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SI 15.11. Older women married to younger men. survxmarroldfem

SI 15.12. Marriage and RS. Bateman gradients? RSxpctmarr discn

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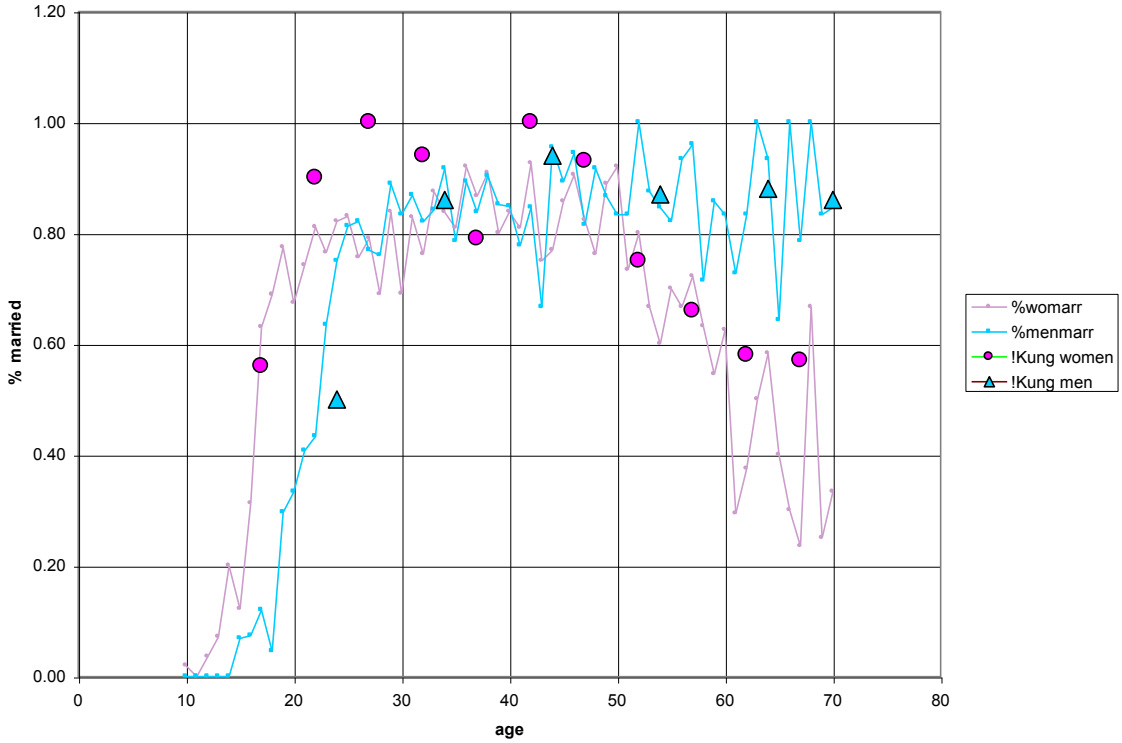
SI 15.13. Relatedness to spouse kinship
SI 15.14. Marriage and survival longevityxmarr
SI 15.15. Dead husband's brother – Levirate? levirate

15.1. !Kung marital status x age vs Hadza. Tables for text figure 15.1

SI figure 15.1.1. Household censuses. Age pattern of proportion of Hadza men and women married with data points for !Kung from Howell (1979 Tables 12.1 and 12.2). Y axis is fraction married, not percent.



SI table 15.1.1. Data for text figure 15.1. Numbers of people of each age who were listed in our household censuses as single or as a married.

	Women		Men				
age	Married	Single	Married	Single	Age	%wom	%men
10	1	50	0	26	10	0.02	0.00
11	0	36	0	31	11	0.00	0.00
12	1	27	0	27	12	0.04	0.00
13	2	26	0	25	13	0.07	0.00
14	6	24	0	27	14	0.20	0.00
15	5	36	2	27	15	0.12	0.07
16	10	22	2	25	16	0.31	0.07
17	29	17	3	22	17	0.63	0.12
18	31	14	1	21	18	0.69	0.05
19	24	7	8	19	19	0.77	0.30

	Women		Men				
age	Married	Single	Married	Single	Age	%wom	%men
20	31	15	10	20	20	0.67	0.33
21	23	8	11	16	21	0.74	0.41
22	30	7	13	17	22	0.81	0.43
23	26	8	26	15	23	0.76	0.63
24	23	5	21	7	24	0.82	0.75
25	49	10	26	6	25	0.83	0.81
26	31	10	23	5	26	0.76	0.82
27	34	9	30	9	27	0.79	0.77
28	20	9	19	6	28	0.69	0.76
29	26	5	24	3	29	0.84	0.89
30	29	13	25	5	30	0.69	0.83
31	29	6	33	5	31	0.83	0.87
32	32	10	32	7	32	0.76	0.82
33	35	5	32	6	33	0.88	0.84
34	31	6	22	2	34	0.84	0.92
35	34	8	22	6	35	0.81	0.79
36	23	2	25	3	36	0.92	0.89
37	26	4	31	6	37	0.87	0.84
38	30	3	28	3	38	0.91	0.90
39	12	3	23	4	39	0.80	0.85
40	26	5	28	5	40	0.84	0.85
41	17	4	14	4	41	0.81	0.78
42	25	2	22	4	42	0.93	0.85
43	15	5	12	6	43	0.75	0.67
44	10	3	21	1	44	0.77	0.95
45	18	3	25	3	45	0.86	0.89
46	19	2	17	1	46	0.90	0.94
47	14	3	22	5	47	0.82	0.81
48	16	5	11	1	48	0.76	0.92
49	8	1	13	2	49	0.89	0.87
50	23	2	20	4	50	0.92	0.83
51	11	4	10	2	51	0.73	0.83
52	16	4	20	0	52	0.80	1.00
53	12	6	7	1	53	0.67	0.88
54	6	4	11	2	54	0.60	0.85
55	21	9	23	5	55	0.70	0.82
56	10	5	14	1	56	0.67	0.93
57	13	5	24	1	57	0.72	0.96
58	12	7	5	2	58	0.63	0.71
59	6	5	12	2	59	0.55	0.86
60	15	9	20	4	60	0.63	0.83
61	5	12	8	3	61	0.29	0.73
62	6	10	15	3	62	0.38	0.83

	Women		Men				
age	Married	Single	Married	Single	Age	%wom	%men
63	7	7	5	0	63	0.50	1.00
64	7	5	14	1	64	0.58	0.93
65	10	15	9	5	65	0.40	0.64
66	3	7	6	0	66	0.30	1.00
67	4	13	11	3	67	0.24	0.79
68	4	2	1	0	68	0.67	1.00
69	2	6	10	2	69	0.25	0.83
70	5	10	11	2	70	0.33	0.85

SI 15.2. Building the marital histories of men and women.

When the initial file for women and the initial file for men had been built these two preliminary files were compared. If a woman named a man as a husband in year x, the computer displayed his record for year x and shortly before and after. This way I could use the information from each to amplify the information from the other. Thus shortly after a woman was listed as newly divorced we might find a man recorded as married to her, evidence of a rapid remarriage. Alternatively, the record might display woman A recorded in year X as married to man B and reveal man B married to a different woman a year later. They had divorced and at least the man had remarried. Working from the men's file we might find man C recorded as married to, or having a child with, woman A about this time, giving an indication of her remarriage. This process did not resolve all contradictions. Some were clearly indications of an "affair" or temporary polygamy.

After this second step in building the files I went through each one examining the gaps in the record. Although sometimes a couple might separate and later remarry, on the whole when a record of A married to B at year 1 was followed by a similar record at year 3, it seemed safe to assume they had remained together and were a couple in year 2. An interpretative record of this sort was built to cover every year between 1985 and 2000 or whenever the individual was last recorded.

Men and women often had more than one marriage, neither the individuals nor the marriages involved in each file are entirely the same. Many marriages appear in both files but in the men's file there are some marriages to women who did not appear in the women's file. In the women's file there are some marriages to men who did not appear in the men's file, for instance to a western Hadza, or to a Swahili.

The two "span" files were set up to use Kaplan-Meier analyses and regression with survival data ("Cox regression"). Each file contained other background information and fields to facilitate links to other files such as nomination scores and reproductive success records.

SI 15.3. Nuptiality and age at first marriage. Procedure.

For each woman, her marital history is scanned from beginning to end. In each year in which she remains unmarried she is recorded as entering that year of life, entering it unmarried, adding to the count of women remaining unmarried at that age. At the first year in which she is recorded as being married, she is flagged as ever-married, a count of 1 is added to newly married women of that age, and to ever-married women of that age. In subsequent recorded years of her career she adds to the count of recorded women of that age, and to the count of ever-married women but does not add to the count of women entering the year unmarried. In the year after her last observation she is censored.

To estimate the "survival" of an average woman as never-married I calculated "qx" in each year from the number marrying for the first time in that year divided by the number entering the year never-married. The "lx" value was calculated for a starting population of 1 and proportion surviving unmarried in each year was l_{x-1} * $(1-q_{x-1})$. The "qx" and "lx" values were calculated in the spreadsheet and graphed.

For many individuals it was possible to estimate their age at their first marriage, and to estimate the mean age, as others have done with anthropological populations. This is a simple but risky method for estimating mean age at first marriage. The method is risky because the censoring problem is not directly addressed. For example, if during the fieldwork I had made a note of the age of people who I had observed just become married for the first time, and then calculated the mean of these ages, I would have neglected those still not married, who would mostly get married at some later age. This would bias the estimated age at marriage downward. Such an effect might account for the difference between my estimate for age at marriage of Hadza men and Marlowe's (2010:171) estimated median age 21 years for men and 17 years for women. But it is also possible that Hadza men began to marry younger if competition with Swahili men increased. Since the marriage file almost exclusively includes those who eventually got married, the risk from ignoring censoring is quite small for my dataset. Using age first married in the marriage summary files gives women's mean age at first marriage as 20.81 (median 19), and for men mean 25.75 (median 24). These agree quite well with the figures derived from the rather better procedure used in the text.

SI table 15.3.1. Hadza women's nuptiality. "survival" in the never married state.

