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Research Article

Heterophily in rural Malawi: A small-area observational study of social interaction

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Abstract

BACKGROUND
A rich layer of empirical research detailing the effects of social networks on attitudes and behavior has accumulated in demography over the last 20 years. But there is limited data on social interaction in general, and odd inconsistencies between network data and observational data in terms of the level of heterophily.

OBJECTIVE
To document actual social interaction and identify covariates of two types of heterophilous interaction – with a person of the opposite sex and a member of a different extended family.

METHODS
Over a nine-hour period, all social interaction of a sample of 48 adult men and women in a single village in Malawi's Central Province was logged (N=1811), along with interactant characteristics. Analysis focuses on heterophilous interaction across gender and kin lines. Two-level mixed models explore covariation between types of interaction and characteristics of interactants and setting.

RESULTS
There is heterogeneity in interactional patterns across individuals, lengthier interactions with kin (than non-kin) and unrelated confidants, a crowding-out effect of large families on interaction with non-kin, fewer but longer interactions among men than women, and more frequent cross-gender than same-gender interaction.

CONCLUSIONS
Differences between reported social networks and observed social interaction raise questions about how well standard conversational network data capture actual patterns of social interaction, whether observed patterns may analytically substitute for, modify, or interact with conversational network effects. The collection of actual interactional data should be scaled up to address these questions.

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1. Introduction

Over the last two decades a rich layer of empirical research detailing the effects of social network on attitudes and behavior has accumulated in demography, especially in studies of fertility and AIDS in sub-Saharan Africa (Valente et al. 1997; Kohler, Behrman, and Watkins 2001; Montgomery et al 2001; Helleringer and Kohler 2005; Kohler, Behrman, and Watkins 2007; Avogo and Agadjanian 2008; Agadjanian and Menjívar 2008). While laudable for embedding measurable aspects of social structure in behavioral models and generating more accurate estimates of program effects, this literature does have at least one problem: it tends to gloss over an important conceptual and empirical distinction between social networks and social interaction in general. That is, much of the underlying theory and qualitative discussion within these papers – and in the broader literature on network effects (Montgomery and Casterline 1996; Watkins 2004) – is framed in relation to ideas about social interaction, whether the mechanism is a conversation about one's own private affairs or gossip about a third party. But actual empirical measures tend to be more circumscribed, typically limited to only four conversational network partners generated with a topic- or domain-specific name generator.[2] The result is that quite a bit is known about the characteristics and composition of these "local" networks (Weinreb 2003; Helleringer and Kohler 2005), and these have demonstrated causal effects on a range of fertility and health-related outcomes (all papers cited above). Yet even where these network data are supplemented by findings from related literatures on kinship and friendship (Smith 1954/1981; Bollig 1998; Bell and Coleman 1999; Adams and Plaut 2003; Grätz 2004), bilingualism, codeswitching, and salutations (Myers-Scotton 1995; Kezilahabi 2001; Ferguson 2003; Thetela 2003), and intergroup relations (LeVine and Campbell 1972; Dixon and Reicher 1997; Collier and Bornman 1999), there remains a dearth of data on actual social interaction. Consequently, we may understand certain things about social interaction, including how it is enacted linguistically, why men in Africa are generally more multilingual than women, and how the strength of situational fluctuations in ethnocentrism affects the frequency and quality of inter-group interaction. But there is no single developing country setting – a similar assertion cannot be made about the US (see Fischer 1982, 2011) – where we can say how many people a given individual interacts with, how many are kin of various types as opposed to unrelated friends, how many are local as opposed to outsiders, how many are the same sex, and so on.

[2] This type of name generator was used by the Malawi Diffusion and Ideation Change Project (MDICP), the main source of network data in African social demography (in later waves renamed the Malawi Longitudinal Study of Families and Health-MLSFH). An introductory question asks "How many people have you chatted with about family planning [or in different waves, AIDS, religion]? I mean people other than your children, husband, or partner." A follow-up then requests "Could you please give me the names of four of these?" A series of questions about each of these reported network partners is then asked.

This paper describes a small-area study that was designed to fill this gap. Fielded in a single site in rural Malawi, close to a research site of the Malawi Diffusion and Ideation Change Project (MDICP), the study employed a simple observational instrument whose general goal was to document actual patterns of social interaction and, in so doing, generate data on a person's "total set of relationships" (Mitchell 1968: 56). Two specific goals followed from this, each rooted in established findings in the social networks literature. The first was to estimate the prevalence of two types of heterophilous social interaction: with a person not of the same gender, and with a person not from the same extended family. The second was to look at correlates of variability in these patterns of interaction, focusing especially on the effects of wealth and household size on the likelihood of heterophily.

