THE UNIVERSITY OF MANITOBA

A FACTOR ANALYSIS OF SOCIAL AREA SPACE: METROPOLITAN WINNIPEG, 1951 - 1961

by

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ABSTRACT

The purpose of this research was to provide a geographic analysis of metropolitan Winnipeg's social space and the changes which altered it in the course of the decade between 1951 and 1961. In particular, this study examined the seven social area dimensions extracted from the data sets utilizing a principal factor solution with quartimax iteration. It was assumed that the factor scores incorporated in a synagraphic mapping technique would give adequate areal expression to each social area dimension. The factor scores for 1951, 1961 and the change data were dependent on information pertaining to metropolitan Winnipeg's census tracts provided by the Dominion Bureau of Statistics.

Conclusions resulting from the analysis were of two types: the first stemmed from the ecological structure of the dimensions; the second reflected the areal expression of these same dimensions. The former conclusions included the increased relative and absolute value of family status and economic status, the increased absolute but relatively stable values of migrant status and household status, and the relative and absolute decline in ethnic status. The most important dimensions of change included economic status, life style and migrant status. There may have been a slight increase in the differentiation of Winnipeg's ecological structure.

The second set of conclusions were entirely dependent on cartographic analysis. Each of the five shared dimensions exhibited some degree of spatial regularity in 1951 and 1961. Migrant status emerged as the only factor in 1961 which did not have a simpler spatial expression than in 1951. Economic status varied by sector, with growth occurring along the outer periphery of each sector, while a wave of change moving outwards from the inner city characterized family status. Ethnic status represented a combination of nuclei, sectors and concentric zones in 1951, but by 1961 this had given way to a predominantly sectorial pattern. Growth patterns had both a sectorial and nucleated distribution. Migrant status offered a complex arrangement of nuclei, concentric zones and sectors, but growth patterns were primarily sectorial. Household status had an underlying concentric zone arrangement, especially in 1961. Growth appeared to take place according to both concentric zones and sectors. These results support the supposition that urban space can be effectively mapped to display the ecological fabric of metropolitan Winnipeg.

Kenneth Franklin Turnbull

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CHAPTER I

CONCEPTS OF SOCIAL SPACE

A. Traditional Spatial Theories:

The purpose of this chapter is to provide a theoretical framework which would support a set of hypotheses concerning social space. The author began with the three traditional theories which included Burgess' and Park's concentric zone hypothesis, Hoyt's sector theory, and Harris' and Ullman's multiple nuclei model.

Burgess' and Park's concentric zone model presented an ideal that "would occur if only one factor, radial expansion from the city centre, determined the pattern of urban growth".[1] The basic assumptions underlying the concentric zone hypothesis were: (1) rapid unrestricted urban expansion, (2) a large and rapidly-increasing population and (3) a "heterogeneous population, differentiated in terms of migration experience, ethnic background and occupation".[2]

Hoyt's sector model concentrated on the changing spatial structure of the city rather than on existing conditions. The sector model was an empirical generalization for making practical decisions about future rental

[1] Duncan Timms, The Urban Mosaic, p. 215.

[2] Ibid., p. 216.

patterns. Both spatial theories emphasized the importance of "physical location and distance from the city centre".[3]

Berry[4] and Salins[5] suggested that Harris' and Ullman's multiple nuclei model should be used to explain the distribution of segregation in a given city. Anderson and Egeland urged that the three models be used in a complementary fashion to describe separate aspects of social differentiation.[6] Salins pointed out that the only way the models could be reconciled was if

> they are shown to describe different aspects of residential location . . . This would be the case if each model were to describe the spatial distribution of a different set of population characteristics.[7]

In a move towards an integrated spatial theory, Berry wrote, "the models are independent, additive contributors to the total socio-economic structuring of city neighbourhoods".[8] In every study there were just three dimensions of variation:

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[3]Ralph Thomlinson, Urban Structure, p. 149.

[4]Brian Berry, "Internal Structure of the City", in R. Evett and R. Leach (eds.) Urban Problems and Prospects, p. 107.

[5]Peter Salins, "Household Location Patterns in American Metropolitan Areas", Brian Berry (ed.), Economic Geography, Vol. 47, No. 2 (Supplement), June 1971, pp. 234-248.

[6]Theodore Anderson and Janice Egeland, "Spatial Aspects of Social Area Analysis", American Sociological Review, Vol. 26, June 1961, pp. 392-399.

[7]Salins, op. cit., p. 234.

[8]Brian Berry and Frank Horton, Geographic Perspectives on Urban Systems, p. 309.

(1) the axial variation of neighbourhoods by socio-economic rank, (2) the concentric variation of neighbourhoods according to family structure, and (3) the localized segregation of particular ethnic groups.[9]

B. Social Area Analysis:

The connection between the traditional spatial theories and social area analysis was that the latter model expressed urban space according to the three orthodox patterns. Social area analysis, as originally conceived by Shevky and Williams and as developed by Shevky and Bell, perceived the urban residential neighbourhoods to be characterized by three indices: economic status (social rank), family status (urbanization) and ethnic status (segregation). On the basis of scores derived from the three indices, census tracts can be arranged to create a typology of distinct social areas.[10]

Social area analysis has been criticized by Hawley and Duncan for: (1) failing to provide an adequate theoretical foundation to explain why urban neighbourhoods are distinguishable, and (2) appearing to be an "ex post facto rationalization for their choice of indices".[11] These criticisms may contain an element of

[9] Berry, op. cit., p. 107.

[10] T. G. Nicholson and M. H. Yeates, "The Ecological and Spatial Structure of the Socio-Economic Characteristics of Winnipeg, 1961", The Canadian Review of Sociology and Anthropology, Vol. 6, No. 3, 1961, pp. 162-178.

[11] A. H. Hawley and D. Duncan, "Social Area Analysis: A Critical Appraisal", Land Economics, Vol. 33, 1957, pp.337-345.

validity, but not to such a degree as to warrant questioning the entire superstructure.

C. Factor Analysis of Social Areas:

Factor analysis was introduced to enhance the objectivity of results from social area studies and to handle the increasing complexity of the data. Taking advantage of this technique, Bell factor analyzed census data from Los Angeles and San Francisco extracting three indices--social rank, urbanization and ethnicity--which were necessary to explain variations between census tract populations.[12]

Johnston argued that an oblique rotation revealed a high degree of inter-factor correlation-- -0.62 for San Francisco and -0.73 for Los Angeles--between ethnic status and economic status.[13] Therefore, the two factors were not independent. Keith defended Bell's factor analysis of census data from Los Angeles and San Francisco by making the following observation:

> The high inter-item correlation within the clusters of variables which related to social status and family status strongly supported the assumption that both factors form unidimensional instruments.[14]

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[12] W. Bell, "Economic, Family and Ethnic Status: An Empirical Test", American Sociological Review, Vol. 20, 1955, pp. 45-52.

[13] R. J. Johnston, "Some Limitations of Factorial Ecologies and Area Analysis", Economic Geography, Vol. 47, No. 2, (Supplement), June 1971, p. 315.

[14] Margaret Keith, "Testing the Theory of Increasing Societal Scale: The Ecology of Toronto, 1951-1961", an unpublished M.A. thesis, p. 14.

There is a contradiction between Johnston's and Keith's conclusions.

D. Factor Ecology:

With the advent of modern computers facilitating the adoption of a larger number of variables than those originally used by Shevky and Bell, factor analysis of social areas became known as factor ecology. This was done to reduce the number of input variables to a few significant factors. As a general rule, Shevky's and Bell's three indices were present in North American studies. The one major exception was the southern United States where studies by Van Arsdol, Camilleri and Schmid[15], and Spodek[16] failed to confirm the validity of the Shevky-Bell constructs. This meant that the existence of the Shevky-Bell indices should be empirically tested rather than assumed. Berry and Horton suggested taking this line of reasoning one step further so that

> many more variables detailing the socio-economic characteristics of census tract populations should be included in the study . . .[17]

This author followed Berry's and Horton's suggestion and included 68 variables in the thesis.

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[15]Maurice Van Arsdol, Santo Camilleri and Calvin Schmid, "The Generality of Urban Social Area Indices", American Sociological Review, Vol. 23, 1958, pp. 277-284.

[16]Howard Spodek, "The Urban Ecology of Shreveport, Louisiana", Centre for Urban Studies, University of Chicago, 1968, (Mimeographed).

[17]Berry and Horton, op. cit., p. 316.

A factor analytic study of Seattle by Schmid and Tagashira on data sets involving 42, 21, 12 and 10 variables, respectively, proved that a small set of carefully selected variables essentially reproduced the same principal factors extracted from a much larger set. Their tests indicated that family status, socio-economic status and ethnic status are normally the basic causes of areal differentiation within cities.[18] The other factors which may occur appear to be the result of either the specific place or the data input.[19] Not unexpectedly, by increasing the number of variables in the data set, one could expect to extract additional factors. Murdie stated, "the results of a factor analysis . . . depend entirely on the nature of the variables which enter the analysis".[20] Latif and Hunter agreed.[21]

E. Spatial Aspects of Factor Ecology:

Since this thesis was particularly concerned with concepts of social space, the author has included a section

[18] Calvin Schmid and Kiyoshi Tagashira, "Ecological and Demographic Indices: A Methodological Analysis", Demography, Vol. 1, 1964, pp. 194-211.

[19] Johnston, op. cit., p. 316.

[20] Robert Murdie, Factorial Ecology of Metropolitan Toronto, 1951-1961, p. 31.

[21] A. H. Latif and A. Hunter, "Stability and Change in the Ecological Structure of Winnipeg: A Multi-Method Approach", Canadian Review of Sociology and Anthropology, Vol. 10, 1973, pp. 308-333.

on the spatial aspects of factor ecology. Anderson and Egeland employed a three-way analysis of variance to test the association of social rank with Burgess' concentric zone model and urbanization with Hoyt's sector hypothesis on four cities--Akron, Dayton, Indianapolis and Syracuse. The results revealed that urbanization varied essentially with respect to distance, suggesting that it was concentrically distributed, whereas social rank varied according to sector.[22]

In a factor ecology of Chicago, Rees discovered that when the area studied was confined to the effective housing and labour market of the metropolis, social rank appeared essentially sectorial and urbanization was primarily zonal.[23] Berry and Horton stressed that the size of any study area has a functional limitation.[24] Accordingly, they would argue that this was the only valid part of Rees' analysis.

Timms wrote, "It appears that the larger the city, the more complicated its spatial structure"[25], but it was more likely that the complicated spatial patterns were due to "the greater heterogeneity of the large city

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[22]Anderson and Egeland, op. cit., pp. 392-399.

[23]Timms, op. cit., p. 233.

[24]Berry and Horton, op. cit., p. 317.

[25]Timms, op. cit., p. 234.

population.[26] The larger the city, the more probable it was that poor, segregated ethnic groups resided in inner city locations where

> their presence is likely to upset the simple nature of the zonal and sectorial effects . . . It may be that the more homogeneous a population in terms of its degree of modernity and differentiation, the more its spatial patterning will approximate to the simple, additive model suggested by Berry.[27]

Salins advanced the hypothesis that social differentiation as formulated in social area analysis could be depicted in such a manner that each of the morphological patterns described the spatial distribution of one of the Shevky-Bell indices. More specifically, social rank exhibited Hoyt's sector pattern, stage of the family cycle presented Burgess' concentric pattern, and ethnic background displayed a clustered, polynucleated pattern corresponding to the Harris-Ullman multiple nuclei model.[28]

F. Social Area Change:

All the previously mentioned models have been essentially static theories. By that, the author meant that they are based upon material referring to one point in time. Social area change was a dynamic model, because it referred to material collected and based upon observations taken at two or more points in time. The aims of

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[26] Ibid. [27] Ibid.

[28] Salins, op. cit., pp. 234-248.

the social area change model were two-fold: (1) to measure the relative degree of change that had taken place over a given time period and (2) to identify the processes which brought about these changes.

There were two ways of approaching the problem of social area change. The first involved a simple comparison of the results taken at each point in time. Three of the earliest pioneers of social area change--Sweetser[29], Pedersen[30] and Greer-Wooten--follow this approach. Greer-Wooten's Montreal study concluded:

> It was earlier thought that a single dimension indicative of 'peripheral expansion versus central contradiction' might result from the analysis . . . Such an oversimplification is not justified. . .[31]

Haynes' factor analytic study of Montreal incorporated a more sophisticated version of the first approach. Utilizing relative rather than absolute data, oblique rotation with unity in the principal diagonal matrices, and spatial filters, Haynes identified five urban dimensions: socio-economic status, family status, recent

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[29]Frank Sweetser, "Factor Structure as Ecological Structure in Helsinki and Boston", Acta Sociologica, Vol. 8, 1965, pp. 205-225.

[30]Paul Pedersen, "An Empirical Model of Urban Population Structure: A Factor Analytic Study of the Population Structure in Copenhagen", Proceedings of the First Scandinavian-Polish Regional Science Seminar, Warszawa, 1967.

[31]Bryn Greer-Wooten, Montreal Intra-Urban Migration Project, Report No. 1, Ottawa, June 24, 1968, p. 16.

growth, minority group ethnic status and an employment and household status factor. The urban ecological structure was naturally orthogonal with strong temporal invariance, although socio-economic status remained the most important factor throughout. The spatial distribution of the factors remained exceptionally stable through time. The most interesting feature of the entire study was the selection of sector, zonal and nucleated algorithms as spatial filters. Even though Haynes admitted that the filters employed arbitrary criteria, the end result was a simpler more easily interpreted cartographic representation of spatial patterns.[32]

The author chose the second approach favoured by Brown and Horton[33] (1969), Murdie (1969) and King (1970). The problem of spatial change was approached by generating change data from the initial cross-sectional data for two or more years. Murdie's study of metropolitan Toronto was not only the most thorough and best documented work available on social area change, but it also has served as an excellent reference for future Canadian studies.

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[32]Kingsley Haynes, "Spatial Change in Urban Structure: Alternative Approaches to Ecological Dynamics", Economic Geography, Vol. 47, No. 2 (Supplement), June 1971, pp. 324-335.

[33]Lawrence Brown and Frank Horton, "Social Area Change: An Empirical Change", Department of Geography, Ohio State University, (Mimeographed) pp. 271-288.

Murdie extracted six change components accounting for 57% of the original variance, by employing coefficients of congruence on the factor structures for 1951 and 1961 as well as a principal components analysis on a matrix of relative change quotients.[34] Murdie called these change components (1) suburbanization, (2) ethnic change, (3) urbanization, (4) changes in residential stability, (5) changes in employment characteristics and (6) east European ethnic changes.[35]

The 1951 and 1961 factor patterns remained relatively stable through time, but the spatial patterning of the change components showed considerable variation. Murdie had observed that

> the economic status dimension moved outwards in a generally sectorial arrangement with the wedges of high and low status widening toward the periphery of the metropolitan area. The family status dimension tended to move outwards from the city centre in a concentric pattern . . . [while] . . . the 1951 ethnic status dimension diffused outwards in two different directions. In both cases the movement was sectorial . . . A component measuring variation in recent growth appeared in both 1951 and 1961 analysis and during the decade moved outwards an average distance of four miles in a generally concentric pattern.[36]

The geographic distribution of the change components were derived from a two-way analysis of variance associated with a grid of concentric zones and sectors

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[34] Murdie, op. cit., pp. 188 and 41-43 and 152-166.

[35] Ibid., p. 118.

[36] Ibid., pp. 142-146.

arbitrarily superimposed over Toronto. A comparison of F ratios identified the following configurations:[37]

Change Components	Primarily Sectorial	More Sectorial Than Zonal	Both Sectorial and Zonal	Primarily Zonal
1. Suburbanization				X
2. Ethnic change	X			
3. Urbanization			X	
4. Residential stability				X
5. Employment characteristics		X		
6. East European ethnic change		X		

King's study noted a definite lack of change in the social fabric of Columbus, Ohio, for the decade 1950 to 1960. Analysis of cross-sectional data revealed three social area indices: economic status, family status and ethnic status. Economic and family status displayed sectorial distribution, while ethnic status presented a nucleated pattern. The five dimensions of change were designated: (1) occupational structure, (2) family life cycle, (3) ethnic composition, (4) residential stability and (5) housing quality. Distorted concentric zonal patterns characterized both residential stability and housing quality change components. Even ethnic composition appeared as a series of nuclei arranged in a concentric manner. However, occupational structure possessed a definite sectorial pattern.

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[37] Ibid., pp. 164-165.

King noted that two currents of change flow from the inner city. The first or

> outer one is associated with upgrading at the urban periphery, while the inner one related to deterioration surrounding the inner core . . . If the exact location of these fronts of change can be identified, and their direction of movement estimated, they may have significance for urban planning.[38]

Since King's thesis accounted for only 40% of the total variance for Columbus, and Brown and Horton just explained 44% for Chicago, one tended to suspect the value of their relative change quotients. Murdie's study explained 57% of the variance for Toronto. The fact that Murdie's results were much better may have been due to a superior change quotient or because he relied on two methods--the relative change quotient and coefficients of congruence. The author believed that since all three studies accounted for relatively low proportions of the original variance, the general weakness may lie with the orthogonal rotation. King agreed for he wrote:

> It would appear . . . that orthogonality was enforced by the analytic technique rather than being an inherent characteristic of the various elements . . . The interrelationships among the characteristics are too complex to be adequately described by a small number of independent factors. It would appear that oblique

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[38]Paul King, "The Spatial Aspects of Social Area Change: Columbus, Ohio, 1950-1960", an unpublished M.A. thesis, p. 3.

> factor analysis might provide more meaningful results taking into account the high degree of intercorrelation between the various elements of social structure.[39]

G. Related Winnipeg Research:

Two geographical studies have been written on metropolitan Winnipeg; neither resembled the present study but both might be viewed as forerunners of it. The first, an unpublished thesis by Baxter (1968), demonstrated the validity of employing computerized factor analysis to identify the natural areas within the city.[40] Next, Nicholson and Yeates[41] (1969) applied principal components analysis to 1961 socio-economic data. Their methodology was an improvement over Baxter's technique in that urban sub-areas were now delineated according to multiple components. Yet by limiting themselves to the 1961 census material, Nicholson and Yeates were describing a dynamic situation in static terms.

A third and more important study by Latif and Hunter (1973), analyzed cross-sectional data on fifteen socio-economic variables representing 84 census tracts for both 1951 and 1961. Their study differed from the

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[39] Ibid., pp. 68-69.

[40] Richard Baxter, "The Use of Diagnostic Variables in Urban Analysis with Particular Reference to Winnipeg". An unpublished M.A. thesis, University of Manitoba.

[41] Nicholson and Yeates, op. cit., p. 176.

present analysis in that they were primarily concerned with increasing societal scale whereas the present study is concerned with sub-area differentiation. In both years, well-defined urbanization, social rank and migration status factors were dominant. Contrary to their expectations, the factor structures differed from those experienced in most American cities. Urbanization replaced economic status as the most important factor in 1961, whereas migration status remained third for both years. Latif and Hunter concluded that the ecological structure of Winnipeg was becoming less complex.[42]

H. Hypotheses:

It should be noted that factor analyses cannot be compared in a satisfactory manner if there are differences in (1) the type and number of input variables, (2) the size and nature of the study area, (3) the size and nature of areal units, (4) the time base, (5) the rotation method or (6) the factor model.

A number of hypotheses based on the preceding theoretical framework will be tested on metropolitan Winnipeg:

(1) Analyses of both cross-sectional and change data will yield at least six dimensions generally relating to eco-

[42]Latif and Hunter, op. cit.

nomic status, family status, ethnic status, migrant status, household status and employment characteristics.

(2) The three most significant social area indices in the cross-sectional analyses will be related to economic status, family status and ethnic status.

(3) Comparison of the 1951 and 1961 cross-sectional analyses will show that the relative importance of family status will increase, that economic status will remain stable and that ethnic status will decline.

(4) The three previously stated social area indices respectively will exhibit sectorial, concentric and nucleated patterns which can be mapped simultaneously into the physical space of the city to identify distinct neighbourhoods.

(5) Considerable variation will be found in the spatial patterns of every factor identified in both 1951 and 1961.

The focus of this thesis is on the spatial aspects of social differentiation in 1951, 1961, and in the change that took place between these two dates.

CHAPTER II

RESEARCH METHODOLOGY

A. Selection of Urban Area:

Winnipeg, Canada's fourth largest city, stands at the junction of the Red and the Assiniboine rivers near the geographic centre of North America. Winnipeg was chosen as the study area for four basic reasons. First, Winnipeg encompassed a large cosmopolitan population and possessed the most complex infra-structure of any city in the Prairie Provinces. This facilitated the extraction of a wide range of socio-economic variables. Second, the open prairie upon which Winnipeg was built offered no natural topographical barriers, except the rivers, which could distort urban spatial patterns. Third, between 1951 and 1961 the population growth and the correspondingly unplanned urban expansion fulfilled one of the key stipulations laid down by Burgess and Hoyt for the successful interpretation of their spatial models. Finally, metropolitan Winnipeg represented a unified housing and labour market which Berry argued was essential for a factor ecological analysis.

B. Sources of Data and Areal Unit of Analysis:

The years 1951 and 1961 were selected for this study because Census of Canada publications were unavailable for intermediate or subsequent years for small area

data. Although the author would have preferred to include 1971 census data, it was not available when this research was undertaken. All data pertaining to demographic and household characteristics was derived from the Dominion Bureau of Statistics (Census of Canada, 1951, Bulletin CT-6; Census of Canada, 1961, Bulletin CT-17)

There were two reasons for choosing the census tract as the basic unit of analysis. First, the Dominion Bureau of Statistics stated that

> census tracts are designed to be relatively uniform in area and population, and such that each is fairly homogeneous with respect to economic status and living conditions.[43]

Hawley and Duncan rejected the idea of homogeneous census tracts, since these boundaries are more often than not the result of historical and accident and political influence. Differences in population size and areal extent of the tracts, plus the wide range of socio-economic traits found within census tracts suggested a greater heterogeneity than the preceding quotation stated.[44]

To overcome the problem of scaling, the data was expressed as a percentage whenever it was possible to do so. This was done because the size of the areal units could have

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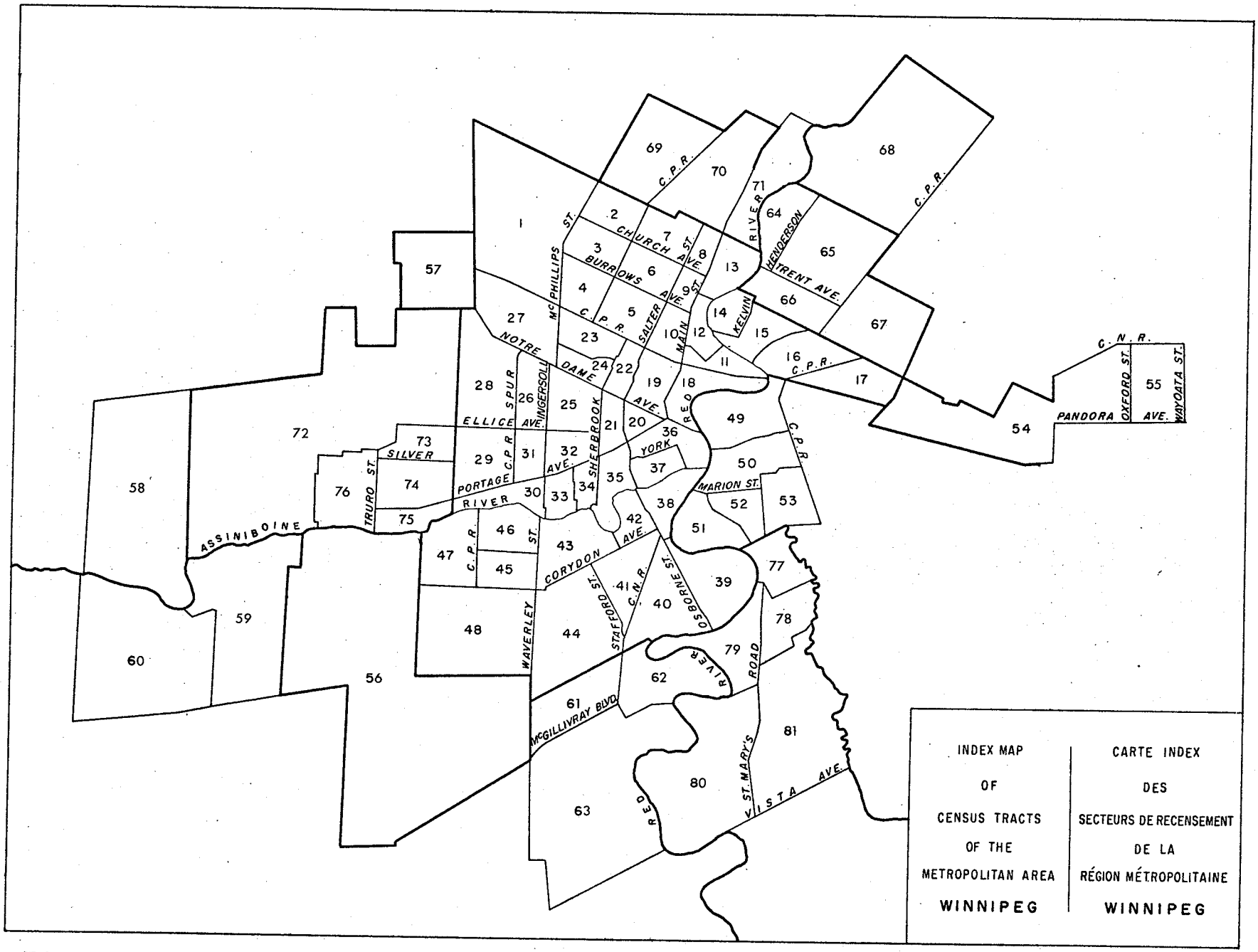
[43] Dominion Bureau of Statistics, Census of Canada, 1961, Bulletin CT-17, p. 3.

[44] Hawley and Duncan, op. cit.

FIGURE 1


INDEX MAP
OF
CENSUS TRACTS
OF THE
METROPOLITAN AREA
WINNIPEG
CARTE INDEX
DES
SECTEURS DE RECENSEMENT
DE LA
RÉGION MÉTROPOLITAINE
WINNIPEG
CENSUS OF CANADA, 1961
RECENSEMENT DU CANADA, 1961
ASSINIBOINE RIVER
PORTAGE AVE.
NOTRE DAME AVE.
ELLICE AVE.
SILVER
YORK
MARION ST.
CHURCH AVE.
BURROWS AVE.
SALTER
MAIN
KELVIN
HENDERSON HIGHWAY
McPHILLIPS ST.
INGERSOLL
SPUR
SHERBROOK
RED
TRURO ST.
C.P.R.
C.N.R.
CORYDON AVE.
WAVERLEY
STAFFORD ST.
OSBORNE ST.
McGILLIVRAY BLVD.
ST. MARY'S ROAD
VISTA AVE.
PANDORA
OXFORD ST.
MAYDATA ST.
AVE.
RIVER
TRENT AVE.

had a direct bearing upon the size of the correlations and the direction of association for the variables under consideration.

The second and more significant reason for using census tracts centred on the ready availability of census material in this form. Therefore, most researchers have depended upon the census tract as their unit of analysis.

To facilitate comparison between 1951 and 1961 data, the areal units had to be exactly the same in both years. For this purpose a modified version of the 1951 census tract boundaries was employed as shown in Figure 1.

C. Choice of Variables:

This writer followed the example set by Brown and Horton[45], Murdie[46], and King[47] in selecting a broad spectrum of socio-economic variables from the Canadian Census. As shown in Table 1, the variables were grouped under the following headings: (1) Age, Sex and Marital Status, (2) Ethnic Origins, (3) Official Language and Religious Affiliation, (4) Population Change, (5) Education, (6) Household Characteristics, (7) Residential Stability, (8) Family Status, (9) Employment, (10) Occupation and (11) Selected Geographical Measurements.

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[45]Brown and Horton, op. cit.

[46]Murdie, op. cit.

[47]King, op. cit.

