

Incest avoidance and prohibition: psychobiological and cultural factors

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Abstract: Although historically the incest prohibitive regulation is considered an almost ubiquitous cultural phenomenon that is not influenced by psychobiological factors related to the evolutionary history of human species, recent findings have challenged this traditional view and argued that the incest avoidance and prohibition are influenced by biological and cognitive factors along with cultural regulation. This article aims to develop a theoretical discussion about incest prohibition and avoidance, emphasizing the evolutionary mechanisms underlying these phenomena. One argues the existence of endogenous mechanisms that have evolved for inhibiting sexual activity between close relatives and form the basis to regulate the incest prohibition (exogenous mechanism) socially. The Westermarck effect is highlighted, in which the close proximity of persons living together from early childhood triggers sexual intercourse aversion between them. The absence of disposition to incest and its institutional prohibition represent a complex integration between psychobiological and cultural factors.

Keywords: incest, avoidance, prohibition, evolution.

Introduction

Incest is defined as the practice of sexual intercourse between persons with degrees of kinship, which may be a short or long-term relationship, with or without generation of children (Lumsden & Wilson, 1980; Read, 2014; Tidefors, Arvidsson, Ingevaldson, & Larsson, 2010). Historically, the social incest regulation, which in general culminates in prohibition, also known as incest taboo, has been considered culturally universal (Noble & Mason, 1978; Wolf & Durham, 2004). Although the wide dissemination of this prohibition gives an idea of ubiquity, there are occurrences of incest registered in some societies, what includes the permitted and sexual abuse cases (DeMause, 1991). The prohibitive rules carry some particularities related to society and historical context, despite there being common prohibitive typifications: it is more probable that in current societies the sexual intercourse between parents and children and between siblings is socially, morally or legally prohibited with universal scope (Sanderson, 2001; Shepher, 1983). In contrast, some societies encourage the marriage between cousins (Hoben, Buunk, & Fischer, 2016). It is discussed thus whether the social rules against incest are universal, or as Thornhill (1991) suggests more properly, almost universal.

In ancient societies, as the Egyptians and Incas, incest has occurred to protect the real blood, even between brothers and sisters, and cases in ancient Jewish peoples (Kutz, 2005; Strong, 2006). In the last few decades, the greatest rates of consanguineous marriages have been observed in North Africa, Middle East and in great portion of Central and South Asia, where more than 25% world population live. The unions between cousins, especially of

second degree, are responsible for $\geq 50\%$ consanguineous marriages in those populations (Zlotogora, Hujerat, Barges, Shalev, & Chakravarti, 2007). The consanguineous second and third degrees marriages offer advantages such as strengthening of familiar bounds and relationships, guarantee of knowing the consort's life history before marriage, facility to make the dowry and goods agreement and simplified pre-matrimonial negotiations.

The incest conceptual boundaries can vary according to the field of study or reference. Thornhill (1991) formulates that behaviors referred to as incestuous in social sciences literature can be divided into three categories: incestuous endogamy, which is concerned to sexual intercourse between individuals with family relationship, that is, whose kinship is by direct descent (for instance, between parents and children or between siblings); the non-incestuous endogamy, which encompasses the sexual intercourse between individuals with more distant kinship (between cousins, for instance); and the sexual activity coming from the adultery between persons without genetic kinship in the familiar context (stepson and stepmother, for instance).

What Thornhill (1991) classifies as incestuous endogamy seems to more robustly delimit the incest conceptual core as the sexual intercourse between close relatives (between parents and children, between siblings), since that type of sexual intercourse leads to greater probability of defective offspring due to the greater chances of receiving a harmful recessive allele inherited from a common ancestral. It is worth mentioning that endogamy and incest are terms that have been more commonly used in biological and social sciences, respectively, many times imprecisely (Moore, 1992). Leavitt (1990) demonstrates that it is not simple to differentiate them, since both terms designate superficially the sexual activity between individuals with close kinship degrees. Specifically,

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endogamy is linked to the idea of reproduction between the individuals with kinship, whereas incest emphasizes the sexual activity that may or not generate offspring. Regarding especially the human species, the sexual activity not always leads to offspring generation. The term incest has been more used in studies on human beings, besides reaching in this species the cultural variable of the prohibition institutionalization (incest taboo).

From the differentiation aforementioned of Thornhill (1991), the term incest will be treated here as reference to the incestuous endogamy classification. The prohibition of sexual intercourse between siblings or parents and children carries the smallest occurrence of this modality of kinship relationship, being understood that those are the genuine type of incest, in which social prohibitions act more strongly when compared with the relationships between relatives of second or third degrees (Saggar & Bittles, 2008).