The paper proceeds in three sections. After describing why such research is important, the setting, data, and data collection, a first series of models evaluates the frequency of the three types of heterophilous social interaction, and describes some characteristics of heterophilous interaction in terms of respondents' and interactions' attributes. A second series of models introduces complex variation to evaluate how much these effects on heterophilous interaction vary across individuals, and across different combinations of interaction:interactant dyads. Overall, results point to considerable heterogeneity in interactional patterns across individuals, lengthier interactions with kin and unrelated confidants than non-kin, and a crowding-out effect of large families on interaction with non-kin. More important for our purposes, they also point to profound deviations from conversational networks data on the frequency of cross-gender interaction, as well as interactions between gender and length of interaction, and relationship to the frequency of non-kin interaction. In particular, same-sex interaction occurs less frequently than interaction with the opposite sex, and same-sex interactions are fewer but longer in duration among men than women.

2. Importance

The lack of data on actual social interaction is a potential problem for research in demography and related health-related fields for two reasons. First, there is a significant mismatch between impressions of social interaction in SSA gleaned from these types of conversational network data and those that arise out of informal interviewing, observation of public space, and "conversational journals kept by cultural insiders" (Watkins and Swidler 2009). Table 1 summarizes characteristics of network partners from two waves of the Malawi Diffusion and Ideation Change Project (MDICP/MLSFH), the main source of network data in African social demography. It presents the percentage of network partners who are the same sex as the respondent, kin

to the respondent, and who live in the same village as the respondent. Separate estimates are given for female and male respondents, and by topic or domain referenced by the name generator used to stimulate the list of network partners: "family planning" and "AIDS" in 2001, and "religion" and "AIDS" in 2004. Based on these data, social interaction looks overwhelmingly homophilous in terms of gender for both women and men. This is particularly true for women on the topic of family planning – in these MDICP-II data 98% of the 5,400 network partners named by women respondents were women. Even where the topic is religion (MDICP-III), an area of day-to-day activity which in this setting has high levels of male and female activity and interaction (Yeatman and Trinitapoli 2008; Trinitapoli and Weinreb 2012), 89% of women's network partners were also women. Table 1 also shows that most of the women's network partners live in the same village, irrespective of topic, and overall most of the men's partners do as well, though this drops below 50% of partners in 2001 (AIDS network) and 2004 (Religion network). Finally, these conversational network data suggest that a substantial portion of social interaction is with kin, though the reduction in percentages across the AIDS conversational network points to a broadening of interaction beyond familial boundaries.[3]

Table 1: Background characteristics of women's and men's named conversational partners, by sex of respondent, topic used in name generator, and year of data collection

% of network	Women – 2001		Women – 2004		Men – 2001		Men – 2004	
	Family Planning	AIDS	Religion	AIDS	Family Planning	AIDS	Religion	AIDS
Same sex	98.1	93.3	89.4	92.7	85.3	94.8	93.5	93.5
Kin[1]	45.2	44.0	33.8	36.5	38.9	33.0	25.3	28.7
Lives in the same village	69.1	58.9	58.7	61.7	55.1	48.0	43.6	61.7

Source: Malawi Diffusion and Ideation Change Project: wave II (2001) and wave III (2004)
Notes: [1] Non-kin includes health workers and religious leaders.

To researchers who have spent time on the ground in these areas of sub-Saharan Africa, the kin- and village-related distributions sound reasonable. But the overwhelming gender homophily does not, especially on topics – like religion and, increasingly, AIDS – that are only moderately gendered. Strict gender homophily is

[3] These characteristics of conversational network partners are not specific to Malawi. A parallel project in Kenya elicited very similar distribution. Among women respondents, 94% of family planning network partners were women and 54% lived in the same village (Kohler, Behrman, and Watkins 2001).

inconsistent with research on premarital relationships in Malawi (Poulin 2007), observations at local churches in which women take leadership roles, and the ways in which non-familial modes of support are organized (Trinitapoli and Weinreb 2012: 169–185). Perhaps most important, the overwhelming gender homophily is completely contrary to the frequency and tenor of cross-gender interaction reported in a series of journals written between 2000 and 2007 by local residents elsewhere in Malawi (for a description, see Watkins and Swidler 2009).[4] Although AIDS-related themes are the intended focus of many stories in the journals, especially in the early years, the conversational context in general is casual, with easy laughs and easy sharing of social space, even with people of the opposite sex. There is no hint, in other words, of the strict gender separation implied by the conversational network data. Nor are there many hints of social discomfort when gender boundaries are breached.