TABLE 1

VARIABLES SELECTED FOR FACTOR ANALYSIS

Variable Number	Variable Groupings	Variable Title
1.	Age Structure	% of pop'n., age 0-14
2.		% of pop'n., age 65 & over
3.	Marital Status	% of pop'n., single (15 years & over)
4.		% of pop'n., married (15 years & over)
5.	Ethnic Origins	% of pop'n., British Isles
6.		% of pop'n., French
7.		% of pop'n., German
8.		% of pop'n., Italian
9.		% of pop'n., Netherlands
10.		% of pop'n., Polish
11.		% of pop'n., Russian
12.		% of pop'n., Scandinavian
13.		% of pop'n., Ukrainian
14.		% of pop'n., Other European
15.		% of pop'n., Asian
16.	Official Language	% of pop'n., speaking neither English nor French
17.	Religious Affiliation	% of pop'n., Jewish
18.	Educational Status	% of pop'n., not attending school
19.		% of pop'n., with no schooling
20.		% of pop'n., with one or more years of elementary schooling
22.		% of pop'n., with {one or more years of university (1961) / 13 or more years of education (1951)}
21.	Population Change	% change in pop'n. {1941-1951 (1951) / 1956-1961 (1961)}

VARIABLES SELECTED FOR FACTOR ANALYSIS, Cont'd:

Variable Number	Variable Groupings	Variable Title
23.	Household Size	% of households, occupied by 3 persons or less
24.		% of households, occupied by 6 persons or more
25.		% of households, occupied by a single family
26.		% of households, with lodgers
27.	Occupied Dwellings	% of dwellings, single detached
28.		% of dwellings, apartments & flats
29.		% of dwellings, owner occupied
30.		% of dwellings, reporting a mortgage
31.	Amenities	% of dwellings, with furnace heating
32.		% of dwellings, with flush toilets (exclusive use)
33.		% of dwellings, with bath or shower (exclusive use)
34.		% of dwellings, with refrigerator (mechanical)
35.		% of dwellings, with passenger automobile
64.		% of dwellings, with {television (1961) / electric cleaner (1951)}
36.	Residential Stability	% of dwellings, occupied 5 years or less
37.		% of dwellings, occupied more than 5 years
38.	Family Status	% of families, with 0-2 children
39.		% of families, with 5 or more children
40.		% of families, with children under age 6
41.		% of families with wage-earner heads
42.	Employment Status	% of employed males
43.		% of employed females
44.	Occupation	% of male managers
45.		% of male clerks
46.		% of male transportation & communication workers

VARIABLES SELECTED FOR FACTOR ANALYSIS, Cont'd:

Variable Number	Variable Groupings	Variable Title
47.	Occupation, cont'd.	% of male service workers
48.		% of male labourers
49.		% of female managers
50.		% of female clerks
51.		% of female transportation and communication workers
52.		% of female service workers
53.		% of female labourers
65.		% of male {professional & technical workers (1961) / professional workers (1951)}
66.		% of male {sales personnel (1961) / commercial & financial workers (1951)}
67.		% of female {professional & technical workers (1961) / professional workers (1951)}
68.		% of female {sales personnel (1961) / commercial & financial workers (1951)}
54.	Miscellaneous	Sex ratios (females per 1000 males)
55.		Rooms per family
56.		Rooms per dwelling
57.		Persons per room
58.		Male earnings {average (1961) / median (1951)}
59.		Female earnings {average (1961) / median (1951)}
60.		Family or household earnings {average (1961) / median (1951)}
61.	Geographical Measures	Pop'n. density
62.		Distance from peak land value (linear)
63.		Pop'n. potential (time travel distance)

Explanatory Notation: In the "Change Analysis", variables 62, 64, 65, 66, 67 and 68 were deleted, leaving 62 of the original 68 variables.

Every observation recorded in the 1951 data set had its counterpart, by definition or function, in the 1961 data. The choice of common change variables proved more difficult. Variable 62, measuring the linear distance from the peak land value to the centre of each census tract, was deleted as the linear distance remained constant between 1951 and 1961. Inevitably, given the nature of the relative change quotient, the degree of change taking place turned out to be zero. For instance, if the distance from peak land value was one mile for both 1951 and 1961, the relative change quotient generated:

$$CV_{ij} = \frac{V_{ij}\ (1961) - V_{ij}\ (1951)}{V_{ij}\ (1951)}$$

$$= \frac{1 - 1}{1}$$

$$= \frac{0}{1} = 0$$

V_{ij} indicates variable i for census tract j. Thus each variable in the change analysis CV_{ij} represents the percentage which occurred between 1951 and 1961 using 1951 as a base.[48]

Variable 64 consisted of two uniquely independent observations--electric cleaners in 1951 and television sets in 1961. Both household items reflected the general affluence of the population in the urban census tract, but were deleted because they were incompatible in a direct comparison. Similarly, variables 65 to 68, which dealt with

[48]Brown and Horton, op. cit., p. 276.

male and female employment in certain occupations, were dropped because of a change in the way these occupations were defined between censuses.

One minor difficulty concerning the common change variables affected variable 21, the population change observation. The figures shown in the 1951 and the 1961 data decks were expressed as percentages which respectively revealed the changes in population from 1941-1951 and from 1956-1961. However, in order to show the population change that had occurred between 1951 and 1961, the raw frequencies representing the total population in each census tract for both years were substituted directly into the relative change quotient.

D. Number of Factors Selected:

There was no universally accepted way of determining the optimum number of common factors. Six factors were selected in this analysis for the following reasons: (1) partly because Murdie had found six in Toronto, (2) partly because the six factors had eigen-values greater than unity, and (3) partly because the six factors satisfied Harris' and Harris' definition of

> a common factor . . . [as] . . . any one which has a minimum of two variables with factor coefficients ("loadings") greater than .30 (absolute).[49]

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[49] Margaret Harris and Chester Harris, "A Factor Analytic Interpretation Strategy", Wisconsin Research and Development Centre for Cognitive Learning, (Mimeographed).

Since the six factors fulfilled the last two requirements which are the only universally accepted requirements, the author believed the six factors actually existed and were not simply the result of statistical artifact.

E. The Factor Model:

I. Introduction:

Factor analysis identifies the chief underlying dimensions associated with social area differentiation in metropolitan Winnipeg. The computer program BMD-08M, formerly known as BMD-X72, combined elements of both component and common factor analysis. More specifically, this meant the correlation matrix, eigen-values and cumulative proportion of total variance were calculated strictly according to principal component analysis. Communalities, rotated factor loading matrix, correlation matrix of the rotated factors and factor scores fell into the realm of common factor analysis.[50]

Factor analysis could not be considered a unitary concept as it incorporated several mathematical procedures. The three major steps were:

(1) the preparation of the correlation matrix

(2) the extraction of the initial factors--the exploration of possible data reduction, and

(3) the rotation to a terminal solution--the search for

[50] Dr. K. Subrahmanian, Department of Statistics, University of Manitoba.

simple and interpretable factors.

Step (1) utilized R-mode correlation between the variables, step (2) defined the factors and step (3) employed oblique rotation. The defined initial components were extracted in such a way that each factor was independent of the other; in other words, the components were orthogonal.

II. Defined Factors:

Principal component solution made no assumptions about the underlying structure of the variables. Principal component solution did not reduce the number of variables:

> Since each component is defined as the best linear summary of variance left in the data after the previous components are taken care of, the first M components--usually much smaller than the number of variables in the set--[51]

accounted for a large proportion of the total variance. The analysis terminated when the remaining components were considered to be insignificant. This meant some of the information contained in the Σ of the variance was lost, but the principal component solution technique kept this loss to a minimum.

The component model was expressed concisely as:

> $Z_j = a_{j1} + a_{j2}F_2 + \ldots + a_{jn}F_n$
> where each of the n observed variables is described linearly in terms of n new uncorrelated components F_1, F_2 . . . F_n, each of which is, in turn, defined as a linear combination of the n original variables.[52]

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[51] Norman Nie, Dale Bent and Hadlai Hull, SPSS: Statistical Package for Social Sciences, p. 210.

[52] Ibid.

III. Oblique Rotation:

Oblique rotation, a common factor analytic technique, was more complex, but it had three decided advantages over orthogonal rotation. First, it defined the clusters of variables better; second, it revealed the correlation between clusters, and third, if orthogonality existed, an oblique rotation yielded orthogonal factors.[53]

There are many techniques for oblique rotation. Carroll took quartimin and covarimin and split the difference to obtain the biquartimin solution. Harman claimed biquartimin provided a more satisfactory simple structure in terms of interfactor correlations and factor loadings than either of its predecessors.[54]

> Carroll has generalized the biquartimin function to a class of solutions termed oblimin that have covarimin and quartimin as subcases. By weighting the functions by two parameters β_1 and β_2, he is able to combine Q and C in different combinations:
>
> $$B^* = \beta_1 Q + \frac{\beta_2 C}{n}$$
>
> Replacing Q and C with the appropriate functions and putting $\gamma = \beta_2 / (\beta_1 + \beta_2)$, Carroll determines the oblimin criterion:
>
> $$\mathcal{B} = \sum_{1<q=1}^{p} \left\{ m \sum_{j=1}^{m} \left(\frac{\alpha_{j1}^2}{h_j^2}\right)\left(\frac{\alpha_{jq}^2}{h_j^2}\right) - \gamma \left[\sum_{j=1}^{m} \left(\frac{\alpha_{j1}^2}{h_j^2}\right)\right]\left[\sum_{j=1}^{m} \left(\frac{\alpha_{jq}^2}{h_j^2}\right)\right] \right\}$$

---

[53] R. J. Rummel, Applied Factor Analysis, p. 171.

[54] Harry H. Harman, Modern Factor Analysis, p. 325.

where α_{jl} was the oblique reference structure loading, and l and q were the lth and qth factors.[55]

Oblimin solutions were completely dependent on the value of gamma. Since gamma = 0.5, a biquartimin solution resulted.

F. Techniques of Analysis:

The factor analysis program BMD-X72 provided the following computer output:

(1) Correlation matrix

(2) Eigen-values

(3) Estimated communality

(4) Factor correlation matrix

(5) Rotated factor matrix

(6) Factor scores

I. Correlation Matrix:

All factor analysis models, including principal component solution, had a correlation matrix. The coefficients of correlation presented

> the degree of relationship between the row and column variables of the matrix. The closer to zero the coefficient, the more tenuous the relationship; the closer to an absolute value of 1, the greater the relationship. A negative sign indicates that the variables are inversely related.
>
> To interpret the coefficient, square it and multiply by 100. This will give the percentage of linear variation in common for the data on the two variables.[56]

---

[55] R. J. Rummel, op. cit., pp. 415-416.

[56] Ibid., pp. 133 and 135.

For example, the correlation between row variables 9 and column variable 6 was .45, and $(.45)^2 \times 100 = 20.25\%$. This meant that 20.25% of the variation in the change data for these two variables was shared.

The correlation matrix served as an excellent means for checking the validity of the component loadings to determine whether they actually existed or were merely the result of statistical artifact.

II. Eigen-values:

Eigen-values were defined as equal to the sum of the column of squared loadings for each unrotated factor. Eigen-values measured the importance of a given factor in terms of the amount of total variance it explained. Algebraically, this could be expressed by the equation[57]

$$\sum_{j=1}^{m} h_j^2$$

For example, variance accounted for by factor 1 in the change data:

$$= \sum_{j=2}^{m} h_j^2$$

$$= (-0.08309)^2 + (-0.62097)^2 + \ldots (0.60843)^2$$

$$= 11.91449$$

= respective eigen-values

> Dividing the eigen-values by either the number of variables or the . . . trace of the correlation matrix . . . and multiplying by 100 determines the per cent total or common variance figures.[58]

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[57] Ibid., pp. 144 and 145. [58] Ibid., p. 144.

Therefore, the proportion of total variance accounted for by factor 1 in the change data $= \frac{\sum_{j=1}^{m} h_j^2}{m} \times 100$

$= \frac{11.91449}{62} \times 100$

$= .19217 \times 100$

$= 19.2\%$

III. Estimated Communality:

The communality equalled the proportion of variance of each variable involved in the factor space.[59] Naturally, variables with high communality were the most important in determining the final solution. The estimated communality h_j^2 was calculated by squaring each variable loading in a given row for each factor and adding them together as shown below:

$$h_1^2 = \sum_{l=1}^{p} \alpha_{1}^{2}$$

$$= (-0.08309)^2 + (0.70033)^2 + \ldots + (0.07192)^2$$

$$= 0.838194$$

> The sum of the column of h^2 values x 100 equals the per cent of total variation in the data that is patterned, that is, the total variance accounted for by the factors. This sum, therefore, measures the order, uniformity or regularity in the data.[60]

The formula employed to calculate the percentage of variance

[59] Ibid., p. 138.

[60] Ibid., p. 143.

among all the variables explained by each factor was:[61]

$$\frac{\sum_{j=1}^{m} h_j^2}{m} \quad X \quad 100 \quad = \quad \sum_{\ell=1}^{P} V_\ell^t$$

IV. Rotated Factor Correlation Matrix:

> This is a correlation matrix between oblique factors found through oblique rotation . . . The data patterns themselves have variance in common to the degree measured by the factor correlations squared.[62]

The interpretation of the relationships among factors was exactly the same as the interpretation for variable correlations.

V. Rotated Factor Matrix:

Customarily, most applied factor analysis research alters the initial or unrotated factor solution to a solution having more desirable properties. These desirable properties were found by rotating the factor-axes around the origin to find a better fit for the data. The oblimin form of oblique simple structure was used as outlined in Section C.

VI. Factor Scores:

The factor score matrix had six scores for each census tract. Exact solutions for the factor scores were not possible with the common factor analysis model. The sum of the best regression coefficients multiplied by the

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[61] Ibid., p. 138.

[62] Ibid., p. 149.

standardized variables yielded the actual factor scores. Socio-economic variables displaying similar factor scores would be broadly similar in structure. Indeed, when these factor scores had been translated into computer mapping printouts, they would reveal distinct social areas.

G. Grouping and Mapping Procedures:

Previous studies had used the H-Group technique. This grouping procedure appeared both arbitrary and subjective. Therefore, the author used another technique which began by ordering the factor scores for each factor from the lowest to the highest value. This was done as follows:

```
Program
Dimension  A (81, 6)
Read 100, [(A {I, J}, J = 1, 6) I = 1, 81]
Punch 101, [(A {I, J}, I = 1, 81), J = 1, 6]
100 Format (6F 10.5)
101 Format (10X, F 10.5)
```

After the factor scores had been ordered, the major breakpoints in the number series were marked. Four breakpoints created five groups for each factor. According to the fifth version of the synagraphic computer manual, five groups give the best visual impression. In theory, the natural breakpoints would represent the four largest gaps in the number series. However, in practice, this was

not always true. Wherever possible, each division included at least five values to facilitate a good visual image and not more than 19 values for the two outside divisions. This condition was not always possible due to the nature of the number series, but it was kept in mind as desirable whenever one major breakpoint could be chosen over another. The author believed that this group procedure was far superior to the H-Group technique.

Version five of synagraphic computer mapping, commonly referred to as "symap", enabled one to objectively and precisely map the five previously selected divisions for each of the 18 factors. Thus, a series of 18 contour maps were printed out by a computer, although the contour lines themselves had been suppressed to improve the visual quality. The original symbols printed on the black and white computer maps made it difficult to distinguish five separate groups. The author experimented with the computer to find five sets of symbols which maximized the contrast between the five divisions. The final choice was:

V

A

- X

.	+	0	0	
1	2	3	4	5
	.	+	0	■

The symbolic representation of divisions four and five was created by overprinting.

The author drew a source map of the study area and carefully located all the control points to which his data applied. This source map was identical in size and shape to the computer map printouts. The information needed to produce these maps was punched on a deck of computer cards. These cards consisted of a series of required and optional packages or categories. The first category was called the Outline. This package described the outline of the study area by specifying the 63 co-ordinate locations along the x and y axis to the nearest tenth of an inch. In this case, the outline corresponded with the outline of metropolitan Winnipeg. The second package, called Data Points, gave the co-ordinate location for the centre of each of the 81 census tracts. The third package, Otolegends, provided the location and legend for all printing on the map, plus the location of all "barriers" such as the rivers and the north Winnipeg C.P.R. tracks. It should be noted here that the author experimented with assigning mathematical values to these physical barriers. It was difficult to assess realistically the relative permeability of the Assiniboine and Red rivers and the C.P.R. tracks for all six factors for each data set. The simple assigning of values to these barriers tripled the consumption of computer time and did not appear to alter the spatial patterns in any radical way. For these reasons, the author did not pursue this line of research, but acknowledged that more research is needed to assess the relative strength of

the barriers in regards to social area change.

The fourth package or category known as Values referred to the 81 factor scores assigned to each factor. Each of the 81 factor scores corresponded with one of the data points previously mentioned. The last section, simply called the Map, contained several electives. The author utilized eight of the options. Option 1 listed the map size at 10.2" by 13.0". Option 3 gave the number of divisions as five. Option 6 specified the breakpoints that would create the five divisions for each map. Option 7 stated the new symbols were $\underset{1}{\cdot}\ \underset{2}{+}\ \underset{3}{\theta}\ \underset{4}{\blacksquare}\ \underset{5}{}$. Option 8 suppressed the contour lines between the divisions. Option 13 fixed the relative scale of the computer map printout at the same dimensions as the source map. Option 15 set the printing at 6 rows per inch and 10 columns per inch. Finally, option 16 provided correcting overprinting.

The computer printout not only provided a fully labelled map of the city, but, in addition, stated the data value extremes, the absolute value range for each division, and a histogram showing the frequency distribution of the factor scores for each of the five divisions.

TABLE 2

HIGH LOADINGS ON 1951 FACTOR STRUCTURE WITH QUARTIMAX ITERATION

Variable Number	Variable Title	Ethnic Status F_1	Family Status F_2	Economic Status F_3	French Status F_4	Migrant Status F_5	Household Status F_6
1.	Age 0-14		-0.98				
2.	Age 65 & over		0.92				
3.	Single marital status		0.91				
4.	Married marital status				-0.66		
5.	British	0.85					
6.	French				0.80		
7.	German						
8.	Italian						
9.	Dutch					0.57	
10.	Polish	-0.80					
11.	Russian	-0.61					
12.	Scandinavian	0.86					
13.	Ukrainian	-0.76					
14.	Other European				0.63		
15.	Asian						-0.82
16.	Speaking neither English nor French	-0.69					
17.	Jewish	-0.69					
18.	Not attending school	0.98					
19.	With no schooling	-0.68					
20.	1 or more yrs. of elementary schooling			-0.65			
21.	Change in population 1941-1951 (1951) 1956-1961 (1961)		-0.73				
22.	1 or more years of university (1961) 13 or more years of education (1951)			0.95			
23.	Three or less persons/household		0.80				
24.	Six or more persons/household						-0.52
25.	Household occupied by a single family		-0.88				
26.	Household with lodger		0.84				-0.49
27.	Single detached dwelling		-0.86				
28.	Apartments		0.87				
29.	Owner occupied dwelling		-0.70				
30.	Mortgaged						
31.	Furnace		0.52			-0.47	
32.	Flush toilet					-0.77	
33.	Bath or shower					-0.67	
34.	Refrigerator			0.66			

Variable Number	Variable Title	Ethnic Status F_1	Family Status F_2	Economic Status F_3	French Status F_4	Migrant Status F_5	Household Status F_6
35.	Automobile			0.78			
36.	Dwellings occupied 5 years or less					-0.75	
37.	Dwellings occupied more than 5 years						
38.	0-2 children		0.75				
39.	5 or more children				0.50		
40.	Children under age 6		-0.85				
41.	Wage earner heads			-0.63			
42.	Employed males		-0.89				
43.	Employed females		0.87				
44.	Male managers			0.92			
45.	Male clerks	0.52					
46.	Male trans. & communic. workers			-0.86			
47.	Male service workers						-0.61
48.	Male labourers			-0.57			
49.	Female managers		0.54				
50.	Female clerks		0.59				
51.	Female trans. & communic. workers						
52.	Female service workers		0.67				
53.	Female labourers	-0.47					
54.	Sex ratio						-0.94
55.	Rooms per family		-0.91				
56.	Rooms per dwelling			0.84			
57.	Persons per room			-0.63			
58.	Male earnings avg.(1961); med.(1951)			0.76			
59.	Female earnings avg.('61); med.('51)				-0.59		
60.	Hshld. earnings avg.('61); med.('51)			0.87			
61.	Pop'n. density		0.81				
62.	Distance from P.L.V.		-0.73				
63.	Pop'n potential		0.78				
64.	Television ('61); vacuum ('51)			0.61			
65.	Male prof. & tech.('61); prof.(51)			0.90			
66.	Male sales ('61); commer. & fin. ('51)			0.57			
67.	Female prof. & tech.('61); prof.(51)				0.53		
68.	Female sales ('61); commer & fin.(51)		0.47	-0.63			
	Eigen-value	19.47	17.08	5.31	4.52	2.94	2.41
	Percentage of total variance explained	28.63	25.12	7.81	6.65	4.32	3.54

For clarity in distinguishing different structures, loadings .47 were not shown.

(1951)

CHAPTER III

FACTOR STRUCTURE OF METROPOLITAN WINNIPEG

A. 1951 Factor Structure:

The purpose of this chapter was to identify those elements which most effectively defined each structural dimension of metropolitan Winnipeg. The cross-sectional analysis of the 1951 data provided the factor loadings in Table 2. The columns contained the highest loadings on the 68 variables for the six extracted factors. All six factors were retained because their eigen-values were greater than unity. As hypothesized, ethnic status, family status and economic status emerged as the three most important factors. These three factors represented 61.56% of the total variance in 1951.

The first factor exhibited a strong positive association with percentage British and percentage Scandinavian. This dimension also demonstrated a strong negative relationship to percentage Polish, percentage Russian, percentage Ukrainian, percentage Jewish, percentage who spoke neither English nor French, and percentage with no schooling. The high loadings on the ethnic variables identified this factor as ethnic status. Examination of the factor loadings indicated that towards one end of the scale this dimension selected census tracts containing relatively high proportions of British and north Europeans who spoke either English or French and had some schooling. At the other end

of the spectrum were tracts containing relatively high proportions of east Europeans, who spoke neither of Canada's official languages and had received no formal schooling. This factor accounted for the most variance--28.63%. Thus, ethnic status explained the most about Winnipeg's ecological structure in 1951.

Examination of the factor loadings in the second column revealed the family status dimension. Ten variables displayed high positive loadings--population sixty-five years or older, single population, population not attending school, households containing three persons or less, households with lodgers, residence in apartments, families with two or less children, employed females, population density and population potential. High negative loadings were associated with population fourteen years of age and under, population change, dwellings occupied by a single family, single detached dwellings, owner occupied dwellings, children under six, employed males, rooms per dwelling and distance from peak land value.

Analysis of the family status dimension revealed that census tracts could be arranged along a continuum. At one end of the continuum, census tracts exhibited the latter stages of the family cycle, while at the opposite end, the formative stages were portrayed. The latter stages of the family cycle were characterized by an older population, small families, employed women, lodgers, apartment living

and densely populated neighbourhoods having close proximity to the city centre in terms of travel time. The early stages of the family cycle were marked by both pre-school and school-age children, employed males and owner occupied detached dwellings located in the city's outlying suburbs. This factor, the second most important dimension, explained 25.12% of the total variance.

Economic status was identified as the third dimension. Eight variables--one or more years of university education, automobile ownership, possession of a refrigerator, rooms per dwelling, male managers, female professional workers, male earnings and household earnings--had high positive loadings. High negative loadings were discovered on the variables measuring some elementary education, persons per room, male transportation and communication workers and families with wage earner heads. As in the cases of the first two factors, the factor loadings for economic status showed that census tracts formed a continuous scale. At one end were those tracts containing well-educated managerial and professional personnel earning high incomes and residing in spacious dwellings. At the opposite end of the scale were census tracts characterized by low education levels, low incomes, overcrowding and without a family head wage earner. This factor was a distant third behind ethnic status and family status, as it explained only 7.81% of the variance.

The last three factors proved more difficult to interpret due to the smaller number of highly loaded variables on each dimension. Nevertheless, the last three factors proved immensely interesting because they represented three relatively unknown dimensions. They accounted for 14.51% of the variance. When all six factors were taken together, the explained variance totalled 76.07%.

Scrutiny of the fourth factor revealed relatively high positive loadings on the variables representing percentage of French, percentage of Other Europeans, percentage of professional female workers and percentage of families with five or more children. Two negatively loaded variables represented the percentage of married people and median female earnings. In an attempt to glean more information, two other variables possessing slightly lower loadings were added. They represented families with two children or less (-0.42), and dwellings occupied more than five years (-0.40). This factor appeared to represent a Roman Catholic ethnic segregation dimension. For lack of a more precise term, this factor has been labelled French ethnic status. At one end of the scale were census tracts containing relatively high proportions of female professional workers and large French and Other European families. At the other extreme were census tracts with relatively high proportions of single people, females with low incomes, families with three to four children and residence in the same dwelling

for less than five years. French ethnic status explained 6.65% of the variance.

The fifth factor portrayed migrant status. The only high positive loading coincided with the percentage from the Netherlands. Relatively high negative loadings denoted flush toilets, bath or shower, furnace and dwellings occupied five years or less. At one end on the scale the Dutch appeared to be the most successful migrant element. Other migrants exhibited a lack of private facilities such a flush toilets, bath or shower and furnaces, deficiencies denoting their poverty. Residential instability characterized most migrants. Migrant status accounted for 4.32% of the total variance.

Household status, the sixth and least important factor, helped to explain Winnipeg's urban ecological structure in 1951. Household status yielded no high positive loadings, but it possessed five high negative loadings--Asians, persons per household, households with lodgers, male service workers and sex ratio. Thus, it appeared that at one end of the scale there were census tracts with a relatively high percentage of females, male service workers, Asians, crowded households and lodgers. At the other extreme were few Asians, few lodgers, few male service workers, uncrowded living quarters and a more equal balance between the sexes. Household status described 3.54% of the total variance.

TABLE 3

FACTOR CORRELATION MATRIX

1951

	Ethnic Status F_1	Family Status F_2	Economic Status F_3	French Ethnic Status F_4	Migrant Status F_5	Household Status F_6
Ethnic Status	1.00					
Family Status	-0.06	1.00				
Economic Status	0.14	0.00	1.00			
French Ethnic Status	-0.12	0.04	-0.29	1.00		
Migrant Status	-0.15	0.00	-0.15	0.11	1.00	
Household Status	0.42	0.09	0.25	-0.43	-0.24	1.00

The hypothesis which proposed that the 1951 cross-sectional analyses would reveal six dimensions related to economic status, family status, ethnic status, migrant status, household status and employment characteristics proved correct in the first five cases. Employment characteristics did not emerge in the sixth case; instead, French ethnic status took its place.

Having identified all six dimensions pertaining to urban structure in Winnipeg in 1951, all that remained was to examine the factor correlation matrix (see Table 3) to determine whether the factors were oblique or orthogonal. Factor two, family status, factor three, economic status and factor five, migrant status, were perfectly uncorrelated and therefore were orthogonal. However, factor six, household status, displayed a relatively strong positive correlation with factor one, ethnic status and a relatively strong negative relationship with factor four, French ethnic status. These correlations between factors one, four and six supported the author's expectation that some of the factors would not be independent. Therefore, oblique quartimax rotation was an appropriate method of iteration.

