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An Apologia of George Peter Murdock. Division of Labor by Gender and Postmarital Residence in Cross-Cultural Perspective: A Reconsideration

Andrey Korotayev
Center for Social Anthropology, Russian State University for the Humanities, Moscow, 125267, 6 Miusskaya ploshchad, Russia; korotayev@yahoo.com

First theories proposed to explain determinants of postmarital residence connected it with the division of labor by gender. However, at the moment all the cross-cultural tests of this hypothesis using worldwide samples have failed to find any significant relationship between these two variables. Our tests have shown that the female contribution to subsistence does correlate significantly with matrilocal residence in general; however, this correlation is hidden by general polygyny factor. Though the rise of female contribution to subsistence tends to lead to matrilocal residence, it also tends simultaneously to lead to general non-sororal polygyny, which effectively destroys matrilocality. This factor being controlled (e.g. through a multiple regression model) labor division turns out to be a significant predictor of postmarital residence. Thus, this paper shows that Murdock's hypotheses regarding the relationships between the labor division and postmarital residence were basically correct, though the actual relationships between those two groups of variables turn out to be more complicated than he expected.

1. A REVIEW OF THEORETICAL BACKGROUNDS AND PREVIOUS CROSS-CULTURAL TESTS

First theories proposed to explain determinants of postmarital residence connected it with the division of labor by gender. It was suggested that the high female contribution to subsistence favors matrilocal residence, roughly equal contribution by both sexes would tend to lead to intermediate residence forms, whereas "patrilocal residence seems to be [particularly] promoted by... any modification in the basic economy whereby masculine activities in the sex division of labor come to yield the principal means of subsistence" (Murdock 1949:206; see also e.g., Lippert 1931:237; Linton 1936:168–169; Eggan 1950:131; Service 1962:120–122, etc.).

The first substantive cross-cultural tests of this theory supported it (Driver 1956; Driver and Massey 1957). However, Driver and Massey used samples limited to aboriginal North America, whereas all the subsequent cross-cultural tests using worldwide samples failed to find the predicted correlation between division of labor and postmarital residence (White 1967; Hiatt 1970; Ember and Ember 1971; Divale 1974, 1975, 1984; see also Levinson and Malone 1980:105–108; Ember and Levinson 1991:85)[1]. On the other hand, no worldwide cross-cultural test has confirmed the existence of the predicted relationship, which seems to justify a recent bold statement by the Embers and Pasternak: "We find no relationship between contribution to subsistence and residence" (Pasternak, Ember, and Ember 1997:223).

2. NEW TESTS

To test the initial hypothesis I first used three sets of coded data on female contribution to subsistence (Barry and Schlegel 1982, 1986 [SCCS 1999, file STDS32.SAV]; Whyte 1985 [SCCS 1999, file STDS28.SAV]; and White 1986 [SCCS 1999, file STDS39.SAV]) for the Standard Cross-Cultural Sample (for its description see Murdock and White 1969). The data on residence were taken by me from Murdock and Wilson 1972, 1985 [SCCS 1999, file STDS03.SAV]).

I also used a five-point marital residence scale, which I constructed on the basis of *Ethnographic Atlas* data for the Standard Cross-Cultural Sample (Murdock 1985). It was done mainly along the lines suggested by Carol Ember (1975; Ember and Ember 1983:278) and runs as follows: –1.0 – patrilocal residence; –0.5 – patrilocal residence with matrilocal alternative, or neolocal residence with patrilocal alternative; 0– non-unilocal residence (bilocal, neolocal, no common residence); +0.5– matrilocal residence with patrilocal alternative, or neolocal residence with matrilocal alternative; +1.0 – matrilocal residence. There is only one major modification here in comparison with Carol Ember's scaling. I put neolocal residence with patrilocal alternative in one category with patrilocal residence with matrilocal alternative, whereas neolocal residence with matrilocal alternative was put in one category with matrilocal residence with patrilocal alternative. The reasoning behind this scaling looks as follows: I assigned a value of –1.0 to patrilocal residence, +1.0 to matrilocal residence, –0.5 to patrilocal alternative, and +0.5 to matrilocal alternative. Thus bilocal residence became 0 (–1+1=0), neolocality became 0 also (0+0=0); patrilocality with matrilocal alternative became –0.5 (–1+0.5=–0.5), neolocality with patrilocal alternative became –0.5 also (0–0.5=–0.5); matrilocality with patrilocal alternative became +0.5 (1–0.5=+0.5), neolocality with matrilocal alternative became +0.5 too (0+0.5=+0.5).

Using these datasets, I started with a retest of the overall correlation between the division of labor and residence. The results looked as follows (see Tables 1–3):

TABLE 1. Female Contribution to Subsistence * Patrilocal Residence (worldwide)

	Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	–0.11	–0.27	–0.05	–0.02
p (1-tailed)	0.1	0.01	0.23	0.42

TABLE 2. Female Contribution to Subsistence * Matrilocal Residence (worldwide)

	Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	+0.1	+0.17	+0.02	+0.08
p (1-tailed)	0.12	0.08	0.38	0.14

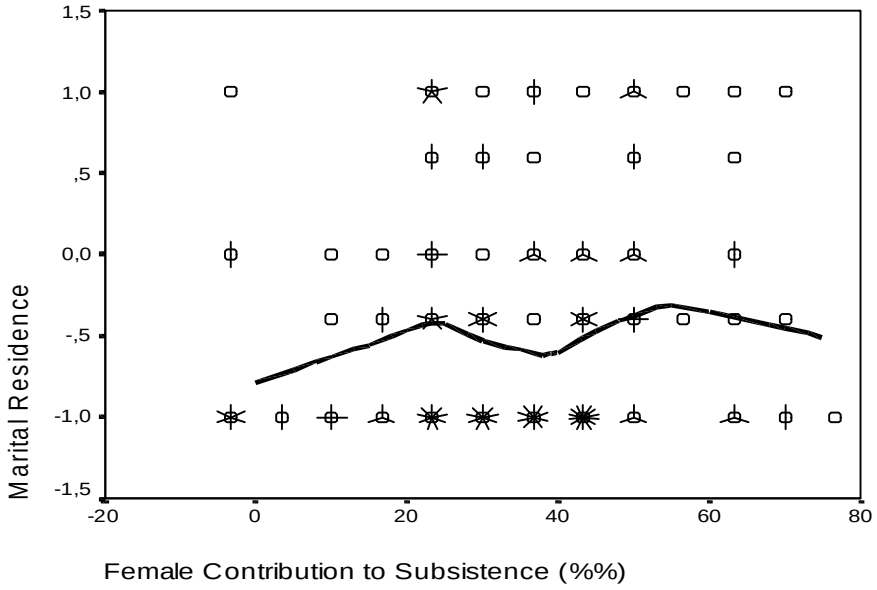
TABLE 3. Female Contribution to Subsistence * Marital Residence (5-point scale, worldwide)

	Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	+0.1	+0.36	+0.04	+0.11
p (1-tailed)	0.15	0.002	0.29	0.08

As we can see, most our tests were quite in line with previous findings. Though in all the tests the correlations are in the predicted (by the division of labor hypothesis) direction, they are mostly entirely insignificant. The only exception are tests with Whyte's data which showed a significant correlation between female contribution to subsistence and postmarital residence, in general, as well as with patrilocality in particular. Thus, finally, we have now at least two tests (yet, using one sample) finding a significant correlation between labor division and marital residence. However, I do not think that such results could affect seriously the conclusions of previous cross-cultural studies. With tests presented above the total number of cross-cultural tests of correlation between labor division and marital residence starts to exceed 20 which makes it necessary to recollect at this point the group chance risk problem. The point is that with such a total number of tests one begins dealing with a rather high probability of getting 1–2 significant correlations just by chance.