According to a traditional portion of social sciences, the universality (or almost universality) of the incest prohibition is predicated on a social-cultural basis that is independent from psychobiological processes compounding the evolutionary history of the human species (Hoebel & Frost, 2006; Wolf & Durham, 2004). This approach emphasizes that the incest is socially interdict, once it somehow jeopardizes the social order. In this direction, according to Lévi-Strauss (1976), the incest prohibition expresses the passage from the natural fact of consanguinity to the cultural fact of alliance. One considers, in this paradigm, the reasons that turn the incest into something socially inconceivable and how it becomes regulated by culture to the detriment of nature.

On the other hand, adopting a perspective that considers only either cultural or environmental variable of certain human beings' behavior, such as sexual behavior, results in falling into obsolete biology vs culture or innate vs learned dichotomies and neglecting that it is possible to describe, at least partially, the problems and adaptive solutions faced by the species ancestors. The evolutionary psychology has the integration between biological and sociocultural factors as one of its transversal pillars. If the human beings produce culture and represent themselves in it, the reason for doing it is that they are biologically cultural (Hattori & Yamamoto, 2012).

In literature on incestuous behavior, traditional theoreticians have focused on the incest cultural prohibition (exogenous mechanism), not considering other human species' mechanism equally important and complementary, which consists in the individual rejection to incest (endogenous mechanism of endogamy inhibition). There was negligence to psychobiological and evolutionary explanations for the incest prohibition and rejection, that is, the cognitive human architecture probably has a circuit that evolves because prohibits the sexual activity between individuals with genetic kinship and the incest institutional regulation does not occur exclusively by sociocultural channel (Lieberman, Tooby, & Cosmides, 2003, 2007).

Only recognizing that the incest prohibition is almost universal does not answer why this phenomenon presents such nature or the reason for the human beings also presenting rejection, avoidance or inhibition regarding incestuous relationships. Thus, there are two but integrated distinct levels: prohibition and avoidance. As Searle (2013) has pointed, inhibition does not mean prohibition, and vice-versa. Better saying, the absence of inclination to sexual relationship between relatives does not explain the almost universal prohibition of this kind of relationship nor does the institutionalized prohibition explain the reason for human beings rejecting incestuous relationships. Why is there a taboo regarding incest and which is its relation with the human species evolution? What is in the taboo center? Why are there prohibitions of a behavior that, apparently, nobody is motivated to have?

Based on literature experimental findings, on recent works in the field of evolutionary psychology, on ethology and neurosciences, this work aims to perform a theoretical discussion on incest inhibition and prohibition, emphasizing the evolutionary mechanisms underlying these phenomena as well as the biological basis, cognitive, behavioral and social aspects involved in the incest taboo. One will expose discussion topics on biological implications of the incestuous sexual relationship, evolutionary mechanisms of incest inhibition and prohibition based on the evolutionary psychology, neurobiological correlatives of morality and incest and ethical and legal considerations.

Biological implication of incest: the risks of endogamy

Frequently it is considered that incest is morally wrong for its undesirable biological consequences coming from sexual relationship between biological relatives (Bittles, 2012). Offspring originating from first degree consanguineous relationships is 17%-40% more likely to suffer diseases or death when compared with children born from non-consanguineous relationships (Aoki, 2004). It is known that in cases of endogamy between father and daughter, a possible diagnosis of an autosomal recessive disorder in an offspring resulting from this relationship is associated with a probability greater than 50% that the endogamy was causal for the offspring disease (Schmidtke & Krawczak, 2010). Other data are more conservative and point 30% probability (Saggar & Bittles, 2008).

Reduced aptitude for consanguineous children, referred to as endogamous depression, has been explained as being due to this probability increase of harmful combinations of the recessive homozygous alleles and to the susceptibility increase to organisms that cause the disease (Bittles & Neel, 1994). Although the endogamous depression acts as inhibitor mechanism for people not to commit incest, justifying their social and moral reprobation, it is a factor with explanatory limitations when considered in isolation. This kind of endogenous inhibition does not apply to incest between relatives of the same

sex, because there is not offspring generation, and, more importantly, does not explain why the incest is avoided even regarding non-biological siblings, without genetic kinship, raised together (Fessler & Navarrete, 2004). With genetic kinship or not, siblings that are raised together have smaller chances to marry or have children, and when marry, they get divorced in a rate greater than couples without any kind of kinship; they present low rate of generation of children and more extramarital relationships (McCabe, 1983). The mechanism of endogamous depression alone cannot explain the incest taboo, because it lacks behavioral and cognitive components that present evolutionary history in human species, according to what is exposed below.