B. 1961 Factor Structure:

The factor loadings listed in Table 4 summarized the ecological factor structure of metropolitan Winnipeg in 1961. Six factors having eigen-values greater than unity

HIGH LOADINGS ON 1961 FACTOR STRUCTURE WITH QUARTIMAX ITERATION

Variable Number	Variable Title	Family Status F_1	Economic Status F_2	Life Style F_3	Ethnic Status F_4	Migrant Status F_5	Household Status F_6
1.	Age 0-14	0.95					
2.	Age 65 & over	-0.81					
3.	Single marital status	-0.79					
4.	Married						0.70
5.	British				-0.65		
6.	French						
7.	German						
8.	Italian						
9.	Dutch						
10.	Polish		-0.66		0.63		
11.	Russian						
12.	Scandinavian				-0.77		
13.	Ukrainian		-0.65		0.58		
14.	Other European				0.95		
15.	Asian						-0.60
16.	Speaking neither English nor French						
17.	Jewish				0.92		
18.	Not attending school	-0.64					
19.	With no schooling	0.80					
20.	1 or more years elementary schooling		-0.66				
21.	Change in pop'n. 1941-1951 (1951) 1956-1961 (1961)	0.66				0.69	
22.	1 or more yrs. of university (1961) 13 or more yrs. of education (1951)		0.97				
23.	3 or less persons/household	-0.88					
24.	6 or more persons/household			-0.80			
25.	Household occupied by single family	0.64					
26.	Household with lodger	-0.64		-0.54			
27.	Single detached dwelling	0.61					0.63
28.	Apartments	-0.75					
29.	Owner occupied dwelling	0.62					0.63
30.	Mortgaged	0.75					
31.	Furnace						
32.	Flush toilet						0.77
33.	Bath or shower						0.77
34.	Refrigerator						0.85

Variable Number	Variable Title	Family Status F_1	Economic Status F_2	Life Style F_3	Ethnic Status F_4	Migrant Status F_5	Household Status F_6
35.	Automobile	0.58					
36.	Dwellings occupied 5 years or less					0.93	
37.	Dwellings occupied more than 5 years					-0.79	0.70
38.	0-2 children	-0.87					
39.	5 or more children	0.64					
40.	Children under age 6	0.85					
41.	Wage earner heads						
42.	Employed males	0.90					
43.	Employed females	-0.88					
44.	Male managers		0.90				
45.	Male clerks			0.53	0.47		
46.	Male trans. & communic. workers		-0.84				
47.	Male service workers						-0.59
48.	Male labourers		-0.60				
49.	Female managers		0.65				
50.	Female clerks	-0.60					
51.	Female trans. & communic. workers	-0.51					
52.	Female service workers						
53.	Female labourers		-0.61				
54.	Sex ratio						-0.55
55.	Rooms per family	0.96					
56.	Rooms per dwelling		0.67	-0.66			
57.	Persons per room		-0.76				
58.	Male earnings avg.('61); med.('51)		0.88				
59.	Female earnings avg.('61); med.('51)		0.75				
60.	Hshld. earnings avg.('61); med.('51)		0.91				
61.	Pop'n. density	-0.79					
62.	Distance from P.L.V.	0.78					
63.	Pop'n. potential	-0.52					
64.	Television ('61); vacuum ('51)						0.59
65.	Male prof. & tech.('61); prof.('51)		0.97				
66.	Male sales ('61); commer. & fin. ('51)		0.64				
67.	Female prof. & tech.('61); prof.('51)		0.52				
68.	Female sales ('61); commer. & fin. ('51)			0.75			
	Eigen-value	20.03	13.47	6.05	4.66	3.27	3.09
	Percentage of total variance explained	29.46	19.81	8.90	6.85	4.81	4.54

For clarity in distinguishing different structures, loadings .47 were not shown.

(1961)

were retained for rotation. This time, however, the three major dimensions did not correspond perfectly with the Shevky-Bell model. Although family status, economic status and ethnic status still existed, ethnic status had dropped to fourth place and a new life style factor had emerged as the third most important dimension. Thus, the hypothesis that the three factors selected by Shevky and Bell would be the most important through time was not borne out.

The first factor, accounting for 29.46% of the total variance, portrayed family status. Family status exhibited high positive loadings on population aged fourteen and under, children under six, five or more children, change in population, single family occupancy, rooms per family, single detached dwellings, owner occupied dwellings, mortgaged dwellings, possession of an automobile, employed males, no schooling and distance from peak land value. High negative loadings were assigned to population aged sixty-five and over, zero to two children, single, employed females, three persons or less per household, not attending school, lodgers, apartments, population density and population potential. Census tracts could be arranged along a continuum with the early and middle stages of the family cycle at one end and the latter stages of this cycle at the other extremity. Large families including both pre-school and school-age children, debts, male employment and

suburban living characterized the early stages of the family cycle. One apparent anomaly, percentage with no schooling, reflected the percentage of children under age six, as the two variables had a 0.94 correlation. The latter stages of the family cycle were identified by the relatively high proportion of both retired and single persons, employed females and apartment living in the older residential areas with ready access to the city centre.

Factor two, economic status, explained 19.81% of the variance. Nine variables representing one or more years of university, male managers, female managers, rooms per dwelling, male earnings, female earnings, household earnings, male professional and technical workers and male sales personnel, possessed high positive loadings. Seven negatively loaded variables included Polish, Ukrainian, one or more years of elementary schooling, male transportation and communication workers, male and female labourers and persons per room. Census tracts at one end of the spectrum incorporated relatively large percentages of well-educated managerial, professional, technical and sales personnel earning high salaries and residing in spacious accommodation. Census tracts representing the other extremity contained large numbers of east Europeans, low education levels, unskilled or semi-skilled workers and crowded living conditions.

The factor designated as life style emerged as the third most important dimension in the ecological structure of Winnipeg in 1961. Female sales personnel, male clerks, female clerks (0.40) and furnaces (0.42) displayed relatively high positive variable loadings. High negative loadings were detected on variables portraying households with six persons or more, lodgers, rooms per dwelling, speak neither English nor French (-0.43), Germans (-0.40) and Italians (-0.40). Census tracts placed on a continuum could be ranked all the way from relatively prosperous male and female white collar workers to the less successful Germans, Italians and other people who spoke neither of the two official languages and who resided in crowded living quarters. The life style factor accounted for 8.90% of the total variance. The presence of the life style dimension in 1961 but not in 1951 meant that Winnipeg's ecological structure did not remain stable through time.

Analysis of the factor loadings in the fourth column unearthed the ethnic status dimension. Four variables reflected high positive loadings--Polish, Ukrainian, Jewish and Other Europeans. Two negatively loaded variables pertained to British and Scandinavian. Therefore, if all the census tracts were placed on a scale, at one end would be the east Europeans and at the other end the north Europeans. Ethnic status, the fourth most important dimension, explained 6.85% of the total variance.

A close examination of the factor loadings in the fifth column identified migrant status. Migrant status displayed relatively high positive variable loadings on population change, dwellings occupied five years or less and children under age six (0.41). Two negatively loaded variables were recognized as dwellings occupied more than five years and sex ratio (-0.44). Apparently census tracts at one end of the spectrum were characterized by small children, population change and residential instability, while census tracts at the opposite end possessed some correlation with the sex ratio (-0.44) and greater residential stability. This fifth factor, migrant status, explained 4.81% of the variance.

The sixth and last factor, representing 4.54% of the total variance, depicted household status. The household status dimension had positive loadings on nine variables--married, single family household, single detached dwelling, owner occupied, occupied more than five years, flush toilets, bath or shower, refrigerator and television. High negatively loaded variables characterized Asians, male service workers and sex ratio. Census tracts at one end of the social scale portrayed married people living in relatively prosperous well-equipped households. Census tracts at the bottom end of the social scale represented a relatively high proportion of Asians, male service workers and more sparsely equipped households.

TABLE 5

FACTOR CORRELATION MATRIX

1961

	Family Status F_1	Economic Status F_2	Life Style F_3	Ethnic Status F_4	Migrant Status F_5	Household Status F_6
Family Status	1.00					
Economic Status	0.02	1.00				
Life Style	0.07	0.30	1.00			
Ethnic Status	-0.05	0.00	-0.08	1.00		
Migrant Status	-0.03	-0.14	-0.08	-0.41	1.00	
Household Status	0.16	0.23	0.28	-0.23	0.16	1.00

The three most important ecological dimensions for metropolitan Winnipeg in 1961, ranked according to the amount of variance each yielded, were family status, economic status and life style. These three dimensions explained 58.17% of the total variance. Shevky's and Williams' original three indices included 56.12% of the variance. Altogether, the six factors--family status, economic status, life style, ethnic status, migrant status and household status--depicted 75.17% of the accumulated variance. Five of the six dimensions extracted from the cross-sectional analysis supported the first hypothesis. Life style offered the single exception, but even here employment characteristics constituted an important element in this factor.

Once identified, it remained to be seen whether or not the previously mentioned factors were independent or dependent. The 1961 factor correlation matrix in Table 5 showed that family status and household status were orthogonal. Economic status displayed a weak positive correlation with life style. The strongest correlation, a negative one, occurred between ethnic status and migrant status. Thus, ethnic status and migrant status appeared to be oblique factors.

C. Changes in the Factor Structure, 1951-1961:

Reviewing the results of the analysis in 1951 and 1961, as shown in Table 6, seven relatively well-defined

factors emerged. Five factors--family status, economic status, ethnic status, migrant status and household status--proved common to both cross-sectional analyses. The 1951 French ethnic status factor had vanished by 1961 when the life style dimension made its appearance. The absence of ethnic status among the three most important dimensions in 1961 effectively refuted the second hypothesis. Likewise, that portion of the third hypothesis which predicted that economic status would remain relatively stable through time proved false. Economic status rose from the third most important dimension in 1951 to become the second most significant dimension in 1961.

The ethnic status dimension declined dramatically between 1951 and 1961, both in absolute value--28.63% to 6.85% of the total variance--and in relative significance--from first to fourth. This loss of significance reflected the much lower variable loadings in 1961 on percentage British, percentage Polish, percentage Ukrainian, percentage Jewish and percentage of male clerks. Four high loadings in 1951 no longer appeared in 1961--percentage Russian, percentage speaking neither English nor French, percentage with no schooling and percentage female labourers. Proportion of Other Europeans provided the one startling anomaly in an otherwise consistent pattern of declining significance through time. The decreasing importance of these particular variables was confirmed by an examination

of their communalities in Table 9 in Appendix B.

Between 1951 and 1961 family status rose in both absolute--25.12% to 29.46% of the accumulated variance--and relative terms--from second to first place. Close scrutiny of both the factor loadings and communalities revealed small subtle increases in the value of variables pertaining to the latter census year. The long list of mutually significant high loadings depicting age zero to fourteen, age sixty-five and over, single population, not attending school, single family households, households with lodgers, single detached dwellings, apartments and flats, household mortgages, zero to two children, five or more children, children under age six, employed males, employed females, female clerks, rooms per family, population density, distance from peak land value, population potential and female professional and technical workers provided a common foundation for meaningful comparison.

Although economic status climbed from third to become the second most influential factor by 1961, the most remarkable aspect of this growth concerned its rise from 7.81% to 19.81% of the total variance. The following ten variables possessed comparable factor loadings in both cross-sectional analyses: one or more years of elementary schooling, one or more years of university, male managers, male transportation and communication workers, male labourers, persons per room, male earnings, family or household earnings,

male professional and technical workers and male sales personnel. Five of the 1961 variables displayed much higher loadings than in 1951: Polish, Ukrainian, female managers, female labourers and female earnings; whereas five other variables were significantly lower: refrigerators, automobiles, rooms per dwelling, televisions and vacuums and female sales personnel. In the space of a decade ethnic status appeared to be influenced increasingly by factor loadings involving east Europeans and female employment and less by material possessions and size of dwellings.

The previously discussed factor structures all had large numbers of shared high loadings, which not only made identification of the factors relatively easy, but also facilitated comparison for the two census years--1951 and 1961. The next factor, migrant status, shared no high loadings, which made comparison difficult. The weakness of migrant status in differentiating census tracts could be attributed to the low levels of variance in 1951--4.32%, and in 1961--4.81%.

Household status, the least important dimension in both cross-sectional analyses, held three high loadings in common: percentage of Asians, male service workers and sex ratio. None of these loadings could have identified the factor without the inclusion of other loadings. Thus, the uniquely high loadings on single population, households

occupied by six or more persons, households with lodgers, single detached dwellings, owner occupied dwellings, flush toilets, bath or shower, refrigerator, dwellings occupied more than five years and televisions or vacuum cleaners provided the means of identifying household status.

The two factors left until the end could not be compared as both were unique to their particular census year. Neither French ethnic status, which occurred in 1951, nor life style, which surfaced in 1961, shared any high loadings on the same variables.

Comparison of the 1951 and 1961 factor correlation matrices revealed that family status remained uncorrelated and independent in both years. Family status represented the only truly orthogonal factor; all others factors had at least a weak relationship with one other dimension in one or both of the cross-sectional analyses. Household status, the most oblique dimension in 1951, had become orthogonal by 1961. Ethnic status, which exhibited a positive correlation with household status in 1951, established a negative relationship with migrant status ten years later. Economic status had a weak negative link with French ethnic status in 1951 and by 1961, economic status correlated positively with life style. This proved most interesting as French ethnic status and life style surfaced in separate cross-sectional analyses. Initially, migrant status was orthogonal, but later it became negatively correlated with ethnic status.

TABLE 6

ECOLOGICAL STRUCTURE OF METROPOLITAN WINNIPEG:

1951 AND 1961

FACTOR TITLE	1951		1961	
	Ranking of Factor	% of Total Variance Explained	Ranking of Factor	% of Total Variance Explained
1. Ethnic Status	1	28.63	4	6.85
2. Family Status	2	25.12	1	29.46
3. Economic Status	3	7.81	2	19.81
4. French Ethnic Status	4	6.65		
5. Migrant Status	5	4.32	5	4.81
6. Household Status	6	3.54	6	4.54
7. Life Style			3	8.90
Percent of Total Variance Explained by the Social Area Factors: (Family Status, Economic Status and Ethnic Status)		61.56		56.12
Percent of Total Variance Explained by Six Factors		76.07		75.17

An assessment of the changes in Winnipeg's ecological structure between 1951 and 1961 could be derived from Table 6. It would appear that there has been a slight increase in Winnipeg's ecological complexity since the proportion of explained variance declined between 1951 and 1961. Nevertheless, as the decline appeared so minimal, this may be a risky generalization. Since the decline of the social area factors from 61.56% to 56.12% could be attributed entirely to the drastic decline in the ethnic status factor, it would appear that ethnic differences are much less meaningful than in the past. Second, this dramatic fall in the value of the ethnic status factor reflected the low level of foreign immigration into Winnipeg.

D. Change Factor Structure:

The factor loadings depicted in Table 7 summarized the change which occurred in the ecological structure of metropolitan Winnipeg for the decade 1951 to 1961. Six factors with eigen-values greater than unity were retained for further analysis. The six change dimensions coincided with the six factors extracted from the 1961 cross-sectional analysis. French ethnic status failed to appear. The six change factors were listed according to the amount of variance each explained: economic status, life style, migrant status, family status, household status and ethnic status. These six change measures only explained 56.40% of the total variance.

HIGH LOADINGS ON CHANGE FACTOR STRUCTURE WITH QUARTIMAX ITERATION

Variable Number	Variable Title	Economic Status F_1	Life Style F_2	Migrant Status F_3	Family Status F_4	Household Status F_5	Ethnic Status F_6
1.	Age 0-14				0.73		
2.	Age 65 & over	-0.53			-0.48		
3.	Single marital status				-0.79		
4.	Married						-0.61
5.	British						0.58
6.	French	-0.64					
7.	German			0.48			
8.	Italian	-0.54					
9.	Dutch						0.66
10.	Polish			0.57			
11.	Russian						0.47
12.	Scandinavian						
13.	Ukrainian			0.70			
14.	Other European						
15.	Asian						0.67
16.	Speaking neither English nor French						
17.	Jewish						
18.	Not attending school						
19.	With no schooling			0.78			
20.	1 or more yrs. elementary schooling						0.50
21.	Change in pop'n. 1941-1951 (1951) 1956-1961 (1961)	0.66					
22.	1 or more yrs. of university (1961) 13 or more yrs. of education (1951)	0.60					
23.	3 or less persons/household				-0.56		
24.	6 or more persons/household					0.85	
25.	Household occupied by single family					0.69	
26.	Household with lodger		0.58				
27.	Single detached dwelling					0.61	
28.	Apartments		0.68				
29.	Owner occupied dwelling					0.84	
30.	Mortgaged						
31.	Furnace						
32.	Flush toilet	0.60					
33.	Bath or shower	0.52					

TABLE 7, Cont'd.

Variable Number	Variable Title	Economic Status F_1	Life Style F_2	Migrant Status F_3	Family Status F_4	Household Status F_5	Ethnic Status F_6
34.	Refrigerator			-0.59			
35.	Automobile						
36.	Dwellings occupied 5 years or less			0.60			
37.	Dwellings occupied more than 5 years						
38.	0-2 children						-0.64
39.	5 or more children						0.60
40.	Children under age 6				0.84		
41.	Wage earner heads		0.70				
42.	Employed males				0.70		
43.	Employed females	0.47			-0.69		
44.	Male managers	0.78					
45.	Male clerks						
46.	Male trans. & communic. workers		0.82				
47.	Male service workers		0.97				
48.	Male labourers	-0.71					
49.	Female managers						
50.	Female clerks	0.79					
51.	Female trans. & communic. workers						
52.	Female service workers						
53.	Female labourers						
54.	Sex ratio		0.64				
55.	Rooms per family						0.66
56.	Rooms per dwelling					0.74	
57.	Persons per room						
58.	Male earnings avg.('61); med.('51)	0.68					
59.	Female earnings avg.('61); med.('51)						
60.	Hshld. earnings avg.('61); med.('51)	0.68					
61.	Pop'n. density	0.66					
63.	Pop'n. potential	0.47				0.48	
	Eigen-value	11.92	7.35	5.38	3.68	3.63	3.00
	Percentage of total variance explained	19.23	11.86	8.68	5.94	5.85	4.84

For clarity in distinguishing different structures, loadings .47 were not shown.

(Change)

The first hypothesis predicted that a minimum of six dimensions generally relating to economic status, family status, ethnic status, migrant status, household status and employment characteristics would be identified. This hypothesis proved substantially correct, although as in 1961, employment characteristics constituted part of a life style dimension rather than appearing as a separate entity.

Economic status, the first and most important dimension of change, accounted for 19.23% of the total variance. The eleven high positive loadings denoted population change, one or more years of university, flush toilet, bath or shower, employed females, male managers, female clerks, male earnings, household earnings, population density and population potential. The four negative loadings portrayed age sixty-five and over, French, Italian and zero to two children. The biggest change in economic status occurred in census tracts with population change, post-secondary education, exclusive use of washroom facilities, employed women, male managers, high male and family earnings, high population density and close proximity to the centre in terms of travel time by car. The least change involved census tracts containing high levels of retired, French, Italian people with small families.

Life style accounted for the second highest proportion of change. This analysis failed to generate high

negative loadings. High positive loadings marked households with lodger, apartments, wage earner household heads, male transportation and communication workers, male service workers and sex ratio. Therefore, census tracts experiencing the greatest change in life style included boarding houses, households with wage earner heads, apartment dwellers, blue collar and service workers and an unbalanced sex ratio. Those census tracts experiencing the least change contained few boarding houses, few apartment buildings, a more balanced sex ratio and fewer blue collar and service workers. Life style totalled 11.86% of the accumulated variance.

Migrant status captured the third highest percentage of change in the ecological structure of metropolitan Winnipeg during the decade 1951 to 1961. Migrant status loaded positively on Germans, Polish, Ukrainians, no schooling and dwellings occupied five years or less and loaded negatively on refrigerators. The greatest changes in migrant status occurred in the census tracts with high positive loadings. The smallest changes took place in census tracts with a high percentage of refrigerators, low numbers of Germans, Poles or Ukrainians, few people with no schooling and a high proportion of dwellings occupied by the same family for more than five years. Migrant status explained 8.68% of the variance.

Family status, the fourth most important change dimension, had three high positive loadings on children fourteen and under, children under age six and employed males. High negative loadings marked age sixty-five and older, single, three or less persons per household and employed females. Therefore, the biggest changes in family status occurred in census tracts representing the early stages of the family cycle and the least changes occurred in census tracts containing a high proportion of people in the latter stages of the family cycle. Family status claimed 5.94% of the total variance.

Household status controlled 5.85% of the variance explaining change which made it the fifth most significant dimension. Six high positive loadings grouped census tracts along a continuum according to whether or not they contained substantial numbers of households with six or more persons, households occupied by a single family, single detached dwellings, owner occupied dwellings, rooms per dwelling and population potential. The last variable referred to the time required to reach the city centre by car from one's residence.

The last factor, ethnic status, explained 4.84% of the total variance associated with change. High positive loadings appeared on British, Dutch, Russian, Asian, some elementary schooling, five or more children and rooms per family. High negative loadings depicted married and

TABLE 8

FACTOR CORRELATION MATRIX

CHANGE

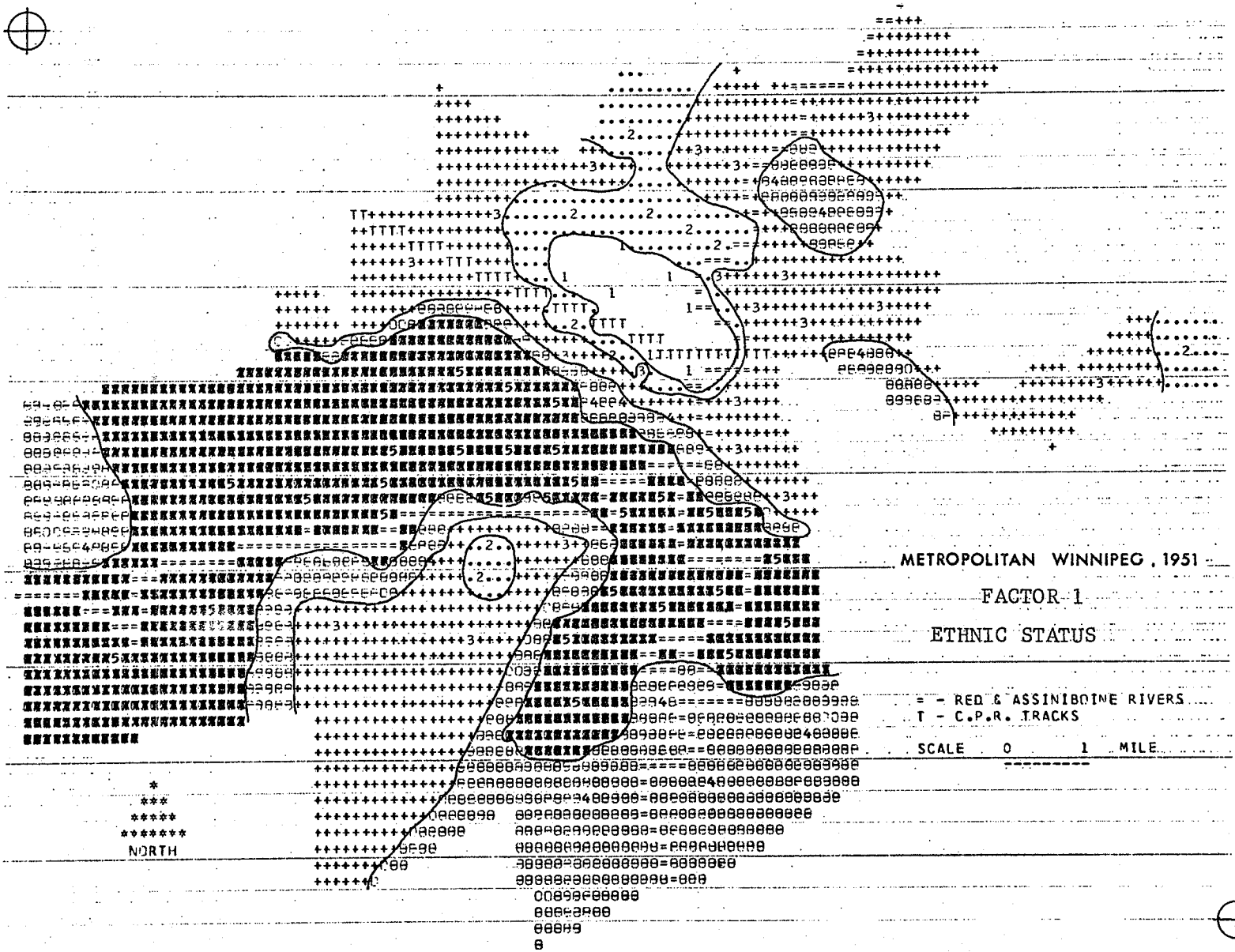
	Economic Status F_1	Life Style F_2	Migrant Status F_3	Family Status F_4	Household Status F_5	Ethnic Status F_6
Economic Status	1.00					
Life Style	-0.02	1.00				
Migrant Status	-0.01	0.00	1.00			
Family Status	0.14	0.18	-0.07	1.00		
Household Status	0.19	0.16	0.06	0.01	1.00	
Ethnic Status	-0.21	0.19	0.12	0.03	-0.11	1.00

two children or less. Census tracts at one end of the spectrum included relatively high proportions of British, Dutch, Russian, Asian, some elementary education, large families and large houses. These census tracts underwent the most change. The most stable census tracts in terms of ethnic status involved married people with few children.

As shown in Table 8, the change factor correlation matrix revealed that the factors were essentially uncorrelated or orthogonal. Therefore, the change factors differed from the earlier cross-sectional analyses in that there was not even one oblique factor.

The change factors contributed only 56.4% of the total variance. This result disappointed the writer, even though it was just slightly lower than Murdie's 57.2% (1969) and noticeably higher than King's 40% (1969) or Brown and Horton's 44% (1970). Thus, oblique rotation did not provide more meaningful results than the more conventional orthogonal rotation.

FIGURE 2


METROPOLITAN WINNIPEG , 1951
FACTOR 1
ETHNIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

CHAPTER IV

SPATIAL PATTERNS OF THE ECOLOGICAL STRUCTURE

A. Introduction:

This chapter should provide the reader with a visual impression of the spatial distribution of the factors identified in the preceding chapter. The cartographic technique, synagraphic mapping, created a series of eighteen symaps--six for the 1951 factor structures, six for the 1961 dimensions and six for the change measurements. The factor scores utilized to produce these symaps are located in Appendix D. Additional information pertaining to the extreme data values, the absolute value range and the percentage of total value range applying to each division and the frequency distribution of data point values in each division is found in Appendix E. It should be remembered that each data point corresponds to a census tract.

