ELSEVIER

Evolution and Human Behavior 25 (2004) 277–294

Evolution and Human Behavior

Third-party attitudes toward sibling incest Evidence for Westermarck's hypotheses

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Received 29 March 2004; accepted 25 May 2004

Abstract

While substantial evidence supports the existence of Westermarck's [Westermarck, E. (1891). *The history of human marriage*. London: Macmillan & Co.] hypothesized inbreeding avoidance mechanism, questions remain. We examined the Westermarck hypothesis using third-party reactions to a fictional case of sibling incest, a method paralleling that of Lieberman et al. [Proc. R. Soc. Lond., B Biol. Sci. 273 (2003) 819]. Controlling for cultural attitudes, a history of cosocialization with an opposite-sex individual was associated with increased disgust at, and decreased tolerance of, others' incestuous behavior. Consistent with parental investment theory, this effect was stronger in females than in males. In males, each additional cosocialized sibling increased the strength of the response; in females, there was a nonsignificant trend in the same direction. Indirect measures failed to reveal a time-limited sensitive period during which cosocialization has maximal effect. These results both bolster the evidence in favor of Westermarck's inbreeding avoidance hypothesis and support his neglected explanation of the origin of incest taboos.

Keywords: Westermarck hypothesis; Inbreeding avoidance; Incest; Taboos; Disgust

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1090-5138/04/$ – see front matter
doi:10.1016/j.evolhumbehav.2004.05.004

1. Introduction

Westermarck (1891) proposed that humans possess an evolved inbreeding avoidance mechanism such that persons exposed to one another for a significant duration during the childhood of one of the pair will later each be averse to sex with the other. After reviewing evidence relevant to this hypothesis, we describe a study paralleling recent research by Lieberman, Tooby, and Cosmides (2003). Results shed light both on the workings of the postulated mechanism and on the relationship between that mechanism and incest taboos.

1.1. Review of evidence on sibling and sibling-like relationships

Shepher (1983) found that despite culturally preferred endogamy, marriage among communally reared Israeli kibbutzim children was virtually absent. However, (a) the combination of age segregation in communal nurseries and a preference for spousal age disparity eliminated most co-reared individuals as candidates for marriage, while (b) compulsory military service exposed both sexes to a vast number of noncohort prospective mates; hence, opportunity alone reduced the likelihood of within-cohort marriages (Hartung, 1985).

Wolf (1993, 1995) examined adoptive marriage in Taiwan and China, finding higher rates of divorce and prostitution use, and lower fertility rates in individuals who had a history of early cosocialization with their spouse. However, this pattern may derive from the bride's hostility toward her foster family due to abusive treatment (Kirkpatrick, 1972), a well-documented pattern (cf. Wolf, 1968, p. 871, 1995, pp. 265–269; Wolf, 1972). Wolf (1995, pp. 268–269) countered that women in patriarchal societies lack the options and perhaps the self-concept needed to resist oppression. However, the evidence suggests otherwise (Jankowiak, 1993, pp. 230–239; Wolf, 1972, pp. 140–147)—in work on a different topic, Wolf (2003) himself argued that Taiwanese women possess agency. Non-Westermarckian explanations of the failure of Taiwanese adoptive marriage are thus not easily dismissed.

McCabe (1983) studied preferred patrilateral parallel cousin marriage in Lebanon, finding higher divorce rates and lower fertility rates compared to other forms of cousin marriage. Lebanese adult brothers often lived in close proximity; hence, a Westermarckian interpretation of these results is plausible. However, because McCabe did not collect childhood propinquity data, the link between marital failure and cosocialization can only be inferred.

Walter and Buyske (2003) surveyed Moroccan young adults, comparing the desirability of various individuals as spouses with the extent of childhood interaction with the subject. For female participants only, daily social contact during the first 7 years correlated with an individual being deemed unattractive as a prospective spouse. While parental investment theory (Trivers, 1972) predicts that females should more vigorously avoid inbreeding, the lack of any male effect is puzzling. Equally odd is the finding that daily social contact during the second 7 years of life has the opposite effect on women's

assessments. Although the authors interpreted this as indicating that "daily social contact" is tantamount to cosocialization only for the first, and not for the second, 7 years of life, this inference is unsupported.

Bevc and Silverman (2000; see also 1993) examined both the extent of cosocialization and sexual behavior with siblings among Canadians. Separation for at least 1 year before age four increased the risk of genital intercourse but not that of other forms of sibling sexual behavior. The authors interpreted their results as both supporting the Westermarck hypothesis and providing evidence of domain specificity in the regulation of sexual behavior since only coitus can produce inbreeding depression. However, clinical data indicate that the likelihood that sibling incest will occur is in part a function of the presence of violence, dysfunctional family structure, and difficulties in social interaction (Flores, Mattos, & Salzano, 1998; Smith & Israel, 1987; Worling, 1995). In an earlier study employing a similar method, Bevc (1988) found that "Respondents with sibling sexual experiences tend to come from a lower socioeconomic class and from crowded conditions; they also change residence more frequently, have fewer friends, and experience greater family discord than respondents without sibling sexual experiences." Although Bevc and Silverman controlled for some relevant factors, they did not examine such key risk factors as family discord and violence. Their claim of "domain specificity" is odd given that, in most cultures, nonconceptive sexual behaviors are "so intimately associated with heterosexual intercourse that they may be considered integral parts of the total coital pattern" (Ford & Beach, 1951, p. 40). Why would a mechanism designed to reduce the likelihood of conceptive sex not preclude forms of sexual behavior that are typically preludes to coitus?

