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SEXUALITY, DELINQUENCY AND *r*/*K* REPRODUCTIVE STRATEGIES: DATA FROM A CANADIAN UNIVERSITY SAMPLE

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Summary—Across species, *r*/*K* reproductive strategies have been postulated to underlie a tradeoff that exists between mating effort and parental effort, also hypothesized to mediate encephalization, longevity, rate of maturation, and altruism. Recent analyses have extrapolated this framework to human differences. Here a test is provided with data gathered from university students in which measures of family size, intelligence, head circumference, and longevity are related to strength of sex drive, genitalia size, sexual attitudes and delinquency. The results indicate that, although the magnitude of the effects are small, many of the variables cohere in a pattern interpretable as an *r*/*K* dimension. For example, aggregate scores on one set of measures were predictive of both delinquency and sexual permissiveness, which were also related to each other.

INTRODUCTION

It has recently been suggested that personality may be related to gene-based *r*/*K* life history strategies (Rushton, 1985). Originating in the mathematics of population biology, the symbols *r* and *K* refer to two ends of a continuum of reproductive behaviour organisms can adopt ranging from extreme *r*, involving maximum egg output and no parental care, to extreme *K*, emphasizing elaborate parental care in which the birthrate is reduced to a minimum. Numerous other life history characteristics have been observed to covary with this trade off between parental investment and egg production, including speed of maturation, length of lifespan, encephalization, reproductive effort, and degree of social cohesion. Following Wilson (1975), Barash (1982), and Eisenberg (1981), these life history traits are listed in Table 1.

Extrapolating from these across-species traits to human differences, Rushton (1985) postulated that those individuals who were higher in *K*, relative to those lower, should be (among other things) larger in size, maturationally delayed, longer lived, intelligent, altruistic, sexually restrained, and come from smaller more stable families, with a wider spacing of births. Thus, diverse and seemingly unrelated human characteristics were postulated to covary.

Consideration of the available evidence offers support for the *K* perspective on human differences. One investigatory approach has used the 'known groups' procedure, contrasting groups known to differ by one criterion, and then examining whether the predicted covariation occurs on other traits. For example, Rushton (1987) contrasted the characteristics of mothers of dizygotic twins who, because they produce more than one egg at a time, can be considered to represent the *r*-strategy, with mothers of singletons representing the *K*-strategy. As expected, the former were found to have a lower age of menarche, a shorter menstrual cycle, a higher number of pregnancies, and an earlier menopause. Similar predicted covariation was found in other contrasts including those made between criminals and non-criminals (Ellis, 1988), between higher SES groups and lower SES groups (Rushton and Bogaert, 1988), and between Mongoloid, Caucasoid, and Negroid populations (Rushton, 1988a, b; Rushton and Bogaert, 1987, 1988; but see Zuckerman and Brody, 1988).

In this paper we go beyond studying 'known groups' to explore whether the *r*/*K* dimension is predictive within the range found in a university sample. To accomplish this, human analogues for each life history construct listed in Table 1 were operationalized and administered to undergraduates. It was hypothesized that these variables would reveal a factor structure resembling the proposed *r*/*K* dimension and that aggregate scores thereon would be related to independent scales assessing sexual attitudes and delinquency.

Table 1. Some life history, social behaviour and physiological differences between *r* and *K*-strategists (following Pianka, 1970)

r-strategists	*K*-strategists
Family characteristics	
Large litter sizes	Small litter sizes
Short birthspacing	Long birthspacing
Many offspring	Few offspring
High infant mortality	Low infant mortality
Low parental care	High parental care
Individual characteristics	
Rapid maturation	Slow maturation
Early reproduction	Delayed reproduction
Short life	Long life
High reproductive effort	Low reproductive effort
Productive energy use	Efficient energy use
Low encephalization	High encephalization
Small body size	Large body size
Population characteristics	
Opportunistic exploiters of environment	Consistent exploiters of environment
Dispersing colonizers	Stable occupiers of the habitat
Variable population size	Stable population size
Competition variable, often lax	Competition keen
Social system characteristics	
Low social organization	High social organization
Low altruism	High altruism

