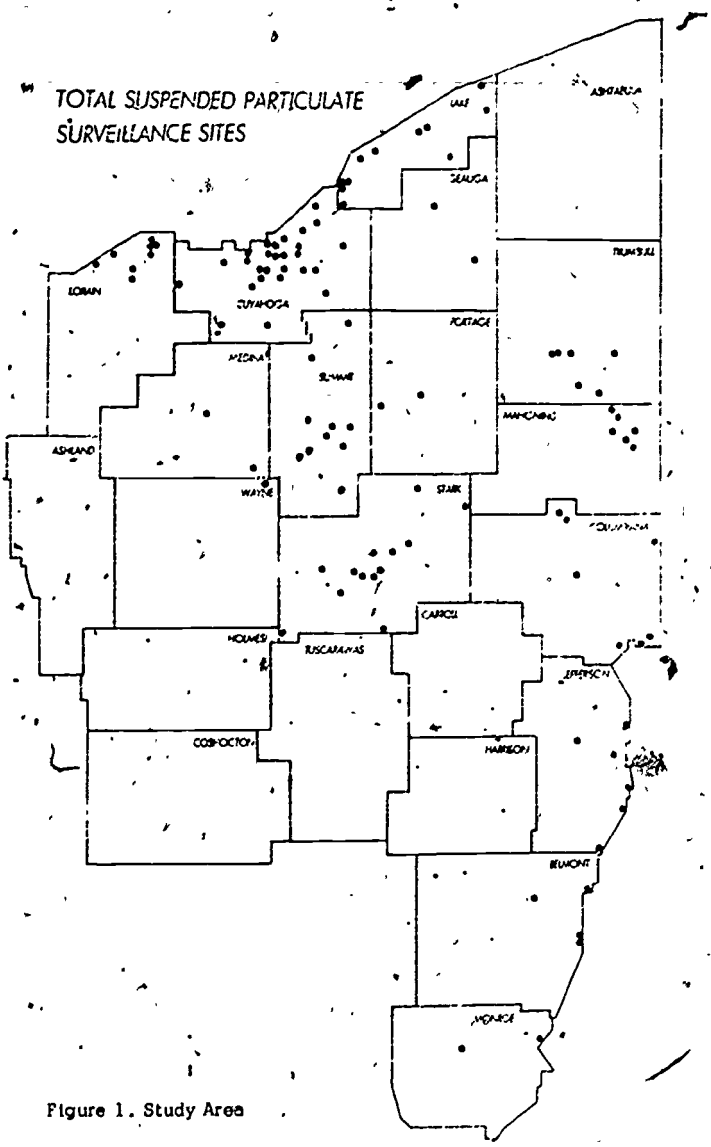

Figure 1. Study Area

THE STUDY

This paper deals with the achievements that have been made to date in our graphical analysis of air quality in the Northeast District. Our data for producing these maps were obtained from computer reports on air quality data and subsequently re-formatted to be used in our graphics routines. By spatially and cartographically analyzing these data, the following objectives will be met:

1. condensing large amounts of air quality data into a useful format for administrators, engineers, planners, analysts and others responsible for air quality.

2. to better understand representable "patterns" in air pollution over a geographic area.

3. to lay the foundation for subsequent diffusion modeling and surveillance network studies necessary in achieving air quality standards.

Two graphic techniques are used, that we have discovered to be the most informative way to translate air quality statistics into a representable pattern. The first is SYMAPS, a two-dimensional representation of air quality, and the second is Three-D plots, which are three-dimensional representations of air quality. The SYMAP computer program is a product of Harvard University's Laboratory for Spatial Analysis. The Three-D plot programs were developed by this author for the University of Akron's Laboratory for Cartographic and Spatial Analysis.

Since diffusion models have not been tried specifically for the Northeast District, it was necessary to make assumptions about the basic dispersal of air pollutants over this area without corroborating evidence. For the SYMAPS, standard levels were used for the contour plots so that all maps produced could be directly analyzed throuth time. The levels were chosen on the basis of the air quality standards, so that areas of bad, poor, fair, good and excellent air quality levels for a particular pollutant could be immediately identified. For the three dimensional representations of data, a nine point quadratic interpolative procedure was chosen since it offered the smoothest transition from each surveillance site without large discontinuities in the surface.