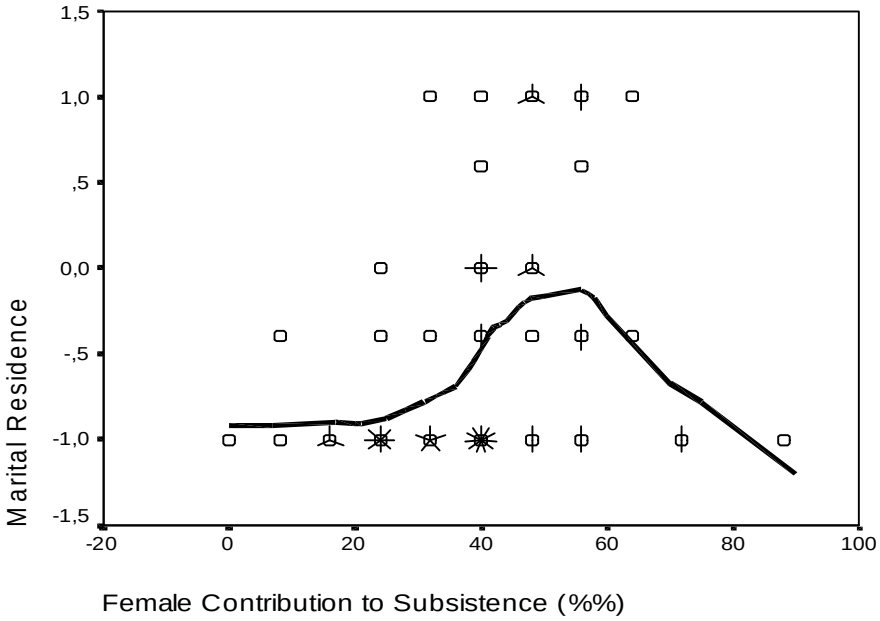
However, after that I decided to scatterplot the data. The results looked as follows (see Figure 1 and 2):

FIGURE 1. Marital Residence * Female Contribution to Subsistence (Murdock–White data for the Standard Cross-Cultural Sample; scatterplot with Lowess line)



–1 = *viri-/patrilocal*
–0.5 = *patrilocal with matrilocal alternative, or neolocal with patrilocal alternative*
0 = *bilocal/neolocal/no common residence*
+0.5 = *uxori-/matrilocal with patrilocal alternative, or neolocal with matrilocal alternative*
+1 = *uxori-/matrilocal*

FIGURE 2. Marital Residence * Female Contribution to Subsistence (Whyte's data for the Standard Cross-Cultural Sample; Scatterplot with Lowess line)



First of all, it is easy to see that in both cases we observe a marked trend from patrilocality to matrilocality with the growth of female contribution in the left part of the diagram. Note that the positive correlation in both cases is very strong. In the White–Murdock dataset for the range 1–22% Rho=+0.6, $p<0.001$. In Whyte's dataset for the range 10–31% Rho=+0.51, $p=0.02$. Incidentally, for the *Ethnographic Atlas* for the range 5–20% Rho=+0.4, $p=0.003$. Indeed, it looks that as soon as women start to contribute substantially to subsistence, this makes the transition to non-unilocal or matrilocal residence much more likely.

However, after female contribution reaches a certain threshold level, something happens. The correlation first disappears, and then becomes reversed! Note that for the right-hand parts of diagrams above we observe a significant negative correlation between female contribution and matrilocality.

In the White–Murdock dataset for the cultures with female contribution = 50% Rho=–0.35, $p=0.04$. In Whyte's dataset for the cultures with female contribution > 43% Rho=–0.37, $p=0.05$, for the cultures with female contribution > 57% Rho=–0.76, $p=0.02$. This negative correlation is quite salient in Barry and Schlegel's data (for the range 55–78% Rho=–0.77, $p=0.003$. Also in the *Ethnographic Atlas* the cultures with female contribution > 70% are significantly more likely to be patrilocal than the ones with female contribution 50–70% (Gamma=–1.0, $p=0.05$).

Thus, what could look at the first glance as an insignificant positive correlation between female contribution to subsistence and matrilocality starts looking like a significant curvilinear relationship. But what could account for the fact that after a certain threshold level the female contribution to subsistence stops to be correlated significantly with matrilocality, whereas with further growth of this contribution a negative correlation appears? Of course, against this background it seems reasonable to look for a determinant of patrilocality/non-matrilocality whose value would grow with the growth of female contribution to subsistence, gradually neutralizing and reversing the matrilocal trend.

Of course, one possible candidate is internal warfare. One may *e.g.* hypothesize that the growth of female contribution to subsistence would give men more spare time to get engaged in warfare activities, whereas as has been shown by Ember and Ember, the internal warfare is a major factor of patrilocality (Ember and Ember 1971; see also 1983:151–197).

However, internal warfare does not appear at all to be significantly correlated with the female contribution to subsistence (see Tables 4 and 5 and Figure 3):

TABLE 4. Female Contribution to Subsistence * Internal Warfare (worldwide)

	Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	+0.09	+0.09	+0.12	+0.12
p (1-tailed)	0.15	0.25	0.07	0.07

