Gynocentric communication among nuclear kin in the USA and Spain

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Abstract

Paternity uncertainty seems to have shaped humans' differential investment in kin. I examined sex differences in communication among nuclear kin to expand inquiry on this matter and address some methodological limitations in prior work. I analyzed data from national surveys in the USA and Spain and a study of mobile phone communication in the immediate aftermath of the 2013 Boston Marathon bombings. Respondents communicated mildly to moderately more with mother than father and more with sister than brother. The differences in communication with mother and father appeared in both subjective survey data and objective mobile telephone records. Across communication modes and studies, women and men did not differ consistently in overall frequency of communication. Matricentric and sororicentric tendencies were larger for the modes likely to involve dyadic communication (such as telephone calling and texting) than modes which often involve communication in group settings (face-to-face). The tendency to communicate more with female than male kin also appeared to be stronger in women respondents than in men. These results are consistent with paternity uncertainty as an ultimate evolutionary cause of differential investment in kin.

"The house does not rest on the earth, but on a woman." - Mexican proverb

Introduction

Women in modern Western societies tend to be more centrally involved in family affairs than men, even beyond the realm of nursing and rearing children (1,2). In North American and European studies, women reported more contact with kin, had a greater proportion of kin in their close personal networks, and identified with kin roles much more often than men (3–7). Similarly, both men and women initiated contact more often with their female kin than with their male kin (8). Furthermore, people of both sexes were much more likely to nominate a female nuclear relative (mother or sister) than a male nuclear relative (father or brother) as the person they felt closest to among all the persons they knew (4).

In Western societies, women are often considered to have primary responsibility for kinship matters (2). In recent decades, sex roles have become less rigidly defined, which makes women's and men's involvement with kin a topic of ongoing interest.

Sex differences in orientation to kin also may have deep evolutionary roots. Analyses of strontium isotopes and mitochondrial DNA in archaeologic human remains indicate that prehistoric hunter-gatherers were predominantly endogamous (marriage between fellow community members) and exogamous marriages strained toward matrilocality (married couples living in wife's community) (9). Cross-culturally, women's sisters, mothers, daughters, cousins, and aunts are the most likely and valued potential or actual helpers, apart from husbands, in child rearing (10). Thus, humans likely evolved in social contexts where kinship was structured with special emphasis on women's relations.

Paternity uncertainty may have shaped these forms of kin structure. Women know with confidence whom their biological children are; men do not. Consequently, kin investments in other relatives tend to flow disproportionately on the maternal line. Indeed, grandparents' differential investment in grandchildren reflects this pattern. In a review of the cross-cultural evidence, Sear and Mace (11) found that maternal grandmothers, who can be certain of their biological relation to their daughters' children, are most strongly associated with child survival. In contrast, paternal grandfathers, who have the least certainty of the four grandparents about biological relatedness to their grandchildren, have no consistent association with child survival. The association of the other grandparent roles with child survival tends to fall in between these extremes.

Consistent with these results, most studies of grandparental investment showed that maternal grandmothers invested the most in grandchildren (e.g., with contact, care, emotional closeness, and gift/wealth transfers), followed by maternal grandfathers, paternal grandmothers, and paternal grandfathers (12–15). Paternity uncertainty may also account for differential relationship strength for other pairs of extended family members. Differences in contact with, concern for, and emotional closeness to different categories of nieces, nephews, aunts, uncles, and cousins also correspond to the degree of paternity uncertainty of the reproductive links between those involved (12,14,16–19).

Varying strengths of ties among nuclear family members may also reflect both cultural norms and ultimate evolutionary tendencies. In several studies, young adult respondents in the USA reported feeling modestly closer emotionally and more responsible for the welfare of female nuclear kin than male nuclear kin, on average, within generic kin role relationships (i.e., mother > father and sister > brother when a respondent reported on both a male and female counterpart for a kin role) (20). Similarly, respondents judged that female kin feel somewhat more responsible for respondents' welfare than male kin, on average, within the same kin role relationships. Furthermore, the mother-daughter dyad may involve the most communication of the four parent-child dyads (mother-daughter, mother-son, father-daughter, father-son), as suggested by data from a large European mobile telephone carrier on the sex and age of mobile phone subscribers and their most frequent contacts (21). This accords with the evidence Troll (1) and Rosenthal (2) reviewed that demonstrated the mother-daughter dyad involves the most contact and emotional closeness of the four parent-child dyads.