Evolutionary incest inhibition and prohibition mechanisms

The proposition that the human species has a mechanism that has evolved to inhibit incest and that such ability has its development during the childhood is not recent. Through broad pioneer anthropological studies, Westermarck (1891/1921, 1906, 1926), in the late 19th and early 20th, has verified that intimate exposition and family living among people during childhood weaken the sexual attraction when in adulthood. When this proximity occurs during the childhood development period leads to the incest aversion, what Lumdsen and Wilson (1980) have pointed as a mechanism or causal explanation for the incest aversion. According to those observations, incest probability (between siblings, for instance), is automatically decreased by epigenetic rules during the sexual development. According to Westermarck (1981/1921): “There is an innate aversion to sexual intercourse between persons living very closely together from early youth, and that, as such persons are in most cases related, this feeling displays itself chiefly as a horror of intercourse between near kin” (p. 320).

The fact that familiar and lasting contact in childhood neutralizes a posterior sexual attraction, in persons with or without kinship, needed more robust evidence. Westermarck (1906, 1926) has given strength to his findings by observing that people who have lived together for a long time in a family environment, even if they did not have genetic kinship, when married have presented high rates of divorce in relation to marriages of people that have not suffered influence from that factor.

Regarding the institutionalization of the incest prohibition, noticing that this kind of taboo is common, Freud (1913/2012) has challenged Westermarck theory to explain why the prohibitions exist for a behavior that, apparently, nobody is motivated to have. Westermarck (1926) has answered that incest taboos are a consequence of our capacity to try others' actions as they were ours – we create the prohibitions in order to avoid that other people have behaviors that we would consider aversive in case we practiced them ourselves. Westermarck (1906) has referred to the disposition to experiment undesirable actions of others as if they were our proper aversive feelings, as a

kind of “egocentric empathy”. For this theoretician, the social rules that regulate the incest prohibition give cultural expression to a “biologically cultural” repugnance (Fessler & Navarrete, 2004).

In other notes, Noble and Mason (1978) consider that man is distinct in relation to other species for having discarded natural protection mechanisms against endogamy, typified by the expulsion of the youth from the family group. In human species it is common that the offspring develop for years being with the parents, compounding a multi-generational group. In this sense, the defense against incest has been developed by the creation of the taboo between the family members. Other authors' argument is that incest confuses the family authority, what strengthens the statute of prohibition of sexual intercourse between family members.

Only in the second half of the past century, with the development of the evolutionary psychology and the strengthening of ethological studies, the authors could give more support for Westermarck theory. Posteriorly, it was known as Westermarck effect, with robust experimental evidence that the natural selection has favored this mechanism as a way to avoid incest, establishing the coresidence as a biological kinship reliable indicator. To test the Westermarck effect, Bevc and Silverman (1993, 2000) have shown that the separation of siblings of opposite gender during the childhood first periods has been associated to the occurrence of consensual sexual experiences between those siblings in adulthood, what supports the hypothesis that the child experience and the coresidence help inhibit incestuous behaviors.

Soon after, Lieberman, Tooby and Cosmides (2003) have brought unpublished findings on the coresidence factor. These authors, known as the influent group of evolutionary psychology from the school of Santa Barbara, defend that morality is influenced by the human species evolution. In this study, the opposition to incest has been used as a means to test hypotheses on the existence of a human kinship system recognition functional architecture, a similar mechanism possibly existing in other animals (Holmes, 2004). The kinship system in the human being is intended, preferably, to two purposes: (1) regulate the allocation of natural altruist resources and the competitive effort according to the selection pressure and (2) inhibit sexual intercourse between reproductively mature family members, because children generated from such unions would born less healthy. Such system includes circuits specialized in detecting certain tracks that have been reliably correlated ancestrally with the genetic kinship. The system operates on those tracks through neural mechanisms that have been developed to produce regulatory variables associated to every individual known, whose magnitude corresponds to the genetic kinship (an estimator of kinship). Throughout the individual's life this magnitude is captured as an input track that regulates behaviors adaptively relevant for the kinship context, such as the allocation of assistance

resources, violence inhibition and sexual attraction or aversion.

