Models for Prehistoric Exchange in the Middle Great Lakes' Basin

Peter Reid

Various models of the distance decay of exchange are applied to the distributions of Kettle Point chert in Archaic, Early/Middle Woodland, and Late Woodland times, and to that of Bayport chert in late prehistoric times. The results, when not equivocal, are not dramatically different from those obtainable by more traditional methods of analysis.

Introduction

The study of prehistoric exchange through the spatial distribution of artifacts has enjoyed a considerable vogue among archaeologists since the mid-1960's. They have borrowed from geographers the methods and assumptions of distance decay studies of human interaction over space, which can be studied by regression analysis. Such studies seemed to offer a link between the archaeological record and those aspects of past ways of life concerned with trade and other forms of economic, social and political interaction.

In this article I examine the utility of distance decay analysis by applying it to four examples of the movements of chipped stone artifacts in southwestern Ontario and also Lower Peninsula Michigan and northwestern Ohio: Kettle Point chert in Archaic, Early/Middle Woodland, and Late Woodland times, and Bayport chert in late prehistoric times.

The archaeologist selects a common, readily identifiable type of artifact, with a reasonably widespread distribution and a known source. A sample is put together of sites yielding such artifacts. Each site is described in terms of two variables: the intensity of interaction between it and the source of the artifacts, and the distance between it and the source. The relation between these variables is displayed on a scattergram, which usually shows that the interaction is less frequent at sites which are further away from the source. This is the distance decay effect of interaction between communities.

A regression curve is fitted to the dots on the scattergram; such a curve is represented mathematically by the general equation ($y = a + bx^m$) (Hodder 1974:172). The dependant variable,y, is the intensity of interaction; the independant variable, x, is distance. The y-intercept, a, represents the hypothetical intensity of interaction at the source, and the slope, b, represents the rate at which interaction decays as one gets further from the source. Thus, the value of b will be negative. The exponent, m, is varied by the analyst depending on what sort of interaction is thought to be occurring. The relation between the two variables in the sample of sites is summarized by r, the correlation coefficient: the better the curve fits the dots on the scattergram, the closer r will be to -1.0. By squaring r the analyst may assess how much of the variation of y is accounted for by variations in x (Blalock 1972:392). If the absolute value of r were 0.7 or less (and r^2, therefore, were 0.49 or less) the archaeologist would know that variations in distance account for less than half of the variations in intensity of interaction. The F-test (Blalock 1972:399-400) should also be performed to see if the pattern on the scattergram is statistically significant or merely the result of chance.

The model represented by the general equation can be varied by varying m and by substituting more complex terms for y and/or x, as will be seen below. These variations represent different kinds of interaction that might account for the observed distribution of artifacts through space. Thus, one sample of sites may give rise to a number of values for r. The archaeologist manipulates the sample data through several variations of the general equation until the largest value for r is obtained. It is expected that a particular pattern of behaviour involved in a particular system of interaction between past communities will be indicated by its own `signature-curve' and its own version of the general equation. The largest r is supposed to indicate the `signature-curve' which is most applicable to a sample of sites, and thus most representative of the interaction behaviour in question.

Models for Interaction

The simplest kind of interaction between a community and the source of a desired commodity involves no distance decay (Table 1). Fig. 1 shows a hypothetical scattergram and the `curve', a straight horizontal line, for a situation in which

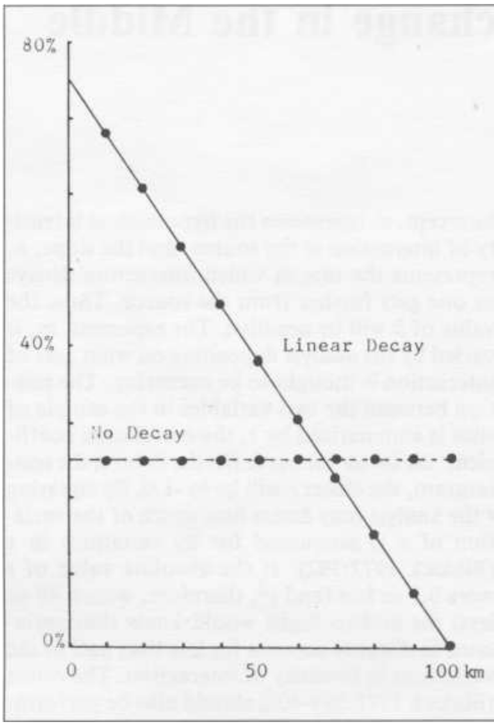

Fig. I
Hypothetical scattergram of the linear model of distance decay.

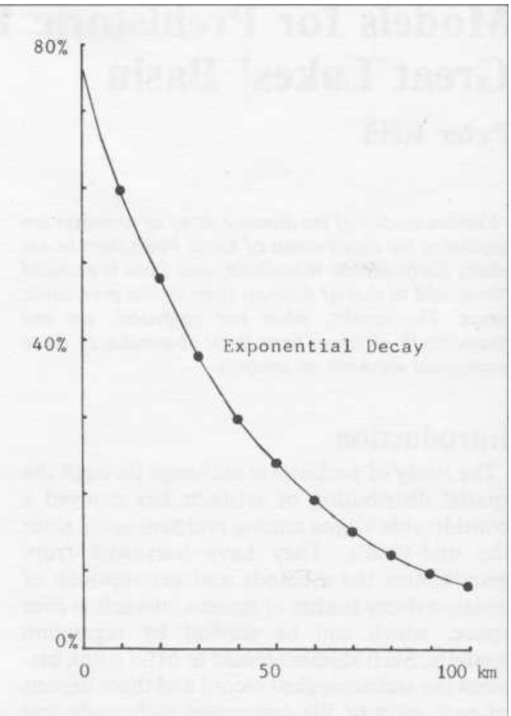

Fig. 2
Hypothetical scattergram of the single log model.

