Evidence for Direct Evolutionary Linkages of Agriculture with Other Customs

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ABSTRACT

In a world sample of diverse societies, geographical and other variations can cause misleading low or high correlations between two customs when measured by scores of individual societies. Evolutionary linkage of agriculture with another custom can be inferred more accurately from differences between paired nearby societies if the pair member that obtains more food from agriculture has either a higher or a lower score on the other custom in most of the pairs. A world sample of 186 societies contains 93 pairs of nearby societies. The pair member that obtained more food from agriculture usually had land transport assisted by animals or vehicles and obtained less food from domesticated animals. Other predominant customs of this pair member were choice of wife by adult relatives instead of by the adolescent boy, less premarital sexual freedom of adolescents, and less frequent corporal punishment of young children. Direct evolutionary linkage of food from agriculture with the associated customs might be attributable to the greater power and wealth obtained by owners of agricultural land.

INTRODUCTION

In each human society, natural selection has caused a group of customs to evolve together because they are compatible with each other. Other potential customs are absent because they are less compatible. Agriculture is the most frequent food source in a world sample of 186 diverse societies selected by Murdock and White (1969). In 109 of the societies, more food is obtained from agri-

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culture than from any of five other food sources. Agriculture is absent in many of the societies. The average percentage of food from agriculture differs among six world regions defined by Murdock (1967), from 82 per cent in sub-Sahara Africa to 33 per cent in North America.

An evolutionary linkage of agriculture with another custom is possible but not proved if the two customs are highly correlated in the sample of societies. Two customs might be correlated because both are absent or present in the same region of the world. For example, food from both agriculture and domesticated animals is obtained in many societies in sub-Sahara Africa, but both food sources are absent in the majority of societies in North America. Two customs might be correlated because they have an evolutionary linkage not with each other but with a third custom. For example, sufficient technological development is necessary for food from agriculture and from domesticated animals. Food from agriculture and food from domesticated animals, therefore, are directly linked with technological development but not necessarily with each other.

Barry (2009) introduced a technique that minimizes environmental differences by applying correlations to differences between paired nearby societies with adjacent serial numbers instead of to scores of individual societies. Nearby societies usually share similar physical and social environments. The two applications were compared for correlations of degree of political integration with other customs. Barry (2011) compared the two applications for correlations of amount of food from domesticated animals with other customs.

An important advantage of applying correlations to differences between the paired nearby societies is to strengthen the inference that a high correlation between two customs is attributable to a direct evolutionary linkage of the customs. Cultural differences between the paired nearby societies are necessary for finding differences between members of the same pair. A difference does not exist if the paired nearby societies have the same score on a custom. Each of the 186 societies has substantial differences from each of the other 185 societies. Most of the societies are separated by more than 100 miles from the nearest other member of the sample.

METHODS

The Pearsonian correlation coefficient, also called the product-moment correlation, was applied to the differences between paired nearby societies and also to the scores of individual societies. The first pair contains serial numbers 1 and 2, in southern Africa. The 93rd pair contains serial numbers 185 and 186, in southern South America. Seven pairs (7.5 per cent) contain members in two of the six world regions. Both members of these seven pairs are close to the border between adjacent regions.

For each pair of nearby societies, the score of the second member is subtracted from the score of the first member for both correlated customs. If both difference scores are positive or negative, the difference contributes to a positive correlation. If one difference score is positive and the other negative, the difference contributes to a negative correlation. The first member of each pair has an odd serial number, beginning with 1, ending with 185. The second member of each pair has an even serial number, beginning with 2, ending with 186. The correlations are influenced by the proportion of the pairs that contribute to a positive or negative correlation and also by the magnitude of the difference scores.

The analysis of the difference between the paired nearby societies necessarily omits pairs with a zero difference score on either custom. The pair also is omitted if either member has no score because of insufficient information about either of the two customs. In previous articles by Barry (2009, 2011), the correlations applied to differences between pair members were compared with correlations applied to the scores of the entire sample of individual societies. Some of the pairs were excluded because of a zero difference score on either custom or because of insufficient information on either member of the pair. The omitted pairs might have characteristics that cause correlations applied to differences between paired societies to differ from correlations applied to scores of the larger number of societies.

