The relationship between serial monogamy and rape in the United States (1960–1995)

Philip T. Starks[1][*] and Caroline A. Blackie[2]

[1]*Environmental Science, Policy and Management, Division of Insect Biology, University of California at Berkeley, 201 Wellman Hall No. 3112, Berkeley, CA 94720-3112, USA*
[2]*Section of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853-2702, USA*

In mating systems where individuals pair, separate and re-pair repeatedly (i.e. serial monogamy), some males monopolize more than one female's reproductive life span and thus leave other males effectively mateless. Males who cannot secure females through traditional methods may seek alternatives, such as rape, to ensure gene passage into future generations. Analysis of US government records shows that (i) divorce and remarriage patterns in the United States are likely to increase the variance in male reproductive success, and (ii) rates of divorce and rape correlate positively. The former result suggests that serial monogamy increases the variance in male, relative to female, reproductive success and the latter result suggests that this variance influences the frequency of rape in American society. Because raped females sometimes become pregnant and take these pregnancies to term, our results indicate that rape has current adaptive significance.

Keywords: alternative reproductive tactics; behavioural plasticity; evolution

1. INTRODUCTION

Serial monogamy describes a societal mating practice in which individuals engage in sequential monogamous pairings (Wright 1994). American society, in which the pattern of marriage, divorce and remarriage is common, can thus be considered serially monogamous. Because Americans have a male-to-female sex ratio close to 1:1, for every male that pairs with multiple females and monopolizes more than the equivalent of one female's reproductive life span, there must be a male that receives less than a full equivalent. From an evolutionary perspective, this variance in male reproductive success should drive mateless males to adopt alternative reproductive tactics or risk being outcompeted by more successful males (Gross 1996).

For males to monopolize more than one female's reproductive life span, males should marry women younger than themselves and, after divorce, remarry women younger than their previous wife. Kunz & Kunz (1994) uncovered this trend through an examination of 3246 marriage licences filed in Salt Lake City, Utah. The discrepancy between male and female age at marriage was larger for previously married males than for previously single males (on average, males were consistently older than their wives). Thus, some males may extract more than the equivalent of one female reproductive life span through the process of marriage and divorce.

Serial monogamy may lead to other indicators of increased variance in male, relative to female, reproductive success. For example, sequentially monopolizing the reproductive life span of multiple females could lead to a disproportionate number of males who will never marry: if males are more likely than females to remarry, then males who remarry must exploit the single female population. Indeed, this seems to be the case. Data gathered by the US government indicate that (i) almost a third of all male marriages are remarriages; (ii) the ratio of male-to-female remarriage is roughly 3:1; and (iii) the population of females who have never married is smaller than that of the males (see § 3). It thus appears that serial monogamy is common and likely to increase the variance in male reproductive success by creating a deficit of single females and a situation where some males can divorce and remarry younger women. Males who are being outcompeted, i.e. those males with relatively low reproductive success, may seek alternative methods to increase the likelihood of successfully getting offspring into the next generation (Gross 1996).

One possible alternative reproductive tactic for mateless males is rape, because rape ensures that males obtain copulations and may provide a direct fitness pay-off (Thornhill & Thornhill 1983; Palmer 1989; Thornhill & Thornhill 1992). Previous reports indicate that most rapists are economically disadvantaged young males unlikely to secure mates (Thornhill & Thornhill 1983), that rape victims are predominantly young, and thus fertile females (Thornhill & Thornhill 1983), and that raped women sometimes become pregnant (Evrard & Gold 1979; Thornhill & Thornhill 1983; Tintinalli & Hoelzer 1985; Palmer 1991; Beebe 1991; Goodman et al. 1993; Holmes et al. 1996) and take these pregnancies to term (Holmes et al. 1996). Indeed, from a sample of over 4000 American women, Holmes et al. (1996) estimated that over 32 000 pregnancies result from rape each year and that over 38% of these pregnancies are taken to term.