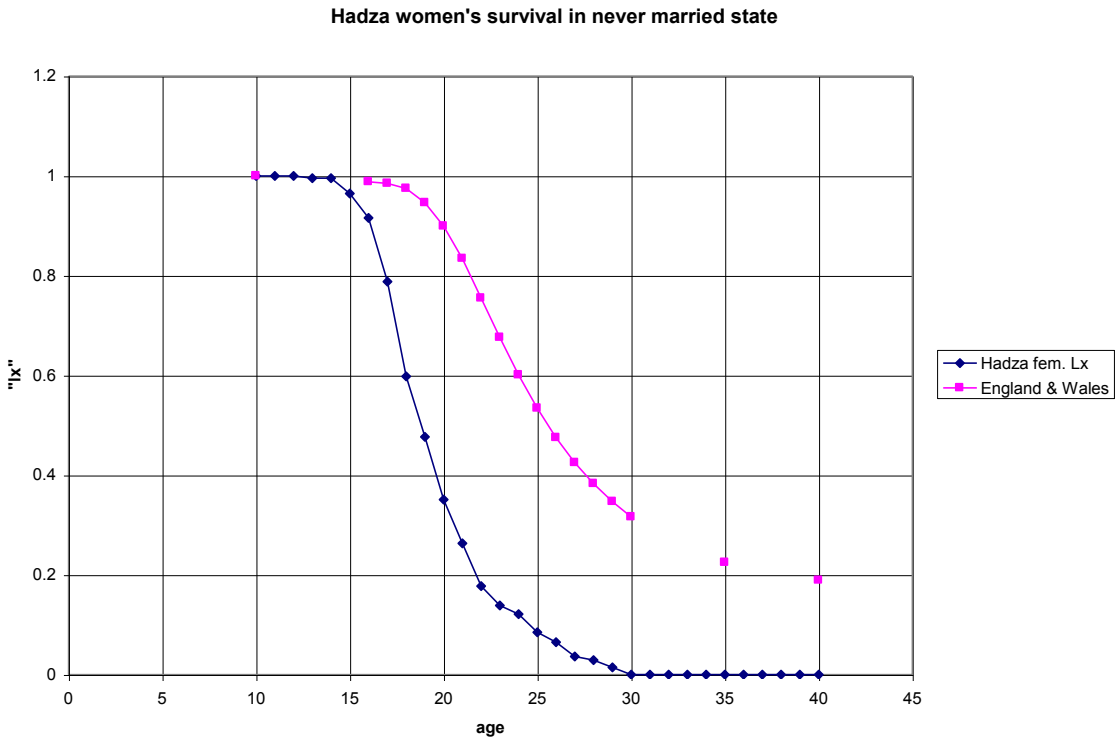
age	nrecs	Enter yrunmr	Ever mr	fstmrec	qx	lx
10	227	227	0	0	0.0000	1.0000
11	227	227	0	0	0.0000	1.0000
12	227	227	0	1	0.0044	1.0000
13	227	226	1	0	0.0000	0.9956
14	227	226	1	7	0.0310	0.9956
15	223	216	7	11	0.0509	0.9648
16	217	201	16	28	0.1393	0.9156
17	213	170	43	41	0.2412	0.7881
18	210	128	82	26	0.2031	0.5980
19	189	95	94	25	0.2632	0.4765
20	178	68	110	17	0.2500	0.3511
21	172	49	123	16	0.3265	0.2634
22	169	32	137	7	0.2188	0.1774
23	164	24	140	3	0.1250	0.1386
24	155	20	135	6	0.3000	0.1212
25	147	13	134	3	0.2308	0.0849
26	135	9	126	4	0.4444	0.0653
27	123	5	118	1	0.2000	0.0363
28	112	2	110	1	0.5000	0.0290
29	108	1	107	1	1.0000	0.0145
30	107	0	107	0	0.0000	0.0000
31	98	0	98	0	0.0000	0.0000
32	98	0	98	0	0.0000	0.0000
33	96	0	96	0	0.0000	0.0000
34	92	0	92	0	0.0000	0.0000
35	86	0	86	0	0.0000	0.0000
36	73	0	73	0	0.0000	0.0000
37	64	0	64	0	0.0000	0.0000
38	57	0	57	0	0.0000	0.0000
39	50	0	50	0	0.0000	0.0000
40	47	0	47	0	0.0000	0.0000

SI table 15.3.2. Hadza men's nuptiality.

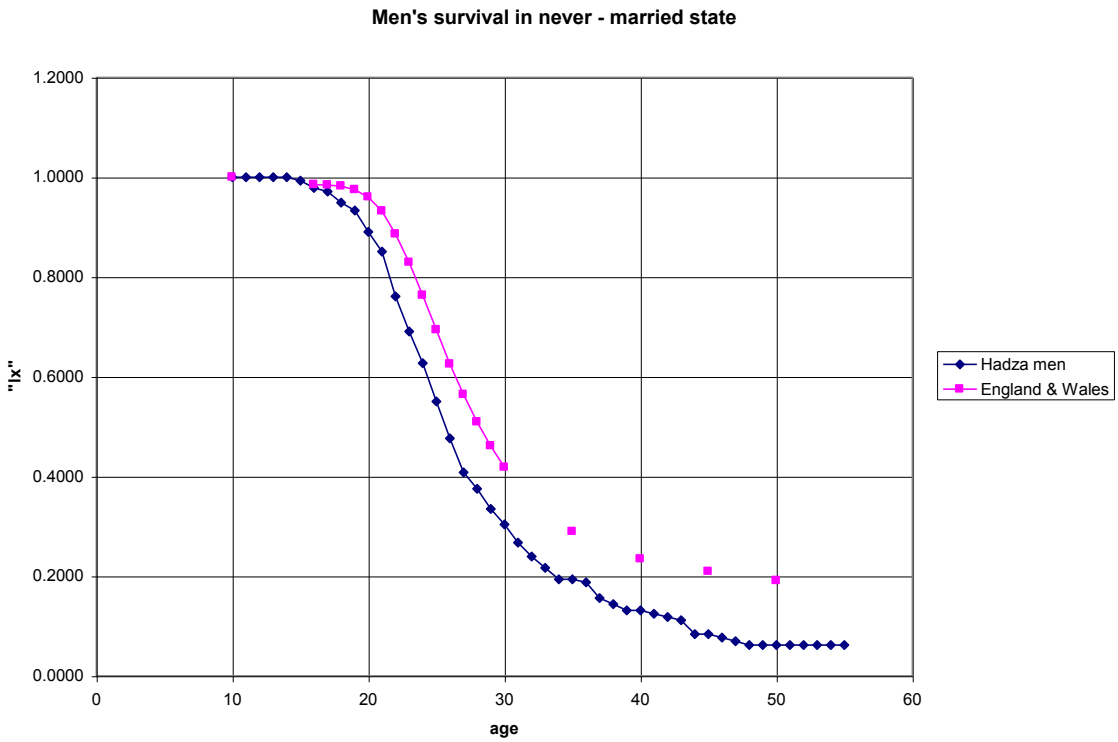
age	nrecs	Enter yr never mr	Ever mr	fstmrec	qx	lx
10	308	308	0	0	0.0000	1.0000
11	300	300	0	0	0.0000	1.0000
12	292	292	0	0	0.0000	1.0000
13	286	286	0	0	0.0000	1.0000
14	281	281	0	2	0.0071	1.0000
15	279	277	2	4	0.0144	0.9929
16	271	266	5	2	0.0075	0.9785
17	263	260	3	6	0.0231	0.9712
18	254	246	8	4	0.0163	0.9488
19	249	239	10	11	0.0460	0.9333
20	244	224	20	10	0.0446	0.8904
21	238	209	29	22	0.1053	0.8506
22	232	183	49	17	0.0929	0.7611
23	226	164	62	15	0.0915	0.6904
24	219	147	72	18	0.1224	0.6273
25	213	126	87	17	0.1349	0.5504
26	206	105	101	15	0.1429	0.4762
27	198	87	111	7	0.0805	0.4082
28	190	74	116	8	0.1081	0.3753
29	179	65	114	6	0.0923	0.3347
30	174	58	116	7	0.1207	0.3038
31	169	48	121	5	0.1042	0.2672
32	166	42	124	4	0.0952	0.2393
33	160	38	122	4	0.1053	0.2165
34	156	32	124	0	0.0000	0.1938
35	151	31	120	1	0.0323	0.1938
36	148	30	118	5	0.1667	0.1875
37	143	25	118	2	0.0800	0.1563
38	141	23	118	2	0.0870	0.1438
39	133	20	113	0	0.0000	0.1313
40	129	20	109	1	0.0500	0.1313
41	121	19	102	1	0.0526	0.1247
42	113	18	95	1	0.0556	0.1181
43	107	16	91	4	0.2500	0.1116
44	104	12	92	0	0.0000	0.0837
45	100	12	88	1	0.0833	0.0837
46	95	11	84	1	0.0909	0.0767
47	90	9	81	1	0.1111	0.0697
48	83	8	75	0	0.0000	0.0620
49	81	8	73	0	0.0000	0.0620
50	80	8	72	0	0.0000	0.0620

age	nrecs	Enter yr never mr	Ever mr	fstmrec	qx	lx
51	77	7	70	0	0.0000	0.0620
52	74	7	67	0	0.0000	0.0620
53	70	7	63	0	0.0000	0.0620
54	67	7	60	0	0.0000	0.0620
55	67	7	60	0	0.0000	0.0620

SI figure 15.3.2. Hadza women's survival in the never-married state. Plotted alongside data from England & Wales from Hinde (1998 Table 7.2).

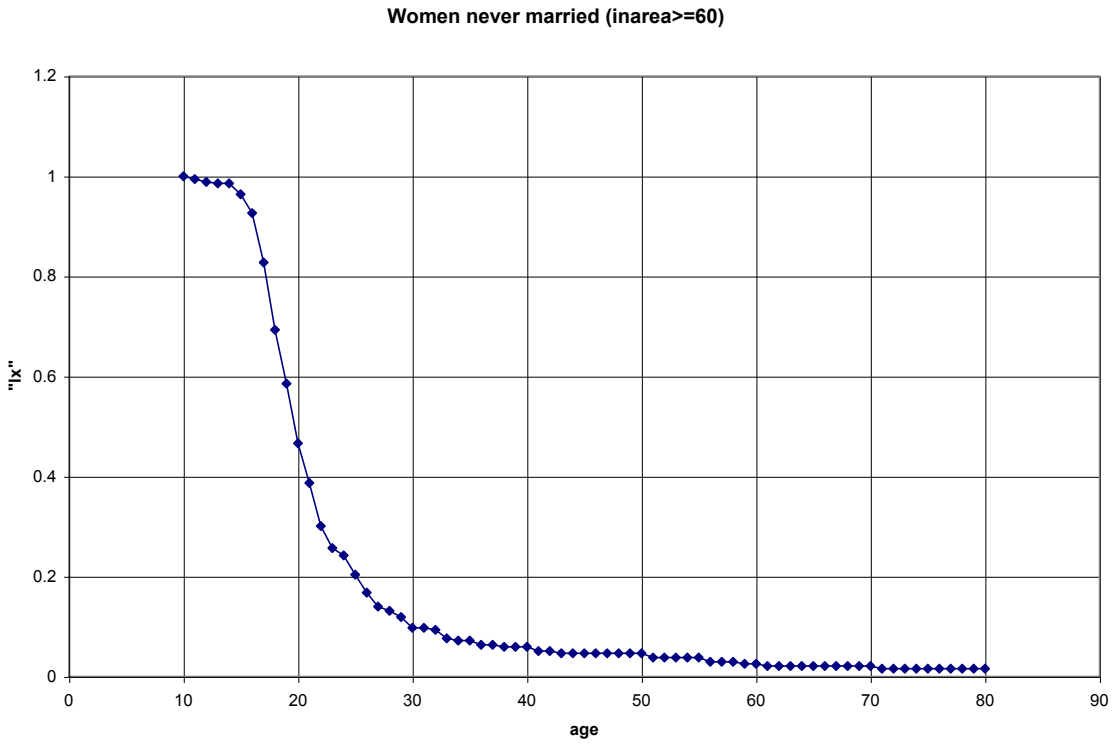


SI figure 15.3.3. Hadza men's survival in the never-married state. Plotted alongside data from England & Wales from Hinde (1998 Table 7.2).



15.4. Replication of nuptiality with women in 3+ censuses and >60% in area to compare men.

SI figure 15.4.1. Women's nuptiality by same method and same source as men's nuptiality.

