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## DEVELOPMENTAL PSYCHOLOGY | RESEARCH ARTICLE

# Sexual imprinting of offspring on their parents and siblings

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**Abstract:** Based on data provided anonymously by 2,611 women and 1,452 men using a computerized questionnaire, we found that 19.2% of women vs. 16% of men ( $p < .001$ ) were aware of being attracted to people with physical characteristics resembling members of their nuclear families, a phenomenon called sexual imprinting. Women reported sexual imprinting on fathers (15.5%), brothers (2.5%), mothers (0.8%), and sisters (0.4%), and men reported sexual imprinting on mothers (11.5%), sisters (2.1%), fathers (1.9%), and brothers (0.5%). The likelihood of women imprinting on fathers increased when fathers were more affectionate to them and when parents were more affectionate to each other. The likelihood of women imprinting on brothers increased when they had an older brother. The likelihood of women imprinting on mothers increased when parents divorced or separated and there was a re-marriage. The likelihood of men imprinting on mothers increased when mothers had a positive attitude about sex. It decreased if they had an older brother and increased if they had been the victim of child sexual abuse (CSA) by an adult female. The likelihood of men imprinting on sisters was increased if parents were affectionate to each other. Three factors predicted the likelihood of men imprinting on fathers.

**Subjects:** Gender Studies - Soc Sci; Psychological Science; Genderrelated Issues

**Keywords:** sexual imprinting; mother; father; sister; brother

### ABOUT THE AUTHORS

The eleven authors are all collaborating researchers in an interdisciplinary, on-going, multi-institutional project involving six different West Virginia campuses (in an area somewhat inland near the eastern coast of the USA, usually referred to as "the mid-Atlantic region") which resulted in collection of data from 4,170 participants in the interval between 2002 and 2014.

### PUBLIC INTEREST STATEMENT

Sexual imprinting appears to explain how we, as unique individuals, came to prefer certain anatomical, psychological, and behavioral attributes when we were searching for our life partners. The present study was conducted using anonymous computerized questionnaire. The data from the study were consistent with many of the study participants being consciously aware of having been looking for the physical attributes of a member of their nuclear family of rearing as they searched for a life-partner. The majority of participants aware of this phenomenon in their own lives reported that they were searching for a person who physically resembled their opposite-sex parent. The next most common report was that they were searching for a person who physically resembled an opposite sex sibling. Study participants with same-sex orientations were more likely to report looking for a person who physically resembled their same-sex parent or a same-sex sibling.

## 1. Introduction

Although our paper is about sexual imprinting in humans, the phenomena of human sexual imprinting parallel phenomena originally studied in birds. In birds, sexual imprinting is defined as the means by which a young bird learns the characteristics that enable it to find a mate of its own species. Sexual imprinting was easier to study in birds than in humans because in birds, eggs of one species could be moved into the nest of other species for hatching and rearing. A newly hatched chick *imprints* on the first “creature” it sees (hopefully a caregiver), even if the creature is not from the same species (or even genus) as the chick. The imprinted chick follows and begs for food from the caregiver until the chick can feed itself. The adulthood outcome of such experiments is that the imprinted bird tries to mate with individuals of its adoptive species, an outcome known as *sexual imprinting* (Irwin & Price, 1999). Mallard ducks raised solely with males ignored females as adults and only attempted to mate with males, providing early evidence of *same-sex* sexual imprinting. When raised with both sexes, on the other hand, male mallards select female partners (Schutz, 1965; cited by Bowlby, 1969, p. 163).

The definition of sexual imprinting has been generalized to apply to humans, and sexual imprinting has also been well described in humans (e.g. Aronsson, Lind, Ghirlanda, & Enquist, 2011; Bereczkei, Gyuris, & Weisfeld, 2004; Bereczkei, Hegedus, & Hajnal, 2009; Nojo, Tamura, & Ihara, 2012; Seki, Ihara, & Aoki, 2012; Vukovic, Boothroyd, Meins, & Burt, 2015). Human studies using techniques that did not depend on awareness of the phenomenon by the participants have shown that women tend to select mates whose facial pictures resemble those of their fathers while men tend to select mates who resembled their mothers (showing sexual imprinting in both women and men, Bereczkei et al., 2004, 2009; Seki et al., 2012; Vukovic et al., 2015).

The height of a participant’s mate was positively correlated with the height of the participant’s opposite-sex parent (Seki et al., 2012). Participant’s mates had similar eye and hair color to those of the participant’s opposite-sex parent (Little, Penton-Voak, Burt, & Perrett, 2003). The hairiness of women’s mates tended to be similar to that of the women’s fathers (Rantala, Polkki, & Rantala, 2010). The relative age difference between a participant and the participant’s mate correlated with the difference between the participant’s parent’s ages (Perrett et al., 2002).

Participants preferred mates with personality characteristics similar to those of their opposite-sex parents (Gyuris, Járai, & Bereczkei, 2010). The quality of individual’s relationship with their opposite-sex parent determined whether or not they preferred mates or potential mates that resembled their opposite-sex parent (Wiszevska, Pawlowski, & Boothroyd, 2007) as early as nine years of age (Vukovic et al., 2015). All these investigators used technology that eliminated investigator bias and did not depend on (or even investigate) whether or not the participant had been aware of having been seeking a partner who resembled their opposite-sex parent.

Bereczkei et al. (2004) excluded the involvement of heritability by demonstrating sexual imprinting in adopted individuals on the adopting parents (based on facial similarities). On the other hand, because the above studies were restricted to people with opposite-sex partners, they did not permit identification of same-sex imprinting in the human. None of the published studies looked for imprinting on siblings. Studies on smoking-partner acceptance (Aronsson et al., 2011), preference for pregnant women (Enquist, Aronsson, Ghirlanda, Jansson, & Jannini, 2011), height (Seki et al., 2012), hair and eye color (Little et al., 2003), the hairiness of women’s mates (Rantala et al., 2010), the relative age difference between a participant and the participant’s mate (Perrett et al., 2002), and personality characteristics (Gyuris et al., 2010) have shown that sexual imprinting is not restricted to facial characteristics or even physical characteristics. Furthermore, demonstration of sexual imprinting on adoptive parents (Bereczkei et al., 2004) revealed that sexual imprinting in humans, like that in birds (Irwin & Price, 1999), is subject to learning rather than being due to genetically determined preferences. The conclusion that sexual imprinting is the result of learning was also supported by the evidence that human sexual imprinting is modulated by the early relationships between a child and his or her opposite-sex parent (Vukovic et al., 2015; Wiszevska et al., 2007) and also by

demonstration of sexual imprinting related to smoking-partner acceptance (Aronsson et al., 2011) and a preference for pregnant women (Enquist et al., 2011).

In their study of male zoophiles (men who have sex with animals), Williams and Weinberg (2003) found data consistent with interspecific sexually explicit human sexual imprinting, even though the authors did not directly address the phenomenon of sexual imprinting in their paper. The first experience of male zoophiles, as early as 14 years of age, was often with an animal of the same sex and species they preferred as sexual partners many years later. Many male zoophiles had never had sex with another human (Williams & Weinberg, 2003). Human sexual imprinting that preserves the early acquired preferences for opposite-sex partners or same-sex partners is also a form of critical period learning (Beard et al., 2013, 2015; O'Keefe et al., 2014). Because it occurs while the brain is developing (Desmarais, Roeber, Smith, & Pollak, 2012; Fox, Levitt, & Nelson, 2010; Fox & Rutter, 2010; Uylings, 2006), critical period learning also explains the enduring quality of sexual imprinting.

