



## THE FINN-KIN STUDY: A SAMPLE AND METHOD DESCRIPTION OF A FINNISH POPULATION-BASED STUDY OF KIN-RECOGNITION, INCEST AVERSION AND ALTRUISM

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### ABSTRACT

Evolutionary theory suggests that the availability of environmental cues of biological relatedness (i.e., kinship cues) is an important predictor of both positive investment (e.g., altruism) and maltreatment (e.g., physical and sexual abuse) within families. Although several studies have supported these assumptions, many suffer methodological limitations. Studies often rely on small convenience samples and often one or only a few possible family relationships are investigated. To combat these shortcomings, we aimed to obtain data on kinship cues, altruism, and sexual aversions from a larger set of family members in a sizeable population-based sample of Finns. Using two surveys (one directed to adults with questions regarding their own children, nieces, and nephews [AtC] and one directed to adults with questions regarding their parents, aunts, and uncles [CtA]) we obtained data from 3,362 individuals living in Finland (Corrected completion rates of those who responded for AtC was 84.5% and AtC was 88.4%). Comparing the response patterns of some key variables with earlier studies, we found our final sample to be representative of the Finnish population. In the present study we describe the methodology of data-collection and report descriptive information regarding kinship cues, altruism, incest aversion, and various individual variables.

### Indexing terms/Keywords

Incest aversion, altruism, kin-recognition cues, population-based study

### Academic Discipline And Sub-Disciplines

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### SUBJECT CLASSIFICATION

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## INTRODUCTION

Natural selection is the process of adaptive change as driven by the differential propagation of genes over generations. Adaptive change can be achieved in several ways. From the view of an individual, propagation of genes can be direct (having and investing in own children) and indirect (investing in collateral or horizontal kin and their children). Kin-selection theory [1] can thus explain behavior towards kin other than one's offspring through adaptive processes. Because we share genetic material also with collateral or horizontal kin, investing in kin can increase the likelihood of this shared genetic material being transmitted to future generations. We also have a tendency to avoid detrimental behaviors such as incest, which can have negative effects on both our and our relatives' reproduction and this can be explained in terms of the inclusive fitness-cost detrimental behavior incurs [2], [3]. There is an increasing body of evidence that kinship modulates social behavior. A number of studies have shown that humans invest more in the well-being of their family members than for example friends, even if they feel emotionally close to both friends and family [4]. Within families, close relatives also receive more investment than more distantly related individuals [5]. Conversely, the likelihood of maltreating other individuals reflects the same pattern: the less probable the genetic relatedness, the higher the risk of maltreatment [6]. For instance, compared to biological fathers, step-fathers are more likely to sexually abuse [7], physically abuse, murder, and neglect their children [8]–[11]. In all, kinship certainty plays an important role in modulating the treatment of other individuals.

Because humans have no direct means of knowing who our relatives really are (with the exception of mothers who, due to the nature of childbirth, can be sure their biological children are theirs), our subjective belief about relatedness to another individual relies on the availability of kinship cues. Kinship cues are cues in the environment that provide sufficiently reliable information about the biological relatedness between two individuals. The role kinship cues play in militating against physical and sexual abuse and simultaneously promoting altruism and sexual avoidance, however, is not always recognized by policy makers, researchers and clinical professionals [12]. Indeed, advances in identifying risk factors of intra-familial child sexual abuse have been made from this theoretical perspective. For example, research testing the so-called Westermarck hypothesis [13] has shown that shared co-residence in childhood decreases the likelihood of incestuous sexual inclinations in adulthood [14], [15]. Other cues are, for example, phenotypic similarity [16], [17], and maternal perinatal association (i.e., seeing an individual being nursed by an individual identified as one's mother; [18], [19]). In sum, evolutionary theory holds that positive altruistic investment and negative treatment can be predicted by two important factors: 1) the availability of cues indicative of kinship and 2) the subjective belief of relatedness.

A number of studies have shown that humans invest more in the well-being of their family members than for example friends, even if they feel emotionally close to both friends and family [4]. Within families, close relatives also receive more investment than more distantly related individuals [5]. Conversely, the likelihood of maltreating other individuals reflects the same pattern: the less probable the genetic relatedness, the higher the risk of maltreatment [6]. For instance, compared to biological fathers, step-fathers are more likely to sexually abuse [7], physically abuse, murder, and neglect their children [8]–[11]. In all, kinship plays an important role in modulating the treatment of other individuals.

Taking this perspective does not mean overlooking other factors that may be of importance. For example, anti-social personality traits [20] and substance abuse [21] have been linked to the likelihood of intra-familial sexual abuse. It is possible that anti-social behavior and substance abuse cause unusual family functioning and thereby affect systems regulating kin-directed behavior.

In recent years, the number of evolutionarily informed studies on the human family and its functioning has grown steadily (e.g. [22]). Nevertheless, the field suffers from some methodological shortcomings. Most studies are conducted on small convenience samples that may introduce biases to the observations [23]. The studies are also often somewhat limited in the number of factors investigated. Many studies investigate either altruism or incest aversion toward only on type of kin, for example, siblings or children or fail to incorporate individual factors, such as substance abuse and/or anti-social personality traits. These methodological shortcomings can, in the worst case, lead to studies failing to find important interactions between individual factors, kinship cues, and behavioral outcomes. Moreover, most studies employ Likert-type scales to measure self-reported beliefs. Such measures are not very sensitive and in some cases they are not valid [24]. Finally, in many studies, interesting variables have also been overlooked. For instance, a number of studies have looked at individual regulation of incest aversion [25]–[27]. However, to the best of our knowledge no study to date has tested whether incest aversion is similar for non-heterosexual and heterosexual individuals. Incestuous sexual inclinations are a concern both same-sex dyads as well as opposite-sex dyads, and nevertheless nothing is known about whether incest aversion is activated in the same way for non-heterosexual individuals as for heterosexual individuals.