We investigated the hypothesis that serial monogamy affects the rate of rape in the United States. To examine this hypothesis we compared divorce and rape rates. Our logic is as follows: (1) divorce leads to serial monogamy; (2) serial monogamy increases variance in male reproductive success; and (3) increased variance in male reproductive success influences some males to rape as an alternative reproductive tactic (figure 1). Although there

this relationship supports the hypothesis labelled (3)

divorce

(1) is an indicator of

serial monogamy

(2) is an indicator of

increased variance in male reproductive success

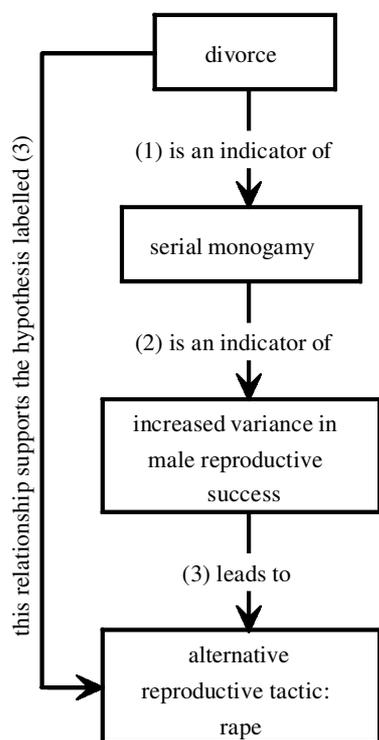(3) leads to

alternative reproductive tactic: rape

Figure 1. Schematic delineating the relationship between the arguments (1 and 2), hypothesis (3) and data.

are inherent difficulties in interpreting results of regression analyses (see §4), experimental manipulation is impossible for obvious ethical reasons. Thus, correlational analysis provides the most powerful tool currently available to examine this hypothesis.

2. METHODS

To examine US population characteristics that may indicate increased variance in male, relative to female, reproductive success and to investigate the hypothesis that serial monogamy affects the rate of rape, we gathered data published by the US federal government (table 1). Due to year-to-year differences in data presentation and/or collection methods, not all years between 1960 and 1995 are represented in the population characteristics. We were able to obtain data for overall US rates of rape and divorce for 1960–1995 and State-specific rates for 1965, 1975, 1985 and 1994 (the last year for which these data were available). The years for which State-specific data were gathered were selected at roughly ten-year intervals to be representative of each time-period; the remaining years were not examined.

3. RESULTS

(a) *Population characteristics*

The male-to-female birth sex ratio was 1.05:1 whereas the male-to-female adult sex ratio was 0.95:1 (figure 2). This result indicates higher male mortality. Although adult females outnumbered adult males, there were significantly fewer females who have never married than males who have never married (paired t-test, $t_{23} = 23.69$, $p < 0.0001$; figure 2). This result may arise because males remarried at a greater rate than females (male, 112.48 ± 2.71; female, 37.43 ± 0.47; paired t-test, $p < 0.0001$; figure 3), thus these remarrying males may have depleted the single female pool.
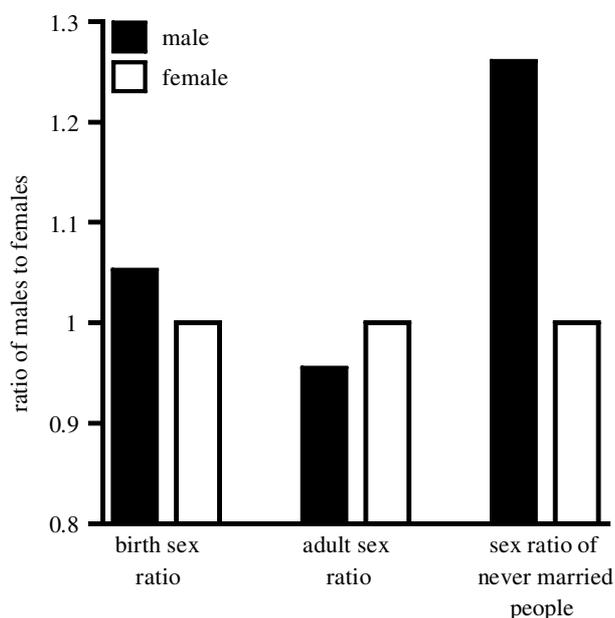
Figure 2. Birth, adult, and never-been-married adult sex ratios. Columns are ratios. Female values have all been set to one.