As mentioned above, Ellis (1988) found *r*/*K* variables to be linked to criminality, and other research has found criminality to be related to sexuality. For example, in a longitudinal study Jessor, Costa, Jessor and Donovan (1983) were able to predict the onset of sexual intercourse among 432 adolescents from knowledge of whether they had low scores in academic achievement and religiosity, and high scores on measures of social deviance, with multiple correlations reaching levels >0.50 over a 9 yr interval. More recently, Rowe, Rodgers, Meseck-Bushey and St John (1989) showed that, among adolescents, 36–49% of the variance in level of sexual intimacy engaged in by one sibling was predicted by the amount of delinquency engaged in by the other. This study examined these relationships further.

METHOD

Subjects and procedure

One hundred and sixteen male and 100 female introductory psychology students with an average age of 20.3 yr participated over a 3 week period. *S*s were tested in groups of 10–50 and given 2 hr to complete questionnaires assessing their intelligence, life histories, delinquency, and attitudes toward sexuality, as well as having an anthropometric assessment made of their head circumference (Bogaert, 1987). Upon completion of the study, *S*s were debriefed and received course credit.

Life history assessment and extant scales

Each *S* received a package containing consent forms and a life history questionnaire assessing the life history constructs in Table 1. A pool of items was generated for each construct listed and then aggregated to form composite variables. Altogether, 18 constructs were measured. Space does not allow a full description of these, but their style can be gauged from Table 2 (see Bogaert, 1987, for details).

To assess encephalization, head circumference was estimated using a stretchless measuring tape. Made along the plane of the skull situated just above the ear, this is one of a number of standard skull size measurements (MacDougall, Wenger and Green, 1982) and gives an indication of the size of the brain case.

In addition to these explicitly created life history measures, several existing questionnaires were given to the *S*s. A group test of intelligence consisted of the short version of the *Multidimensional*

Table 2. Life history constructs

Construct	No. of items	Examples
(1) Litter size	1	"Do you have twins in your family?"
(2) Birthspacing	1	Average monthly interval between siblings
(3) Offspring production	5	"How many brothers and sisters do you have?" "How many aunts and uncles do you have?"
(4) Infant mortality	3	"Have you ever had (or been involved with an) abortion?" "Have you ever had a brother or sister who died before 18 years of age?"
(5) Parental care	7	"Compared to others and on scale from 1 to 7, estimate the degree to which your parents cared what happened to you" "Compared to others and on scale from 1 to 7, estimate the degree to which your parents invested their time in you"
(6) Maturation rate	8	"At what age did you enter puberty (e.g. menarche or growth spurt)?" "Were you an early, medium (9 months), or late baby?"
(7) Onset of reproduction	11	"At what age did you first have sexual intercourse?" "How old was your mother when she had her first child?"
(8) Longevity	6	"At what age did your grandparents die?"
(9) Reproductive effort	12	"How many sexual partners have you had?" "How large are your breasts (females)?" "How large are your penis and testes (males)?"
(10) Metabolism	3	"Compared to others, I am a person who gains weight easily"
(11) Encephalization	3	Multidimensional Aptitude Battery Skull circumference
(12) Body size	2	"How tall are you?" "How much do you weigh?"
(13) Exploitation of environment	1	16 item 'Orderliness' scale
(14) Dispersion	3	"How many different residences have you lived in?"
(15) Density	3	"Compared to others, I am a person who dislikes crowds"
(16) Competition	4	"What is your family's yearly income?"
(17) Social organization	5	"Have your parents ever been divorced or separated?"
(18) Altruism	5	"On a scale from 1 to 7, indicate your willingness to lay down your life for your biological brothers and sisters" "On a scale from 1 to 7, indicate your willingness to give half of all you owned to your parents or brothers and sisters"