To be able to address these shortcomings, we aimed in the present data-collection to gather valuable data from a representative sample of a complete population.

### The Purpose and Methodology of the Finn-Kin Study

To combat some of the limitations in earlier studies on the role of kinship-cues in modulating family psychology we set out to gather data from a population-based sample of Finns. We included questions regarding a large number of kin, using several measures of altruism and incestuous sexual inclinations. We also aimed to improve the properties of these measures. However, in order to obtain reliable responses we had to overcome a number of obstacles:

Asking sensitive questions may both influence the validity of the data and diminish completion rates. Also, due to the off-putting nature of the questions ceiling effects are common in studies concerning intra-familial sexual abuse [28]. Because information about sensitive topics cannot be obtained by excluding sensitive questions, we made efforts to assure participants that the survey was anonymous and that all data would be treated confidentially. Furthermore, when conducting surveys the objective is to obtain high response and completion rates as this tends to decrease the risk of biased observations. Therefore, we also made sure we could compare the final sample to some known variables to test eventual biased responding. The completion rate is a better measure of whether the questions posed in the survey were



upsetting to the degree than respondents preferred not responding to them. When there are no differences between respondents and non-respondents or between completers and drop-outs, or when differences are not associated with the variables of interest, response rates and completion rates only have a negative impact on the statistical power. Because data of interest are difficult to obtain from non-respondents, it is often difficult to empirically test whether there are differences and whether these are likely to have an effect on obtained data.

Although a recent meta-analysis shows that web-surveys yield about 11% less responses than paper-and-pen surveys in general, and 23% lower when the survey is directed to the general population [29] we chose to seek participants for a web-based survey. This decision was necessary for the following reasons: Due to the length of the survey we wanted to exclude all questions that were not relevant for a given participant based on prior information. Moreover, we needed to create an adaptive survey structure, including logical commands, facilitating functions, and randomizations in order to maintain sufficient experimental control. Individual randomization of questions was needed in order to avoid order-effects that could have compromised the validity of responses. This is difficult to achieve in pen-and-paper surveys.

## The Finnish Population: Demographics and Family Structures

Due to The Population Registry Center of Finland [30] which contains demographic information about all individuals registered as living in Finland, large-scale population-based studies are relatively easy to conduct. The Finnish population is largely comparable to other populations in the northwestern part of Europe. According to Statistics Finland (2014) close to 5,427,000 individuals live in Finland and of these 4,075,000 (or 75%) live in families. The average size of a Finnish family is 2.8 persons. The relatively small family size is explained by the fact that 36% of all families consist of unmarried and/or childless couples. Currently, the average age of first time mothers is 28.4 years. Families with at least one child below 18 years of age make up 40% of all family types. About a fifth of underage children live with only one of their biological parents. This is usually the mother. There are only 16,100 (2.8%) families in which a single father lives with his children. Nine percent of all families are blended families, and the children in these families are usually the mother's biological children. Of all children under 18 years of age, 61% have married parents, although today more than half of firstborns are born out of wedlock.

Moreover, the mean annual income in Finland is 21,500 euros, with a slightly higher annual income (25,700 euros) for a household with two adults versus a slightly lowered mean income for households with only one adult (17,400 euro). By law [31] Finns have to take part in a nine year basic education (grades 1 to 9). Additionally as many as 69% pursue a higher education, 37-43% completing a secondary education and 25-32% of all Finns achieving a degree from an university or a technical college. Finland is a bilingual country where 90.9% of the population speaks Finnish as their mother tongue and 5.4% of the population speaks Swedish.

## Aims of the Present Study

In the present study our aim was threefold. Firstly, we wanted to describe the methodology and sample used in the study. Secondly our aim was to evaluate the data-collection in terms of response rates, completion rates, and generalizability of the obtained responses. Lastly, we wanted to present descriptive data regarding key variables, such as kin-directed altruism, incest aversion, and individual difference-variables. The data obtained in this data-collection can in future studies be used to assess specific hypothesis derived from evolutionary theory.

