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INTERVENING OPPORTUNITIES: A THEORY RELATING MOBILITY AND DISTANCE*

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THE movement of people in space is a basic subject of sociological inquiry. Since the classic work of Ravenstein a half century ago, numerous studies have demonstrated a close relationship between mobility and distance. Most people go a short distance; few people go a long distance.[1]

Distance is such an important factor that it needs more explicit study than it has received. Whether one is seeking to explain "why" persons go to a particular place to get jobs, "why" they go to trade at a particular store, "why" they go to a particular neighborhood to commit crime, or "why" they marry the particular spouses they choose, the factor of spatial distance is of obvious significance.

Recently, the writer listened to a conversation between two educators who were talking about a survey made on students' reasons for choosing a certain small college. One educator asked the other to guess the most im-

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[1] E. G. Ravenstein, "The Laws of Migration," *J. Royal Statist. Soc.* 48: 167–235, June 1885; 52: 241–305, June 1889. A comprehensive annotated bibliography of modern studies is available in Dorothy S. Thomas, *Research Memorandum on Migration Differentials*, Social Science Research Council Bulletin No. 43, New York, 1938. Studies in which distance appears as an explicit factor are indexed in Thomas' monograph, pages 420–21. An important study, published too late to be listed in the monograph, should be cited: H. Makower, J. Marschak, and H. W. Robinson, "Studies in Mobility of Labor: A Tentative Statistical Measure," *Oxford Economic Papers*, Oct. 1938; see also two recent articles by the same authors, "Studies in Mobility of Labor: Analysis for Great Britain, Part I," *Oxford Economic Papers*, May 1939, 70–97, and same title and journal, Part II, Sept. 1940, 39–62.

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portant reasons. A half dozen were suggested. "You have missed the most important," was the reply. "It is simply proximity." Yet, in the extensive literature, there has been little effort to analyze the ways in which distance operates to determine the distribution of population movements. Concepts like "push" and "pull" are used frequently, but it is not likely that their analysis can be very fruitful until the distance component in "push" and "pull" is conceptually and empirically isolated. If we say that Chicago has more "pull" on people from Iowa than does New York and that New York has more "pull" on people from Massachusetts than does Chicago, it is clear that we must deal with the distance factor in any analysis of the attraction of the two cities.

This paper seeks to make an addition to sociological theory by proposing a conceptual framework for attacking the problem of distance. The theory is offered as a key which may open at least an outer door, although like any simple abstract theory it may require considerable elaboration and modification if it is to explain a wide variety of actual events. The writer believes that what sociology most needs is basic theories which can be so stated that verification in particular cases is possible. Therefore, painstaking effort has been made to test the theory in a particular case. If other studies confirm the success of this initial effort at verification, we have here a modest formulation of a new sociological law. The ultimate utility of the abstract theory will be determined by the variety and abundance of concrete situations in which it proves helpful in providing at least an initial ordering of thinking and of data. As will be illustrated subsequently, a systematic numerical application is not likely to be easy. Data collected for other purposes may be suitable rarely. Even when quantitative data are inadequate or unavailable, the theory may have its uses in contributing to a logical framework for analyzing *tendencies*.

The theory here proposed and studied empirically assumes that there is no necessary relationship between mobility and distance. Instead, it introduces the concept of *intervening opportunities*. It proposes that *the number of persons going a given distance is directly proportional to the number of opportunities at that distance and inversely proportional to the number of intervening opportunities*. Another way of stating the same hypothesis is that the number of persons going a given distance is directly proportional to the percentage increase in opportunities at that distance. Symbolically, let

Δy = the number of persons moving from an origin to a circular band of width Δs, its inner boundary being $s-1/2\Delta s$ units of distance from the origin or center of the circle and its outer boundary being $s+1/2\Delta s$ units from the origin. (Distance may be measured in units of space, or even of time or cost).

x = the number of intervening opportunities, that is, the cumulated number of opportunities between the origin and distance s. (Opportunities must be precisely defined in any employment of the theory. The particular operational definition appropriate will depend on the type of social situation investigated. This is the

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hardest problem in any practical application. In the main body of the paper, a precise definition, appropriate to the concrete study here made, is developed.)

Δx = the number of opportunities within the band of width Δs.

Then, we postulate

$$\frac{\Delta y}{\Delta s} = \frac{a}{x}\frac{\Delta x}{\Delta s} \tag{1}$$

This mathematical formulation has the virtue of precision and, with the aid of operational definitions of distance and opportunities, lends itself to verification. Actually, it merely says in symbols what is said more picturesquely and less precisely in the statement: A basic concept in handling movement and distance is the ratio of opportunities in the promised land to the intervening opportunities.

The main part of this paper is devoted to a verification of Equation 1 in a particular case. Before proceeding, however, some consideration of its implications may be desirable. Equation 1 does not specify a direct and invariant relation between mobility and distance. Rather it postulates a direct relation between mobility and opportunities. The relation between mobility and distance may be said to depend on an auxiliary relationship, which expresses the cumulated (intervening) opportunities as a function of distance. This latter relationship may take any form, subject, of course, to the intrinsic limitation that it never decreases with increasing distance. It is not necessary to assume that it is a continuous function. Actually, the distribution of opportunities over space is the result of a multitude of historical, geographic, economic, political, and social factors and will vary from situation to situation. The distribution of opportunities in farming would radiate from an Indiana township quite differently from the way in which it would from a Texas township. The distribution of opportunities for stenographers or nurses would be different from the distribution of opportunities for unskilled laborers or Negro sharecroppers. If the theory embodied in Equation 1 holds, we should eventually be able to account for some of the observed differentials in the distance moved by members of different types of occupational groups, perhaps by sex and age. It is to be hoped that the new mobility data collected by the 1940 United States Census will be helpful in such a future investigation. Even where full numerical data are missing, the abstract theory presented here should, if it stands up under further research, serve to provide a cue for predicting the tendency of different types of specific population groups to assume certain types of spatial patterns in their mobility. Equation 1, as formulated, also has some interesting mathematical and psychological implications.[2]

[2] If we assume the existence of some continuous function

$$x = f(s) \tag{2}$$

and if we substitute differentials in Equation 1, giving

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Test of Theory on Cleveland Residential Mobility Data. We now proceed to a direct empirical investigation of Equation 1. The data selected are data on residential mobility in Cleveland, Ohio.[3] They are probably unique in the United States in their detail. Each year, for the three years 1933-35, Howard Whipple Green obtained the addresses of all families moving within the Cleveland Metropolitan District. In a table, containing 321 × 321 cells, he tabulated the number of families moving from each census tract to every other census tract.

If Equation 1 holds, and if we can control enough disturbing factors, we should be able to use Green's data as a test of the theory of intervening op-

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$$\frac{dy}{ds} = \frac{a}{x}\frac{dx}{ds} \tag{3}$$

we have, upon substituting (2) in (3) and integrating,

$$y = a \log f(s) + c \tag{4}$$

Equation 4 enables one to formulate the theory in somewhat different words. It will be understood that in Equation 4, y is the cumulated number of movers between the origin and a circle of radius s, and that $f(s)$ is the cumulated number of opportunities within that circle. Thus Equation 4 says that the total number of movers who stop *at any point within the circle* is directly proportional to the *logarithm* of the number of opportunities within the circle.