In addition, males remarried more rapidly than females (paired t-test, $t_{18} = 30.92$, $p < 0.0001$; figure 3), were older than their wives at the times of both their first and second marriage (figure 4), and remarried women younger than their previous wife (paired t-test, $t_{25} = 44.25$, $p < 0.0001$; figure 4). Combined, these data strongly suggest that some American males are monopolizing more than one female's reproductive life span and thus American males may have more variance in reproductive success than their female counterparts.

(b) *Rape and divorce*

Multiple regression analysis uncovered a strong positive relationship between the rate of rape and both the divorce rate and time (table 2). The relationship between rape and divorce was significant within years when comparing across individual States (table 2). These results suggest a consistent relationship between rape and divorce.

4. DISCUSSION

Alexander *et al.* (1979) concluded that human males had greater variance in reproductive success than human females based on morphological (i.e. sexual dimorphism), population (i.e. sex ratio) and life-history (i.e. mortality) characteristics. We present behavioural data supporting this conclusion: (i) more males than females never marry (figure 2); (ii) males remarry at a greater rate than females (figure 3); (iii) males remarry more rapidly than females (figure 3); (iv) husbands are typically older than their wives (figure 4); and (v) the age difference between married couples increases as males remarry (figure 4). Combined, these data strongly suggest that males in the United States have more variable reproductive success than females. Because some of this variation in reproductive success can be attributed to serially monogamous mating practices, the divorce rate should be an indicator of the relative degree of variance in male reproductive success.

Table 1. *US government data*

(Sources: 1, US National Center for Health Statistics. *Vital statistics of the United States, vol. I. Natality.* US Department of Health and Human Services, Maryland, Annual. 2, US Bureau of the Census. *Statistical abstract of the United States.* Washington, DC. Annual. 3, US National Center for Health Statistics. *Vital statistics of the United States, vol. III. Marriages and divorces.* US Department of Health and Human Services, Maryland, Annual. 4, US National Center for Health Statistics. *Monthly vital statistics reports.* US Department of Health and Human Services, Maryland. 5, Federal Bureau of Investigation. *United States: uniform crime reports.* Bureau of Justice Statistics, Washington, 1998.)

characteristic	years covered	notes	source
birth sex ratio	1960–1992	ratio of males to females for all documented live births	1
population sex ratio	1960–1992, 1994–1995	ratio of males to females for individuals over the age of 18. Data for 1993 were unavailable	2
number of individuals who have never been married	1971–1995	data for ages 18 and over. Prior to 1971, data were for ages 14 and over and, for consistency, were excluded	2
time to remarriage	1970–1988	mean number of years until remarriage. We are unaware of data published in this form for 1960–1969 and 1989–1995	3
rate of remarriage	1963–1988	number of marriages per 1000 previously married males or females. We are unaware of data published in this form for 1960–1962 and 1989–1995	3
divorce rate (overall)	1960–1995	number of divorces per 1000 population	4
divorce rate (State and year specific)	1965, 1975, 1985, and 1994	number of divorces per 1000 population	3
rape rate (overall)	1960–1995	number of rapes per 100 000 inhabitants	5
rape rate (State and year specific)	1965, 1975, 1985, and 1994	number of rapes per 100 000 inhabitants	5

Increased variation in male reproductive success may influence individuals who cannot compete with the standard reproductive tactic to alter their tactics (Gross 1996). Although multiple alternative tactics may be available to outcompeted males, one obvious alternative is rape (Thornhill & Thornhill 1983). Indeed, rape is likely to confer a fitness pay-off because some raped females become pregnant (Evrard & Gold 1979; Thornhill & Thornhill 1983; Tintinalli & Hoelzer 1985; Palmer 1991; Beebe 1991; Goodman *et al.* 1993; Holmes *et al.* 1996) and take these pregnancies to term (Holmes *et al.* 1996).

Our analysis shows that both the rate of divorce and year correlated positively with the rate of rape in the United States (table 2). A gradual increase in reporting rape could drive the correlation between rape and year, but the analysis also reveals a stronger, alarmingly high correlation between rape and divorce. This relationship is significant within years when comparing across individual States (table 2), suggesting that this correlation is not a by-product of an unstable age distribution (i.e. an artefact of an ageing 'baby-boom' generation). This correlation may not have been surprising if both rape and divorce had been steadily increasing, but in recent years both have decreased in frequency. Thus, our results suggest that the pattern of divorce and remarriage leads to increased variance in male reproductive success and that this variance may influence outcompeted males to rape as an alternative reproductive tactic. Because divorce rate often varied only slightly between years and between States, these data suggest that males are sensitive to small changes in the degree of serial monogamy.