Aptitude Battery (Jackson, 1984a) assessing the same components of cognitive performance as the *Wechsler Adult Intelligence Scale* (*WAIS*). To assess 'exploitation of the environment', the Order scale (e.g. "I am often disorganized") from the *Personality Research Form* was administered (Jackson, 1984b). Two indicators of sexual attitudes were the 21 item *Sexual Opinion Survey* measuring erotophobia–erotophilia, the inclination to like or dislike sexuality (Fisher, Byrne, White and Kelley, 1988) and the male (28 item) and female (39 item) versions of the *Sex Guilt Scale* (Mosher, 1966, 1968). A typical item from the Sexual Opinion Survey would be "Engaging in group sex is an entertaining idea" and from the Sex Guilt Scale "Masturbation is wrong and will ruin you". A *Self-Report Delinquency Scale* measuring 20 items of misbehaviour such as "I have drunk alcohol under the legal age" was provided (Rushton and Chrisjohn, 1981).

RESULTS

Means and standard deviations for some of the life history items and extant scales are shown in Table 3. Scores on the short version of the Multidimensional Aptitude Battery were converted to WAIS equivalents, yielding an IQ score of 113 for the sample. Although males appear to score higher on the Sex Guilt Scale than females, this finding is not interpretable because different scales are used for males and females (Mosher, 1966, 1968). More typical of findings in the domain of sexual attitudes are those using the Sexual Opinion Scale where males typically report enjoying sex more than females do (Eysenck, 1976; Fisher *et al.*, 1988; Symons, 1979).

Alpha coefficients were generated for constructs with more than two items. Missing data were replaced with the mean for each variable, a process that leads to homogeneity and does not bias the results in favour of r/K. The α coefficients ranged from 0.02 to 0.87 with a mean of 0.56. Only three of the constructs had α coefficients <0.50, and all of these had three items or less. The internal consistency of the 'reproductive effort' ($\alpha = 0.51$) is particularly noteworthy here because the items (genitalia size, ejaculate volume, intercourse frequencies, speed of orgasm, number of partners) had no basis for clustering except from predictions derived from r/K theory.

Table 3. Means, standard deviations and sample sizes for selected variables and extant scales

	Males			Females		
Variable/scale	Mean	(SD)	*N*	Mean	(SD)	*N*
Head size (mm)	580.4	(18.0)	114	553.1	(13.3)	100
Menarche onset (yr)	—	—	—	13.2	(1.4)	99
Height (cm)	179.5	(10.8)	116	165.5	(6.7)	99
Weight (kg)	75.4	(9.4)	116	56.7	(7.8)	99
Flaccid penis length (cm)	8.9	(3.5)	109	—	—	—
Erect penis length (cm)	18.0	(4.8)	111	—	—	—
First masturbation (yr)	15.1	(4.5)	76	15.7	(2.9)	43
First fondling (yr)	14.3	(3.5)	104	15.6	(2.3)	78
First intercourse (yr)	17.1	(2.0)	94	17.6	(1.6)	63
Sexual partners in lifetime	10.4	(16.3)	103	3.8	(7.2)	80
Intelligence test	113	(15.1)	115	112	(10.9)	98
Sex guilt	7.7	(4.3)	116	6.1	(5.7)	100
Sexual permissiveness	76.9	(15.5)	108	61.8	(20.9)	90
Delinquency scores	38.7	(9.9)	114	32.1	(5.9)	100

IQ, brain size and size of genitalia

When the total sample was used and after controlling for sex, scores on the IQ test correlated positively with an aggregate measure of 'head size', with a correlation of $r = 0.14$, $P < 0.05$ (0.18, after correcting for unreliability of measurement, and 0.21 after also correcting for restriction of range). The 'head size' measure included self-report hat size in addition to the objective tape measured head circumference. Error in males came from their not knowing their hat size and in females from placing the tape around different hair styles. When body size was partialled, the corrected correlations reduced from 0.21 to 0.18.