B. 1951 Spatial Patterns:

The first symap, Figure 2, represented the ethnic status dimension. Two nuclei, the larger one in north-central Winnipeg and the much smaller one in south-central Winnipeg, appeared near the apex of two separate sectors. Nevertheless, the fundamental pattern appeared to distinguish two separate series of concentric zones almost surrounding both sectors and with the peripheries of the concentric zones merging midway between the two foci. Both foci

FIGURE 3

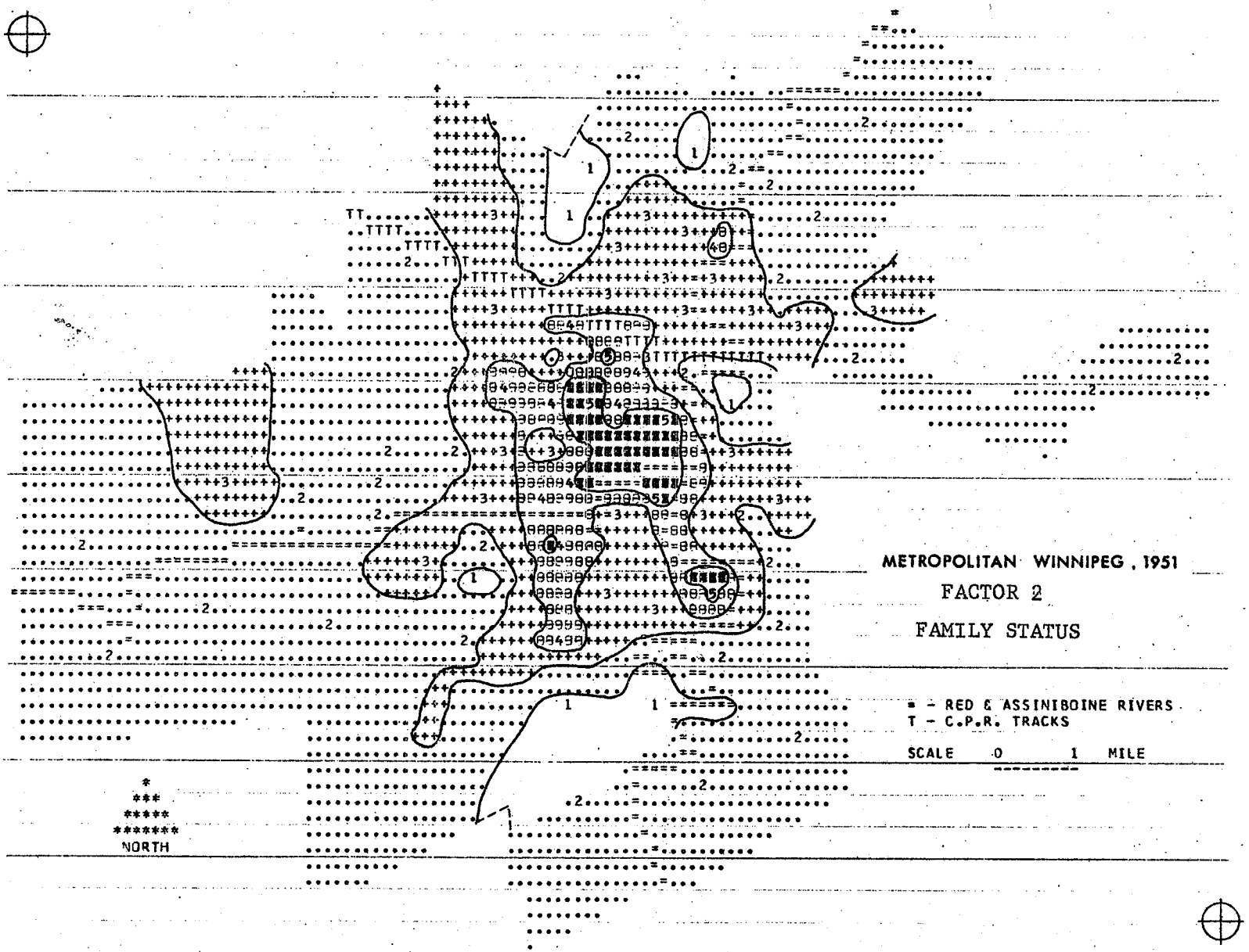
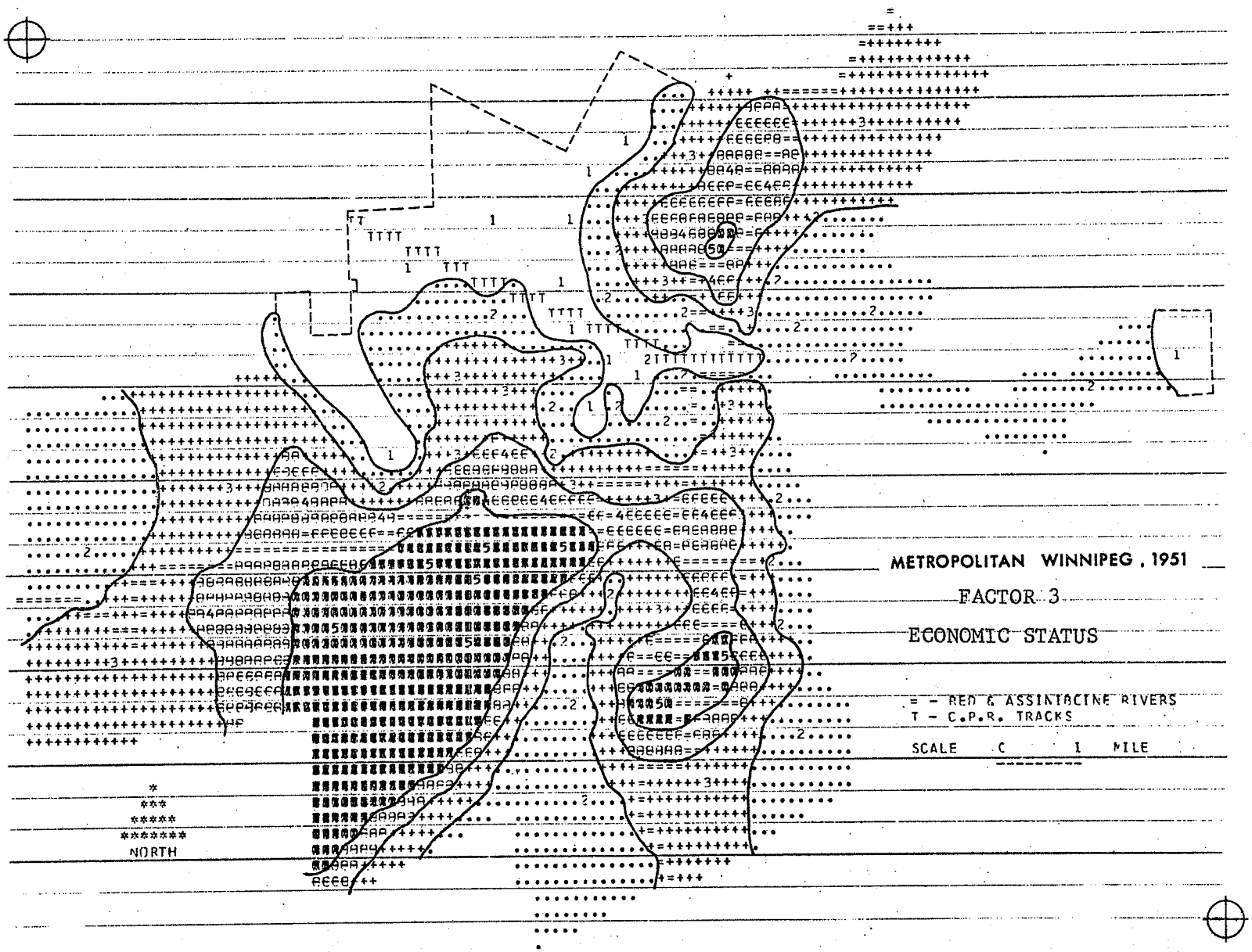

METROPOLITAN WINNIPEG, 1951
FACTOR 2
FAMILY STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 4

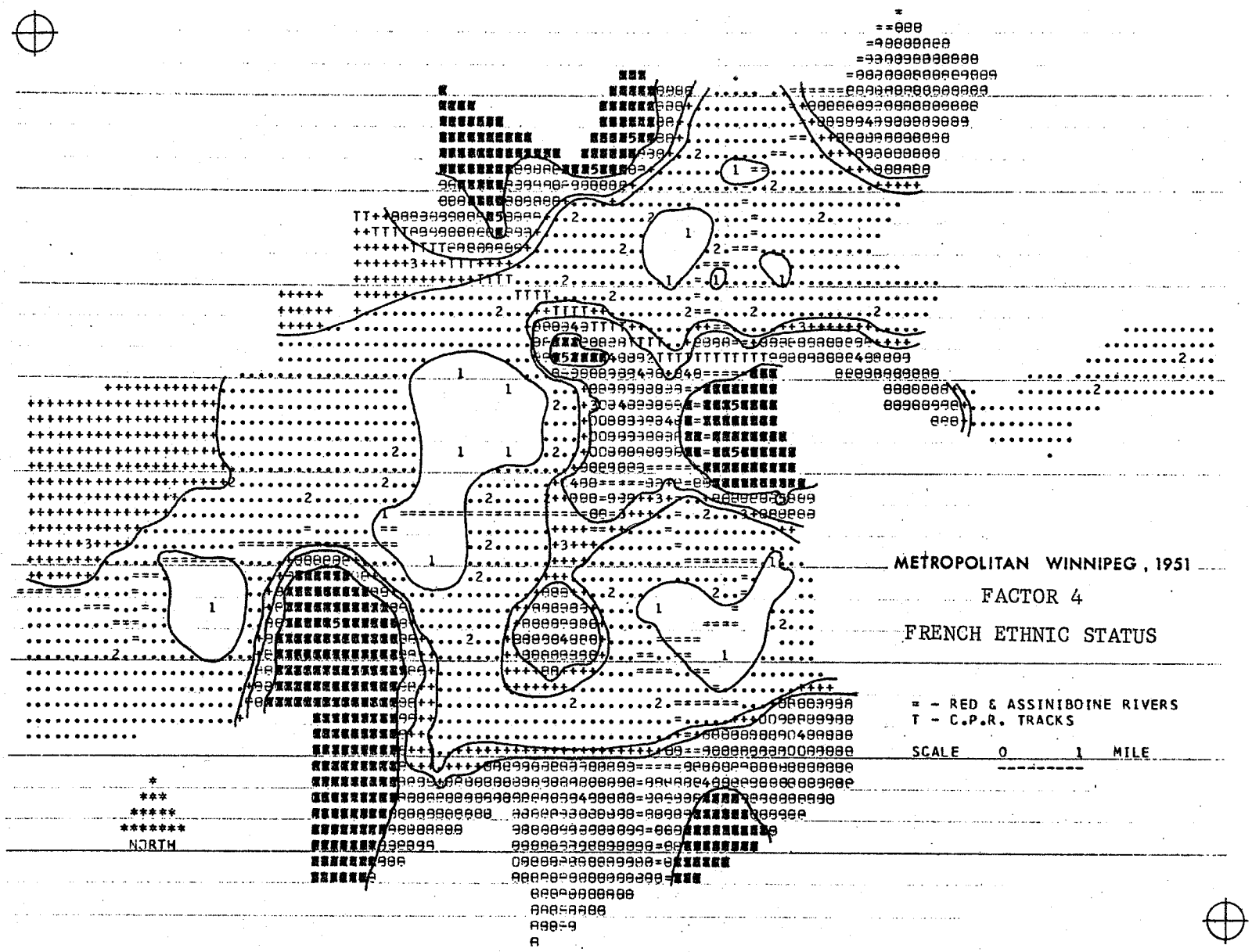

METROPOLITAN WINNIPEG , 1951
FACTOR 3
ECONOMIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE C 1 MILE
NORTH

contained a high proportion of east Europeans, low education levels and many people who spoke neither English nor French. The two most striking features of the entire map involved the east European dominance in north-central Winnipeg and the north European presence in the south and west half of the city.

Figure 3 illustrated the second most relevant dimension in 1951, family status. This symap presented a basically concentric pattern, although once again there were some sectorial overtones. The concentric pattern appeared to have been distorted somewhat by major arteries such as: Main Street-St. Mary's Road, Osborne-Balmoral-Isabel and Stafford-Wellington-Maryland. The residential pattern in the inner city could be attributed to people in the latter stages of the family cycle, whereas the suburbs portrayed people in the early stages of this social phenomenon.

Figure 4 portrayed economic status, the third most significant factor. This symap exhibited a strong sectorial pattern. The three highest economic status areas in order of declining importance were: Tuxedo-River Heights, Fort Garry-St. Vital along the Red River and that portion of West and East Kildonan having close proximity to the Red River. The areas delineating the lowest economic status included those residences having close proximity to the C.P.R. rail yards, the north-west corner of metropolitan Winnipeg and the easternmost portion of Transcona. Inter-

FIGURE 5


METROPOLITAN WINNIPEG, 1951
FACTOR 4
FRENCH ETHNIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

estingly enough, the only low economic status in south Winnipeg coincided with the main C.N.R. and C.P.R. rail lines running into the city centre. Low economic status and the presence of railway lines appeared to coincide.

The fourth hypothesis which predicted that economic status would have a sectorial pattern, that family status would be concentric and that ethnic status would display a nucleated pattern proved correct in just the first two cases. Ethnic status exhibited little of the expected nucleated pattern and manifested a combination of sectorial and concentric zonal attributes. Thus, ethnic status did not conform to the forecast pattern.

The fourth factor called French ethnic status displayed a polynucleated pattern. The census tracts with the highest communalities occurred in the east-central part and also along the southern and northern peripheries of metropolitan Winnipeg. The lowest communalities formed seven nucleations ranging from small enclaves in the northern regions of the city to a large sub-area covering much of eastern St. James. Figure 5 illustrated the French ethnic status factor.

Migrant status, the fifth dimension, offered a complex combination of polynucleations, concentric zones and sectors for inspection. Zones one and two not only failed to attract new migrants but probably suffered a relative although not absolute decline in urban population,

FIGURE 6

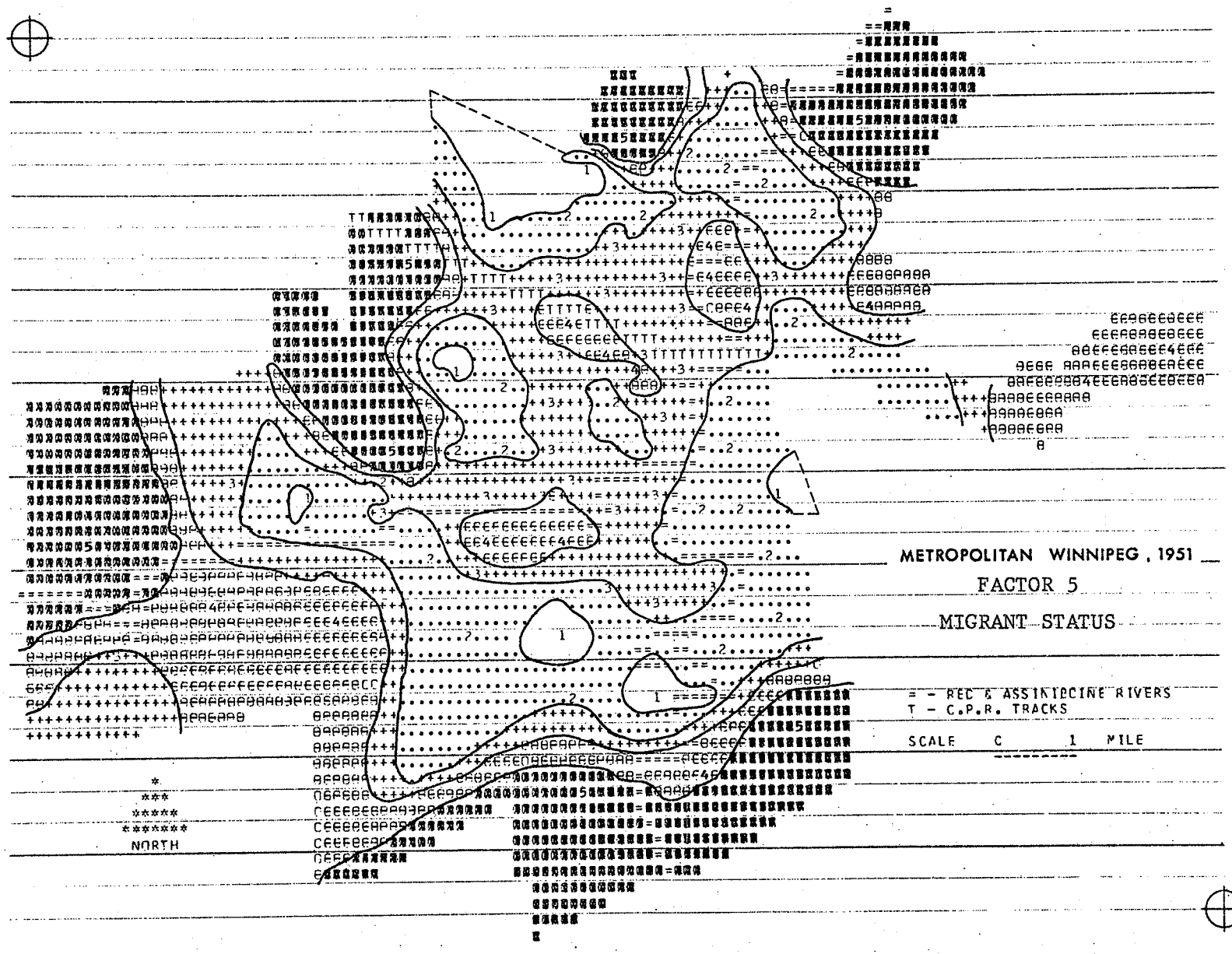
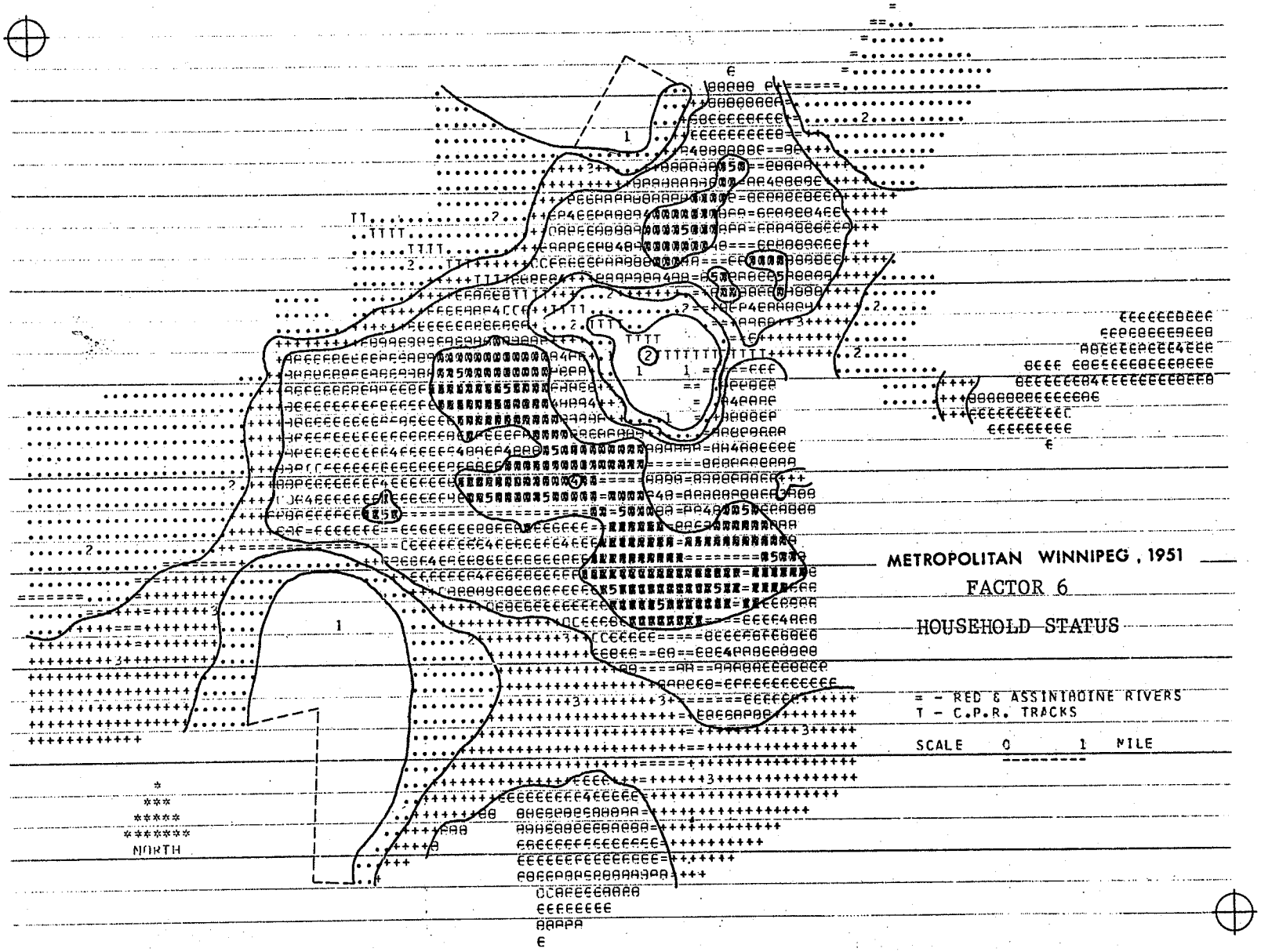

METROPOLITAN WINNIPEG, 1951
FACTOR 5
MIGRANT STATUS
= - REC & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE C 1 MILE
NORTH

FIGURE 7


METROPOLITAN WINNIPEG , 1951
FACTOR 6
HOUSEHOLD STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

zone three remained reasonably stable, and zones four and five experienced the majority of the new growth. Most of the growth areas coincided with the city's periphery, but as Figure 6 showed, three central locations attracted new migrants.

Figure 7 illustrated household status, the sixth and last dimension. The fundamental pattern appeared to be concentric zones with some attributes of sectors. The highest communalities associated with household status occurred in census tracts which occupied the inner suburbs with the single exception being limited to the slums along Main Street near the C.P.R. main line. The two remaining areas of lowest household status emerged in Tuxedo and in the north-west corner of West Kildonan. Failure of the outer suburbs to match the high household values of the inner suburbs could not be explained satisfactorily except to suggest that some of the outer suburbs may have been contaminated by rural characteristics.

C. 1961 Spatial Patterns:

Family status, the most relevant factor in 1961, appeared to be simpler and more strongly concentric than it had been ten years earlier. Indeed, family status in 1961 possessed the classic concentric zones of the Burgess model. Once again, the latter stages of the family cycle characterized the inner city while the suburbs corresponded with the early phases of this cycle. There appeared to be an almost

FIGURE 8

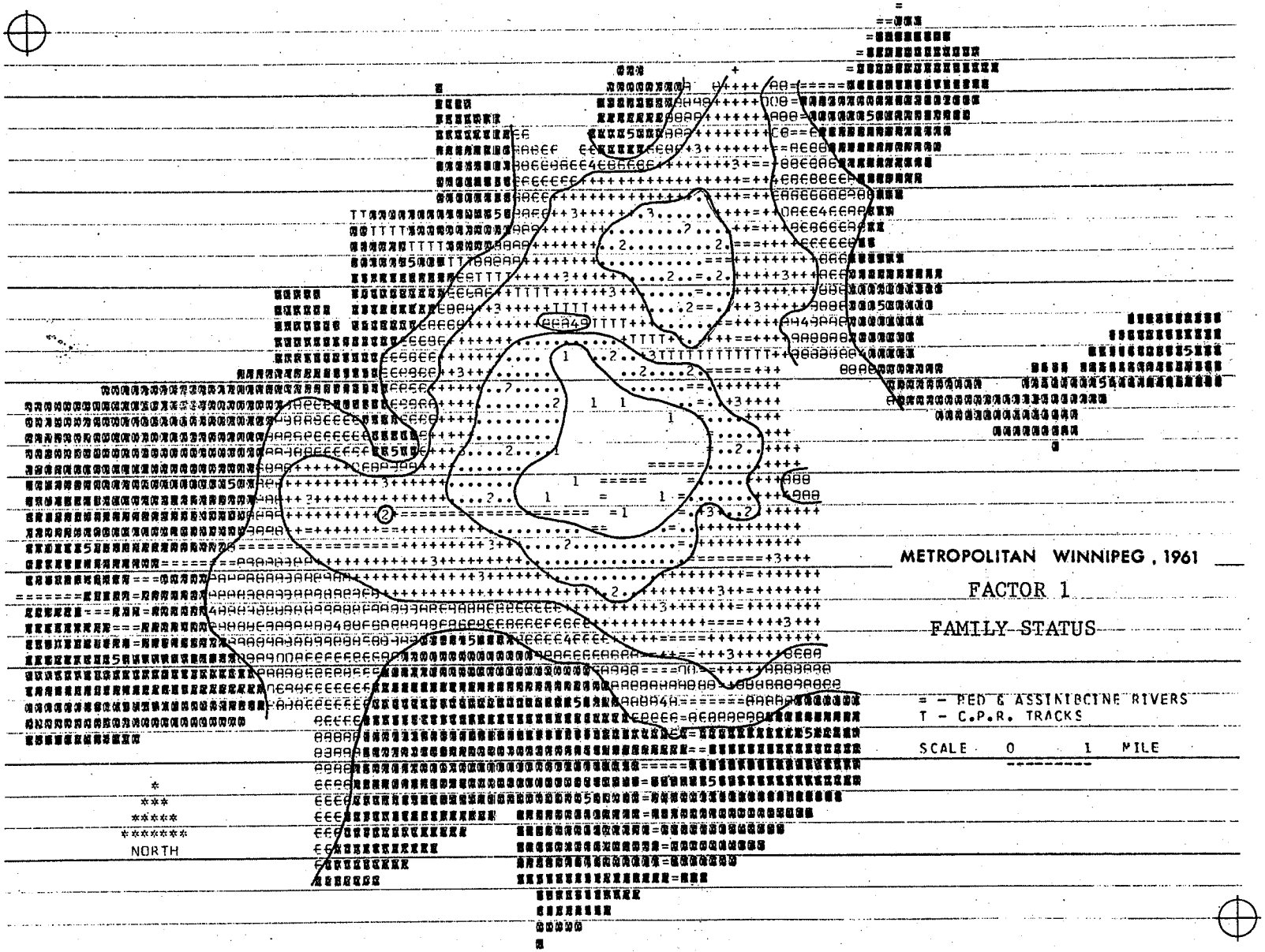
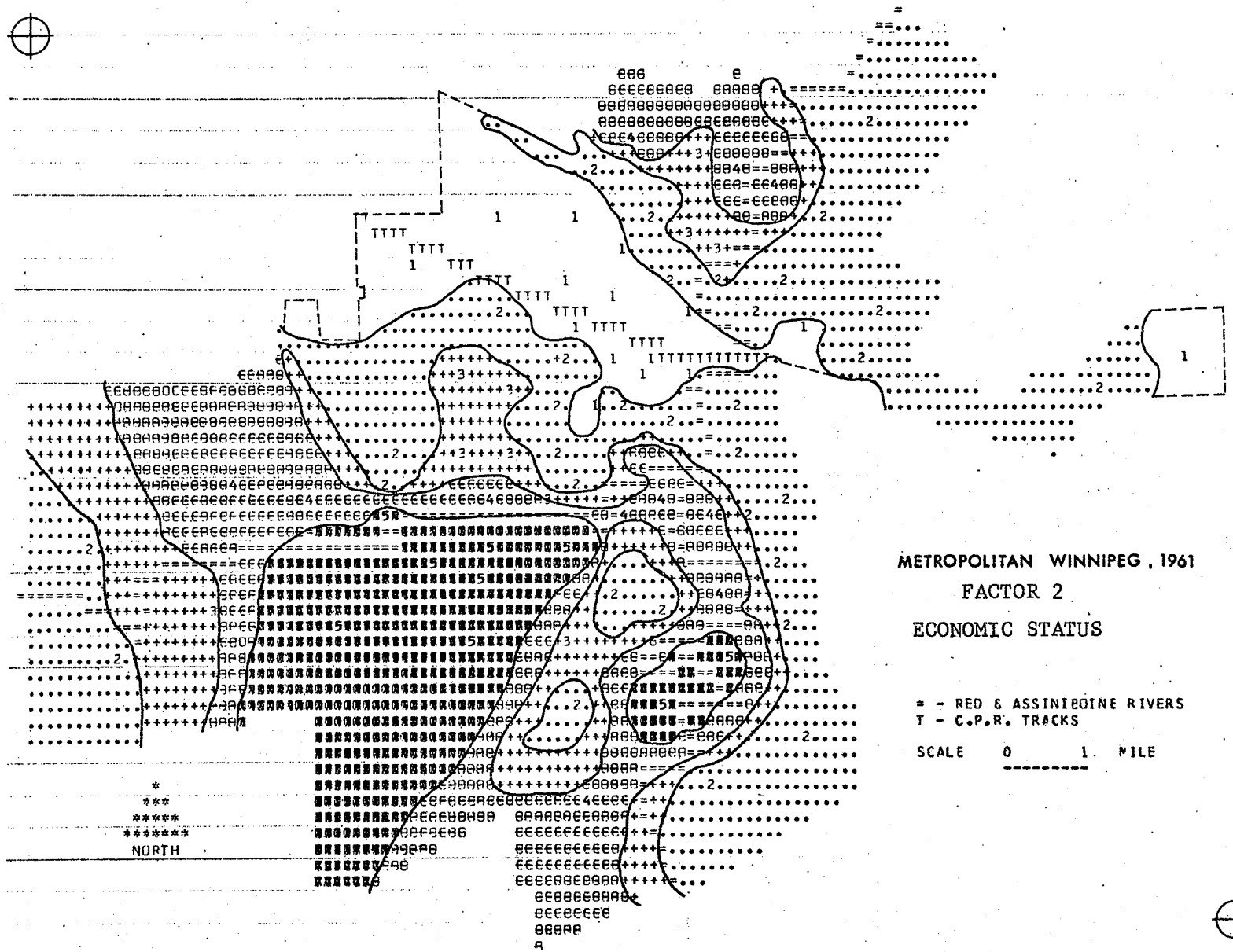

METROPOLITAN WINNIPEG , 1961
FACTOR 1
FAMILY STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 9


METROPOLITAN WINNIPEG , 1961
FACTOR 2
ECONOMIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

perfectly graduated rise from the first division to the fifth division as one travelled outwards from the city core. Figure 8 portrayed the family status dimension.