TABLE 1

MODELS for the DECAY of EXCHANGE OVER DISTANCE

Model	**Equation**	**Significance**
No Decay	$y = a$	Nomadic groups visit source seasonally. No exchange between groups.
Linear	$y = a + bx^{1}$	Settled groups visit source directly. No exchange between groups.
Single Log	$\log y = a + bx^{m}$	Down-the-line exchange between groups to source. b varies directly with `cost' of exchange, inversely with value of goods. m varies directly with value of goods and scale of production at source, and also with efficiency of exchange system.
Single Logit	$\log\left(\frac{Y}{100-y}\right) = a + bx^{m}$	As above, when *amount of exchange is* represnted by percentages.
Double Log	$\log y = a + b \log x^{m}$	Infrequent exchange between groups. Perhaps very high-value goods exchanged "politically".
Double Logit	$\log\left(\frac{y}{100-y}\right) = a + b \log x^{m}$	As above, when *amount of exchange is* represented by percentages.

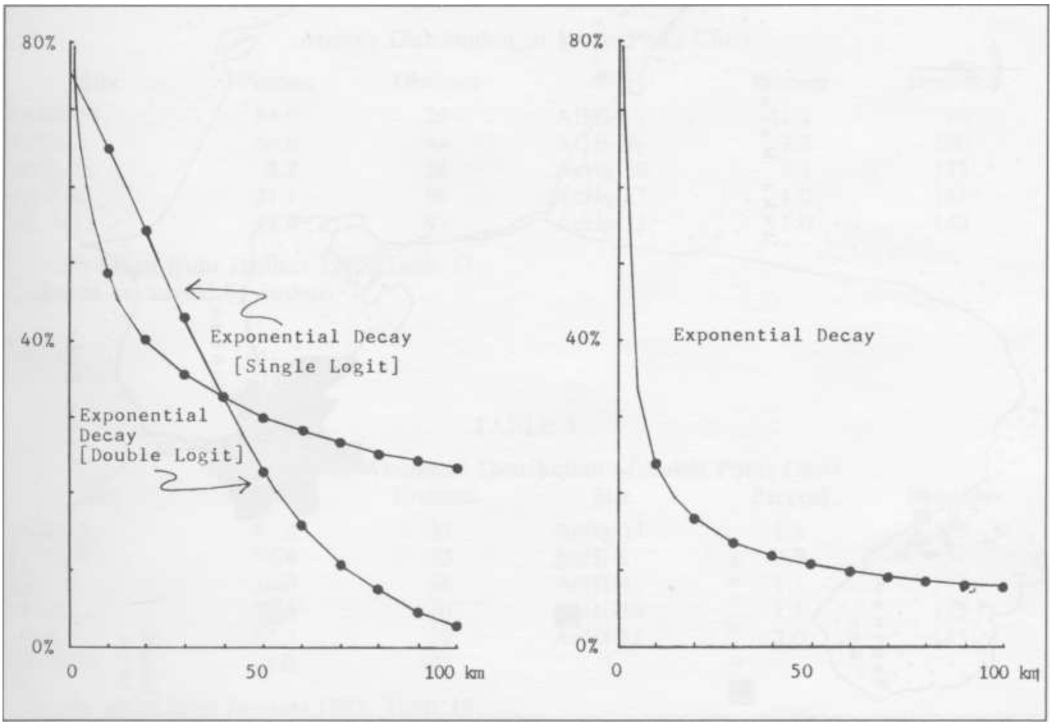

Fig. 3
Hypothetical scattergram of single logit curve.

Fig. 4
Hypothetical scattergram of the double log curve.

the intensity of interaction remains the same no matter what the distance is from the source. The general equation in this case is reduced to its simplest form: $y = a$. Dr. Chris Ellis (personal communication) tells me that such a pattern seems to exist for the distribution of Collingwood (Fossil Hill) chert in the southwestern Ontario Paleo-Indian Parkhill Complex. In the case of this particular raw material there was no interaction between communities. Nomadic bands apparently returned on their own to the chert source as part of the regular seasonal round of their movements.

Interaction may decline as a function of distance only (Table 1). Fig. 1 also shows a hypothetical scattergram for this situation: the `curve' is now a straight line descending to the right. This is the `linear' model of distance decay, for which the general equation assumes the form $y= a + bx^1$. Sedentary communities which supply themselves by sending people directly to the source would be expected to show this pattern, providing they had more than one source for the commodity. If they did not, then they would have to get it from the one source, no matter how far away it was. Then there would be no distance decay and the `curve' would be the same as that discussed in the preceding paragraph. In either case, however, the interaction is still between communities and sources, and not between different communities.