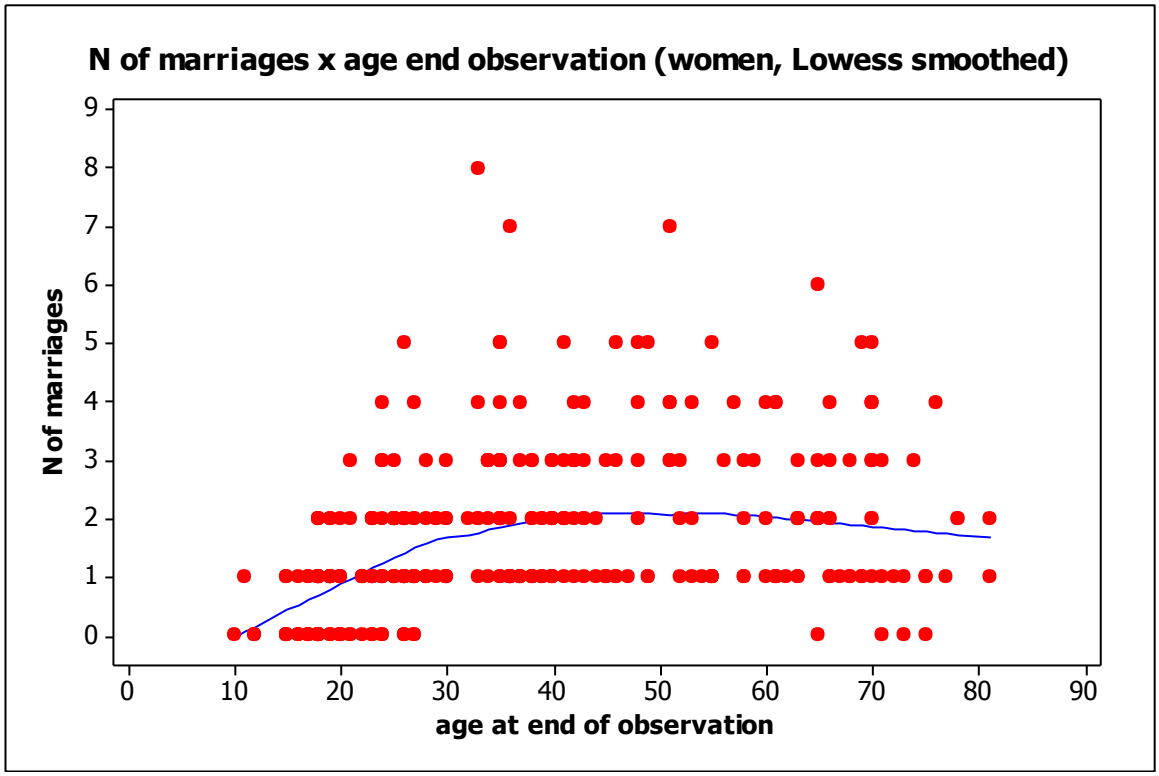


15.5. Number of marriages

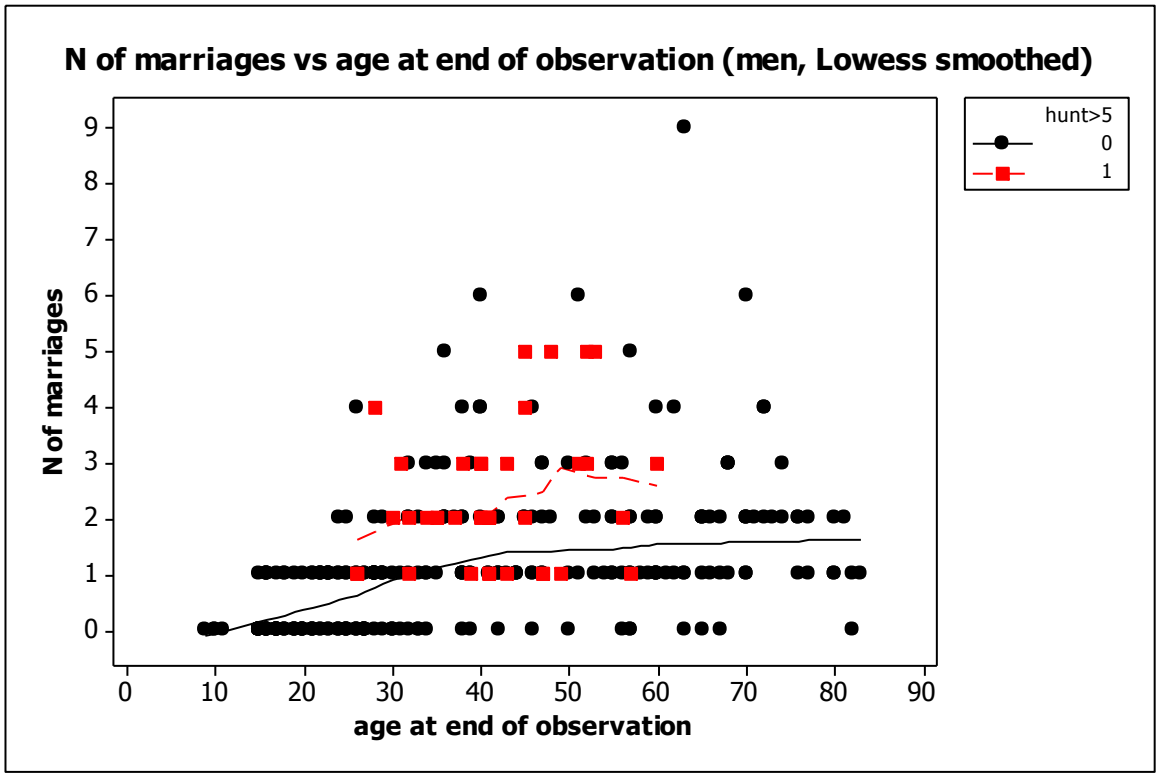
SI table 15.5.1. Number of marriages recorded from men and women up to age last observed. From marriage long summary files (306 men, 323 women). For example: 89 men had not married by time last observed, 10 women had 5 marriages each. Note that the marriage histories of many individuals cease when they are quite young. The following graphs give a better impression of likely lifetime number of marriages.

N of marriages	Men	Women
0	89	41
1	111	133
2	61	73
3	24	42
4	11	20
5	6	10
6	3	1
7	0	2
8	0	1
9	1	0

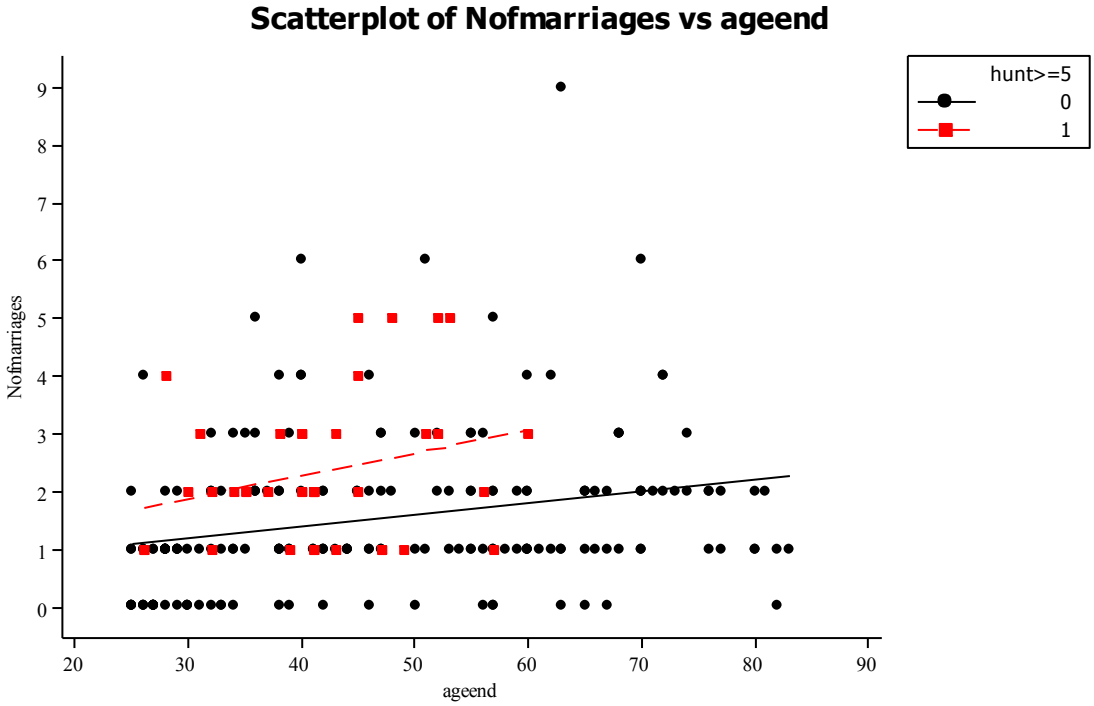
SI figure 15.5.1 Number of marriages reported by women at end of observation. Blue line is a Lowess smoothing.



SI figure 15.5.2. Number of marriages reported by Hadza men at end of observation. Black line is a Lowess smoothing for men who had less than 5 nominations as an expert hunter. Red broken line is for men who had 5 or more nominations as an expert hunter.



SI figure 15.5.3. Number of marriages x age at end of observation. Fitted regression. Note that among men with 4 or more marriages many have low hunting reputations.



Is the number of marriages a good measure of mating success?

It only makes sense to think of number of marriages as a measure of mating success in a few contexts. Examples might be in a population in which women limit themselves to one or two births early in the marriage (as in industrial nations), or when in a polygynous society we count each wife as a marriage, or in a polyandrous society count each husband as a marriage. The latter count is about as unlikely to predict number of births or live children as a count of number of marriages among the Hadza, because females' time is such an important limit. Thus when serial monogamy is common, as among Hadza, number of marriages is not a sensible proxy measure for number of copulations or number of likely conceptions.

There is another point to make about number of marriages. The median and mean length of divorce spans encompasses the mean inter-birth interval (just under 3 years in Hadza chapter 17). Consider two tactics. A man leaves at or soon after the birth of a child. He can expect to take 2 to 4 years to remarry. A man stays when his wife has just delivered a baby, she will be fertile again in 2.5 - 3 years. Which tactic yields the greatest fitness depends on whether it is easier to stay, and guard his wife from potential lovers, or leave and compete for another woman against jealous husbands or eager rivals.

15.6. Duration of marriages

Dissolution by death or divorce.

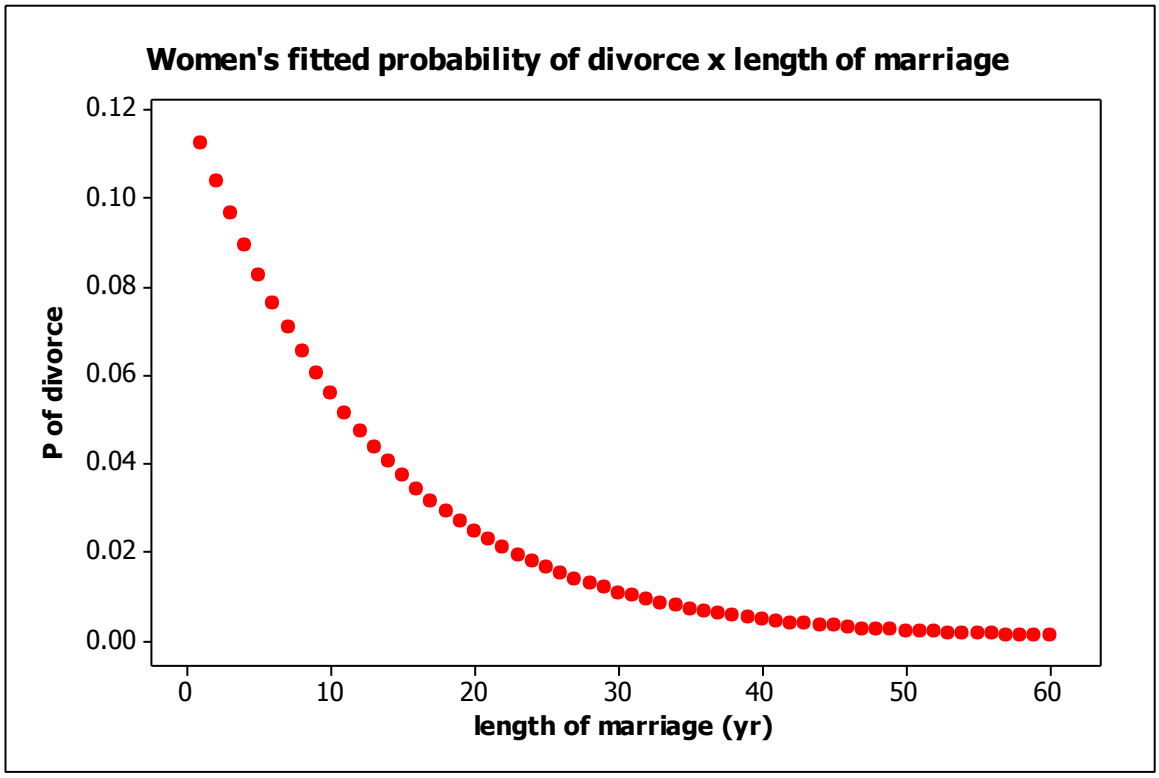
The survival of men and women's marriages against death seems to diverge after about 15 – 20 years of marriage. Men are older than women when they first marry, so a man who has been married for 20 years will be on average 45 years old, while a woman will be 38. Thus among marriages that end in death we should expect more widowing of women early, and more widowing of men late. The observations conform to expectations in that for women marriages dissolve faster by widowing than by the woman's death. For men the reverse occurs, marriages dissolve faster by his death than by his wife's death. The patterns may not exactly follow life expectancy because as Hadza men age, some of them remarry younger women after each divorce, the gap in age between spouses increases with time.