Surprisingly, existing evidence suggests that the per event reproductive success rate of rape may exceed that of non-rape. Data gathered from a US national sample of women indicated that the probability of a reproductively viable woman becoming pregnant was 5.0% per rape (Holmes *et al.* 1996). This value is higher than a World Health Organization estimate: out of 6467 non-contracepting reproductive cycles, in which at least one coital event occurred, only 1.2% resulted in pregnancy (World Health Organization 1983). In addition, 11.8% of pregnancies resulting from rape ended in spontaneous abortion (Holmes *et al.* 1996), whereas the overall spontaneous abortion rate in the US is 13.8% (Saraiya *et al.* 1999). Thus, the rape tactic may exceed that of non-rape tactics in both the probability of impregnating women and in the probability of foetus survival.

This disturbing interpretation is speculative and these data are preliminary. Due to differences in data collection, the studies cited above are possibly not suitable for direct comparison. However, if these data are accurate, at least three non-mutually exclusive adaptive hypotheses may explain these results: (i) rapists can detect when women are most likely to conceive, and preferentially attack at that time; (ii) rapists can detect women who are most likely to carry a child to term and preferentially attack these women; and/or (iii) rapists invest more energy, per copulation, in terms of sperm production and/or force of ejaculation than non-rapists. To the best of our knowledge, no data support hypotheses (i) and (iii), but the fact that rapists tend to attack females who are in their peak reproductive years (Thornhill & Thornhill 1983) provides support for hypothesis (ii). An additional
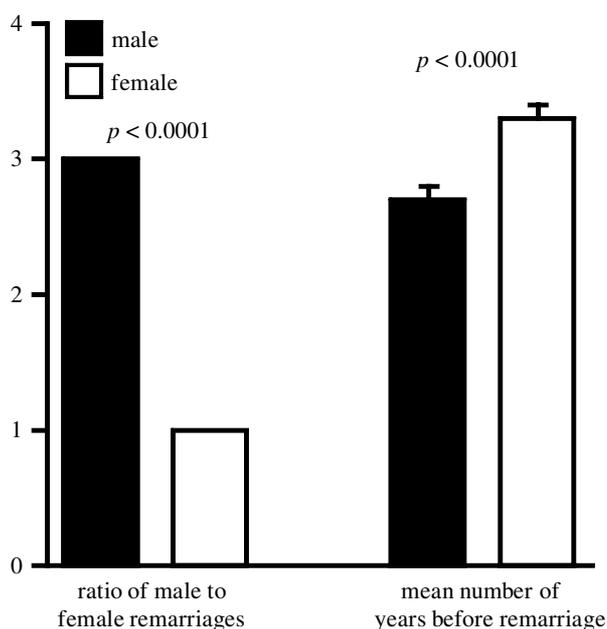
Figure 3. Ratio of male-to-female remarriages and the mean number of years between marriages for remarrying males and females.
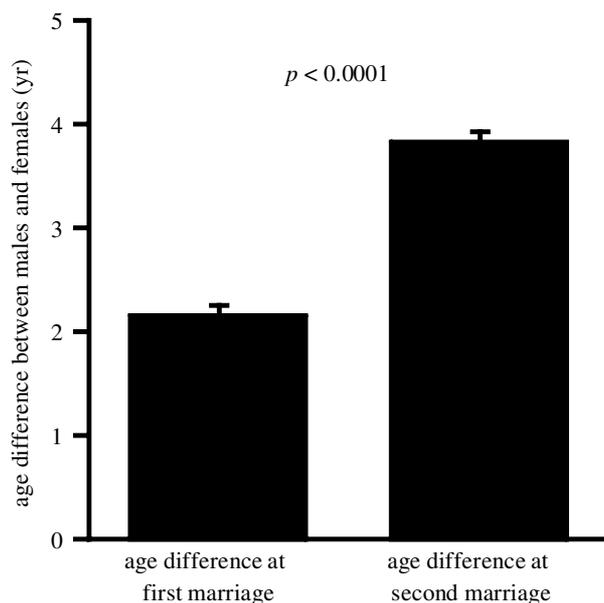

Figure 4. Male minus female age at first marriage and at the male's second marriage. Positive values indicate that, on average, males were older than the females they married.