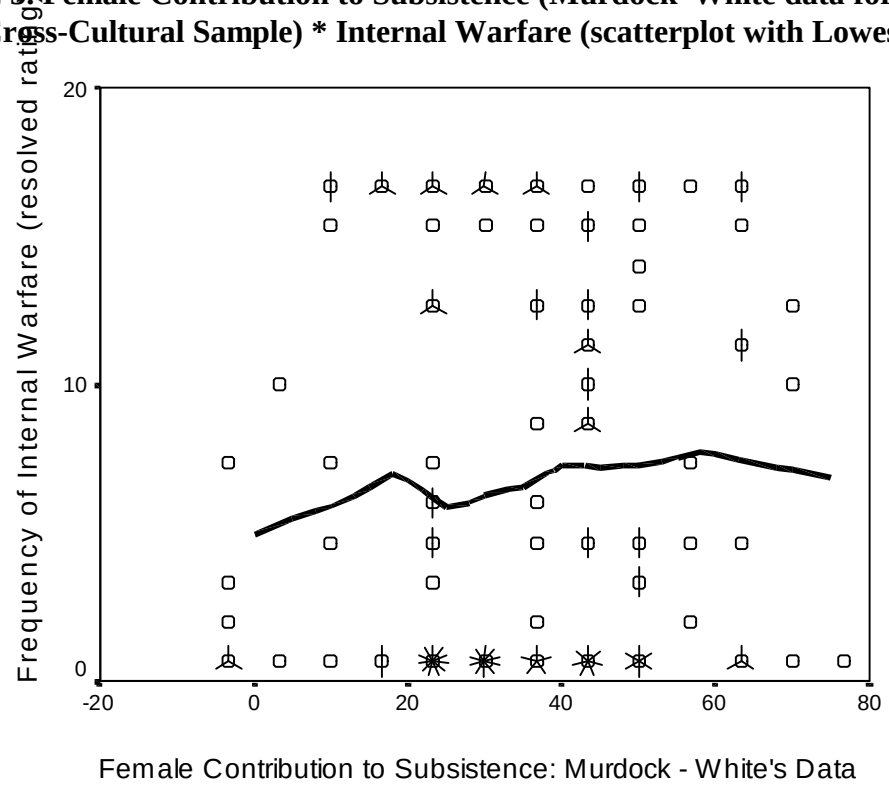
NOTE: The data on internal warfare are from Ember and Ember 1992b [SCCS, 1999, file STDS78.SAV, V1649].

TABLE 5. Female Contribution to Subsistence * Internal Warfare (cases with the highest reliability ratings only, worldwide)

	Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	+0.08	+0.22	+0.18	+0.18
p (1-tailed)	0.28	0.13	0.07	0.07

NOTE: The data on reliability ratings are from Ember and Ember 1992b [SCCS, 1999, file STDS78.SAV, V1652].

FIGURE 3. Female Contribution to Subsistence (Murdock–White data for the Standard Cross-Cultural Sample) * Internal Warfare (scatterplot with Lowess line)



Yet, there appears to be another (and much more likely) candidate. This is just general non-sororal polygyny. The general reasoning here would look as follows.

Though the growth of female contribution to subsistence tends to lead matrilocal residence, it

at the same time makes polygyny more and more attractive for men. An average intensive plow agriculturalist in a culture with a very low female contribution to subsistence would never even consider seriously the possibility of having five wives (as he would not simply be able to feed all of them [together with their children]). Yet, this would not constitute a serious problem for a hoe horticulturalist within a culture with a very high female contribution to subsistence. The former, acquiring 5 wives gets first of all 5 mouths which he will have to feed; whereas the latter, getting 5 wives, first of all acquires 10 hands which may feed the horticulturalist himself. Hence, it is hardly surprising that a considerable number of previous cross-cultural tests have shown that there is a significant positive correlation between female contribution to subsistence and polygyny (Heath 1958; Osmond 1965; Lee 1979; Burton and Reitz 1981; Schlegel and Barry 1986; White, Burton and Dow 1981; White and Burton 1988; Low 1988).[3]

If general polygyny develops in sororal form, it can well be quite compatible with matrilocal residence. However, it does not appear to solve completely the problem of maximization of wife number for many men. A woman may not have sisters at all, and number of sisters is limited in any case. Hence, with a very high female contribution to subsistence any more or less influential and wealthy male would be inclined to prefer non-sororal polygyny to the sororal form. Hence, it is not surprising that sororal polygyny is associated with the female contribution to subsistence much less significantly than the non-sororal one (see Tables 6 and 7 and Figures 10 and 11).

TABLE 6. Female Contribution to Subsistence * General Non-Sororal Polygyny *(*worldwide*;* for *Ethnographic Atlas* cultures*)*

Female Contribution to Subsistence	*General Non-Sororal Polygyny*		*Total*
	0 absent	1 present	
1 (extremely low, <10%)	**39** *95.1%*	**2** *4.9%*	41 100.0%
2 (low, [10-25[%)	**86** *76.1%*	**27** *23.9%*	113 100.0%
3 (medium, [25-40[%)	**141** *70.5%*	**59** *29.5%*	200 100.0%
4 (high, [40-65]%)	**162** *60.4%*	**106** *39.6%*	268 100.0%
5 (very high, >65%)	**6** *50.0%*	**6** *50.0%*	12 100.0%
Total	434 68.5%	200 31.5%	634 100.0%

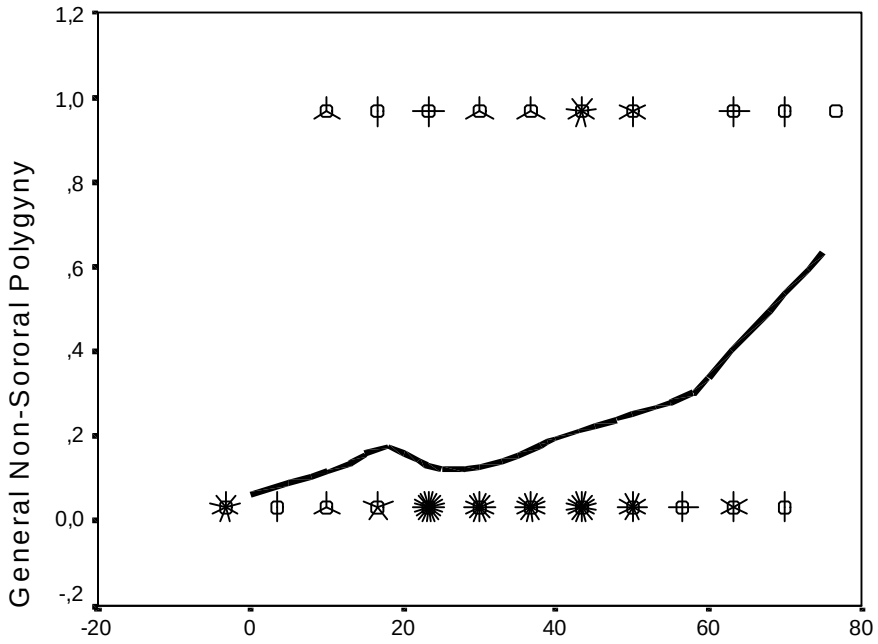
NOTE: Rho=+0.2; p=0.0000003, one tail; Gamma=+0.33; p=0.000001

TABLE 7. Female Contribution to Subsistence * General Sororal Polygyny (worldwide; for *Ethnographic Atlas* cultures)