Figure 2 is illustrative of the SYMAP technique used in this study. This is a map of total suspended particulates for April, 1973, based on

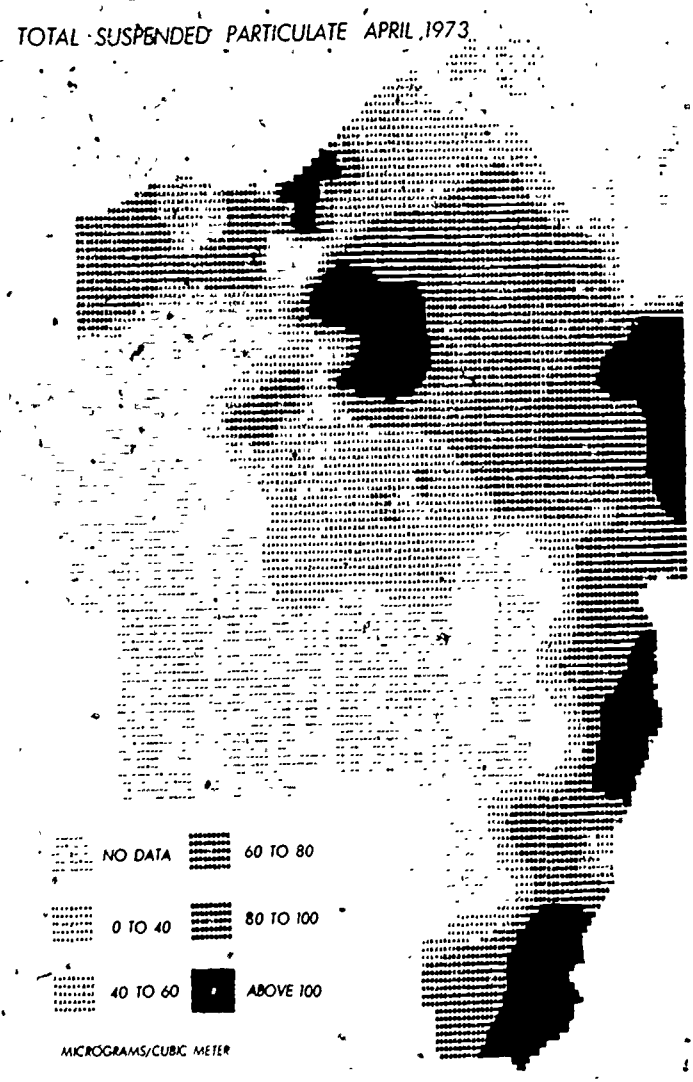

Figure 2. Study Area: SYMAP of Air Quality for the Northeast District of Ohio.

the geometric means of the data for the surveillance sites located within the area. High particulate values are noticeable in Cleveland, Akron, Youngstown, Steubenville, and North Ohio Valley area. By utilizing a two dimensional representation, significant "patterns" can be extracted from large quantities of air quality data.

Figure 3 is a representative Three-D plot of air quality over the Northeast District for April, 1973. Generally, a more complex "pattern" is obtained utilizing Three-D plots. This results from the use of an actual data value for a particular cell, whereas with the SYMAP representation, the data is categorized (e.g. 0-40, 40-60, etc.). Three-D plots can be used as a semi-quantitative way of presenting air quality data.

A comparison of the SYMAP and Three-D plot clearly shows differences that exist in presentation of data. The Three-D plot is more striking and can be more easily interpreted, but a familiar outline is necessary for geographic recognition (e.g. State of Ohio). Also, particular values may be chosen for a specific area, and areas that are very high are discernable. However, the SYMAPS are useful in arriving at "patterns" in air quality, and they may be easily analyzed through time. They also are more easily utilized by engineers and administrators for estimates needed in making evaluations.

CONCLUSIONS AND FUTURE GOALS

To meet the specialized and complex needs of environmental protection agencies concerned with air pollution, researchers must have accurate and efficient methods of reducing large quantities of air quality data. These methods are essential in the charting of regional trends of air pollution dispersal and are necessary for effective air quality management. The SYMAPS and Three-D graphical representations of data presented here help meet these demands.