As Lieberman, Tooby and Cosmides (2003) have emphasized, the evolution of the kinship recognition system depends on the selection of tracks that: (1) provide probabilistic information that certainly predicts the kinship; (2) have been stable throughout generations amidst the adaptations and (3) could be sufficiently detected at low cost. In this study, the authors have made a survey of 186 Californian students, and asked the participants to set 19 acts in order, from the less to the most morally wrong; consensual sexual intercourse and marriage between siblings of opposite gender have been included in this list. Information on the familiar composition has been collected, including the presence of people of same and opposite genders, half-siblings in the childhood and adolescence, coresidence duration, and the ages of the subjects during the coresidence period. According to the results found, the coresidence duration has pointed the genetic kinship, making it a reliable track of the recognition system, besides identifying the intensity of opposition to incest (the recognition system is not aware, calibrated by the coresidence). In other words, the human familiar recognition system uses the coresidence duration as a central track to compute the estimate of kinship between siblings.

Lieberman, Tooby and Cosmides (2003) have concluded, until then, that (1) human beings have a kinship recognition system that is based on the proximity throughout the maturation as a kinship suggestion; (2) congruent with the parental investment theory, in their findings there was a difference between the genders regarding the impact of such proximity in attitudes related to incest, since women acquire enough information during the childhood to develop aversion, whereas the information collection for men lasts for long time; and (3) the culture seems not to influence the attitudes regarding incest, since the participants' evaluations on incest moral inappropriateness are independent from their attitudes and their parents' attitudes evaluations in relation to sexual behavior in general, finding that has been subject to several critiques according to the previously exposed.

Four years later, Lieberman, Tooby and Cosmides (2007) published other work in which amplified the previous method, and with new results. They have added an axis to the kinship recognition system, that is, the maternal perinatal association (MPA), what has resulted in three computational axes: (1) coresidence duration; (2) the MPA and (3) the tracks detection on the genetic kinship. The first two modulate the altruism and the sexual aversion. The model then started being called kinship index (KI). To calculate the kinship index, the recognition system requires a monitoring system to register kinship signals, and a computational device, the kinship estimator, whose action has been tuned by selection history to register these tracks and turn them into the KI.

With the theoretical MPA addition, the authors indicate that ancestrally, if the individual observed a child

in a lasting relationship with his own mother, then it was highly likely that the child was her own child. In summary, Lieberman, Tooby and Cosmides (2007) have concluded that kinship detection system uses two distinct tracks, ancestrally valid to compute the genetic kinship: maternal perinatal association and coresidence duration between the siblings. In other more recent research, Lieberman and Lobel (2012) have confirmed that in male individuals the coresidence duration with their opposite gender pairs in the Israeli kibbutzim population predicts greater self-report of sexual aversion to those pairs, corroborating the previous findings on the influence of the childhood coresidence as reliable indicator of biological kinship, and a mechanism that impedes incest.

Other parallel and independent studies have confirmed and/or expanded some of these findings and have also robustly disagreed with some notes. Fessler & Navarrete (2004) have approached the incest avoidance from endogenous and exogenous components, respectively represented by avoidance mechanisms that have been selected evolutionarily and by internalized cultural prescriptions. In this study, individuals that experiment co-socializations with other gender sibling have reacted more strongly to the incestuous behavior than those that have not experienced that condition. Moreover, women with brothers have a stronger aversion reaction to incest than women without brothers. In the same way, men with sisters have demonstrated stronger aversion to incest than the ones that do not have sisters.

Regarding the gender differences of the incest aversion, according to Fessler & Navarrete (2004), women have reported stronger aversion to incest when compared with men, what is in accordance with the parental investment theory. Such difference has not been found for men and women that do not have siblings. Antfolk, Karlsson, Bäckström and Santtila (2012) have confirmed the previous findings and shown that women presented stronger incest aversion than men. In this study, the incest aversion was stronger between relatives that presented the coresidence factor and, interestingly, incest between fathers and daughters has been more condemnable than between siblings, being that type of incestuous relationship less explored in other experimental studies.

A recent study in Karo Batak, North of Sumatra, has demonstrated that the Westermarck effect combined with local cultural dynamic may explain the rare occurrence of matrilineal cross cousin marriage in this culture (Kushnick & Fessler, 2011). These authors have emphasized how it is important for the researchers to study the details of personal histories of co-socialization and coresidence between children, in order to discover additional mechanisms for the incest aversion that work at wide regulation level of the specific culture. In other cultures, data collected from certain Chinese students population have also confirmed the effects of the coresidence duration and maternal perinatal association on the incest aversion between siblings (Luo, 2011).