The differences between the two samples of societies are abolished if the correlations applied to the scores of individual societies are limited to the same smaller sample of societies when the correlations are applied to differences between the pair members. Barry (2009) accordingly limited correlations applied to the scores of the

same individual societies to the same societies that were included in the correlations applied to the differences between the paired societies. The number of individual societies was twice the number of pairs because the individual societies included both members of each pair. The correlations applied to the scores of individual societies therefore combined societies that were members of the same pair with societies that were the only member of their pair.

The present report introduces a preferable method for using the same sample of societies when applying correlations to differences between pair members and to scores of individual societies. The correlations applied to scores of individual societies are computed separately for the scores of the first and second pair members. Only one score for each pair of nearby societies is obtained from the difference between the scores of the pair members.

Murdock and Morrow (1970) used an ordinal scale of seven categories to measure the amount of food from agriculture. Barry (2011) converted the scale to five levels, each with a different level of amount of food: (0) None; (1) Little, less than 10 per cent of the total; (2) Some, more than 10 per cent of the total; (3) Plurality, more food than any other single source but less than 50 per cent of the total; and (4) Majority, more than 50 per cent of the total. The same conversion to a scale of five levels was applied to five other food sources. They are amount of food from domesticated animals, from hunting, from fishing, from gathering, and from intercommunity trade.

Ten measures of cultural complexity (Murdock and Provost 1973) use an ordinal scale with five levels. One type of complexity, assisted land transport, had a much higher correlation with amount of food from agriculture when applied to differences between paired nearby societies than to scores of individual societies: (0) Human carriers; (1) Pack animals; (2) Draft animals; (3) Animal-drawn wheeled vehicles; and (4) Automotive vehicles.

More food from agriculture had higher correlations with two measures of adult control over adolescents when applied to differences between paired nearby societies than when applied to scores of individual societies. Schlegel and Barry (1991) reported an ordinal scale with four levels on choice of spouse by adult family members instead of by the adolescent boy or girl: (0) Solely by the adoles-

cent; (1) Mostly by the adolescent; (2) Mostly by adult relatives; and (3) Solely by adult relatives. The correlation with food from agriculture is positive instead of negative if the pair member with more food from agriculture also has a higher score on choice of spouse by adult family members instead of by the adolescent. The measure includes the majority of societies because marriage choice is usually prior to the end of adolescence.

A measure of sexual freedom of adolescents is an ordinal scale reported by Barry and Schlegel (1984). Scores between 0 and 20, separately for boys and girls, are the total of scores between 0 and 10 on measures of sexual expression and sexual non-restraint.

Corporal punishment during early childhood is another measure, reported by Barry, Josephson, Lauer, and Marshall (1977). Early childhood is from approximately four years of age until several years prior to adolescence. The ordinal scale is from 0 to 10. Frequency is the principal criterion, but severity also influences the score.

For most of the customs included in this article, the scores on the individual societies were originally published in the Journal *Ethnology*. The scores were subsequently reproduced in a book edited by Barry and Schlegel (1980).

Statistical significance of the difference of each correlation from zero was tested by the more stringent two-tailed criterion, estimating the probability that a difference from zero correlation is larger than can be attributed to random variation in either the positive or negative direction. A probability of less than 5 per cent ($p < .05$) is generally regarded as statistically significant.

The statistical analyses used Version 20 of SPSS, a component of the IBM Corporation. Norusis (2009) describes some of the programs.

RESULTS

Correlations of more food from agriculture with other cultural customs are shown in Table 1. Food from agriculture had a high positive correlation with assisted land transport when applied to differences between paired nearby societies. The correlations were much closer to zero when applied to scores of individual societies.