Figure 9 depicted economic status, the second most important dimension. The sectorial pattern dominated the symap, but even so the concentric zone influence could be readily identified. Economic status bore a striking resemblance to the 1951 patterns. This observation effectively refuted the fifth hypothesis which expected considerable variation to exist in the spatial patterns for both years. Two basic changes involved a greater concentration of economic status around Tuxedo-River Heights and a drop in the relative economic status of East and North Kildonan. In north Winnipeg the highest economic sector shifted slightly north and west towards the urban periphery in the manner described by Hoyt. The lowest division of economic status formed a belt which ran parallel to the C.P.R. main line in north Winnipeg and which reappeared in east Transcona. The influence of the C.N.R. and C.P.R. rail lines in lowering economic status in south Winnipeg could still be recognized.

The third most important factor, life style, appeared for the first time in Figure 10. A complicated combination of polynucleations, concentric zones and sectors appeared in the symap. The highest life style divisions formed two huge sub-areas. The largest resembled a belt stretching from western St. James and Tuxedo into eastern St. Boniface

FIGURE 10

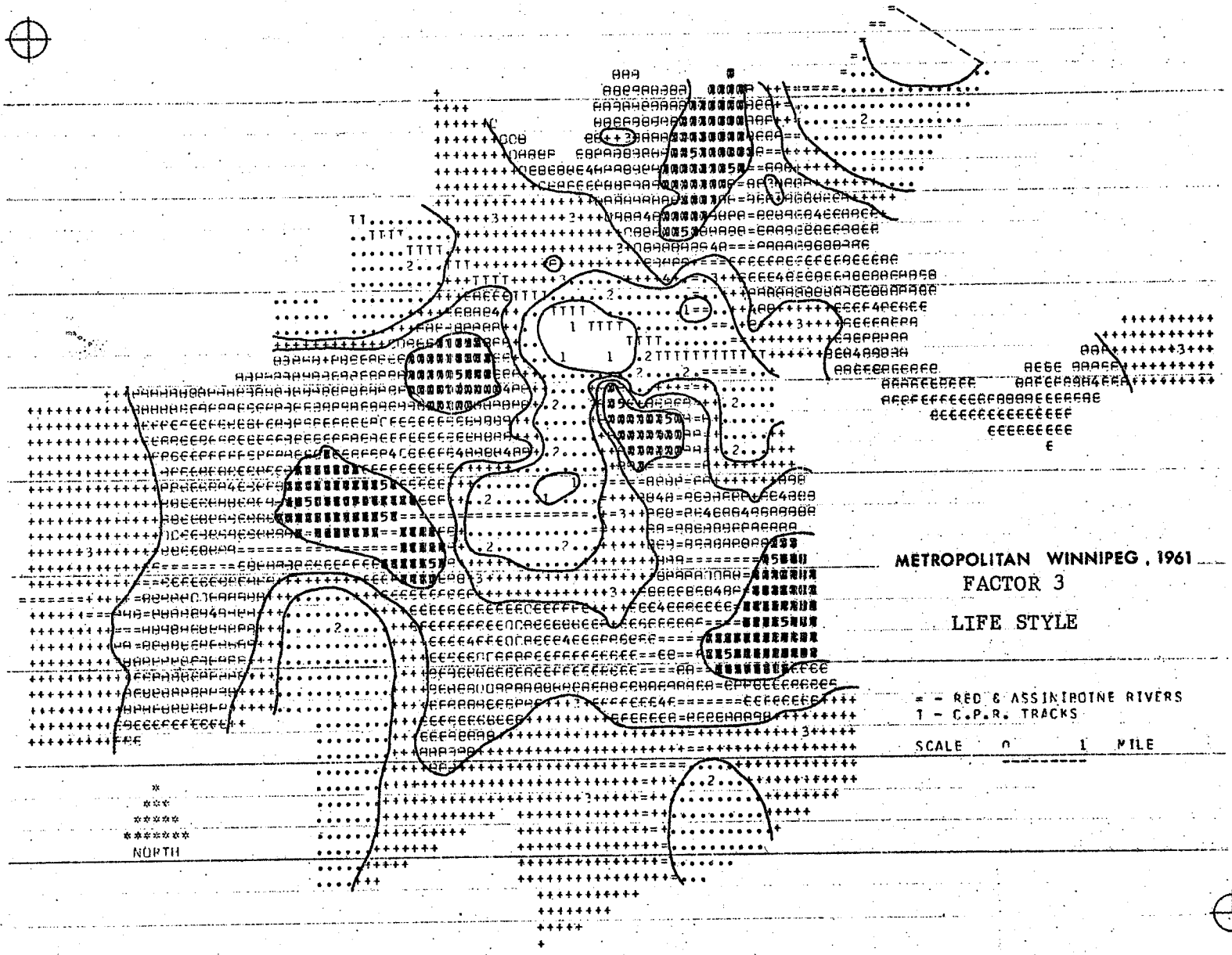
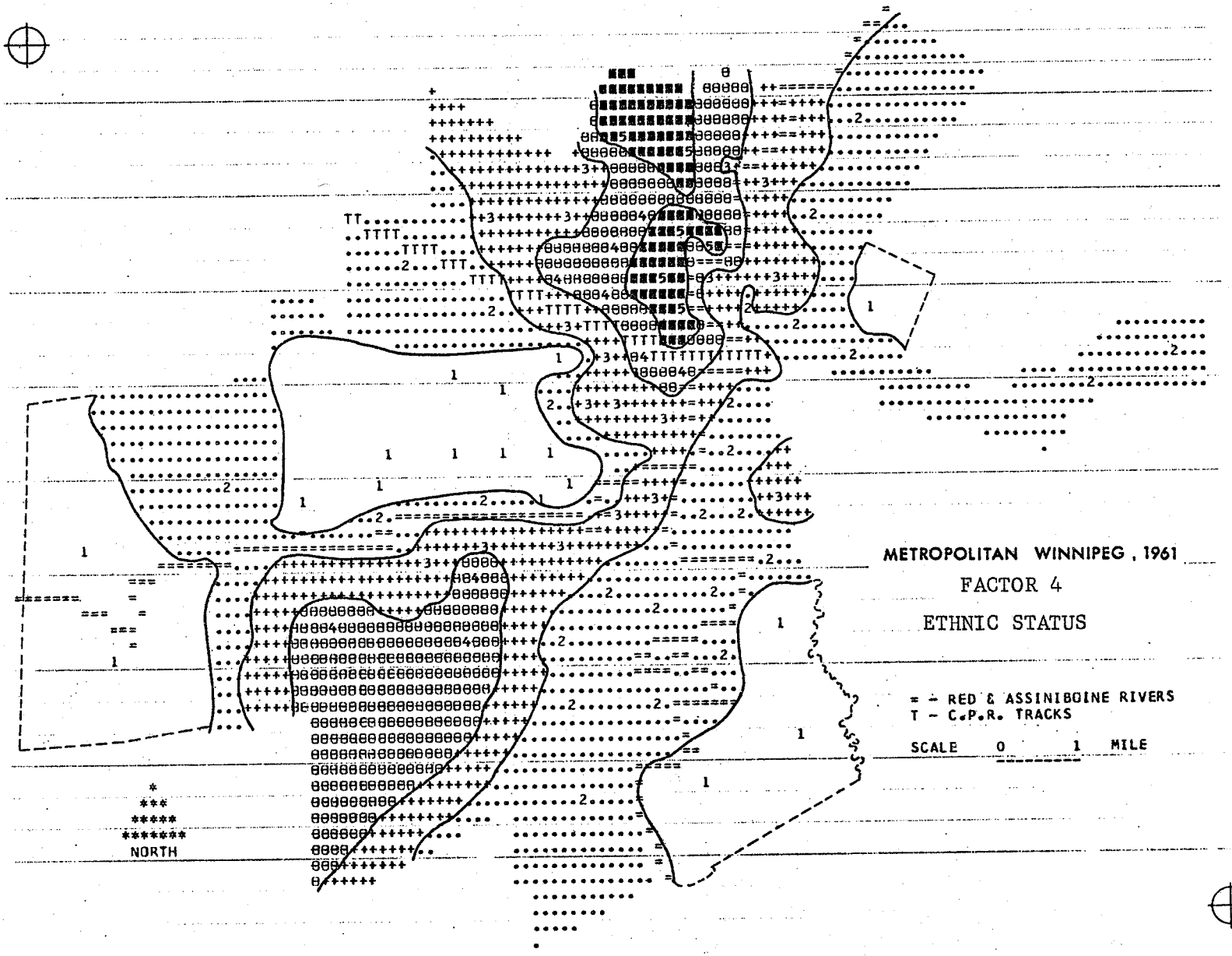

METROPOLITAN WINNIPEG , 1961
FACTOR 3
LIFE STYLE
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 11


METROPOLITAN WINNIPEG , 1961
FACTOR 4
ETHNIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

and St. Vital while simultaneously avoiding north River Heights and the southern urban fringe. Similarly, a northern counterpart stretched from east West Kildonan all the way to west Transcona while excluding North Kildonan. Both high life style belts skirted the inner city. The lowest divisions of life style found along the urban fringe may have been influenced by the rural nature of some of these census tracts. Deprived life styles in the inner city reflected the generally low economic position held by these people.

Ethnic status, as shown in Figure 11, displayed a strong sectorial pattern. The nucleated and concentric zone effect had disappeared. In north Winnipeg and in Tuxedo-River Heights the east European and Jewish influence had strengthened. There appeared to be a relative lack of east Europeans in either the western or eastern thirds of the city, whereas the influence of the east Europeans in the inner third of the city appeared to have increased.

Family status with its concentric zone pattern and economic status with its sectorial pattern confirmed part of the fourth hypothesis. Once more, ethnic status contradicted the hypothesis. Ethnic status displayed a sectorial pattern making it much simpler than it had been in 1951. Ethnic status did not have a nucleated pattern. In all three cases, the patterns were simpler and easier to interpret in 1961.

FIGURE 12

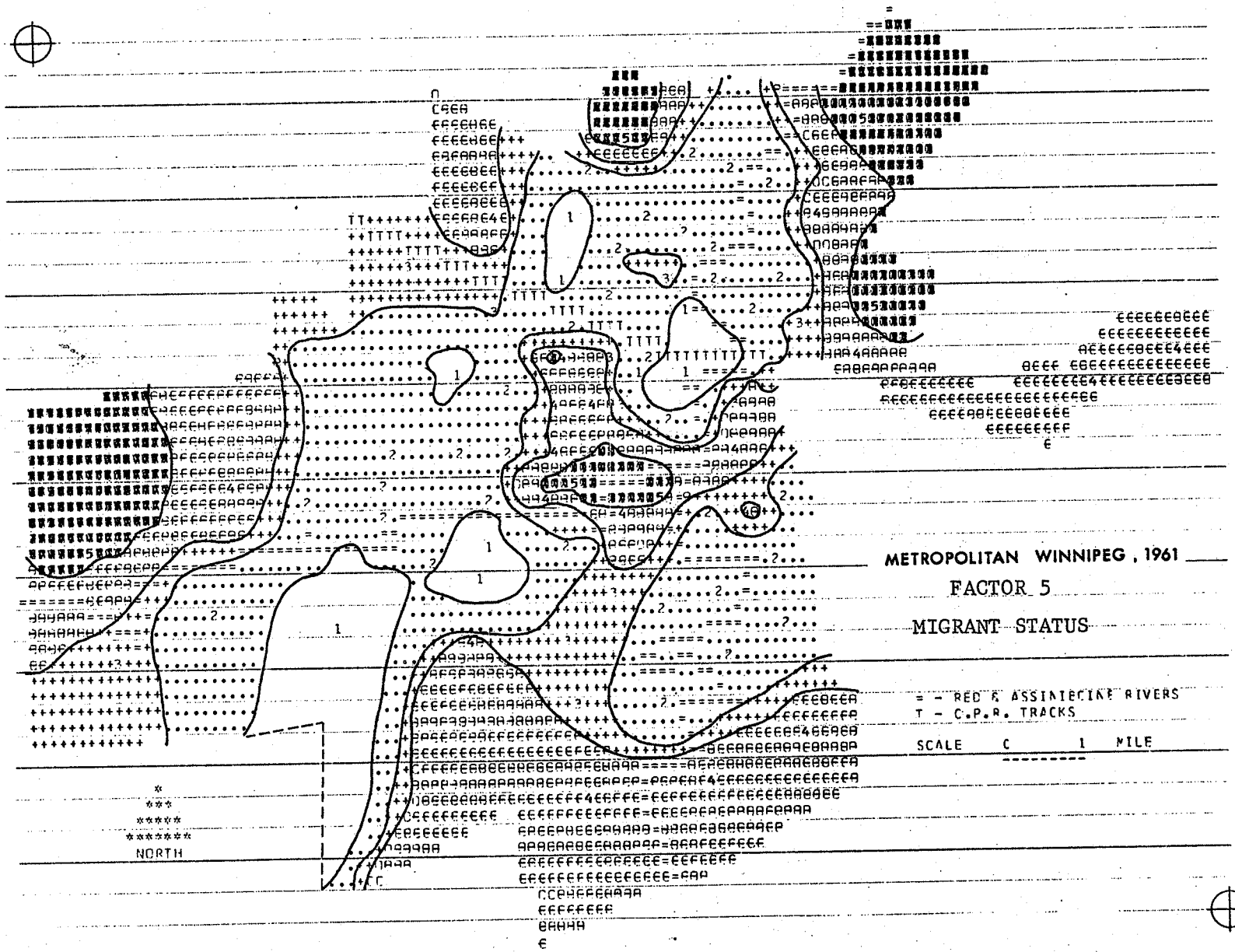
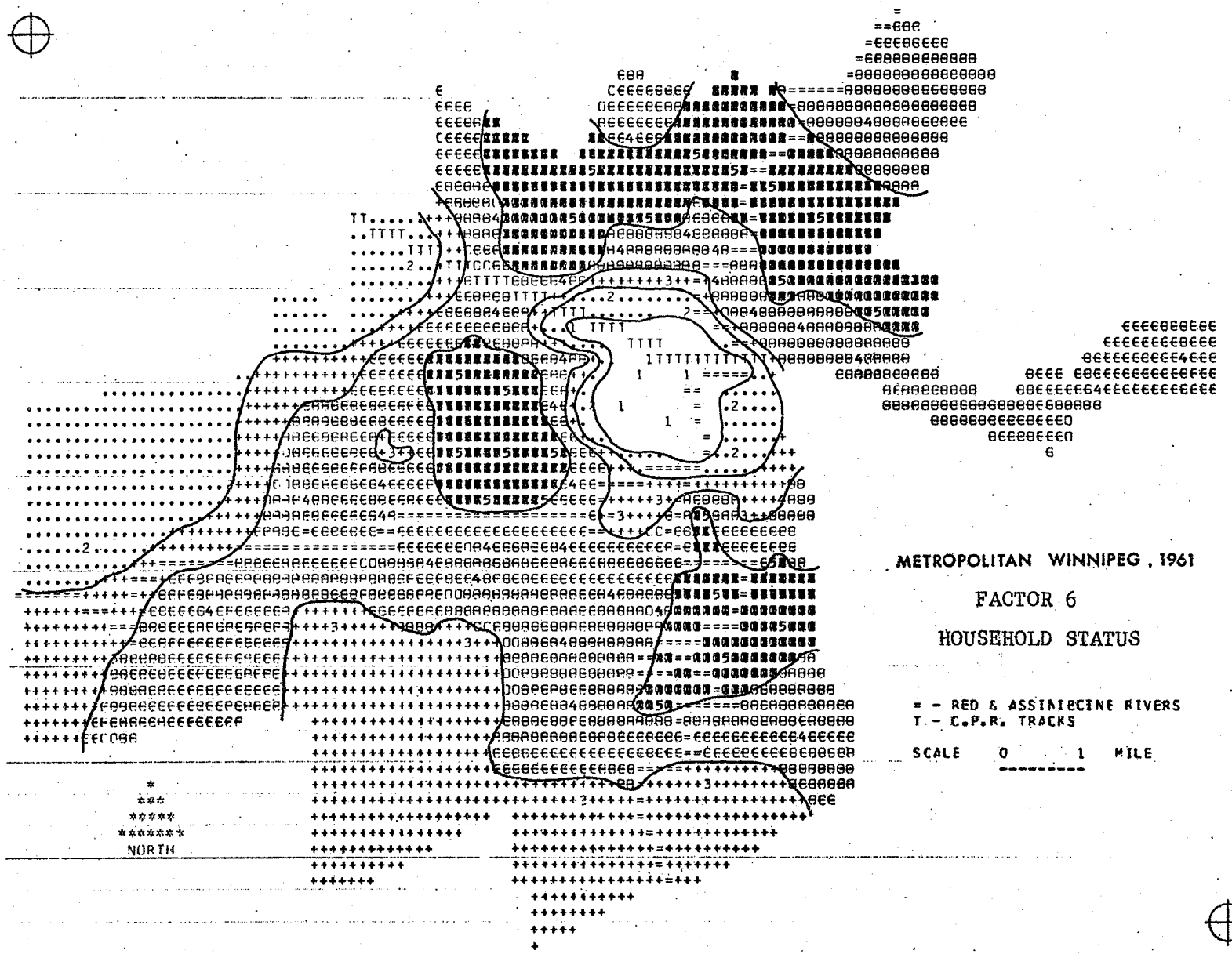

METROPOLITAN WINNIPEG , 1961
FACTOR 5
MIGRANT STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE C 1 MILE
NORTH

FIGURE 13


METROPOLITAN WINNIPEG , 1961
FACTOR 6
HOUSEHOLD STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

Migrant status, the fifth most significant dimension, presented a complex fabric of polynucleations, concentric zones and sectors. As in 1951, zones one and two experienced a relative but not absolute loss in population, zone three remained stable and zones four and five gained new migrants. The western, southern, northern and north-eastern periphery of Winnipeg grew rapidly. Even the inner city attracted more people. Tuxedo, portions of north River Heights, the area adjacent to where the C.P.R. crosses Main Street and the inner part of north-west Winnipeg failed to attract new migrants. Reversing the trend for the first four factors in 1961, Figure 12 appeared to be more complex than the spatial patterns in the 1951 version.

Household status, as designated in Figure 13, re-established the trend towards simpler spatial patterns in 1961. Household status, the least important dimension, had a predominately concentric pattern, although the sectorial pattern could still be detected. An expanded inner city area could be labelled low household status. High household status, while retaining its hold on the inner suburbs, expanded out into the suburbs. Assiniboia and parts of north-west St. James retained their low household status. This may have had something to do with their remoteness from the city centre. The largest rise in household status occurred in the northern parts of metropolitan Winnipeg.

It should be noted that in the five cases where

FIGURE 14

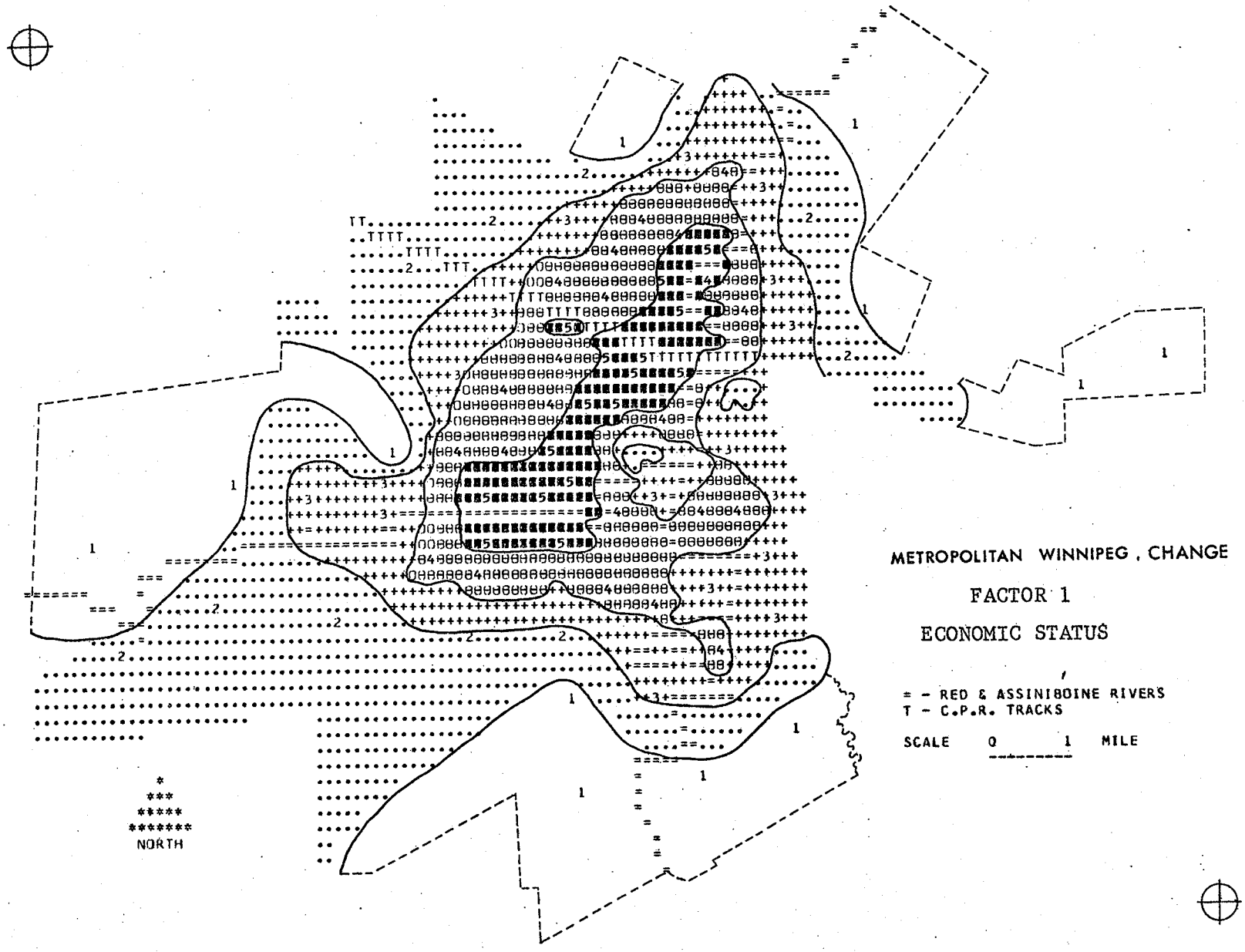
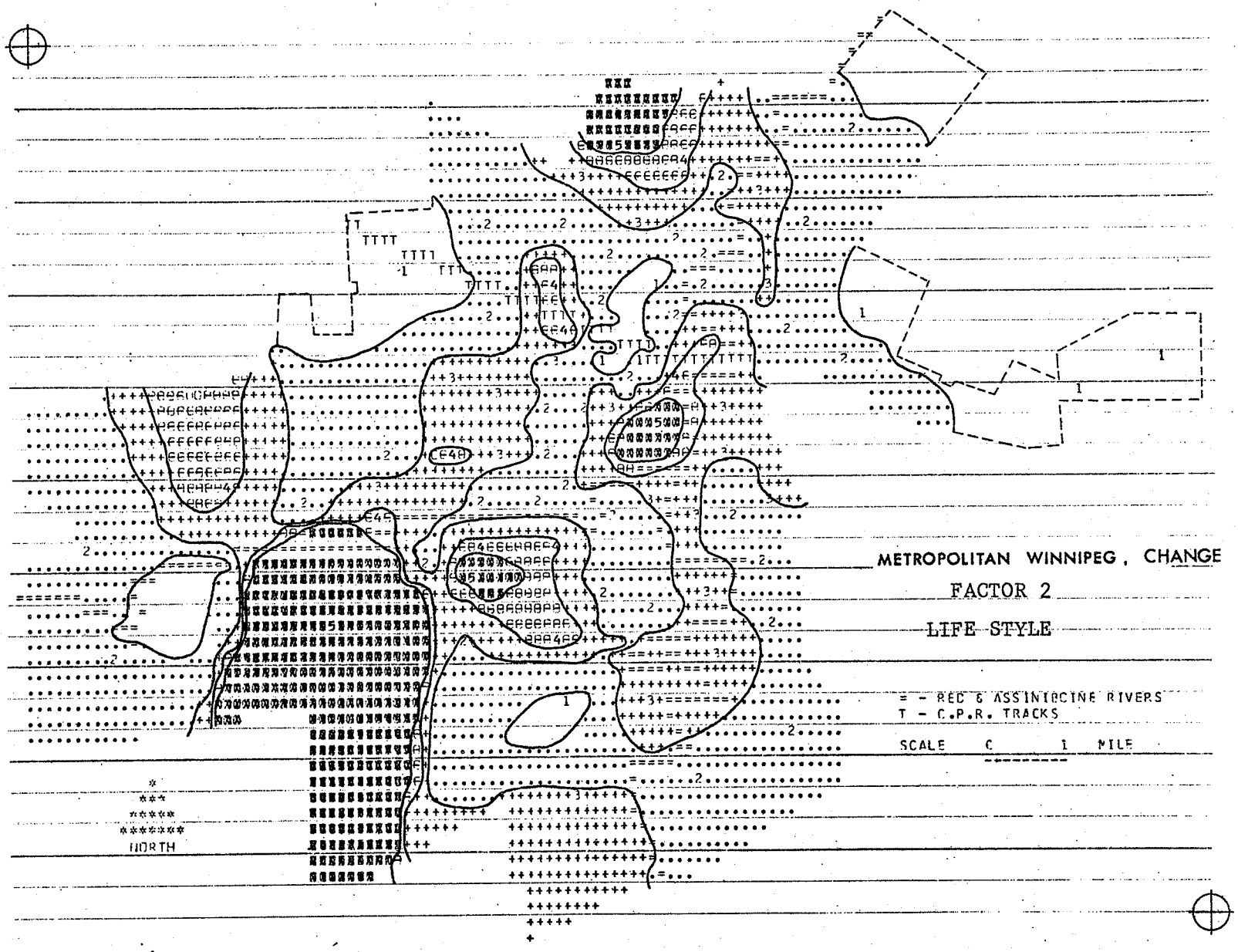

METROPOLITAN WINNIPEG , CHANGE
FACTOR 1
ECONOMIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 15


METROPOLITAN WINNIPEG, CHANGE
FACTOR 2
LIFE STYLE
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

common factors could be compared between 1951 and 1961, the basic underlying patterns were similar. The spatial patterns for economic status coincided remarkably. These results refuted the fifth hypothesis which predicted considerable pattern variation and offered hope for the development of new and improved theories concerning urban space. One surprising trend concerned the emergence of simpler spatial patterns for Winnipeg in 1961. This would suggest that Winnipeg's social space is becoming less differentiated through time.

D. Changes in the Spatial Patterns, 1951-1961:

The patterns represented in the following six symaps concerned the changes that have taken place in the spatial dimension of each factor throughout the period from 1951 to 1961. Economic status, the single most important factor in accounting for change, had expanded in a concentric fashion. Figure 14 portrayed this change dimension. The inner city experienced the maximum of change in economic status. As one travelled outwards from the city centre, the changes grew progressively less significant.