Female Contribution to Subsistence	*General Sororal Polygyny*		*Total*
	0 absent	1 present	
1 (extremely low, <10%)	**38** *92.7%*	**3** *7.3%*	41 100.0%
2 (low, [10-25[%)	**98** *86.7%*	**15** *13.3%*	113 100.0%
3 (medium, [25-40[%)	**183** *91.5%*	**17** *8.5%*	200 100.0%
4 (high, [40-65]%)	**244** *91.0%*	**24** *9.0%*	268 100.0%
5 (very high, >65%)	**10** *82.3%*	**2** *16.7%*	12 100.0%
Total	573 90.4%	61 9.6%	634 100.0%

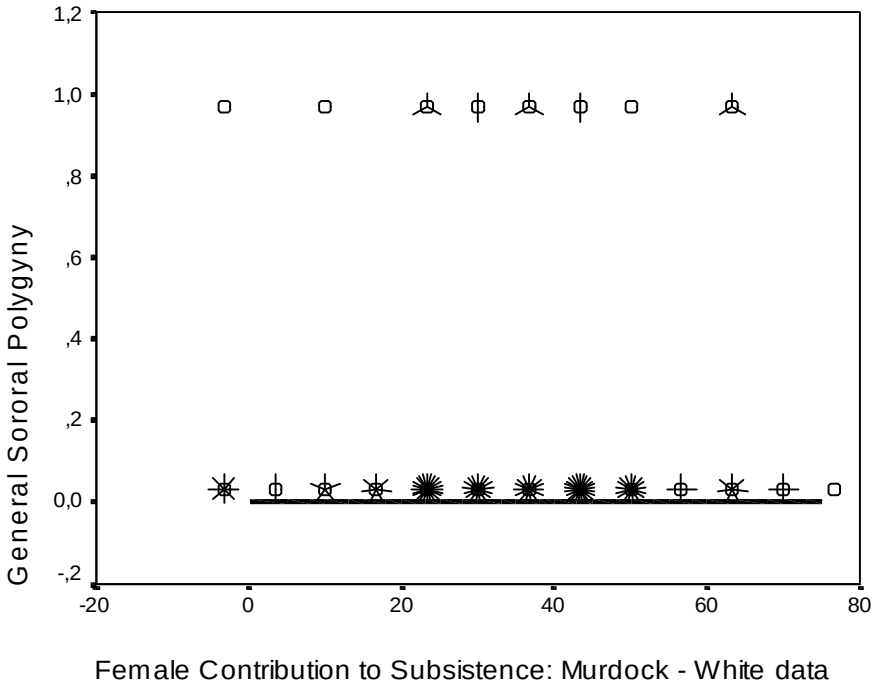
NOTE: Rho=–0.02; p=0.34, one tail; Gamma=–0.04; p=0.69

FIGURE 4. Female Contribution to Subsistence (Murdock–White data for the Standard Cross-Cultural Sample) * General Non-Sororal Polygyny (scatterplot with Lowess line)



NOTE: Rho=+0.2; p=0.01, one tail; Gamma=+0.25; p=0.03
For cultures with female contribution = 55%: Rho=+0.39;
p=0.05, one tail; Gamma=+0.59; p=0.05

FIGURE 5. Female Contribution to Subsistence (Murdock–White data for the Standard Cross-Cultural Sample) * General Sororal Polygyny (scatterplot with Lowess line)



NOTE: Rho=+0.01; p=0.44, one tail; Gamma=+0.02; p=0.89

On the other hand, the general polygyny (and especially the general non-sororal polygyny) turns out to be associated positively with patrilocality and negatively with matrilocality (see Tables 8–15):

TABLE 8. General Polygyny * Patrilocality (Standard Cross-Cultural Sample)

Viri-/Patrilocal Residence	*General Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**53** *41.4%*	**14** *24.6%*	67
1 (present)	**75** *58.6%*	**43** *75.4%*	118
Total	128 *100.0%*	57 *100.0%*	185

NOTE: p=0.02, one tail, by Fisher's Exact Test; Gamma=+0.37; p=0.02. The data are from Murdock and Wilson 1972, 1985 [SCCS 1999, file STDS03.SAV].

TABLE 9. General Non-Sororal Polygyny * Patrilocality (Standard Cross-Cultural Sample)

Viri-/Patrilocal Residence	*General Non-Sororal Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**59** *43.4%*	**8** *16.7%*	67
1 (present)	**77** *56.6%*	**40** *75.4%*	117
Total	136 *100.0%*	48 *100.0%*	184

NOTE: p=0.001, one tail, by Fisher's Exact Test; Gamma=+0.59; p=0.0004. The data on postmarital residence are from Murdock and Wilson 1972, 1985 [SCCS 1999, file STDS03.SAV]. The data on non-sororal polygyny are from Murdock, 1985, [SCCS 1999, file STDS09.SAV].

TABLE 10. General Polygyny * Matrilocality (Standard Cross-Cultural Sample)

Uxori-/Matrilocal Residence	*General Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**97** *75.8%*	**50** *87.7%*	147
1 (present)	**31** *24.2%*	**7** *12.3%*	38
Total	128 *100.0%*	57 *100.0%*	185

NOTE: p=0.045, one tail, by Fisher's Exact Test; Gamma=–0.39; p=0.04. The data are from Murdock and Wilson 1972, 1985 [SCCS 1999, file STDS03.SAV].

TABLE 11. General Non-Sororal Polygyny * Matrilocality (Standard Cross-Cultural Sample)

Uxori-/Matrilocal Residence	*General Non-Sororal Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**100** *73.5%*	**46** *95.8%*	146
1 (present)	**36** *26.5%*	**2** *4.2%*	38
Total	136 *100.0%*	48 *100.0%*	184

NOTE: p=0.0004, one tail, by Fisher's Exact Test; Gamma=–0.78; p=0.00001. The data on postmarital residence are from Murdock and Wilson 1972, 1985 [SCCS 1999, file STDS03.SAV]. The data on non-sororal polygyny are from Murdock, 1985 [SCCS 1999, file STDS09.SAV].

TABLE 12. General Polygyny * Patrilocality (*Ethnographic Atlas*)

Viri-/Patrilocal Residence	*General Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**168** *37.8%*	**99** *17.0%*	267
1 (present)	**277** *62.2%*	**483** *83.0%*	760
Total	445 *100.0%*	582 *100.0%*	1027

NOTE: p=0.000000000000006, one tail, by Fisher's Exact Test; Gamma=+0.49; p<0.00000000000000001. The data are from Murdock 1967; Murdock *et al.* 1986, 1990, 1999–2000.

TABLE 13. General Non-Sororal Polygyny * Patrilocality (*Ethnographic Atlas*)

Viri-/Patrilocal Residence	*General Non-Sororal Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**296** *41.2%*	**62** *12.5%*	358
1 (present)	**422** *58.8%*	**434** *87.5%*	856
Total	718 *100.0%*	496 *100.0%*	1214

NOTE: p<0.00000000000000001, one tail, by Fisher's Exact Test; Gamma=+0.66; p<0.00000000000000001. The data are from Murdock 1967; Murdock *et al.* 1986, 1990, 1999–2000.