Marriage survival in industrial nations is often (and often misleadingly because the figure depends on the age of marriages in the sample, and therefore on the population age structure) expressed as a percentage of marriages that end in divorce. In our Hadza women's data, 73.5% of marriages whose end was recorded, ended in divorce. Thus 26.5% ended in death of either partner (20% were widowed, 6.5% died while still married, widowing their husbands). The percentages were closely similar if the sample of marriages was restricted to those followed from 1985 to 2000.

An average woman in our annual marital history data file had a probability of becoming a widow at any age of 0.0201 (0.015 – 0.026) more than 2 x greater than a man's (0.0101 (0.0063 – 0.0152) $p < .000$), almost certainly due to the age difference between spouses. The husbands will be dying at the rate of the older men that they are. Not surprisingly a married woman's probability of being widowed is significantly related to her age and accelerates during old age. A man's probability of being widowed is also related to his age but even at the oldest ages his chance of being widowed is a small fraction of a woman's chance.

SI figure 15.6.1. Probability of a married woman getting divorced estimated by logistic regression from annual marital histories.

It is commonly found that the probability of divorce declines with time in the marriage. I have seen no analysis that tests among possible reasons. Costs to the children (a cost of desertion, for which there is little evidence in my Hadza data) could be one but age effects, abundance or scarcity of prospective mates, and solution of coordination problems could also be reasons.



SI figure 15.6.2. Plot of instantaneous hazard of marriage ending x length of marriage. From Kaplan-Meier analysis of survival of marriages. Using lognormal distribution, which is the best fit to the above data. 579 marriages of 300 women, marriage span file, hadza husbands only. When data restricted to 1985-2000 plot appears very similar, with median 9.9 and peak at the same place, 511 marriages of 252 women.

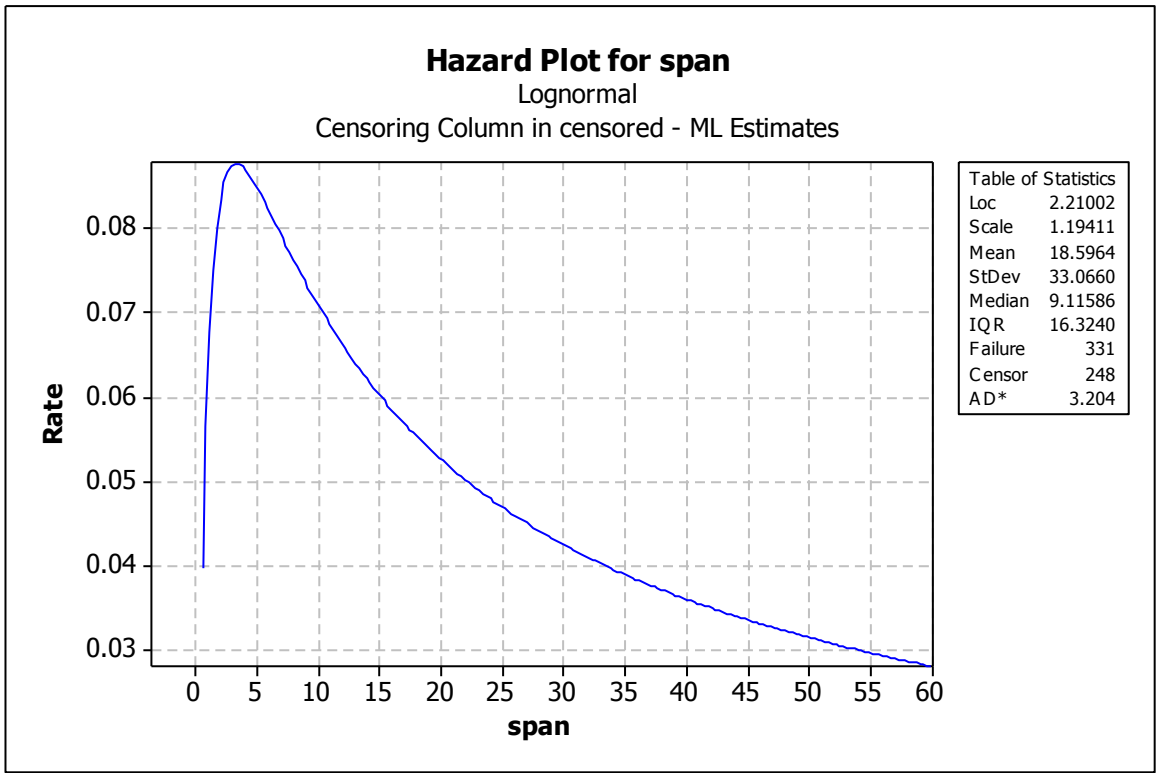


Figure 15.6.3. Survival of Hadza women's marriages against divorce or death of either partner.

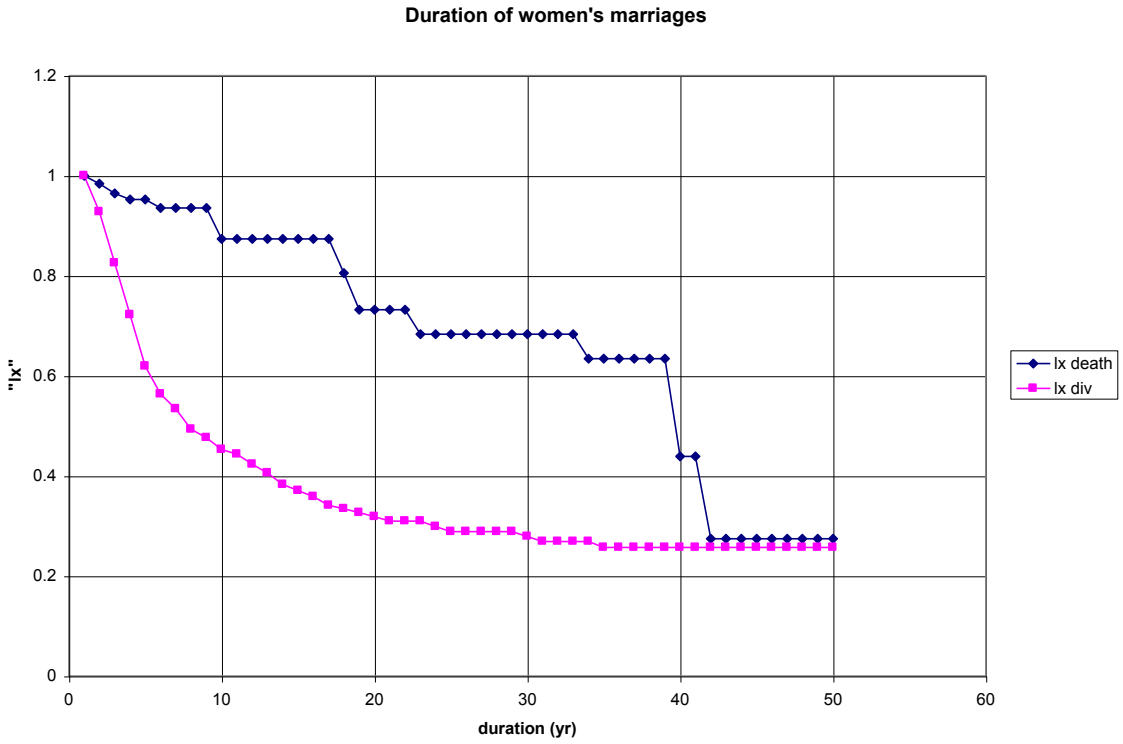


Figure 15.6.4. Survival of Hadza men's marriages against divorce or death of either partner.

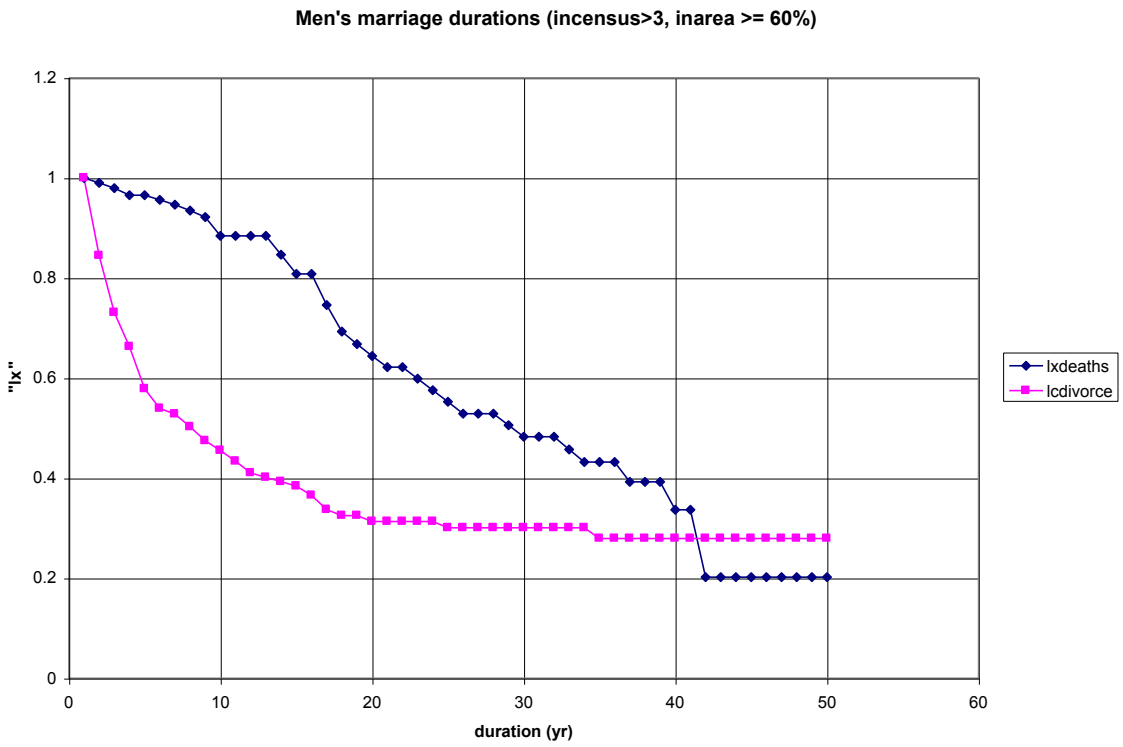
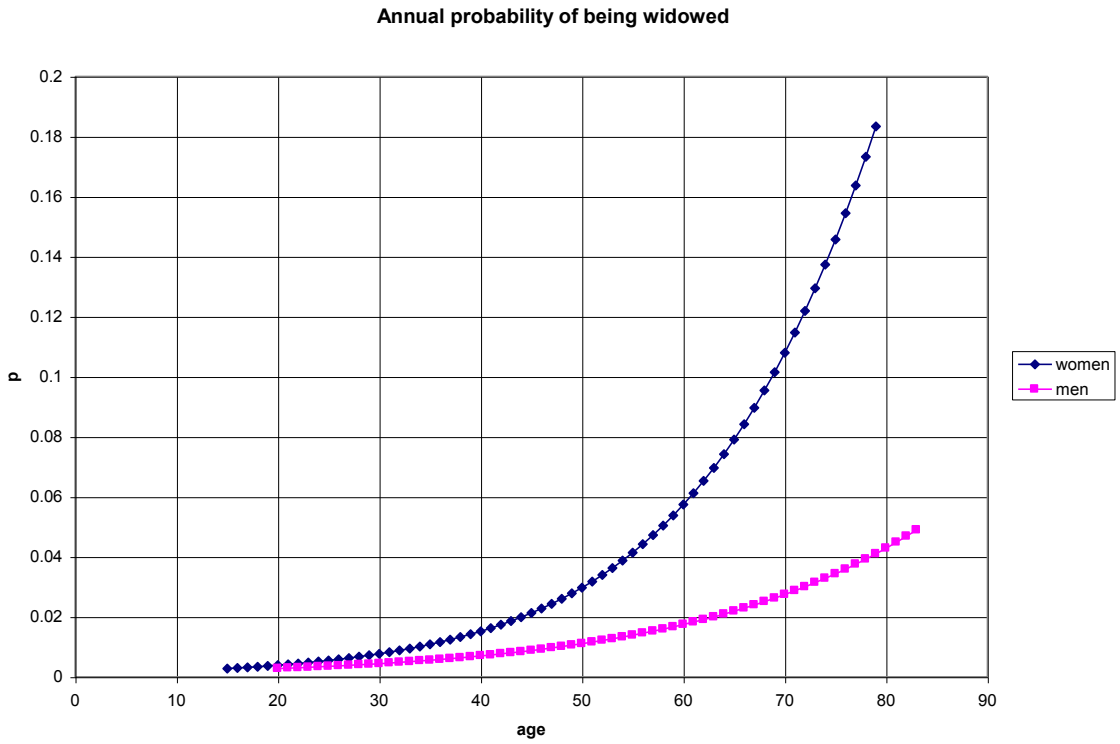


Figure 15.6.5. Probability of losing a spouse through death is much higher for women than for men. Husbands are older than their wives, and men die younger than women.