It may be asked why Equations 1 or 3 could not have been set up in such a form that Equation 4 would show the total number who stop at any point within the circle to be some function, other than the logarithm, of the number of opportunities within the circle. The answer is, of course, that this could have been done. However, there is at least some good common sense basis for the type of equation chosen, apart from its great virtue of simplicity. It is unlikely that a person will have the same detailed knowledge of each far distant opportunity that he has of the nearby opportunities. Let us call the opportunities of which he is aware, *apparent* opportunities, and denote them by the symbol z, in contrast with x, the *actual* opportunities. Let us then postulate that y_i, the number of persons who will move somewhere within distance s_i, is directly proportional to z_i, the number of *apparent* opportunities within the distance s_i. We now have

$$y_i = kz_i \tag{5}$$

But z_i is some function of x_i, such that as x_i increases, z_i increases more slowly. If we were dealing here with a simple problem in perception, the relationship between z_i and x_i, the *apparent* and *actual* number of opportunities, could be represented by the equation

$$z_i = m \log x_i + c' \tag{6}$$

the well-known Fechner law. This would be too simple a postulate to represent the actual sociopsychological situation. There is good reason to suspect, however, that the net effects of the complex actual factors, whatever they may be, would produce an equation closely analogous to Equation 6. It is unlikely that data exist at the present time enabling one to test a hypothesis involving an equation containing more parameters than those in Equation 6. Hence, there is no hesitation, as a first approximation, in substituting (6) in (5) and obtaining (4).

One further implication of Equation 4 may be noted. In an ideal special case, in which opportunities are distributed continuously throughout an area with a distribution function $x=ks^b$, Equation 4 would take the form

$$y = a' \log s + c' \tag{7}$$

This special case would be, as indicated, an ideal situation, probably never realized in experience, except possibly within a very short distance from the center of out-movement.

[3] H. W. Green, *Movements of Families Within the Cleveland Metropolitan District*, Report No. 7 of the Real Property Inventory of the Metropolitan District, Cleveland, Ohio, 1936.

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portunities, as applied to residential mobility in one metropolitan city. Specifically, we should be able to distribute theoretically the families moving from dwellings within a given census tract to their places of future dwelling within the Cleveland Metropolitan District, and this expected spatial distribution should tend to agree with observations.

First, we report the results of applying Equation 1 to the movers from twelve census tracts inhabited by white persons. Of these tracts, seven are on the west side of Cleveland, five on the east side.

Chart 1-a based on Table 1, summarizes the expected and actual frequency distribution of all moves according to distance from the twelve tracts combined, during the three-year period. A more detailed discussion will be given later. The open circles connected by a dotted line represent the theoretical distribution, predicted by Equation 1; the black circles connected by a solid line the actual distribution. In general, it will be seen that the theory of intervening opportunities represented in Equation 1 agrees closely enough with observation to be encouraging. Many of the discrepancies are too large to attribute to chance, but a closer fit hardly would be expected, in view of the assumptions and approximations, presently to be discussed, which were involved in the processing of the data.

Chart 1-b uses the same data, but presents the results in different form. Here we have a cumulative distribution of families moving. On the vertical axis is plotted the number moving a given distance or less. On the horizontal axis is plotted the logarithm of the distance. As in Chart 1-a, the expected numbers are shown by open circles and dotted lines, the observed, by black circles and solid lines.

Chart 1-b portrays, as does Chart 1-a, the general agreement between theory and observation, but it reveals more adequately an interesting discrepancy in the early middle distances. This discrepancy, as will be pointed out in more detail later, reflects the effect of a directional factor in the movement which could be only partly taken into account with the available data. In general, the excess movements to middle distances represent movements toward the edge of the city, westward if the tract lay west of the business section, eastward if the tract lay east of the business section. The long distances represent movements across the city to the edges on the opposite side, and such movements, except at the most extreme distances, were slightly less numerous than were predicted.[4]

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[4] Chart 1-b is also of interest as showing how the theory based on Equation 1 and the observations *agree* in their uniform departure from what we postulated would have been the distribution in the ideal case represented by Equation 7 (footnote 3). If the opportunities actually had been homogeneously distributed, the data in Chart 1-b should have formed a logarithmic straight line ($y=a' \log s+c$). Both lines clearly curve, reflecting the fact that the empirical distribution of cumulated opportunities increased rapidly in the early and middle distances and then, with considerable abruptness, began to slow up, eventually becoming asymptotic.

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A more detailed graphic comparison of the agreement between expectation and observation appears in Chart 2. Here, for each of the twelve census tracts, the expected number of families moving within a given distance band is plotted on the x-axis and the observed number on the y-axis. The data are taken from Table 2. If the theory represented by Equation 1 predicted the observations perfectly, the data would all lie on the diagonal. For example, we predict that 431 families will move within a distance of 3000 feet from their home in A2. The observed number is 440.

TABLE 1. NUMBER OF FAMILIES MOVING FROM LOCATIONS WITHIN TWELVE WHITE CENSUS TRACTS, BY INTERVALS OF DISTANCE. COMPARISON OF EXPECTATION, FROM EQUATION 1, WITH ACTUAL DISTRIBUTION, CLEVELAND, OHIO, 1933–35

Distance in Thousands of Feet	Expected	Observed	Distance in Thousands of Feet	Expected	Observed
(1)	(2)	(3)	(4)	(5)	(6)
0– 2.9	5834	5585	48–50.9	57	30
3– 5.9	2332	2471	51–53.9	46	39
6– 8.9	1065	1313	54–56.9	39	31
9–11.9	563	737	57–59.9	27	17
12–14.9	355	431	60–62.9	17	12
15–17.9	217	320	63–65.9	8	5
18–20.9	214	217	66–68.9	6	3
21–23.9	223	178	69–71.9	6	4
24–26.9	204	172	72–74.9	7	4
27–29.9	207	125	75–77.9	1	2
30–32.9	196	137	78–80.9	—	2
33–35.9	175	106	81–83.9	—	2
36–38.9	157	85	84–86.9	—	2
39–41.9	133	102	87–89.9	—	—
42–44.9	111	102	90–92.9	—	1
45–47.9	78	57			
			Total	12,278	12,292

It was thought that a particularly interesting test of the theory would be provided by applying it to Negro tracts because of the barriers erected against free mobility. Therefore, ten tracts extending through the heart of the Black Belt were chosen and an effort made to predict the intratract and intertract movements by Equation 1. The results are shown in Chart 3, the data appearing in Table 3. As in Chart 2, the observed data are plotted against the actual data and perfect agreement would be represented by all points lying on the diagonal. For example, we predict that in Table 3, 70 would leave Tract H9 for Tract M8. Actually, the observed number was 65. As we inspect Chart 3, we see, as in the white tracts, a rather satisfactory agreement. The tracts nearer the center of the city, such as H9, I7, and I8, tended to receive slightly less in-movers than expected and the tracts farther from the center of the city, such as M3, M4 and M5, slightly more,