TABLE 14. General Polygyny * Matrilocality (*Ethnographic Atlas*)

Uxori-/Matrilocal Residence	*General Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**351** *78.9%*	**517** *88.8%*	868
1 (present)	**94** *21.1%*	**65** *11.2%*	159
Total	445 *100.0%*	582 *100.0%*	1027

NOTE: p=0.00001, one tail, by Fisher's Exact Test; Gamma=–0.36; p=0.00002. The data are from Murdock 1967; Murdock *et al.* 1986, 1990, 1999–2000.

TABLE 15. General Non-Sororal Polygyny * Matrilocality (*Ethnographic Atlas*)

Uxori-/Matrilocal Residence	*General Non-Sororal Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**561** *78.1%*	**456** *91.9%*	1017
1 (present)	**157** *21.9%*	**40** *8.1%*	197
Total	718 *100.0%*	496 *100.0%*	1214

NOTE: p=0.00000000003, one tail, by Fisher's Exact Test; Gamma=–0.52; p<0.00000000000000001. The data are from Murdock 1967; Murdock *et al.* 1986, 1990, 1999–2000.

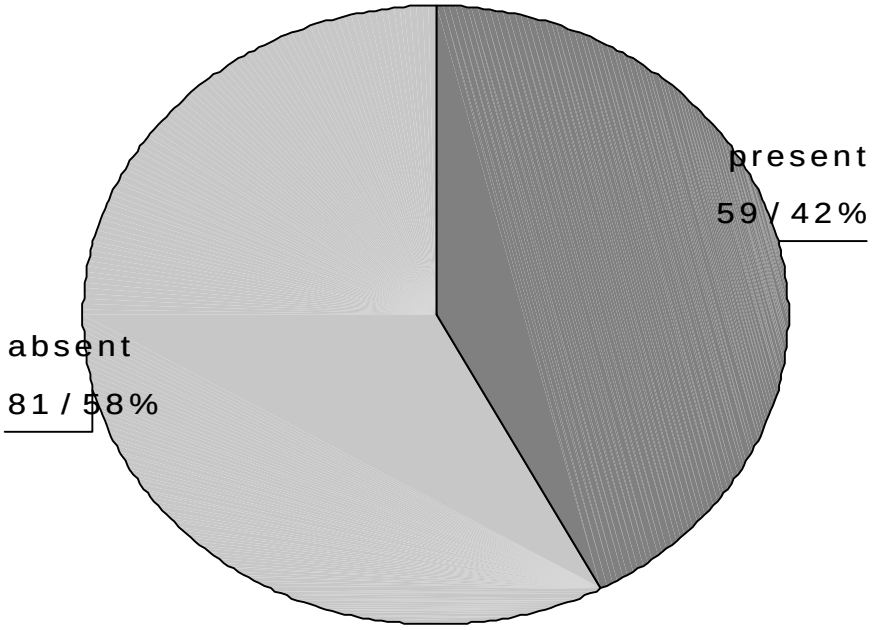
This was already Murdock (1949) who noticed the negative association between non-sororal polygyny and matrilocality, on the one hand, and the positive relationship between polygyny and patrilocality, on the other hand:

> Polygyny... is practically impossible, except in the sororal form, under matrilocal residence. It is, however, particularly congenial to patrilocal residence, where women are isolated from their kinsmen and tend to be economically and socially inferior to men. Hence, anything that favors polygyny likewise favors the development of patrilocal residence (Murdock 1949:206).

Note that Murdock above speaks about association between the two variables, and not a causal link. This is the way he also appears to have been understood by other cross-culturalists. For example, Burton and White maintain that "Murdock [1949] emphasized the importance of warfare, slavery and capture of women in explaining both polygyny and patrilocal residence" (Burton and White 1987:154).

But could not the growing general non-sororal polygyny cause the transition from matrilocal to patrilocal residence? On the one hand, the growth of general non-sororal polygyny in matrilocal society implies at least partial destruction of matrilocality just by definition. If an average number of wives per husband exceeds 2 (and such cases are well known [see e.g. Thomas 1910:15]), the marriage will stop being matrilocal for at least half of the women. On the other hand, note that a very substantial proportion of matrilocal cultures have patrilocality as a frequent alternative residence pattern (see Figure 12):

FIGURE 6. Patrilocality as a Frequent Alternative Residence Pattern among Matrilocal Cultures of the *Ethnographic Atlas*



In the rest of matrilocal societies, it is an infrequent (but still real) alternative. This is extremely rare when in the matrilocal societies patrilocality is never practiced by anyone under any possible conditions.

As non-sororal polygyny is incompatible with matrilocal residence, but perfectly compatible with patrilocal one, one would expect that against the background of growing non-sororal polygyny the men intending to establish finally a non-sororal polygynous household (first of all, of course the members of social elites among whom this is more likely to be a norm than among the commoners) would tend to opt for patrilocal rather than matrilocal residence. Incidentally, it is remarkable that in the matrilocal societies with patrilocal alternative and at least occasional non-sororal polygyny these are elite families (which unlike the commoner household are almost always polygynous) that would tend to have patrilocal residence (see *e.g.* Divale 1974:83; Butinov 1985). However, with the transformation of occasional non-sororal polygyny into general one the commoners would start opting for patrilocal residence too. Thus, the growth of general non-sororal polygyny would tend to destroy matrilocality.

Note, that though in the passage cited above Murdock does not imply the causal link between the general non-sororal polygyny and patrilocality (and he was understood this way by some other cross-culturalists), elsewhere he describes the mechanism through which the transition to the general non-sororal polygyny could cause just the transition from matrilocality to patrilocality; actually, as we shall see soon, he considers the general non-sororal polygyny as the main factor causing the transition from matrilocality to patrilocality (though he does not

appear to have noticed that this would complicate the interrelation between the female contribution and residence):