Interaction may decline exponentially with distance. Fig. 2 shows a hypothetical scattergram with its curve descending to the right. This is the `single log' model of distance decay (Table 1), for which the general equation assumes the form $log\ y = a$ + bxm. Renfrew (1972:466) has suggested that when m = 1, as it does for the curve on Fig. 2, `down-the-line' trade is indicated: ' . . . a chain of villages equally spaced. Each village down the line would receive obsidian through exchange from its neighbour near the source, and pass on a given proportion...'. A unidirectional sequence of trade connects the source and several communities, each trading only with its immediate neighbour up and down the line. The slope of the curve depends on how much the communities were passing along: the greater the proportion

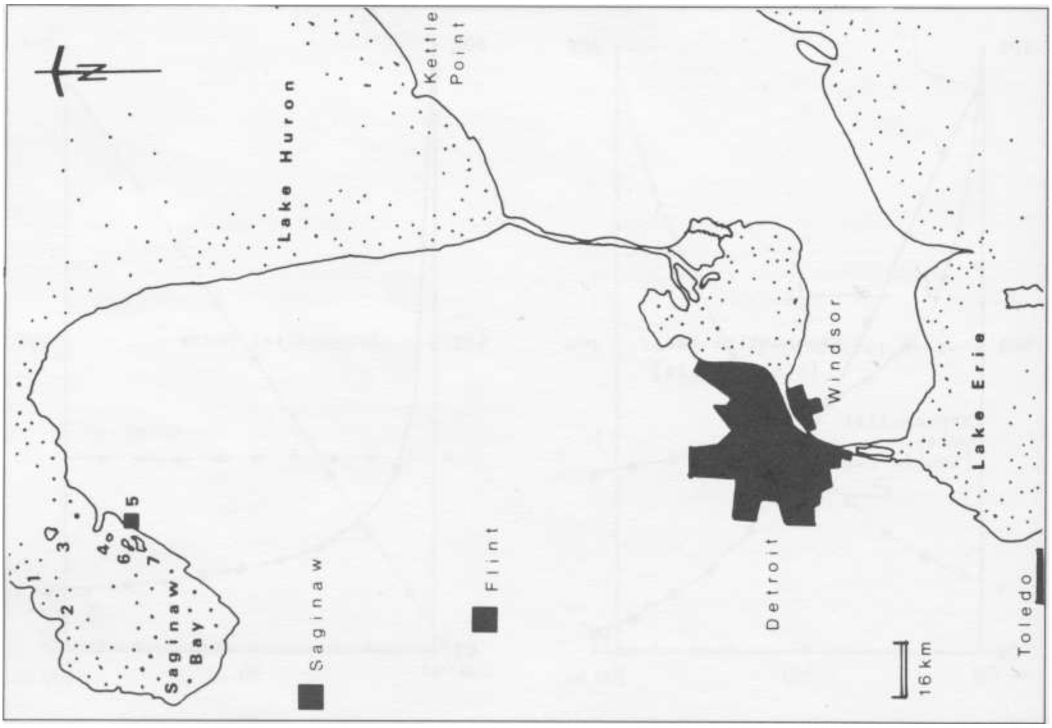

Fig. 5
Sources of Kettle Point and Bayport Chert
(1) Lookout Point (2) Point au Gres (3) Charity Is. (4) North Is. (5) Bayport (6) Stony Is. (7) Katechay Is.

retained, the steeper the slope (that is, the greater the absolute value of *b*). In `prestige-chaintrade', communities retain small proportions and pass on large proportions of highly valued goods. The slope of the curve is shallow and b is small (Renfrew 1972:467-468).

Hodder has suggested (1974: Fig. 19) that steep slopes (where the absolute value of *b* is equal to or greater than 0.05) will occur where goods are bulky, where their sources are not producing all that many of them, and where the costs of transportation are high. He has also suggested (Hodder 1974:174) that low values for m (between 0.1 and 0.6) would indicate the distribution of low-value, bulky goods, from small-scale production centres serving a very local hinterland of consumers who dealt directly with suppliers. Large m's (between 0.9 and 2.5) indicate sources with large outputs, or the distribution of more highly valued goods. Where m lies between 1.0 and 2.0 costly movement is indicated (Hodder 1974:174).

Ian Kenyon (personal communication) informs me that if the dependant variable, intensity of interaction, is represented by percentages instead of absolute quantities, the `single logit' model is more appropriate than the single log model (Table 1). Fig. 3 shows a single logit curve fitted to a hypothetical scattergram. The general equation is now modified to $log(y/100-y) = a + (bx^m)$ (m = 1 for the curve on Fig. 3). It is assumed that consumers had a choice between two kinds of raw material: for example, Bayport chert *versus* other cherts. The decline in the pro-portion for the first kind is matched by a rise in the proportion of the second. Otherwise the assumptions previously outlined for the single log model apply.

Interaction may decline exponentially with the logarithm of distance (Table 1). Fig. 4 shows a hypothetical scattergram with such a `double log' curve fitted to it. The general equation is now modified to $log\ y = a + b\ log\ x^m$ (m = 1 for the curve on Fig. 4). Geographers have used double log models for such things as migrations or marriages between communities (Taylor 1971:223-229). Double log interactions involve infrequent moves, by people or goods, between communities. Such a model *might* characterize the exchange of very highly valued goods in

TABLE 2

Archaic Distribution of Kettle Point Chert

Site	Percent	Distance	Site	Percent	Distance
AhHk-54	84.0	20	AfHi-3	11.2	98
AdHo-5	56.6	44	AfHi-26	3.8	100
BbHj-2a	8.2	56	AeHg-10	4.1	133
BeHh-6	21.1	86	AeHg-27	1.0	141
ML v 15	19.6	95	AeHg-53	1.0	140

Percents taken from Janusas 1983: Table 17.
Distances calculated by author.