## METHOD

### Sampling Frame

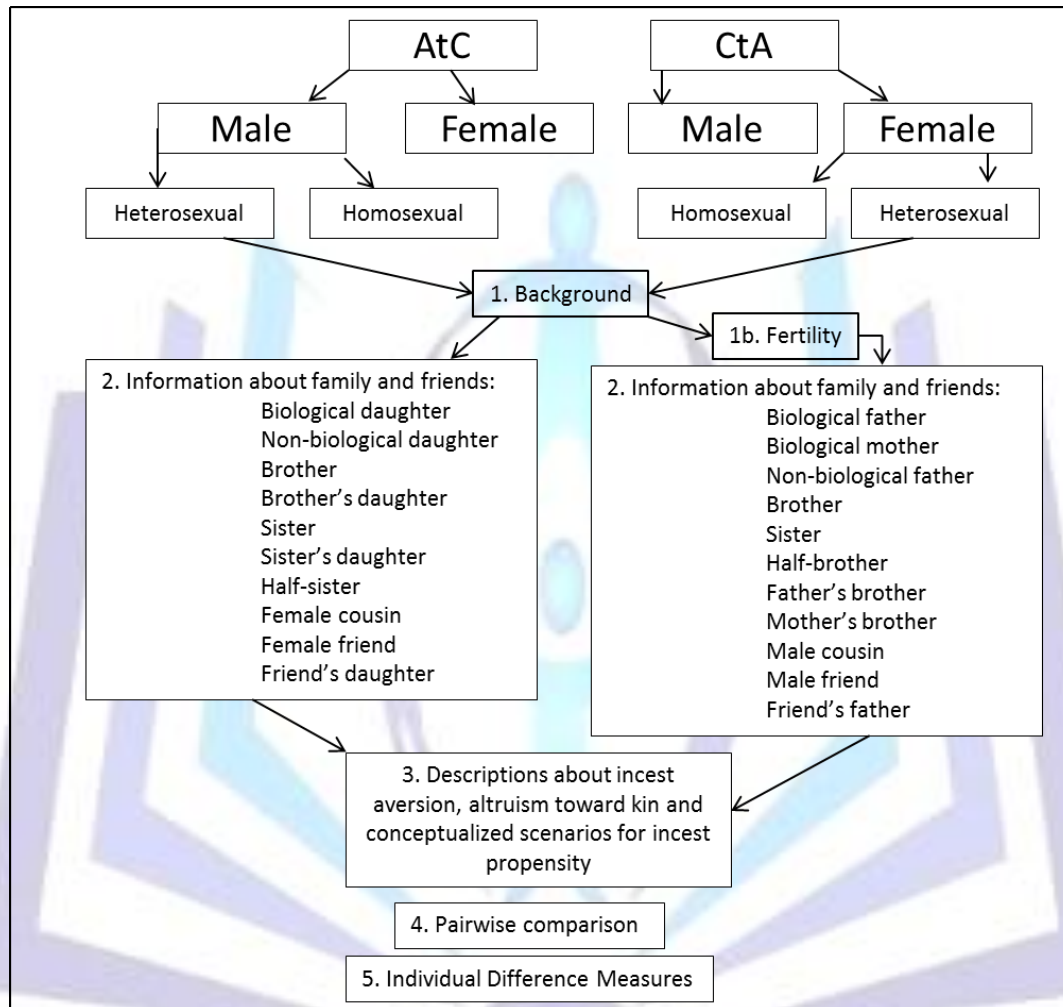
After estimating cell sizes for the key analyses, given an expected response rate at 25% and an expected completion rate at 60%, we decided to invite 16,000 (8,000 male and 8,000 female) Finnish individuals to participate in the study. The participants who completed the survey were offered a chance to participate in a raffle in which the prizes were one gift voucher worth 1,000 euros and two gift vouchers worth 500 euros. To avoid compromising anonymity the participants were redirected at the end of the survey to another website where they could enter their e-mail address in order to take part in the raffle. The criteria for selection included a minimum age of 18 and having a living opposite-sex parent or child. We also put an upper age limit at 49 years of age, as older individuals were considered less likely to have access to the Internet [32], which could both decrease and bias participation. Half of the participants (8,000; 4,000 men, 4,000 women) were invited to participate as "parents", partaking in the survey concerning kin-recognition and kin-directed behavior with reference to children (Adults-to-Children; AtC) and the other half (8,000; 4,000 men, 4,000 women) were invited to participate as "children", partaking in the survey concerning kin-recognition and kin-directed behavior to adults (Children-to-Adults; CtA). An invitation letter, containing information about the study (See Appendix 1) and a link to the web-based survey, was sent to addresses obtained from The Population Register Centre of Finland, which includes information on everyone registered as living in Finland [30]. Both the survey and the invitation letter were written in both Finnish and Swedish.

### Ethical Approval

Before piloting the study we received permission from the Ethical Board of the Department of Psychology and Logopedics in February 2012.

### Procedure

Whether a participant answered from an adult’s perspective (AtC) or a child’s perspective (CtA) had been predetermined when sending out letters inviting to participate in the study. Upon answering the survey participants first stated their sex. After this participants were asked two questions regarding sexual orientation. “Imagine a scale from completely heterosexual to completely homosexual. Where would you place yourself when it comes to 1) sexual behavior or 2) erotic attraction?”. The reply options were *completely heterosexual*, *mostly heterosexual*, *as heterosexual as homosexual*, *mostly homosexual* and *completely homosexual*. Unless the participants indicated that they saw themselves as completely homosexual, mostly homosexual or as much heterosexual as homosexual for either behavior or erotic attraction they were coded as heterosexual and proceeded with the survey as shown in Figure 1. Other participants were coded as homosexual and followed a slightly different pathway which will be explained in more detail for each of the sections presented below.



**Fig 1. An example of the logic of the survey.**

*Note.* For the sake of simplicity the logic is described from the point of views of a heterosexual male participant answering from the adult-to-child (AtC) perspective and a heterosexual female participant answering from the child-to-adult (CtA) perspective. The actual survey included male and female, heterosexual and homosexual participants in both the AtC perspective and the CtA perspective. Fertility related questions (1b.) were only asked of female participants.

**Part one: Background variables.**

The survey itself consisted of five parts. In the first part all respondents were asked about *inter alia* their socioeconomic and marital status, sexual background and attitudes about sex. Moreover female participants were asked questions about their menstrual-cycle position and the use of hormonal contraceptives. Regardless of sexual orientation all participants answered the same questions.

**Part two: Information about family members and friends.**

In the second part, participants answered questions about relationships of interest (see Table 1.). The questions regarding family members and friends included the name (the name was only obtained to facilitate subsequent questioning as was not included in the data file) and age of the relationship of interest, the degree of certainty in biological relatedness to the relationship of interest, duration of co-residence with the relationship of interest, phenotypic and behavioral similarity with



the relationship of interest, the attractiveness and appeal as a partner of the relationship of interest as well as emotional closeness to the relationship of interest. In case the participant did not have a specific relationship of interest no subsequent questions regarding that relationship of interest were included in the survey. If the participant reported having more than one family member of the same category (e.g., a participant had more than one brother), subsequent questions regarded only the family member closest to the participant in age.