Several methodological limitations in prior work hamper a full understanding of sex differences in family communication networks. First, previous studies were based almost entirely on self-reported data, and those based on objective data did not capture information about specific kin roles. Second, no prior research has examined family communication networks by different modes of communication. Mobile phone communication, in particular, offers an opportunity to examine dyadic relationships with improved precision. Mobile phone use is now very common, and such communication is typically between two individuals only, while communication by other modes often is not strictly dyadic (occurring between more than two persons). Third, most past research on family communication has mixed together participants with different family compositions. Family composition is likely associated with many demographic characteristics. Differences between families of different composition may blur or exaggerate results on communication in specific kin relationships. Also, evolutionary ideas refer to *differential* investment within families, among multiple kin, and meaningful tests of these ideas require family compositions with such options. Fourth, sex differences in family communication have typically been studied without investigating differences in communication behavior overall, which might account for any differences in family communication.

I addressed these shortcomings in the present study. I examined communication within nuclear families in diverse and broad-based samples of adults in two countries, and focused on specific communication modes. I controlled for sex of respondent, family composition, and generation of kin, employed both subjective and objective measures of communication, and compared respondents' communication with kin to their communication overall.

Methods

I analyzed three data sets. Two of the data sets are based on national web surveys of adults in the USA and Spain carried out in March, 2013. The third data set is from a study of adults who completed a smartphone app survey on the aftermath of the April 2013 Boston Marathon bombings.

National web surveys in the USA and Spain

The web survey firm YouGov conducted the national surveys. YouGov recruits web survey respondents to their panel with web and email advertising and telephone and postal sampling. Through selective invitations sent to panel members, YouGov attempted to assemble samples that approximated, in aggregate, selected demographic summaries of the corresponding country. The USA sample was further restricted to members who participated in the pre-election wave of the 2012 Cooperative Campaign Election Study (22). One thousand respondents participated in each national survey. YouGov respondents receive only a limited number of survey invitations each month. Respondents earn points for completing surveys, which they can use to redeem rewards, such as gift and prepaid debit cards.

Preprints

The national surveys focused primarily on respondents' mobile phone communication behavior. One set of questions assessed respondents' overall typical weekly number of outgoing landline telephone calls (response options: >100, 51-100, 11-50, <11), outgoing mobile telephone calls (response options: >100, 51-100, 11-50, <11), and texts sent/received (response options: >300, 101-300, 51 to 100, 11 to 50, 3 to 10, <3). Two types of questions in the survey are relevant for examining sex-biased communication patterns within families. The first type of question concerned respondents' "top contacts" by mobile phone. Respondents who had mobile phones reported the three persons with whom they talked the most by mobile phone and the three persons with whom they texted the most. For some respondents, these sets of persons overlapped. Also, some respondents reported talking or texting with fewer than three persons. Respondents indicated their top contacts' role relationships in response to subsequent questions. The most specific kin relationships included in the response options were mother, father, sister, and brother.

For the second relevant type of question, respondents reported how frequently they communicated with others in particular role relationships, including mother, father, sister, and brother, among others. Respondents reported frequency of communication by specific modes, including telephone, texting, email, computer-mediated voice/video calling (e.g., Skype), and face-to-face. I did not analyze computer-mediated voice/video calling because few respondents reported using this mode with kin. Respondents reported frequencies of communication on an ordinal scale (2+ times daily, once daily, 1-6 times/week, 1-3 times/month, less than monthly, not at all). Questions about a particular kin role were asked only if a respondent reported having a living family member in that role. When a respondent reported having multiple sisters or multiple brothers, the survey prompted the respondent to focus on the sister or brother who had the next birthday for questions about that kin role.