Table 1

Amount of food from Agriculture has Higher Correlations with the Following Customs when Applied to the Difference between Pairs of Nearby Societies (Diff.) than when Applied to Scores of the 1st and 2nd Member of the Pair. The Number of Pairs Applies to All Three Correlations

Other Custom	Correlation			Number
	Diff.	1st	2nd	
Assisted Land Transport	.66**	.20	.27	16
Food from Domestic Animals	–.43*	–.09	–.29	34
Adult Relatives Choose Wife	.66**	.33**	.48*	22
Adult Relatives Choose Husband	.28	–.01	–.01	16
Sexual Freedom of Adolescent Boys	–.36*	–.11	–.13	32
Sexual Freedom of Adolescent Girls	–.37*	–.17	–.17	31
Corporal Punishment of Young Boys	–.40*	–.11	–.08	26
Corporal Punishment of Young Girls	–.30	–.13	.01	23

* P < .05 ** p < .01

The pair member that obtained more food from agriculture usually obtained less food from domesticated animals. The negative correlation was closer to zero when applied to the scores of the first and second member of each pair. The differences between paired nearby societies therefore indicate a tendency for one pair member to obtain more food from agriculture while the other pair member obtained more food from domesticated animals.

Separate measures were choice of wife by the adolescent boy or by adult relatives, and choice of husband by the adolescent girl or by adult relatives. For boys, correlation of more food from agriculture with choice of wife by relatives was highly positive when ap-

plied to differences between paired nearby societies. The correlations were also positive but closer to zero when applied to the scores of the first and second member of the pairs. For adolescent girls, the positive correlation of more food from agriculture with choice of husband by relatives was lower, and the difference from zero was not statistically significant. The correlations were very close to zero when applied to scores of the first and second members of the pairs.

More food from agriculture was correlated with low sexual freedom of adolescents. For both boys and girls, the correlations were similar and statistically significant when applied to differences between paired nearby societies. The correlations were close to zero when applied to scores of individual societies.

More food from agriculture had a statistically significant correlation with less frequent corporal punishment of young boys when applied to differences between pair members. The correlations were close to zero when applied to scores of individual societies. The negative correlation for young girls, applied to the difference between pair members, was lower and the difference from zero was not statistically significant. The correlations were closer to zero when applied to scores of individual societies.

Table 2 shows the scores on food from agriculture (A) and on wife chosen by relatives (W) for each of the 44 societies that were members of 22 paired nearby societies. The sequence of members of the same pair does not affect the correlations. Table 2 places first the pair member that obtained more food from agriculture regardless of whether its serial number is odd or even. The last two columns in Table 2 show each numerical difference score between the pair members for food from agriculture (DA) and for wife chosen by relatives (DW). Both difference scores are positive for 19 pairs. Only three pairs had difference scores that were positive for food from agriculture and negative for wife chosen by relatives.

Table 2

Each row identifies a pair of nearby societies. The pair member with more food from agriculture is followed by the pair member with less. The score of both societies is shown on food from agriculture (A) and on wife (W) chosen by relatives or by adolescent boy. The last two columns, DA and DW, show the difference between the pair members on the two customs

More Agriculture	A	W	Less Agriculture	A	W	DA	DW
Relatives Choose Wife				Boy Chooses Wife			
10 Luguru	4	2	9 Hadza	0	1	+4	+1
23 Tallensi	4	3	24 Songhai	3	2	+1	+1
30 Otoro Nuba	4	2	29 Fur	3	1	+1	+1
33 Kaffa	4	3	34 Masai	1	1	+3	+2
39 Kenuzi Nubians	4	4	40 Teda	1	1	+3	+3
42 Riffians	4	2	41 Ahaggaren Tuareg	2	1	+2	+1
59 Wst Punjabi	4	4	60 Maria Gond	3	1	+1	+3
62 Santal	4	4	61 Toda	0	2	+4	+2
78 Nicobarese	4	2	77 Semang	1	1	+3	+1
83 Javanese	4	3	84 Balinese	3	1	+1	+2
85 Iban	4	2	86 Tawi-Tawi Badjau	1	1	+3	+1
148 Chiricahua	1	3	147 Comanche	0	2	+1	+1
158 Cuna	4	4	157 Talamanca	3	1	+1	+3
160 Haitians	4	3	159 Goajiro	1	2	+3	+1
163 Yanomamo	4	4	164 Barama Carib	2	2	+2	+2
170 Amacvuaha	4	4	169 Jivaro	3	1	+1	+3
171 Inca	4	2	172 Aymara	3	1	+1	+1
179 Shavante	2	4	180 Aweikoma	1	1	+1	+3
184 Araucanians	4	2	183 Abipon	0	1	+4	+1
More Agriculture	A	W	Less Agriculture	A	W	DA	DW
Boy Chooses Wife				Relatives Choose Wife			
43 Egyptians	4	3	44 Hebrews	3	4	+1	–1
66 Khalka Mongols	1	2	65 Kazak	0	4	+1	–2
70 Lakher	4	2	69 Garo	3	4	+1	–2