In addition to the researches with questionnaires and self-reports, the psychophysiological methods turn into a potentially interesting tool for the investigation of incest aversion, even more because the psychophysiological measures are immediate and presumably less subject to biases present in the questionnaires and self-reports. Smet, Speybroeck and Verplaetse (2014) have used psychophysiological measures to corroborate the effects of the coresidence duration and maternal perinatal association. They have analyzed the answers from 63 heterosexual women students that have seen sexual and not sexual activity images while imagining to perform these activities whether the partner or the brothers. The electromyography results have shown that the duration of coresidence with the brother has been related to the activity of certain facial muscles that are highly active when the subject presents the facial distaste/disgust expression. The strength of those answers has been predicted by the frequency of having taken a shower and shared the bedroom with the brother in the first childhood period, being both activities tracks that inform on the kinship, since they generally occur with children genetically related.

It is important to discuss the critiques from Fessler and Navarrete (2004) to some points of Lieberman, Tooby and Cosmides (2003), once they have represented small or no influence from culture. The weakness of these authors' work measures is that they have used indirect measures. However, the most plausible argument of Fessler and Navarrete (2004) is that if the exogenous factors have not had an important role in the attitude opposite to the incestuous behavior, then the subjects that have not tried the co-socialization in childhood should be indifferent to the incestuous behavior of others, what is not clearly demonstrated in the researches. Thus, the knowledge socially transmitted influences the others' belief on the feelings and attitudes regarding incest.

The works initiated by Lieberman, Tooby and Cosmides (2003, 2007) have been highly important for confronting the idea that moral attitudes regarding sexual activity between relatives are answers due only to cultural normalizations independent from psychological tendencies/mechanisms evolved. On the other hand, the mentioned group has minimized the influence of culture to a level that seemed to ignore that psychological tendencies evolved are largely flexible and react actively with the present environment. Within the evolutionary psychology itself there are critiques to the Santa Barbara school and to how this group's influent principles (environment of evolutionary adaptation, gradualism, massive modularity and universal human nature) in evolutionary psychology are interpreted (Bolhuis, Brown, Richardson, & Laland, 2011). As Fessler and Navarrete (2004) and Kushnick and Fessler (2011) have demonstrated, the subject's attitude in relation to incest is guided by two interactive factors, namely: an endogenous contribution produced by the mechanisms of endogamy avoidance and an exogenous contribution produced by internalized cultural prescriptions that vary in transmission degrees.

These authors have agreed with Westermarck by arguing that incest prohibitions have their origin in spontaneous reactions for the others, reactions that are better explained as a system that has evolved because inhibits endogamy. As exposed, the authors additionally recognize the importance of the knowledge of incest socially transmitted, so that its avoidance does not come exclusively from an innate ability. This raises the question about the reason human beings have propensity to reactions to third parties of enough magnitude to originate institutionalized prohibitions. The authors have been developing a theoretical frame for incest avoidance expanding the egocentric empathy mechanism, in which, for the incest context, fear, disgust and displeasure occupy a central role. This mechanism comes from the fact that when the individuals are involved in dangerous activities that contaminate, incest for instance, many times put in danger the coexistent elements of the community or group – in the same way when somebody consumes pathogen-rich materials, or attracts attention from great predators -, what brings disease or predation to the community.

In ancestral evolutionary environments, it might have been frequently advantageous for the group or group leaderships to intervene on behaviors that caused fear, disgust and displeasure to others and that generally brought risks to the group, it being a consequently shared reaction. Given that the disgust is an emotional reaction that has evolved originally because protects and avoids pathogens (Curtis, Aunger, & Rabie, 2004; Fessler & Navarrete, 2003a), and that subsequently has been extended to the sexual behavior scope (Fessler & Navarrete, 2003b), it is possible to apply this mechanism to the incest context. The hypotheses on the mechanisms that avoid the endogamy and on the incest taboo exemplify the power of the evolutionary process when confronting the human species mental architecture and the restriction on which these processes operate.

In short, the studies exposed until now support the Westermarck effect and, more importantly, evidence the existence of a developmental mechanism in human species that has evolved to inhibit the incestuous sexual activity (endogenous mechanism) and on which the people have culturally institutionalized the incestuous relationships prohibitions (exogenous mechanism). Nevertheless, it is important to ponder which models of behavior regulatory systems of sexual intercourse between relatives suffer limitations. In relation to the Westermarck effect, this is little applied to incest between parents (father and mother) and children, since the model considers it is necessary an intimate living of the parties in childhood, for instance, in coresidence and co-socialization. In other words, at close ages in the child development period. For this reason, the explanatory power of the Westermarck effect is satisfactory in the studies with siblings and cousins. However, the systems of incest avoidance between parents and children remain less enlightened.