Computer graphics, along with the computer processing of air quality data, lay the foundation for future, more elaborate analysis as well as for the work that has already been started. Analysis will include extensive diffusion modeling studies on all air quality data that is available for this area, computerization and utilization of meteorological data relevant to the study; correlation, regression, factor analysis, and

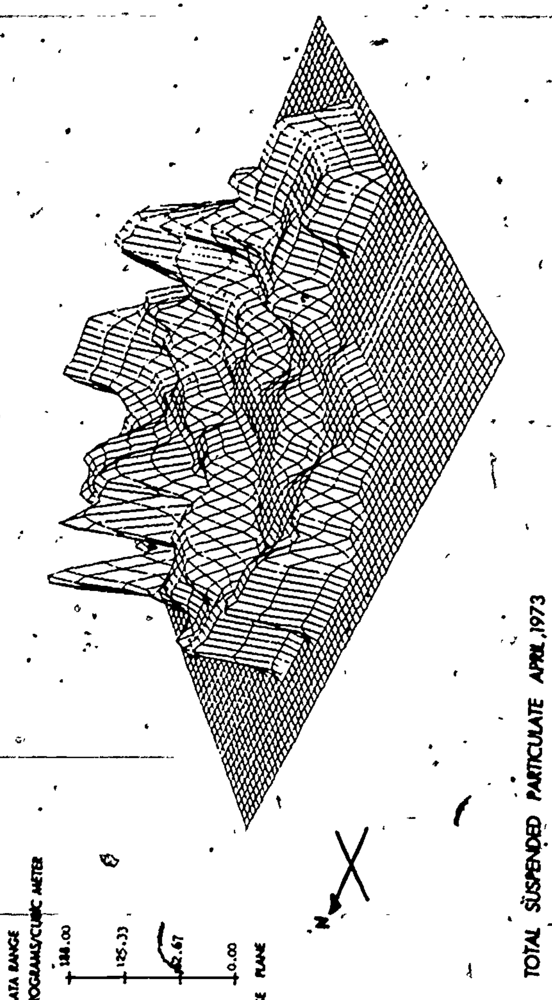

Figure 3. Study Area: Three-D Plot of Air Quality for the Northeast District of Ohio.

other statistical evaluation on air quality data (and meteorological and topographical conditions), the implementation of this system on a state wide basis for the timely evaluation of air quality data, the use of this system in special case studies, and surveillance site evaluation studies.

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REFERENCES CITED

Cleaning Our Environment, The Chemical Basis for Action, A Report by the Subcommittee on Environmental Improvement, Committee on Chemistry and Public Affairs, American Chemical Society (1969) pp. 3-7.

"Ohio Establishes Clean Air Goal" Newsleaf, The State of Ohio Environmental Protection Agency, Vol. 1, No. 3 (1973).

AN URBAN ATLAS, OR ONLY COMPUTER-MAPPING: WHICH WAY SHOULD GEOGRAPHERS GO?

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ABSTRACT: - Geographers are sometimes asked by their colleagues from other disciplines to produce thematic maps, illustrating complicated data or interrelated spatial distribution of research elements. Mapping is the time consuming major language of geographers, which makes interdisciplinary cooperation possible. Dissatisfied younger representatives of our profession have turned to computer mapping as a solution. Yet, there is nothing wrong with any technique of cartography provided the result justifies the effort and makes the geographer respected for his achievement. I contend that for each assignment a special technique is necessary and useful.

Planning issues may be obscured and wrong information fed into computers. Adequate thematic mapping should present the interrelationship of contour-lines, vegetation and waterbodies, political units and man's activities near and in urban centers. Color and symbols on such maps can help to illustrate complex situations. The computer is only a limited tool to achieve these ends. Geographers should not concede their obligation to society where model building and allocation schemes are considered. Computer mapping should start only after a planning atlas has been produced.

During my work as teacher, city planner and geographer, I had the opportunity, challenge and obligation to produce maps for Vienna, Toronto, Peoria, Akron and Youngstown. I believe that the quality of the language of geographers is indicative, how we, as geographers can communicate with our colleagues or fellow-men, when we present the facts of spatial interrelationship in cities or regions. The language of geographers includes the art and science of map making. For the analysis of a city or region

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we may use data from geology, soil science, climate, population studies as well as behavioral data in order to prepare a geographic synthesis of cities or regions, thus assisting in selection of sites and certain land uses, now and in the future, realizing the best interest for people living in our cities.