TABLE 3

Early/Middle Woodland Distribution of Kettle Point Chert

Site	Percent	Distance	Site	Percent	Distance
AhHk-3	99.0	21	AeHg-11	1.2	135
AgHk-4	94.6	25	AeHi-6	0.9	138
BbHj-3	14.0	56	AeHf-4	1.1	145
BcHi-7	58.6	70	AeHf-30	1.1	145
BdHi-1	54.3	70	AeHf-32	2.0	145
AeHh-29	1.0	125			

Percents taken from Janusas 1983: Table 18.
Distances calculated by author.

TABLE 4

Late Woodland Distribution of Kettle Point Chert

Site	Percent	Distance	Site	Percent	Distance
AdHo-1	7.5	36	AfHg-1	21.6	125
Furton	12.7	45	BdHb-1	19.0	126
R au Vase	44.7	46	BcHb-27	13.0	131
Verchave I	5.8	50	AfHf-3	2.5	144
AcHm-3	1.5	64	BcHb-17	10.2	146
Fort Wayne	3.9	68	BcHb-10	29.3	148
Af.Hj-28	53.5	87	AeHg-18	8.1	149
Smale	53.1	91	BbHa-10	32.8	156
AaHp-20*	3.8	100	AdHf-4	4.0	158
AaHp-21 *	4.6	100	BbHa-6	7.2	159
AaHq-8*	4.4	100	BbHa-7	62.6	159
AfHi-23	15.9	102	AeHf-14	1.0	160
AgHh-1	85.5	115	AeHf-9	3.7	162
AgHh-9	24.0	117	AeHf-34	1.6	163
AgHh-10	8.3	117	AhGx-20	2.2	250
AgHh-14	65.2	117			

Percents taken from Janusas 1983: Table 19. Percents for (*) sites taken from Reid 1983: Table 7. Distances calculated by author.

TABLE 5

Late Woodland Distribution of Kettle Point Chert from the Lawson Site

Site	Percent	Distance	Site	Percent	Distance
AgHh-1	85.5	0	AfHf-3	2.5	32
AgHh-9	24.0	2	AfHj-28	53.5	35
AgHh-10	8.3	2	AeHg-18	8.1	53
AgHh-14	65.2	2	AdHf-4	4.0	69
AfHi-23	15.9	13	AeHf-14	1.0	74
AfHg-1	21.6	16	AeHf-34	1.6	75
Smale	53.1	31	AeHf-9	3.7	76

Percents taken from Janusas 1983: Table 19.
Distances calculated by author.

TABLE 6

Late Prehistoric Distribution of Bayport Chert

Site	Percent	Distance	Site	Percent	Distance
20 BY 29	99.4	15	11 H8a	1.2	163
20 TU 6	98.7	19	11 H10	0.9	165
20 IS 1	56.6	29	33 W0128	0.4	165
20 IS 10	94.7	30	AcHk-1	2.3	166
20 SA 74	99.3	53	33 WO 74*	0.3	166
AfHo-1	9.4	88	33 WO 4*	1.2	166
20 MB 3	3.8	100	33 WO 8*	1.1	168
AcHo-1	6.2	110	AeHj-2	1.0	170
20 LA 1	29.1	110	33 LU391	1.1	173
20 MK 1	0.8	117	33 LU394	1.0	173
20 MK 19	0.5	124	20 GT 26	0.4	175
AcHm-2	3.7	129	20 GT 2	0.1	182
AcHm-3	0.8	129	20 JA 32	14.1	215
20 EM 19	1.0	131	AfHh-28	1.6	217
AcHm-1	1.5	132	AfHi-23	0.2	220
20 MA 11	0.4	140	AgHh-1	0.4	223
AbHs-7	4.2	143	20 NE117	10.2	225
20 IB 1	59.3	145	20 JA 52	7.2	230
AdHm-29	0.2	145	20 NM 18	9.1	250
20 MR 5	1.0	150	20 LK 3	19.3	250
20 CX 24	0.4	152	AgHd-9	1.3	283
20 EM 18	1.3	154	AgHd-11	0.5	284
20 MR161	1.4	155	20 AE 56	0.8	310
20 MR166	0.9	155	20 AE 58	0.2	320
33 LU 11*	0.2	159	20 BE 8	1.4	348

Michigan (20 -- --) percents taken from Luedtke 1976.
(*) percents taken from Graves 1984; Redmond 1981, 1984; and Rutter 1984. Other percents including 20 MR161, 166 and all distances calculated by author.

TABLE 7

Regression Analysis Results for Five Cases of Prehistoric Exchange

Case	No. of Sites	r	r^2	b	m	Best-Fitting Model
Kettle Point Chert: Archaic	10	-.908	.825	-0.325	0.5	Single Logit
Kettle Point Chert: E/M Woodland	11	-.964	.929	-4.141	0.2	Single Logit
Kettle Point Chert: Late Woodland	31	-.259	Result not statistically significant			
Kettle Point Chert: From Lawson Site	14	-.768	.590	-0.000205	2.0	Single Log
Bayport Chert: Late Prehistoric	50	-.857	.734	-738.308	0.01	Double Logit