Boston Marathon bombings app study
At 2:49 PM on April 15, 2013, terrorists detonated two bombs near the finish line of the Boston Marathon while many runners were completing the race. In Massachusetts, April 15th is Patriots' Day, a civic holiday. The Boston Marathon is perhaps the most famous marathon in the world and it attracts hundreds of thousands of spectators each year. The bombings killed three persons and injured 264 others (23).

To assess mobile phone communication in the aftermath of the bombings, I developed (jointly with David Lazer and Drew Margolin) an app (application) that runs on Android smartphones. The app is a survey that includes questions about, among other topics, the 4 contacts with whom a respondent talked the most and the 4 contacts with whom a respondent texted the most in the 9 hours after the bombings (9 hours, 11 minutes – from the moment of the bombings until midnight that day). The app identified these top contacts from the phone's call/text log.

The app summarized the log for this period by unique telephone number. The app first selected the number with the most total call minutes (regardless of call direction) in the 9 hours after the

bombings, and asked whether the respondent recognized the number or contact name associated with the number (if a name was present for that number in the phone's contact list). If the respondent answered affirmatively, then the app asked several questions about the contact, including some about the contact's role relationship with the respondent. When the number belonged to a household, the app asked the respondent to think about the person s/he talked most within the household. The app then repeated this process for other numbers, in descending order of their total call minutes in the 9 hours after the bombings. For these subsequent numbers, the app also asked the respondent whether the contact had already been asked about earlier in the survey (if so, the app selected the next number). This process continued until the respondent had reported fully on 4 separate call contacts.

The app then performed a parallel selection and questioning process for telephone numbers in descending order of their number of texts (regardless of direction) in the 9 hours after the bombings. The app excluded numbers previously asked about in the survey. This process continued until the respondent had reported fully on 4 separate and additional contacts. If a respondent had fewer than 4 call contacts or fewer than 4 text contacts in the 9 hours after the bombings, the app compensated by selecting more text or call contacts, respectively, up to a total of 8 top contacts.

As with the national surveys, the most specific kin relationships included in the app questions on top contacts' role relationships were mother, father, sister, and brother. In a different section of the app survey, the app asked a respondent how many sisters and brothers, respectively, s/he had and whether his/her mother and father were alive.

The app preserved respondents' and contacts' anonymity by transmitting only non-identifiable data to the study server. Included in these data were the numbers of total incoming/outgoing calls and texts recorded in respondents' logs for the 30 days prior to the bombings. At the end of the survey, respondents received a brief summary of their mobile phone communication in the 9 hours after the bombings. As a further incentive for participating in the survey, the research project made a donation of $3 on behalf of each respondent to a charity benefiting families affected by the bombings.

Two weeks after the bombings, my colleagues and I made the free app available publicly at Google Play, the marketplace for Android apps. We recruited participants with mobile online advertising (especially in the Boston Globe newspaper), advertising in free Android apps, advertising in the subway line that runs closest to the site of the bombings, social media, from among our acquaintances, and from flyers on the Northeastern University campus. The study also benefited from coverage on the front page of the Boston Globe newspaper just as the study launched. I used data from the 151 respondents who completed the app survey between May and November, 2013.

Ethical approval

The Northeastern University Institutional Review Board approved the procedures for the national surveys and app study (approval #13-04-11). Respondents in the national surveys and app study gave their explicit informed consent with electronic responses before participating. All survey data delivered by YouGov and all app study data are non-identifiable.

Analytic structure and measures

Dyadic communication patterns within families can be summarized meaningfully only when the families included have similar family compositions. To examine sex biases in kin communication patterns *within* families, a respondent must have both male and female counterparts for a given role relationship. That is, for assessing sex biases in communication with parents, a respondent must have a living mother and a living father; for assessing sex biases in communication with siblings, a respondent must have a brother and a sister. Focusing comparisons on generic kin roles (e.g., parents, siblings) also eliminates confounding of communication patterns by generation. Similarly, I analyzed male and female respondents separately to isolate any biases in communication to the sex of the respondent's kin member.