The goals and problems of urban America were well defined by a governmental publication in 1967 (Urban America, 1967). Politicians usually decide priorities according to funding and needs. Urban planners are eager to extinquish poverty, help increase the quality of urban life and organize within our urban communities the social environment necessary for the well being of our citizenry. The problems of inner cities require legal, educational, medical and architectural assistance. The public sector needs private help when both together take up their burden for our country.

Only an urban atlas can scientifically present the threads of the city, the activities of its dwellers and the urban environment, which is the scene of urban life. We as geographers should feel responsible to be in the forefront of map making activities. We, as servants to the "Mother of Natural Sciences" have seen so many offsprings deny the old roots. Geologists, sociologists and lately urban environmentalists, try to push geographers away from our old obligations. Can we not blame ourselves? Have we produced maps or atlases, when there is an urban need?

The purpose of this paper is to demonstrate the need for an urban atlas and to outline a work program, which as a geographic task needs performance in each city which has a geography department. An urban atlas can be produced as other countries have proven to us. Table 1 is a tentative outline for one hundred variables which can be drawn on maps, at a scale 1:24,000. This scale would permit rapid production as U. S. Geological Survey photographs could be the base. I shall describe examples of urban atlases in the U. S. A., England, Germany and Austria. I believe we in this country have neglected this task probably hoping for miracles from the computer.

An urban atlas describes locational qualities and potentials of the city, it analyzes the political structure and the historical development.

TABLE 1

TENTATIVE OUTLINE FOR AN URBAN ATLAS

1. Location and Size
2. Geology, Bedrock
3. Relief
4. Geomorphology
5. Climate
6. Pollution Level
7. Soils
8. Vegetation, Original
9. Drainage Pattern
10. Floodplain
11. Water Supply
12. Mineral Resources
13. Phenology
14. Agricultural Land
15. Forest Reserves
16. Amenities
17. Administration
18. Settlement Pattern
19. Historical Development
20. Built-up Areas
21. Limitations for Building
22. Population Distribution
23. Change of Population
24. Migration
25. Populace by Agegroups
26. Welfare Cases
27. Religious Distribution
28. Ethnic Concentration
29. Areas of Black Americans
30. Housing Distribution
31. Overcrowding
32. Value of Homes
33. Homeownership
34. Rental Areas
35. Apartments
36. Public Housing
37. Urban Renewal
38. Vacant Land
39. Land Use
40. Residential
41. Commercial
42. Industrial
43. Open Space
44. Offices
45. Iron and Steel
46. Electrical Industry
47. Textile Industry
48. Chemical Industry
49. Food Industry
50. Small Businessmen
51. Employment, Total
52. " by Place of Work
53. " by Place of Residence
54. Home Occupation
55. Wholesale
56. Banks and Insurance
57. Foreign Trade
58. Hotels and Motels
59. Agriculture
60. Planning Issues
61. Federal Ownership
62. State Ownership
63. Local Governmental Ownership
64. Taxexempt Areas
65. Transportation
66. Network
67. Facilities and Plants
68. Modes of Transportation
69. Isochrones
70. Accident Areas
71. Masstransit
72. Airport Connection
73. Railroad Connection
74. Waterbound Connection
75. Commuters
76. Traffic Generators
77. Highway System
78. Service Areas
79. Capacity of Streets
80. Water Pipes and Sewers
81. Utility Lines
82. Parklands
83. Playgrounds
84. Community Facilities
85. Churches
86. Youth Facilities
87. Facilities for Senior Citize
88. Hospital Services
89. Medical Centers
90. Structure of the City
91. Zoning
92. Police Districts
93. Land Value Areas
94. Conservation Areas
95. Taxation Surplus
96. Taxation Deficiency
97. Historical Buildings
98. Educational Facilities
99. Structure of the City
100. Land for Future Expansion

A large section should be devoted to the population structure, with special descriptions of the housing situation. Land description with land uses as the catalyst of all urban functions would be followed by a thorough analysis of the employment structure, as the economy determines the life of a city. Planning issues as executed between the political tiers will be followed by an analysis of transportation problems. The community facilities would illustrate the deeds of politicians for the populace. Concepts for the image of the city of the future could follow.