Changes in life style involved a complicated integrated pattern of concentric zones, sectors and polynucleations. Figure 15 revealed that the most extensive changes appeared in Tuxedo-River Heights, central Winnipeg, Garden City and in Assiniboia. The fewest changes in this second most vital

FIGURE 16

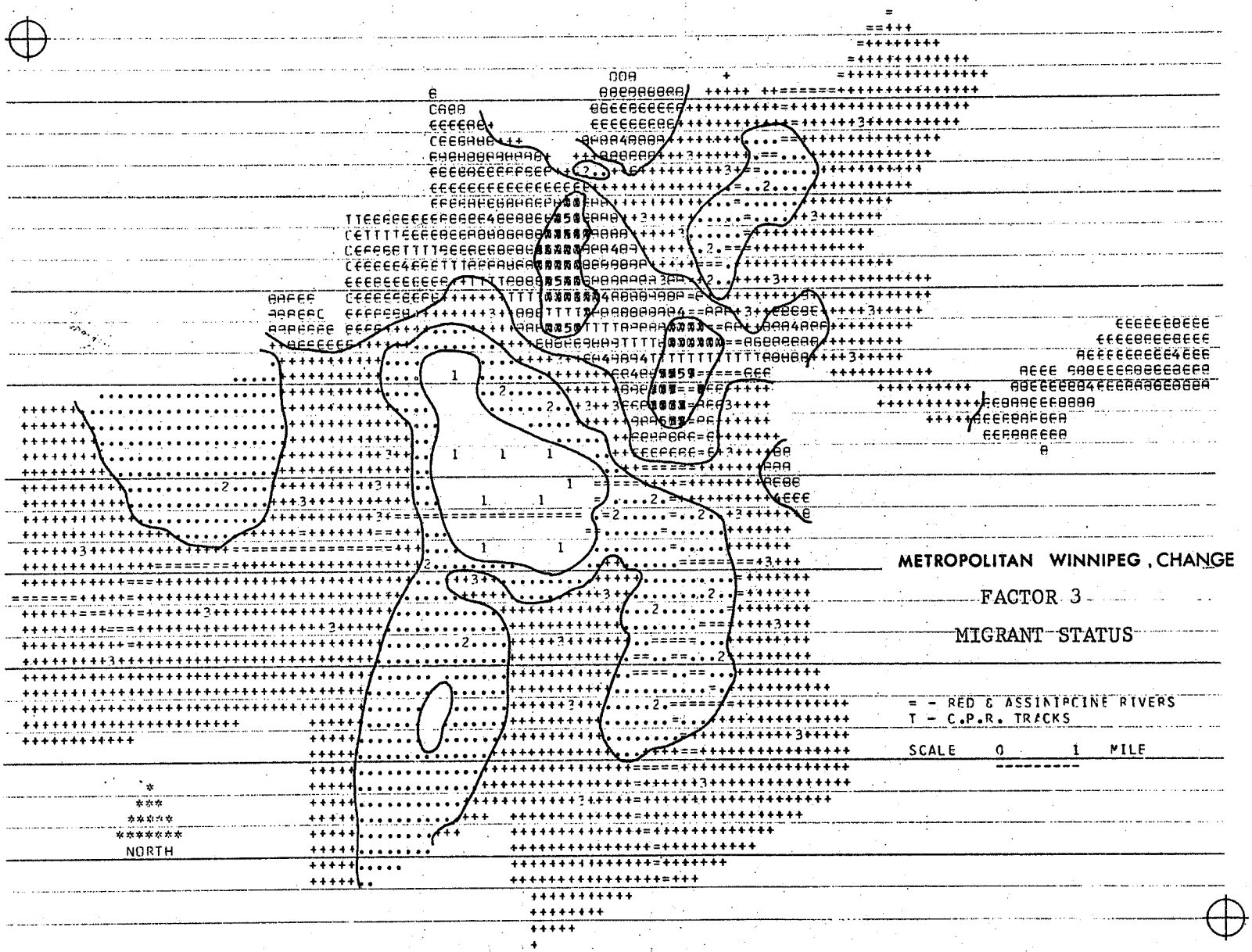
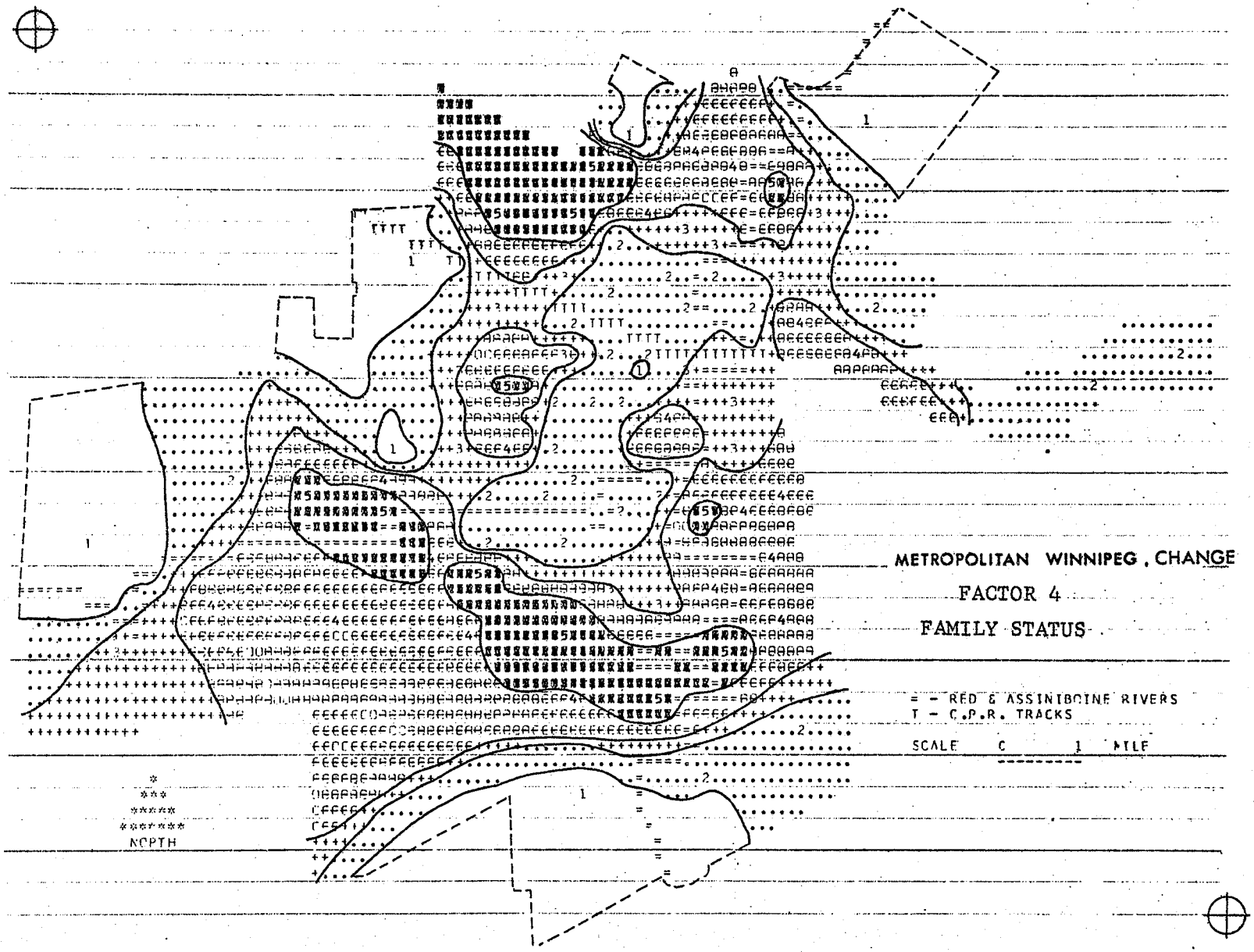

METROPOLITAN WINNIPEG , CHANGE
FACTOR 3
MIGRANT STATUS
= - RED & ASSINIPCINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 17


METROPOLITAN WINNIPEG , CHANGE
FACTOR 4
FAMILY STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

facet of change were found in widely separated parts of the city. The three largest areas of least change occurred on the periphery of metropolitan Winnipeg in St. James-Brooklands, North Kildonan and Transcona. Three less significant areas included part of Charleswood, a small area in Fort Garry and a tiny area along north Main Street, most of which lay north of the C.P.R. tracks.

Figure 16 illustrated the third most important realm of change, migrant status. Migrant status had expanded by sectors, although both the concentric zone and nucleated influence were in evidence. The greatest changes in metropolitan Winnipeg delineated a belt beginning on the northwest side of the city and continuing through north-central Winnipeg into Transcona. The least change in migrant status occurred in the south-central part of the city.

Figure 17 showed that the fourth change factor, family status, offered a complex picture of concentric zones, sectors and multiple nuclei. The maximum weight of change fell on north Winnipeg near the periphery and also formed a belt running across St. James, River Heights, Fort Garry and into St. Vital. The least change occurred along the periphery in Assiniboia, St. James-Brooklands, Garden City, North Kildonan and southern Fort Garry and St. Vital. The inner city exhibited only slight changes in family status.

Household status, the fifth dimension, appeared in

FIGURE 18

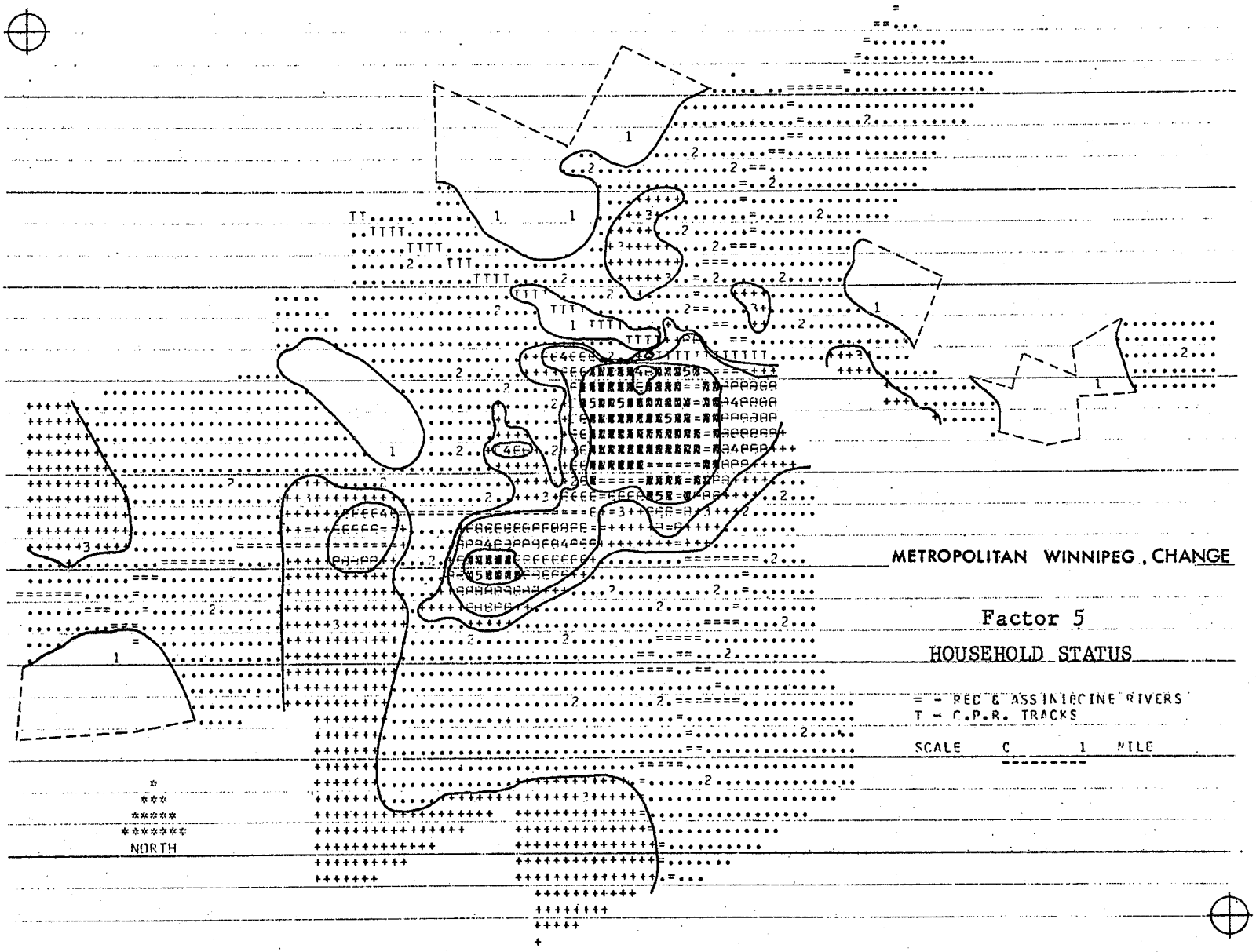

METROPOLITAN WINNIPEG , CHANGE
Factor 5
HOUSEHOLD STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

FIGURE 19

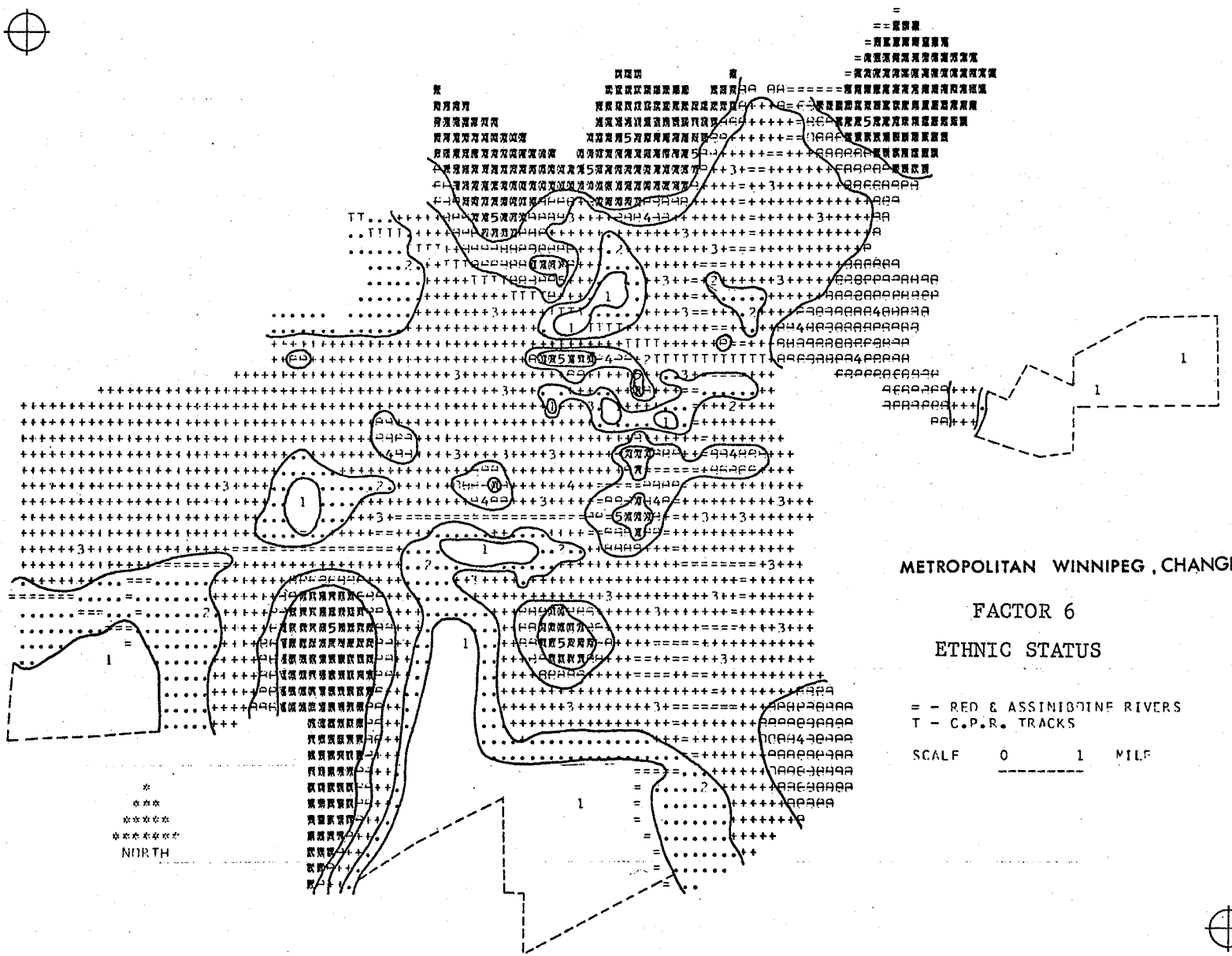

METROPOLITAN WINNIPEG , CHANGE
FACTOR 6
ETHNIC STATUS
= - RED & ASSINIBOINE RIVERS
T - C.P.R. TRACKS
SCALE 0 1 MILE
NORTH

Figure 18. The overall pattern, while basically simple, combined both sectors and concentric zones to explain urban growth. The greatest changes occurred in the centre of the city and in north River Heights. The smallest changes coincided with peripheral locations in the outer suburbs. Areas of least change were: the south-west corner of Charleswood, east of the airport, north-west Winnipeg, part of North Kildonan and central Transcona.

The sixth and least important indicator of change, ethnic status, presented a pattern of sectors and poly-nucleations. The largest changes appeared in Tuxedo, north Winnipeg and North Kildonan. Transcona, south Fort Garry, south River Heights and south-west Charleswood exhibited the least change in ethnic status. Fluctuations in the degree of ethnic change ranged from extreme highs to extreme lows in the central city. These fluctuations, shown in Figure 19, marked the instability of this area.

CHAPTER V

CONCLUSION AND SYNTHESIS

This chapter summarizes the preceding research and provides a synthesis with an earlier study on metropolitan Winnipeg by Latif and Hunter (1973). Six major dimensions summarized approximately three-quarters of the total variance identified in each of the two cross-sectional analyses. Comparison of the 1951 and 1961 analyses revealed a relatively stable ecological structure. Five of the six factors were the same in both years. The five dimensions displaying persistence through time differentiated social space by economic status, family status, ethnic status, migrant status and household status. As hypothesized, economic status had a sectorial distribution and family status varied according to concentric zones. Ethnic status represented a combination of nucleations, sectors and concentric zones in 1951, but by 1961, this had given way to a predominantly sectorial pattern. Migrant status presented a complex combination of polynucleations, concentric zones and sectors. Household status had an underlying concentric zone arrangement, especially in 1961.

Little has been written to explain why a specific sector or zone occurred where it did, or why variations from the idealized model existed. The purpose of the present study was to identify the main dimensions of socio-economic structure and change in metropolitan Winnipeg and

to determine their spatial expression.

Although the character of some of the social regions persisted through time, the city grew and underwent spatial change as growth altered each dimension. In contrast to the relatively stable ecological structure, the dimensions changed during the decade. Nevertheless, except for ethnic status, each of the shared dimensions exhibited the same spatial regularity in 1951 and 1961. Changes in the symaps reflected rapid growth within Winnipeg as opposed to the redistribution of neighbourhood types. For example, economic status varied sectorially with growth occurring along the outer periphery of each sector, while a wave of change moving outwards from the inner city characterized family status. As Winnipeg grew during the decade, the core of apartment dwelling small family units expanded towards areas where the large family dwelt in a single detached residence. The dimensions of differentiation in the ecological structure of Winnipeg demonstrated that

> within the limits of the technology and resources at their command, people choose to minimize, through living apart from those unlike themselves, the possibilities of conflict because of class, generational, racial, and religious or national differences.[63]

Analysis of 1951-1961 change data substantiated impressions drawn from the comparison of cross-sectional data. However, the change analysis proved most disappointing as the amount of total variance explained fell substantially

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[63]Berry and Horton, op. cit., p. 386.

lower than in either of the cross-sectional analyses. Obviously, the relative change quotient was not sophisticated enough to catch a high percentage of variance. Until such time as a relative change quotient explained as much variance as a cross-sectional analysis, this promising research technique will be used sparingly. The most significant dimension of ecological change pertained to economic status. This factor summarized changes in population change, density and potential, plus percentage French, percentage Italian, household amenities and variables traditionally linked with economic status. Other important dimensions of change included life style and migrant status.

A recent study (1973) conducted by Latif and Hunter on metropolitan Winnipeg has provided some interesting contrasts with results contained in this study.[64] Their research showed that economic status declined relatively, although not absolutely, between 1951 and 1961. To this writer's surprise, the present study contradicted their findings, in that economic status not only increased both relatively and absolutely, but it also accounted for the most change during the decade. One possible explanation for this discrepancy might be the fact that Latif and Hunter relied upon a much smaller sampling of variables

[64]Latif and Hunter, op. cit.

than this analysis employed. In the limited list of variables, it would be extremely difficult to know if one had selected the most meaningful variables. The extended list, for all its faults, would not suffer from this liability. Latif and Hunter have argued that there should be approximately four times as many observations as there are variables. In other words, given the number of census tracts (N = 81), there should be twenty or less variables in this study. This may have some empirical support, but in practice, this restricted one to a very small list of variables. One solution for future research which would not only solve this problem but also would eliminate any danger of sizing errors in the data stemming from the differences in census tract size, would be to utilize enumeration units. The smaller and more numerous enumeration units should facilitate further analytic studies.

Although this study did not agree with Latif's and Hunter's findings pertaining to economic status, it confirmed their research with regards to family status. Family status increased both in relative and absolute terms. Latif and Hunter also suggested that Winnipeg's ecological differentiation was probably decreasing through time. Following the identical procedures; namely, an examination of the explained variance for both years, and the correlation between obliquely rotated factors, there appeared to be a slight increase in the overall differentiation of

Winnipeg. This remained true whether the first three or all six factors were examined. Thus once again, this present study differed with that of Latif and Hunter.

There are several promising lines of research that could be investigated in metropolitan Winnipeg. Perhaps the most obvious would be to find out precisely why the above contradictions did occur. The focus of this thesis has been limited to formal characteristics of social space. However, other types of social space can be discerned when one accepts Murdie's definition of social areas or communities as

> a relatively large scale homogeneous region within the city, usually encompassing several smaller neighbourhoods. Ideally, a community is characterized by similar socio-economic characteristics, common patterns of movement and association with uniformly perceived boundaries.[65]

Of course, communities seldom display such homogeneity. Certainly, at the community level, circulatory social space pertaining to household activity systems, and functional social space referring to the perception of the urban environment, offer two excellent avenues for urban research in Winnipeg.

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[65]Murdie, op. cit., p. 168.

APPENDIX A

GLOSSARY OF TERMS

Infra-structure	the arrangement of interrelation of all the primary, secondary and tertiary activities that make up the economic base.
Ethnic Status	(ethnicity or segregation) refers to a series of census characteristics describing the racial and ethnic composition of the city.
Family Status	(urbanization) refers to a series of census characteristics associated with fertility, women in the labour force and type of household.
Economic Status	(social rank) refers to a series of census characteristics related to measures of education, occupation and income.
French Ethnic Status	refers to a series of census characteristics pertaining to ethnic origin, marital status, family size and female income.
Migrant Status	refers to a series of census characteristics associated with residential stability and population change,
Household Status	refers to a series of census characteristics related to residential stability, ownership, type of dwelling, social amenities within the dwelling and marital status.
Life Style	refers to a series of census characteristics pertaining to occupation, sex ratio, type of dwelling, rooms per dwelling, persons per household and lodgers.

APPENDIX B - TABLE 9

COMMUNALITIES OF THE VARIABLES

Variable Number and Title	1951	1961	Change
1. Age 0-14	.97	.98	.84
2. Age 65 & over	.85	.87	.80
3. Single	.98	.89	.79
4. Married	.87	.68	.74
5. British	.87	.86	.49
6. French	.54	.15	.49
7. German	.12	.36	.35
8. Italian	.20	.43	.31
9. Dutch	.50	.34	.52
10. Polish	.86	.81	.48
11. Russian	.42	.29	.26
12. Scandinavian	.64	.56	.10
13. Ukrainian	.81	.74	.64
14. Other European	.42	.75	.25
15. Asiatic	.71	.49	.59
16. Speaking neither English nor French	.75	.76	.34
17. Jewish	.52	.74	.04
18. Not attending school	.95	.58	.24
19. With no schooling	.87	.92	.69
20. 1 or more years of elementary schooling	.93	.85	.74
21. Change in pop'n: 1941-1951(1951); 1956-1961(1961)	.82	.88	.87
22. 1 or more years of university (1961) 13 or more years of education (1951)	.92	.93	.48
23. Three or less persons/household	.79	.84	.63
24. Six or more persons/household	.78	.83	.77
25. Household occupied by a single family	.91	.91	.69
26. Household with lodger	.87	.87	.65
27. Single detached welling	.91	.94	.58
28. Apartments	.90	.91	.51
29. Owner occupied dwelling	.88	.95	.64
30. Mortgaged	.69	.87	.10
31. Furnace	.85	.37	.40
32. Flush toilet	.84	.73	.75
33. Bath or shower	.88	.83	.79
34. Refrigerator	.91	.66	.81

COMMUNALITIES OF THE VARIABLES, Cont'd.