There is now overwhelming evidence of critical periods in human development beyond which deprived individuals are not able to catch up to individuals who learned certain abilities before the end of the critical period (Desmarais et al., 2012; Fox & Rutter, 2010; Fox et al., 2010; Uylings, 2006). Examples of critical period learning include second-language learning (Johnson & Newport, 1989; Zhang & Wang, 2007), chess playing (Gobet & Campitelli, 2007), binocular vision (Hess, Mansouri, & Thompson, 2010), first language learning (Bouton, Serniclaes, Bertoncini, & Cole', 2012; Redcay, Haist, & Courchesne, 2008; Tomblin, Barker, & Hubbs, 2007), and musicianship (Penhune, 2011). Critical period learning investigations usually compare lucky early learners with unlucky individuals deprived of the opportunities for learning by environmental deprivation or sensory defects (Fox & Rutter, 2010; Fox et al., 2010; Uylings, 2006). The theoretical basis for critical period learning is the fact that development of the human brain continues after birth and even through puberty. Ongoing brain development and the high plasticity of the developing brain provides advantages to learning that occurs conterminously (Desmarais et al., 2012; Fox & Rutter, 2010; Fox et al., 2010; Uylings, 2006).

In other research, human sexual development, as measured by adult interest in sex, has been shown to be subject to critical period learning with individuals who engage in early masturbation or early sexual experiences with partners having a greater interest in sex as adults than those who had no early masturbation experiences or early sexual experiences with partners (Griffee et al., 2014a, 2014b). Nuclear family variables that implied that the opposite-sex parent was not modeling a satisfactory heterosexual romantic partner predicted early same-sex crushes (Beard et al., 2015), and early same-sex crushes were the most powerful predictor of adult sexual orientations (Beard et al., 2015). The effects of the nuclear family variables on the gender of early crushes and the apparent power of the gender of early crushes to effect adult sexual orientation appear to be phenomena that are related to sexual imprinting (Beard et al., 2015).

Like imprinted birds, children attach to their parents (Bowlby, 1969, 1988), even if the child is of a race different from the parents. In a process called romantic attachment, people then attach to their sexual partners as adults (Simpson & Rholes, 1998), a process parallel to the well-studied phenomenon of sexual imprinting in birds. When attachment to the biological or adoptive parents has been problematic, the individual's adult romantic attachment is also negatively affected, explaining the high rate of divorce in the affected individuals (Carlson, Sroufe, & Egeland, 2004; Henry & Holmes, 1998; Roisman, Collins, Sroufe, & Egeland, 2005; Roisman, Madsen, Henninghausen, Sroufe, & Collins, 2001; Rusby, 2010; Simpson & Rholes, 1998).

In the present study, we tested the hypothesis that sexual imprinting on family members occurred by taking the somewhat-novel, but very direct, approach of asking participants to tell us whether they had been aware of having sought partners who had physical characteristics similar to those of members of their nuclear families. This tested not only for sexual imprinting but also for the volunteer's awareness of the sexual imprinting. The options available in the survey-items included

parents of both sexes and siblings of both sexes, allowing us to identify both opposite-sex and same-sex sexual imprinting and also whether the sexual imprinting was on a parent or a sibling. We also tested the hypothesis that the direction of sexual imprinting (same-sex vs. opposite-sex) would be dependent not only on the availability of a parent of that sex in the nuclear family, but also on whether or not the parent modeled being a good or a bad sexual partner in their relationship with the other parent, as demonstrated for crushes experienced by young children (Model #19M and Model #21M, Table 10, Beard et al., 2015). We controlled statistically for early incest and other factors that might be expected to influence sexual imprinting.

## 2. Method

Of the 4,063 participants who provided the data used in the present study; 3.8% had only high school, 72.1% did not have a degree but had participated in college courses, 16.5% had a bachelor's degree, 5.3% had a master's degree, and 2.2% had a doctoral degree. The 2,611 female participants had a median age of 21 and a mean age of  $24.6 \pm 9.3$  years (mean  $\pm$  SD). The 1,452 male participants had a median age of 21 and a mean age of  $26.1 \pm 11.5$  years. The 4,063 participants in the present study include the 1,242 male and 2,201 female participants included in the paper by Beard et al. (2015).

### 2.1. Measures

Items reproduced from computer-assisted self-interview (CASI) program S-SAPE1©S-SAPE, LLC were reproduced by permission of S-SAPE, LLC, 2002, P.O. Box 11081, Charleston, WV 25339. The study items appear in quotation marks within the text, tables, and appendix of this paper. Permission must be obtained from the rights holder to reuse those items.

#### 2.1.1. Sexual imprinting on family members reported by participants

We used the P34 item (Appendix A) "I find that I am attracted to people with physical characteristics resembling those of:" followed by five choices to identify sexual imprinting recognized by the participant or to deny that any such thing existed in their case. These five choices were: "My mother or mother figure," "My father or father figure," "My sister or stepsister, etc.," "My brother or stepbrother, etc.," and "This question is not applicable since I never became aware of looking for physical characteristics resembling any family member."

#### 2.1.2. Identification of cases of father-daughter incest (FDI) or mother-son incest (MSI)

We provided two sufficient mechanisms by which the participants who were victims of FDI could indicate that they had been victims of incest with their father or father figure. The first mechanism that participants encountered during participation was sub-item f in Appendix A (items 1 and 2) that ask whether their father had been involved in sexual behavior of any kind with them before they reached 18 years of age. Two statements (S93 and S62, Appendix A) presented as agree-disagree provided the second mechanism that participants encountered for reporting FDI. Both statements included a larger pool of possible perpetrators than the first mechanism because both clearly specified that the reported behaviors included those with their fathers and also those with a father-figure. Endorsing either S93 or S62 was sufficient for a participant to receive the FDI victim designation. Neither statement S93 nor statement S62 provided any opportunity to enter details about the FDI behaviors.

#### 2.1.3. Identification of cases of mother-daughter incest (MDI) or mother-son incest (MSI)

We used the items analogous to those used to identify FDI and FSI to identify mother daughter incest MDI and mother-son incest MSI. These were the items analogous to Items 1 and 2 and also items S79 and S149.

*2.1.4. Identification of cases of child sexual abuse by an adult male other than the father (CSA-AM)*

All participants who used either items 1 or 2 in Appendix A to indicate that they had been involved in sexual behavior of any kind with an adult male before they reached 18 years of age were considered to be victims of CSA-AM if they were not victims of FDI or FSI.

*2.1.5. Identification of cases of child sexual abuse by an adult female other than the mother (CSA-AF)*

All participants who used the items analogous to either items 1 and 2 in Appendix A to indicate that they had been involved in sexual behavior of any kind with an adult female before they reached 18 years of age were considered to be victims of CSA-AF if they were not victims of MDI or MSI for female and male participants, respectively.

*2.1.6. Identification of cases of brother–sister (BSI) or brother–brother incest (BBI)*

We used items 1 and 2 and sub-item g to identify cases of incest with a brother that occurred before the participant reached 18 years of age.

*2.1.7. Identification of cases of sister–sister (SSI) or sister–brother incest (SBI)*

We used the female-analogous items 1 and 2 and sub-item (g) to identify cases of incest with a sister that occurred before the participant reached 18 years of age.

*2.1.8. The male sexual orientation scale (MSOS) and the female sexual orientation scale (FSOS)*

The MSOS and the FSOS items are based on behaviors and items from S-SAPE1©S-SAPE, LLC 2002, P.O. Box 11081, Charleston, WV 25339. The actual MSOS and the FSOS items are presented in Table 1 of Beard et al. (2015). The Cronbach alphas (used to measure internal consistency) of the FSOS were .857 and .843 in the female and male participants, respectively, based on the data for the current study. The Cronbach alphas of the MSOS were .710 and .959 in the female and male participants, respectively.

*2.1.9. Family of rearing (Item 3, Appendix A)*

This item provided a total of 10 choices for the participant in a drop-down menu. For statistical analysis, this variable was recoded to create 10 0/1 dummy variables with each variable coded to represent one of the 10 possible responses. To prevent collinearity, only the most powerful of the 10 was permitted to be entered into any final regression model.

