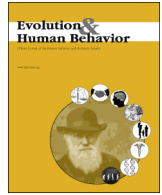




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Original Article

The Westermarck effect revisited: a psychophysiological study of sibling incest aversion in young female adults[☆]Delphine De Smet^{*,1}, Linda Van Speybroeck¹, Jan Verplaetse

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ABSTRACT

Research on human inbreeding avoidance has uncovered at least two central cues to the detection of siblings: witnessing an infant being taken care of by one's mother (i.e. maternal perinatal association) and growing up in close proximity to a child (the so-called Westermarck effect). Both cues have been supported by fieldwork in populations under specific cultural conditions, and by survey research mainly in student populations. Both types of research have relied often on self-reporting. Unfortunately, this method is frequently colored by ceiling effects and notions of social desirability. In order to circumvent this problem, we explored a complementary method for investigating incest aversion that involved measuring psychophysiological responses during an imagery task. As such, we analyzed data on 63 heterosexual female students who viewed pictures of sexual and non-sexual activities while imagining performing these activities with either their partner or their brother. In female subjects with only (one or more) older brothers—a proxy for lacking maternal perinatal association with an opposite-sex sibling—the duration of coresidence with brother(s) predicted activity in the *mm. levator labii superioris* and *alaeque nasi*, facial muscles that are highly active when a subject expresses facial disgust. The strength of these responses was also predicted by the frequency of having bathed and shared a bedroom with a brother in early childhood; two activities that may serve as additional cues for relatedness as it can be expected that they are typically performed with genetically related children. As a result, the psychophysiological approach not only complements the use of self-reports in recent research on incest aversion, but also has the potential to fine-tune well-established cues for sibling detection, or to uncover additional ones.

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1. Introduction

In order to explain the widespread dissemination of incest avoiding behavior, the Finnish anthropologist Edward Westermarck (1891, 1908) hypothesized that humans spontaneously develop a sexual aversion toward individuals they have lived with during childhood. He believed that natural selection favors such a mechanism as it prevents inbreeding and establishes childhood coresidence as a reliable indicator of biological relatedness. While it initially attracted few attention, this mechanism, dubbed the Westermarck effect, gained increasing empirical support through field studies. By examining exceptional cases of unrelated children growing up together, these studies showed that such children are not typically attracted to one another sexually in later life (cf. the study of co-raised children in

Israeli kibbutzim by Shepher, 1971), and that—when pressed to marry one another—they demonstrate lower fertility rates, higher divorce rates or more frequent extra-marital relationships (cf. the study of Taiwanese minor marriages by Wolf, 1995 and the study of Lebanese cousin marriages by McCabe, 1983). However, their underlying methods have been subject to the criticism that they cannot exclude alternative explanations for the attested findings. Shor & Simchai (2009) for instance recently casted doubt on the notion that early-life cosocialization really led to sexual aversion in the case of Israeli kibbutzim. They suggested that sexual aversion should not be analyzed through the presence or absence of marriages, but instead by probing the feelings of the people who grew up in these peer groups. Based on in-depth interviews with such individuals, they concluded that sociological factors—such as the importance of social cohesion and group unity—provide sufficient explanation for the absence of sexual relationships. Questionnaire-based research of Lieberman & Lobel (2012) however confirmed that in male subjects the duration of coresidence with opposite-sex peers in Israeli kibbutzim predicts higher self-reported sexual aversion to them. In female subjects, the opposite pattern was found (i.e. increasing sexual attraction with longer coresidence), which according to the authors may be due to a ceiling effect in females' responses. Recent field work among the North Sumatran Karo Batak suggested that the

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Westermarck effect in combination with cultural dynamics can explain the rare occurrence of the culturally ideal marriage between matrilineal cross cousins (Kushnick & Fessler, 2011). These authors also emphasized how important it is for researchers to further dig into the personal histories of cosocialization between children, in order to uncover additional mechanisms for incest aversion.

A decade ago, survey-based research emerged as a key method for testing the Westermarck hypothesis. Unless stated otherwise, the following studies report data collected from Western industrialized countries (mainly the United States). Bevc and Silverman (1993, 2000) were the first to adopt this method and showed that separation from an opposite-sex sibling during early childhood was linked to certain consensual sexual experiences with that opposite-sex sibling in adulthood. Lieberman et al. (2003) first showed that childhood coresidence duration with opposite-sex siblings correlated positively with moral rejection of consensual third-party sibling incest, and later reported on its positive correlation with personal sexual aversion to an opposite-sex sibling (Lieberman et al., 2007). These effects were found to be present in males and females alike and were independent of genetic relatedness to opposite-sex siblings (Lieberman et al., 2003, 2007) and of subjects' and parents' general attitudes toward sexual behavior (Lieberman et al., 2003). Similarly, Fessler & Navarrete (2004) found that third-party sibling incest aversion (measured as avoidance, self-reported disgust and punitive inclinations regarding siblings who had sex consensually) was predicted by having an opposite-sex sibling, but also by one's general attitudes toward sex, crime and punishment. Females reported higher sibling incest aversion than did males; interestingly, an additive effect produced by having several opposite-sex siblings was found only among males. The authors concluded that third-party incest aversion is the product of both inherited inbreeding avoidance mechanisms and cultural proscriptions. In contrast, Royzman et al. (2008) were unable to confirm the relation between having an opposite-sex sibling and self-reported oral inhibition regarding consensual sibling incest, leading the authors to stress the importance of culturally transmitted information in moral attitudes toward third-party incest. Recently, however, Lieberman & Lobel's (2012) results showed that coresidence duration with opposite-sex peers in Israeli kibbutzim is related to moral rejection of other co-raised peers having sex but not to moral rejection of third-party sibling incest, which again suggests that such moral attitudes might be the byproducts of personal sexual aversions.