Variable Number and Title	1951	1961	Change
35. Automobile	.83	.89	.68
36. Dwellings occupied 5 years or less	.59	.71	.43
37. Dwellings occupied more than 5 years	.48	.82	.22
38. 0-2 children	.89	.79	.49
39. 5 or more children	.81	.65	.82
40. Children under age 6	.92	.96	.87
41. Wage earner heads	.79	.78	.66
42. Employed males	.95	.93	.57
43. Employed females	.94	.92	.80
44. Male managers	.93	.94	.69
45. Male clerks	.75	.79	.17
46. Male trans. & communic. workers	.86	.83	.80
47. Male service workers	.37	.32	.89
48. Male labourers	.89	.94	.71
49. Female managers	.44	.50	.19
50. Female clerks	.85	.88	.68
51. Female trans. & communic. workers	.58	.53	.25
52. Female service workers	.79	.49	.33
53. Female labourers	.64	.53	.10
54. Sex ratio	.84	.72	.57
55. Rooms per family	.95	.94	.79
56. Rooms per dwelling	.72	.86	.64
57. Persons per room	.85	.83	.62
58. Male earnings average (1961); median (1951)	.82	.93	.88
59. Female earnings average (1961); median (1951)	.58	.90	.25
60. Household earnings average (1961); median (1951)	.85	.93	.83
61. Population density	.81	.79	.87
62. Distance from peak land value	.69	.73	
63. Population potential	.70	.43	.83
64. Television (1961); vacuum (1951)	.94	.78	
65. Male professional & technical (1961); professional ('51)	.91	.92	
66. Male sales (1961); commercial & financial (1951)	.78	.79	
67. Female professional & technical (1961); prof. (1951)	.67	.52	
68. Female sales (1961); commercial & financial (1951)	.71	.73	

APPENDIX C - TABLE 10

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES

1 9 5 1

Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	-0.38	0.01	0.89	-0.98	0.05	-0.09
2.	0.35	0.13	-0.80	0.92	0.01	0.10
3.	0.63	0.00	-0.68	0.91	-0.09	0.07
4.	-0.61	-0.10	-0.03	-0.28	0.04	-0.01
5.	-0.68	0.85	-0.25	-0.02	0.43	0.31
6.	0.22	-0.02	0.07	-0.04	0.14	-0.04
7.	0.21	-0.07	0.24	-0.10	0.03	-0.19
8.	0.22	0.16	-0.08	0.19	0.35	-0.35
9.	-0.01	0.37	0.34	-0.24	0.34	-0.09
10.	0.64	-0.80	0.22	0.07	-0.39	-0.45
11.	0.39	-0.61	0.03	0.13	-0.47	0.04
12.	-0.22	0.86	-0.19	0.18	0.55	-0.10
13.	0.60	-0.76	0.27	0.01	-0.38	-0.44
14.	0.34	0.00	0.09	0.05	0.05	-0.06
15.	0.55	0.11	0.19	0.22	-0.14	-0.14
16.	0.63	-0.69	0.11	0.20	-0.48	-0.27
17.	-0.03	-0.69	-0.16	0.06	-0.57	0.29
18.	0.49	0.05	-0.81	0.98	0.03	-0.06
19.	0.50	-0.68	0.62	-0.32	-0.39	-0.39
20.	0.93	-0.33	0.17	0.32	-0.01	-0.65
21.	-0.67	0.21	0.44	-0.73	0.03	0.22
22.	-0.54	0.04	-0.56	0.20	-0.41	0.95
23.	0.17	0.12	-0.81	0.80	0.16	0.04
24.	0.72	-0.03	0.19	0.24	-0.10	-0.19
25.	-0.69	-0.15	0.57	-0.88	-0.58	0.17
26.	0.68	0.07	-0.52	0.84	-0.04	-0.17
27.	-0.71	0.18	0.62	-0.86	0.10	0.11
28.	0.66	-0.17	-0.66	0.87	-0.07	-0.10
29.	-0.77	0.11	0.38	-0.70	0.04	0.28
30.	-0.82	0.29	0.03	-0.41	0.01	0.41
31.	-0.33	0.18	-0.80	0.52	-0.10	0.44
32.	-0.42	-0.09	-0.43	0.11	-0.20	0.26
33.	-0.59	0.08	-0.48	0.08	-0.10	0.36
34.	-0.69	0.18	-0.61	0.16	-0.13	0.66
35.	-0.82	0.33	-0.13	-0.27	-0.18	0.78
36.	-0.09	0.05	-0.14	0.04	-0.07	0.06
37.	0.11	-0.19	-0.40	0.40	0.03	-0.13
38.	-0.01	0.03	-0.86	0.75	-0.01	0.09
39.	0.30	-0.08	0.67	-0.44	0.00	-0.12
40.	-0.20	0.12	0.86	-0.85	0.09	-0.15

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	-0.04	0.13	0.13	-0.00	-0.07	0.03
2.	-0.05	-0.17	-0.24	0.11	0.15	-0.15
3.	-0.29	0.22	-0.03	0.05	0.04	-0.21
4.	0.69	-0.66	-0.15	-0.11	0.02	0.38
5.	-0.22	-0.25	-0.16	0.05	0.30	-0.18
6.	-0.39	0.80	0.36	-0.05	-0.42	0.31
7.	-0.01	0.01	-0.14	0.20	-0.03	-0.04
8.	0.08	-0.03	-0.11	0.15	-0.05	0.14
9.	-0.32	0.11	-0.40	0.57	-0.07	-0.03
10.	0.48	-0.14	0.12	-0.16	-0.05	0.03
11.	0.12	0.02	-0.12	0.11	-0.13	0.02
12.	-0.18	-0.29	-0.07	-0.03	0.47	-0.42
13.	0.47	-0.18	0.10	-0.15	-0.01	-0.01
14.	-0.42	0.63	0.27	-0.02	-0.21	0.01
15.	-0.32	-0.12	-0.17	0.16	0.47	-0.82
16.	0.33	-0.19	0.01	-0.10	0.08	-0.19
17.	0.33	-0.14	-0.10	-0.02	-0.21	0.27
18.	0.06	-0.18	-0.13	0.00	0.16	-0.13
19.	0.27	-0.08	0.03	-0.00	0.00	-0.15
20.	0.13	-0.04	-0.10	0.16	0.06	-0.21
21.	-0.09	0.13	0.41	-0.38	0.05	-0.02
22.	-0.36	0.20	-0.04	-0.02	-0.11	0.05
23.	0.11	-0.16	-0.24	0.13	-0.05	0.22
24.	-0.44	0.31	0.00	0.16	0.14	-0.52
25.	0.22	-0.09	-0.02	0.03	-0.21	0.36
26.	-0.13	-0.04	0.07	-0.14	0.33	-0.49
27.	0.09	-0.21	-0.12	0.11	0.02	0.08
28.	-0.06	0.22	0.11	-0.10	-0.06	-0.00
29.	0.13	-0.26	-0.32	0.27	-0.11	0.27
30.	0.05	-0.24	0.03	-0.17	0.13	0.02
31.	0.03	-0.09	0.27	-0.47	0.15	-0.01
32.	0.32	-0.16	0.56	-0.77	0.14	0.08
33.	0.23	-0.13	0.47	-0.67	0.10	0.14
34.	-0.03	0.00	0.22	-0.36	-0.02	0.19
35.	-0.32	0.02	0.01	-0.08	0.09	-0.12
36.	-0.04	0.22	0.73	-0.75	0.16	-0.16
37.	0.43	-0.40	-0.34	0.19	-0.08	0.31
38.	0.36	-0.42	-0.02	-0.25	0.17	0.07
39.	-0.45	0.50	-0.12	0.43	-0.23	-0.08
40.	-0.22	0.27	0.28	-0.10	0.02	-0.17

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES, Cont'd:

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Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	-0.09	0.44	0.49	-0.45	0.59	-0.63
42.	-0.49	-0.07	0.78	-0.89	-0.16	0.03
43.	0.41	0.07	-0.81	0.87	0.20	-0.02
44.	-0.75	-0.08	-0.29	-0.13	-0.52	0.92
45.	-0.55	0.52	-0.06	-0.19	0.55	-0.22
46.	0.18	0.18	0.58	-0.42	0.61	-0.86
47.	0.19	0.29	0.16	0.03	-0.02	0.05
48.	0.78	-0.46	0.45	-0.01	-0.19	-0.57
49.	0.18	0.07	-0.44	0.54	-0.23	0.30
50.	-0.20	0.33	-0.81	0.59	0.36	0.09
51.	0.05	0.45	-0.44	0.39	0.54	-0.12
52.	0.65	-0.03	-0.40	0.67	-0.14	0.06
53.	0.71	-0.47	0.28	0.08	-0.17	-0.46
54.	0.33	-0.05	0.48	-0.15	-0.34	-0.11
55.	-0.23	-0.07	0.90	-0.91	-0.08	0.01
56.	-0.67	0.08	-0.23	-0.12	-0.36	0.84
57.	0.65	-0.11	0.53	-0.13	0.07	-0.63
58.	-0.81	0.01	-0.22	-0.23	-0.32	0.76
59.	-0.51	0.35	-0.32	0.10	0.13	0.19
60.	-0.79	0.03	-0.23	-0.20	-0.39	0.87
61.	0.44	-0.21	-0.73	0.81	-0.00	-0.14
62.	-0.42	0.14	0.64	-0.73	0.06	0.09
63.	0.48	0.02	-0.64	0.78	0.13	-0.20
64.	-0.83	0.41	-0.48	0.02	0.04	0.61
65.	-0.75	0.05	-0.38	-0.06	-0.40	0.90
66.	-0.84	0.33	-0.24	-0.19	-0.04	0.57
67.	-0.12	0.08	-0.62	0.41	0.03	0.43
68.	0.46	0.15	-0.30	0.47	0.57	-0.63

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	0.16	-0.09	0.35	-0.30	0.22	-0.09
42.	0.18	-0.34	-0.06	-0.01	0.19	-0.19
43.	-0.12	0.32	0.05	0.01	-0.24	0.30
44.	-0.12	-0.09	-0.04	-0.12	0.02	-0.02
45.	0.35	-0.41	0.06	-0.20	0.17	0.19
46.	0.32	-0.09	0.12	-0.02	-0.01	0.18
47.	-0.44	0.13	0.06	-0.00	0.32	-0.61
48.	0.14	-0.02	0.06	-0.01	0.12	-0.31
49.	-0.20	-0.15	-0.21	0.09	0.26	-0.41
50.	0.13	-0.07	-0.02	-0.08	-0.11	0.41
51.	-0.19	0.33	0.07	0.06	-0.22	0.34
52.	-0.43	0.39	0.05	0.06	0.02	-0.29
53.	0.12	0.10	0.10	-0.02	-0.03	-0.12
54.	-0.13	-0.31	-0.03	-0.06	0.60	-0.94
55.	-0.23	0.28	0.08	0.11	-0.11	-0.07
56.	-0.25	-0.03	-0.17	0.08	-0.00	-0.04
57.	-0.03	0.14	0.31	-0.19	0.20	-0.40
58.	-0.04	-0.08	-0.03	-0.10	-0.06	0.15
59.	0.24	-0.59	-0.23	-0.03	0.30	-0.08
60.	-0.17	-0.02	-0.07	-0.04	-0.04	0.06
61.	0.24	0.00	0.10	-0.18	-0.11	0.25
62.	-0.11	-0.06	-0.29	0.36	-0.04	-0.00
63.	0.06	0.08	0.18	-0.21	0.02	0.03
64.	-0.05	-0.14	0.09	-0.25	0.09	0.10
65.	-0.19	0.01	0.04	-0.17	0.00	0.01
66.	-0.02	-0.20	0.04	-0.20	0.12	0.03
67.	-0.31	0.53	0.13	-0.01	-0.39	0.43
68.	0.22	0.05	-0.00	0.07	-0.17	0.37

APPENDIX C - TABLE 11

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES

1 9 6 1

Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	0.76	0.95	-0.62	-0.13	-0.02	-0.04
2.	-0.75	-0.81	0.47	0.07	-0.10	0.05
3.	-0.83	-0.79	0.41	0.11	-0.11	-0.08
4.	0.58	0.15	0.21	0.06	0.23	0.19
5.	0.45	0.01	0.60	0.62	0.05	0.19
6.	-0.21	0.01	-0.18	-0.12	-0.02	-0.03
7.	-0.01	0.01	-0.23	-0.22	0.25	-0.40
8.	-0.52	-0.28	-0.17	-0.21	0.01	-0.40
9.	0.28	0.34	-0.29	-0.13	0.23	-0.07
10.	-0.35	-0.06	-0.51	-0.66	0.06	-0.11
11.	-0.17	-0.04	-0.03	0.12	-0.38	-0.34
12.	0.22	-0.00	0.25	0.20	0.24	0.08
13.	-0.25	0.01	-0.49	-0.65	0.08	-0.05
14.	-0.13	-0.01	-0.02	0.08	-0.38	0.10
15.	-0.45	-0.07	-0.18	-0.11	-0.31	0.01
16.	-0.61	-0.13	-0.47	-0.41	-0.25	-0.43
17.	0.09	0.05	0.12	0.21	-0.33	0.17
18.	-0.69	-0.64	0.22	0.10	0.10	0.04
19.	0.30	0.80	-0.87	-0.41	-0.08	-0.10
20.	-0.81	-0.37	-0.40	-0.66	0.07	-0.07
21.	0.67	0.66	-0.26	0.18	0.03	-0.06
22.	0.30	-0.13	0.76	0.97	-0.48	-0.17
23.	-0.65	-0.88	0.56	-0.04	0.20	0.28
24.	-0.09	0.27	-0.59	-0.26	-0.07	-0.80
25.	0.81	0.64	-0.29	-0.13	0.16	0.01
26.	-0.81	-0.64	0.02	-0.19	0.02	-0.54
27.	0.88	0.61	-0.15	0.03	0.17	-0.06
28.	-0.83	-0.75	0.29	-0.04	0.04	0.13
29.	0.90	0.62	-0.12	0.07	0.15	-0.06
30.	0.91	0.75	-0.14	0.23	0.03	0.14
31.	0.02	-0.24	0.16	-0.26	0.50	0.42
32.	0.61	0.13	0.19	-0.01	0.37	0.19
33.	0.70	0.16	0.27	0.10	0.39	0.19
34.	0.46	-0.00	0.16	-0.07	0.46	-0.04
35.	0.93	0.58	0.11	0.39	0.02	-0.02
36.	0.02	0.00	-0.04	-0.01	0.23	0.13
37.	0.15	-0.21	0.21	-0.18	0.28	-0.05
38.	-0.60	-0.87	0.58	0.01	0.19	0.16
39.	0.16	0.64	-0.70	-0.26	-0.17	-0.24
40.	0.39	0.85	-0.78	-0.22	-0.11	-0.15

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	-0.10	-0.00	0.11	0.17	-0.00	0.12
2.	0.08	-0.03	-0.25	-0.31	-0.02	-0.25
3.	-0.14	-0.10	-0.08	-0.10	0.04	-0.39
4.	0.49	0.18	-0.06	-0.17	-0.02	0.70
5.	-0.45	-0.65	-0.30	-0.15	0.04	-0.07
6.	-0.27	-0.16	-0.01	0.07	-0.01	-0.31
7.	0.03	-0.01	0.31	0.19	0.38	0.35
8.	-0.15	-0.15	0.05	-0.03	0.32	-0.16
9.	-0.32	-0.27	0.14	0.24	0.10	0.03
10.	0.64	0.63	0.15	-0.06	-0.01	0.30
11.	0.28	0.34	0.07	-0.12	0.17	0.01
12.	-0.54	-0.77	-0.30	-0.15	0.15	-0.11
13.	0.65	0.58	0.06	-0.14	-0.04	0.33
14.	0.52	0.95	0.42	0.35	-0.37	-0.00
15.	-0.18	-0.12	-0.33	-0.28	-0.10	-0.60
16.	0.24	0.31	0.05	-0.15	0.22	-0.15
17.	0.53	0.92	0.44	0.38	-0.38	0.13
18.	-0.12	0.03	0.14	0.19	-0.08	-0.26
19.	-0.11	0.18	0.22	0.30	-0.08	-0.15
20.	0.11	0.10	-0.11	-0.17	-0.01	-0.26
21.	-0.20	0.18	0.57	0.69	-0.05	0.14
22.	0.06	0.17	0.14	0.05	0.10	0.06
23.	0.15	0.01	-0.15	-0.16	-0.16	-0.04
24.	-0.10	-0.19	0.10	-0.12	0.67	0.10
25.	0.37	0.12	-0.04	-0.15	0.09	0.64
26.	-0.01	-0.08	0.08	-0.15	0.46	-0.06
27.	0.23	-0.14	-0.15	-0.26	0.22	0.63
28.	-0.15	0.17	0.26	0.36	-0.23	-0.40
29.	0.22	-0.11	-0.12	-0.22	0.22	0.63
30.	-0.14	-0.12	0.06	0.17	-0.07	0.20
31.	0.15	0.07	0.10	0.19	-0.26	0.31
32.	0.43	0.07	-0.05	-0.15	0.04	0.77
33.	0.33	-0.01	-0.02	-0.08	0.05	0.77
34.	0.38	0.02	0.10	-0.06	0.24	0.85
35.	0.05	-0.09	0.03	0.01	0.12	0.45
36.	-0.20	0.32	0.75	0.93	-0.25	-0.01
37.	0.55	-0.18	-0.52	-0.79	0.32	0.70
38.	0.24	0.14	0.01	-0.05	-0.08	0.11
39.	-0.28	-0.18	-0.07	-0.02	0.12	-0.30
40.	-0.32	0.03	0.28	0.41	-0.03	-0.23

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES, Cont'd:

1 9 6 1

Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	0.35	0.38	-0.43	-0.46	0.59	0.16
42.	0.81	0.90	-0.34	0.16	-0.32	0.10
43.	-0.62	-0.88	0.48	-0.05	0.44	-0.12
44.	0.63	0.32	0.48	0.90	-0.55	-0.04
45.	0.39	0.03	0.09	-0.33	0.70	0.53
46.	0.04	0.37	-0.75	-0.84	0.48	0.20
47.	-0.28	0.03	-0.15	-0.07	-0.21	0.18
48.	-0.63	-0.03	-0.63	-0.60	-0.24	-0.24
49.	-0.00	-0.21	0.55	0.65	-0.42	-0.02
50.	-0.02	-0.60	0.71	0.17	0.57	0.40
51.	-0.28	-0.51	0.33	0.10	0.28	-0.37
52.	-0.51	-0.03	-0.44	-0.40	-0.18	-0.10
53.	-0.39	-0.07	-0.50	-0.61	0.14	-0.24
54.	-0.21	0.32	-0.50	-0.27	-0.43	0.07
55.	0.72	0.96	-0.61	-0.04	-0.17	-0.12
56.	0.49	0.24	0.26	0.67	-0.41	-0.66
57.	-0.05	0.46	-0.86	-0.76	0.23	0.09
58.	0.72	0.32	0.51	0.88	-0.37	-0.07
59.	0.18	-0.42	0.92	0.75	0.01	0.14
60.	0.65	0.21	0.60	0.91	-0.38	-0.08
61.	-0.69	-0.79	0.23	-0.24	0.29	-0.19
62.	0.79	0.78	-0.24	0.20	-0.09	0.09
63.	-0.45	-0.52	0.19	-0.09	0.27	-0.07
64.	0.82	0.40	0.15	0.23	0.23	0.09
65.	0.53	0.12	0.65	0.97	0.45	-0.10
66.	0.74	0.38	0.39	0.64	-0.16	0.29
67.	-0.08	-0.41	0.57	0.52	0.01	-0.27
68.	0.29	-0.09	0.23	-0.24	0.59	0.75

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	-0.35	-0.44	0.05	0.23	0.00	0.16
42.	0.10	0.12	-0.15	-0.13	-0.15	0.04
43.	-0.12	-0.18	0.24	0.22	0.21	0.15
44.	0.07	0.19	0.15	0.02	-0.03	0.03
45.	-0.04	-0.47	-0.34	-0.20	-0.16	0.40
46.	-0.11	-0.22	-0.12	-0.01	-0.10	0.03
47.	-0.28	-0.10	-0.18	-0.02	-0.26	-0.59
48.	0.25	0.27	-0.16	-0.30	0.06	-0.28
49.	0.07	0.24	0.10	0.06	-0.07	-0.13
50.	-0.16	-0.29	0.09	0.24	-0.14	0.26
51.	-0.16	-0.26	0.23	0.15	0.43	0.24
52.	0.04	0.18	-0.04	-0.06	-0.06	-0.36
53.	0.26	0.23	0.10	-0.04	0.16	0.14
54.	0.01	0.03	-0.46	-0.44	-0.19	-0.55
55.	-0.14	-0.04	0.02	0.06	0.04	-0.00
56.	0.15	-0.01	0.05	-0.23	0.60	0.38
57.	-0.12	-0.05	-0.02	0.09	-0.13	-0.17
58.	-0.06	-0.04	0.03	0.01	0.08	0.12
59.	-0.13	-0.20	0.01	0.06	0.00	0.11
60.	-0.03	-0.03	0.00	-0.03	0.09	0.13
61.	0.24	0.22	0.30	0.16	0.18	0.26
62.	-0.17	-0.05	0.08	0.19	-0.10	0.04
63.	-0.13	-0.01	0.32	0.35	0.06	0.01
64.	0.13	-0.01	0.14	0.13	0.05	0.59
65.	-0.05	0.05	0.10	0.07	0.07	0.05
66.	-0.11	0.04	0.10	0.23	-0.25	0.06
67.	-0.25	-0.24	0.20	0.17	0.30	0.05
68.	0.11	-0.11	-0.18	0.00	-0.45	0.31

APPENDIX C - TABLE 12

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES

C H A N G E

Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	-0.08	-0.28	0.70	0.05	-0.29	0.04
2.	-0.62	-0.53	-0.49	-0.28	0.18	-0.16
3.	-0.48	-0.15	-0.26	0.22	0.52	0.17
4.	0.55	0.03	-0.40	-0.43	0.17	0.13
5.	-0.10	0.21	0.07	-0.11	-0.35	-0.41
6.	-0.54	-0.64	0.24	0.13	-0.19	-0.11
7.	0.05	-0.10	0.25	-0.09	0.44	0.48
8.	-0.28	-0.54	-0.16	-0.05	0.02	0.01
9.	-0.45	-0.21	0.23	-0.04	0.04	-0.16
10.	-0.05	0.05	0.20	-0.10	0.63	0.57
11.	-0.12	0.12	0.19	-0.11	0.14	0.16
12.	0.21	0.22	0.10	0.11	-0.16	-0.06
13.	-0.05	-0.11	-0.04	-0.08	0.75	0.70
14.	-0.28	-0.46	-0.09	0.09	-0.10	-0.13
15.	-0.47	-0.07	0.08	-0.12	0.35	0.19
16.	-0.32	-0.46	-0.05	-0.13	0.33	0.31
17.	0.04	-0.06	-0.12	-0.13	-0.04	0.01
18.	0.37	0.25	0.02	0.19	-0.04	-0.03
19.	0.03	0.13	0.36	0.05	0.48	0.78
20.	-0.76	-0.32	0.23	0.38	0.12	-0.00
21.	0.73	0.66	0.42	0.18	0.35	0.33
22.	0.65	0.60	-0.01	-0.10	0.14	0.15
23.	-0.35	-0.29	-0.61	-0.06	0.11	-0.17
24.	0.05	-0.17	0.58	-0.02	0.28	0.12
25.	0.56	0.35	0.32	-0.01	0.07	-0.19
26.	-0.33	-0.45	0.52	0.58	0.04	0.09
27.	0.27	0.00	0.42	-0.01	0.43	0.41
28.	-0.12	0.15	0.31	0.68	0.11	0.27
29.	0.21	-0.13	0.37	-0.12	0.13	-0.08
30.	0.21	0.29	-0.02	-0.10	0.11	0.01
31.	0.52	0.43	0.10	0.16	-0.23	-0.24
32.	0.78	0.60	0.27	-0.03	-0.23	-0.08
33.	0.76	0.52	0.24	-0.05	-0.39	-0.29
34.	0.53	0.28	0.17	0.13	-0.66	-0.59
35.	0.54	0.20	0.21	0.18	-0.34	-0.40
36.	0.16	0.24	0.17	0.15	0.46	0.60
37.	-0.23	-0.29	-0.21	-0.05	0.16	-0.04
38.	0.07	-0.21	-0.50	-0.09	-0.06	0.02
39.	-0.65	-0.18	0.48	0.45	0.24	0.18
40.	-0.23	-0.34	0.55	0.18	-0.52	-0.02

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
1.	0.50	0.73	0.05	0.45	0.07	0.27
2.	-0.01	-0.48	0.29	-0.07	0.24	0.21
3.	-0.46	-0.79	0.09	-0.22	0.02	0.12
4.	0.29	-0.01	0.30	0.24	-0.28	-0.61
5.	-0.08	0.14	-0.24	-0.12	0.54	0.58
6.	0.21	0.20	0.27	0.19	-0.04	0.12
7.	0.29	0.06	0.08	0.33	-0.08	0.01
8.	0.17	-0.05	0.35	0.12	-0.23	-0.27
9.	0.01	-0.09	0.10	0.21	0.50	0.66
10.	0.16	-0.13	-0.11	0.18	0.10	0.26
11.	0.12	0.11	-0.28	-0.02	0.31	0.47
12.	-0.07	0.13	-0.12	-0.05	-0.05	-0.06
13.	0.15	-0.28	0.01	0.09	-0.23	-0.14
14.	0.02	-0.07	0.34	0.08	-0.19	-0.21
15.	0.02	-0.21	-0.20	-0.06	0.44	0.67
16.	0.28	-0.07	0.19	0.15	-0.12	-0.04
17.	0.13	0.09	0.00	-0.03	-0.06	-0.11
18.	-0.20	-0.06	0.07	0.03	-0.23	-0.35
19.	0.29	0.25	-0.46	-0.07	-0.19	0.09
20.	-0.27	-0.28	-0.05	-0.15	0.19	0.50
21.	-0.16	-0.05	-0.01	0.37	-0.07	-0.13
22.	-0.07	0.01	-0.18	0.03	-0.02	-0.17
23.	-0.26	-0.56	0.21	-0.29	-0.07	-0.19
24.	0.21	0.03	0.50	0.85	0.25	0.29
25.	-0.13	-0.12	0.45	0.69	0.24	0.04
26.	-0.12	-0.04	0.40	0.35	-0.31	-0.12
27.	0.22	0.04	0.29	0.61	-0.08	-0.06
28.	-0.41	-0.12	-0.28	-0.32	-0.38	-0.13
29.	0.18	0.01	0.61	0.84	0.21	0.10
30.	-0.08	-0.10	-0.08	0.02	0.17	0.11
31.	-0.25	0.03	0.07	0.12	-0.05	-0.21
32.	0.04	0.38	-0.11	0.22	-0.00	-0.16
33.	0.03	0.39	0.04	0.30	0.06	-0.16
34.	-0.13	0.32	0.22	0.23	-0.01	-0.25
35.	-0.16	0.09	0.44	0.45	-0.09	0.34
36.	0.01	-0.03	-0.30	-0.10	-0.26	-0.12
37.	-0.06	-0.32	0.30	0.09	-0.01	-0.06
38.	0.06	-0.06	0.11	-0.25	-0.47	-0.64
39.	-0.23	-0.18	-0.15	-0.04	0.20	0.60
40.	0.43	0.84	-0.18	0.05	-0.14	0.11

(Change)

LOADINGS ON UNROTATED AND ROTATED FACTOR MATRICES, Cont'd:

C H A N G E

Variable Number	Factor 1		Factor 2		Factor 3	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	0.02	0.07	0.69	0.70	-0.03	0.26
42.	0.17	-0.02	0.06	-0.39	-0.21	0.18
43.	0.42	0.47	-0.00	0.01	0.53	0.04
44.	0.76	0.78	-0.07	-0.17	0.02	-0.12
45.	0.17	0.15	-0.18	-0.19	-0.29	-0.30
46.	-0.44	-0.18	0.59	0.82	-0.27	-0.12
47.	-0.36	-0.08	0.56	0.97	-0.14	-0.01
48.	-0.77	-0.71	-0.00	-0.00	0.21	0.22
49.	0.21	0.25	-0.08	-0.11	0.32	0.11
50.	0.58	0.79	-0.14	0.04	0.18	-0.08
51.	0.01	0.18	0.11	0.10	0.26	0.42
52.	0.25	0.37	-0.05	0.05	-0.17	-0.42
53.	-0.02	0.00	0.19	0.02	0.13	0.26
54.	-0.52	-0.36	0.33	0.64	-0.19	0.02
55.	-0.15	0.09	0.76	0.25	-0.15	-0.04
56.	0.46	-0.04	0.19	-0.29	0.04	-0.04
57.	-0.11	0.04	0.73	0.32	0.23	0.30
58.	0.84	0.68	-0.22	-0.51	0.12	0.14
59.	0.13	0.08	-0.35	-0.35	0.14	0.19
60.	0.81	0.68	-0.29	-0.42	0.16	0.16
61.	0.74	0.66	0.42	0.18	0.35	0.33
63.	0.61	0.47	0.48	0.18	0.45	0.44

Variable Number	Factor 4		Factor 5		Factor 6	
	Unrotated	Rotated	Unrotated	Rotated	Unrotated	Rotated
41.	-0.18	0.23	-0.10	0.08	-0.39	-0.13
42.	0.62	0.70	-0.33	-0.05	-0.02	0.01
43.	-0.42	-0.67	0.33	0.40	0.24	0.05
44.	-0.20	-0.08	-0.13	0.08	0.22	-0.02
45.	0.01	0.11	-0.06	-0.09	0.16	0.02
46.	-0.39	0.06	-0.03	-0.08	-0.19	0.13
47.	-0.56	-0.10	-0.04	-0.15	-0.34	-0.03
48.	0.23	-0.06	0.10	-0.04	-0.03	0.21
49.	-0.13	-0.30	0.06	0.12	0.13	0.05
50.	-0.49	-0.41	-0.14	-0.09	0.18	-0.01
51.	0.02	0.05	-0.38	-0.23	-0.13	0.04
52.	-0.37	-0.24	0.11	0.07	0.29	0.13
53.	0.15	0.16	-0.15	0.01	-0.05	0.07
54.	-0.21	0.07	-0.05	-0.22	-0.34	-0.05
55.	0.04	0.36	-0.16	0.27	0.38	0.66
56.	0.33	0.17	0.52	0.74	0.05	-0.17
57.	0.02	0.14	-0.05	0.35	0.14	0.42
58.	0.20	0.16	-0.25	0.04	0.11	-0.15
59.	0.21	0.03	-0.20	-0.21	-0.05	-0.13
60.	0.09	0.04	-0.24	-0.04	0.02	-0.25
61.	-0.16	-0.05	-0.02	0.37	-0.08	-0.13
63.	-0.06	-0.04	-0.09	0.48	-0.13	-0.14

(Change)