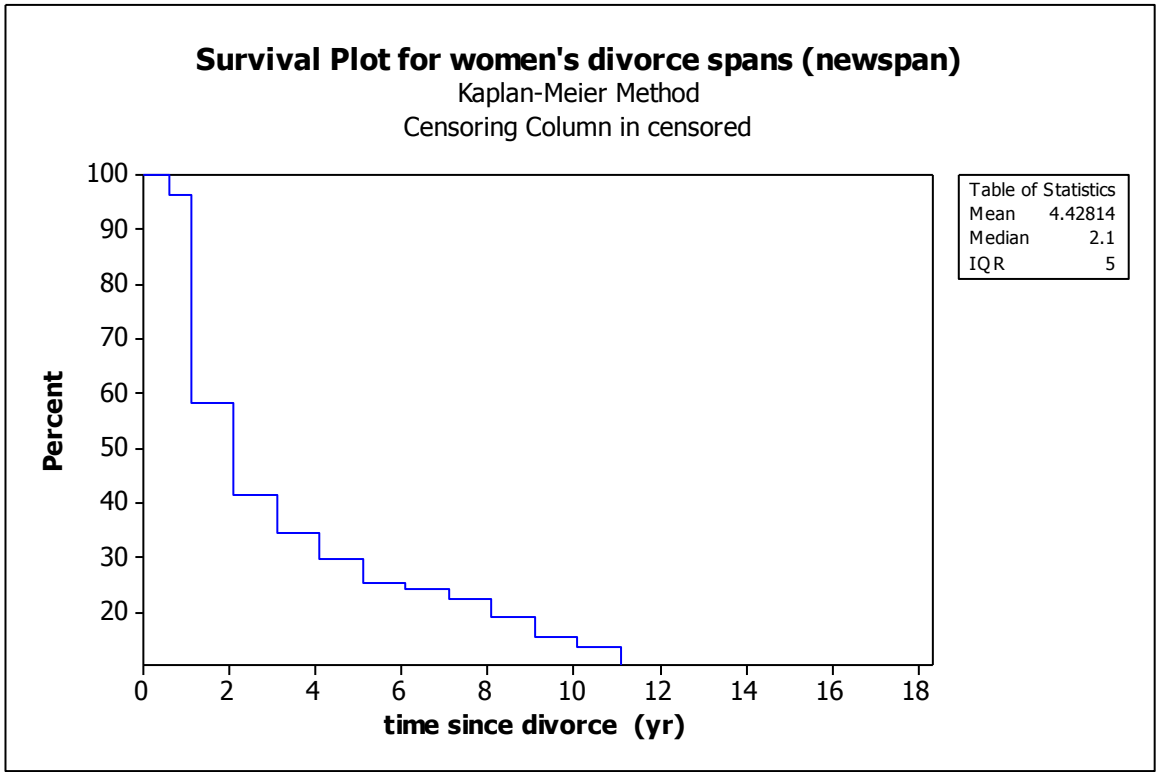
SI 15.6 continued. Comparing my estimate of crude divorce rate with Woodburn's 1968 estimate. Was there a secular change in divorce rate?

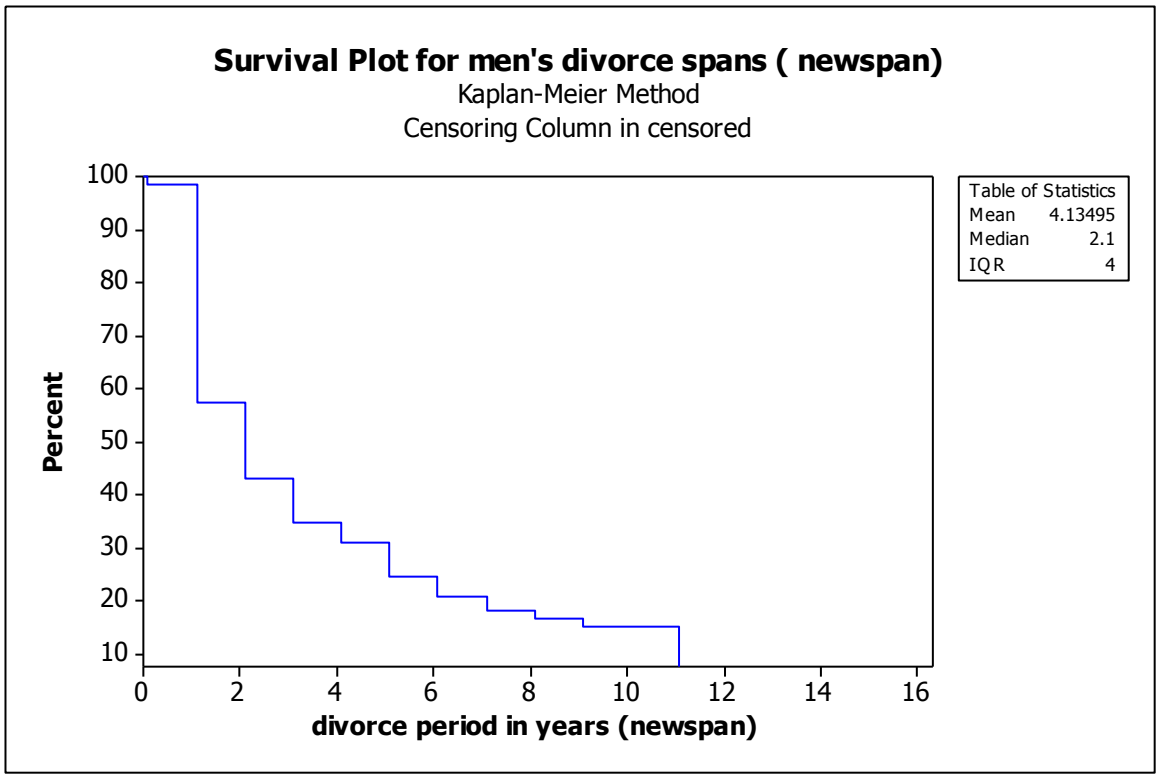
Woodburn estimated the divorce rate at 49/1000 years of marriage (1968 p.107). To compare my data with this I ran Minitab's proportion test on the marital history file for married women aged 15 or more during the years 1985 to 2000. The result was 170 divorces in 2632 married woman years of data, 0 .064 per year (95% interval .055 - .075). This is significantly higher than Woodburn's figure. The corresponding figure for men was 0.060, which is not significantly different from women and is also significantly higher than Woodburn's figure.

This measure of divorce rate, though very much better than many, is likely to be sensitive to variations in age structure, and to the proportion of young marriages in the sample. If we run Minitab proportions on the whole file, including years of marriage before 1985, we get 274 divorces in 5780 years of marriage, a divorce rate of 47.4/1000 years of marriage (95% confidence interval 41.9 to 53.0 which easily encompasses Woodburn's estimate). If we run Minitab proportions on a subset of the 1985-2000 data that includes only the years of marriage after the first 2, the proportion for women is 0.056 (0.047 – 0.066) which overlaps Woodburn's figure and does not differ from it significantly ($p = 0.138$). If we repeat this for years of marriage after the first three we get a rate of 0.48, almost identical to Woodburn's. Since Woodburn had many field aims in addition to demography and probably had a smaller sample than ours, we cannot be sure that we have demonstrated an increase in the divorce rate. If there has indeed been an increase I would be tempted to attribute it to a higher number of marriages to Swahilis, and to the difficulty people appeared to have with encroachments on their habitat. However, removing years of marriage to a Swahili husband makes no difference to women's divorce rate. Nor was there a secular trend in divorce within our data (no significant association with calendar year). A dummy variable representing the drought year 1997 had a large but not significant negative relationship to probability of divorce (fewer divorces in 1997, $b = -0.343$, p .340).

SI 15.6 continued. Divorce spans. Remarriage.

Each record included the year of the divorce, the year of remarriage if any, the duration of the divorced period, whether the divorce ended in remarriage, or death, or the end of the observations (right censored). The file included only divorces whose year was known, so divorce spans were of known beginning, there were no left censored divorce spans. Each record included the number of the divorce – was it the first, second, etc for this subject.




Survival Plot for men's divorce spans (newspan)
Kaplan-Meier Method
Censoring Column in censored
Percent
100
90
80
70
60
50
40
30
20
10
0
2
4
6
8
10
12
14
16
divorce period in years (newspan)
Table of Statistics
Mean 4.13495
Median 2.1
IQR 4

SI 15.7. Affairs, second wives, second husbands.

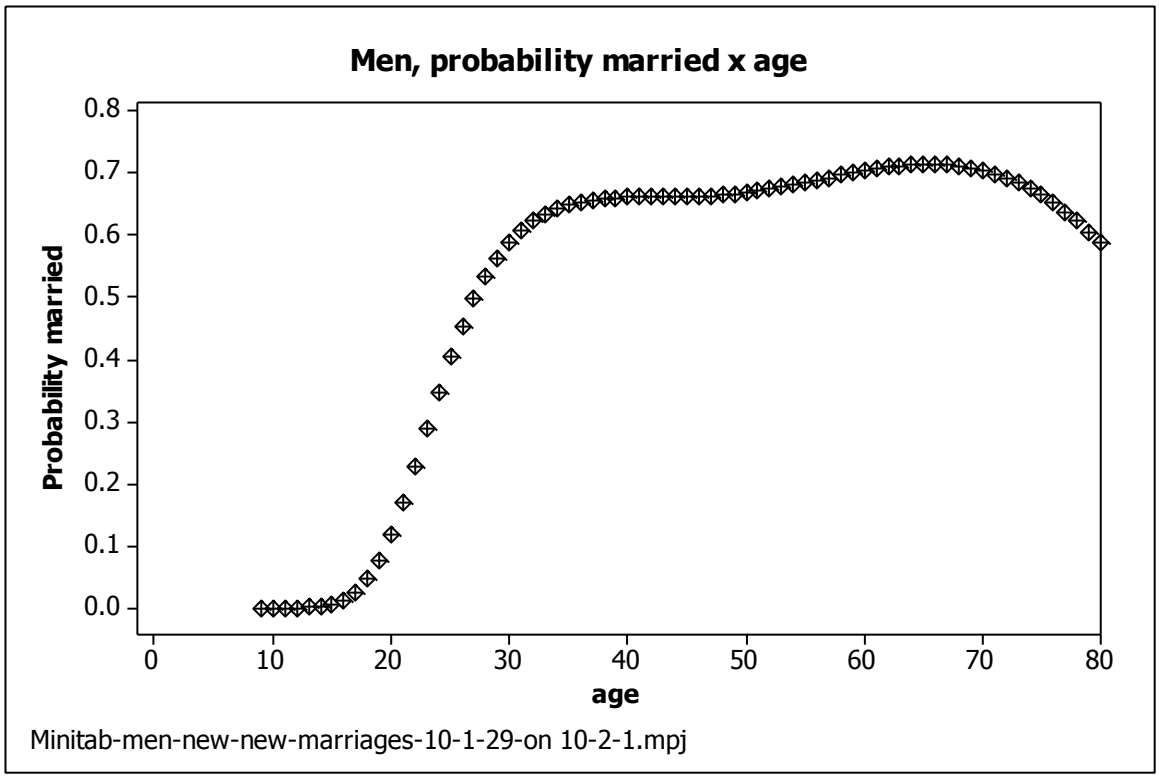
SI Table 15.7.1. Duration of men's "second wife", and women's "second husband" arrangements. For example, between 1985 and 2000 three men had a "second wife" for a span of 6 years. Between 1985 and 2000, 56 men had an affair, and 30 women.