It seems paradoxical that the first urban atlas in the United States was edited by architects (Passonneau and Wurman, 1966). A St. Louis team selected twenty U. S. cities and prepared a basemap, at a scale 1:48,000, illustrating two computer calculated analyses of population density, and income for industrial and commercial activities. We have to praise their courage to tackle a complex problem. The objective or goals for the urban atlas fell short of perfection, as the language of architecture alone was employed. Geometric form and programming of design were the only objectives, as if a city can live by form alone. The photon-model 713 process of printing maps has to be improved as the authors realized themselves. Two factual presentations are not enough to describe the intricate and complex structure of our cities. That is why I recommend revised editions and to draw at least one hundred maps.

The following atlases have been edited by geographers and indicate by their excellence the possibility for geographers to produce an urban atlas for the benefit of all concerned.

The Atlas of London (Jones and Sinclair, 1968) was started in 1962, one year after the census, but in the same year as a thorough transportation study. Dr. Jones, a geographer, lead the team of experts. He was assisted by computer wizards applying special printing techniques. The result is a marvelous atlas.

You can take the maps out of the box and compare them with each other. The City of London, County and Region are displayed on 70 sheets. Physical and historical development on three sheets, the description of society on 30, sixteen for population, ten for housing, four for the economy, nine for land use and seven for employment. The last 16 sheets

illustrate the complex data analyzing the transportation study.

Gaits (1968, 1969) and his British co-workers developed the LINMAP technique, different from the SYMAP system used at Harvard. The British use a lineprinter with color notation. Computer assisted maps can only be printed on one surface, which may simplify or even distort facts, especially when more than one base notation would improve readability or cross reference. The same color tone in harbor areas may give a wrong picture of the distribution of housing densities over larger areas than they occupy. In reality, the net density in the vicinity of industrial complexes is higher than illustrated. The color code is strong and pleasing to the eye, the message from the geographer to the reader is easy to understand and even for complex subject matter, well defined.

It is a tradition for central European geographers to produce excellent maps and atlases. For the Atlas of Berlin, (Behrmann and Schroeder, 1962), politicians provided the funding and enabled a team of scientists, geographers, architects, engineers and planners, to complete the most modern urban atlas. The Academy for Spatial Research and Regional Planning supervised the edition of regional atlases, which will cover the whole territory of the Federal German Republic (Boustedt, 1962).

The atlas comprises a total of 101 sheets. Figures in brackets indicate the number of maps devoted to each subject. The topography (4), physiographic input (8), population characteristics (11), settlement and physical planning elements (17), are described on 40 sheets. The economy, industry and employment (17), transportation problems (27) follow next. Community facilities and planning issues are mapped on 17 sheets.

The base are soft toned topographic maps, which permit maximum identification and excellent readability of the overprints. The scale varies from 1:500,000 for comparative regional maps to 1:50,000 for the major maps. Color tones on the base are in tune with overprints. Symbols make the reading of the atlas easy and mapping techniques follow the complex nature of the subject. Each map is a final presentation and by comparison can be used as an input for planning decisions.

The presentation of employment data by place of work and by residence permits the study of journeys to work. A sequence of location maps illustrates the internal structure of functions. Intensity ribbons and arrows

bring additional information to the reader. The effect of color-mix is instructive and pleasing to the eye.

The Viennese school of cartography is active in thematic cartography, a subject less well practiced in the U. S. A. Dr. Arnberger (1966), a personal friend, is chairman of a department of cartography, which is attached to geography in Vienna.

Hettner taught his students to improve the language of geographers. A reader should be able to visualize factual interrelationships. Eckert founded the logistics of cartography, which is the science that teaches methods and techniques of map construction. Symbols, color and script can reproduce an image of reality, even project several dimensions into a two-dimensional expression. Dr. Arnberger uses the scale 1:25,000 for his atlas maps in urban areas. He is a master of symbol combinations which make the most complex data readable on his maps. Dr. Arnberger edited, following Professors Hassinger and Bobek, the Austria Atlas and a Vienna Atlas. I consider each map a piece of cartographic art. The idea, the themes of the maps, are geographic expressions and are the result of experimentation. His latest results show Arnberger, achieving near-perfection. His text, Thematic Cartography ..., has not been translated, but I imagine, that it could well become an excellent textbook for our schools.

The topographic map stores a gigantic amount of data. Roberts (1962), calculated that a computer deck of the contents of one sheet would need 600 million bits. No computer could thus store the data for the whole of Ohio. That is why we try to compromise, reduce the number of facts and possibilities; and distort.