Fox (1962, 1980) reasoned that if early intimacy elicits a Westermarckian response, then to the extent that cultural rules and institutions hinder childhood interaction, adult aversions will be lessened; if incestuous relations are socially disruptive, cultural evolution will then create compensatory adult avoidance rules. Comparing six cultures, Fox (1962) found the predicted inverse correlation between degree of childhood intimacy and stringency of adult avoidance rules; van den Berghe (1983, p. 101) summarized a positive test of this proposition across four cultures. Both authors interpreted these findings as supporting the Westermarck hypothesis. However, in a sample of 38 cultures, while reporting the same positive correlation between childhood segregation and adult avoidance rules, Quinn (1961) also found that (a) sibling separation typically occurred between ages 5 and 8 (thus failing to preclude early learning experiences), and (b) childhood heterosexual play, including sex play, was positively correlated with the severity of adult avoidance rules. Moreover, correlations between proscriptions on behavior in childhood and those on behavior in adulthood may reflect a third variable, such as the degree to which a culture regulates interaction between the sexes (cf. Smith, 1983, p. 115).

Ember (1975) examined prohibitions on cousin marriage as a function of degree of local endogamy, reasoning that if the Westermarck effect occurs, endogamous communities should prohibit cousin marriage because cousins would be coresident throughout childhood (and hence would develop aversions to marrying cousins, later expressed as prohibitions), agamous communities should be less likely to proscribe cousin marriage

because some cousins would not be coresident, and exogamous communities should be least likely to prohibit such relationships since most cousins would not be coresident. Examining 717 cultures, Ember found that while the first and second predictions held, the third did not.

1.2. Third-party attitudes: a new avenue for investigating the Westermarck hypothesis

Taken together, the research summarized above offers substantial support for Westermarck's ideas. Nevertheless, because nontrivial objections or counter evidence applies to each of these investigations, it is important to further test the Westermarck hypothesis. One alternative to the approaches reviewed above is to examine subjects not characterized by the special circumstances (specific marriage prescriptions, unique childhood circumstances, deviant behavior, etc.) typical of past research. Working independently, we and Lieberman et al. (2003) sought to explore Westermarckian phenomena by comparing university students' reactions to the possibility of sibling incest in light of their respective family backgrounds.

Surveying 186 Californian undergraduates, Lieberman et al. (2003) asked subjects to rank order 19 acts from least to most morally wrong; included in this list were (a) consensual sex between opposite-sex siblings and (b) marriage between opposite-sex siblings. Information about natal family composition was collected, including the presence of same- and opposite-sex full, step, and half-siblings during childhood and adolescence, the duration of coresidence, and the subject's ages during the period(s) of coresidence. Subjects were also asked to assess the degree of permissiveness characteristic of both their own and their parents' attitudes toward sex, established by comparing these attitudes to those held by other people known to the subject (D. Lieberman, personal communication). The dependent variable, termed moral wrongness, was the combination of the ranks assigned to the two hypothetical events (sex and marriage) involving sibling incest. For subjects having multiple siblings, duration of coresidence was summed within siblings of each sex.

Lieberman et al. (2003) found that moral wrongness was positively correlated with the duration of coresidence with opposite-sex siblings, but not with that of same-sex siblings. Relatedness to co-reared individuals had no effect independent of duration of coresidence. For male subjects, coresidence in adolescence (ages 11–18) made an additional contribution to moral wrongness beyond that of coresidence during childhood (ages 0–10); no such pattern was found in females. In both sexes, the number of co-reared members of the opposite sex had no effect on moral wrongness independent of years of cosocialization. Neither parental attitudes toward sex nor own attitudes toward sex contributed to the positive correlation between moral wrongness and coresidence with opposite-sex siblings. Lieberman et al. argued that these results indicate that (a) humans possess a kin recognition mechanism that relies exclusively on propinquity during maturation as a cue of relatedness; (b) congruent with parental investment theory, there is a sex difference in the impact of such propinquity on attitudes toward incest, with females acquiring sufficient information during childhood to develop an aversion, while male information gathering continues for a longer period of time; and (c) culture does not influence attitudes toward incest, as participants' assessments of

moral wrongness of incest are independent of their assessments of their own and their parents' attitudes toward sexual behavior in general.

In contrast to Lieberman et al.'s (2003) conclusions regarding the role of culture, we hypothesized that an individual's attitude toward sex with close kin is a product of two factors, namely, (a) an endogenous contribution produced by inbreeding avoidance mechanisms, and (b) an exogenous contribution produced by cultural proscriptions internalized to varying degrees. Following Westermarck, we further presumed that, particularly with regard to their endogenous component, attitudes toward sex with close kin are infused with emotion.