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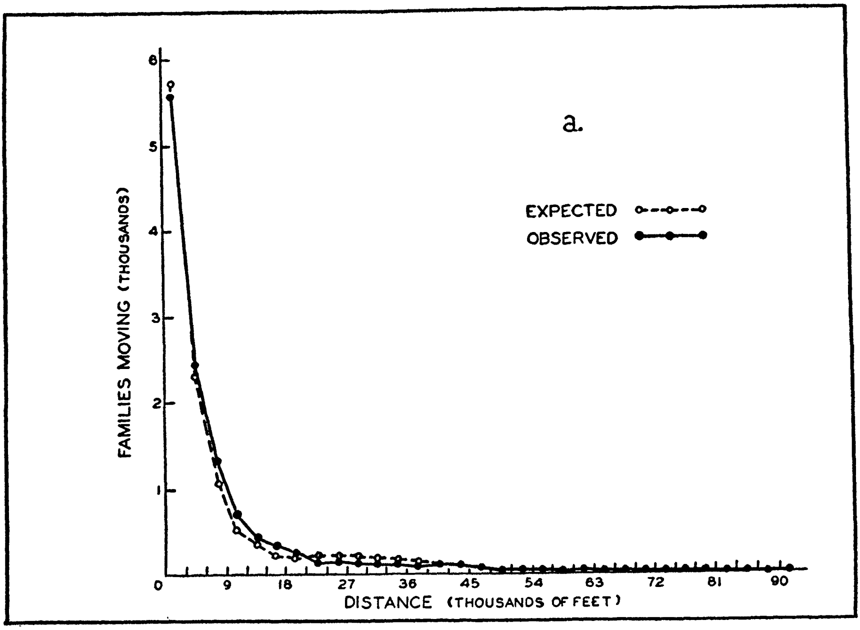
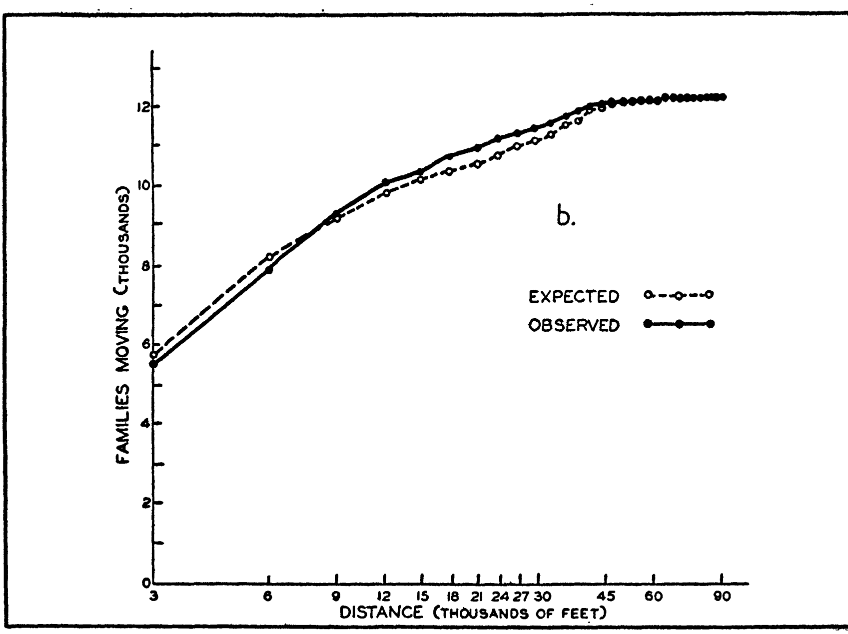
CHART 1. NUMBER OF FAMILIES MOVING FROM LOCATIONS WITHIN TWELVE WHITE CENSUS TRACTS, BY INTERVALS OF DISTANCE. COMPARISON OF EXPECTATION, FROM EQUATION 1, WITH ACTUAL DISTRIBUTION. CLEVELAND, OHIO, 1933–35.[1]





[1] The data in Chart 1-a are taken from Table 1. Chart 1-b is a cumulated distribution of the data in Chart 1-a, with distance in logarithmic measure.

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TABLE 2. NUMBER OF FAMILIES FROM LOCATIONS WITHIN EACH OF TWELVE WHITE CENSUS TRACTS, BY INTERVALS OF DISTANCE. COMPARISON OF EXPECTATION FROM EQUATION 1, WITH ACTUAL DISTRIBUTION. CLEVELAND, OHIO, 1933–35.

Distance in Thousands of Feet	A2		A8		A9		B4		B5		B8		C4		K8		L6		P4		R3		R4	
	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.	Exp.	Obs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)
0– 2.9	431	440	513	493	349	311	508	410	485	473	288	253	572	609	452	483	528	536	793	784	491	442	424	351
3– 5.9	199	187	194	258	60	78	296	280	253	258	98	92	242	260	125	122	146	153	172	250	318	287	229	246
6– 8.9	80	97	88	118	64	81	141	173	91	126	46	84	105	120	77	94	86	74	87	97	130	156	70	93
9–11.9	54	73	54	57	25	40	66	112	43	72	15	22	59	56	27	27	51	66	73	52	56	92	40	68
12–14.9	44	50	35	43	21	21	47	77	30	35	9	15	32	38	29	18	28	23	28	33	36	56	16	22
15–17.9	26	30	13	17	7	17	22	50	12	35	15	22	24	37	19	9	26	27	23	18	17	26	13	32
18–19.9	17	19	19	17	11	13	21	49	16	13	15	17	26	21	17	8	22	14	19	16	21	22	10	8
21–23.9	22	27	18	17	14	8	13	18	24	14	11	11	34	14	25	13	22	13	15	15	12	9	13	19
24–26.9	19	14	26	14	13	10	12	21	22	21	14	8	30	26	18	11	11	14	22	23	9	4	8	6
27–29.9	23	19	17	3	16	8	16	11	28	10	13	13	33	17	17	14	10	4	17	14	8	7	9	5
30–32.9	24	20	29	20	13	6	17	23	24	9	9	3	31	21	8	12	8	7	22	2	6	10	5	4
33–35.9	17	6	26	25	9	6	36	15	23	11	6	4	21	12	6	4	6	4	13	7	7	4	5	8
36–38.9	20	8	19	3	11	7	27	12	15	10	5	3	21	10	5	6	7	10	12	2	9	10	6	4
39–41.9	18	14	18	6	7	3	28	21	14	11	2	1	14	14	6	6	7	8	6	8	5	3	8	7
42–44.9	15	13	13	12	6	10	19	10	12	12	1	2	7	8	3	5	8	8	12	8	11	12	4	2
45–47.9	8	8	8	3	3	4	16	10	5	1	1	1	5	6	4	6	6	11	8	2	7	2	7	3
48–50.9	4	3	5	1	1	3	12	5	4	1	2	—	5	2	2	2	4	1	6	4	6	4	6	4
51–53.9	4	4	4	1	2	2	6	6	3	—	1	1	4	1	1	1	5	10	5	3	6	7	5	3
54–56.9	3	1	4	1	1	1	3	4	3	4	—	—	2	—	1	2	3	2	7	5	7	9	5	2
57–59.9	1	1	3	1	—	1	5	1	2	1	—	—	2	—	1	—	2	1	3	3	4	3	4	5
60–62.9	1	—	2	1	—	2	3	2	2	1	—	—	2	—	—	—	—	—	2	1	2	3	3	2
63–65.9	—	—	2	1	—	—	1	2	1	—	—	—	1	1	—	—	1	1	—	—	—	—	2	—
66–68.9	1	—	—	—	—	2	1	—	2	—	—	—	1	—	—	—	—	—	—	—	1	1	—	—
69–71.9	1	—	2	1	—	—	—	2	—	—	—	—	1	—	—	—	2	—	—	—	—	1	—	—
72–74.9	—	—	2	—	—	—	—	1	2	—	—	—	—	—	—	—	1	3	—	—	2	—	—	—
75–77.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	—
78–80.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—
81–83.9	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
84–86.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—
87–89.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
90–92.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Total	1032	1034	1114	1113	633	634	1316	1316	1116	1118	551	552	1274	1273	843	845	990	991	1345	1349	1171	1172	893	895