N of years	Men with marital history and an RS record. N = 175	Men 1985-2k N = 244	Women `1985-2k N = 328
0	123	188	298
1	12	16	21
2	13	15	4
3	7	8	3
4	5	3	
5	4	4	
6	4	3	
7			1
8	2	5	
9	1		1
10			
11	1	1	
12	1	1 (13yrs)	
15	1		
17	1		
Total individuals	175	244	328

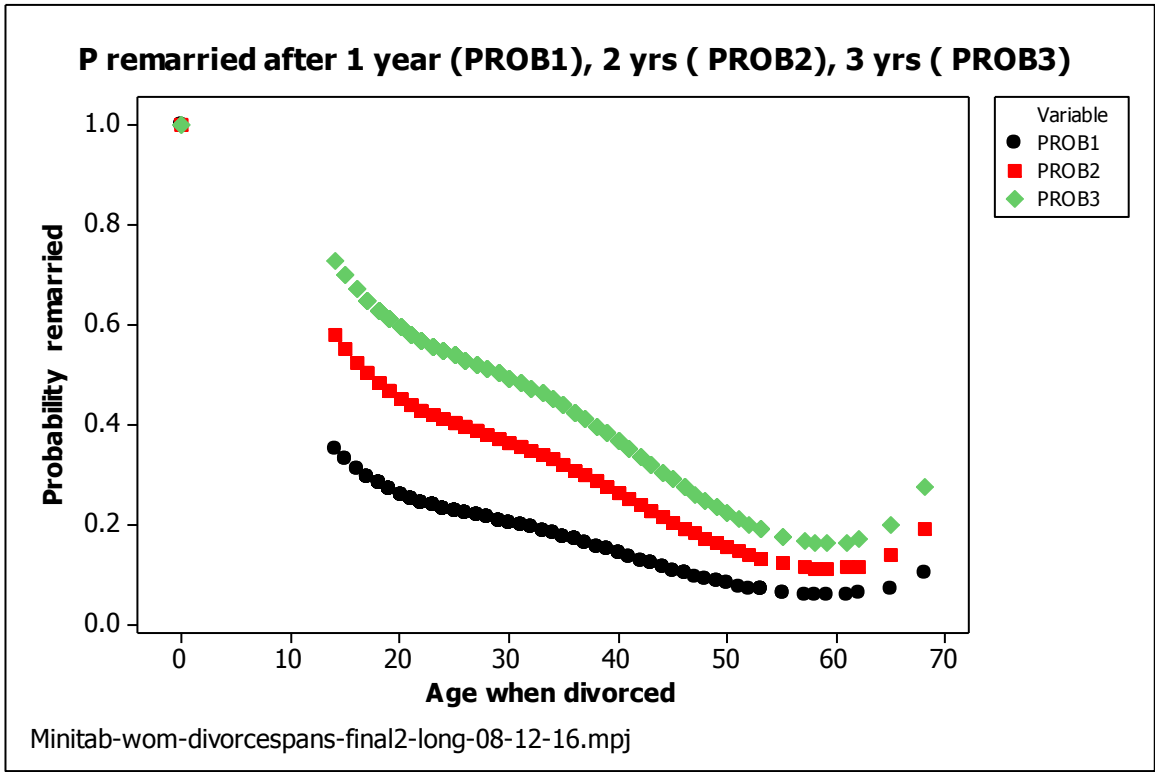
SI 15.8. Do women's marriage prospects track their age and fertility?

The marital histories of the women who were noted as suffering from primary sterility, aged 30 or more but yet to bear a child, should be informative. We should expect them to remain unmarried longer than others of their age, so long as men know who they are and regard their infertility as a lasting condition. There are only six of them so it may not be surprising that there is no significant difference between their mean % of time married and that of others. Two of them were married continuously for the whole study period. Their divorce spans were no longer than others. Each of these two (1062 & 1482) had a husband nominated as an expert hunter. The six infertile women had nearly twice as many divorces as the majority (mean 1.33 vs 0.703).

The following two graphs show best fits of probability married by age, for Hadza women, and Hadza men.


Men, probability married x age
Probability married
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0
10
20
30
40
50
60
70
80
age
Minitab-men-new-new-marriages-10-1-29-on 10-2-1.mpj

Women's speed of remarriage x their age at divorce.



SI 15.9. Do men avoid stepchildren? Is there an effect of women's burden of small children?

Women's speed of remarriage x number of children aged under 5 or under 7.

Contrary to my expectations, women with more small children remarry faster. Hadza men do not avoid step-children.

The table in the text is a simplification and improvement of my initial analysis which is shown in the table below. This original table compares various sub-samples of interviewed women: "All", all interviewed women who had been married and divorced. "1985+" restricted to those whose divorces were in 1985 or later (to limit the sample to the most reliable data). "< 40" restricts sample to divorces that happened when the woman was aged less than 40 (to limit the sample to fertile women).

The analysis used Cox regression, with dependent variable "divorce spans" the duration from divorce to remarriage or end of observation (thus right censored.).

The table summarizes six different models. For example, line 1 reports model: woman's time to remarry = her age + sequence number of her divorce (her first, second, etc) + N of live children aged under 5, for entire marriage history file.

Only the most recent infant is at all likely to be the child of the new husband from some pre-divorce liaison. My "newburden" measure (used in text table 15.2) was aimed at minimizing the number of such children scored. Newburden (N of live children under 5 at time of remarriage or end of observation, minus any birth in year of remarriage).

Length of divorce span x	beta	p	N women	N divorce spans
All burdn5	-.2715	.006	86	140
All burd7	-.1917	.011	86	140
< 40 burdn5	-.2747	.005	85	132
<40 burdn7	-.1919	.011	85	132
1985+ burden5	-.2398	.037	75	111
Burden7	-.1726	.059	75	111
1985<40 burd5	-.2321	.043	71	103
Burden7	-.1568	.095	71	103

15.9 continued. More details about women's remarriage.

Women with small children are not "settling for" a less nominated man when they remarry.

Variables are: new husband general nominations, new husband hunt nominations, new husband trade nominations, new husband arrow nominations.

Comparing nominations of old husband and new husband. Divorces after 1985 to women aged < 40 at divorce. Paired T-Test.

	N	Mean	sd	se
Old hb hunt pr	80	5.53	9.64	1.08
New hb hunt pr	80	4.58	6.98	0.78
Difference	80	0.95	10.01	1.12

95% CI for mean difference: (-1.28, 3.18)
T-Test of mean difference = 0 (vs not = 0): T-Value = 0.85 P-Value = 0.398

	N	Mean	sd	se
Old hb trade pr	80	3.84	6.12	0.68
New hb trade pr	80	3.71	6.52	0.73
difference	80	0.128	7.43	0.83

95% CI for mean difference: (-1.526, 1.782)
T-Test of mean difference = 0 (vs not = 0): T-Value = 0.15 P-Value = 0.878

	N	Mean	sd	se
Old hb arrow	80	3.72	7.49	0.84
New hb arrow	80	4.39	9.86	1.10
Difference	80	-0.67	12.28	1.37

95% CI for mean difference: (-3.40, 2.07)
T-Test of mean difference = 0 (vs not = 0): T-Value = -0.49 P-Value = 0.628

If a woman divorces a highly nominated man (oldhb) she is likely to remarry to a highly nominated man (New hb, new husband).

Cell Contents: Pearson correlation
P-Value

	Old hb genom	Old hb hunt	Old hb trade	Old hb arrow
New hb genom	0.236, p .007	0.203, p .043	0.369, p .000	-0.049, p 0.626
New hb hunt	0.236, p .024	0.309, p .005	0.184, p .103	-0.044, p .697
New hb trade	0.126, p .235	0.018, p .874	0.310, p .005	-0.069, p .543
New hb arrow	0.107, p .314	0.111, p .326	0.265, p .018	0.016, p .886

A piece of support for the paternal investment theory?

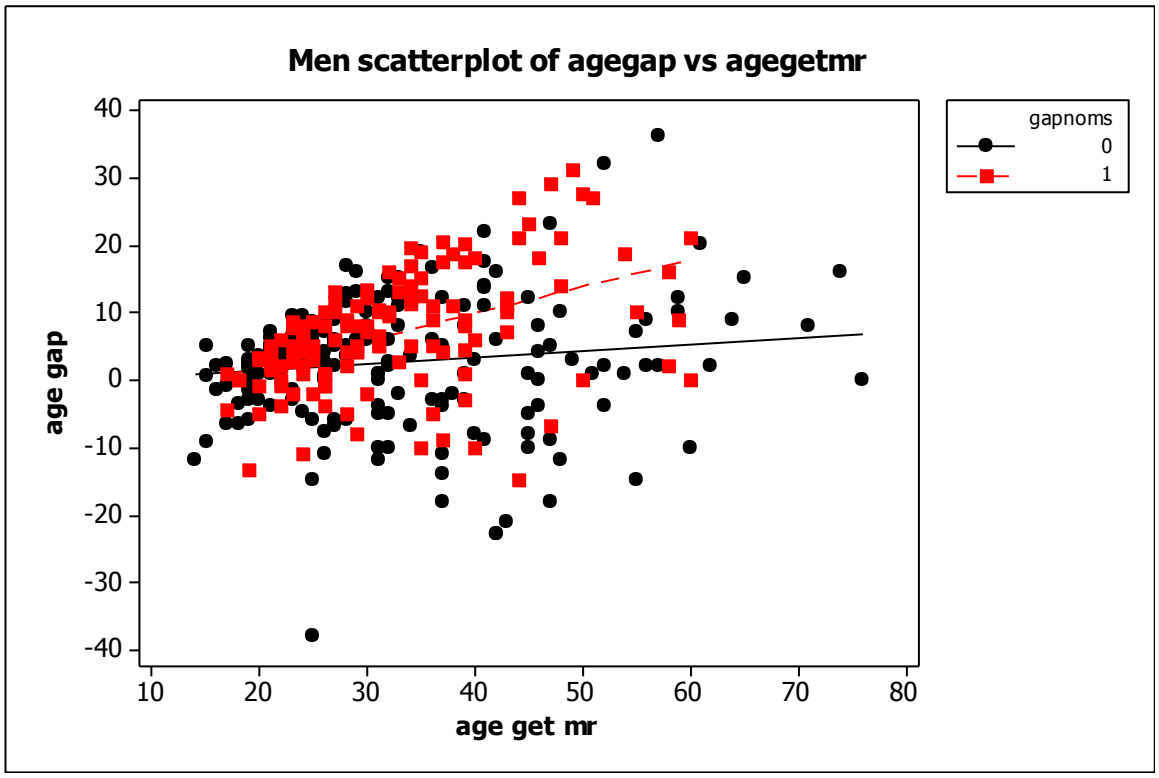
One result could be interpreted as support for the paternal investment theory of marriage. The duration of marriage is associated with the wife's "burden" of small children at the end of the marriage. The more small children, the longer the couple stays together. Perhaps the couple stays together because of the vulnerable children. However, a different interpretation is at least as credible – it takes time to accumulate children, the result may merely show that more children are accumulated as time in the marriage goes by, and divorce becomes less likely as the marriage continues.

SI 15.10 Men's nominations and marriage.