Though predicated on claims regarding the effect of the rearing environment on behavior, Westermarck's thesis is psychological as well as ethological, for it is concerned with the subjective factors underlying action. Westermarck asserted that in the course of everyday life, people are normally indifferent to the prospect of sex with cosocialized others, but that this indifference transforms to active aversion, manifested as disgust, when the possibility of such a union is contemplated (Westermarck, 1926, pp. 80 and 84). Congruent with Westermarck's proposal, (a) there is substantial evidence that disgust diminishes sexual arousal, and (b) a pervasive association exists between disgust and aberrant sexual behaviors, including incest (reviewed in Fessler & Navarrete, 2003a).

We initially attempted to explore the relative contributions of exogenous and endogenous factors to attitudes toward incest by asking subjects to first imagine themselves having sex with a close family member and then describe the resulting emotions. However, this technique suffers from severe limitations. Although, congruent with Westermarck's position, disgust was the prevailing emotion, the majority of subjects reported such strong reactions that ceiling effects made it difficult to discern the contribution of various childhood experiences to attitudes toward sex with kin. Second, this method likely elicits strong impression management effects since subjects are being asked to report how they feel when imagining themselves engaged in a highly proscribed behavior. Lastly, the clearest contrast should be between those who were and those who were not cosocialized with others. However, in our visualization technique, the stimuli presented to the two categories are not equivalent since the former are being asked to imagine sex with an actual person, while the latter are being asked to imagine sex with a hypothetical person. In order to both improve the resolution in subjects' responses and create a stimulus that is uniform across subjects, like Lieberman et al. (2003), we designed a second method, inspired by Westermarck's remarks on the origins of incest taboos.

Noting that incest taboos are widespread, Freud (1938, Book V, Totem and Taboo, pp. 901–902) challenged Westermarck to explain why prohibitions should exist for a behavior that, ostensibly, no one is motivated to perform. Westermarck countered that taboos are a consequence of our ability to experience others' actions as if they were our own—we create prohibitions in order to prevent others from engaging in behavior that we would find aversive were we to engage in it ourselves (Westermarck, 1926, p. 84).

Westermarck's explanation of taboos begs the question as to why natural selection would favor a propensity to incur costs in order to prevent others from engaging in acts that do not affect one. Moreover, neither in Westermarck's own work nor in subsequent studies of

inbreeding avoidance is there support for this proposition (Parker & Parker, 1986). Nonetheless, our research on a different topic, food taboos (Fessler & Navarrete, 2003b), suggested to us that, at least in some circumstances, people may indeed work hard to keep others from doing things that they would find disgusting were they to engage in them. Westermarck referred to the propensity to experience others' displeasing actions as if they were one's own as "sentimental aversion" (Westermarck, 1906, pp. 116–117). Seeking greater precision, we term the postulated process "egocentric empathy" since individuals empathically experience others' behavior as if it were their own, yet ignore others' subjective states, relying on their own dispositions instead (Fessler & Navarrete, 2003b). We suggest that egocentric empathy is incomplete due to lack of sensory depth. For example, however aversive it may be to watch someone eat something disgusting, it is likely to be less aversive than eating that item oneself. By reducing the strength of the response, egocentric empathy offers a means of circumventing ceiling effects that occur when subjects are asked to contemplate sex with their close kin. Egocentric empathy also offers a means of presenting subjects with a uniform stimulus regardless of subjects' backgrounds, since all subjects can be asked to contemplate the same case. We therefore asked participants to report their reactions to consensual sibling incest committed by two hypothetical adults, then evaluated their reactions in light of their childhood cosocialization experiences.

Combining Westermarck's ideas regarding (a) the emotional nature of the reaction to the prospect of sex with close kin and (b) the origin of taboos, we expected that the subjective aspect of third-party reactions to incest would be composed of three interwoven factors, namely, (1) an egocentric empathic disgust reaction, (2) a desire to avoid regularly interacting with others who engage in such actions (since such interactions would repeatedly evoke egocentric empathic reactions), and (3) a desire to prevent others from engaging in such actions and to punish those who do.

We hypothesized that in the absence of cosocialization experiences, the mechanisms proposed by Westermarck would lie dormant. This led to our principal prediction, namely:

1. Stronger disgust, avoidance, and desire to punish will be displayed by subjects who experienced cosocialization compared to those who did not since the former's reactions will reflect both an exogenous and an endogenous component, while the latter's reactions will only reflect the exogenous factor. The clearest contrast should be between subjects who were cosocialized with an opposite-sex individual and those who were not, since (a) we assume that the effect will be strongest when individuals are cosocialized with others of the sex to which they are attracted, and (b) heterosexuality is more common than homosexuality.

Extending Westermarck's hypothesis in light of others' claims of a sensitive period in early childhood (Bevc & Silverman, 2000; Fox, 1980; Shepher, 1983; van den Berghe, 1983; Wolf, 1993, 1995), we generated the following subsidiary prediction:

2. Because kin recognition mechanisms operate during a sensitive period, both the direction and the absolute value of age differences between a subject and his or her

opposite-sex sibling will affect the intensity of the aversive third-party reaction to a hypothetical case of sibling incest.