**Table 1. Relationships of Interest in Part Two of the Survey**

Adult-to-Child Survey (AtC)	Child-to-Adult Survey (CtA)
Opposite-sex biological child	Opposite-Sex biological parent
Opposite-sex non-biological child	Opposite-Sex non-biological parent
Same-sex sibling	Same-sex sibling
Brother's child*	Mother's sibling
Sister's child*	Father's sibling*
Opposite-sex sibling	Opposite-sex sibling
Opposite-sex half-sibling	Opposite-sex half-sibling
Opposite sex cousin	Opposite-sex cousin
Opposite sex friend	Opposite-sex friend
Friend's child*	Friend's parent*

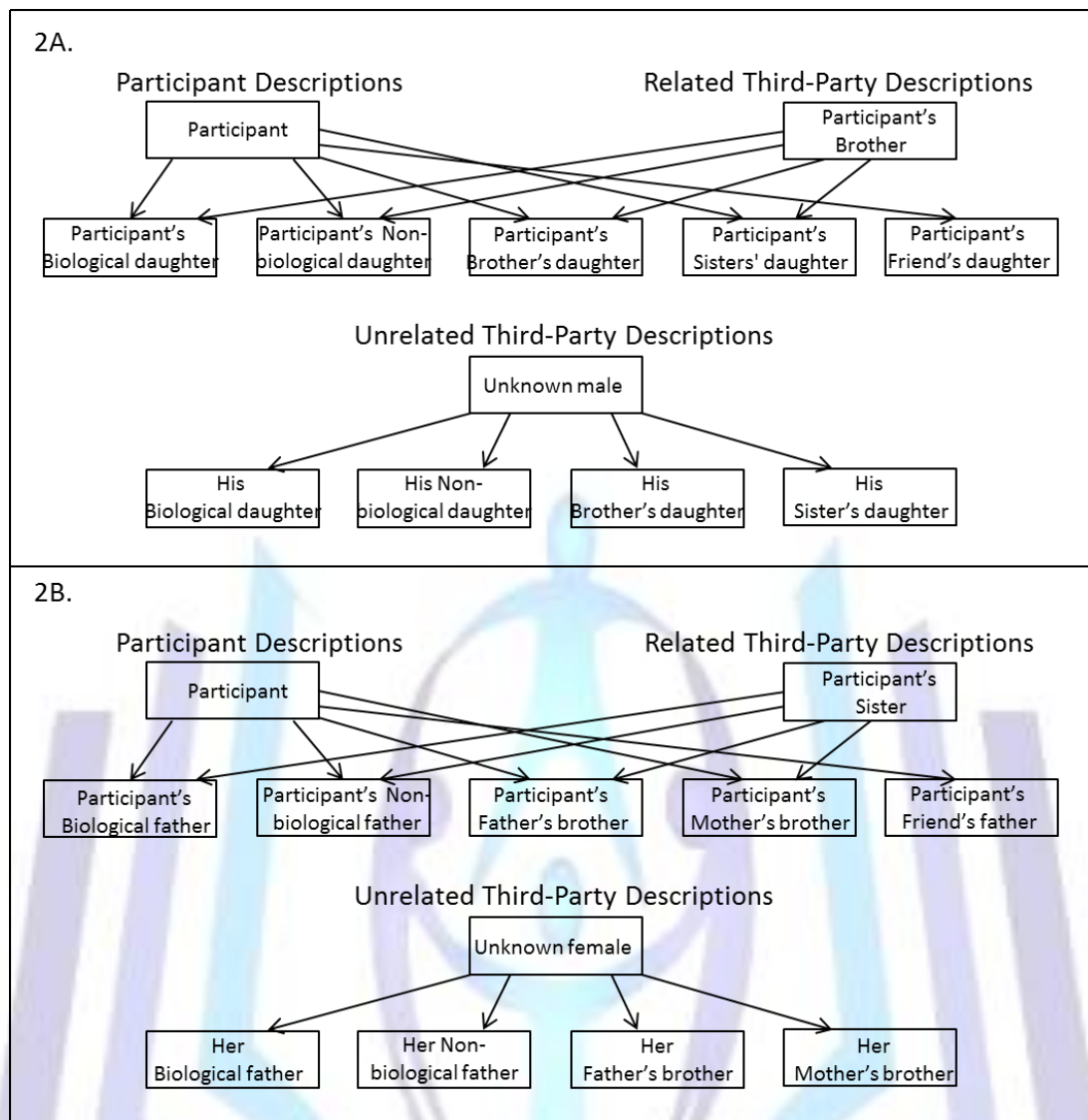
Note. The sex of the person denoted by an \* is opposite-sex to the participant. Non-heterosexual respondents answered questions about both opposite-sex and same-sex family members.

Participants were in most cases asked questions regarding opposite-sex family members and friends. The exception to this was same-sex siblings as these were used in later parts of the survey, to create third-party descriptions used to measure inbreeding aversion to sexual contact between relatives (explained in the next section). Also, in the CtA-survey participants were asked questions about both biological parents. This was necessary in order to establish the nature of the relationship between the parents and the childhood environment of the participant. Participants coded as homosexual responded to questions regarding both same-sex and opposite-sex relationships of interest.