*2.1.10. Mother’s attitude about sex (Item 4, Appendix A)*

“Select the choice which best fits your mother’s (or mother figure’s) attitude about sex.”(1) I had so little contact with my mother that I have no idea what attitude she had. (2) Mother thought sex was dirty and filthy, but she never was able to discuss it with me. (3) Mother thought sex was dirty and filthy, and she did her best to teach her view to me. (4) Mother thought sex was healthy, but she never was able to discuss it with me. (5) Mother thought sex was healthy, and she provided me with healthy information. To produce a binary predictor variable for the present research, “1”, “2”, and “3” were recoded to “0” and “4” and “5” were recoded to “1” to produce a binary variable with “1” coding for a positive attitude about sex.

*2.1.11. Father’s attitude about sex (Item 5, Appendix A)*

This item and its recoding were completely parallel to that described above for mother’s attitude about sex.

*2.1.12. Parental modeling of affection (Item 6, Appendix A)*

“Select the phrase that best describes your parent’s demonstration of affection for one another in your presence.” (1) My parents never kissed or hugged in my presence. (2) My parents sometimes kissed or hugged in my presence. (3) My parents often hugged or kissed in my presence. (4) My

parents often hugged or kissed and did some genital petting in my presence. (5) My parents often hugged or kissed in my presence and I witnessed intercourse by sight or sound. After recoding “4” and “5” to “3,” the predictor variable was coded 1 to 3 and modeled as a continuous variable that took on only three possible values.

#### 2.1.13. *Maternal affection (Item 7, Appendix A)*

“Select the phrase which most closely describes the way that your mother demonstrated affection for you.” (1) “My mother never kissed or hugged me.” (2) “My mother seldom kissed or hugged me.” (3) “My mother often kissed or hugged me.” The predictor variable was coded 1 to 3 and modeled as a continuous variable that took on only three possible values.

#### 2.1.14. *Paternal affection (Item 8, Appendix A)*

“Select the phrase which most closely describes the way that your father demonstrated affection for you.” (1) “My father never kissed or hugged me.” (2) “My father seldom kissed or hugged me.” (3) “My father often kissed or hugged me.” The predictor variable was coded 1 to 3 and modeled as a continuous variable that took on only three possible values.

#### 2.1.15. *My parent’s relationship (P5 of Appendix A)*

“The best way to describe my parents’ relationship while I was growing up is: (1) My parents’ relationship was not good: there was verbal fighting, anger, criticism, distance, and little or no love or affection. (2) My parents’ relationship was very mixed: there were periods of love and affection interspersed with verbal fighting, anger, criticism, or distance. (3) My parents’ relationship was reserved: I did not see fighting, criticism, or physical display of affection, but I believe that there was quiet love and respect underneath. (4) My parents’ relationship included a lot of physical fighting and/or brutality. (5) My parent’ relationship was very good with lots of love, support, and physical affection and few times when there was fighting, anger, criticism or distance.” For statistical analysis, this variable was recoded to create five 0/1 dummy variables with each variable coded to represent one of the five possible responses. To prevent collinearity, only the most powerful of the five was permitted to be entered into any final regression model.

#### 2.1.16. *How my parents handled disagreements (P6 of Appendix A)*

“The best way to describe the way that my parents handled disagreements about how to deal with me as a child was: (1) There was often an obvious disagreement between my parents with my mother taking my part against my father. (2) There was often an obvious disagreement between my parents with my father taking my part against my mother. (3) I was mostly raised in a single-parent family by my mother. (4) I was mostly raised in a single-parent family by my father. (5) If my parents had disagreements about how to deal with me as a child, they seemed to work them out where I could not hear, and I saw a united approach to me.” For statistical analysis, this variable was recoded to create five 0/1 dummy variables with each variable coded to represent one of the five possible responses. To prevent collinearity, only the most powerful of the five was permitted to be entered into any final regression model.

#### 2.1.17. *Crush items [reproduced in this paragraph with modification from Beard et al. (2015), under a creative commons attribution (CC-BY) 4.0 license]*

(Item A—P87, Appendix A) “The best way to describe the genders of the individuals outside my family that I had crushes on (or was in love with) before I hit puberty is: (1) only boys or adult men before I hit puberty (2) only girls or adult women before I hit puberty (3) mostly boys or adult men but some girls or adult women before I hit puberty (4) mostly girls or adult women but some boys or adult men before I hit puberty (5) I never had crushes on anybody outside my family before I hit puberty.” (Item B—P89, Appendix A) Item B was identical to Item A except that the phrase “before puberty” was replaced with “after puberty”. (Item C—S165) “As a child I always seemed to have a crush on one female or another.” (Item D—S166) “As a child I always seemed to have a crush on one male or another.” Item C and item D were each presented as agree/disagree. For item A and item B, the numbers in parentheses represent the initial coding. To create a total of four binary variables, items

A and B were each recoded as follows to produce a total of four binary variables. For the first two binary variables, one and three were recoded to one; all other entries were recoded to zero to code for “mostly males.” For the second two binary variables, two and four were recoded to one; all other entries were recoded to zero to code for “mostly females.” The four crush items were added to the survey program after the first 128 male participants and the first 236 female participants had filed their data.”

The crush items were used in the statistical analysis of the current paper for correlation analysis with the sexual imprinting variables.

## **2.2. Procedure**

The present study was a portion of a far larger research undertaking entitled: “Effects of Recalled Family Attitudes and Childhood Sexual Experiences on Adult Sexual Attitudes and Adjustment.” That research project was approved by the institutional review boards of all institutions at which data were input by participants. Those institutions included: Marshall University, Charleston Area Medical Center/West Virginia University, West Virginia University, West Virginia State University, and Concord University. All data for the study were input anonymously by the participants themselves between 2002 and 2014 into a database with a very large number of collected variables in university computer laboratories with up to 40 computers per laboratory using the S-SAPE1 computer program. Immediately before study participants were again informed that their participation was completely anonymous and of the multiple protections to their anonymity. These protections included the following: Participants were seated within the computer laboratory so that their computer screens could not be seen by others. All computers were logged on by the researcher rather than the participant so that the computers were unaware of the participant’s identity. There were no unique identifiers collected. All data were filed in random locations in encrypted format in random access files that were initially filled with fake data. Multiple lines of fake encrypted data were also filed in random locations at the same time that the real lines were filed. Decoding was performed en masse by the database manager at a remote time and location just prior to data analysis. We obtained informed consent using forms approved by the institutional review boards of six mid-Atlantic colleges of moderate-size. The six campuses used bulletin board announcements, and professors made announcements to their own classes to promote the study as a “cradle to the grave study of human sexuality”. We also increased diversity by recruiting faculty and adults in the general population near the campuses. We also recruited adults at “Pride” parades and picnics and institutions selectively frequented by gay and lesbian individuals. In addition, we did “snowball” recruiting by inviting potential participants to bring their adult friends and acquaintances as participants. Participants were not paid, but many students did receive extra credit. All volunteers over 18 years of age were accepted as participants in the study. It took approximately two hours to complete the survey.

### **2.2.1. Selection of participants for the study**

We used two criteria to select the 1,452 male and 2,611 female participants in the study from a file containing data from a total of 4,170 individuals: We excluded transsexual individuals because at the time that the early incest occurred, their gender at study participation was opposite from their birth sex. The sex reversal would have made group assignment for the ANOVAs and logistic regressions confounding, ambiguous, and misleading for the effects we planned to measure. We also excluded individuals who had genital anomalies or other problems that interfered with their ability to engage in sex with a partner because those problems would have confounded the MSOS and FSOS variables (which include sexual behaviors with partners).