We also reasoned that because kin recognition and inbreeding avoidance must be focused on specific individuals, a Westermarckian mechanism might be activated anew for each opposite-sex individual with whom a subject is cosocialized, thus generating an independent aversion directed at each cosocialized individual. If contemplating others' incestuous behavior activates each of these aversions independently, then each should make a separate contribution to the resulting emotional response. This led to the following prediction:

3. For individuals who were cosocialized with more than one person of the opposite sex, there will be an additive effect of number of cosocialized others on the strength of the third-party reaction.

Parental investment theory (Trivers, 1972) predicts that women, for whom each pregnancy constitutes a substantial fraction of total reproductive potential, should more stridently avoid the detrimental consequences of inbreeding when compared to men, for whom any given copulation entails only minimal obligate investment (Haig, 1999; Lieberman et al., 2003; Shepher, 1983; van den Berghe, 1983), generating the following prediction:

4. Women should be more averse to sibling incest than men and hence should exhibit greater egocentric empathic response and therefore stronger third-party reactions. Likewise, cosocialization experience should have a greater impact on women's third-party responses than on men's.

2. Methods

2.1. Participants

Using flyers and class announcements, we recruited 250 UCLA undergraduates to anonymously participate in a study on "a forbidden form of sexual behavior" in exchange for US$4.00. Subjects were given a four-part questionnaire and directed to complete it in a quiet lab room at their own pace. After discarding 17 incompletely or incorrectly filled out surveys, we had responses from 233 subjects (91 male, 142 female). Participants ranged in age from 18 to 39 (mean age = 20.7, S.D. = 2.82).

2.2. Measures

The questionnaire contained a story about two young adult siblings who live together to save money, begin experimenting with consensual incest, and decide to pose as husband and wife. The story makes it clear that neighbors are aware that the couple have a passionate sex life. Eventually, the neighbors also discover the true nature of their relationship. Subjects

were asked to use Likert-type scales to answer questions gauging (1) how comfortable they would be living near, working with, and interacting with the brother and sister (avoidance), and (2) the degree to which they found the behavior disgusting (disgust). The story then continued, explaining that because their relationship is illegal, the brother and sister are arrested. Subjects were then asked to recommend the length of the jail sentence and the size of the fine appropriate to the case (punitive). These items were open-ended.

Using structured questions, we asked subjects to report on the number, sex, and age of siblings and step-siblings and the duration of coresidence with each.

Because we expected ideological differences of exogenous origin to influence participants' responses, we included questions designed to gauge subjects' attitudes toward individual autonomy, sexuality, and crime and punishment (e.g., "Actions, such as drug use and prostitution, that do not harm anyone other than the actor should not be illegal—adults should be able to do whatever they want as long as it doesn't hurt other people"). Five statements were each paired with an 11-point Likert scale anchored by 0 = *strongly disagree* to 10 = *strongly agree*. To control for the possibility that the incest vignette might influence subjects' responses to these questions, order of presentation was counterbalanced, with this section placed on the first page in half of the packets. A composite score of liberal versus controlling attitudes towards sex and crime and punishment was then created, with a high score connoting less tolerance for victimless crime and stronger punitive sentiments toward crime and deviance. This measure provided a statistical control for the possible influence of general attitudes, thus disaggregating the influence of exogenous and endogenous factors.

We collected information on participant's sex, age, years in college, and academic major. In addition to a sex difference in incest aversion predicted by parental investment theory, we anticipated several other possible influences on reactions to the fictional scenario. First, because UCLA is a fairly liberal institution, and because students in the humanities and anthropology are generally liberal in orientation, we suspected that advanced college standing and majoring in a humanity program or anthropology might each be associated with increased tolerance for deviant behavior. Second, in light of the fact that we expected disgust reactions to play a central role in participants' responses to the fictional scenario, because other investigations (Curtis, Aunger, & Rabie, 2004; Quigley, Sherman, & Sherman, 1997) indicate that disgust sensitivity declines with age, we anticipated that advancing age might similarly increase tolerance toward the protagonists.

2.3. Statistical methods

In order to test our predictions that (1) cosocialization with opposite-sex individuals will contribute to third-party responses, (2) cosocialization effects will be additive, and (3) this effect will be stronger among females, we conducted analyses using the dependent measures disgust, avoidance, and punitive inclinations directed at the fictitious incestuous couple. Following Westermarck, we presumed that disgust, avoidance, and punitive inclinations would be strongly interconnected. Correlations among each construct were indeed strong (disgust–avoid: $r = .65$, $p < .0001$; disgust–punitive: $r = .45$, $p < .0001$; avoid–punitive: $r = .36$, $p < .0001$). The three

measures were weighted equally and combined to create a standardized composite value, which we term sibling incest aversion.

Multiple regression analyses with robust standard errors were performed measuring the effect of various predictors on the subject's sibling incest aversion score. Separate analyses were carried out for male and female subjects. In an initial stepwise regression, sibling incest aversion scores were regressed on the following dichotomous predictors: the effect of having an opposite-sex sibling; the effect of being a humanities/anthropology major; and the effect of the order in which the social attitudes questionnaire was presented in the packet. In order to examine possible effects of biological relatedness, a dummy variable indicating step-sibling status was also included. The following continuous variables were added to the model: attitudes toward sex, crime, and punishment; year in college; age; and the age difference between the subject and his or her closest (in years) opposite-sex sibling (see below). Two of the variables, the effect of an opposite-sex sibling and the age difference with an opposite-sex sibling, were buffered from the stepwise elimination process because of their importance to our a priori predictions. All tests were one tailed unless otherwise specified.