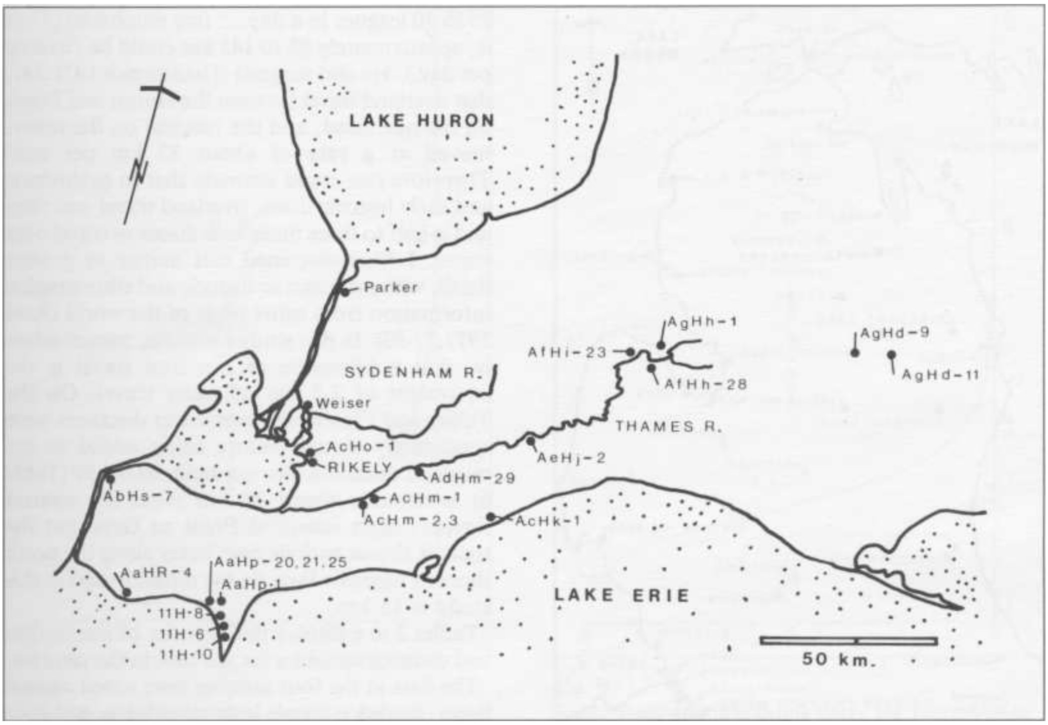

Fig. 6
Late prehistoric sites in southwestern Ontario yielding Bayport chert.

political or diplomatic situations, rather than in trade as the term is usually understood. Where percentages represent intensity of interaction 'double logit' models should replace double log models (Table 1). The general equation becomes $\log (y/100-y) = a + b \log x'''$. Fig. 3 shows a hypothetical example (m = 1).

Analysis

For this study I examined the distributions of Kettle Point chert, a high quality Middle Devonian material whose source is the place of that name on the southeastern shore of Lake Huron (Fig. 5), and of Bayport chert, an Upper Mississippian material outcropping in the town of that name on Saginaw Bay, as well as at several other locations in that part of Michigan (Fig. 5). I selected four samples of sites for this analysis: ten Archaic sites from southwestern Ontario (Table 2), eleven Early and Middle Woodland sites from southwestern Ontario (Table 3), and thirty-one Late Woodland sites from southwestern Ontario and southeastern Michigan (Table 4): all of these yielded Kettle Point chert (see Janusas 1983: Figs. 26,27 and 28 for the locations of these sites). Fifty sites yielding Bayport chert, from Lower Peninsula Michigan, northwestern Ohio, and southwestern Ontario, dating to late prehistoric times, made up the fourth sample (Table 6; Figs. 6,7). In all cases, only sites with at least fifty chipped stone artifacts were included (see Blalock 1972:34). To the best of my knowledge, these 102 sites include all those in the regions mentioned above where the chipped stone assemblages have been examined to determine the sources of their raw materials, by myself, or by other scholars, and where the minimum of fifty artifacts per assemblage was available.

I measured intensity of interaction by the percentage which the numbers of pieces of the chert in question made up out of the total numbers of chert artifacts which made up the chipped stone assemblages at each site. For the three site samples involving the Kettle Point material, I used data from Janusas' (1983) study, plus data from three sites I myself had investigated (Reid 1983). For the Bayport sample data from Luedtke's (1976) study, Graves' (1984) report, Redmond's (1981, 1984) reports, and Rutter's (1984) report was

Fig. 7
Late prehistoric sites in Michigan and Northwestern Ohio yielding Bayport Chert.

used, along with data I personally obtained through the examination of twenty-one chipped stone assemblages from Ontario, Ohio and Michigan. The present study thus builds on the earlier comprehensive studies of Janusas and Luedtke, but includes data not available to them. All of this data I tested against a wider range of distance decay models than the authors of these two previous studies were able to do.

I measured the kilometre distance between the chert sources and the sites in the sample. Although aware of the problems involved in doing so (Luedtke 1976:322-323), I tried to measure distance over the land and water routes that prehistoric groups were likely to have used. Therefore my distance measurements differ from those in Janusas' and Luedtke's studies, in which this variable was measured along a straight line between sources and sites.