I believe that no computer can ever replace the capacity of the human brain in data reading and handling of variables. In addition, I see that damage can be done by error when data are fed onto tapes. I strongly believe that at present computer-mapping is no match for the urban atlas-concept.

Dr. Taylor (1972) compiles a bibliography on computer-mapping, which indicates the wide lead of American geographers in this field, but much more has to be done. I am not convinced, that by 1976 or within two years

we can improve computer mapping sufficiently. Each University with a geography department should complete an urban atlas. It is my contention, that once we have urban atlases, similar to the European, the knowledge we could derive from them for Ohio and the U. S. A. could bring us ahead in the field of computer-mapping.

On computer-maps I miss a real contour-line. I perceive that everybody simplifies variables to satisfy the almighty computer. This can only be a distortion of the facts. The maximum number of variables you can use on a computer-map is ten, what are we going to do in a case where the situation requires more than ten parameters or symbols? Make another map? Use more paper? What a waste measured against the result. These statements should not be construed as claiming computers are useless, on the contrary, computers will help planners especially to make additional variations of plans, shorten the time for allocation models, help to distribute funds in capital improvement programs or for many other useful applications.

In the forefront of urban research many American geographers have made impressive contributions. We can hope to complete urban atlases sooner, hopefully by 1976, the year of the U. S. bicentennial festivities. We geographers have to pool ideas, concepts and artistic interpretations of the reality, exemplified in urban atlases from all over the world, in order to meet this challenge.

In Youngstown our department is trying to start an urban atlas with student assistance. I realize what we face, but we have decided to go on. I wish sincerely that you, ladies and gentlemen, follow and compete with us in the interest of our cities and our country.

The slides presented may indicate the progress which could be achieved in some places in the world (Schwarz, 1966). May we hope that during the preparation of an urban atlas for cities and regions a new feeling for state and country may develop. May the spirit of cooperation and exchange of ideas bring the geographic community in Ohio together and create new friendships all over the State.

REFERENCES CITED

Arnberger, Erik, "Handbuch der thematischen Kartographie" (Wien: Deuticke Verlag, 1966). (Handbook of Thematic Cartography.)

Behrmann, W. and K. Schroeder, "Deutscher Planungsatlas: Vol. #9. Atlas von Berlin," (Hannover: Gebruder Janecke Verlag, 1962).

Boustedt, Olaf, "The Significance of Planning Atlases: The German Experience," The Canadian Geographer Vol. VI (No. 1, 1962), pp. 32-39.

Dudnik, Elliot E. "SYMAP User's Manual for Synagraphic Computer-Mapping," University of Chicago: Department of Architecture, 1972).

Gaits, G. M. "Thematic Mapping for Computer-LINMAP," The Cartographic Journal, Vol. 5, (1968) and Vol. 6, (1969), pp. 50-68.

Greer-Wootten, Bryn, A Bibliography of Statistical Application in Geography, Washington: A.A.G. Committee on College Geography - Technical Paper No. 9, 1972.

Jones, Emrys and O. T. Sinclair, Atlas of London and The Region, (London: Pergamon Press Ltd., 1968).

Nie, Norman H., Dale H. Bent, C. Hudlow Hull, S.P.S.S. Statistical Package for the Social Sciences, (New York: McGraw-Hill Book Comp., 1970).

Passonneau, Joseph R. and Richard Saul Wurman, Urban Atlas: 20 American Cities, A Communication Study Noting Selected Urban Data at a Scale 1:48,000 (St. Louis: M.I.T. Press, 1966).

Roberts, J. A., "The Topographic Map in the World of Computers," Professional Geographer, Vol. XIV (Nov. 1962), pp. 12-13.

Schwarz, Gabriele, Allgmeine Siedlungsgeographie, (Berlin: Walter DeGruyter and Comp., 1966).
(General Settlement Geography, esp. p. 363-621).

Taylor, D. R. F., Bibliography on Computer Mapping, (Monticello, Ill.: Council of Planning Librarians, Exchange Bibliography 263, 1972).

Urban America: Goals and Problems, (Washington: U.S. Congress, Material compiled and prepared for the Subcommittee on Urban Affairs of the Joint Economic Committee, 1967).