### Part three: Descriptions about incest aversion, altruism toward kin and scenarios measuring incest propensity.

In the third part of the survey, the names of family members provided in the second part were included in vignette-type descriptions. The descriptions were used to prompt various reactions (e.g., aversion, arousal, altruism) in the participant. The descriptions were grouped into three perspectives (see figure. 2); *participant descriptions* that in the AtC-survey consisted of descriptions of the participant and an opposite-sex biological child, a non-biological child, a friend's child and opposite sex children of both a sister and a brother. The *related third-party descriptions* included the participant's same-sex sibling and the participant's opposite-sex biological child, a non-biological child, and opposite sex children of the participant's sister and a brother. The *unrelated third-party descriptions* included an unknown same-sex person and this person's opposite-sex biological child, non-biological child and a child of both a male and female sibling. The descriptions in the CtA-survey followed the same principles as in the AtC perspective. The only difference was substituting relationships of interest for the ones mentioned in Table 1 for CtA. Homosexual respondents were presented with both same-sex and opposite-sex family members in the *participant descriptions* and in the *unrelated third-party descriptions*. However, in the *related third-party descriptions* the homosexual participants followed the same system as heterosexual respondents as the sexual orientation of the same-sex sibling was unclear and, given the population-base rate of non-heterosexuality, the sibling was likely heterosexual. The order in which the three groups of descriptions were presented to the participants was randomized.

Descriptions prompting reactions to inbreeding included three questions, such as "Imagine making out with [name of relationship of interest]" for the participant descriptions. For the related third-party descriptions the same-sex sibling's name was used and participants answered three questions 1. "Imagine you and [name] making out", 2. "Imagine sitting in the sauna with [name] and [name] would purposefully touch your inner thigh", and 3. "Imagine having sex with [name]". The unrelated third-party descriptions consisted of the same questions but from the point of view of an unrelated same-sex person, e.g. "Imagine an unknown male having sex with his biological daughter". For each description the participant was asked to rate, using a scale from 0 (*not at all disgusting*) to 100 (*very disgusting*) how disgusted the description made them feel and also how arousing the description was using a scale from 0 (*not at all*) to 100 (*very arousing*). Altruism related questions toward different family members were only included in the participant descriptions and were measured using three questions, 1. "How willing would you be to donate your kidney to [name] if she/he would need it; 2. "Imagine [name] being sentenced to jail for 12 months, how willing would you be to sit off the sentence instead of [name]"; and 3. "How willing would you be to give half of one month's salary to [name]". A scale ranging from 0 (*not at all*) to 100 (*of course*) was used to measure altruism.



**Figure 2. The different descriptions included and the persons involved in part three of the survey in both the AtC-survey (panel A) and the CtA-survey perspective (panel B).**

*Note.* For the sake of simplicity the descriptions are from a male participant's perspective in the AtC-survey (panel A) and a female participant's perspective in the CtA-survey (panel B).

Apart from the descriptions mentioned above, four separate conceptualized scenarios were created to measure the participant's propensity to engage in incest. The scenarios included the same opposite-sex family members as in the participant perspective previously mentioned. The exception from this was that we only included the niece/nephew (AtC-survey) aunt/uncle (CtA-survey) closest to the participant in age in case the participant had two nieces/nephews or aunts/uncles. To control for order effects and for level effects of the different scenarios, the scenarios were presented in a random order and for each scenario one of the four relationships of interest was randomly assigned to one of the four scenarios. An example of a scenario:

"Imagine that you and [name] are on a secluded beach. It's really hot, the sun is shining and you are afraid of getting a sun burn. Therefore you ask [name] to spread sun lotion on your skin. [Name] starts by rubbing sun lotion on your back and then on your chest. Suddenly you feel [name] fondling your genitals."

After reading the scenario participants were asked "How likely would you encourage [name of family member] to continue caressing you in a similar situation?" and "How aroused would you become in a similar situation?", the response scales ranged from 0 (*not at all*) to 100 (*very likely*) and respectively 0 (*not at all*) to 100 (*very aroused*). Homosexual participants were not presented with conceptualized scenarios as it would have needed twice the amount of scenarios to include both opposite-sex and same-sex relationships of interest.

#### Part four: Pairwise comparison.

In the fourth part of the survey we asked participants to make forced choices between different sexual scenarios. Using a repeated forced-choice method participants were asked to choose the more aversive of two inbreeding scenarios (e.g., you having sex with Jim vs. Jane having sex with Jim) pairing the possible situations, given the actual relatives each participant had reported earlier in the study. Such paired comparisons allow for more precise estimates of the relative



difference in aversion to various scenarios. In order not to make the survey too long, a maximum of 36 pairings were presented to the participant. These 36 pairs were chosen so that if the participant reported having more uncommon family members (e.g., step-children or step-parents) these family members were preferred over more common family members (e.g., biological children and biological parents). Homosexual respondents did not participate in this part of the survey.

### Part five: Individual difference measures.

The fifth part of the survey consisted of different individual difference measures. Regardless of sex, sexual orientation, and survey perspective all respondents answered all the items presented in this part of the survey. In order to keep the survey feasible items with the highest factor loadings for each subscale were chosen when this was possible. (See Table 2 for an overview of the included scales).