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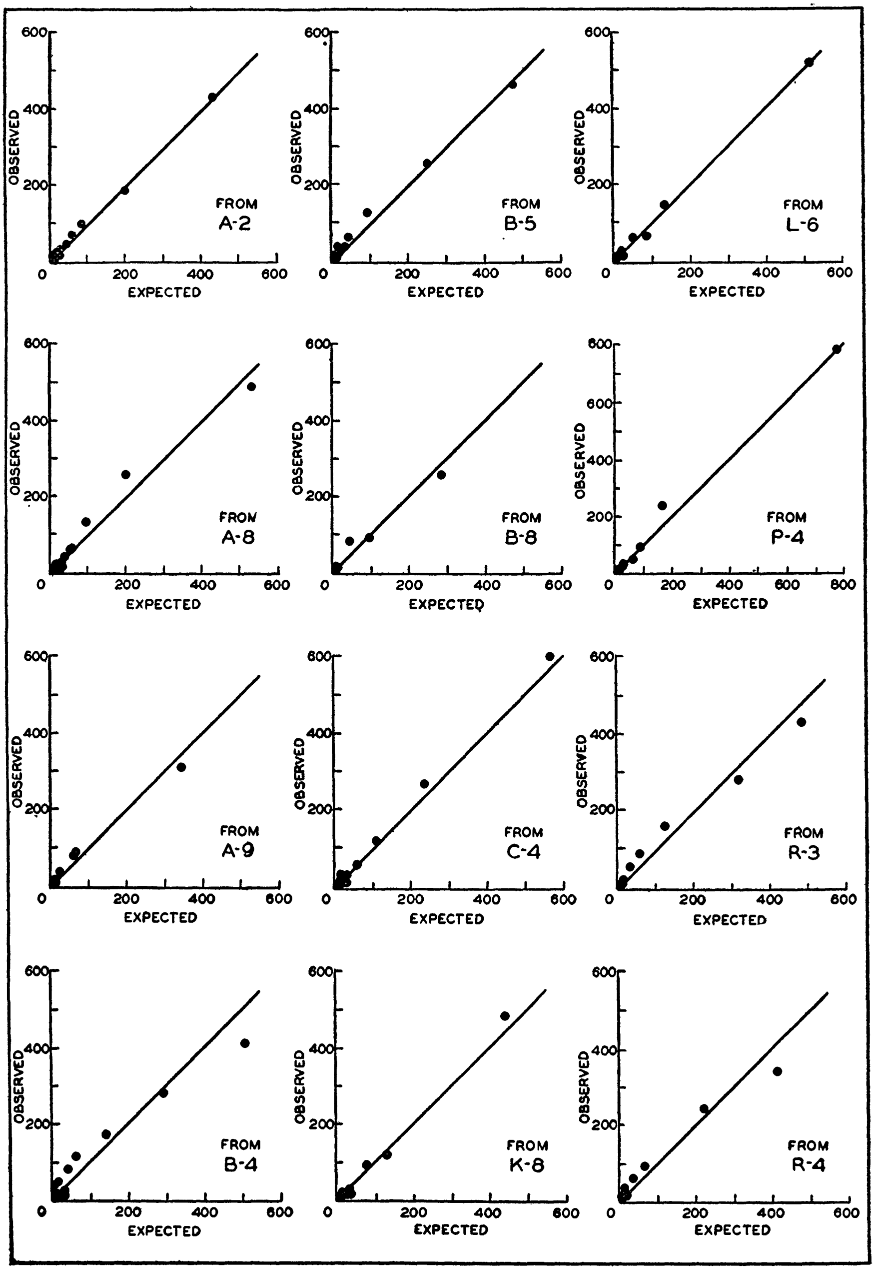
CHART 2. NUMBER OF FAMILIES MOVING FROM LOCATIONS WITHIN EACH OF TWELVE WHITE CENSUS TRACTS, BY INTERVALS OF DISTANCE. COMPARISON OF EXPECTATION, FROM EQUATION 1, WITH ACTUAL DISTRIBUTION. CLEVELAND, OHIO, 1933–35. DATA ARE FROM TABLE 2.



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indicating, as in the white tracts, the operation of a directional factor which data and technique did not permit taking fully into account. The general pattern of agreement between expectation and observation is, however, unmistakable.

TABLE 3. NUMBER OF FAMILIES MOVING FROM LOCATIONS WITHIN EACH OF TEN NEGRO TRACTS, BY TRACT OF NEW LOCATION. COMPARISON OF EXPECTATION, FROM EQUATION 1 WITH ACTUAL DISTRIBUTION, CLEVELAND, OHIO, 1933–35

Tracts from which Families Moved	Comparisons	Tracts to which Families Moved										Totals
		H9	I3	I7	I8	L9	M3	M4	M5	M7	M8	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
H9	Observed	351	49	52	62	50	9	11	7	32	65	688
	Expected	303	54	45	40	54	25	11	11	75	70	688
I3	Observed	93	336	69	21	16	13	2	6	10	18	584
	Expected	88	310	59	22	25	15	9	—	23	33	584
I7	Observed	68	60	191	45	11	3	3	5	12	27	425
	Expected	68	62	172	43	17	12	6	6	14	25	425
I8	Observed	94	26	49	169	22	15	4	8	28	120	535
	Expected	78	23	69	174	24	15	6	8	28	109	534
L9	Observed	32	12	4	5	489	189	50	48	123	52	1004
	Expected	59	15	13	16	487	140	31	32	138	72	1003
M3	Observed	14	2	1	4	132	481	131	96	38	34	933
	Expected	23	9	9	9	117	499	114	53	48	52	933
M4	Observed	5	3	1	1	45	121	208	119	9	13	525
	Expected	11	7	6	5	31	117	211	102	15	21	526
M5	Observed	7	3	—	1	26	77	111	407	11	12	655
	Expected	14	—	5	6	37	65	102	383	18	24	654
M7	Observed	37	5	10	7	118	64	19	19	300	134	713
	Expected	69	13	11	23	120	43	12	11	264	148	714
M8	Observed	51	18	9	42	82	36	18	29	132	552	969
	Expected	61	22	21	58	66	47	16	17	143	519	970

Description of the Technique Used in Testing the Theory. The first problem is to formulate an operational definition of opportunities. If a person moves from Tract X to a house or apartment in Tract Y, there must have been previously created in Tract Y a vacancy which he could occupy. The particular vacancy which he occupied and similar vacancies anywhere in the city which he might have occupied but did not, we will call *opportunities.*

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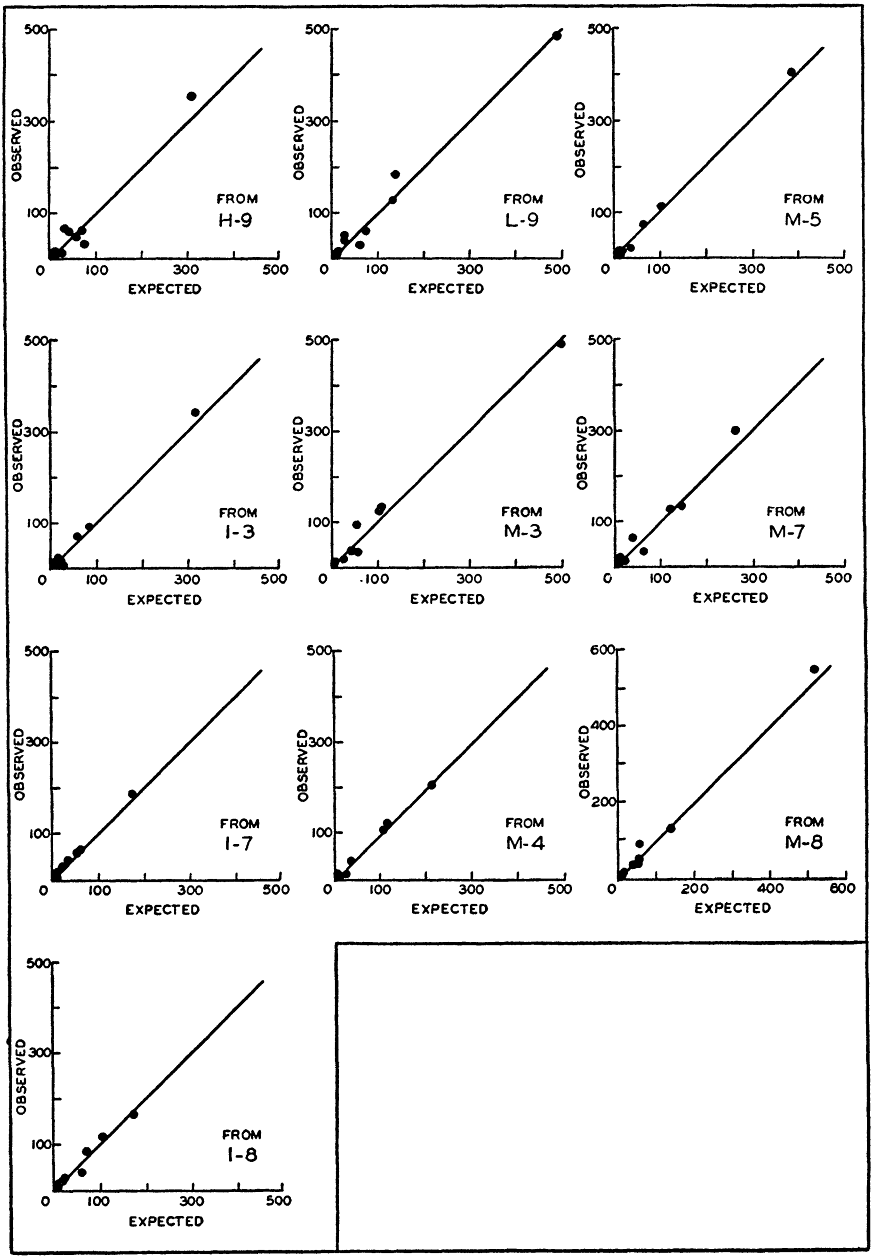
CHART 3. NUMBER OF FAMILIES MOVING FROM LOCATIONS WITHIN EACH OF TEN NEGRO TRACTS, TO OTHER NEGRO TRACTS. COMPARISON OF EXPECTATION, FROM EQUATION 1, WITH ACTUAL DISTRIBUTION. CLEVELAND, OHIO, 1933–35. DATA ARE FROM TABLE 3.