In order to check for an additive effect for each additional opposite-sex sibling, an additional regression analysis was performed. Using only subjects of the target sex who possessed opposite-sex siblings, subject's sibling incest aversion score was regressed on the number of opposite-sex siblings in the household, with the social attitudes score held constant.

To test for the possibility of a sensitive period, we examined the effect of increasing age disparity between the subject and the closest opposite-sex sibling. First, subjects with an older sibling would have been potentially exposed to the given individual since birth, thereby maximizing both total cosocialization and cosocialization during a sensitive period. However, the greater the age disparity between subject and older sibling, the less exposure that would have occurred, as age stratification would likely lead the two parties to participate in disparate social activities. Second, subjects with a younger sibling would have been potentially exposed to the given sibling only after reaching the age equal to the disparity in their ages. The greater this age disparity, the less likely it would be that exposure would occur during the subject's sensitive period and the lower the total amount of exposure, an effect that would be compounded by age stratification. Consider four subjects: O_1 has a sibling who is older by 1 year, Y_1 has a sibling who is younger by 1 year, O_5 has a sibling who is older by 5 years, and Y_5 has a sibling who is younger by 5 years. With regard to both amount of cosocialization during the sensitive period and total cosocialization, the following obtain:

$$O_1 > Y_1,$$
$$O_5 > Y_5$$
$$O_1 > O_5,$$
$$Y_1 > Y_5$$

This allowed us to perform two tests. First, we reasoned that subjects with less age-disparate siblings should have experienced greater cosocialization and hence should exhibit greater aversion than those with more age-disparate siblings (e.g., $[O_1+Y_1] > [O_5+Y_5]$, etc.).

Because our dependent measure captures the cumulative consequences of all cosocialization experiences, yet we are concerned here only with the impact of cosocialization with the sibling closest in age to the subject, we also examined variation in family composition across subjects in light of the age difference criterion, as such variation could produce differences in cumulative cosocialization that might obscure effects due to age difference. Second, we reasoned that addressing the older versus younger distinction while ignoring age disparity, those with older siblings should have experienced greater cosocialization than those with younger siblings (e.g., $[O_1+O_5] > [Y_1+Y_5]$, etc.); once again, an auxiliary test is needed to ensure that overall family composition does not differ across the classes of subjects being compared. Note that because both tests measure the combined effect of early exposure and total exposure, only negative results are informative with regard to the (non)existence of a sensitive period, as positive results do not allow us to determine whether both factors are at work, or only total exposure.

Tests for a sensitive period were operationalized as follows: For the older sibling variable, if subjects had both a full and a step-sibling of the opposite sex, we treated the full sibling as the focal sibling since the subject would have been exposed to this individual since birth. Likewise, for the younger sibling variable, if subjects had both a younger full and a step-sibling of the opposite sex, we chose the full sibling since in most cases step-siblings arrive after dissolution of the natal parental relationship, and hence subjects will have had greater exposure to a younger full sibling than to a younger step-sibling. For both variables, if the subject had only step-siblings, we focused on the opposite-sex step-sibling who entered the family earliest; if two entered simultaneously, we focused on the younger.

3. Results

3.1. Effects of possessing an opposite-sex sibling

For female subjects, in the initial analysis using all variables, other than the primary predictors of (1) having a male sibling and (2) the age differences between female subjects and their brothers, the only predictor retained in the model after the stepwise deletion was the variable for subject's score on social attitudes toward sex, crime, and punishment (SCP) (SCP range = 1.0–9.6, mean = 4.7, S.D. = 1.5). Results of the final regression analysis are shown in Table 1. After controlling for SCP score, the analysis revealed a significant effect for females with male siblings (MALE SIB; Table 1), as subjects with male siblings reported a higher sibling incest aversion reaction than those with no male siblings.

For male subjects, in the initial analysis, other than the primary predictors of having a female sibling and the age differences between male subjects and their sisters, the only predictor retained in the model after stepwise deletion was SCP score (SCP range = 1.2–8.6, mean = 4.3, S.D. = 1.7). Results of the final regression analysis are shown in Table 1. After controlling for SCP score, the analysis revealed a significant effect for male subjects with female siblings (FEM SIB), as males with female siblings reported a higher sibling incest aversion reaction than males with no female siblings.