Since across group comparisons have shown that brain size correlates negatively with genitalia size (Rushton, 1988a), the relationship between these two variables was investigated further. For males the correlation between an encephalization aggregate (IQ, measured head circumference and hat size) and an aggregate of size of reproductive structures (self-report penis size, testes size, ejaculate volume) corrected for unreliability was −0.14. For females, the correlation between the encephalization aggregate and the reproductive structures' aggregate (breast size, buttock size, clitoris size, speed of menstrual cycle) corrected for unreliability was +0.30, opposite to prediction.

Correlation matrices and factor structure

All variables included in the measurement of each construct were converted to standard scores and added to form 18 aggregate life history constructs. Although the magnitude of the correlations are very small (X = 0.05, 0.09 corrected for unreliability), more were in the predicted direction than would be expected by chance, i.e. 63% (192/306, $z = 4.4$, $P < 0.001$). Moreover, of the 57 correlations reaching statistical significance, 48 (or 89/122 after correcting for unreliability) were in the predicted direction, a result also not likely to occur by chance ($z = 5.0$, $P < 0.001$). The results did not differ much by sex, although the male correlations were slightly more consistent with *K* theory, with 67% (103/153) being in the predicted direction compared to 58% (89/153) for females ($z = 4.4$, $P < 0.001$ and $z = 2.2$, $P < 0.01$, respectively).

The uncorrected life history correlations were subjected to a principal component analysis. Loadings for a first, unrotated factor for males and females are presented in Table 4. As shown, the male dimension had 17 out of 18 ($z = 3.5$, $P < 0.001$) life history constructs in the predicted direction, with a mean of 0.31. This first factor had an eigenvalue of 2.36 and accounted for 13.1% of the variance. The five constructs defining this dimension are late sexual reproduction (+0.71), late maturation (+0.60), high reproductive effort (−0.60), high infant mortality (−0.47) and efficient energy use (+0.46), where the '+' or '−' signs indicate the direction of loading. The only construct loading (weakly) in the opposite to predicted direction was multiple birthing, a variable on which there was little variance.

The female dimension had 14 out of 18 ($z = 2.1$, $P < 0.025$) loadings in the predicted direction, with a mean of 0.31. This first factor had an eigenvalue of 2.35, and accounted for 13.0% of the variance, and is defined by parental investment (+0.71), altruism (+0.60), low social organization (−0.58), high competition (+0.52), and high reproductive effort (−0.41). However, several life

Table 4. Factor loadings for a first, unrotated principal factor

Life history constructs	Males	Females
Multiple birthing	0.098	0.027
Long birth spacing	0.231	−0.203
Offspring number	−0.107	−0.236
Infant mortality	−0.471	−0.285
Parental investment	0.372	0.711
Late growth and puberty onset	0.593	0.038
Late sexual reproduction	0.712	0.037
Body size (body mass ratio)	−0.279	−0.239
Longevity	0.107	0.352
Reproductive effort	−0.601	−0.414
Efficient energy use	0.462	0.275
Encephalization	0.182	−0.179
Consistent exploitation of environment	0.242	0.321
High dispersion	−0.068	−0.353
Low density preference	0.314	−0.193
Competition	0.114	0.520
Low social organization	−0.409	−0.578
Altruism	0.071	0.596
Eigenvalue	2.4	2.4
(% of variance)	(13.1)	(13.0)

history constructs loaded in the direction opposite to prediction: multiple birthing (+0.03), birth spacing (−0.20), encephalization (−0.18) and preference for low density (−0.19).