In terms of the effort involved a kilometre of travel overland is `longer' than a kilometre of travel by water. How much longer? Following Sagard and other ethnohistoric sources, Heidenreich (1971:245) suggests `... Under *very good conditions,* a Huron canoe could cover some 25 to 30 leagues in a day...' (my emphasis) (That is, approximately 95 to 145 km could be covered per day.). He also suggests (Heidenreich 1971:247) that overland travel between the Huron and Petun on the one hand, and the Neutral on the other, moved at a rate of about 32 km per day. Therefore one could estimate that in prehistoric and early historic times, overland travel was two-and-a-half to three times as arduous as travel over water. I have discussed this matter in greater detail, with reference to historic and ethnographic information from other parts of the world (Reid 1977:77-80). In this study I assume, conservatively, that a kilometre of overland travel is the equivalent of 2.5 km of water travel. On the Tables and Figures the over-water distances were accordingly shrunk before being added to the overland distances. For example, 20 BY 29 (Table 6) is actually about 37 km from the nearest Bayport chert source at Point au Gres, but the route is almost entirely over water along the north shore of Saginaw Bay. So the distance used in this study is 15 km.

Tables 2 to 6 display the intensity of interaction and distance variables for the sites in the samples. The data in the four samples were tested against linear, single log, single logit, double log, and double logit models. The value of m was varied in each case between 0.01 and 2.0. A correlation and regression programme written by Ian Kenyon in BASIC was used to carry out the necessary arithmetic (see Reid 1985:10). Table 7 displays the results of my analyses.

For the Archaic Kettle Point sample the single logit model proved the most appropriate (Fig. 8). This suggests down-the-line trade; the moderately high value of *b* and low value of *m* suggest the exchange of bulky, low value goods from a source with a low production output, through a costly, time and effort consuming transportation network.

For the Early and Middle Woodland Kettle Point sample the single logit model was also the best (Fig. 9). The quite high value of *b* and the low value of m suggest the same pattern of ex-change behaviour as is indicated for the Archaic sample. However, I found that the double logit model provided a curve which fit the EarlyMiddle Woodland scattergram almost exactly as well as did the single logit curve (Fig. 10). *This* would suggest the movement of the chert by means of quite infrequent events, a conclusion very nearly the opposite to that suggested by the single logit model, which assumes regular and fairly frequent contacts between communities. Such equivocal results are not uncommon in the regression

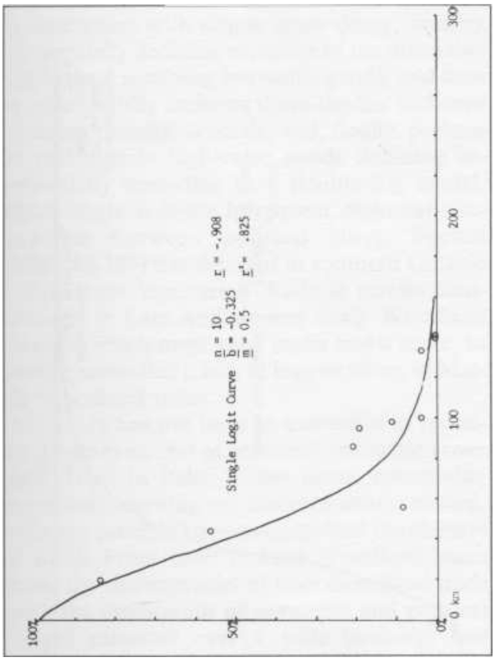

Fig. 8
Scattergram and best-fitting curve for Archaic Kettle Point chert.

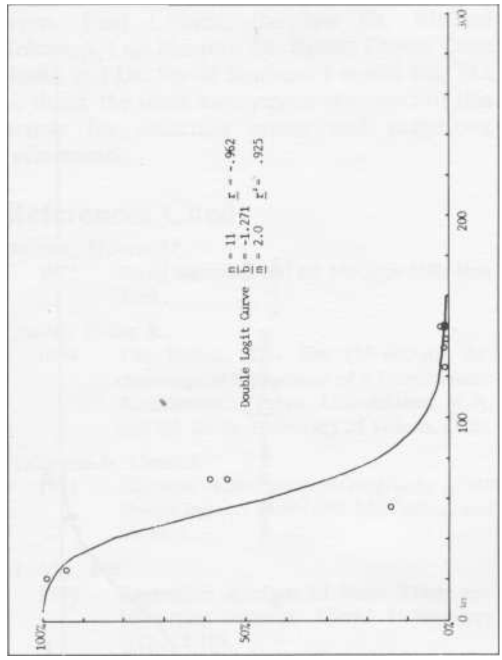

Fig. 9
Scattergram and best-fitting curve for Early/Middle Woodland Kettle Point chert.

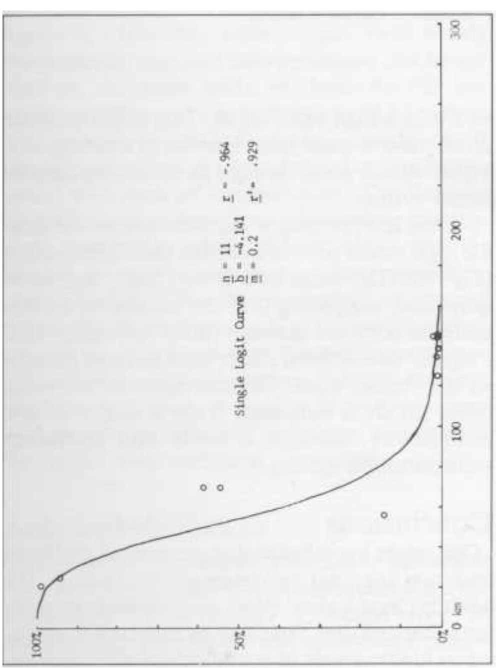

Fig. 10
Scattergram and alternative curve for Early/Middle Woodland Kettle Point chert.