The second reason that this dearth of data on actual social interaction, and the apparent mismatch between reported conversational networks and actual social interactions, might be a problem for demography is a type of identification problem. As we develop more complex relational models of behavior, the relative lack of data on actual social interaction may impede our ability to accurately identify the interactional boundaries which circumscribe marriage markets, support networks, and a range of other relational phenomena that shape demographic outcomes. It is important to identify those interactional boundaries accurately because they demarcate the pathways – followed by some, crossed by others – along which an array of ideas and materials flow: information and moral messages on the one hand; pathogens on the other.[5]

3. The setting

The study was fielded in a single village in Mchinji District, in Malawi's Central Province. Nestled between Tanzania, Mozambique, and Zambia, Malawi is a useful national setting for a study of social interaction in sub-Saharan Africa. First, its relative poverty – in 2008 its Gross National Income Purchasing Power Parity (GNI PPP) per capita was 830 USD (2008), relative to an East Africa average of 1,030 USD (Population Reference Bureau 2010) – and absence of a formal insurance system (public safety net) strengthens the centrality of both the broader extended-family network and non-familial networks of friends. Both historical and contemporary

[4] Links to many of these journals can be found at: http://malawi.pop.upenn.edu/malawi-data-qualitative-journals.

[5] To some, this boundary-crossing is a deviation from an inward-looking, homophilous mode of interaction (Jacobsen 1973; Bell and Coleman 1999), a deviation that is rooted in associational freedoms of modern *gesselschaften* communities (though see Coleman 2010: 201 on the "Occidentalism" of this view).

sources point to the importance of these systems in Malawi (Frazer 1914; Young 1932/1970; Mitchell 1956; Hirschman 1990; Mtika 2000; Weinreb 2002). Second, since Malawi achieved independence in 1963 it has been spared the civil wars which have affected, at one time or another, many other countries in sub-Saharan Africa. This relative political stability has likely had implications for social interaction in general, since it means that there are no deep-seated ethnopolitical barriers to interacting with outsiders, as is found in many other African settings (Kaspin 1995; Horowitz 2000).

Within Malawi, the specific site of the study – Kayesa village, Mchinji District, in Malawi's Central Province – has two advantages. First, it can be considered broadly representative of villages in the area. At the time of fieldwork it had 43 compounds, two-thirds of which had at least two independent homes, and was spread around a 0.27km^2 area surrounded by agricultural land. In terms of size, this places Kayesa roughly in the middle of the distribution of other villages in the MDICP's Central Region sample. Likewise, in terms of characteristics that might affect interactional patterns, whether across gender or kin boundaries, Kayesa was broadly representative: every household in the village collected water from a single water pump; and there were no churches, stores, or other formal businesses within the village, but there were several within a couple of kilometers, mostly on the main artery linking Lilongwe with Zambia, which is a kilometer from the village. More generally, this means that Kayesa is neither completely isolated nor close to one of the major cities. Rather, it is an hour and a half drive from Malawi's political capital, Lilongwe. It is also about four kilometers from the local district capital (Mchinji town). Kayesa therefore offers good variation in interactional characteristics, reflecting both traditional village-centered activities and increasing social and geographic mobility.

Kayesa's second major advantage is that it is about 30 kilometers from one of the three study sites of the MDICP, whose baseline data on conversational networks were used in Table 1. Like most of those MDICP villages, Kayesa is an ethnic Chewa village. Together, these two factors make for a reasonable comparison on cultural grounds, with the physical distance from the MDICP site sufficient to have avoided effects associated with repeated visits by MDICP research teams.

4. Data

Since the data used in this paper – and associated data collection methods – are relatively unusual, description of fieldwork is more extensive than normal.

4.1 Data collection process

The study involved the direct observation of social interaction among a sample of 48 adults, 24 men, 24 women; all residents of Kayesa Village.[6] All 48 individuals were shadowed for one day each for nine hours by one of four local 'observers', each of whom was given a list of sampled names and their compounds. Observers approached one of the people on their list first thing in the morning – they were allowed to dictate the order based on the organic field situation – and asked if they could spend the day with them. Where an observer could not find that person, s/he made an 'appointment' through a family member for a different day and then moved on to the next person. The nine-hour observational period varied from 8:00 to 17:00, or 9:00 to 18:00.

Each person who participated in the project received a small gift, a 1kg bag of sugar, as a token of appreciation. This was in addition to the observers helping them with whatever tasks they happened to be doing (though observers did not announce that they would help while introducing themselves in the morning).

4.2 The instrument

Using a simple observational instrument, observers recorded every interaction involving verbal communication between the sampled individuals and some other adult or adolescent across the nine-hour period. Interactions with those who looked younger than age 10 were not recorded (out of concern that the young age-structure in this population would yield too many interactions to record accurately). Across the 48 sampled individuals, this yielded a dataset of 1,811 interactions (range from 19 to 62) with 774 unique interactants (range from 5 to 41). These included everything from the exchange of simple greetings to long conversations. Nonverbal signaling was not recorded.[7]

[6] Respondents were selected using a spatially randomized sampling procedure that took advantage of Kayesa's location at the foot of a tall hill. A series of photographs of the village were taken from that hill and digitally merged. All homes, some of which were stand-alone houses, others clustered in compounds, were then sampled from that list. This image was combined with a list of individuals provided by the village headman (in this case, unusually, a headwoman), allowing for a randomized distribution of interactants to the four observers, while matching on gender. Subsequent checks showed that the headman's list was spatially random. That is, the people on her list were not more likely to be resident in one area of the village than in another.