I restricted the main analyses of communication with siblings to those respondents who had exactly one brother and exactly one sister to control for differences in opportunities to communicate with a brother or sister in families of different compositions (as well as other unmeasured differences between families of different compositions). I also analyzed frequency of communication by specific modes for respondents with three or more siblings, as long as they had at least one brother and at least one sister. The pseudo-random selection of siblings when a respondent had more than one brother or more than one sister makes comparisons meaningful for these respondents. The pseudo-random selection also introduces sampling variation which likely attenuates any association that might be present.

Both the national surveys and the app survey ascertained only respondents' numbers of children, not the numbers of sons and daughters separately, so I could not assess sex biases in communication with children. My assessment of sex biases in communication with siblings in the Spanish survey is limited because respondents reported many more brothers (hermanos) than sisters (hermanas) on average. This was likely due to an error in the questionnaire design: the question about the number of brothers came before the question about the number of sisters, and only one question was visible at a time. In that context, the word "hermanos" was likely often interpreted by respondents as the generic term for "siblings" rather than "brothers." Consequently, I can analyze frequency of communication by mode only for those Spanish respondents whom the data would suggest have at least one sister and at least one brother (reported 2+ hermanos, 1+ hermanas, and more hermanos than hermanas). These analyses may also suffer from attenuation bias due to variation from sampling brothers and/or sisters.

I used two measures of frequency of communication. First, I noted whether a particular kin role relationship was among a respondent's top mobile phone contacts ("top contacts"), as defined

earlier. Second, I used national survey respondents' reported frequencies of communication with particular kin role relationships by communication mode.

All results I report, except for those on overall mobile phone communication, are based on analyses planned before I had conducted any bivariate or multivariate analyses. The protocol for my analyses and a replication data set are archived at the Open Science Framework (https://osf.io/74rcv).

Results

Respondent characteristics

National survey respondents were demographically diverse and roughly representative of their respective countries in terms of several characteristics (Table 1). They were also broadly representative of their countries in geographic terms (data not shown). Participants in the Boston Marathon bombings app study tended to be young and highly educated. Fifteen percent reported they saw or heard the bombings as they occurred.

Table 1. Respondent characteristics

Variable	USA survey	Spain survey	Boston bombings app survey
mean (SD) age (years)	48 (16)	43 (13)	72% under age 36
% females	57	47	54
% employed	50	57	82
% 4-year university degree	32	25	75
% own a mobile phone	94	96	100
% whites	76	---	83
% texted in last 12 months	82	91	---
median interview length (mins)	13	16	8

Note: n = 1,000 for each national survey, n = 151 for Boston Marathon bombings app study

Communication with parents

In all three studies, respondents were 59% to 108% more likely to have mother than father in their top mobile phone contacts (Fig. 1). On average, mother was in the top contacts for about half of respondents; father was in the top contacts for slightly more than a quarter of respondents. Table S1 in the supplementary material shows the proportions of respondents who had mother and father, respectively, in their top contacts, and the precise relative risk values and corresponding confidence intervals.
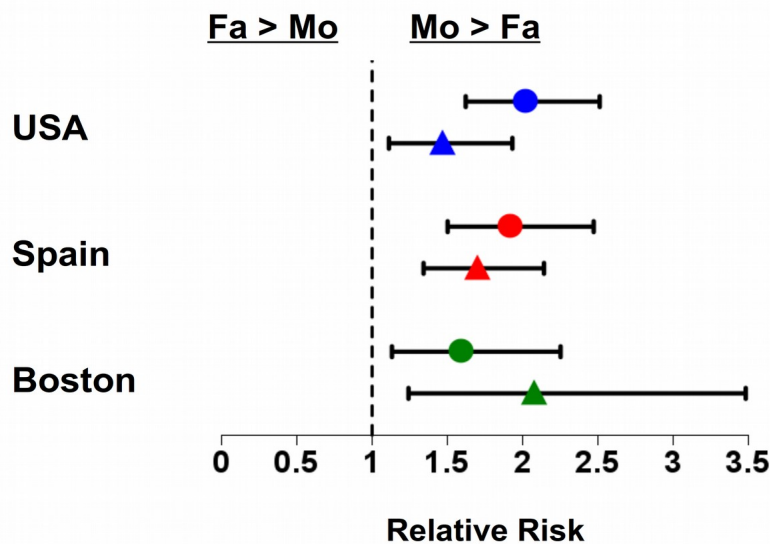
Figure 1. Relative likelihood of mother and father being in respondents' top (most frequent) mobile phone contacts. Circles represent women respondents and triangles represent men respondents. Bars show 95% confidence intervals for paired data (24,25). n = 52-212 across subsamples.