## **3. Results**

### **3.1. Sexual imprinting on family members reported by participants**

We used the item “I find that I am attracted to people with physical characteristics resembling those of:” followed by the five choices listed in the methods section and Table 1 to identify sexual imprinting recognized by the participant or to deny that that any such thing existed in their case. As can be

**Table 1. Percentages of the 4,063 participants who experienced sexual imprinting**

“I find that I am attracted to people with physical characteristics resembling those of:” (P34) Choices	Women		Men	
	n <sup>a</sup>	% <sup>b</sup>	n <sup>a</sup>	% <sup>b</sup>
1. “My mother or mother figure”	22	0.8	167	11.5
2. “My father or father figure”	404	15.5	27	1.9
3. “My sister or stepsister, etc.”	10	0.4	31	2.1
4. “My brother or stepbrother, etc.”	65	2.5	7	0.5
5. “This question is not applicable since I never became aware of looking for physical characteristics resembling any family member”	2,110	80.8	1,220	84.0
Column totals	2,611	100	1,452	100

Notes:  $\chi^2(4, 4063) = 441.68, p < .001$ , indicating a highly significant difference in the endorsement distribution between women and men.

<sup>a</sup>Count of those who selected the choice.

<sup>b</sup>Percentage of those who selected the choice.

seen in Table 1, a slightly larger percentage of women than men reported being aware of being attracted to other people resembling people in their nuclear family [19.2% of the women vs. 16.0% of the men,  $\chi^2(1, 4063) = 6.29, p = .012$ ]. The vast majority of sexual imprinting reported by women and men was on the opposite sex (93.6 and 85.3%, respectively), and the majority of sexual imprinting in women and men was on a parent rather than on a sibling (79.4 and 84.3%, respectively).

### 3.2. Factors involved in awareness of sexual imprinting

Based on data in the literature, we hypothesized that the composition of the nuclear family, displays of affection of parents for the participant as a child, behaviors of parents that either modeled behaviors of good or bad heterosexual life-partners, attitudes of parents about sex, and sexual traumas that involved sexual behaviors with members of the nuclear family or adults outside the nuclear family might influence the likelihood that participants would endorse choices consistent with sexual imprinting. We used binary logistic regression to identify the most powerful predictors from a total of 38 possible binary predictor or continuous variables, including 10 types of nuclear families (Item 3, Appendix A), six types of sexual traumas (incest with a sister, incest with a brother, incest with father or father-figure, incest with mother or a mother-figure, child sexual abuse by an adult male [CSA] other than the father or father figure, and CSA by an adult female), the five possible choices, each, for multiple choice items P5 and P6 (Appendix A), and whether or not participants had at least one older brother, older sister, younger brother, or younger sister or any sister or any brother. Coding for each of the four logistic regression was done with the variable representing those who selected the choice being analyzed coded “1” if the participant selected that choice and coded “0” for participants who selected one of the other five choices. Those coded “0” were referred to in subsequent text as the “controls” for the analysis because logistic regression results can be interpreted as providing estimates of the relative likelihood of choosing the answer coded “1” compared to the likelihood of choosing an answer not coded “1.” Only predictors that were statistically significant based on the “score” statistic at step-zero of the logistic regression were considered eligible for inclusion in the model. Model building (Table 2) was continued until either the maximum number of predictors that were supported by the data were identified or none of the eligible potential predictors remained statistically significant after adjusting for the independent variables already in the model. We required that there were at least 10 participants receiving a code of “1” for the dependent variable for each predictor in the model (see Table 1 and N1 in Table 2 for these counts). The predictors were numbered and entered into Table 2 in order of addition to the model which was also in the order of decreasing predictive power.



**Table 2. Logistic regression analyses**

<b>Predictor #, variables (in order of decreasing predictive power) and models</b>					
		<b>B</b>	<b>Std. error</b>	<b>p</b>	<b>e<sup>B</sup></b>
	<i>Model #1a, Nagelkerke r<sup>2</sup> = .021 N = 2,611; n<sub>1</sub> = 404</i>	<i>Analysis for predicting sexual imprinting on father in women</i>			
1	Paternal Affection (coded 1-3)	0.360	0.088	<.001	1.433
2	Modeling (coded 1-3)	0.1733	0.085	.043	1.189
	Constant	-2.957	0.248	<.001	
	<i>Model #1b, Nagelkerke r<sup>2</sup> = .009 N = 2,611; n<sub>1</sub> = 404</i>	<i>Analysis for predicting sexual imprinting on father in women</i>			
1	"My parents never married (excludes common law marriages) before I reached 18 and did not live together"	-0.800	0.353	.024	0.449
2	"My parent' relationship was very good with lots of love, support, and physical affection and few times when there was fighting, anger, criticism or distance"	0.246	0.111	.026	1.279
	Constant	-1.767	0.072	<.001	
	<i>Model #2, Nagelkerke r<sup>2</sup> = .086 N = 2,611; n<sub>1</sub> = 65</i>	<i>Analysis for predicting sexual imprinting on brother in women</i>			
1	At least one older brother (coded 0/1)	1.835	0.297	<.001	6.267
	Constant	-4.708	0.259	<.001	
	<i>Model #3, Nagelkerke r<sup>2</sup> = .031 N = 2,611; n<sub>1</sub> = 22</i>	<i>Analysis for predicting sexual imprinting on mother in women</i>			
1	"My parents divorced or separated, and there was a remarriage or a new partner in my home before I reached 18"	0.413	0.144	.004	1.512
	Constant	-5.158	0.290	<.001	
	<i>Model #4a, Nagelkerke r<sup>2</sup> = .024 N = 2,611; n<sub>1</sub> = 10</i>	<i>Analyses for predicting sexual imprinting on sister in women</i>			
	CSA-AF	2.522	1.075	.019	12.454
	Constant	-5.658	0.334	<.001	
	<i>Model #4b, Nagelkerke r<sup>2</sup> = .017 N = 2611; n<sub>1</sub> = 10</i>				
1	My parents' relationship included a lot of physical fighting and/or brutality	2.014	1.067	.059	7.494
	Constant	-5.652	0.334	<.001	
	<i>Model #5, Nagelkerke r<sup>2</sup> = .030 N = 1,452; n<sub>1</sub> = 167</i>	<i>Analysis for predicting sexual imprinting on mother in men</i>			
1	Maternal attitude about sex (coded 1-3)	0.719	0.220	.001	2.052
2	Older brother (coded 0/1)	-0.411	0.180	.023	0.663
3	CSA-AF	0.515	0.239	.031	1.673
	Constant	-1.964	0.105	<.001	
	<i>Model #6 Nagelkerke r<sup>2</sup> = .020 N = 1,452; n<sub>1</sub> = 31</i>	<i>Analysis for predicting sexual imprinting on sister in men</i>			
1	Parental modeling of affection (coded 1-3)	0.670	0.300	.026	1.953
	Constant	-5.399	0.766	<.001	
	<i>Model #7, Nagelkerke r<sup>2</sup> = .055 N = 1,452; n<sub>1</sub> = 27</i>	<i>Analysis for predicting sexual imprinting on father in men</i>			
1	SBI coded 0/1	1.646	0.654	.012	5.188
2	CSA-AM	1.344	0.661	.042	3.835
3	"There was often an obvious disagreement between my parents with my mother taking my part against my father"	0.924	.413	.025	2.520
	Constant	-4.379	0.258	<.001	

### 3.3. Predictors for female participants

The odds ratios from the multiple logistic regression models were all adjusted for the effects of the other variables in the model. There were two significant predictors in multiple logistic regression Model #1a (Table 2). The likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her father (including biological father, step father, or other father figure,  $n_1 = 404$ ) increased when her father was more affectionate to her during childhood and adolescence. The likelihood of a woman reporting that she had been attracted to people with physical

characteristics resembling her father also increased when her parents were more openly affectionate to each other in her nuclear family. When the father's affection and parental modeling of affection for each other were removed from the list of potential predictors, we obtained Model #1b which also contained two predictors. The odds ratios from Model #1b showed that the likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her father was reduced by 0.45 times if she came from a nuclear family in which her parents had never married before she reached 18 years of age and did not live together. The likelihood of being attracted to people with physical characteristics resembling her father was increased by 1.3 times if her parents' relationship was very good (Table 2, Model #1b).

The likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her brother ( $n_1 = 65$ ) was increased by 6.3 times if she had at least one older brother, the sole predictor (Table 2, Model #2). The likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her mother (including biological mother, step mother, or other mother figure,  $n_1 = 22$ ) was increased by approximately 1.5 times if her parents had divorced or separated and there had been a remarriage or a new partner in her home (Table 2, Model #3).

The equation estimating the likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her sister was based on the data from a small number of participants with that outcome ( $n_1 = 10$ ) with all the rest coded as controls (0), so that data can theoretically support at most a single predictor. The likelihood of a woman reporting that she had been attracted to people with physical characteristics resembling her sister was increased by 12 times if she had been the victim of CSA-AF (Table 2, Model #4a). The other potential predictor (P5\_4, a parent's relationship with a lot of physical fighting or brutality) was of borderline significance ( $p = .057$  in the alternative logistic regression equation). A parent's relationship with the spouse that involved a lot of physical fighting or brutality predicted an increased likelihood that was 7.5 times the likelihood in the families with other types of parental relationships (Table 2, Model #4b).

### **3.4. Adult sexual orientations of the women**

Women who indicated that they were looking for partners whose physical characteristics resembled those of their fathers or their brothers had MSOS scores that were significantly higher than those of the controls who were not aware of looking for partners who resembled family members (Table 3). This indicated a strong sexual orientation toward sex with male partners. Women who indicated that they were looking for partners whose physical characteristics resembled those of their sisters had MSOS scores that were significantly lower than those of the controls. The effect sizes for the groups included in the ANOVA of the MSOS scores as measured by the partial eta squared ( $\eta^2$ ) were numerically largest for the group looking for a partner resembling the participant's *father* and next largest for the group looking for a partner who resembled the participant's *sister* (Table 3).

Women who indicated that they were looking for partners whose physical characteristics resembled those of their mothers or sisters had FSOS scores that were significantly higher than those of the controls, indicating a strong sexual orientation toward sex with female partners. The effect sizes of the groups included in the ANOVA of the FSOS as measured by  $\eta^2$  were numerically largest for the group looking for a partner resembling the participant's *sister* and next largest for the group looking for a partner that resembled the participant's *mother* (Table 3).

### **3.5. Correlation of the binary sexual-imprinting variables with the binary crush variables in females ( $n = 2,375$ )**

The variable describing sexual imprinting on her father was significantly negatively correlated with the P87 variable representing crushes on females before puberty ( $-0.056, p = .006$ ) and the P89 variable representing crushes on females after puberty ( $-0.049, p = .017$ ). The variable describing sexual imprinting on her mother was significantly correlated with the S165 variable describing crushes on females ( $.108, p < .001$ ) and with the P87 variable representing crushes on females before puberty

**Table 3. Sexual orientation in female participants tabulated by imprinted family member**

Choices	n	MSOS				FSOS			
		M ± SE	Mdn	p <sup>1</sup>	η <sup>2</sup>	M ± SE	Mdn	p <sup>1</sup>	η <sup>2</sup>
1. "My mother or mother figure"	22	5.7 ± 2.8	6	ns	.001	3.6 ± 3.9	1.5	.001	.005
2. "My father or father figure"	404	7.6 ± 2.0	8	<.001	.016	1.0 ± 1.7	0	ns	.002
3. "My sister or stepsister, etc."	10	2.3 ± 2.3	1.5	<.001	.007	8.2 ± 2.3	8	<.001	.014
4. "My brother or stepbrother, etc."	65	7.6 ± 2.0	8	.003	.004	0.7 ± 1.5	0	ns	<.001
5. "This question is not applicable ..." (Controls)	2,110	6.7 ± 2.4	7	Control	*	1.1 ± 2.1	0	Control	*

Notes:  $p$  and  $\eta^2$  (the partial eta squared, a measure of effect size) were calculated on the rank transformed data to correct for heterogeneity of data variance in the untransformed data.  $p^1$  was calculated from the rank  $t$ -test and adjusted for multiple comparisons to a single control using Dunnett's tables.

\*  $\eta^2$  was not calculated for this parameter which was set to zero because it was redundant.

(.104,  $p < .001$ ), and it was negatively correlated with the P87 variable representing crushes on males before puberty ( $-.065$ ,  $p = .002$ ). The variable representing sexual imprinting on her brother was significantly correlated only with the S166 variable representing crushes on males (.047,  $p = .021$ ). The variable representing sexual imprinting on her sister was significantly correlated with the variables representing crushes on females (.233,  $p < .001$ ), with the P87 variable representing crushes on females before puberty (.247,  $p < .001$ ), and with the P87 variable representing crushes on females after puberty (.246,  $p < .001$ ), and it was negatively correlated with the P87 variable representing crushes on males before puberty ( $-.139$ ,  $p < .001$ ) and negatively correlated with the P87 variable representing crushes on males after puberty ( $-.181$ ,  $p < .001$ ).

### 3.6. Predictors for male participants

There were three statistically significant predictors in the logistic regression equation for predicting the likelihood of a man reporting that he had been attracted to people resembling his mother (including biological mother, step mother, or other mother figure,  $n_1 = 167$ , Model #5, Table 2). That likelihood was increased by about 2.1 times if his mother's attitude was positive about sex. It was decreased by about 0.7 times if he had at least one older brother, and it was increased by about 1.7 times if he was the victim of CSA-AF (Model #5, Table 2).

The likelihood of a man reporting that he had been attracted to people with physical characteristics resembling his sister ( $n_1 = 31$ ) increased when his parents modeled more affection for each other within the nuclear family (Model #6, Table 2). The variable indicating whether or not he had a sister was also a significant predictor at step-0 of the logistic regression. It would also have been significant as the second most powerful predictor in the model, but it was left out of the regression equation because imprinting on a sister would have been impossible if a participant did not have a sister.

There were three statistically significant predictors in the logistic regression equation for predicting the likelihood of a man reporting that he had been attracted to people with physical characteristics resembling his father (including biological father, step father, or other father figure,  $n_1 = 27$ , Model #7, Table 2). That likelihood was increased by 5.2 times if a participant was the victim of sister-brother incest (SBI). It was increased by 3.8 times if he was the victim of CSA-AM. And, it was increased by 2.5 times if his mother took his side against his father if there were disagreements between his parents. This result appears to be related to the somewhat similar result observed by Beard et al. (2015, in Model #19M and Model #21M, Table 10) for prediction of same sex crushes. There were not enough data to search for predictors of the likelihood of a man reporting that he had

been attracted to people with physical characteristics resembling his brother ( $n_1 = 7$ , which was less than the minimum value of 10 required to support a single predictor).

### 3.7. Correlation of the binary sexual-imprinting variables with the binary crush variables in males ( $n = 1,324$ )

The variable describing sexual imprinting on his father was significantly correlated with the S165 variable indicating crushes on males (.245,  $p < .001$ ), with the P87 variable representing crushes on males before puberty (.308,  $p < .001$ ) and the P89 variable representing crushes on males after puberty (-.313,  $p < .001$ ). It was significantly negatively correlated with the S166 variable indicating crushes on females (-.118,  $p < .001$ ) and significantly negatively correlated with the P87 variable representing crushes on females before puberty (-.246,  $p < .001$ ) and the P89 variable representing crushes on females after puberty (-.240,  $p < .001$ ).

The variable describing sexual imprinting on his mother was significantly correlated with the S165 describing crushes on females (.075,  $p = .007$ ), with the P87 variable representing crushes on females before puberty (.067,  $p = .014$ ), and with the P87 variable representing crushes on females after puberty (.082,  $p = .003$ ). It was negatively correlated with the S166 variable representing crushes on males, the P87 variable representing crushes on males before puberty (-.080,  $p = .003$ ), and with the P87 variable representing crushes on males after puberty (-.086,  $p = .002$ ).