Predictive utility of the r/K dimension

The life history constructs were converted to z-scores and added to form an aggregate r/K scale (α for males, 0.54; for females, 0.48) and correlated with the Sexual Opinion Survey ($\alpha = 0.86$), the Sex Guilt Scale [$\alpha = 0.96$, as reported in Mosher and Cross (1971)], the Self-Report Delinquency Scale ($\alpha = 0.78$, as reported in Rushton and Chrisjohn, 1981) and the Multidimensional Aptitude Battery test of intelligence ($\alpha = 0.98$). As shown in Table 5, all correlations with the r/K total score, except IQ for females (no relationship), were statistically significant in the predicted directions ($P < 0.05$, after corrections for unreliability). The Self-Report Delinquency Scale was the measure with the strongest association with the r/K dimension for both males and females. As expected, the Sexual Opinion Survey was related to the Sex Guilty Scale, and both correlated with self-report delinquency. Opposite to predictions, however, were the absence of a relation between IQ and delinquency and the positive relation between IQ and having sexually permissive sexual attitudes. The battery of results shown in Table 5 did not alter when three separate indicators of social class were partialled out (father's education level, parental income, and self-reported socioeconomic status of the family).

DISCUSSION

Some support has been found for the application of r/K theory to differences among Canadian university students. First, the items composing the component constructs of r/K were internally

Table 5. Pearson product-moment correlations between linear aggregate of r/K constructs and sexual attitude scales

Scales	1	2	3	4	5
		Males			
(1) K dimension	1	−08 (−13)*	20 (28)**	−22 (−35)**	20 (29)**
(2) Sexual Opinion Survey		1	−51 (−58)**	34 (42)**	15 (18)**
(3) Sex Guilt Scale			1	−47 (−53)**	−07 (−08)
(4) Self-Report Delinquency				1	01 (02)
(5) IQ					1
		Females			
(1) K dimension	1	−30 (−50)**	28 (44)**	−22 (−39)**	−03 (−05)
(2) Sexual Opinion Survey		1	−66 (−71)**	41 (50)**	31 (34)**
(3) Sex Guilt Scale			1	−31 (−38)**	−14 (−15)*
(4) Self-Report Delinquency				1	25 (28)**
(5) IQ					1

*$P < 0.10$; **$P < 0.05$. (Decimals have been removed, and values in parentheses are corrected for unreliability.)

consistent, many having no theoretical basis for clustering prior to that generated from theory. For example, diverse variables such as penis size, testes size, and intercourse frequency formed an internally consistent 'reproductive effort' construct. Second, after correcting for attenuation due to unreliability many of the correlations among the constructs reached significance, with more being in the predicted direction than could be expected by chance (89 out of 122). Third, the principal factor solutions describe an r/K dimension, with 17 out of 18 loadings being in the predicted direction for males, and 14 out of 18 for females. Fourth, as predicted, the aggregate r/K dimension was significantly correlated with both permissive sexual attitudes measured by both the Sexual Opinion Survey and the Sex Guilt Scale, and with (non-sexual) delinquency.

The correlations between r/K and sexuality and delinquency are of interest because little overlap in content occurs between the r/K dimension and these scales. Although sexual variables are included in the 'reproductive effort' construct on the r/K dimension, it should be noted that these are only part of one of the 18 constructs making up the dimension. Other constructs such as 'family size', 'longevity', and 'altruism' were equally weighted. The correlations among the measures of sexual attitudes and delinquency, controlling for social class, extends the research showing a relationship between sexuality and delinquent behaviour (Jessor *et al.*, 1983; Rowe *et al.*, 1989). Finally, the finding of a positive correlation between IQ scores and head size after controlling for body size replicates previous studies of this relationship (see Passingham, 1982, for a review).

An important question arising out of this study is, why were our results not stronger? For example, the average correlation between indices of K was only 0.09 even after correcting for attenuation, and the average factor loading was only 0.31. We would argue that the answer lies in the restriction of range occurring in the sample. Previous research has shown a direct relation between amount of variation and the strength of the effects. The r/K framework has shown much utility when applied to between species (e.g. Eisenberg, 1981; Wilson, 1975) and to human populations differing in, for example, multiple-egg production (Ellis, 1988; Rushton, 1987, 1988a, b; Rushton and Bogaert, 1987, 1988). Indications of support for this view are also available from the present data sets when comparing the results of the males and the females. The male results were both more supportive for r/K theory, and more variable. Future research therefore might more profitably concentrate on more heterogeneous samples.

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