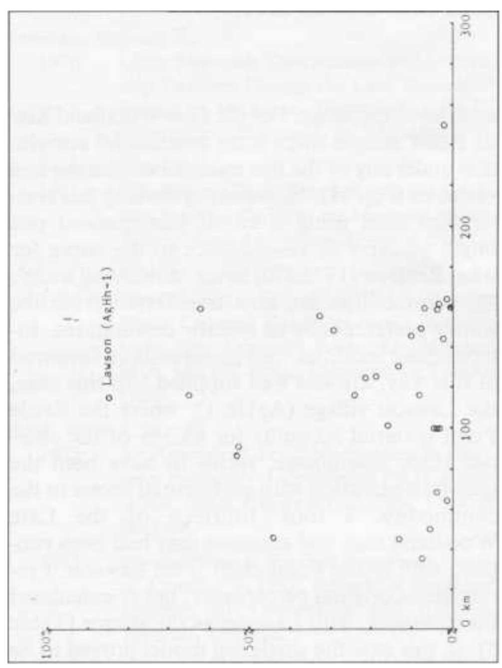

Fig 11.
Scattergram for Late Woodland Kettle Point chert.

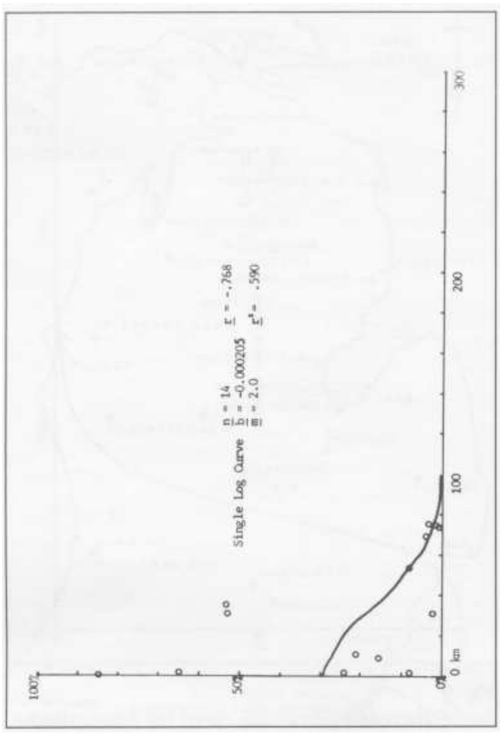

Fig. 12
Scattergram and best-fitting curve for L. Woodland Kettle Point chert fm Lawson

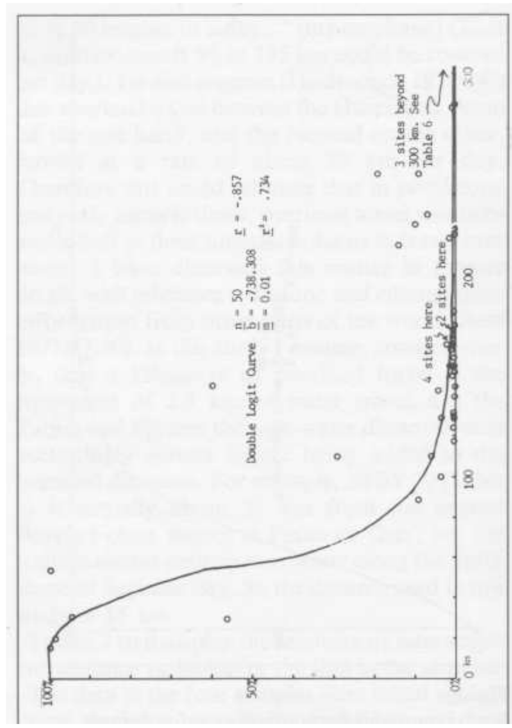

Fig. 13
Scattergram and best-fitting curve for Late Prehistoric Bayport chert.

analysis of exchange. For the Late Woodland Kettle Point sample there is no meaningful correlation under any of the five models between the two variables (Fig. 11). However, eyeballing this scattergram (and using a bit of imagination) one might perceive its resemblance to the curve for what Renfrew (1972:470) terms `directional trade': `... commodities are now transferred from the source preferentially to specific destinations. Intermediate localities, not preferentially favoured in this way, are less well supplied.' In this case, the Lawson village (AgHh-1), where the Kettle Point material accounts for 85.5% of the chipped stone assemblage, seems to have been the specific destination with preferential access to the commodity. I took fourteen of the Late Woodland sites and assumed they had been sup-plied with Kettle Point chert from Lawson. I retained the original percentages, but re-calculated the distances, with Lawson as the source (Table 5). In this case the single *log* model proved to be most appropriate (Fig. 12), with a very low value of *b* and a high value of *m*. This might indicate down-the-line trade from Lawson of a prestigious, highly-valued good through an efficient transportation system.

For the late prehistoric Bayport sample the double logit model proved to be the most appropriate (Fig. 13). The value of *b* is very high, that of *m* quite low, suggesting that the movement of this material occurred through rather infrequent and irregular interactions, rather than through sustained and regular trade. The movement of low-value bulky goods is indicated, from a source of low productivity, through a costly and inefficient transportation system.