APPENDIX D - TABLE 13

FACTOR SCORES

1 9 5 1

Census Tracts	Ethnic Status F_1	Family Status F_2	Economic Status F_3	French Ethnic Status F_4	Migrant Status F_5	Household Status F_6
1.	-0.53	-1.49	-1.07	1.16	-1.16	-0.93
2.	0.17	-1.69	-0.87	1.47	-2.28	-0.30
3.	-1.31	-0.60	-0.95	-0.20	-0.99	0.10
4.	-1.86	-0.09	-1.01	-0.63	0.05	0.22
5.	-2.49	0.43	-0.71	-0.39	-0.18	-0.47
6.	-1.64	0.47	-0.43	-0.79	-0.17	0.58
7.	-0.87	-0.16	0.30	-0.74	-0.51	0.44
8.	-0.82	0.58	0.68	-1.03	0.01	0.90
9.	-1.85	0.73	0.25	-0.92	-0.15	0.60
10.	-3.05	0.60	-0.59	-0.08	-0.17	-0.78
11.	-2.29	0.43	-1.23	0.81	0.01	-1.22
12.	-2.97	0.86	-0.80	-0.25	-0.14	-0.79
13.	-1.28	0.50	1.37	-0.68	0.57	0.55
14.	0.04	0.36	0.70	-0.91	0.78	0.77
15.	-0.02	0.14	-0.23	-0.59	0.59	0.27
16.	0.15	-0.71	-0.73	0.31	-0.47	-0.24
17.	0.29	-1.09	-0.69	0.69	-0.85	-0.45
18.	-2.04	1.13	-0.58	0.70	0.29	-5.45
19.	-0.54	1.33	-1.09	0.77	0.67	-3.42
20.	0.50	2.21	-0.77	0.86	-0.74	-0.24
21.	0.55	1.87	-0.94	0.34	-0.18	0.15
22.	-0.84	1.04	-0.95	0.95	0.55	-1.21
23.	-0.76	-0.12	-1.22	0.74	0.70	-0.92
24.	0.00	0.94	-0.17	1.43	0.25	0.39
25.	1.00	1.11	-0.57	-0.77	-0.17	0.60
26.	1.18	0.07	0.08	-1.35	-0.42	1.12
27.	0.20	-0.35	-0.64	-0.15	-0.17	0.29
28.	1.53	-0.48	-0.21	-1.03	-1.26	0.69
29.	0.88	-0.05	0.31	-1.32	-0.33	0.56
30.	0.82	0.68	1.06	-0.56	0.23	0.75
31.	0.95	0.17	0.53	-1.00	-0.62	0.40
32.	0.98	1.16	-0.45	-0.74	0.08	0.94
33.	0.78	1.52	0.74	-0.17	0.22	0.95
34.	0.79	1.96	0.22	0.60	0.29	0.38
35.	0.93	2.52	-0.12	1.00	-0.11	1.07
36.	0.36	1.84	-0.65	0.70	0.12	-1.12
37.	0.75	2.33	-0.27	0.64	-0.36	0.74
38.	0.78	1.76	0.07	0.33	0.04	0.53
39.	0.81	0.11	0.56	-0.78	-0.24	0.88
40.	0.81	0.03	-0.15	-1.00	-0.06	0.85

FACTOR SCORES, Cont'd:

1 9 5 1

Census Tracts	Ethnic Status F_1	Family Status F_2	Economic Status F_3	French Ethnic Status F_4	Migrant Status F_5	Household Status F_6
41.	0.68	0.29	-0.45	-0.46	-0.26	0.91
42.	0.72	1.63	0.56	0.31	-0.03	0.73
43.	0.02	1.00	2.59	0.23	0.52	0.45
44.	0.67	-1.39	-0.43	1.02	-1.60	-0.13
45.	-0.82	-0.36	3.35	-0.72	-0.21	0.31
46.	-0.97	0.34	3.50	-0.70	0.85	0.44
47.	0.31	-0.29	1.89	-0.47	-0.83	0.12
48.	-0.18	-1.30	2.27	-0.11	-0.97	-0.45
49.	-0.25	0.05	-0.29	3.46	-0.52	0.33
50.	-0.05	0.36	-0.29	3.45	-0.79	0.40
51.	0.65	-0.41	1.14	-0.51	-1.05	0.47
52.	0.65	0.21	0.15	0.26	-0.68	0.79
53.	-0.46	-0.77	-0.69	1.22	-1.23	-0.15
54.	-0.36	-0.51	-0.72	-0.72	0.55	0.41
55.	-0.70	-0.66	-0.86	-0.30	0.85	0.38
56.	0.09	-0.77	1.47	2.76	0.80	-2.71
57.	-0.37	-0.72	-0.91	0.23	2.00	-0.55
58.	0.54	-0.90	-0.55	0.23	2.60	-0.55
59.	0.78	-0.84	0.42	-1.23	0.69	-0.36
60.	0.89	-1.42	-0.20	-0.07	0.15	-0.33
61.	0.89	-1.50	-0.73	-0.14	-0.37	-0.25
62.	0.44	-1.17	1.84	-0.34	-1.40	-0.15
63.	0.27	-0.87	-0.50	0.91	1.44	0.00
64.	0.52	-0.87	0.89	-0.56	-0.77	0.29
65.	0.47	-0.82	-0.38	-0.44	-0.52	0.02
66.	-0.19	-0.18	-0.55	-0.87	-0.26	0.65
67.	-0.07	-0.98	-0.51	-0.24	0.68	-0.48
68.	-0.27	-0.88	-0.07	0.81	2.37	-0.90
69.	1.39	-1.36	-1.18	1.61	3.87	-1.70
70.	-0.21	-0.75	-0.05	-0.42	-0.68	0.22
71.	-0.08	-0.19	0.68	-0.88	-0.47	0.68
72.	0.87	-0.82	-0.12	0.07	-0.13	-0.51
73.	0.75	-0.59	-1.11	-0.66	3.18	0.40
74.	0.88	-0.32	-0.50	-0.63	-0.37	0.49
75.	0.96	-0.28	0.75	-0.99	-0.20	0.74
76.	0.78	-0.62	1.00	-0.62	-1.11	0.35
77.	0.95	-0.45	-0.39	-0.91	-0.93	0.80
78.	0.88	-0.56	-0.36	-0.81	-0.65	0.42
79.	0.65	-0.54	1.46	-1.09	-0.58	0.52
80.	0.54	-0.77	-0.17	1.06	0.93	-0.11
81.	0.43	-1.01	-0.75	0.85	1.46	-0.19

APPENDIX D - TABLE 14

FACTOR SCORES

1 9 6 1

Census Tracts	Family Status F_1	Economic Status F_2	Life Style F_3	Ethnic Status F_4	Migrant Status F_5	Household Status F_6
1.	1.08	-0.86	0.06	-0.23	0.75	0.37
2.	0.59	-0.66	0.59	0.57	-0.23	0.97
3.	0.16	-1.52	0.01	0.69	-1.37	3.72
4.	-0.19	-1.17	0.09	1.37	-1.24	0.33
5.	0.06	-1.37	-0.88	1.49	-0.17	-0.85
6.	-0.42	-0.94	-0.03	1.51	-0.05	0.22
7.	-0.21	-0.27	0.77	1.71	-0.70	0.77
8.	-0.54	0.23	1.07	1.96	-0.16	0.34
9.	-0.81	-0.63	0.31	2.37	0.08	-0.09
10.	-0.12	-1.36	-1.23	1.81	-0.11	-1.58
11.	-0.16	-0.92	-1.38	1.74	-1.73	-1.56
12.	-0.57	-1.16	-1.83	2.28	-1.33	-0.82
13.	-0.32	0.27	0.45	1.97	-0.30	0.23
14.	-0.40	-0.00	-0.20	0.04	-0.34	0.41
15.	0.10	-0.66	0.27	-0.39	-0.26	0.36
16.	0.47	-0.95	-0.13	-0.54	0.05	0.28
17.	0.89	-0.57	0.35	-0.56	0.78	0.31
18.	-0.30	-0.87	-0.48	1.77	-3.67	-4.40
19.	-0.37	-1.25	-1.27	0.59	-1.41	-3.30
20.	-1.94	-0.59	1.17	0.18	0.42	-2.19
21.	-1.61	-1.03	-0.81	-0.16	0.90	-0.84
22.	-0.42	-1.45	-2.79	0.31	0.23	-1.33
23.	0.76	-1.45	-3.41	0.03	-0.87	-1.11
24.	-1.30	-0.10	-1.92	-0.85	1.07	0.06
25.	-0.91	-0.57	-0.84	-0.69	0.62	0.27
26.	-0.56	0.17	0.85	-0.83	-0.65	0.80
27.	0.35	-0.70	0.40	-0.58	0.11	0.23
28.	0.25	0.17	1.38	-0.77	-1.09	0.63
29.	-0.22	0.21	0.41	-0.86	-0.40	0.75
30.	-0.81	0.78	-0.82	-0.59	-0.19	0.74
31.	-0.70	0.16	0.30	-1.13	-0.05	0.80
32.	-1.20	-0.46	-1.19	-1.07	0.56	0.71
33.	-1.59	0.18	-1.69	-0.93	1.20	0.72
34.	-1.98	-0.26	-2.35	-1.17	1.73	0.34
35.	-2.59	0.18	-0.48	-0.94	1.68	0.05
36.	-1.80	-0.32	1.51	0.09	-0.59	-2.20
37.	-2.82	0.76	1.81	-0.40	1.22	-0.63
38.	-1.75	0.56	0.56	-0.05	1.54	-0.37
39.	-0.21	0.66	0.47	-0.65	-0.26	0.59
40.	-0.07	-0.10	0.37	-0.67	-0.18	0.43

FACTOR SCORES, Cont'd:

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Census Tracts	Family Status F_1	Economic Status F_2	Life Style F_3	Ethnic Status F_4	Migrant Status F_5	Household Status F_6
41.	-0.45	-0.43	-0.16	-0.65	0.43	0.26
42.	-1.82	0.44	-0.00	-0.07	1.21	-0.25
43.	-0.63	1.94	-0.57	0.30	-0.39	0.08
44.	0.68	0.32	0.57	-0.60	0.23	0.38
45.	0.01	3.22	0.09	1.32	-2.12	0.47
46.	0.07	2.91	-0.68	0.80	-1.75	0.25
47.	0.05	1.48	1.25	-0.17	-0.86	0.19
48.	1.14	1.82	0.32	1.57	0.65	-0.27
49.	-0.07	-0.31	-0.53	-0.33	0.44	-0.79
50.	-0.45	-0.48	-0.67	-0.60	0.84	-0.72
51.	-0.07	0.74	0.66	-0.55	-0.32	0.58
52.	-0.43	-0.07	0.32	-0.40	0.56	-0.12
53.	0.54	-0.70	0.26	0.09	-0.32	-0.06
54.	1.07	-0.72	0.29	-0.54	1.04	0.07
55.	1.16	-0.87	-0.04	-0.43	0.81	0.09
56.	0.80	3.27	-0.99	1.32	-1.69	-0.14
57.	1.47	-1.10	-1.07	-0.55	0.14	-0.73
58.	1.82	0.04	0.02	-0.83	1.49	-0.63
59.	0.88	0.34	0.59	-0.79	-0.50	0.15
60.	1.70	0.02	0.19	-1.16	0.15	-0.08
61.	1.20	-0.13	0.17	-0.53	0.40	0.12
62	0.68	1.80	0.39	-0.42	-0.76	0.51
63.	1.50	0.52	-0.08	-0.49	0.99	-0.16
64.	0.50	0.82	0.17	-0.00	-0.48	0.92
65.	0.72	-0.21	0.49	-0.51	0.72	0.73
66.	0.08	-0.36	0.53	0.39	-0.58	0.56
67.	1.36	0.61	0.32	-0.91	1.97	0.59
68.	1.36	-0.61	-1.48	-0.35	1.65	0.19
69.	1.51	0.91	0.19	2.08	1.97	0.34
70.	0.25	0.33	1.27	1.99	-0.23	0.62
71.	0.08	0.57	1.05	0.94	-0.61	0.67
72.	1.18	0.95	0.38	-0.59	1.10	-0.50
73.	1.14	-0.28	0.48	-1.18	-0.39	-0.13
74.	0.22	-0.23	0.99	-0.88	-0.52	0.31
75.	-0.35	1.30	1.37	-0.64	-0.72	0.27
76.	0.15	0.82	1.12	-0.81	-0.28	0.32
77.	0.23	-0.11	1.32	-0.69	-0.61	0.58
78.	0.31	-0.13	1.37	-0.91	-0.45	0.58
79.	0.18	1.26	1.14	-0.70	-0.49	0.75
80.	1.32	-0.21	-0.52	-1.04	0.97	-0.23
81.	1.11	-0.40	-0.01	-0.87	0.75	0.01

APPENDIX D - TABLE 15

FACTOR SCORES

C H A N G E

Census Tracts	Economic Status F_1	Life Style F_2	Migrant Status F_3	Family Status F_4	Household Status F_5	Ethnic Status F_6
1.	-1.00	-0.42	0.47	1.20	-0.70	0.80
2.	-0.79	0.10	-0.52	3.27	-0.27	2.14
3.	-0.29	-0.22	2.04	1.32	-1.35	-0.03
4.	0.61	0.46	1.90	0.20	-0.48	0.84
5.	0.40	-0.54	1.52	-0.96	-0.09	-1.04
6.	0.39	-0.38	0.81	-0.46	-0.00	-0.59
7.	0.80	0.14	-0.14	0.52	0.11	0.54
8.	0.85	-0.11	-0.41	0.02	-0.22	-0.12
9.	0.90	-0.70	0.02	-0.38	0.10	-0.09
10.	1.10	-0.75	1.17	-0.70	-0.16	-0.60
11.	1.36	0.48	3.40	0.16	-1.31	0.42
12.	1.03	-0.25	1.37	-1.06	-0.42	0.07
13.	1.13	-0.49	-0.74	0.01	-0.27	0.12
14.	0.76	-0.11	-0.52	-0.37	-0.10	-0.55
15.	0.39	-0.04	-0.02	-0.89	0.08	-0.55
16.	0.06	-0.30	0.65	0.63	-0.22	0.55
17.	-0.71	-0.30	-0.03	0.55	0.00	0.36
18.	1.00	0.39	3.61	-0.12	2.87	-0.41
19.	1.21	-0.25	1.18	-1.30	0.25	0.67
20.	0.98	0.24	-0.29	-0.55	4.39	-0.77
21.	0.97	-0.34	-0.27	-0.70	0.84	-0.16
22.	1.10	-0.61	0.88	-0.64	-0.30	0.45
23.	1.05	0.45	1.89	-0.57	-1.26	-0.85
24.	0.37	-0.04	0.17	0.23	0.36	0.68
25.	0.50	-0.15	-0.78	-0.25	-0.50	-0.75
26.	0.70	0.20	-0.75	1.07	-0.07	-0.00
27.	-0.09	-0.52	-0.09	0.14	-0.33	0.10
28.	0.15	0.03	-1.12	0.18	-0.37	-0.25
29.	0.83	0.33	-1.26	0.14	-0.38	0.04
30.	1.18	-0.21	-1.75	-0.32	-0.19	0.52
31.	0.63	0.13	-1.01	0.66	0.18	-0.06
32.	1.04	-0.24	-1.09	-0.76	-0.18	-0.14
33.	1.23	-0.30	-1.75	-0.71	0.08	-0.12
34.	1.59	-0.40	-1.37	-1.06	-0.09	0.30
35.	0.94	0.17	-1.19	-1.14	1.00	-0.36
36.	0.67	0.85	1.86	0.62	2.98	-0.80
37.	-0.88	0.63	0.58	0.66	4.93	1.08
38.	-0.15	-0.02	-0.49	-0.36	0.93	0.34
39.	-0.05	0.05	-0.66	0.50	-0.19	-0.36
40.	0.33	-0.19	-0.62	0.10	-0.39	-0.20

FACTOR SCORES, Cont'd:

C H A N G E

Census Tracts	Economic Status F_1	Life Style F_2	Migrant Status F_3	Family Status F_4	Household Status F_5	Ethnic Status F_6
41.	0.47	-0.27	-0.22	0.12	-0.34	-0.11
42.	0.72	-0.47	-0.68	-0.75	0.05	0.83
43.	0.98	0.31	-1.31	-0.79	0.47	-0.62
44.	-0.53	0.45	0.11	1.81	-0.36	1.02
45.	0.57	0.68	-0.29	1.20	0.80	-0.32
46.	1.06	0.36	-1.10	-0.58	0.48	-1.13
47.	0.39	-0.22	-0.52	0.91	-0.47	-0.59
48.	-0.58	-0.10	-0.87	0.89	-0.23	-0.87
49.	-0.50	0.03	0.12	0.06	0.38	-0.51
50.	0.19	-0.02	0.19	-0.04	0.30	0.41
51.	0.53	0.04	-0.56	1.29	0.06	-0.29
52.	0.61	-0.34	-0.36	0.48	-0.08	-0.10
53.	-0.09	0.01	0.52	0.77	-0.12	-0.02
54.	-1.43	-0.90	0.57	0.94	-0.75	-1.14
55.	-1.36	-0.70	1.12	-0.72	-0.44	-1.01
56.	-0.89	8.18	-0.31	0.35	0.10	1.03
57.	-0.96	-0.88	0.88	-2.11	-0.47	-0.61
58.	-2.59	-0.55	-0.31	-2.65	0.05	-0.33
59.	-0.97	-0.64	0.26	0.37	-0.37	-0.49
60.	-0.88	-0.40	-0.04	-0.02	-0.87	-0.78
61.	-1.43	-0.75	-0.25	0.88	-0.49	-0.26
62.	-0.26	0.23	-0.82	1.66	-0.14	-0.39
63.	-3.18	0.09	-0.43	-1.96	0.11	-1.15
64.	-0.15	0.26	-0.66	1.13	-0.45	-0.25
65.	-0.95	-0.26	-0.39	0.02	-0.53	0.02
66.	0.08	-0.04	0.25	0.10	0.24	-0.30
67.	-1.52	-0.79	-0.13	-1.02	-0.93	0.47
68.	-1.46	-0.53	-0.28	-2.04	-0.19	0.80
69.	-2.26	0.65	1.45	-1.47	-1.04	7.07
70.	-0.25	0.37	-0.35	0.84	-0.37	0.75
71.	0.35	-0.11	-0.38	0.63	-0.30	-0.23
72.	-1.42	0.38	-0.82	-0.37	-0.60	0.05
73.	-1.72	-0.37	-0.06	-1.37	-0.89	0.27
74.	0.02	-0.02	-0.16	0.54	-0.40	-0.54
75.	-0.12	0.45	0.09	1.86	0.54	-0.18
76.	-0.04	-0.21	-0.20	1.12	0.08	-0.80
77.	0.04	-0.28	-0.09	0.55	-0.27	-0.43
78.	-0.31	-0.13	0.01	0.72	-0.26	-0.40
79.	0.34	0.12	-0.50	1.26	-0.14	-0.11
80.	-1.25	-0.25	0.04	-1.09	-0.22	-0.50
81.	-1.57	-0.22	-0.19	-0.53	-0.51	0.54

APPENDIX E - TABLE 16

SYMAP DIVISIONS OF 1951 SOCIAL AREA DIMENSIONS

Division	Data Value Extremes	Absolute Range Value Per Division Minimum	Maximum	Percentage of Total Absolute Value Range Per Division	Frequency Distribution of Data Point Values Per Division
		FACTOR 1 - ETHNIC STATUS			
1.	-3.05	-3.05	-1.60	31.74	8
2.		-1.60	-0.60	21.74	10
3.		-0.60	0.22	17.83	21
4.		0.22	0.60	8.26	12
5.	1.53	0.60	1.53	20.43	30
		FACTOR 2 - FAMILY STATUS			
1.	-1.69	-1.69	-1.20	11.76	7
2.		-1.20	-0.25	22.35	31
3.		-0.25	0.74	23.53	26
4.		0.74	1.63	21.18	10
5.	2.52	1.63	2.52	21.18	7
		FACTOR 3 - ECONOMIC STATUS			
1.	-1.23	-1.23	-0.83	8.46	13
2.		-0.83	-0.35	10.15	26
3.		-0.35	0.35	14.80	20
4.		0.35	1.20	17.97	13
5.	3.50	1.20	3.50	48.63	9
		FACTOR 4 - FRENCH ETHNIC STATUS			
1.	-1.47	-1.47	-0.85	12.58	15
2.		-0.85	0.10	19.27	34
3.		0.10	0.35	5.07	8
4.		0.35	1.10	15.21	16
5.	3.45	1.10	3.45	47.87	8
		FACTOR 5 - MIGRANT STATUS			
1.	-2.27	-2.27	-1.10	19.16	7
2.		-1.10	-0.30	12.90	24
3.		-0.30	0.30	9.74	29
4.		0.30	0.95	10.55	14
5.	3.87	0.95	3.87	47.56	7
		FACTOR 6 - HOUSEHOLD STATUS			
1.	-5.45	-5.45	-1.10	66.26	7
2.		-1.10	-0.40	10.64	12
3.		-0.40	-0.05	5.32	11
4.		-0.05	0.61	10.03	33
5.	1.12	0.61	1.12	7.75	18

APPENDIX E - TABLE 17

SYMAP DIVISIONS OF 1961 SOCIAL AREA DIMENSIONS

Division	Data Value Extremes	Absolute Range Value Per Division Minimum	Maximum	Percentage of Total Absolute Value Range Per Division	Frequency Distribution of Data Point Values Per Division
		FACTOR 1 - FAMILY STATUS			
1.	-2.82	-2.82	-1.10	36.99	11
2.		-1.10	-0.25	18.28	18
3.		-0.25	0.40	13.98	25
4.		0.40	0.89	10.75	11
5.	1.82	0.89	1.82	20.00	16
		FACTOR 2 - ECONOMIC STATUS			
1.	-1.52	-1.52	-0.81	14.82	16
2.		-0.81	0.05	17.95	33
3.		0.05	0.41	7.52	11
4.		0.41	1.04	13.58	12
5.	3.27	1.04	3.27	46.56	9
		FACTOR 3 - LIFE STYLE			
1.	-3.41	-3.41	-1.60	34.67	6
2.		-1.60	-0.40	22.99	18
3.		-0.40	0.20	11.49	17
4.		0.20	0.90	13.41	26
5.	1.81	0.90	1.81	17.43	14
		FACTOR 4 - ETHNIC STATUS			
1.	-1.18	-1.18	-0.74	12.39	19
2.		-0.74	-0.30	12.39	27
3.		-0.30	0.95	35.21	19
4.		0.95	1.85	25.35	10
5.	2.37	1.85	2.37	14.65	6
		FACTOR 5 - MIGRANT STATUS			
1.	-3.67	-3.67	-0.95	48.23	10
2.		-0.95	-0.00	16.84	34
3.		-0.00	0.45	7.98	11
4.		0.45	1.30	15.07	19
5.	1.97	1.30	1.97	11.88	7
		FACTOR 6 - HOUSEHOLD STATUS			
1.	-4.40	-4.40	-1.05	41.15	8
2.		-1.05	-0.45	7.48	9
3.		-0.45	-0.07	4.61	10
4.		-0.07	0.48	6.86	32
5.	3.72	0.48	3.72	39.90	22

APPENDIX E - TABLE 18

SYMAP DIVISIONS OF CHANGE SOCIAL AREA DIMENSIONS

Division	Data Value Extremes	Absolute Range Value Per Division Minimum	Maximum	Percentage of Total Absolute Value Range Per Division	Frequency Distribution of Data Point Values Per Division
		FACTOR 1 - ECONOMIC STATUS			
1.	-3.17	-3.17	-1.15	42.47	12
2.		-1.15	-0.40	15.69	12
3.		-0.40	0.25	13.60	17
4.		0.25	0.86	12.97	22
5.	1.59	0.86	1.59	15.27	18
		FACTOR 2 - LIFE STYLE			
1.	-0.90	-0.90	-0.55	3.85	9
2.		-0.55	-0.04	5.60	35
3.		-0.04	0.30	3.85	21
4.		0.30	0.50	2.20	11
5.	8.18	0.50	8.18	84.51	5
		FACTOR 3 - MIGRANT STATUS			
1.	-1.75	-1.75	-0.89	16.01	10
2.		-0.89	-0.44	8.38	16
3.		-0.44	0.30	13.97	35
4.		0.30	1.60	24.21	14
5.	3.61	1.60	3.61	37.43	6
		FACTOR 4 - FAMILY STATUS			
1.	-2.65	-2.65	-1.15	25.42	7
2.		-1.15	-0.20	15.99	27
3.		-0.20	0.25	7.58	16
4.		0.25	1.00	12.63	19
5.	3.27	1.00	3.27	38.38	12
		FACTOR 5 - HOUSEHOLD STATUS			
1.	-1.35	-1.35	-0.65	11.15	9
2.		-0.65	-0.05	9.55	44
3.		-0.05	0.15	3.18	12
4.		0.15	0.60	7.17	8
5.	4.93	0.60	4.93	68.95	8
		FACTOR 6 - ETHNIC STATUS			
1.	-1.15	-1.15	-0.69	5.58	12
2.		-0.69	-0.44	3.03	11
3.		-0.44	0.21	7.89	34
4.		0.21	0.60	4.85	12
5.	7.07	0.60	7.07	78.64	12

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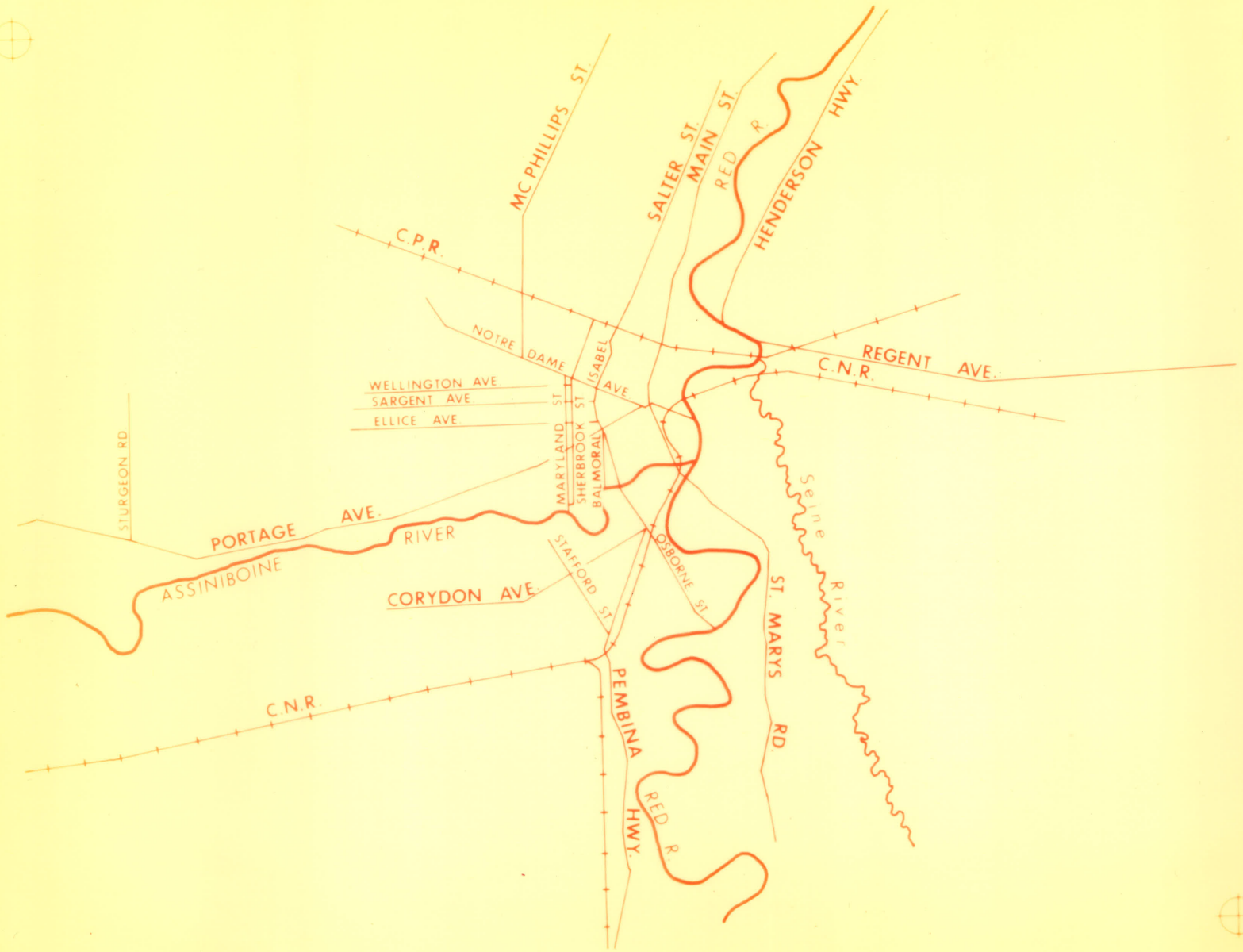
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