Table 2. *Results of regression analyses*

((a) Multiple linear regression analysis was performed on the US yearly overall rates of rape and divorce from 1960–1995, and (b) simple linear regression was performed on State-specific rates of rape and divorce for specified years.)

(a)

dependent variable	independent variables	d.f.	coefficient	s.e.	R^2	F-ratio	p-value
rape	constant	33	− 1433.65	83.44	0.98	872	$\leqslant 0.001$
	year (1960–1995)		0.73	0.04			$\leqslant 0.001$
	divorce		3.76	0.42			$\leqslant 0.001$

(b)

dependent variable	independent variables	d.f.[a]	coefficient	s.e.	r^2	F-ratio	p-value
rape (1965)	constant	48	8.61	0.96	0.09	4.8	$\leqslant 0.001$
	divorce (1965)		0.49	2.18			0.034
rape (1975)	constant	47	10.14	3.90	0.25	15.2	0.013
	divorce (1975)		2.65	0.70			$\leqslant 0.001$
rape (1985)	constant	48	14.19	5.72	0.21	12.9	0.017
	divorce (1985)		3.67	1.02			$\leqslant 0.001$
rape (1994)	constant	46	16.97	7.20	0.19	10.7	0.023
	divorce (1994)[b]		4.75	1.45			0.003

[a] Degrees of freedom vary because not all States reported divorce rates. Divorce rates were missing for California (1994), Indiana (1975 and 1994) and Louisiana (1965, 1975, 1985 and 1994).
[b] 1994 was the last year for which we had divorce rates for individual States.

non-adaptive hypothesis, which we favour but cannot support, is that the likelihood of reporting rape greatly increases if the rape results in pregnancy, thus explaining the high probability of pregnancy per rape.

Rape is a complex behaviour, and thinking it could be explained only as an alternative tactic in the male reproductive strategy would be naive. Rape, in some circumstances, may be a by-product of heightened male sexual arousal (Palmer 1991). Indeed, the range of rape victims includes those that could not possibly provide a direct fitness pay-off to the rapist (i.e. children, post-menopausal women, other males, etc.). However, rape sometimes provides a fitness pay-off, and our data suggest that the frequency of rape varies predictably with variance in male reproductive success. This correlation is explicitly predicted by the 'rape as an alternative tactic' hypothesis, while not being a clear prediction of the 'rape as a by-product' hypothesis. Thus, we believe that a complete explanation of rape must include an evolutionary approach to the alternative tactics in male sexual behaviour.

In summary, we present the following argument: (i) divorce leads to serial monogamy; (ii) serial monogamy increases variance in male reproductive success; and (iii) increased variance in male reproductive success influences some males to rape as an alternative reproductive tactic (figure 1). Demographic data (figures 2–4) and the relationship between divorce and rape (table 2) supports this argument. This study does not suggest that only divorce leads to rape. Indeed, our suggestion is that anything that leads to increased variance in male reproductive success will increase the prevalence of alternative male reproductive tactics, e.g. rape. However, because of the mating pattern (i.e. serial monogamy), divorce may be an exceptionally good predictor of the behaviour in the US.

We have described a relationship that supports the hypothesis that rape is an alternative reproductive tactic. This explanation is evolutionary in that it describes a behaviour performed to increase the probability of gene transfer to future generations. We have not addressed the proximate mechanisms of the performance of this behaviour (see Malamuth & Heilman (1998) for a review of mechanisms). It has been suggested that rape is about male power over, or hatred of, women. While these hypotheses may be correct, they do not conflict with our conclusion. Males who receive little or no reproductive opportunity may feel hatred towards women and express that anger through rape. However, forced copulations (i.e. rape) may lead to the production of offspring and thus have evolutionary implications.