The variable representing sexual imprinting on his brother was significantly correlated only with the S166 variable representing crushes on males (.071,  $p = .010$ ), with the P87 variable representing crushes on males before puberty (0.153,  $p < .001$ ), and the P89 variable representing crushes on males after puberty (.144,  $p < .001$ ). It was significantly negatively correlated with the S165 variable indicating crushes on females (-.087,  $p = .002$ ) and significantly negatively correlated with the P87 variable representing crushes on females before puberty (-0.167,  $p < .001$ ) and the P89 variable representing crushes on females after puberty (-.142,  $p < .001$ ).

The variable representing sexual imprinting on his sister was not significantly correlated with any of the variables representing crushes.

### 3.8. Adult sexual orientations of the men

Men who indicated that they were looking for partners whose physical characteristics resembled those of their fathers or brothers had MSOS scores that were significantly higher than those of the controls who were not aware of looking for partners who resembled family members (Table 4). This indicated a strong sexual orientation toward sex with male partners. The effect sizes for the groups

**Table 4. Sexual orientation in male participants tabulated by imprinted family member**

Choices	n	MSOS				FSOS			
		M ± SE	Mdn	p <sup>1</sup>	η <sup>2</sup>	M ± SE	Mdn	p <sup>1</sup>	η <sup>2</sup>
1. "My mother or mother figure"	167	0.3 ± 0.9	0	ns	<.001	9.4 ± 1.5	10	<.001	.010
2. "My father or father figure"	27	7.8 ± 4.5	10	<.001	.058	3.0 ± 3.7	2	<.001	.024
3. "My sister or stepsister, etc."	31	0.5 ± 1.2	0	ns	<.001	9.2 ± 2.0	10	ns	.002
4. "My brother or stepbrother, etc."	7	6.7 ± 4.8	8	<.001	.012	3.7 ± 4.2	1	.006	.005
5. "This question is not applicable ..." (Controls)	1,220	0.9 ± 2.6	0	Control	*	8.4 ± 2.8	9	Control	*

Notes:  $p$  and  $\eta^2$  (the partial eta squared, a measure of effect size) were calculated on the rank transformed data to correct for heterogeneity of data variance in the untransformed data.  $p^1$  was calculated from the rank  $t$ -test and adjusted for multiple comparisons to a single control using Dunnett's tables.

\*  $\eta^2$  was not calculated for this parameter which was set to zero because it was redundant.

included in the ANOVA of the MSOS scores as measured by the partial eta squared ( $\eta^2$ ) were numerically largest for the group looking for a partner resembling the participant's father and next largest for the group looking for a partner that resembled the participant's brother (Table 4).

Men who indicated that they were looking for partners whose physical characteristics resembled those of their mothers had FSOS scores that were significantly higher than those of the controls, indicating a strong sexual orientation toward sex with female partners (Table 4). Men who indicated that they were looking for partners whose physical characteristics resembled those of their fathers or brothers had FSOS scores that were significantly lower than those of the controls, indicating a weak sexual orientation toward sex with female partners. The effect sizes of the groups included in the ANOVA of the FSOS as measured by  $\eta^2$  were numerically largest for the group looking for a partner resembling the participant's father and next largest for the group looking for a partner that resembled the participant's mother (Table 4).

#### 4. Discussion

To our knowledge, this is the first paper on sexual imprinting in the human to use a measure that required conscious awareness of the sexual imprinting, the first to show same-sex sexual imprinting in the human, the first to look for sexual imprinting on siblings in humans, and the first to use an open-ended measure that searched for imprinting of unspecified characteristics known only to the respondent (e.g. height, weight, hair-color, skin color or texture, body-fat distribution, or personality). Although only 16% of men and 19% of women who were participants in the study were aware of looking for characteristics of a family member in potential romantic and sexual partners, it is possible that sexual imprinting is acting below the level of awareness in a far larger percentage of the human population or that some sexual imprinting was not reported in the present study because it did not fit within the description of the item we used to identify sexual imprinting. For example, it is possible that some sexual imprinting is on unrelated individuals who were objects of early crushes or partners in early sexual experiences. It is even possible that some sexual imprinting that would not have been identified in our study is on individuals seen only in media (e.g. actors or actresses seen in movies, on television, or on a computer or other digital device) or on animals of other species.

What we did show was, in addition to sexual imprinting on opposite-sex parents, there was also (but less frequent) sexual imprinting on opposite-sex siblings. Also, we demonstrated that there was (even less frequently) sexual imprinting on same-sex parents and also on same-sex siblings. In a study published 13 years after we began data collection for our present study but before we began the statistical analysis for the present paper, Vukovic et al. (2015) showed that the relationship between a child and his or her parent was a predictor of whether or not children preferred images similar in appearance to their parents. In our study, we showed that there were statistically significant predictors for various types of sexual imprinting among variables that described a variety of different types of nuclear families, different attitudes and behaviors of parents, and presence or absence of older or younger siblings of both sexes. Because the power in our study to detect predictors for imprinting was dependent on the size of the sample and the number of people who displayed each type of sexual imprinting, our data on sexual imprinting of women on their fathers and our data on the sexual imprinting of men on their mothers provided more powerful sets of data for identification of predictors for sexual imprinting predictor variables than the data for detecting sexual imprinting on same-sex parents, opposite-sex siblings, or same-sex siblings which were rarer phenomena with relatively small *ns*.

The fact that the majority of sexual imprinting that women were aware of was on their father was consistent with our hypothesis and also the reports of Bereczkei et al. (2004, 2009). In further support of our hypotheses, the two most powerful predictors of sexual imprinting of women on their fathers were his having been affectionate to her as she was growing up and her parents having demonstrated affection for one another where she could see it. High scores on both of these predictors were consistent with the father having modeled a good heterosexual romantic and sexual partner to his wife (or long-term partner) during the participant's developmental years in the nuclear family (Table 2, Model #1a).

Unlike, the findings of Vukovic et al. (2015), the parent's demonstrating affection for each other where the participant could see it was an important predictor for the father having been chosen as a model for sexual imprinting. However, the fact that the most important predictor was the affection that the father demonstrated for the participant, herself, was consistent with our hypothesis that the father served as a model of a good romantic partner and also in line with the affection demonstrated by the father for the participant predicting some form of attachment of the participant to her father as demonstrated by Vukovic et al. (2015) at the beginning of puberty.

In men, their mother's having a positive attitude about sex was the most powerful predictor of the participant having been aware of looking for romantic and sexual partners having physical characteristics similar to those of their mother. Having an older brother decreased the likelihood of a participant identifying sexual imprinting on his mother, apparently, as a result of that variable also being the sole significant predictor of a participant's identifying being sexually imprinted on his brother. The fact that having been a victim of CSA-AF also increased the likelihood of male participants having awareness of looking for romantic and sexual partners having physical characteristics similar to those of the participant's mother was, perhaps, because either the earliest or one of the earliest of his female sexual partners was an adult female.

An opposite-sex sibling was the next most common family member in both sexes to be identified as the person whose physical characteristics participants were looking for in potential romantic and sexual partners. In women, the most powerful predictor for such an outcome was having indicated in another item that she had at least one older brother, providing further evidence of the veracity of her claim (Table 2, Model #2). In men, the most powerful predictor of sexual imprinting on a sister was having parents who hugged and kissed each other where they could be observed by the participant. Having at least one sister was also a significant predictor, (again demonstrating the veracity of the claim) but having at least one sister was left out of the model to avoid adjusting the odds ratio for the parameter measuring parental demonstration of affection.