The correlation of .61, shown in Table 1, takes into account the magnitude of the difference scores. Among the 19 pairs of positive difference scores from 38 societies, for food from agriculture and for wife chosen by relatives, the difference score was 2 for 19 pair members (50 per cent) and 3 or higher for 12 pair members (32 per cent). Among the last three pairs of difference scores from six societies, which were positive for food from agriculture and negative for choice of wife by relatives, the difference score was 2 for two pair members (33 per cent) and higher for none.

Unusual attributes of the last three pairs of societies in Table 2 might have contributed to the unusual relationship between more food from agriculture and choice of spouse by family members. The recent Egyptians were more than 2,500 years later than the ancient Hebrews. The Khalka Mongols and Kazak both obtained a small proportion of food from agriculture. The Lakher tribe was much smaller and more isolated than the Garo tribe.

DISCUSSION

Correlations applied to differences between members of paired nearby societies have the same purpose as correlations applied to differences between matched pairs of individuals. Functional relationships between the correlated variables become more prominent when some of the differences between the paired societies or individuals are minimized.

Food obtained from agriculture might engender powerful and wealthy owners of agricultural land. Assisted land transport might augment the power and wealth of the owners of land. Choice of spouse by relatives instead of by the adolescent and low sexual freedom of adolescents might be consequences of more stringent control of adolescents by the owners of land. Less frequent corporal punishment of young children in agricultural societies might be enabled by more effective prevention of antagonistic behavior by young children. These are possible evolutionary linkages between more food from agriculture and the other customs.

In the United States of America, the Russian Federation, and other industrialized nations, the wife formerly was often chosen by relatives of her future husband. Now the wife is prevalently chosen by her future husband. The current custom is associated with recent industrialism of many agricultural countries, resulting in greater

individual freedom, more advanced education, and later age of marriage.

The industrialization and other changes in agricultural societies are insufficiently represented in the standard sample of 186 societies. The sample appears to contain only 11 modern industrialized countries. They are Russia, Egypt, Turkey, Ireland, Burma, Vietnam, Thailand, China, Korea, Japan, and Haiti. The focal community for each of the 11 nations is a small village instead of a city.

The evidence for evolutionary linkage of more food obtained from agriculture with other customs does not determine the causal direction. The evolutionary linkage might begin either with a shift to agriculture or with a shift to the other custom. Another possibility is simultaneous origin of both customs because they are compatible with each other

A disadvantage of analyzing differences between pair members is the smaller number of 93 pairs than of 186 individual societies. A more severe disadvantage is that analysis of differences between the pair members requires a different score on both customs. In Table 1, all of the correlations applied to differences between pair members are limited to 34 or fewer pairs, thereby 68 or fewer societies.

Information can be obtained on more than the 186 societies selected by Murdock and White (1969). The last book by Murdock (1981) contains information on 561 societies. The information on this larger sample of societies includes most but not all of the customs in the *Ethnographic Atlas* (Murdock 1967).

Differences between adjacent or nearby nations have been compared with separate scores of the same nations (Barry 2015). Quantitative scores on national dimensions of Individualism and Masculinity were reported by Hofstede (2001) on more than 60 nations. The correlations between the two dimensions were close to zero when applied to scores of separate nations but were highly positive when applied to differences between paired adjacent or nearby nations. Prevalent male dominance probably induces a positive correlation of individualism with masculinity, which was revealed by differences between adjacent or nearby nations.

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