Table 1
Sibling incest aversion scores regressed on family composition predictors (MALE SIB = possession of a male sibling or step-sibling; FEMALE SIB = possession of female sibling or step-sibling; SCP score = attitudes toward sex, crime, and punishment; AGE DIFF = age difference between subject and opposite-sex sibling or step-sibling closest in age)

Sibling incest aversion score	*B* (raw)	Robust S.E.	*t*	*p* value	Test	*β*
Female subjects						
MALE SIB	0.910	0.348	2.62	<.01	one tailed	.46
SCP score	0.067	0.010	7.48	<.0001	one tailed	.51
AGE DIFF	−0.001	0.003	−0.26	N.S.	one tailed	−.02
(Constant)	0.157					
Male subjects						
FEMALE SIB	0.665	0.372	1.79	<.05	one tailed	.31
AGE DIFF	−0.01	0.003	−2.67	<.01	one tailed	−.21
SCP score	0.62	0.08	7.25	<.0001	one tailed	.51
(Constant)	−1.95					

Female sibling incest aversion scores range from 1.97 to 9.67; male scores range from 1.00 to 9.25.

3.2. Tests for a sensitive period

For female subjects with an older male sibling, age difference with the focal sibling ranged from 0 to 168 months (mean = 47, S.D. = 39; the zero difference indicates a fraternal twin or a stepbrother less than 2 weeks older than the subject); for female subjects with a younger male sibling, the range of age difference was 0–168 months (mean = 22, S.D. = 32). In the first test for a sensitive period, there was no significant effect in the predicted direction for age differences between female subjects and their opposite-sex siblings. This was not due to masking effects of variation in family composition, as the auxiliary test revealed that age difference did not predict number of opposite-sex siblings (n.s., two tailed). In the second test for a sensitive period, we checked the slope difference between aversion scores of female subjects with older male siblings and females with younger male siblings. Holding SCP score constant, the difference between aversion scores was not significant, and neither slope was significantly different from a slope of zero. The absence of an effect again does not reflect obscuring variation in family composition, as a separate test revealed that females with at least one older opposite-sex sibling did not have more brothers than did those who had only younger brothers (n.s., two tailed).

For male subjects with an older female sibling, age difference with the focal sibling ranged from 0 to 156 months (mean = 26, S.D. = 36); for male subjects with a younger female sibling, the range of age difference was 0–192 months (mean = 39, S.D. = 39). The first test revealed a significant effect in the predicted direction for age differences between male subjects and their opposite-sex siblings (AGE DIFF); the greater the age disparity between male subjects and their sisters, the lower their sibling incest aversion score. The auxiliary test revealed that this effect was not driven by differences in extent of cosocialization due to overall family composition, as age difference did not predict number of opposite-sex siblings (n.s., two tailed). In the second test for a sensitive period, holding SCP score constant, the difference

between aversion scores of male subjects with older female siblings and males with younger female siblings was not significant. The absence of an effect did not result from obscuring consequences of differences in extent of cosocialization due to overall family composition, as a separate test revealed no difference in number of opposite-sex siblings between the two classes of subjects (n.s., two tailed).

3.3. Additive effects of multiple opposite-sex siblings

For female subjects, the separate regression testing for an additive effect of opposite-sex siblings failed to reveal a significant increase in aversion score for each additional male sibling, although there was a weak trend in the predicted direction [$\beta = .08$; $F(1,92) = 1.21$; $p = .14$]. In contrast, for male subjects, there was a significant increase in aversion score for each additional female sibling possessed by a subject.

3.4. Sex differences in incest aversion

Females reported greater sibling incest aversion reactions than males (mean male score = 4.63, S.D. = 2.14; mean female score = 5.31, S.D. = 1.98). While this difference was statistically significant, more importantly, it remained so after controlling for differences in SCP scores ($t = 1.44$, $p < .05$; two tailed). Bartlett's test for equal variances did not reveal a statistically significant difference for variance in responses between males and females, $\chi^2 = 0.68$, $p = .41$. The effect size for increased incest aversion (in terms of beta weights) was larger for female subjects with male siblings than for male subjects with female siblings (female: $\beta = .46$; male: $\beta = .31$); however, this difference failed to reach significance, $t < 1$. There were no differences between males and females who did not have siblings, $t < 1$.

4. Discussion

After controlling for broader attitudes concerning sexual behavior, crime, and punishment, we found strong support for our central prediction, namely, that individuals who have experienced cosocialization will react more strongly to others' incestuous behavior than those who have not. Like Lieberman et al. (2003), we found that actual biological relatedness was irrelevant in this regard, as the status of siblings (step vs. full) did not mediate this effect.

The prediction that there should be a negative relationship between (a) the age disparity between the subject and the subject's closest opposite-sex sibling and (b) the subject's level of sibling incest aversion was supported by our data for male subjects, but the effect did not reach statistical significance for female subjects. Moreover, the related prediction that subjects with older siblings should be more averse than subjects with younger siblings was not upheld for either female or male subjects. Together with Lieberman et al.'s (2003) observations regarding the effect on males of coresidence during adolescence, these results call into question the existence of a sharply demarcated sensitive period (cf. Bevc, 1999, p. 102).

We predicted that the number of cosocialized others should have an additive effect on egocentric empathic responses. This prediction was supported by our data for male subjects, and there was a distinct trend in the same direction for female subjects (compare with Arndt & Ladd, 1981). Consistent with parental investment theory, females reported greater aversion to the incest scenario. Controlling for differences in SCP scores, this general difference was statistically significant. Examining the subsidiary prediction that females would be more sensitive to the developmental triggers of Westermarckian aversion, although we found that the effect size for increased incest aversion was larger for female subjects with male siblings than for male subjects with female siblings, this difference failed to reach significance.