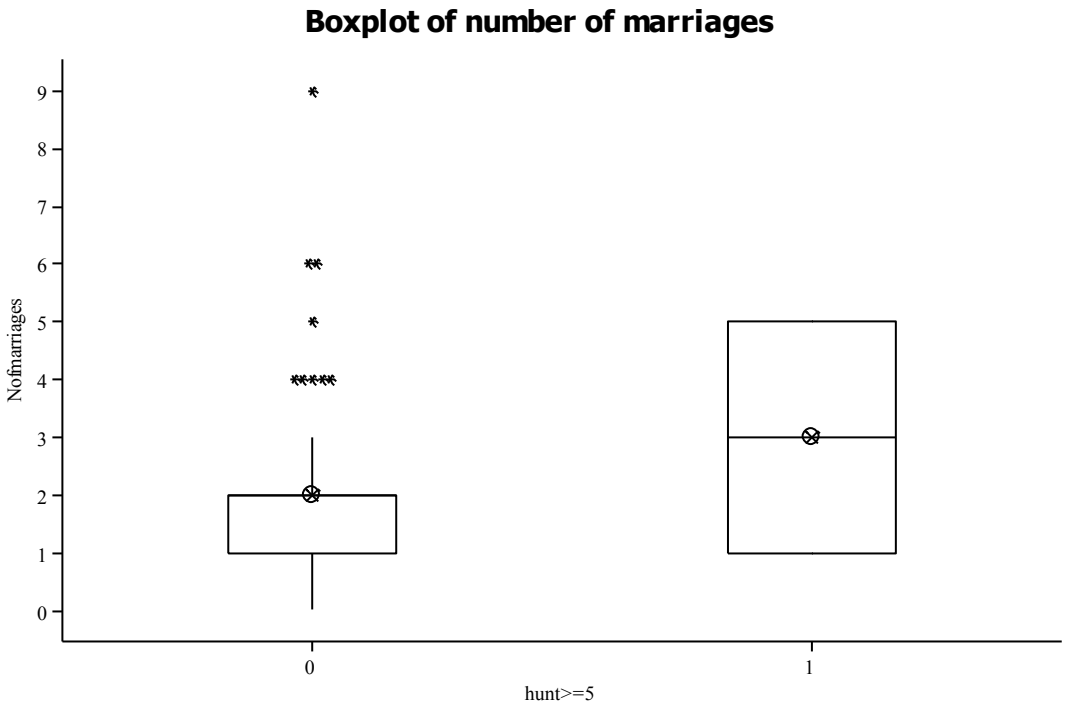
Do high reputation men tend to be married to high reputation women? The correlations are small but several are significant.
Sum nom pr is sum of pro-rated nominations in all categories.
Hunt + arrow = sum of prorated scores for hunt and for arrow making
hunt + trade = sum of prorated scores of hunt and trader

	Correlation coefficient with wife's nominations	P value
Sum nom pr	0.142	.029
Hunt pr	0.049	.449
Trade pr	0.224	.001
Arrow pr	0.088	.177
Hunt + arrow pr	0.150	.021
Hunt + trade pr	0.150	.021

Color version of text figure 15.6. Red symbols for men with > 5 hunt nominations. The age gap increases with age, faster for expert hunters as they remarry younger women. "gapnoms" is same measure as "hunt>5".

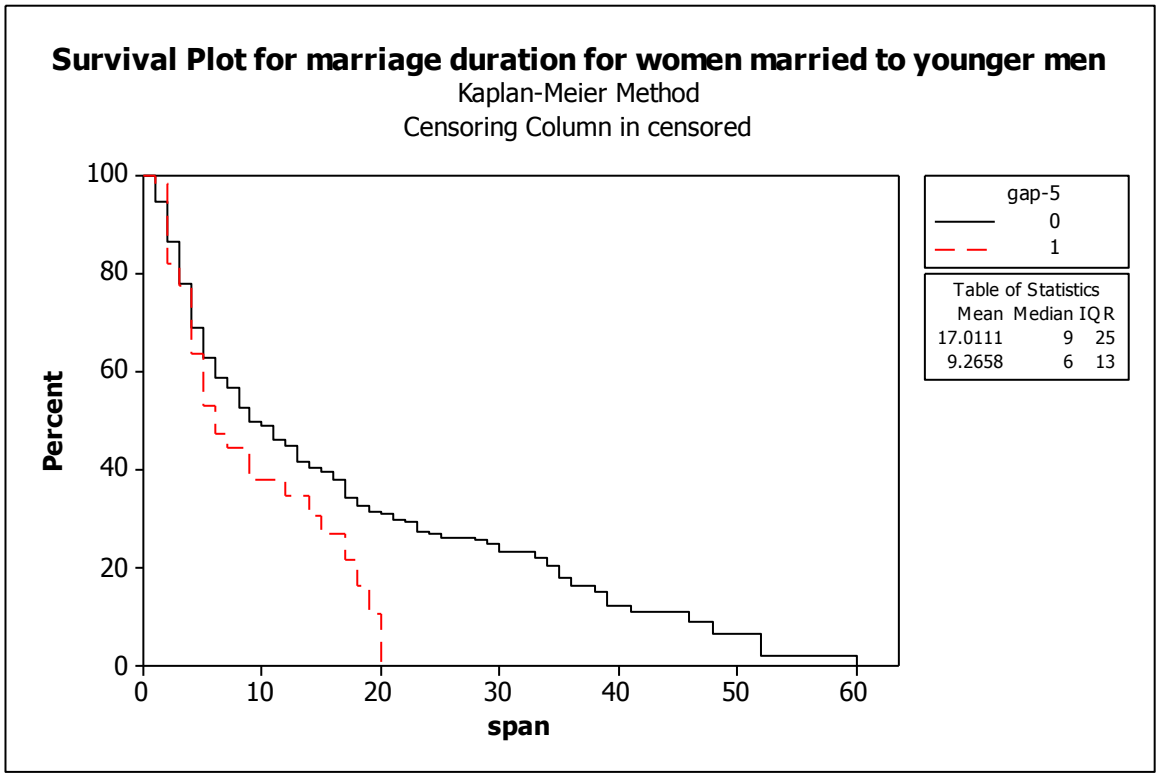


Note the “outlier” men with less than 5 nominations as expert hunter but large number of marriages. They are discussed in chapter 15 and elsewhere as “charmers” or “philanderers” in preference to the older label “cads”. They have only average reproductive success.



SI 15.11. Older women married to younger men.

Shorter survival of marriages of Hadza women married to men who are more than 5 years younger (red broken line). (43 men).



SI 15.12. Marriage and RS. Bateman gradients?

SI Figure 15.12a. How much does marriage affect men's reproductive success (RS)? A "Bateman gradient" for 133 men. Y axis: Residuals of N live children x age at final observation. X axis: fraction of adult life in a marriage. The fits (and 95% confidence intervals) in the figure are to marriage + marriage-squared + marriage-cubed, to allow the fits to escape the constraints of a linear or quadratic relationship (R-squared 36.7%). In a linear regression RS = - 3.08 + 4.49 pctmarr in linear regression. P = 0.000, R-sqd = 33.7%).

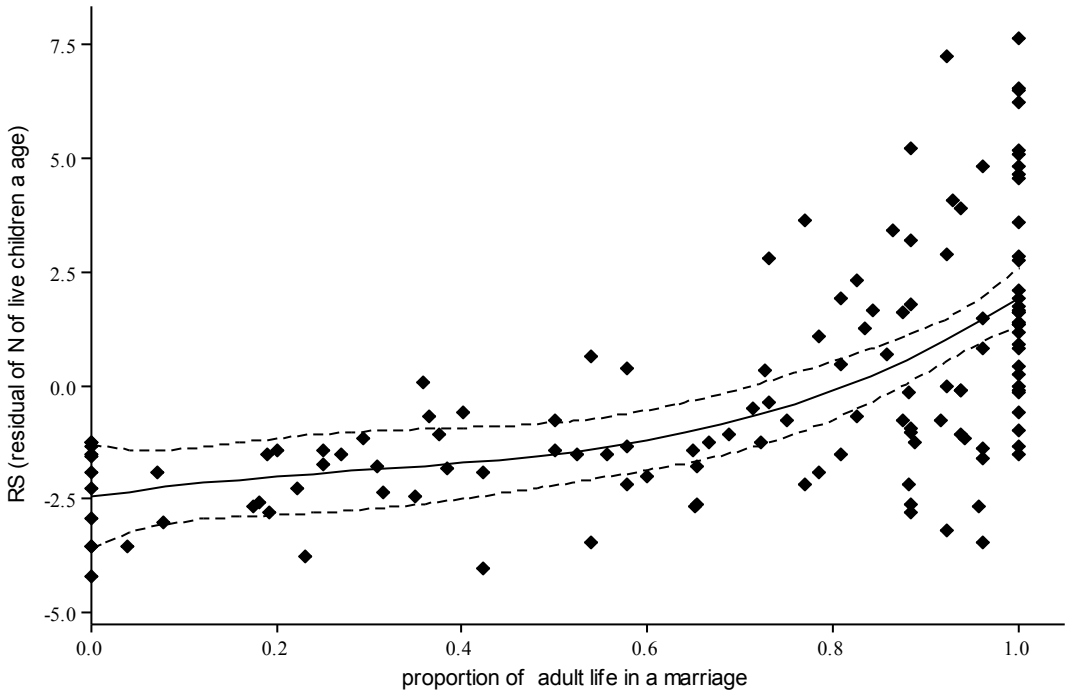
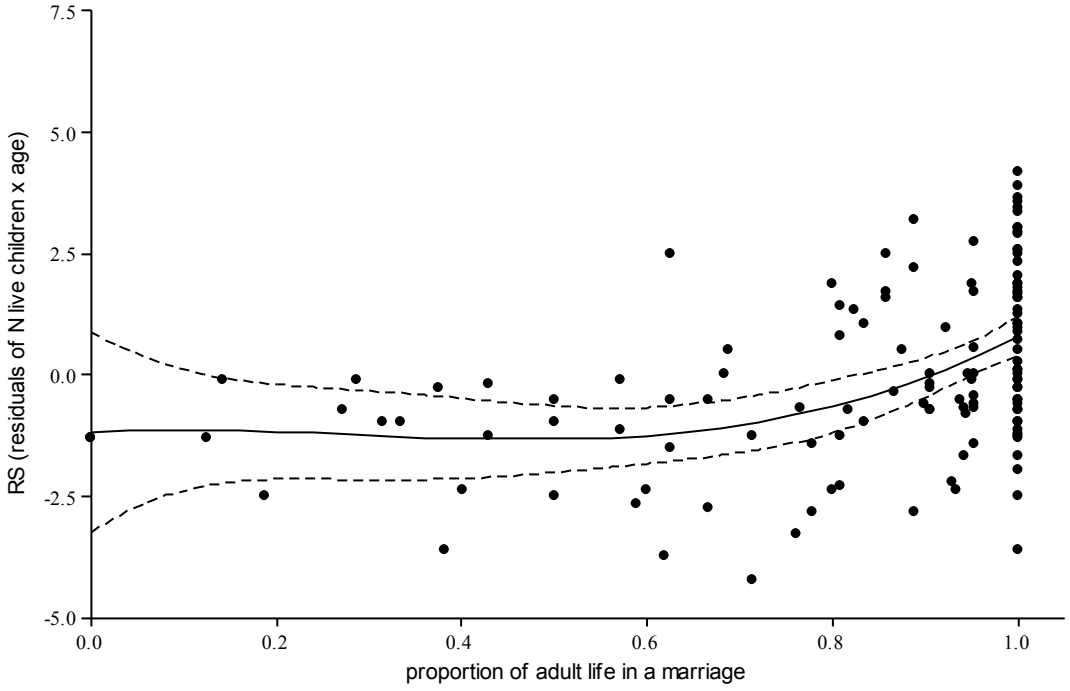


Figure 15.12b. How much does marriage affect women's reproductive success (RS)? A "Bateman gradient" for 130 women. Y axis: Residuals of N live children x age at final observation. X axis fraction of adult life in a marriage. The fits (and 95% confidence intervals) in the figure are to marriage + marriage-squared + marriage-cubed, to allow the fits to escape the constraints of a linear or quadratic relationship (R-squared = 18.6%). In a linear regression RS = -2.46 + 2.97 pctmarr. P = .000. R-squared = 14.7%.