**Table 2. Individual Differences Measures Used in the Survey**

Measure	Construct	No. of subscales (no. of items per subscale)	Example Question
IRMA	Rape myth acceptance	5 (1)	If a girl doesn't physically fight back, you can't really say it was rape
SRP-III	Psychopathic traits	4 (3)	It's amusing to see other people get tricked.
TDDS	Disgust sensitivity	3 (2)	Standing close to a person who has body odor
BIS/BAS	Behavioral inhibition	4 (1)	I will often do things for no other reason than that they might be fun.
CTQ	Experienced child abuse	5 (1)	Growing up... I was probably sexually abused
AUDIT	Alcohol use	5 (1)	How often do you have a drink containing alcohol?
DUDIT	Drug use	1 (3)	How often do you use drugs other than alcohol?
TUPI	Personality	5 (2)	I see myself as... extraverted, enthusiastic
IRI	Empathy	4 (2)	I believe that there are two sides to every question and try to look at them both

*Note.* IRMA, Updated Illinois Rape Myth Acceptance Scale ; SRP-III, Self-Report Psychopathy Test III; TDDS, Three Domain Disgust Scale; BIS/BAS, Behavioral Inhibition Scale and Behavioral Activation Scale; CTQ, Childhood Trauma Questionnaire; AUDIT, Alcohol Use Disorders Identification Test; DUDIT, Drug Use Disorders Identification Test; TIPI, Ten Item Personality Inventory; IRI, Interpersonal Reactivity Index.

The purpose of the Updated Illinois Rape Myth Acceptance Scale (IRMA; [33]) is to measure attitudes and beliefs about rape. The scale consists of five sub-scales and the items loading highest for each factor in the scale were chosen. The items are measured on 5 point Likert-scales with the anchors (1) "strongly disagree" and (5) "strongly agree". A higher score means a stronger belief in rape myths. The scale has been shown to have validity and sufficient reliability ( $\alpha = .87$ ) [33].

Self-Report-Psychopathy Test-III (SRP-III; [34]) was included to measure psychopathy. The scale has four subscales. We used 12 items all in all, three items for each subscale. The items were measured on a five point Likert-scale with the anchors (1) "strongly disagree" and (5) "strongly agree". A higher score means a higher tendency for psychopathic behavior. The SRP-III has been shown to have good validity and reliability ( $\alpha = .86$ ) in non-clinical and non-forensic samples ([35]).

The Three Dimensions Disgust Scale (TDDS; [36]) consists of three subscales measuring pathogen, sexual, and moral disgust. Two items from each subscale were included in the survey. The TDDS as a three-factor measure of disgust has been shown to have good internal consistency [37].

The Behavioral Inhibition System and Behavioral Activation System (BIS/BAS) Scales are used to measure motivational systems underlining behavior and affect [38]. The measure consists of four subscales and has a total of 24 items of which four were included in the survey, one from each subscale. The scale has been known to correlate well with other existing measures (Carver & White, 1994).

The Childhood Trauma Questionnaire short form (CTQ-SF) is a 28 item retrospective self-report inventory that can be used to provide reliable and valid information about traumatic childhood conditions [39]. There are five subscales and one item from each subscale was included in the survey.

Alcohol and Drug Disorders Identification Test scales are both published by the World Health Organization (WHO) and are used to screen for problematic alcohol and drug use [40]. The psychometric properties of abbreviated versions like the one used in this study are as satisfactory as the original 10-item AUDIT version [41]. Both AUDIT and DUDIT have been validated in relation to other screening and assessment tools [40].

The Ten-Item Personality Inventory (TIPI, [42]) is a brief measure of the Big-Five personality domains with two items for each domain. Each item is rated on a 7-point scale that ranges from 1 "disagree strongly" to 7 "agree strongly". TIPI has been shown to have adequate convergent and discriminant validity, test-retest reliability and correlates well with longer Big-Five instruments [42].

The Interpersonal Reactivity Index (IRI, [43], [44]) is a 28-item self-report questionnaire used to measure individual differences in empathy. It has four subscales from which two items per scale were included in the survey. The IRI correlates well with other empathy measures and scales measuring emotionality and sensitivity to others [44].



Due to the complex branching structure and randomization requirements of the Finn-Kin survey we were unable to create it using our typical service providers. Instead we approached Delosis Ltd (London, UK) who implemented the entire assessment battery using their online questionnaire platform.

## RESULTS

### Response Rates

As a first step we investigated the response and completion rates for the survey. Of the 8,000 individuals invited to participate in the AtC-survey, 1,654 (20.7%) individuals started the survey. For the CtA-survey, out of 8,000 invitees, 2,220 started the survey (27.5%). As 1.4% of the Finns change addresses during one month [32] and as 9% of the Finns use the Internet less than once a week [32], 4.9% do not have Finnish or Swedish as a first language [30] and a software bug affected about 2.5% of the respondents, the corrected response rate was estimated to be 25.2% for the AtC-survey and 33.9% for the CtA-survey. Of these, 1399 participants (84.5%) in the AtC-survey and 1962 participants (88.4%) in the CtA-survey completed the study. Thus, the total number of respondents was 3,362. However, due to the structural logic of the study the number of observations per individual and per variable varies. In sum, the response rate was slightly below similar studies conducted in the same population (36% and 46%; [45], [46]) while the completion rate was high.