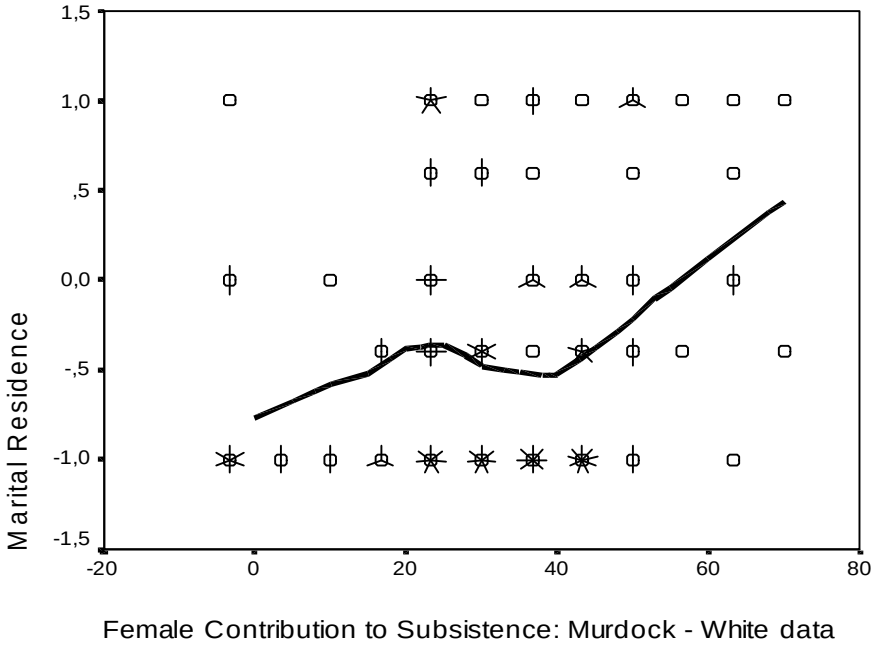
> We are now in a position to examine the exact mechanics by which a transition to the patrilineate occurs in a previously matrilocal and matrilineal community. For demonstrative purposes, we may conceive of such a community as a small settlement containing two matri-clans, each localized on one side of the main village thoroughfare. Before a change takes place, a man simply moves across the street when he marries, and settles in a hut belonging to his wife. He carries on all his economic activities in the same environing territory as before his marriage, and his closest relatives live just over the way, where he can visit them at any time and cooperate with them in the ways to which he became accustomed as a bachelor.
>
> Let it be assumed that there now appears some factor that places a premium upon patrilocal residence–perhaps the introduction of cattle, or slaves, or shell money, accompanied by the idea that personal prestige can be enhanced through polygyny. One man after another, as he acquires wealth, is able to persuade other men to allow their daughters to remove to his home in marriage in return for the payment of a bride-price, and one man after another begins to leave some of his property to his own sons instead of bequeathing it all to his sisters' sons. Bit by bit, ties with patrilineal kinsmen are strengthened, while those with matrilineal relatives undergo a diminution in importance. Interpersonal relationships are readjusted gradually, naturally, and without strain.
>
> Almost before the population of the village realizes that anything particularly significant has happened, they discover that the houses on one side of the street are now occupied by patrilineally related males with their wives and children, and that a similar group lives across the way. Patrilocal residence has become firmly established, patrilineal inheritance is accepted, and the former matri-clans have been transformed into incipient patri-clans (Murdock 1949:216).

If our (*i.e.* Murdock's and mine) suggestion is correct, one would expect that if we control for the general non-sororal polygyny factor the positive correlation between the female contribution to subsistence and matrilocality will resurface throughout the worldwide cross-cultural samples. And indeed, if we drop the general non-sororal polygyny cases, the correlation between labor division and postmarital residence becomes significant in most samples (see Table 16 and Figure 7):

TABLE 16. Female Contribution to Subsistence * Marital Residence (5-point scale, worldwide; for cultures without general non-sororal polygyny)

	Ethno-graphic Atlas	Standard Cross-Cultural Sample			
		Murdock – White	*Whyte*	*Barry & Schlegel*	*Average of Three Scores*
Rho	+ 0.11	+ 0.18	+ 0.42	+ 0.12	+ 0.21
p (1-tailed)	0.01	0.03	0.001	0.08	0.01

FIGURE 7. Marital Residence * Female Contribution to Subsistence (Murdock–White data for the Standard Cross-Cultural Sample societies without general non-sororal polygyny; scatterplot with Lowess line)



NOTE: Rho=+0.2; p=0.03, one tail; for cultures with female contribution = 45%: Rho=+0.46; p=0.015, one tail

Hence, one of the possible preliminary conclusions is that if the growth of female contribution to subsistence is not accompanied by the development of general non-sororal polygyny, it does tend to lead to a trend from patrilocality to matrilocality.

Finally, I decided to test this hypothesis with multiple regression models. A methodological problem here is that such an analysis requires interval level data, whereas we are dealing here with ordinal level ones. However, Labowitz (1967, 1970) and Ember and Ember (1998:680; 2001:125) suggest that "statistical tests designed for interval-level data may be used with ordinal data when the number of ordered scale scores isn't very small". Actually, the Embers have already set precedents of using multiple regression analysis when dependent variables had five or more ordinal scale scores (1992a, 1994). Our main dependent variable (marital residence) has, fortunately, just five scale scores.

Predictably, for a bivariate regression models for Postmarital Residence *vs.* Labor Division the association between the two variables turns out to be totally insignificant (see Tables 17 and 18):

TABLE 17. Regression 1, Dependant Variable Marital Residence (for *Ethnographic Atlas*)

Independent Variables	Standardized Beta Coefficient	p
Female Contribution to Subsistence	+ 0.04	0.38

TABLE 18. Regression 2, Dependant Variable Marital Residence (for Standard Cross-Cultural Sample)

Independent Variables	Standardized Beta Coefficient	p
Female Contribution to Subsistence, Average of Three Scores	+ 0.1	0.2

However, as soon as we add to the regression models the General Non-Sororal Polygyny Factor, the association between the labor division and postmarital residence turns out to be significant (and in the predicted direction, see Tables 19 and 20):

TABLE 19. Regression 3, Dependant Variable Marital Residence (for *Ethnographic Atlas*)

Independent Variables	Standardized Beta Coefficient	p
General Non-Sororal Polygyny	– 0.34	< 0.001
Female Contribution to Subsistence	+ 0.1	0.02

TABLE 20. Regression 3, Dependant Variable Marital Residence (for Standard Cross-Cultural Sample)

Independent Variables	Standardized Beta Coefficient	p
General Non-Sororal Polygyny	– 0.31	< 0.001
Female Contribution to Subsistence, Average of Three Scores	+ 0.16	0.03

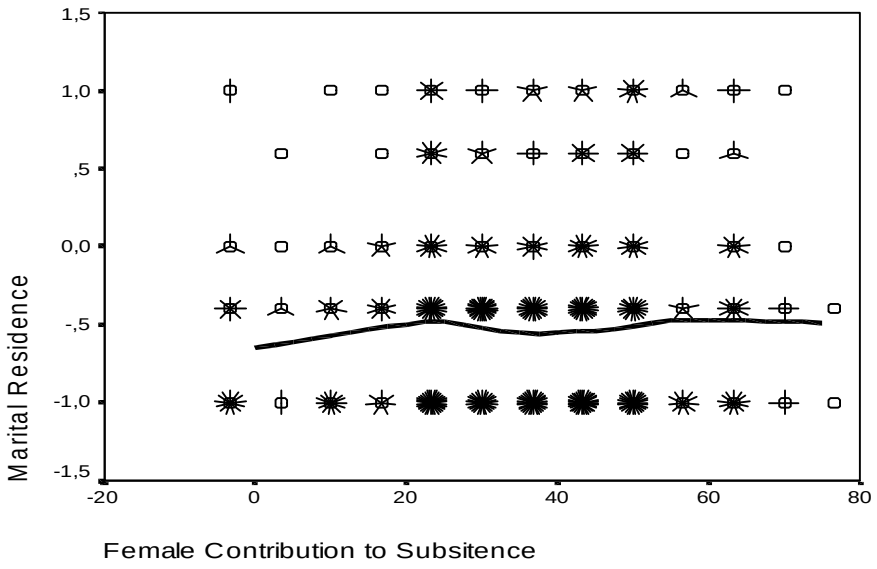
3. DISCUSSION

Thus, finally, unlike our predecessors we DO FIND a significant association between the labor division and postmarital residence (hidden, however, behind the general non-sororal polygyny factor).