It seems quite wrong to interpret Bateman's results (or mine) as evidence that males are unvaryingly promiscuous and females unvaryingly "coy", an issue that seems to have come back into prominence recently. The difference in standardized variance between males and females has for long been proposed as an index of opportunity for sexual selection (Wade & Schuster 2005). "Opportunity" seems to get forgotten. The measure summarizes the extent to which selection could act on characteristics that predictably led to higher RS. Such characteristics may exist, may have been selected already, or evolution may yet be waiting for a mutation that increases a male's chance of being among the higher scoring end of the distribution.

We should not neglect competition among females, as I mostly have done. If males provision then females may compete for good provisioners. They may also compete for non-infanticiders, or for males who do not impede female fitness in argument or "fighting".

SI 15.13. Relatedness to spouse

In a very small population such as the Hadza one might expect some unusual patterns of relatedness between spouses out of mere necessity. Obst (1912), writing at a time when eastern Hadza population was even smaller than today, claimed an extreme example, "We will get to know all the inhabitants of the camp in Figure 8: the old man who after his wife's death, took his own grandchild as a wife,…". Woodburn 1968 p 151-152 writes "The Hadza say that a man should not marry a first cousin of any sort, but one occasionally finds cases of marriage with either the parallel or the cross-cousin. The preferred marriage is a cross - generational one with the classificatory sister's daughter, though, as with any cross-generational marriage, it is rare in practice." Perhaps Obst's remarks really concerned such an instance. Marlowe (2010:49-52) summarizes the Hadza kinship system. A more linguistically profound account of kinship terminology is in preparation by Kirk Miller and Bonny Sands.

I examined the parents and grandparents of the 653 couples in the women's marital history summary file where both spouses are Hadza and appear in the population register, using a Visual Basic program. The program traces ancestry through the population register and reports any shared ancestor of husband and wife. There are undoubtedly errors in the identification of parents of the older people. The commonest error would be in the direction of giving one ID number to what had been actually two people of a bygone generation who had the same name. This possibility would give us a very small number of "false positives", an apparent common ancestor who was actually not one person but two. This error means that our results give us an upper limit to the real number of marriages of people who shared an ancestor within the generations since the great-grandparents. The real figure will be a little lower than our results suggest.

Among the 653 couples listed, 15 were found in which husband and wife shared a grandparent. This is 2.3% of couples, involving 15 different women, found with a shared ancestor when the genealogy was pursued only as far back as grandparents. Only 3 of these were between "full" cousins, sharing both a grandfather and a grandmother. Four shared just one grandparent (2 on father's side, 2 on mother's side). Five others shared ancestors who were parents of one partner, and grandparents of the other. Three represented couples which probably should not have been classed as marriages.

When the program was allowed to pursue genealogies as far back as great-grandparents (where the information is not always complete, and is much more likely to contain errors) we found 50 couples (involving 44 women) with some shared ancestry. This comprised 7.6% of couples. Some couples shared more than one common ancestor, so there were 91 common ancestors in total. There was a similar picture of cross-generation links – a grandfather of one spouse being a great-grandfather of the other spouse. In 30 cases out of the 91, the wife's ancestor was of a higher generation than the husband's, and the reverse in 12 cases. Thus in 30 cases the woman married a man who was the child of her grandfather, or child or grandchild of her great-grandfather (and/or

great-grandmother, there was no obvious predominance of either sex). Given that Hadza husbands are often substantially older than their wives, this result may not be surprising.

Bittles & Black (2010) summarize their compilation of close-kin marriage as showing that 10.4% of the global population of marriages are between people related as second cousins or closer (second cousins share great-grandparents, first cousins share grandparents). The Hadza rates are below this global average. Stevens et al (1977) reported data on inbreeding from Woodburn's Hadza genealogies. Woodburn's genealogies had more depth than ours and Stevens reported them in greater detail but in a way which is difficult to compare with ours. Firstly, I report relatedness between couples, while Stevens reports common ancestors of an individual (the equivalent of a child of my couples). If we extract from Stevens' Table 3 just the shared great-grandparents of ego, equivalent to my grandparents of the couple, we find at .0625, 48 people out of 621, or 7.73%, comfortingly close to my figure.

SI 15.14. Marriage and survival

Sociologists have reported marriage in industrial societies as protective to both men, and women, the effect tends to be weaker for women than for men (Rendall et al 2011, Henretta 2010, Lillard & Panis 1996). Biologists tend to reverse the causal arrows. Selecting a mate with good health and survival prospects has been discussed frequently in the biological literature, but the above references also control for this possibility. Lillard & Panis show that less healthy men marry earlier than more healthy men, as if to acquire the health benefits of marriage. It is unlikely that we would be able to distinguish cause from effect in the present study but it may be worth trying to see if there is any correlation between marriage and health or survival in the Hadza population. The result may fit, or discord with, ideas about marriage to be discussed later.

I had an additional reason for looking at this issue. I want to test ways in which a Hadza husband may materially help his wife. If, as many would expect, he provides her with food, which she allocates to maximize her fitness, her allocation should include her own survival (given that by surviving she can improve the fitness of her offspring and grand-offspring). Among some socially monogamous birds it has been found that when males are removed, the females can raise as many offspring as the control group (for example see Clutton-Brock 1991 Table 8.3). But in a few cases the experimental females (male removed, or clutch experimentally enlarged or delayed) lose weight and/or suffer a greater risk of death during the following winter (e.g Hannon & Martin 1992, Askenmo 1979). These explorations of possible costs of reproduction or benefits of male care provoked me to look for effects of husbands on maternal depletion, and into the current attempt to look for an effect of marriage on Hadza women's survival.

I linked the file that contains individuals' annual survival or mortality to the annual marriage histories. I ran multilevel logistic regressions (in MlWin) predicting

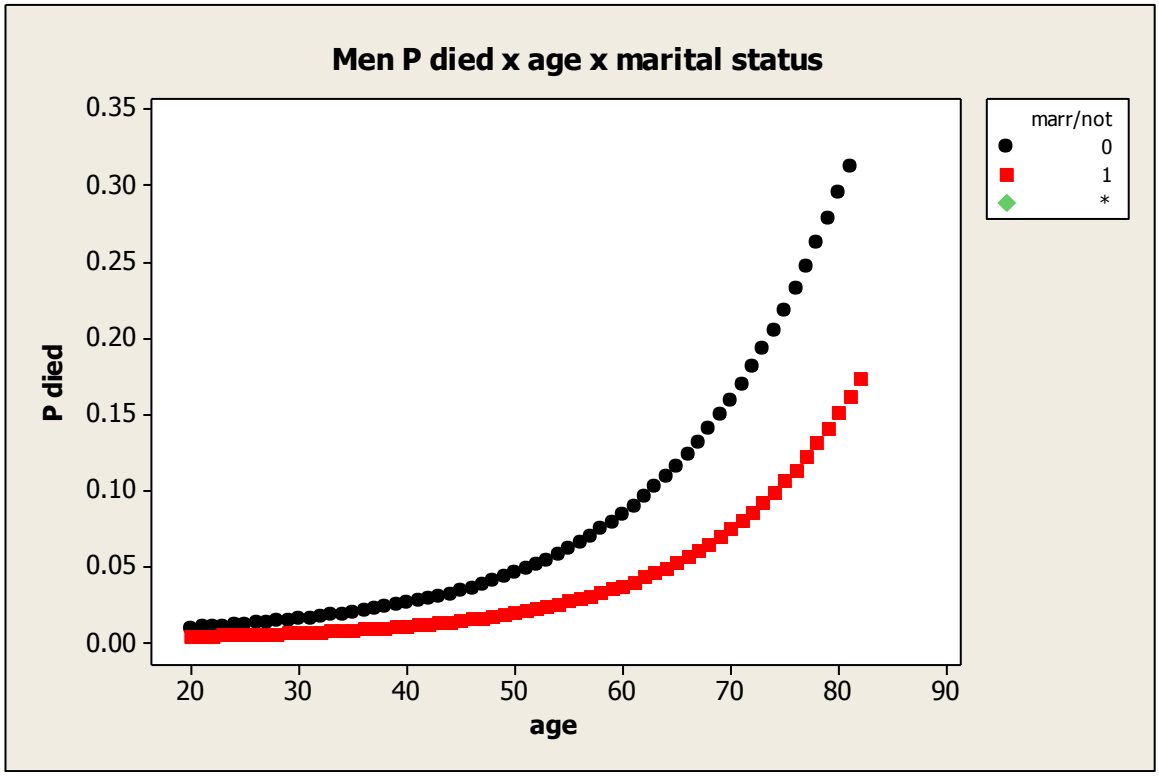
"live or dead" from age, age-squared, age-cubed, and marital status. Controlling for age, people were significantly less likely to die while married.
(male subset logistic regression model live or die = age + agesqd + marr/not b -.8823 p <.000 Odds Ratio 0.41)
(female subset logistic regression model live or die = age + agesqd + marr/not b = -0.6571 p = .020 Odds Ratio 0.52). The "health benefit" does not strongly differ between the sexes.

In another model with percent of adult life in a marriage as the independent variables, current marital status was also a significant predictor of survival (female b – 0.016 (se .006) p < .05).

The effect of current marital status (marr/not) could arise from desertion of, or by, a sick or ailing partner. Such things have been observed in western societies, and among the Hadza a case comes quickly to mind in which a long married woman took herself off to stay at a village with a clinic ("hospital") and before she returned her elderly husband of at least 20 years had found himself a new wife. Perhaps we can distinguish such desertions by controlling for the immediate effect of being in a marriage (marr/not) when looking at the long term effect of marriage (pctmarr) by entering both in the model. Percentage of adult life in a marriage continues to make a small but significant contribution to predicting the hazard of death (b – 0.014 (se .007) p = .05).

This result could nonetheless indicate not an effect of marriage on survival but a long term effect of health on marriage and separately on survival. Our only practicable measure of health was height and weight. "Comboht" and "combowt" are adult average height and weight during 1985-2000, or if not recorded, height and weight from Lars Smith's 1977 data (if adult in 1977). This enables us to include heights and weights of people who died before being measured by us. However, neither height nor weight predicted adult survival and they did not change the contribution of marriage to predicting survival in multilevel logistic regression.

Fitted survival of married and single men.



15.15. Dead husband's brother – Levirate?

Some (up to 6 at some time during the study period) Hadza women were married to the brother of their former husband. In every case the previous husband had died. Kohl- Larsen (1958), who leaned heavily on reports by his Isanzu helpers, described this as a recognized event on the death of a man but of course gives no numbers. When I tried to discuss the issue with one older woman her only comment was that nowadays the husband's family cannot "capture" the wife in this way.

Nonetheless such marriages continue to form, some very successfully. During our fieldwork there was one marriage of a young couple, both newly bereaved. She had one child by the dead brother, made a home for the new husband's two sons by his late wife, and proceeded to have 6 more children with her new husband. Another example was of an older couple. The woman had been widowed for some years. Then her brother-in-law left his wife where they had lived in a village and moved to live with his widowed sister-in-law in the bush until after the end of my fieldwork. Another case occurred sometime between Lars Smith's census in 1977 and our first household list during our pilot visit in 1984 and concerned an older, post-childbearing woman with many children by her late husband. The few other cases that we know are of older people and we do not know how recent the marriages were. Marlowe (2010: 171) describes such marriages as "quite common" but emphasizes that such marriages appear optional, regarded as good and normal but by no means obligatory.

Howell (1979: 239) reports a similar incidence (six cases) of marriages to a brother of a dead husband among the !Kung. She points out that its occurrence in a society in which transmission of property is not an issue is interesting. But one should estimate the random probability of such marriages before claiming that they indicate anything more than absence of a prohibition against such marriages. In a small population, in which close blood relatives are avoided, the available and eligible men may quite likely include a dead husband's brother. The incidence may reflect merely the age-shaped incidence of bereavements and the small number of people in the population.