### Representability of the Sample

As a second step we compared the responses to some key variables with responses from other studies of the same population. Mean age of the sexual debut in our sample was 17.2 ( $SD = 3.0$ ) in both surveys. This is comparable to other studies (17.5 in [45] and 17.4 in [47]). The number of non-heterosexual individuals was 4.2% in the AtC-survey and 9.5% in the CtA-survey. This difference was likely due to the fact that for the AtC-survey, only individuals with a biological child were sampled. As homosexual individuals might be less likely to have biological children this could explain the lower prevalence of non-heterosexual individuals in the AtC-survey. The prevalence of non-heterosexual respondents in the CtA-survey compares well to the prevalence of non-heterosexual respondents in other studies using similar operationalization (8.5% in [48]; 11.3% in [16]). The prevalence of experienced sexual abuse was 5.2% (13.0% in the AtC-survey and 4.2% in the CtA-survey). These numbers are comparable to estimates in other studies (4.6% in [49]). Finally, we compared the family-structure variables to available data. Participants reported 1.01 ( $SD = 1.26$ ) male and 0.93 ( $SD = 1.16$ ) female siblings in the AtC-survey and 0.84 ( $SD = 1.08$ ) male and 0.81 ( $SD = 1.02$ ) female siblings in the CtA-survey. These numbers are comparable to the number of children born per woman in Finland, which in 1969 was 2.1 [30]. Taken together, across these variables our sample is representative of the general Finnish population. Because participants who chose to quit the study before reaching the end were offered the possibility of removing all the data they had entered, analyses of differences between completing and non-completing participants were not possible to carry out.

### Participant Descriptives

The mean ages of the participants as well as their relationship status, level of education and annual income *inter alia* are presented in Table 3.

**Table 3. Participant Characteristics for the Adult to Child (AtC) and the Child to Adult (CtA) Surveys**

Characteristics	Child-to-Adult (CtA)			Adult-to-Child (AtC)		
	Women	Men	All	Women	Men	All
Age	30.1 (8.8)	30.8 (9.3)	30.3 (9.98)	38.0 (7.6)	40.0 (6.6)	38.8 (7.3)
Residence						
City > 50,000	54.50%	54.50%	54.50%	35.70%	43.20%	38.60%
City 10,000 – 50,000	28.20%	27.30%	27.90%	33.30%	29.40%	31.80%
Village < 10,000	10.80%	11.60%	11.10%	19.00%	17.10%	18.30%
Countryside	6.50%	6.60%	6.50%	12.00%	10.30%	11.40%
Education						
Primary school	2.60%	6.40%	3.80%	4.10%	3.90%	4.00%
High/Vocational school	38.80%	47.90%	41.60%	45.50%	46.90%	46.00%
University/Vocational college	58.60%	45.70%	54.60%	50.40%	49.20%	49.90%
Marital status						
Single	23.80%	30.50%	25.90%	7.20%	5.30%	6.40%
Relationship, living apart	14.00%	13.60%	13.90%	5.30%	5.30%	5.80%
Relationship, co-habiting	34.50%	29.50%	33.00%	21.10%	20.10%	20.70%





Married/Registered partnership	27.60%	26.40%	27.20%	65.70%	69.40%	67.10%
Sexual Orientation						
Mainly heterosexual	96.30%	95.90%	96.30%	98.80%	99.60%	99.10%
Mainly homosexual	3.80%	4.10%	3.70%	1.20%	0.40%	0.90%

### Family structures

In the AtC survey 98.7 % of the participants had a biological opposite-sex parent and 10.7 % an opposite-sex non-biological parent. In the CtA survey 96.9 % had an opposite-sex biological parent and 8.8% a non-biological parent of the opposite-sex. The mean age of the biological parents was 59.1 (*SD* = 9.1) and the mean age of the non-biological parents was 55.5 (*SD* = 11.1). The mean age of the biological children was 11.2 (*SD* = 7.3) year and the mean age of the non-biological children 16.7 (*SD* = 7.5).

### Kin-Recognition and Kinship Cues

The first main aim of the present study was to obtain data on kinship-cues and on subjective certainty regarding biological relatedness to family members. Our results suggest that the kinship cues measured follow the same pattern across different kin groups. They are more readily available in first-degree biological relationships (biological child and biological parents) and the least present in socio-legal relationships (non-biological child and non-biological parents). (See Table 4.)

### Altruism

We found that altruism was reliably measured over three items measuring altruistic attitudes. Participants were more motivated to donate a kidney to another individual than to sit off a sentence for someone. Participants were the least motivated to carry out a prison sentence in someone else’s stead (See Table 5).

### Incest Aversion

We found that incest aversion was measured reliably over three items and two types of operationalization. The disgust scale was highly negatively correlated with the arousal scale ( $r_{AtC} = -.678, p < .001$  and  $r_{CtA} = -.777, p < .001$ ). (See Table 6).

**Table 4 Subjective Certainty and Co-Residence for Relatedness to Family Members**

Kinship Cues	Relationship of interest			
	Adult-to-Child (AtC)			
	Biological Child	Non-Biological Child	Brother’s Child	Sister’s Child
Subjective Certainty*	95.7 (13.7) <sup>c</sup>	--	93.5 (16.2) <sup>a,d</sup>	96.3 (13.9) <sup>c</sup>
Co-residence***	9.72 (5.8) <sup>b,c,d</sup>	3.77 (4.2) <sup>a,c,d</sup>	0.1 (1.0) <sup>a,b,d</sup>	1.5 (4.2) <sup>a,b,c</sup>
	Child-to-Adult (CtA)			
	Biological Parent	Non-Biological Parent	Maternal Aunt/Uncle	Paternal Aunt/Uncle
Subjective Certainty***	96.7 (12.6) <sup>b,c</sup>	--	93.6 (16.2) <sup>a</sup>	92.9 (18.2) <sup>a</sup>
Co-residence***	16.39 (3.6) <sup>b,c,d</sup>	6.16 (5.5) <sup>a,c,d</sup>	0.2 (1.6) <sup>a,b</sup>	0.2 (1.7) <sup>a,b</sup>

Note. Superscripted letters indicate that the mean differs significantly ( $p < .05$ ) from the mean for <sup>a</sup> Biological Child/Biological Parent, <sup>b</sup> Non-biological Child/Non-biological Parent, <sup>c</sup> Brother’s Child/Maternal Aunt/Uncle, and <sup>d</sup> Sister’s Child/Paternal Aunt/Uncle. Higher values indicate higher certainty in relatedness and more readily available kinship cues. \* $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$  for individual Generalized Estimating Equation Analyses.