Moreover, it is reasonable to defend that the Westermarck effect is not a mechanism totally independent from learning. Although Westermarck has emphasized the avoidance innate facet (predisposition) of sexual intercourse between relatives, what is comprehensible for a time in which the debate on the innate-learned dichotomy was very intense and rivaled, the effect of the experience and knowledge socially transmitted is important for the mechanism of avoidance and subsequently component of the institutionalized prohibition. The Westermarck effect is integrative and does not separate biology and culture.

At other analysis level, if there are inhibitory and prohibitive factors, why do those happen? Even rare, what guides two consanguineous siblings to engage in voluntary and consensual sexual relationship, for instance? Except for the cases of incest due to sexual abuse (for the abusive nature of the relationship and of the involuntary and not consensual character regarding the victim), the answers are not clear. As previously explained, the sexual intercourse between parents and children are the genuine incest typification (Thornhill, 1991). As more distant kinship degrees are included, the incest concept tends to dilute. The available studies on the factors that lead to consanguineous sexual intercourses and marriages in the area of evolutionary psychology have focused on marriages between cousins. Although it is not the ideal casuistry for incest, it may offer important indicatives.

It was previously exposed that marriage between cousins presents social reasons for the parties, such as guarantee of knowing the consort's life history before the marriage, facility to make the dowry and goods agreement and simplified pre-matrimonial negotiations. Under the evolutionary perspective, some studies have evidenced that the sexual activity and the marriage between cousins may bring adaptive solutions of survival and reproduction. One of the most important findings is that it was observed that areas with historical high rates of pathogens prevalence have presented higher rates of consanguineous marriages between cousins (Hoben, Buunk, Fincher, Thornhill, & Schaller, 2010). In other more recent study, Hoben, Buunk and Fischer (2016) have demonstrated that the variance in the practice of consanguineous marriage between cousins may reflect functional answers to local ecological and environmental pressures. The results have indicated that the geographic isolation and the high prevalence of pathogens are independent factors and predictor of the possibility of marriages between first degree cousins. It seems that marrying a cousin may potentially increase the probability that the genes necessary to fight against the local pathogens are expressed in the following offspring, even if the involved elements are not free from the risk of endogamy. This way, the marriage between cousins will be a behavior that tends to be exhibited in geographically isolated area and with great prevalence of pathogens, what constitutes an adaptive solution for the problem of partners solution, depending on the environment in which the population lives. Probably, this strategy is not beneficial

for the incestuous endogamy between parents and children and between siblings due to the greater risks of endogamy.

It is possible to make another note that, although lacks robust evidence, may help explain the problem. Is it reasonable to think that these marriages between cousins may be the most adaptive solution under conditions where there is lack of partners diversity due to the geographic isolation? It seems so. Under an evolutionary perspective, it may be better to relate with a cousin and take endogamy risks than not to marry anyone and, after all, not to reproduce (Hoben, Buunk, & Fischer, 2016).

The findings discussed until then reinforce the integrative proposal regarding the old dichotomies and conflicts in history of psychology, anthropology and biology, such as the nature-culture, learned-innate or biological-social debate. The incest taboo is an example that helps overcome these conflicts: in the human species, nature and culture are not separated. Sexuality and sexual behavior of humans are evidently influenced by a complex combination of biological, evolutionary, psychological and sociocultural factors (Shor, 2015). The dissolution of those dichotomies goes towards the authors who identify themselves with the developmental systems theory (DST), which has gained considerable strength within the evolutionary psychology (Oyama, Gray, & Griffiths, 2001; Ingold, 2001). The DST sees the ontogeny as contingent cycles of interaction between a varied set of resources of development, such as DNA, cellular structure, brain functioning, and social and ecological factors.

Applying the multidimensional nature of the theme in question to the DST's main points, one can highlight (1) the joint determination for multiple causes (the incest avoidance and prohibition are influenced by biological, psychological and social factors); (2) the cause significance of incest avoidance and prohibition as contingent to the system; (3) the inheritance extended (the factors related to the incest avoidance, inherited by the human being, interact with the environment) and (4) to evolve as construction, that is, the evolution is not a question of organisms or populations being molded only by their environments, but of organism-environment systems changing over the course of time (Lewontin, 2001).