Note that the general non-sororal polygyny factor may help to explain an apparent paradox already mentioned above: though all the previous attempts to find a significant correlation between labor division and postmarital residence failed, all such attempts with respect to aboriginal North American samples were successful. I tried to replicate this result with *Ethnographic Atlas* samples and, indeed, the previous results were completely replicated:

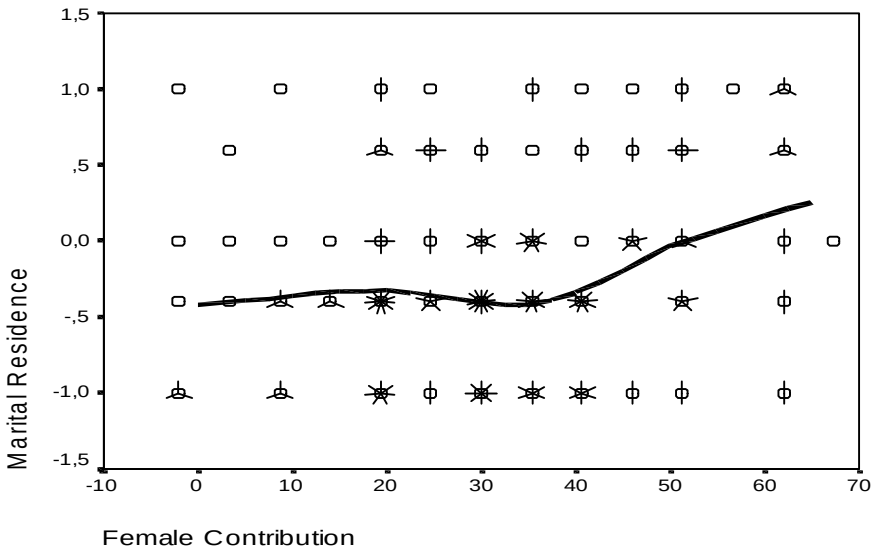
though the correlation between the two variables for the worldwide sample is insignificant (see Figure 8) it is definitely significant for the native North American sample (see Figure 9):

FIGURE 8. Marital Residence * Female Contribution to Subsistence (for the *Ethnographic Atlas*, worldwide; scatterplot with Lowess line)



NOTE: Rho=+0.007; p=0.43, one tail; Gamma=+0.006; p=0.86

FIGURE 9. Marital Residence * Female Contribution to Subsistence (for the *Ethnographic Atlas*, Native North America; scatterplot with Lowess line)



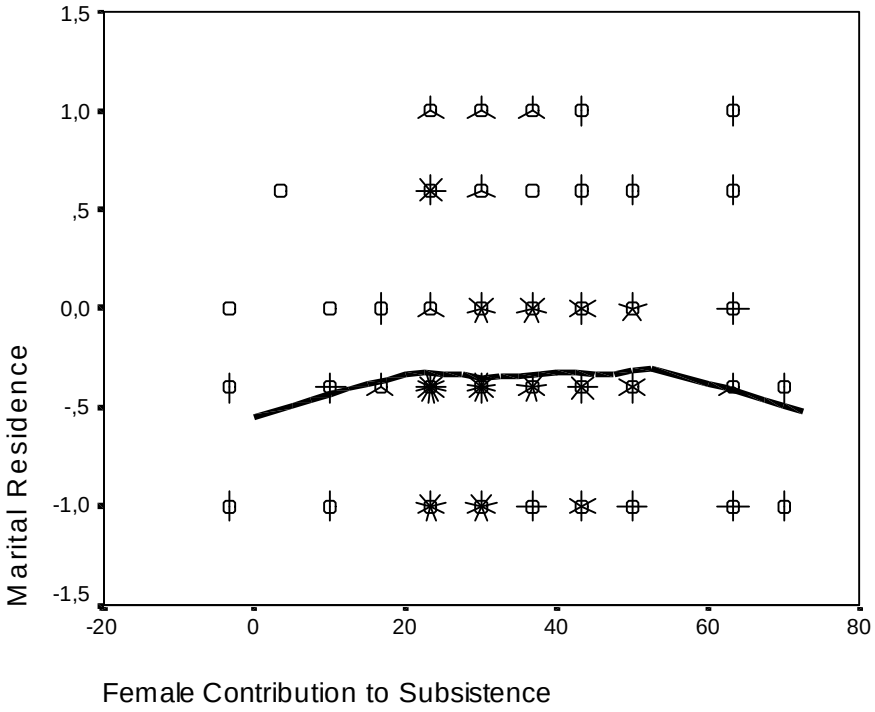
NOTE: Rho=+0.17; p=0.01, one tail

C. Ember (1975) explained this paradox in the following way: in the ethnographic record

most native North American societies are hunter-gatherers (and native North America is an exceptional ethnographic mega-region in this respect). Ember finds a significant correlation between labor division and postmarital residence just among the hunter-gatherers. And, according to her, it is this, which accounts for a significant correlation between the two variables among native North American cultures (Ember 1975:202).

However, I have failed to find a significant correlation between the two variables for the *Ethnographic Atlas* hunter-gatherers in the predicted direction (see Figure 16). If anything, there is a significant CURVILINEAL relationship.

FIGURE 10. Marital Residence * Female Contribution to Subsistence (for the *Ethnographic Atlas*, worldwide, hunter-gatherers [food production <15%]; scatterplot with Lowess line)



NOTE: Rho=+0.02; p=0.38, one tail; for cultures with female contribution <25%: Rho=+0.29; p=0.02, one tail; for cultures with female contribution = 60%: Rho=–0.45; p=0.03, one tail; Gamma=–0.63; p=0.009

Thus, this factor cannot explain the significant correlation (in the predicted direction) between the two variables for the *Ethnographic Atlas* native North American cultures.