To assess whether national survey respondents reported communicating more with mother or father by specific modes, I created a contingency table crossing communication frequency by parent role (mother vs. father) for each mode. In these tables, each respondent contributed two observations: a reported frequency for mother and another for father. The ordinal Goodman and Kruskal gamma correlation for a table indicates the extent to which communication is more frequent with mother (positive value) or father (negative value).

Respondents in each country reported communicating more with mother than father, on average, by telephone calling, text, email, and face-to-face contact, respectively (Figs. 2 and 3). In nearly every subsample, the gamma correlations were stronger (more communication with mother) for the call and text modes than email or face-to-face. Also, for almost every mode, the gammas were stronger for women respondents than men respondents. The 95% confidence intervals in

these figures are conventional and do not reflect the paired nature of the data; thus, these intervals are somewhat too wide. I could not find published methods for computing intervals that account for the paired nature of the data. Tables S2-S5 in the supplementary material show each of the contingency tables and the corresponding precise gamma values and confidence intervals.
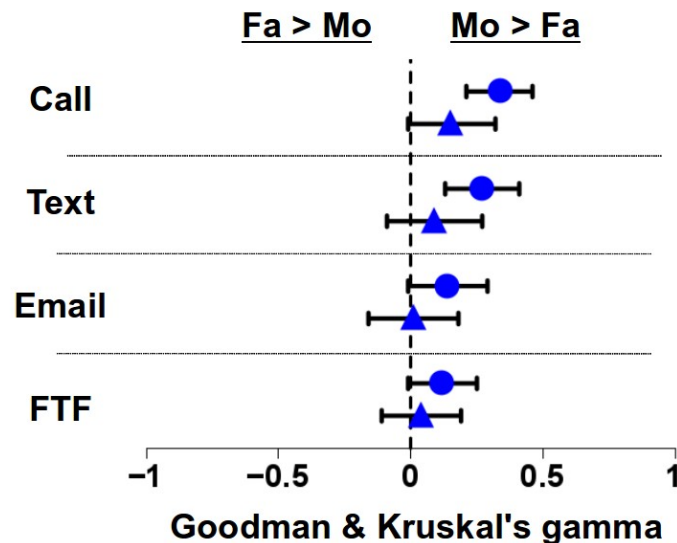

Figure 2. Relative frequency of communication with mother vs. father, by mode, USA survey. Circles represent women respondents and triangles represent men respondents. Bars show 95% conventional confidence intervals that do not account for the paired nature of the data. FTF = face-to-face. n = 146-219 across subsamples/modes.
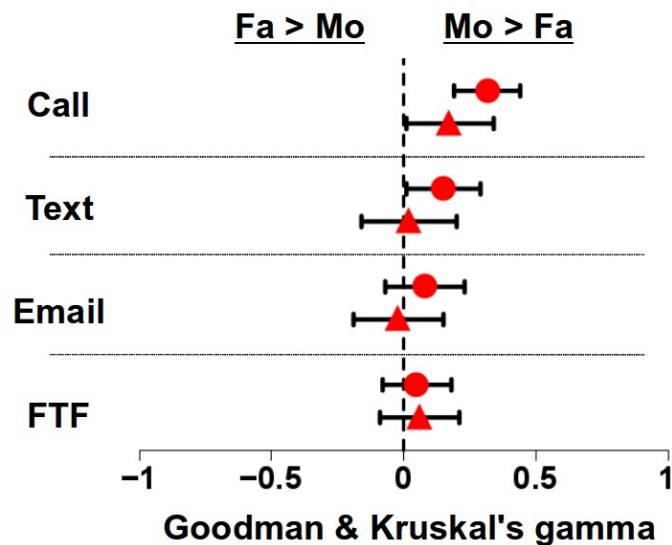
Figure 3. Relative frequency of communication with mother vs. father, by mode, Spain survey. Circles represent women respondents and triangles represent men respondents. Bars show 95% conventional confidence intervals that do not account for the paired nature of the data. FTF = face-to-face. n = 190-225 across subsamples/modes.