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Similar vacancies which are closer to his former residence in X than the dwelling he occupied in Y, we shall call *intervening opportunities*.[5]

But this is not enough. What do we mean by *similar* vacancies? Since no two vacancies are exactly alike, we must select certain relevant characteristics. One might be the economic character of the dwelling, as measured by the rental. For example, if he pays $50 per month for his new dwelling, the similar opportunities would be limited to vacancies at about the same rental value. Another characteristic might depend on whether he is moving to a rented home or buying a home. If the latter, the similar opportunities would be limited to purchasable residences at about the same value. Other characteristics might be determined by the direction, the newness of the neighborhood to which he moved, or the nationality composition. Thus, an area zoned against Negroes would not provide any opportunities for Negroes, or an area settled solidly by Italians would provide few opportunities for members of other ethnic groups, unless it were an area in transition.

Actually, in the present study only two of the criteria of similarity suggested have been used, namely, rental and race. The following working definition of opportunities, determined by restrictions of data presently to be discussed, was adopted: *For a white family leaving a dwelling in rental group K in Tract X, the number of opportunities in Tract Y is proportional to the total number of white families, whatever their place of origin, moving to dwellings in rental group K within Tract Y.* For a Negro family, substitute Negro for white in the above definition.[6]

Even the necessary information on rental and race, however, was not directly available. The Cleveland data do not report the new rental paid by a family moving from A2 to A1, for example. Nor do the data report any other characteristics of this family. They simply report the total number of families moving. The first problem which had to be solved then, was how to infer the characteristics of the family indirectly.

Another publication,[7] based upon a real property inventory in 1934, opened the road to an approximation. First, it showed that such a large proportion of the movement was to rented homes that for all practical purposes movements to newly purchased residences could be ignored. Second, it gave for each tract a frequency distribution by broad class intervals of rental of the dwellings occupied less than one year by their

[5] In studying some other kind of mobility, different definitions of opportunities would be needed, of course; for example, job openings or farms available.

[6] At first glance, this definition may seem to favor the hypothesis unduly; actually, it does not because it says nothing about the origin of those moving. It simply postulates that the number of opportunities in an area is proportionate to the number of families moving to dwellings within the area. These families merely may have moved from next door or may have come long distances. The theory then attempts to account for the number moving from a *particular origin* to this area.

[7] H. W. Green, *Standards of Living in the Cleveland Metropolitan District*, Special 1935 Report of the Real Property Inventory of Metropolitan Cleveland, Cleveland, Ohio, 1935.

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tenants. This could be converted into a percentage distribution as in illustrative Table 4. The total number of people moving to tract A1 at any time in the three-year period, namely, 2975, was assumed to be distributed, by rental, in the same proportions. Similar calculations were made for A2 and for all other tracts.

From Table 4, we estimate, for example, that in the three-year period, 565 families moved to locations within A1, renting at $50 to $74. It is evident, however, that these vacancies could not constitute opportunities for many movers from A2, since only ten of the dwellings vacated by residents of A2 and reoccupied, rented for $50 to $74. Unless those vacating dwellings in A2 stepped up decidedly in rental, there could have been almost no movement from A2 to the $50 to $74 dwellings in A1. Since the higher rental tracts as a whole did not gain by migration appreciably more than the lower rental tracts, and vice versa, it is probable that the change in economic conditions between 1933 and 1935 was not marked by any substantial average movement upward or downward in the rental scale.[8]

TABLE 4. DATA FOR TWO CENSUS TRACTS TO ILLUSTRATE METHOD OF ALLOCATING THE OBSERVED DATA TO RENTAL GROUPS

Items	Tract	Rental							Total
		Under $10	$10 to $14	$15 to $19	$20 to $29	$30 to $49	$50 to $74	$75 and over	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Percentage distribution of rented homes occupied less than one year (1934)	A1	—	.5	3.8	19.6	52.4	19.0	4.7	100.0
	A2	.2	6.9	15.6	42.6	33.9	.8	—	100.0
Number of families moving to Census Tract (1933–35)	A1	(—)[1]	(15)	(113)	(583)	(1559)	(565)	(140)	2975
	A2	(2)	(85)	(191)	(522)	(415)	(10)	(—)	1225
Number of families moving from Census Tract (1933–35)	A2	(2)	(71)	(161)	(441)	(351)	(8)	(—)	1034

[1] Figures in parentheses are estimates, made by applying percentages in the first two rows to observed totals. Thus, .038×2975=113, .069×1225=85, .069×1034=71. For source, see text.

[8] From tracts with 1930 median rental under $40, 23,251 families moved out and 25,446 families moved in at some time during 1933–35. From tracts with median rental over $40, 27,115 families moved out and 30,834 families moved in. (Computed from data in *Movements of Families Within the Cleveland Metropolitan District; op. cit.*, p. 4). Objection may be raised that the procedure employed would not be applicable if there were great upward mobility, that is, if most movers shifted to better homes; or vice versa. However, a numerical adjustment could have been made with relative ease to take care of this situation. The application of the theory is not limited to a relatively static economic time interval.

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Therefore, we can simplify our task if we divide the families leaving A2 into separate economic strata and conceive each group as moving, on the average, within its own respective stratum. Actually, 1034 families moved out from dwellings inside of A2. We assume that, on the average, they were distributed in new dwellings in the same rental groups as the newcomers replacing them in A2. Thus if, from Table 4, 15.6 percent of the newcomers to A2 occupied homes renting from \$15 to \$19, we assume that 15.6 percent of the 1034 families leaving a location in A2, or 161 families, moved into homes renting from \$15 to \$19. In other words, we define, for each of these 161 families, "opportunities" as constituting those *available* dwellings anywhere in the Cleveland Metropolitan District which had rented within the past year for \$15 to \$19. From Table 4, column 5, we see that there were 113 such opportunities in A1. By extending Table 4 to include all tracts in the city, it was possible to estimate the number of opportunities, corresponding to 113 in A1, in each tract.