4.1. Limitations of the present study

Our study relied on paper-and-pencil responses to a hypothetical scenario. Self-reports may not accurately index subjects' degree of aversive arousal, and fictional stories may elicit different responses than real events. Our subject population is not representative of the diversity of cultural backgrounds characteristic of our species. While we have sought to control for the influence of subjects' larger ideologies on their punitiveness and disgust reactions, it is possible that parochial cultural ideas and culturally shaped experiences influence subjects' responses in ways not measured by our probes. If aversive reactions function to decrease sexual attraction, then the effects of cosocialization may in part be a function of sexual orientation, a factor we did not explore.

The Westermarck hypotheses is not the sole explanatory framework consistent with our results. John Hartung (personal communication) and Allen Johnson (personal communication) have each suggested that increased parental instruction might occur in families containing opposite-sex siblings simply because sibling incest is a possibility only for those who actually have siblings. Although we cannot rule out this explanation, the picture is somewhat clearer when it comes to an ancillary prediction made by Hartung (personal communication), namely, that given that men are less discriminating in their choice of sexual partners (and, we might add, more likely to use physical coercion to obtain sexual access), parents of opposite-sex children should be more strongly motivated to inculcate the incest taboo in their sons than in their daughters. That we find hints of a greater effect of opposite-sex cosocialization on females runs counter to this aspect of the instruction–opportunity hypothesis.

5. Conclusion

In the century since it was first advanced, the Westermarck hypothesis has been tested using a variety of methods. Although results are largely supportive of the hypothesis, questions remain. We employed a method that (a) does not depend on special circumstances or deviant behavior, (b) seeks to control for larger cultural factors, and (c) can be adapted to fit a wide variety of cultural settings. In its initial application among U.S. undergraduates, this method produced evidence supporting the Westermarck hypothesis and illuminating a

number of details of the workings of the postulated psychological mechanisms, including the relative contributions of subject's sex and number of siblings.

5.1. Comparisons with the work of Lieberman et al. (2003)

Our core finding, that a history of cosocialization with an opposite-sex sibling corresponds with increased opposition to sibling incest, replicates results obtained by Lieberman et al. (2003) using an analogous method. Although we did not find traces of the dose-dependent effect of years of cosocialization that Lieberman et al. documented, our means of analysis was less direct on this question than theirs; hence, caution is in order in interpreting our findings. We found an additive effect of multiple opposite-sex siblings on incest aversion in male subjects and a similar trend in females. While Lieberman et al. reported that after controlling for years of cosocialization, number of siblings did not contribute to incest aversion (p. 825), this does not challenge our position since their tactic of counting years of cosocialization contributed by each sibling and then summing across siblings (p. 822) presumes the pattern that we postulate, namely, independent activation of the Westermarckian mechanism for each cosocialized other.

Although, like us, Lieberman et al. (2003) employed parental investment theory in predicting that women should be more averse to sibling incest than men, their results provide only indirect evidence of such a sex difference. The authors demonstrated that coresidence beyond age 10 with an opposite-sex sibling increases moral wrongness scores only in male participants. Their interpretation of this result, namely, that females arrive at certainty regarding relatedness on the basis of less information, is congruent with parental investment theory. However, the authors overlooked more direct measures of the predicted sex difference in aversion. A simple test would be to compare mean moral wrongness scores by sex; in the analog of such a test, we found that our female subjects exhibited greater aversive rejection of the incest scenario than did our male subjects. Inspection of Lieberman et al.'s (2003, Table 1) results reveals that at each stage in their regression, the effect size is larger for males than for females, a pattern that would seem to suggest that cosocialization with an opposite-sex sibling has a greater impact on males' aversion to sibling incest than it does on females' aversion, the converse of the trend that we found. While it is not clear why the two investigations seem to have produced divergent findings on the question of sexual dimorphism, it is possible that differences in method are responsible.

Our position differs from that of Lieberman et al. (2003) regarding the impact of socially transmitted information. Citing the absence of a contribution of both parental sexual restrictiveness and own sexual restrictiveness to moral wrongness, Lieberman et al. argued that culture makes no significant contribution to attitudes toward incest—in their words, "Taken together, these findings suggest that moral sentiments regarding incestuous acts are mediated by a different system from the one that governs culturally transmitted moral values" (p, 825). We suggest that caution is in order here for several reasons. First, the authors' measure of cultural values is indirect—"sexual restrictiveness" is a rather broad concept. Second, if exogenous factors made no contribution to attitudes toward incest, then subjects who did not experience cosocialization should be indifferent to others' incestuous behavior.

Although Lieberman et al. did not present moral wrongness scores for subjects who lack siblings, the authors did contrast scores of subjects who were and were not cosocialized with their siblings (mean±S.D. = 9.41±3.32 vs. 11.52±2.55, respectively) (p. 823). Recalling that the moral wrongness score is the average of the ranking of two items (sibling sex and sibling marriage) out of 19 behaviors, if exogenous factors were irrelevant to this assessment, one might expect both that the latter score would be substantially lower and that the difference between the two scores would be substantially larger.