However, this apparent paradox disappears entirely as soon as we take into consideration the general non-sororal polygyny factor. Indeed, unlike in the rest of the world the general polygyny developed in North America mainly in sororal form (which does not destroy matrilocality [actually, it is positively associated with matrilocality, see Table 21]), see Figures 11 and 12:

TABLE 21. General Sororal Polygyny * Matrilocality (*Ethnographic Atlas*)

Uxori-/Matrilocal Residence	*General Sororal Polygyny*		Total
	0 (absent)	1 (present)	
0 (absent)	**956** *84.8%*	**61** *70.9%*	1017
1 (present)	**172** *15.2%*	**25** *29.1%*	197
Total	1128 *100.0%*	86 *100.0%*	1214

NOTE: p=0.001, one tail, by Fisher's Exact Test; Gamma=+0.39; p=0.008. The data are from Murdock 1967; Murdock *et al.* 1986, 1990, 1999–2000.

FIGURE 11. Forms of General Polygyny among the Native North American Cultures of the *Ethnographic Atlas*

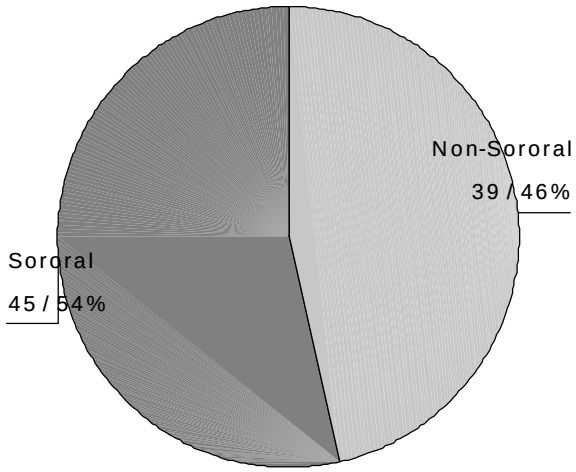
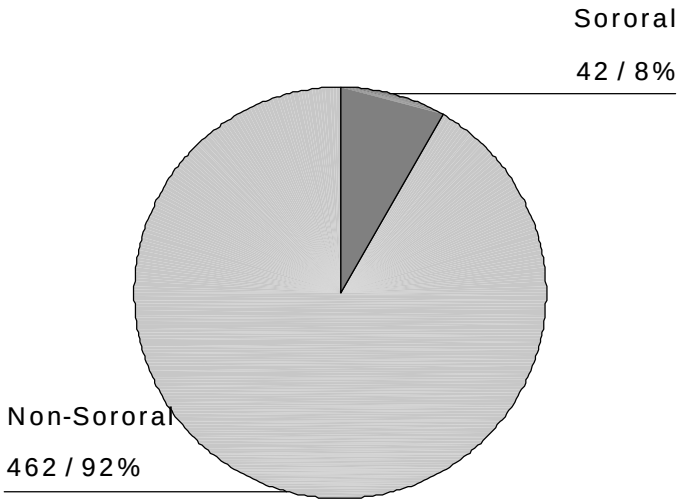


FIGURE 12. Forms of General Polygyny among the Rest of the World Cultures of the *Ethnographic Atlas*



Hence, we may say that for the Native North America the general non-sororal polygyny factor was actually controlled in a natural way (*i.e.*, not artificially). That is why the fact that we find a significant correlation between labor division and postmarital residence does not appear surprising at all.

Note also that cultures with extremely high female contribution to subsistence in the North American subsample are much less frequent than in the rest of the world, *i.e.*, just that part of the range where we observe a negative correlation between female contribution to subsistence and matrilocality is represented in the North American subsample much less prominently than in the rest of the world (see Table 32):

TABLE 22. Native North America *vs.* the Rest of the World * Female Contribution to Subsistence (for *Ethnographic Atlas* cultures)

Female Contribution to Subsistence	0 **Rest of the World**	1 **Native North America**	Total
1 (extremely low, <10%)	**30** **6.6%**	**11** **6.1%**	41 6.4%
2 (low, [10-25[%)	**65** **14.2%**	**50** **27.6%**	115 18.0%
3 (medium, [25-40[%)	**142** **31.0%**	**61** **33.7%**	203 31.8%
4 (high, [40-65]%)	**209** **45.6%**	**59** **32.6%**	268 41.9%
5 (very high, >65%)	**12** **2.6%**		12 1.9%
Total	458 100.0%	181 100.0%	639 100.0%

NOTE: Rho=–0.16; $p<0.001$, one tail; Gamma=–0.27; $p<0.001$

This might have contributed to the underdevelopment of the general non-sororal polygyny in native North America, though I think that the prevalence of general sororal polygyny over non-sororal one cannot be explained here without taking into consideration network autocorrelation ("Galton") effects.

And one more final remark. Murdock suggested that roughly equal contributions by both sexes to subsistence must be associated with the non-unilocal residence (Murdock, 1949:203–205). Some scatterplots above (see Figures 1, 2, 7, 8, 9 and 10) suggest that he might not have been entirely wrong at this point either.

Indeed, our tests have shown that the ambilocal (rather than patri- or matrilocal) residence is significantly more likely to develop if both sexes make a more or less substantial contributions to subsistence (see Table 36):

TABLE 36 Female Contribution to Subsistence * Patri-/Matrilocal Residence *vs.* Ambilocal Residence (worldwide; *Ethnographic Atlas* data; dichotomized)

	Female Contribution Extremes (<10% | >60%)		Total
Postmarital Residence	0 (absent)	1 (present)	
0 (ambilocal)	**169** *30.0%*	**13** *18.6%*	182 *28.8%*
1 (patri-/matrilocal)	**394** *70.0%*	**57** *81.4%*	451 *71.2%*
Total	563 *100.0%*	70 *100.0%*	633 *100.0%*

NOTE: Gamma=–0.5; $p=0.03$

4. CONCLUSIONS

Hence, most of Murdock's suggestions regarding the relationships between labor division and postmarital residence turn out to be basically correct. There seems to be only one major flaw in his reasoning. Murdock noticed that female contribution to subsistence predicted matrilocality, he also noticed that general non-sororal polygyny predicted non-matrilocal residence. However, he does not appear to have taken into consideration the fact that the female contribution to subsistence is significantly correlated with the general non-sororal polygyny, from which one would have to assume that any straightforward tests of correlation between female contribution to subsistence and matrilocality would yield insignificant results unless general non-sororal polygyny factor is controlled in some way.

5. NOTES

1. However, three of these studies confirmed the existence of the predicted relationship between division of labor and residence for Native North American cultures (White 1967; Ember and Ember 1971; Divale 1974).

2. As the summary data on female contribution are not published there, I had to calculate them myself using the data on the division of labor in main subsistence spheres and the contribution of these spheres to the overall diet using the calculation scheme suggested by Ember and Ember (1971; 1983:153-154).

3. As in the ethnographic record societies with high female contribution to subsistence were normally characterized by a rather high level of warfare frequency and intensity, the problem of getting more than one wife was usually facilitated by skewed sex ratio. In addition, a differential marriage age normally developed within such a context (girls get married immediately after puberty, whereas males often can only marry after getting a full social status which may take place e.g., well after the age of 30).

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