Neurobiological correlates of morality and incest

In the last few decades, the development and sophistication of the neuroimaging techniques have allowed the performance of some studies within the neurosciences field regarding moral questions of human sexuality, what includes the incestuous relationships. There are indications in literature that emotions related to social experiences are more lateraled by the left hemisphere (Ross, Homan, & Buck, 1994). One has identified neural networks associated to the processing of moral stimulus, such as medial prefrontal cortex, temporoparietal junction, posterior cingulate cortex, and anterior temporal lobe (Greene,

Nystrom, Engell, Darley, & Cohen, 2004; Moll, Zahn, Oliveira-Sousa, Krueger, & Grafman, 2005).

Cope et al. (2010) have evaluated how far the neural circuits underlying the immoral judgments show hemispheric lateralization. Through this analysis of studies that employ different paradigms (Harenski, Antonenko, Shane, & Kiehl, 2008; Schaich Borg, Lieberman, & Kiehl, 2008), the authors have verified that the processing of immoral stimulus, including the incestuous ones, is a process more lateraled by the left hemisphere than by the right one. The regions of gathering, common to the findings, include the left prefrontal medial cortex, the left temporoparietal junction and the left posterior cingulate cortex.

In other research lines, it is known that there is greater disposition of pro social behavior to faces that carry similarities (Volk & Quinsey, 2007). The people may unconsciously make comparisons of facial traces, expressions and aspect through cognitive representations of their own and their families' faces. Findings evidence a neurocognitive mechanism of facial recognition that helps in the discrimination of the kinship with correlates of right frontoparietal cerebral activation (Platek et al., 2006; Uddin, Kaplan, Molnar-Szakacs, Zaidel, & Iacoboni, 2005). Faces that are similar to the individual's face activate similarly neural substrates activated by the relatives' faces. The facial resemblance is considered, thus, a track for the genetic kinship. Platek & Kemp (2009) have compared relatives' faces with friends' faces and found a greater activation of the anterior cingulate and cuneus region. Other parietal and medial frontal regions have been gathered in the categorizations of similarities and differences between relatives' faces and faces of other relations. The authors have concluded that cerebral areas such as visual, frontal and medial substrates are involved in the coordination of multiple systems implicated in the discrimination of relatives. Areas of the medial posterior region may be involved in the facial categorization (family or friend, for instance) when the faces are similar or express some level of familiarity.

Ethical and legal considerations

In addition to the psychobiological and psychosocial factors previously discussed, incest raises ethical and legal questions when practiced in such a way as it harms or threatens people's integrity, especially when there are abusive forms of coercion and without consent. The incest between an adult and a person below the age of consent is considered a form of sexual child abuse, what is identified as one of the most extreme forms of this kind of abuse and that generally results in serious and lasting psychological traumas (especially if it is a case of incest between parents and children). The risk of incest between stepfather and stepdaughter is 15 times greater than between biological father and daughter (Sariola & Uutela, 1996). Daughters that are victims of incest with the father present problems

regarding sexual esteem, depressive symptomatology and psychological suffering. The start age of this kind of incest is premature, with estimates from 5 to 8 eight years old for the daughter. More than 80% victims feel distant from both parents or only from the male progenitor, indicating affection damage (Stroebel et al., 2012). In a Brazilian study, Flores, Mattos and Salzano (1998) have shown that 74% incest cases involved violence in the familiar environment and that complex factors of the familiar context (extreme poverty and difficulties regarding social interactions) have also molded these cases.

Although father-daughter incest has been considered for many years the most common type of incest, more recently it has been suggested that incest between siblings, especially of older siblings having sexual intercourse with younger ones, is the most common form of incest. More importantly, it has greater negative implications, because there is the choice of the older siblings for the younger ones, abuse of the victims for a long period, use of more frequent and severe violence than when it is used by adults, greater number of sexual acts with penetration when compared to abuses committed by parents or stepparents (Cyr, Wright, McDuff, & Perron, 2002). Bevc (1988) has verified that the interviewees that have had sexual experiences with siblings tend to come from lower socioeconomic class; they also change residence more frequently, have less friends, and experience greater familiar conflicts than the interviewees that have not had sexual experiences with the siblings.

Regarding the legal consent between adults, jurisprudence and laws on the permissive sexual intercourse between close relatives vary among the countries, and depend on especially the nature of the familiar relationship of the parties involved, as well as the age. To their legal-institutional prohibition, close relatives cannot register unions at notary's offices nor at churches (at this due to the incestuous practice conception sin), including being subject to judgment and punishment to the incestuous practice (Bittles, 2012). It is notable that, different from most countries, such as the United States, in Brazil incest is not legally prohibited (it is not set forth in Penal Code), that is, it is not crime if the elements involved are at the age of majority. However, it suffers the cultural regulation that prohibits it symbolically: the Brazilian society censures it; the Judeo-Christian religions reinforce such an aversion.