The next step was to construct a spot map of Cleveland on which all opportunities in the rental group \$15 to \$19 were recorded. This step introduced another major problem in procedure, in addition to the inferring of the characteristics of the family by the above indirect means. We did not have the exact addresses of these dwellings. Therefore their approximate location within a tract had to be estimated. This was done with the aid of maps giving assessed valuations for the Cleveland Metropolitan District,[9] and with the generous assistance of Robert Winch, a graduate student at the University of Chicago. He also is a resident of Cleveland and knows the city well. For each rental group, a spot map was made of the Cleveland Metropolitan District, by census tracts, the dots being located as accurately as possible on the basis of the above knowledge. It was found by empirical test that errors in the spotting of dwellings or "opportunities" would not appreciably affect the results when considered in relation to a tract of out-movement which was at a distance of over a mile or two. However, when the tract of out-movement considered was one close to the tract providing the opportunities, small changes in the location of the dots made relatively greater difference. In the latter case, plotting errors were minimized if the tracts were small and densely populated, but errors were probably larger in sparsely populated tracts, due to the difficulty in accurately centering the dots.

To reduce the subsequent labor (which required several months of clerical work), class intervals were used in spotting. Thus, in the rental group \$15 to \$19, one dot represented fifty opportunities, except in tracts far distant from those selected for out-movement investigation. In the dis-

[9] *The Principles of Land and Building Appraisals as Scientifically Applied in Cuyahoga County*, published in 1932 by the Board of County Commissioners, Cuyahoga County, Ohio.

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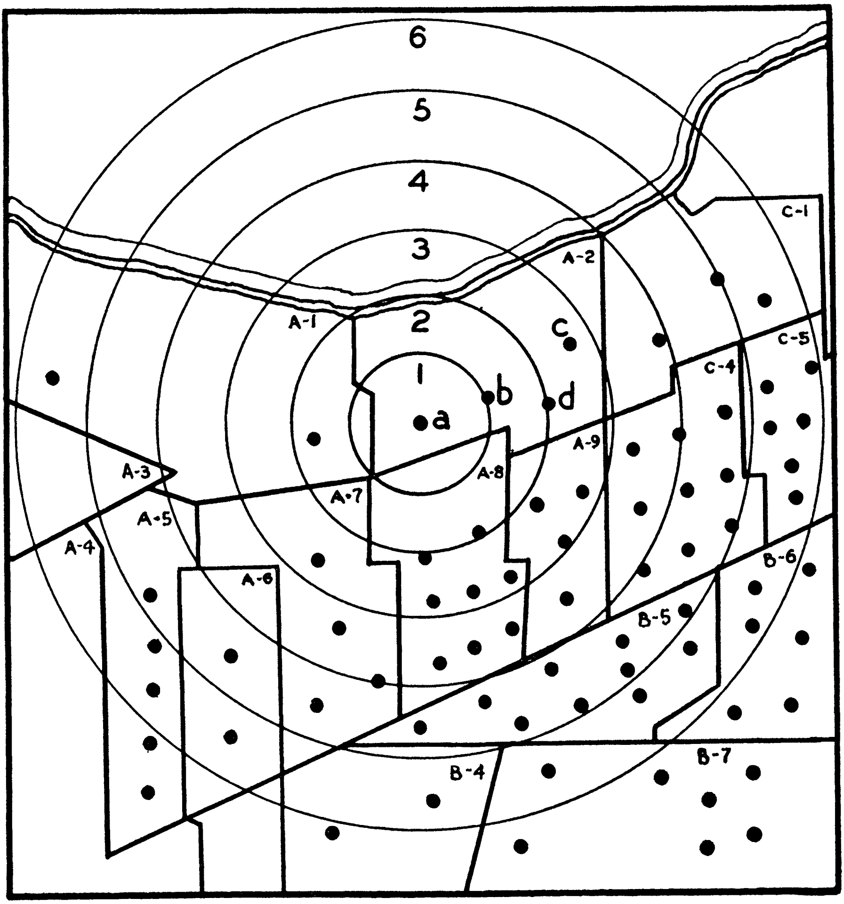
tant tracts, a number was entered to represent the number of dots which might have been plotted.

Imagine then a spot map of the Cleveland Metropolitan District showing the opportunities available within each tract at rental \$15 to \$19. The next step may be understood by reference to Chart 4, which reproduces a very

CHART 4. SEGMENT OF MAP OF CLEVELAND, OHIO, WITH DOTS AND CIRCLES TO ILLUSTRATE METHOD OF CALCULATING THE DISTRIBUTION OF "OPPORTUNITIES." SEE PP. 858–62



small segment of this map surrounding Tract A2. This map is drawn to the same scale as Green's map of Cleveland.[10] Consider the dot in A2 here labeled *a*. A sheet of transparent paper, ruled in concentric circles, was laid on the map, with the center of the circles at *a*. The intervals between the

[10] H. W. Green, *Census Tracts of Greater Cleveland*, map published by Cleveland Health Council.

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circles represent 1000 feet on Green's map. We now count the number of dots lying within one interval of *a*, two intervals, three intervals, etc., and record the tract in which they lie. For example, for a family leaving a dwelling in the region of spot *a*, there was one (times 50, of course) opportunity

TABLE 5. SECTION OF WORK SHEET ILLUSTRATING METHOD OF TABULATING OPPORTUNITIES AVAILABLE TO MOVERS FROM $15 TO $19 LOCATIONS WITHIN TRACT A2

(The entry 1, opposite A1 in column headed 1–1.9 means that the opportunities in A1 at this distance from A2 were 1 (times 50).)

Tract in which Opportunity Occurred	Distance from Location in A2 (thousands of feet)														
	0–.9	1–1.9	2–2.9	3–3.9	4–4.9	5–5.9	6–6.9	7–7.9	8–8.9	9–11.9	12–14.9	15–17.9	18–20.9	*	78–80.9
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		(15)
A1		1	1	1	1	1	1	2						*	
A2	8	5	3											*	
A3							3	4	5	4				*	
A5					1	3	6	6	3	1				*	
A6					1	3	3	1						*	
A7			1	3	7	4	1							*	
A8		1	11	14	5	1								*	
A9		3	10	3										*	
B4						1	4	5	4	2				*	
B5				2	29	8	1							*	
B6					6	14	15	4	1					*	
B7						4	12	9	3					*	
C1		2	2	5	2	1								*	
C2					1	3	2	1	1					*	
C4		2	11	16	6	1								*	
C5				10	15	10	5							*	
C6					1	8	8	6	4	1				*	
C8						5	8	10	6	3				*	
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Other Tracts							2	20	48	140	124	60	44	*	8
Δx	8	14	39	54	75	67	71	68	75	151	124	60	44	*	8
$\Sigma\Delta x$	8	22	61	115	190	257	328	396	471	622	746	806	850	*	3006
x	4	15	42	88	153	224	293	362	434	547	684	776	828	*	3002

* Omitted to save space. This is an illustrative table.

in the first interval of distance, lying within A2;[11] three opportunities in the second interval of distance, of which one was in A2, one in A1, and one in A8; ten opportunities in the third interval, of which two were in A2, one in A1, four in A8, and three in A9, and similarly for other intervals of distance. When these data were recorded, the map was shifted to center the circles at dot *b*, and similarly at *c* and *d*.

[11] For each family in the neighborhood of dot *a*, there would be fifty opportunities, or possibly more strictly, $50-1=49$.

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Upon adding the data for a, b, c, and d, a table similar to illustrative Table 5 was constructed. The sum of the columns gives Δx for this rental group, where Δx is proportional to the number of opportunities within a

TABLE 6. SECTION OF WORK SHEET ILLUSTRATING METHOD OF APPLYING EQUATION 1 TO THE DATA IN TABLE 5

(The procedure is to redistribute $100\frac{\Delta x}{x}$ from Table 5 within each column in the same proportion as individual cell entries in Table 5 bear to Δx. The final column (17) is the expected numbers leaving a location within A2 for each specified new location within rental group \$15 to \$19.)