The results from the statistical analyses were consistent with a two-step mechanism for development of sexual imprinting of a male on a sister. The first step would be that the mother modeled a good opposite-sex partner. The second step (depending on having at least one sister) would be for him to use his sister as a model of an idealized female romantic partner closer to his own age than his mother. This sister-model, would be free to develop and evolve as his sister matured, keeping the sister-model closer in sync with his own age than his far-older mother, who would also continue to age. The fact that having a sister at all was a stronger predictor than having an older or a younger sister and also a stronger predictor than having been involved in any sort of sexual relationship with a sister was consistent with the above interpretation.

The third most common form of sexual imprinting in both sexes was imprinting on the same-sex parent. In women, there were only 22 such cases among the 2,611 total cases in the female data-set. The 22 female participants who were imprinted on their mother was a number ( $n_i$ ) only large enough to identify one predictor in our data-set. The most powerful predictor of sexual imprinting on the woman's mother was coming from a nuclear family in which there had been a divorce and a subsequent remarriage in the home before the participant turned 18 years of age. Coming from that kind of home reduced the chance that there was an opposite-sex parent in the home who served as a model of a good opposite-sex adult sexual partner. Further studies with a much larger number of cases with imprinting on the respondent's mother will be necessary to fully delineate the predictors for such an outcome in women.

In men, there were only 27 cases in which the respondent was sexually imprinted on his father among the 1,452 total cases in the male data-set. This small number of cases was sufficient to support, at most, a model with two predictors: being a victim of SBI and being a victim of CSA-AM. The most powerful predictor of the son being sexually imprinted on his father was the son being a victim of SBI. One apparent reason for SBI serving as a predictor of sexual imprinting on the father is that

boys who are victims of SBI are more likely than controls to become involved in early sexual behaviors with other males due to the increased interest in sex resulting from the sibling-incest experience (O'Keefe et al., 2014). The early experience with other males increases the chance that the study participant will have an adult bisexual or same-sex orientation in adulthood (O'Keefe et al., 2014). The second most powerful predictor of a male sexually imprinting on his father was CSA-AM. Being a victim of CSA-AM is also known to increase the likelihood that the victim will have an adult same-sex or bisexual orientation (O'Keefe et al., 2014). From a mechanistic point of view, it appears that being involved in behaviors that led to early development of a same-sex orientation was the first step in a man becoming sexually imprinted on his father. The second step appears to have been choosing the father as an idealized example of a male sexual partner. As expected from the above rationale, the MSOS scores of the men who were sexually imprinted on their fathers were significantly higher than those of the controls (Table 4). Our interpretation of the above mechanism was supported by the fact that both predictors in the model were far more powerful predictors of the outcome than being the victim of FSI. We can say this with reasonable certainty because we had data from other items that increased the number of FSI cases to a number higher than the number of FDI identified solely as a subset of the CSA-AM variable cases.

The fourth most common type of sexual imprinting in our study was imprinting on a same-sex sibling. Among the female participants, there were only 10 such cases, a number that was very borderline for identifying even a single predictor. Among the male participants there were only seven such cases, too few to allow identification of even a single predictor. Clearly, data sets with larger numbers of cases of these types will be required to identify predictors for these two outcomes.

Because we were struck by the similarities between the predictors identified in the present study for sexual imprinting on an opposite-sex parent and the predictors identified by Beard et al. (2015) for early crushes, we analyzed all 24 of the possible correlations between the binary sexual imprinting variables and the binary crush variables in the data from the women and all 24 in the data from the men. Eleven of the correlations were statistically significant in the data from the women and 17 of the 24 were statistically significant in the data from the men, even though the *ns* for the men were smaller than those for the women. The correlation analyses clearly established that there were a large number of correlations between the imprinting data and the data on crushes. We suspect that both the sexual imprinting phenomena and the crush phenomena are important ways to look at the early developmental steps involved in the human romantic attachment mechanisms that are so important in forming human marital unions and nuclear families. As mentioned in the introduction, when attachment to the biological or adoptive parents has been problematic, the individual's adult romantic attachment is also negatively affected, explaining the high rate of divorce in the affected individuals (Carlson et al., 2004; Henry & Holmes, 1998; Roisman et al., 2001, 2005; Rusby, 2010; Simpson & Rholes, 1998).

#### **4.1. Limitations to the study**

This was an epidemiological study, a cohort study, and one based on a self-selected convenience sample. Because the participants were not identified at birth and then randomized into groups to be subjected to being raised in specific types of families and subjected to early sexual experiences under supervision of the experimenters, it can be said that the present study was correlational in nature. However, it would not be ethical to initiate such an experiment (Friedrich, 2005, p. 44). As a result, analysis of retrospective data based on the experiences of large groups of individuals is the only ethical way to study early sexual imprinting. Also, because we did not have a random sample, the incidences that we describe cannot be used to describe any specific general population.

From an evolutionary point of view, our observations, like those in ducks and other birds, were consistent with the idea that evolution has provided a mechanism in birds and mammals which works quite well as a way to identify satisfactory opposite-sex sexual partners of the same species with which an individual can procreate as long as ideal species-typical conditions prevail in the rearing environment. As was demonstrated experimentally by manipulating the rearing environment of

birds, moving eggs to nests of birds of a different “parent” species resulted in sexual imprinting of the hatched birds on birds of the “parent” species, a result that would be clearly detrimental to procreative success of that chick in adulthood (Irwin & Price, 1999). Similarly, experimental rearing of ducklings among only male siblings resulted in sexual imprinting of the male ducklings on males (Schutz, 1965), an outcome that was also clearly detrimental to the procreative success of those ducks.

When also viewed from an evolutionary and reproductive-success point of view, the results or our statistical analyses revealed that when humans are raised in nuclear families with good relationships between parents of two different sexes, the sexual imprinting mechanism tends to produce sexual imprinting on an opposite-sex individual of the same species as the child and the parent. The reproductively effective working of the human sexual imprinting mechanism (like that in ducks: Schutz, 1965) also appears to benefit from the presence of opposite-sex siblings within the nuclear family.

From the point of view of fostering reproductively optimum mating (Irwin & Price, 1999), our study revealed that the human sexual imprinting mechanism is vulnerable to events such as absence of a good model of an opposite-sex parent as well as events that lead to development of same-sex orientations. Furthermore, the studies of Williams and Weinberg (2003) appear to have shown that human sexual imprinting on animals of other species could occur when the first sexual partner was an animal of that other species. Understanding that sexual imprinting is a mechanism that can produce a variety of results in humans that are dependent on the individual’s rearing environment can be helpful in a number of ways.

Most importantly, it should encourage parents to work to optimize their own relationship so that their relationship can provide a good model of a healthy relationship between committed adult sexual partners for their children. For health care, mental healthcare, social work, and criminal justice professionals, our results should underscore the importance of supporting and maintaining-intact the nuclear families that are raising children. After all, those children will become part of the next generation of adults. It is important that all of the risks and benefits of the proposed intervention be evaluated before instituting it, including long-term effects on sexual imprinting and the romantic attachment capacity of the child as an adult.

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## Appendix A

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*Items from computer-assisted self-interview (CASI) program S-SAPE1©S-SAPE, LLC. Reproduced by permission of S-SAPE, LLC, 2002, P.O. Box 11081, Charleston, WV 25339. Permission to reuse must be obtained from the rights holder.*

### SEXUAL BEHAVIOR SCREEN

The screen displayed each *behavior* item (one at a time), detailing not only the behavior but also that it was voluntary or coerced. Each item specified the age of the respondent at the time, the age-differential category, and sex of the partner. The questions were presented in a multi-tiered hierarchically structured format.

**Items for behaviors during sex with partners.** Items (1) and (2) below represent second-tier screening questions that only allowed access to third-tier questions if they were answered affirmatively. Item numbers (1) and (2) are presented below as examples that described CSA by an adult male. When paired with each of four partner age differentials and both male and female sexes, they form a total of 16 items that describe sexual behaviors that occurred before participants in the study reached 18 years of age. With insertion of 18–99 for “Your age range:” and both male and female sexes, Item (1) and Item (2) each describe sexual behaviors of participants as adult males with other adults of both sexes.