Communication with siblings

In the USA national survey, women were almost nine times more likely to have sister than brother in their top mobile phone contacts (31% vs. 4%), and men were slightly more likely to have sister than brother in their top contacts (18% vs. 15%) (Fig. 4). Table S6 in the supplementary material shows the precise relative risk values and corresponding confidence intervals.

Respondents in the USA national survey also reported communicating more with sister than brother, on average, by telephone calling, text, email, and face-to-face contact, respectively (Figs. 5 and 6). In nearly every case for respondents with one brother and one sister, the gamma correlations tended to be stronger (more communication with sister) for the call and text modes than for email or face-to-face. As expected, the bias toward communicating with sisters tends to be somewhat attenuated for respondents with three or more siblings in the USA survey and three or more siblings (with conditions) in the Spain survey (Fig. 7). For almost every mode, the gammas are stronger for women respondents than men respondents. Tables S7-S12 in the supplementary material show each of the contingency tables underlying these results as well as the corresponding precise gamma values and confidence intervals.

I did not compute sibling results for the Boston Marathon bombings app study because too few Boston respondents reported exactly one brother and exactly one sister (9 men and 13 women) for reliable estimates.
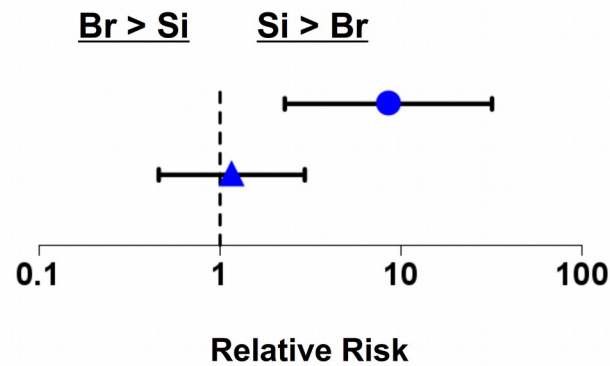

Figure 4. Relative likelihood of sister and brother being in respondents' top (most frequent) mobile phone contacts, USA survey. Circles represent women respondents and triangles represent men respondents. Bars show 95% confidence intervals for paired data (24,25). n = 39-55 across subsamples.
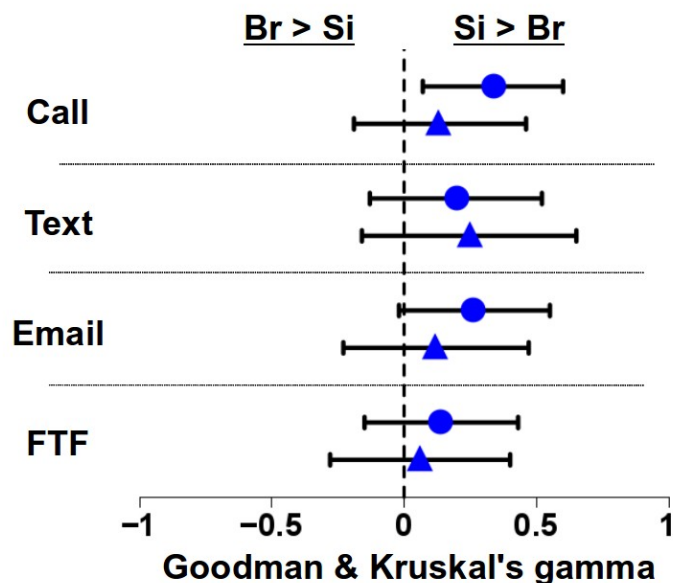