Final considerations

According to what has been discussed until now, the recent works on evolutionary psychology, ethology, neurosciences fields and anthropology branches confront the traditional positioning that the incest prohibition is a strictly sociocultural phenomenon and it is not influenced by psychobiological factors present in the human behavior evolution. The evidence indicates, on the contrary, the existence of psychobiological mechanisms that have evolved because inhibit the sexual activity between relatives (endogenous mechanisms for endogamy

inhibition) and that form the basis for institutionalization of incest prohibition and for its social and cultural regulation (exogenous mechanism). The Westermarck effect presents

itself as an important theoretical window that congregates these dimensions and helps explain the incest avoidance-prohibition binomial.

Evitação e proibição do incesto: fatores psicobiológicos e culturais

Resumo: Embora historicamente a regulação proibitiva do incesto seja considerada um fenômeno cultural quase universal que não é influenciado por fatores psicobiológicos relativos à história evolutiva da espécie humana, evidências recentes têm questionado essa visão tradicional e defendido que a evitação e a proibição do incesto são influenciadas biológica e cognitivamente com a cultura. Este artigo objetiva desenvolver uma discussão teórica acerca da inibição e proibição do incesto, enfatizando os mecanismos evolutivos subjacentes a esses fenômenos. Argumenta-se a existência de mecanismos endógenos que evoluíram porque inibem a atividade sexual entre parentes próximos e que formam a base para regular socialmente a proibição do incesto (mecanismo exógeno). Destaca-se o efeito Westermarck, no qual a proximidade de pessoas que vivem juntas desde a infância provoca uma aversão ao intercurso sexual entre elas. A ausência de propensão ao incesto e sua proibição institucional constituem uma complexa integração entre fatores psicobiológicos e culturais.

Palavras-chave: incesto, evitação, proibição, evolução.

Évitement et prohibition de l'inceste : facteurs psychobiologiques et culturels

Résumé: Bien que, historiquement, le règlement prohibitif de l'inceste est considéré comme un phénomène culturel presque omniprésente pas influencé par des facteurs psychobiologiques liés à l'évolutionniste de l'histoire de l'espèce humaine, des preuves récentes ont contesté ce point de vue traditionnel et fait valoir que la prévention et la prohibition de l'inceste sont influencées biologiquement et cognitivement le long à la réglementation culturelle. Cet article vise à développer une discussion théorique sur l'interdiction et la prévention de l'inceste, mettant l'accent sur les mécanismes de l'évolution sous-tendent à ces phénomènes. On fait valoir l'existence de mécanismes endogènes qui ont évolué car ils inhibent l'activité sexuelle entre proches parents et qui forment la base de l'interdiction formulée culturellement de l'inceste (mécanisme exogène). L'effet Westermarck est mis en évidence, dans lequel la proximité des personnes qui vivent ensemble depuis la petite enfance déclenche une aversion pour les rapports sexuels entre eux. L'absence de propension à l'inceste et son interdiction institutionnelle représentent une intégration complexe entre les facteurs psychobiologiques et culturels.

Mots-clés: incest, évitement, prohibition, évolution.

La evitación y la prohibición del incesto: factores psicobiológicos y culturales

Resumen: Aunque históricamente la prohibición del incesto es considerada como un fenómeno cultural, casi universal, que no está influenciada por factores psicobiológicos relacionados con la historia evolutiva de la especie humana, las evidencias recientes han desafiado este punto de vista tradicional, argumentando que la prevención y la prohibición del incesto son influenciados biológica y cognitivamente juntos a la regulación cultural. Este texto tiene como objetivo desarrollar una discusión teórica de la inhibición y el tabú del incesto, subrayando los mecanismos evolutivos que subyacen a estos fenómenos. Argumenta la existencia de mecanismos endógenos evolutivos que inhiben la actividad sexual entre parientes cercanos y forman la base para la prohibición del incesto culturalmente formulado (mecanismo exógeno). Se pone de relieve el efecto Westermarck en el que la proximidad de las personas que viven juntas desde la primera infancia provoca una aversión a las relaciones sexuales entre ellas. La falta de propensión hacia el incesto y su prohibición institucional forman una integración compleja entre los factores psicobiológicos y culturales.

Palabras clave: incesto, evitación, prohibición, evolución.

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