Tract in which Opportunity Occurred	Distance from Location in A2 (thousands of feet)																Adjusted Total
	1	2	3	4	5	6	7	8	9	10–11.9	13–15	16–18	19–21	*	78–80.9	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)		(15)	(16)	(17)
A1		7	2	1	1			1						*		12	3
A2	200	33	7											*		240	51
A3							1	1	1	1				*		4	1
A5					1	1	2	2	1					*		7	1
A6					1	1	1							*		3	1
A7			2	3	5	2								*		12	3
A8		7	26	16	3									*		52	11
A9		20	24	3										*		47	10
B4							1	1	1					*		3	1
B5				2	19	4								*		25	5
B6					4	6	5	1						*		16	3
B7						2	4	2	1					*		9	2
C1		13	5	6	1									*		25	5
C2					1	1	1							*		3	1
C4		13	26	18	4									*		61	13
C5				11	10	4	2							*		27	6
C6					1	4	3	2	1					*		11	2
C8						2	3	3	1	1				*		10	2
*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
Other Tracts							1	6	11	26	18	8	5	*	0	197[1]	42[1]
$100\frac{\Delta x}{x}$	200	93	93	61	49	30	24	19	17	28	18	8	5	*	0	764	163[2]

* Omitted to save space.

[1] Actually, separate figures were calculated for tracts, within each interval of distance.

[2] From illustrative Table 4, the number leaving a location within Tract A2 for locations renting at \$15 to \$19 is estimated at 161. The discrepancy between 163 and 161 is due to rounding. The figures in column (17) were obtained by multiplying those in column (16) by 161/764.

given distance band. The values of Δx were cumulated and x, the intervening opportunities, determined by linear interpolation on the cumulative distribution. Thus, x_2 at the second interval of distance $=x_1+(1/2)(\Delta x_2)=8+(1/2)(14)=15$.

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Next we calculate the ratios $\Delta x/x$ which appear on the bottom row of illustrative Table 6. In Equation 1, it will be remembered $\Delta x/x$ represents the ratio of opportunities in a given distance band to the intervening opportunities. (Actually, 100 $\Delta x/x$ was calculated, to avoid decimals.) Each of these ratios was then broken down and distributed among the various tracts in the same proportions as the opportunities in each tract (as shown in Table 5). In the third column of Table 5, for example, 1/14 of the opportunities were in A1. In Table 6 in the third column of the row opposite A1, therefore, we enter $(1/14)(100\,\Delta x/x) = (1/14)(93) = 7$. When we add across the rows, we have for each tract an expected number of movers to it from all points in A2 which should be proportional to the actual number. For example, the sum for A1 is 12. Such sums are shown in the next to last column of Table 6 and have a total of 764. But the total in rental group \$15 to \$19 who left a dwelling in A2 we estimated earlier (Table 4) at 161 families. Therefore, by multiplying the individual values in the next to last column by 161/764, we have our expectation of the number who left Tract A2 for all tracts in the metropolitan area. The ratio 161/764 is *a*, the constant of proportionality, in Equation 1.

We still cannot check these numbers against observation, because, it will be remembered, our observations of families actually moving from A2 to, say, A1, are not broken down by rental groups. Therefore, we repeat for all other rental groups the procedure described above with respect to rental group \$15 to \$19. Then we form Table 7. The third column of numbers in this table, it will be observed, is the same as the last column of Table 6 and the other columns are analogous for other rental groups. Adding the entries in a given row, we have a sum which represents the expected number moving from all points within A2 to the tract represented in that row. This sum is entered in the next to last column of Table 7 and the observed number is entered in the last column. For example, to Tract A1, we estimated that 3 families would go in rental groups \$15 to \$19, 13 in group \$20 to \$29, and 41 in group \$30 to \$49. Total, 57; actually, 70 went. To points within Tract A2 itself, we estimated that 329 would go; the actual number was 373.

Because of the crudities of the procedure, particularly the errors introduced by the use of broad class intervals and arbitrary spotting, there is bound to be considerable inaccuracy in predicting the movement to individual tracts. If more detailed data had been accessible, many of these errors might have been avoided. Therefore, it is preferable to make a final grouping of tracts into broader intervals. This was done by taking intervals of 3000 feet and assigning each tract in its entirety to that interval of distance from A2 in which the majority of the opportunities occurred. Thus, A8 and A9, as well as A2 itself, fall in the first interval, A1, A7, B5, C1, C4, and C5 in the second interval, etc. The sum of the expectations in the first interval is 431; of the observations, 440. The sum of the expectations in the second interval is 199; of the observations, 187.

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These are the data appearing in Table 2 and Chart 2 for movements from each of the twelve white tracts studied. Table 1 is formed by summing Table 2 for each interval of distance.

TABLE 7. SECTION OF CONSOLIDATION SHEET ILLUSTRATING METHOD OF COMBINING ESTIMATES FROM LAST COLUMN OF WORK SHEETS LIKE TABLE 6 TO OBTAIN FINAL ESTIMATE OF NUMBER OF FAMILIES LEAVING A LOCATION WITHIN A-2 TO OTHER LOCATIONS

Tract of Destination	Expected Number of Families Moving, by Rental Groups				Expected Number of Families Moving	Observed Number of Families Moving
	$10–14	$15–19	$20–29	$30–49		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A1	—	3	13	41	57	70
A2	24	51	141	113	329	373
A3	—	1	5	7	13	31
A5	—	1	7	6	14	28
A6	—	1	4	2	7	15
A7	—	3	13	9	25	22
A8	3	11	25	17	56	47
A9	3	10	22	7	42	18
B4	—	1	9	5	15	10
B5	2	5	8	3	18	8
B6	2	3	3	—	8	3
B7	1	2	4	—	7	2
C1	2	5	9	5	21	37
C2	—	1	1	—	2	3
C4	9	13	28	6	56	43
C5	3	6	8	3	20	7
C6	2	2	3	2	9	4
C8	1	2	2	—	5	1
To Other Tracts[1]	19	42	137	130	328	312
Expected	71	163	442	356	1032	—
Observed[2]	73[3]	161	441	359[4]	—	1034

[1] Actually, separate figures were calculated for tracts within each interval of distance.
[2] The total of the observed, 1034, is known. See Table 4. The distribution of the observed, by rental, is estimated by the procedure illustrated in Table 4.
[3] Includes two families from rental <$10.
[4] Includes eight families from rental $50–74.

Actually, one other restriction was made in the operational definition of opportunities as described above. Since, except in a few transitional census tracts, a dwelling vacated by a Negro would not be sought by a white person and vice versa, it was necessary to make separate estimates of opportunities for Negroes and whites. In the absence of direct information on mobility by race, an indirect method was required. This method is illustrated in Table 8, for Tract M4. First, the percentage of Negroes living in each rental group (for rented homes only) was calculated from data in the Real Property Inventory. In rental group $20 to $29, for example, the per-

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centage was 91.5. Second, the percentage in each rental group reported as living in rented homes less than one year was arbitrarily divided into white and Negro by multiplying by this percentage. In Table 8, the percentage 27.6 (column 6) on the second line was multiplied by .915, giving new percentages, 2.3 for whites, and 25.3 for Negroes, which were entered on the third and fourth lines, respectively. From the mobility volume, as in illustrative Table 4, we know that 980 families moved at some time within the three-year period into a dwelling in Tract M4. We distribute this number by race according to rental, in lines six and seven of Table 8 by multiplying it by the respective percentages in lines three and four. Similarly, we know that 866 left dwellings in Tract M4 for some other point in the Cleveland Metropolitan District. We distribute these 866 families by race according to rental by multiplying 866 by the percentages in lines three and four and record the numbers in lines nine and ten.