Importantly, survey-based research uncovered an additional cue that appears to regulate sibling detection, namely witnessing one's mother taking care of an infant (maternal perinatal association or MPA). Lieberman et al. (2007) demonstrated that MPA with an opposite-sex sibling predicts self-reported altruistic behavior toward one's sibling, as well as moral rejection of consensual third-party sibling incest. Coresidence duration therefore appears to be a cue for sibling detection only when MPA is absent, a hypothesis supported by reanalysis of fertility rates in Taiwanese minor marriages (Lieberman, 2009). Data collected from a Chinese student population also confirmed the effects of coresidence duration and MPA on sibling incest aversion (Luo, 2011).

Notwithstanding the progress made studying various human populations, this rather sensitive topic remains difficult to investigate. Frequent reliance on self-reporting renders incest aversion studies susceptible to certain limitations that are inherent to the method (cf. Lieberman & Lobel, 2012). Rating and ranking tasks, for instance, are vulnerable to social desirability and ceiling effects which may obscure the identification of additional cues. As a result, further methods that could help expose the mechanisms behind human sibling detection would be a welcome addition to the field.

Emotional processes are not only characterized by subjective response systems, but also by behavioral and physiological systems (Vrana, 1993). As these systems do not necessarily function in syn-

chrony, psychophysiological response patterns to incest may differ in type and intensity from the responses that people report subjectively. Alongside self-reporting, this makes the psychophysiology method a potentially interesting tool for investigating incest aversion, even more so because psychophysiological measures are immediate and presumably less subjectable to conscious control.

In this study, we began to explore the extent to which this psychophysiology method could be useful for incest aversion research. We designed an experiment in which young female adults were instructed to observe pictures of sexual and non-sexual activities and to imagine performing these activities with either their partner or their brother. Meanwhile, heart rate (HR), skin conductance response (SCR) and facial electromyography (EMG) of the *mm. levator labii superioris* and *alaeque nasi* were measured with millisecond precision. We avoided potential gender differences in incest aversion by including female subjects only. Questionnaires were used to verify coresidence duration with brother(s) and the characteristics of brother relation(s), such as genetic relatedness, past and present quality of relationship and shared experiences during childhood. As thinking about incest evokes behavioral disgust reactions (Fessler & Navarrete, 2004; Royzman et al., 2008) and activates brain regions that partly overlap with regions that are active while thinking of pathogen disgust (Borg et al., 2008), we expected our subjects' psychophysiological responses to be comparable to those evoked by other disgust-related items. As the *mm. levator labii* region is activated distinctively by disgust-related images (Vrana, 1993), EMG activity was expected to be a highly relevant psychophysiology measure. According to Rozin et al. (2008), disgust experiences are associated with activation of the parasympathetic nervous system, but empirical research has shown varying responses in HR and SCR to disgusting stimuli (e.g. Rohrmann et al., 2009; Rohrmann & Hopp, 2008; Stark et al., 2005; Schienle et al., 2001). Therefore, it can be expected that both these measures will be less discriminating for disgust than EMG. However, as HR and SCR have not previously been reported in the context of imagining incest, we opted to include them in our experimental design.

This psychophysiology method provided us with the opportunity to replicate the well-established effects of coresidence duration and MPA. Following the original Westermarck hypothesis, we expected coresidence duration with brothers to be a predictor of psychophysiological responses, in particular EMG, in women imagining having sex with their brother. Following the Lieberman et al. (2007) model of the computational architecture of sibling detection, we expected coresidence duration with brother(s) to be relevant only among participants who had not experienced MPA. Based on previous research (Lieberman et al. 2003, Lieberman et al. 2007), we anticipated that coresidence with multiple opposite-sex siblings would have a cumulative effect.

Additionally, our set-up also aimed to explore the possible relevance of additional cues for sibling relatedness, focusing on particular shared experiences with opposite-sex siblings during childhood. Although this part of our study had an exploratory purpose, we did expect that certain experiences would matter more to sibling incest aversion than others. We hypothesized that activities typically performed with genetically related children but not with unrelated children (e.g. bathing together and sleeping in the same bedroom) would have a larger impact on our psychophysiology measures than activities performed with related and unrelated children alike (e.g. playing together).

2. Methods

2.1. Participants

A total of 77 female students from Ghent University, Belgium, were recruited online to participate in a psychophysiology experiment.

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