Figure 5. Relative frequency of communication with sister vs. brother, by mode, USA survey. Results for respondents with exactly one brother and one sister. Circles represent women respondents and triangles represent men respondents. Bars show 95% conventional confidence intervals that do not account for the paired nature of the data. FTF = face-to-face. n = 39-55 across subsamples/modes.
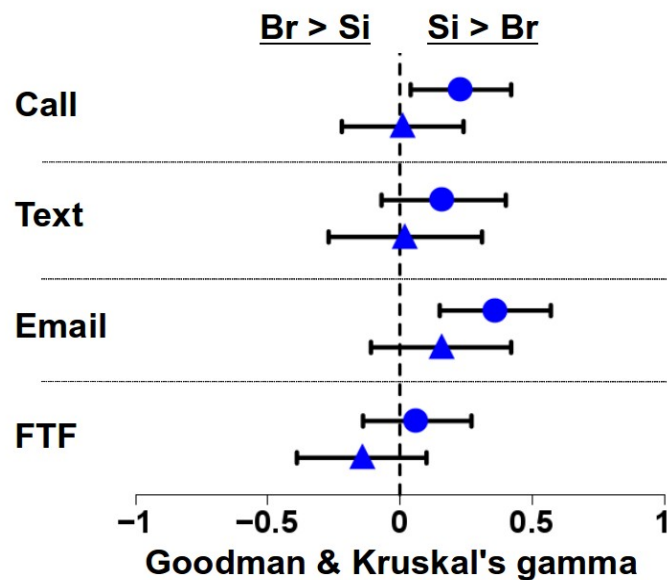
Figure 6. Relative frequency of communication with sister vs. brother, by mode, USA survey. Results for respondents with three or more siblings (including at least one brother and one sister). Circles represent women respondents and triangles represent men respondents. Bars show 95% conventional confidence intervals that do not account for the paired nature of the data. FTF = face-to-face. n = 66-119 across subsamples/measures.
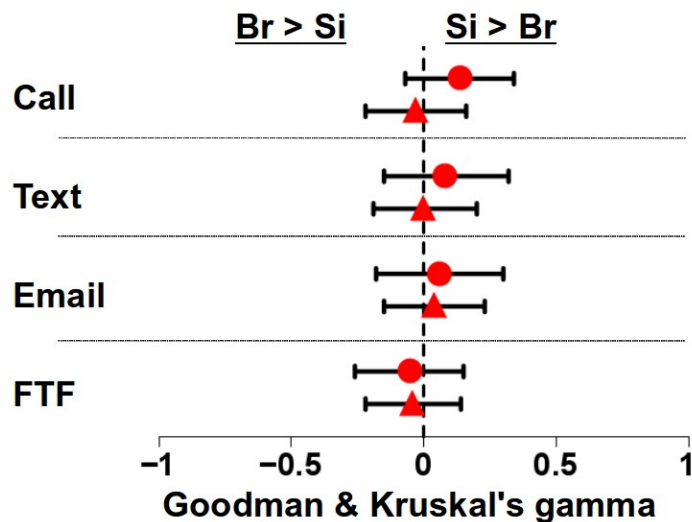
Figure 7. Relative frequency of communication with sister vs. brother, by mode, Spain survey. Results for respondents with three or more siblings (including at least one brother, one sister, and more brothers than sisters). Circles represent women respondents and triangles represent men respondents. Bars show 95% conventional confidence intervals that do not account for the paired nature of the data. FTF = face-to-face. n = 78-115 across subsamples/measures.