It is important to note that correlational relationships may suggest, but on their own do not conclusively establish, causation. Our argument here is that increased variance in male reproductive success influences some males to engage in alternative reproductive tactics, and we use a likely correlate of this variance (i.e. divorce) in our analysis. It is possible that divorce is linearly related to another variable, and that this other variable is more indicative of causal factors. In our multiple linear regression we used both 'year' and 'divorce' as independent variables, thereby controlling for other factors which may vary predictably with time, such as the likelihood of reporting rape, societal attitudes towards sex, etc. Despite this control in our analysis, a significant positive partial correlation between rape and divorce still emerged. (Naturally, factors which vary predictably with time were irrelevant in the within-year analyses, which also showed a significant positive relationship between rape and divorce.) Although these results should be viewed cautiously due to the nature of the analysis, it is important to note that these results are explicitly predicted by the rape as an alternative reproductive tactic hypothesis, and thus provide the most critical support for the hypothesis to date.

In closing, this study does not suggest that rapists are conscious of the ultimate factors leading to the performance of this tactic, that serial monogamy is the only factor influencing rape, or that individuals who have experienced divorce are more likely to rape than those who have not. Our report is not a justification of rape and does not promote remaining in a bad marriage. However, our analyses reveal a strong positive correlation between rape and divorce, suggesting that the degree of serial monogamy in America influences the frequency of rape. Finally, because males are sensitive to small changes in the degree of serial monogamy, and because raped females sometimes become pregnant and take these pregnancies to term, these results suggest that rape has current adaptive significance.

REFERENCES

Alexander, R. D., Hoogland, J. L., Howard, R. D., Noonan, K. M. & Sherman, P. W. 1979 Sexual dimorphisms and breeding systems in Pinnipeds, Ungulates, Primates, and humans. In *Evolutionary biology and human social behavior: an anthropological perspective* (ed. N. A. Chagnon & W. Irons), pp. 402–435. North Scitivate, MA: Duxbury Press.

Beebe, D. K. 1991 Emergency management of the adult female rape victim. *Am. Fam. Physician.* **43**, 2041–2046.

Evrard, J. R. & Gold, E. M. 1979 Epidemiology and management of sexual assault victims. *Obstet. Gynecol.* **53**, 381–387.

Goodman, L. A., Koss, M. P. & Russo, N. F. 1993 Violence against women: physical and mental health effects. I. Research findings. *Appl. Prev. Psychol.* **2**, 79–89.

Gross, M. R. 1996 Alternative reproductive strategies and tactics: diversity within sexes. *Trends Ecol. Evol.* **11**, 92–98.

Holmes, M. M., Resnick, H. S., Kilpatrick, D. G. & Best, C. L. 1996 Rape-related pregnancy: estimates and descriptive characteristics from a national sample of women. *Am. J. Obstet. Gynecol.* **175**, 320–324.

Kunz, J. & Kunz, P. R. 1994 Social setting and remarriage: ages of husband and wife. *Psychological Reports* **75**, 719–722.

Malamuth, N. M. & Heilman, M. F. 1998 Evolutionary psychology and sexual aggression. In *Handbook of evolutionary psychology: ideas, issues and applications* (ed. C. Crawford & D. L. Krebs), pp. 515–542. Mahwah, NJ: Lawrence Erlbaum.

Palmer, C. T. 1989 Is rape a cultural universal—a re-examination of the ethnographic data. *Ethnology* **28**, 1–16.

Palmer, C. T. 1991 Human rape—adaptation or by-product. *J. Sex Res.* **28**, 365–386.

Saraiya, M., Berg, C. J., Shulman, H., Green, C. A. & Atrash, H. K. 1999 Estimates of the annual number of clinically recognized pregnancies in the United States, 1981–1991. *Am. J. Epidemiol.* **149**, 1025–1029.

Thornhill, R. & Thornhill, N. W. 1983 Human rape: an evolutionary analysis. *Ethol. Sociobiol.* **4**, 137–173.

Thornhill, R. & Thornhill, N. W. 1992 The evolutionary psychology of men's coercive sexuality. *Behav. Brain Sci.* **15**, 363–375.

Tintinalli, J. E. & Hoelzer, M. 1985 Clinical findings and legal resolutions in sexual assault. *A. Emerg. Med.* **14**, 447–453.

World Health Organization 1983 A prospective multicentre trial of the ovulation method of natural family planning. III. Characteristics of the menstrual cycle and of the fertile phase. *Fertil. Steril.* **40**, 773–778.

Wright, R. 1994 *The moral animal: the new science of evolutionary psychology.* New York: Pantheon.