Conclusions

One might hypothesize that patterns of exchange and raw material procurement changed in the Middle Great Lakes' Basin as prehistoric cultures here changed over time and, in some cases, evolved to higher levels of social complexity. For example, one might anticipate a sequence in which interaction with no distance decay is succeeded by interaction with simple linear decay, then by exponentially declining exchange of the down-the-line variety, involving low-value goods, and then by exponentially declining down-the-line exchange involving prestigious goods, and, finally, perhaps by exchange in high-value goods declining exponentially according to a double log model, which might indicate infrequent diplomatic interaction between political elites. Spence (1982:186-187) has detected in southern Ontario a shift from `egalitarian' trade in certain commodities in Late Archaic and Early Woodland times, in which most adult males had a share, to an elite controlled trade, at least in silver, in Middle Woodland times.

My study has not been so successful in revealing a neat evolution of economic interaction over time. True, in Paleo-Indian times, commodity movement showing no distance decay existed, while the possible Lawson-controlled distribution of Kettle Point chert in Late Woodland times shows the characteristics of both directional trade (with the implication of economic and political control extended over a wide territory) and prestige-chain exchange. The exchange of Kettle Point chert in Archaic times also falls into a rudimentary evolutionary scheme, insofar as it appears to have been down-the-line trade of a low-value commodity. The pattern for the trade in Kettle Point chert in Early and Middle Woodland times is, frankly, ambiguous: two nearly diametrically opposed interpretations can be applied to the same body of data. As for late prehistoric Bayport chert, the *form* of its pattern of distribution might indicate diplomatic contacts between elites, but the b and m values are inconsistent with such an interpretation. The Bayport material seems to have been a low-value, cumber-some commodity which did not move very far beyond the source area in any great quantities. One wonders if the thin scatterings of chipped stone artifacts over hundreds of square kilometres are not too fragile to bear the weighty assumptions of mathematical studies. Perhaps the time has come to reassess the utility of archaeological studies of interaction and exchange, and to treat the results with measured scepticism.

Acknowledgements

The research on which this article is based was done in 1984-5 while I was on sabbatical from the University of Windsor. I would like to acknowledge the support and assistance I received from my colleagues during that time: Dr. Charles Cleland, Dr. Chris Ellis, Bill Fox, Dr. William Finlayson, Dr. David Keenlyside, Ian Kenyon, Paul Lennox, the late Dr. Richard Johnston, Carl Murphy, Dr. Robert Pearce, Dave Smith and Dr. David Stothers. I would also like to thank the three anonymous reviewers of this article for detecting errors and suggesting refinements.

References Cited

Blalock, Hubert M.
1972 *Social Statistics.* 2nd ed. McGraw Hill, New York.

Graves, James R.
1984 The Indian Hills Site (33-WO-4): Archaeological Reflections of a Protohistoric Assistaeronon Town. Unpublished M.A. and Ed. thesis, University of Toledo, Ohio.

Heidenreich, Conrad
1971 *Huronia: A History and Geography of the Huron Indians 1600-1650.* McClelland and Stewart.

Hodder, Ian
1974 Regression Analysis of Some Trade and Marketing Patterns. *World Archaeology* 6(2):172-189.

Janusas, Scarlet E.
1983 A Petrological Analysis of Kettle Point Chert and its Spatial and Temporal Distribution in Regional Prehistory. Unpublished M.A. thesis, Department of Anthropology, Trent University, Ontario.

Luedtke, Barbara E.
1976 Lithic Materials Distributions and Interaction Patterns During the Late Woodland Period in Michigan. Unpublished Ph.D. dissertation, University of Michigan.

Redmond, Brian G.
1981 The Orleans Park Site: A Sandusky Tradition Hunting Camp in the Maumee Valley. *Toledo Area Aboriginal Research Bulletin* 10:1-25.

1984 The Doctors Site (33-LU-11): Younge Phase Cultural Dynamics in the Western Lake Erie Drainage Basin. Unpublished M.A. and Ed. thesis, University of Toledo, Ohio.

Reid, Peter E.W.
1977 An Analysis of Trade Mechanisms in European Prehistory. Unpublished Ph.D. dissertation, State University of New York at Buffalo.

1983 Investigations at the Dick Site, Essex County, Ontario, in 1982. Report on file at the Ministry of Citizenship and Culture, Toronto, Ontario.

1985 You, Your Microcomputer, and Basic Decay. *Kewa, Newsletter of the London*

Chapter, Ontario Archaeological Society 85(1):5-10.

Renfrew, Colin
1972 *The Emergence of Civilisation: The Cyclades and the Aegean in the Third Millenium B.C.* Methuen and Co. Ltd., London.

Rutter, William E.
1984 The Upper Mississippian Component at the Fort Meigs Site, With Special Emphasis on the Analysis of the Ceramic Assemblage. Unpublished M.A. thesis, Western Michigan University.

Spence, Michael W.
1982 The Social Context of Production and Exchange, In *Contexts for Prehistoric Exchange (J.E.* Earle and T.K. Ericson, editors, Academic Press, New York.

Taylor, Peter J.
1971 Distance Transformations and Distance Decay Functions. *Geographical Analysis* 3:221-238.

Department of Sociology and Anthropology
University of Windsor
Windsor, Ontario
N9B 3P4

Peter Reid
1986 Models for Prehistoric Exchange in the Middle Great Lakes' Basin. *Ontario Archaeology 46:33-44*