TABLE 8. DATA TO ILLUSTRATE METHOD OF ALLOCATING OBSERVED DATA BY RACE, ACCORDING TO RENTAL, FOR CENSUS TRACT M4

Items	Lines	Rental					Total
		Under $10	$10 to $14	$15 to $19	$20 to $29	$30 to $49	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Percentage of Negro Families Among Families Living in Rented Homes (1934)	(1)	77.4	86.4	86.2	91.5	91.5	—
Percentage Distribution of Rented Homes Occupied Less than 1 year (1934)							
Total	(2)	5.9	21.1	32.9	27.6	12.5	100.0
Whites (Estimated)	(3)	1.3	2.9	4.5	2.3	1.1	
Negroes (Estimated)	(4)	4.6	18.2	28.4	25.3	11.4	
Number of Families Moving to M4 (1933–35)	(5)						980
Whites (Estimated)	(6)	13	28	44	22	11	
Negroes (Estimated)	(7)	45	179	278	248	112	
Number of Families Leaving M4 for Other Locations in Cleveland Metropolitan District (1933–35)	(8)						866
Whites (Estimated)	(9)	11	25	39	20	9	
Negroes (Estimated)	(10)	40	158	246	219	99	

The opportunities for movers from the white tracts, therefore, were defined as limited to the numbers in line six. These numbers, not the totals for both races, were plotted on the maps for calculating opportunities for families moving from the twelve white tracts.

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A completely new set of maps was required, in addition, for calculating the movements from the ten Negro tracts reported earlier in Chart 3 and Table 3. These maps showed Negro opportunities only, such as defined for M4 by line seven of Table 8. In other words, for the Negro tracts, twice as many operations were required as for the white tracts, since separate and independent estimates had to be made of the movements of Negroes and whites within these tracts. Thus, for movement from a Negro tract, we had two tables corresponding to Table 7, and then combined the figures in the last column. However, the task was lightened by the fact that the Negro population is so heavily concentrated in a rather small area.

A word should be said about the problem of spotting Negro and white opportunities on the map for tracts containing both races. This was necessarily rather rough, but it was facilitated by the courtesy of the Bureau of the Census. Leon E. Truesdell furnished a special tabulation for each mixed tract of the 1930 population by enumeration districts according to race, and Clarence E. Batschelet supplied photostats of maps showing enumeration district boundaries. Some allowance was made, in plotting, for probable shifts in racial composition between 1930 and 1935.

Concluding Comments. The detailed description of the operations has doubtless been tedious to the reader, but there is no other way of making explicit and objective the mould in which the definitions adopted had to be shaped. The definition of opportunities, given in italics on page 856, is a general verbal formulation, but the definition as used cannot be completely understood except in terms of the unfolding statistical operations.

We have shown, then, in Charts 1, 2, and 3 and accompanying tables, that the agreement between expectation and observation is encouraging. The principal discrepancies arise, as would be expected by anyone familiar with the process of city growth, because the opportunities, *as defined*, take no account of *direction* of movement. Extend a line from the center of the city through Tract X. Actually, a dwelling in rental group K lying on or near this line farther from the center of the city than X is likely to be more attractive, *on the average*, to a mover from X than a dwelling in rental group K lying nearer the center of the city than X and the same distance from X as the outlying dwelling. Indeed, if this bias had not appeared in Charts 1, 2, and 3 we should have been surprised and puzzled. It would be quite possible, however, to subsume this directional factor within the theory here presented. Just as we divided our universe into two racial groups and again into several rental groups, we could make one further subdivision, as follows: (a) those to whom direction is irrelevant; and (b) those for whom opportunities comprise only dwellings of rental group K *in a certain general direction* from Tract X. The entire study could be done in duplicate by applying Equation 1 to each of these two groups, (a) and (b), and the results pooled at the end. There would be a difficult empirical problem of determin-

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ing the relative total numbers assignable to (a) and (b), respectively. (This also was difficult with respect to race and rental.) Empirically, as a first approximation, one might go through the operations as in the present study, determine the total excess of the observed to expected in a given direction, and use this excess as a basis for estimating the relative size of (b). Then, considering only opportunities in the one direction, one could redistribute the excess by a reapplication of Equation 1. The point to be made here is that the directional factor involves no more *logical* difficulties with our theory than the racial or economic factor.

Still another factor, not explicitly considered in the present operations, is the nationality (other than racial) factor. Again, logically, this involves no insurmountable difficulties. Practically, however, because of lack of data it was not possible to deal with it as neatly as was the case with Negroes. To a considerable extent, the control by rental seemed to take care of ethnic differences, but not entirely. The influence of the ethnic factor (other than Negro-white) may be seen, for example, in the movements from the east side tracts studied. At the eastern edge of Cleveland, where the city merges into East Cleveland, was the largest concentration of Jewish population in 1930. Tracts P5 and P6 were Jewish areas with moderately high rentals. From Tract P4, also a Jewish tract, the observed movement to P5 and P6 was 257, as compared with only 156 as estimated by Equation 1 using a definition of opportunities which ignored the ethnic (other than Negro-white) factor. From Tracts K8, L6, R3, and R4, containing relatively few Jewish families, the observed movement to P5 and P6 was 142, as compared with 170 estimated. Similarly, some of the discrepancies in movement from Tract A2 on the west side may be attributable to a large Italian population in part of the tract. A redefinition of opportunities to take direct account of the ethnic factor was not attempted for lack of data on the individual families moving. There would be special difficulties, since members of an ethnic group might fall into two types in their movement, namely, those who follow the trend of movement within their nationality group and those who deliberately seek to dissociate themselves from their group. Here is an intriguing problem for further study. The application of Equation 1 somewhat as in the present study, might serve, as a first approximation, to permit a rough estimate of the relative numbers in the two types; and as a second approximation, the equation could be reapplied to each type separately, using for each type separate universes of opportunities.

A word should be said as to the application of the theory, not to all movements, as in the present study, but only to the net movement after a lapse of several years. The 1940 Census will provide data on place of residence April 1, 1940, and place of residence five years earlier. Some persons will have moved several times during this interval. It follows necessarily from the theory that after several moves persons will be more widely dispersed

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in space than after one move. If the general spatial pattern of opportunities remains relatively constant during a time interval, the expected distribution after *t* years could be estimated by successive applications, year by year, of Equation 1. Practically, this would be exceedingly laborious. Introducing some shortcut approximations, Severn Provus, research assistant to the writer, is attempting this for Chicago physicians with Loop offices whose changes of residence for several years can be traced.

There is one class of mobility to which it would be rather easy to make a direct application of Equation 1, namely, movements of farmers to other farms. Here, the place of work and place of residence coincide, while in residential mobility the place of work may introduce restrictions on place of residence accounting for some variation from expectation of the theory as here expressed in simple form. In defining opportunities in connection with the movement of farmers, care must be taken to hold constant the type of farming involved. Thus, ordinarily, cotton farmers might be more likely to move a long distance to another cotton farm than a short distance to a stock farm. Such tendencies are fully consistent with the theory here introduced, and can be adequately handled statistically if appropriate definitions of opportunity are laid down.

In conclusion, we should like to repeat what was said in the beginning, namely, that even where numerical data are inadequate for direct application of the theory of intervening opportunities, the general idea may be useful as a basic organizing principle in accounting for the *tendency* toward certain types of spatial patterns of population. It may be found that there are certain types of mobility which cannot be subsumed within the present theory—for example, the importation of a train-load of Mexicans from southern Texas to a northern industry. At the same time, it may be found that other sociological phenomena, such as the relationship of spatial propinquity to the selection of marriage mates, the relationship between certain types of crime and the residence of criminals, the choice of colleges, and the utilization of leisure time in vacation travel, may be illuminated by application of the general theory.

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