**Table 5. Item and Scale Descriptives of Altruism for the Adult to Child (AtC) and the Child to Adult (CtA) Surveys**

Item	AtC		CtA	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1.	70.1	33.5	44.6	36.3
2.	23.9	34.5	12.6	24.8
3.	31.6	34.5	22.4	31.1
Scale	41.9	28.5	26.6	26.2
Reliability	$\alpha = .779$		$\alpha = .779$	



*Note.* The items were 1. “How willing would you be to donate your kidney to [name] if she/he would need it; 2. “Imagine [name] being sentenced to jail for 12 months, how willing would you be to sit off the sentence instead of [name]”; and 3. “How willing would you be to give half of one month’s salary to [name]”. For each item, the scale ranged from (0) to (100) with higher values indicating more altruistic attitudes.

**Table 6. Item and Scale Descriptives for Incest Aversion (Disgust and Arousal) of the Adult to Child (AtC) and the Child to Adult (CtA) Surveys**

Item	AtC				CtA			
	Disgust		Arousal		Disgust		Arousal	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
1.	95.3	15	4.5	15.3	94.7	17.2	4.98	17
2.	92.6	19.1	4.9	15.8	94.2	18.1	5.57	18
3.	95.3	15.7	4.6	15.5	94.6	17.7	5.43	18
Scale	94.4	15.2	4.7	15.5	94.5	17	5.33	16.7
Reliability	$\alpha = .898$		$\alpha = .929$		$\alpha = .929$		$\alpha = .942$	

*Note.* For Incest aversion disgust and arousal, the items were 1. “Imagine you and [name] making out”, 2. “Imagine sitting in the sauna with [name] and [name] would purposefully touch your inner thigh”, and 3. “Imagine having sex with [name]”. Responses to each item could be given on a scale from 0 to 100. For disgust, higher values indicate more elicited disgust and for arousal, higher values indicate more arousal.

### Individual Factors

Finally, we investigated the responses to the measures of individual factors. (See Table 7 for means and standard deviations).

**Table 7. Means, Standard Deviations, and Number of Respondents for Individual Difference Scales**

Scale	Descriptives					
	AtC			CtA		
	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>
CTQ	1.6	0.5	1062	1.6	0.5	1422
SRP	1.9	0.5	1065	2.1	0.6	1424
IRMA	8.9	3.4	1125	8.6	3.1	1495
AUDIT	4.0	1.9	951	4.4	2.1	1422
DUDIT	2.2	1.1	25	2.5	1.5	140
TDDS	12.5	7.0	1067	10.8	6.7	1427
IR1	52.5	10.3	1066	54.7	10.7	1424

CTQ Higher numbers indicate more abuse and neglect; SRP Higher numbers indicate higher levels of psychopathy; IRMA Higher values indicate higher acceptance of rape myths; AUDIT Higher values indicate more drinking problems; DUDIT Higher numbers indicate more drug use; TDDS Higher values indicate higher disgust sensitivity; IRI Higher numbers indicate more empathy.

### DISCUSSION

The aim of the data-collection described in the present study was to investigate the presence of kin-recognition cues and their relationship to altruistic behavior and incest aversion in a population-based sample. The data-collection was conducted during October and November 2013. To obtain a population-based sample, invitation letters and reminders were sent to, in total, 16,000 addresses obtained from the Central Population Register in Finland. The aim of the present study was to describe and evaluate the data-collection process and the final sample. Moreover, generalizability of the results was addressed. This aim was based on our belief that presenting this valuable data set to other scientists within evolutionary psychology may promote collaborative research efforts.

The response rate was comparable to other studies conducted in Finland at the same time. Because the invitation letter contained no information likely to have made respondents unwilling to participate, the low response rate was likely due to



factors other than the contents of the survey. This explanation is supported by the high completion rate. In analyzing the response patterns to some key variables regarding sexuality and family structures, we found that they were comparable to data obtained from other large scale population-based studies in Finland. This suggests that the low response rate did not compromise the generalizability of the study. It should, nevertheless, be noted that comparisons regarding many variables were impossible. This is because this data-collection is the first population-based study conducted in Finland that includes questions regarding family structures, altruism, and incest aversion. As expected we found that kinship cues were readily available in biological relationships and in our sample in general. This is probably due to the fact that most respondents lived in nuclear family systems. However, we also noted that the availability of kinship cues was lower in socio-legal relationships. The observed variation in the availability of kinship cues will allow for analyses of how these factors are associated with altruism and incest aversion, both in biological and non-biological relationships. In addition, the data-collection allows investigating the effect of available kinship cues on altruism and sexual aversion.

## Limitations

The study we conducted included some limitations. Firstly, the response rate was quite low. However, as the completion rate was very high and due to reasons outlined above the current data should be representative of the whole population. Secondly, there were problems with some of the items showing ceiling or floor effects. Women have a tendency to react with stronger disgust than men, making it hard to estimate exact effect sizes for the difference between women's and men's emotional reactions to incest.

The data obtained in this data-collection can be used to test several different research hypothesis as the study was very comprehensive and looked at kin-recognition, incest aversion and altruism from several perspectives, covering both children's and parents' point of views. To the authors' best knowledge there are no other similar studies based on population samples or samples as large as this one.

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