We assessed participants' attitudes toward punishment and victimless crime, including attitudes toward nonincestuous criminal sexual behavior. We therefore find it revealing that this collection of attitudes was the single strongest predictor of third-party reactions to consensual sibling incest, as this is congruent with the extensive corpus of research indicating that culture is an important determinant of opinions about the acceptability of various forms of sexual behavior (Ford & Beach, 1951; Frayser, 1985; Marshall & Suggs, 1971). Hence, while we wholeheartedly concur with Lieberman et al. (2003) that conventional social science theories are untenable to the extent that they ignore both the logic and the evidence in favor of Westermarck's position, we nevertheless urge others not to throw the baby out with the bathwater and thereby conclude that socially transmitted beliefs play no part in people's feelings about incest.

5.2. General discussion

In disregard of Westermarck's formulation (Westermarck, 1926, pp. 80 and 84), following Ellis' (1926) thoughts on the subject, many contemporary theorists have sought to explain the Westermarck effect in terms of habituation (e.g., Bischof, 1972; Demarest, 1977; Parker, 1976; also Parker & Parker, 1986). Consistent with Westermarck's original claim, we found that individuals with siblings were more disgusted by the behavior of an incestuous couple, less willing to interact with them, and more willing to punish them. These are hallmarks not of a lack of interest, but rather of overt aversion. Habituation is thus unable to explain the strength of the emotional reaction elicited by incest in this and other studies.

Our findings and those of Lieberman et al. (2003) are consistent with the view that moral reasoning is influenced by intuitions, emotions, and other inchoate experiences that are in part the products of evolved psychological mechanisms (Haidt, 2001; Lieberman et al., 2003). The specific contours of incest taboos in any given culture may reflect either self-interested strategies employed by the arbiters of culture, cultural evolution favoring group-beneficial norms, accidents of history, or all three of these. Nevertheless, these results suggest that Westermarck was correct in arguing that such proscriptions have their origins in individuals' spontaneous reactions to others' behavior, reactions that are best explained as the products of an evolved inbreeding avoidance mechanism. This raises the question as to why humans possess a propensity for third-party reactions of sufficient magnitude to give rise to institutionalized prohibitions.

Lieberman et al. (2003) suggested that third-party reactions to incest may be either (a) the result of evolutionary disequilibrium or (b) a by-product of self-regulation. With

regard to the former, the authors proposed that in ancestral populations, relatedness within social groups was sufficiently high as to reward individuals who prevented others from inbreeding; in the contemporary world, this propensity misfires, leading individuals to mistakenly interfere with the incestuous behavior of nonrelatives. We are not persuaded by this suggestion given both the authors' argument that a propinquity-based kin recognition mechanism accurately captures variations in relatedness and their results showing (a) a strong correlation between extent of coresidence and actual degree of relatedness and (b) a dose-dependent effect of coresidence on aversion to incest. If a propinquity-based mechanism differentiates close kin from distant kin, and distant kin from nonkin, then why should people care about the sexual behavior of either unnamed others (as in Lieberman et al.'s, 2003, investigation) or fictional characters who clearly have no connection to them (as in our study)?

We concur with Lieberman et al.'s (2003) second suggestion, namely, that third-party reactions to incest may be a by-product of self-regulation. Although the authors did not elaborate on why natural selection has not eliminated such a potentially costly side effect, we believe that the answer lies in the role of disgust in inbreeding avoidance. Elsewhere (Fessler & Navarrete, 2003b), we have suggested that disgust and fear may be uniquely central to egocentric empathy—for example, it seems to be easy to feel egocentrically empathic disgust when watching a baby happily consume feces, or egocentrically empathic fear when watching a fearless lion tamer, but it seems to be difficult (perhaps impossible?) to feel egocentrically empathic sadness or regret when watching a devil-may-care coworker get fired. We propose that the centrality of disgust and fear in egocentric empathy stems from the fact that when individuals engage in contaminating or dangerous activities, they often endanger bystanders as well—someone who consumes pathogen-rich materials, or attracts the attention of large predators, brings disease or predation into the community. In ancestral environments, it may therefore have often been advantageous to intervene when others engaged in intensively disgust- or fear-inducing behaviors, as the costs of interfering in others' affairs would have been outweighed by the costs of inaction, a disparity that would have been heightened if the costs of interference were shared with others who experienced similar reactions. Given that it is likely that disgust originally evolved to protect against pathogen exposure (Curtis et al., 2004; Fessler & Navarrete, 2003b) and was subsequently exapted to the domain of sexual behavior (Cosmides & Tooby, 2000; Fessler & Navarrete, 2003a), it may simply not have been possible to separate sexual disgust from egocentric empathy. Seen in this light, Westermarck's paired hypotheses concerning inbreeding avoidance and the genesis of incest taboos may exemplify both the power of evolutionary processes to shape mental architecture and the constraints under which these processes operate.

Acknowledgments

We thank Debra Lieberman, John Hartung, Allen Johnson, Robert Kurzban, Margo Wilson, and the members of the UCLA Experimental Biological Anthropology Lab

for helpful feedback, and are grateful to the UCLA undergraduates who assisted in this research.

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