Item 1. “Your age range: 1-17 years; Behavior: Sexual experimentation of any kind with a male age 18 or older and more than 4 years older than yourself. Give your best guess for numbers—don't get hung up on being precise!”

Item 2. “Your age range: 1-17 years; Behavior: Coerced sexual situations of any kind with a male age 18 or older and more than 4 years older than yourself. Give your best guess for numbers—don’t get hung up on being precise!”

The four age-differential categories were presented in the following order: (a) The partner’s age was within 4 years of the respondent’s age, (b) The partner was more than 4 years older than the respondent but under the age of 18, (c) The partner was more than 4 years older than the respondent and over the age of 18 (as shown in items 1 and 2), and (d) The partner was more than 4 years younger than the respondent. Two items analogous to items 1 and two differing only by substitution of the word “female” for the word “male” provided analogous data for sex with female partners.

**Sexual behavior sub-items.** The following sub-item variables were the actual prompts used in the sexual behavior screen to obtain the data used in this research.

- (a) “Did you ever engage in this behavior in this age range?” (No/Yes coded 0/1)
- (b) “Number of partners:”
- (c) “On about how many occasions did you engage in this behavior?”
- (d) and (e) “What were the earliest and latest ages in the ‘(applicable age range)’ age interval that you engaged in this behavior?”
- (f) “Was mother involved” or “Was father involved” These questions were only asked when the partner described in the item was more than four years older and over age 18 and of the female sex (for mother) or the male sex (for father), respectively. (No/Yes coded 0/1)
- (g) “Was sister involved?” (for female partners) or “Was brother involved?” (for male partners) was asked for all partner-age categories. (No/Yes coded 0/1)

**Item 3.** “Select the choice which best describes your family of rearing whether by biological parents or adoptive parents.” (1) My parents remained married (including common-law) and together until I reached 18. (2) My parents divorced or separated, and there was no remarriage or new partner in my home before I reached 18. (3) My parents divorced or separated, and there was a remarriage or a new partner in my home before I reached 18. (4) My parents never married (excludes common-law marriages) before I reached 18 and did not live together. (5) One of my parents died, but there was no remarriage or new partner in my home before I reached 18. (6) One of my parents died, and there was a remarriage or a new partner in my home before I reached 18. (7) I was raised almost exclusively in an orphanage. (8) I was raised in a series of foster homes. (9) I was raised by my grandparent or grandparents. (10) I was adopted later, and I don’t remember my biological parents.

**Item 4.** “Select the choice which best fits your mother’s (or mother figure’s) attitude about sex.”

(1) I had so little contact with my mother that I have no idea what attitude she had. (2) Mother thought sex was dirty and filthy, but she never was able to discuss it with me. (3) Mother thought sex was dirty and filthy, and she did her best to teach her view to me. (4) Mother thought sex was healthy, but she never was able to discuss it with me. (5) Mother thought sex was healthy, and she provided me with healthy information.

**Item 5.** “Select the choice which best fits your father’s (or father figure’s) attitude about sex.” (1) I had so little contact with my father that I have no idea what attitude he had. (2) Father thought sex was dirty and filthy, but he never was able to discuss it with me. (3) Father thought sex was dirty and filthy, and he did his best to teach his view to me. (4) Father thought sex was healthy, but he never was able to discuss it with me. (5) Father thought sex was healthy, and he provided me with healthy information.

**Item 6.** “Select the phrase that best describes your parent’s demonstration of affection for one another in your presence.” (1) My parents never kissed or hugged in my presence. (2) My parents sometimes kissed or hugged in my presence. (3) My parents often hugged or kissed in my presence. (4) My parents often hugged or kissed and did some genital petting in my presence.

(5) My parents often hugged or kissed in my presence and I witnessed intercourse by sight or sound.

**Item 7.** “Select the phrase which most closely describes the way that your mother demonstrated affection for you.” (1) My mother never kissed or hugged me. (2) My mother seldom kissed or hugged me. (3) My mother often kissed or hugged me.

**Item 8.** “Select the phrase which most closely describes the way that your father demonstrated affection for you.” (1) My father never kissed or hugged me. (2) My father seldom kissed or hugged me. (3) My father often kissed or hugged me.

**P5.** “The best way to describe my parents’ relationship while I was growing up is: (1) My parents’ relationship was not good: there was verbal fighting, anger, criticism, distance, and little or no love or affection. (2) My parents’ relationship was very mixed: there were periods of love and affection interspersed with verbal fighting, anger, criticism, or distance. (3) My parents’ relationship was reserved: I did not see fighting, criticism, or physical display of affection, but I believe that there was quiet love and respect underneath. (4) My parents’ relationship included a lot of physical fighting and/or brutality. (5) My parent’ relationship was very good with lots of love, support, and physical affection and few times when there was fighting, anger, criticism or distance.”

**P6.** “The best way to describe the way that my parents handled disagreements about how to deal with me as a child was: (1) There was often an obvious disagreement between my parents with my mother taking my part against my father. (2) There was often an obvious disagreement between my parents with my father taking my part against my mother. (3) I was mostly raised in a single-parent family by my mother. (4) I was mostly raised in a single-parent family by my father. (5) If my parents had disagreements about how to deal with me as a child, they seemed to work them out where I could not hear, and I saw a united approach to me.”

**P34** “I find that I am attracted to people with physical characteristics resembling those of: (1) my mother or mother figure (2) my father or father figure (3) my sister or stepsister etc. (4) my brother or stepbrother etc. (5) This question is not applicable since I never became aware of looking for physical characteristics resembling any family member.

**P87** “The best way to describe the genders of the individuals outside my family that I had crushes on (or was in love with) before I hit puberty is: (1) only boys or adult men before I hit puberty (2) only girls or adult women before I hit puberty (3) mostly boys or adult men but some girls or adult women before I hit puberty (4) mostly girls or adult women but some boys or adult men before I hit puberty (5) I never had crushes on anybody outside my family before I hit puberty.”

**P89** “The best way to describe the genders of the individuals outside my family that I had crushes on (or was in love with) from the time that I hit puberty to age 18 is: (1) only boys or adult men from the time that I hit puberty to age 18 (2) only girls or adult women from the time that I hit puberty to age 18 (3) mostly boys or adult men but some girls or adult women from the time that I hit puberty to age 18 (4) mostly girls or adult women but some boys or adult men from the time that I hit puberty to age 18 (5) I never had crushes on anybody outside my family from the time that I hit puberty to age 18.”

- S62 “My father or father figure has been reported to the authorities for sexually abusing me.”  
S79 “My mother or mother figure has been reported to the authorities for sexually abusing me.”  
S93 “I was sexually abused by my father or father figure.”  
S149 “I was sexually abused by my mother or mother figure.”  
S165 “As a child I always seemed to have a crush on one female or another.”  
S166 “As a child I always seemed to have a crush on one male or another.”

The order in which items were presented to the participants was as follows. The basic information about biological age, biological sex, family structure, and items 3–8 were presented first followed by the sexual behavior screen (which presented Item 1 and Item 2 as well as multiple other items that preceded or followed S1 and S2), followed by the multiple-choice items (e.g. ... P5–P87 ...), followed by the items presented as agree/disagree (e.g. ... S62–S166 ...). The numbering of the “P” items and the “S” items reflects both the order in which they were presented to the participants and the number of intervening items of similar format. The presentation of items was designed to present multiple items on a wide variety of topics scattered among hundreds of other items in an order that would appear to be random to the participants. The items were each presented on a different computer screen page with the instructions appropriate to the item. The computer program did not allow participants to return to any prior screen to retrospectively change their answers.



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