Overall volume of mobile phone calls and texts

In the USA national survey, men reported slightly more outgoing landline (gamma = .10, 95% CI -.06 to .26) and mobile (gamma = .15, 95% CI .04 to .27) phone calls per week than women on average, but women reported sending slightly more texts than men on average (gamma = -.15, 95% CI -.26 to -.04). Similarly, in the Boston Marathon bombings app study, men had mildly more mobile phone calls (mean = 59, median = 51) than women (mean = 46, median = 42; Hedges' g = 0.26, 95% CI -0.05 to 0.58), but women sent slightly more texts (mean = 219, median = 112) than men (mean = 185, median = 139; Hedges' g = -0.14, 95% CI -0.46 to 0.18). In the Spain national survey, men reported slightly to modestly more outgoing landline (gamma = .08, 95% CI -.04 to .20) and mobile (gamma = .29, 95% CI .19 to .39) phone calls than women on average, and slightly more texts as well (gamma = .13, 95% CI to .24). Tables S13 to S18 show the cross-tabulations for the national surveys.

Discussion

Respondents in the USA and Spain communicated mildly to moderately more with mother than father and more with sister than brother. The differences in communication with mother and father appeared in both subjective survey data and objective mobile telephone records. The within-family nature of my analyses ensures that the results are not confounded by family

composition or any associated respondent- or family-level variables. In each study, women made fewer telephone calls than men on average; in the USA studies, women texted slightly more than men, but in Spain, men texted slightly more than women. This means that the results on communication between kin cannot be explained by women simply communicating more by telephone in general than men. Matricentric and sororicentric tendencies were larger for the modes likely to involve dyadic communication (telephone calling, texting, and to a lesser extent, emailing). In contrast, face-to-face communication among kin often occurs in group settings (3 or more persons present), which may dilute the communicative significance of any particular dyad in that context. The tendency to communicate more with female than male kin also appeared to be stronger in women respondents than in men.

The gynocentric (6) communication patterns I observed among nuclear kin are consistent with longstanding Western cultural norms as well as the ultimate evolutionary impact of paternity uncertainty. Children can be more confident of their biological relation to their mothers than their fathers (and mothers can be certain of their relation to the children, while fathers cannot). Similarly, siblings can be more confident of their biological relation to their sisters' (future) offspring than to their brothers' (future) offspring, and thus investment in siblings might be expected to flow more to sisters than brothers. Investment in nieces and nephews, especially in the most crucial childhood years, occurs through siblings. It is difficult to invest in nieces and nephews without also communicating with and investing in siblings (the parents of those nieces and nephews). Of course, if the observed communication patterns represent differential investment and reflect evolved adaptations to paternity uncertainty, it is not necessary for individuals to be aware of their evolutionary foundations or logic for this explanation to be valid. It is probable that other cognitive and emotional drivers (such as fulfilling cultural norms, "feeling more comfortable", greater liking, or interpersonal style) are the proximate mechanisms that produce differences in behavior.

Communication frequency is not necessarily a direct indicator of investment in evolutionary terms. However, communication is typically necessary for providing other forms of investment, and the research I reviewed in the introduction shows that contact follows the same patterns as expected by theory as other measures of investment. Moreover, it would seem that communication during a crisis situation (such as after the Boston Marathon bombings) reflects investment.

Structurally, women's kin ties seem to play bridging roles in families and women are in positions to control the flow of information within families. My results reinforce long-held beliefs regarding the importance of involving women in any interventions in which information is intended to diffuse through families.

Although the samples in the national surveys were diverse and broad-based, they were not probability samples of adults in these countries. A further limitation of my results is that they are based on respondents who were literate Internet users.

To evaluate evolutionary hypotheses about communication among and investment in kin, more cross-cultural tests are required. Studies in patrilocal and/or patrilineal societies would be especially valuable. In a meta-analysis, Strassmann and Garrard (26) showed that "...even in patrilineal societies, living maternal grandparents are more positively associated with grandoffspring survival than living paternal grandparents" (p. 216-217). This suggests that the influence of paternity uncertainty on patterns of social and other support among kin may be universal, regardless of a society's descent system. Cross-cultural tests that include measures of communication by mobile phone may be very informative, because mobile phone communication is not necessarily constrained by living arrangements, geography, or descent systems. Future research might also profitably focus on other kin roles, such as children and cousins. Moreover, it is worth investigating whether other dimensions of communication, beyond frequency, can distinguish among kin and other roles of communicants in both objective and subjective data.

Acknowledgments

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