[7] Though treating non-verbal signaling and active avoidance/ignoring other people as types of non-interaction is not ideal, it is often difficult in practice to identify when an individual is doing one thing rather than the other. Moreover, verbal interaction demands proactive signaling between two individuals, so is different in a fundamental way from either one-way attempts to interact or more subtle forms of mutual nonverbal interaction.

Figure 1: Single page of the interaction log

Social Interaction Observational Pilot Mchinji area, Aug – Sept 2007 Page __ of __

`		1	2	3	4	5	6	7	8
INT	Interviewer								
RESP	Respondent ID								
TIME1	Time meet								
PLACE	Where interaction occurred								
I_ID	I's code								
TYPE	Type of interaction								
TIME2	Time part								
GEND	I's gender (M or F)								
REL	I's relationship to R								
VILL	I's village								

CODES

PLACE (where interaction occurred)	**REL** (I's relationship to R)			**VILL** (I's village)
1 = in own compound	02 = wife/husband	10 = pat. aunt/uncle	18=step-parent	1 Same as Responden
2 = errand in village	03 = son/daughter	11 = mat. aunt/uncle	19= HH help/relative of HH help	2 Different
3 = errand out of village	04 = father/mother	12 = sister/brother	20 = Unrelated confidant/friend	
4 = market	05 = grandchild	13 = pat. niece/nephew	21 = Unrelated acquaintance	
	06 = grandparent	14 = mat. niece/nephew	22 = religious leader	
TYPE (Type of interaction)	07 = moth/fath-in-law	15 = paternal cousin	99 = other (SPECIFY)	
1 Just greetings	08 = son/daughter-in-law	16 = maternal cousin		
2 Short conversation	09 = broth/sist-in-law	17=step-child		
3 Long conversation				
4 Argument	**ACTIVITY LOG**			

The instrument itself had two parts. The cover page collected basic sociodemographic information about the respondents themselves. The main body of the instrument was composed of an 'interaction log', one sheet of which is depicted in Figure 1. Each interaction generates a small series of data points in a single column. These included the following information about both the interaction and the interactant:

- the time the interaction began and ended (hour and minute);
- where it was initiated (in the respondent's own compound, elsewhere in the village, outside the village);
- selected characteristics of the interactants (their gender, type of relationship to the observed individual, and whether or not they were from the village).

4.3 The observers

Four observers collected the data: two men and two women. All four were secondary school graduates in their early 20s who grew up in villages in the area, and three of the

four remained village residents, though not in Kayesa Village (the fourth resided in Mchinji town). Note that local observers were used both for practical reasons – they were more readily available and less costly to employ than observers from other areas – and for methodological ones. In particular, I assumed that local observers would generate less instrumentation bias than outsiders, since being more familiar with local codes and even having acquaintances in common with those they observed, they would be less likely to alter the interactional climate than an observer from outside the area. This approach is in line with methodological studies in other developing country settings that show how "reactivity" to observers' presence attenuates with each additional visit (e.g., Cousens et al. 1996 in Burkina Faso; Gittelsohn et al. 1997 in Nepal; Weinreb 2006 in Kenya).

After a single day of training, each of the observers then conducted 12 days of observation, working Monday to Saturday.[8] In all cases, sampled men were assigned to male observers, and sampled women to female observers. They were also instructed to dress as if they were working in their own village, both to reduce the extent to which they could signal their relatively elevated social status – enumerators and interviewers in these settings typically have higher than average education – and to facilitate their own participation in ongoing tasks, some physical and onerous.

Finally, observers were closely supervised at all stages of data collection. They were debriefed as they exited the village at the end of each day, sharing their experiences with each other, the project investigator, and the project's RA.

4.4 Data limitations

The data generated by this log clearly have their limitations. The major one is sample size and coverage: only 48 individuals were observed for a nine-hour period on a single day. Even with zero unit non-response – all 48 people in the sample agreed to be observed – reasonable questions can be raised about how accurately that single day of observation represents all interaction in this setting. Our assumption is that these observational data may be slightly biased toward residents who tended to be more local on the day of observation, though it is only slight since observers were explicitly instructed to go with the respondent wherever they were going – on a few occasions this included to the market in the local town. To the extent that this is the case, they may

[8] Training only took one day because the observation log was a very simple instrument and all four observers had some experience working on interview-based research projects. Most of the training day was devoted to extensive role-playing in order to standardize how different types of interaction should be coded. Observers were also instructed how to introduce the project: that its core goal was to learn how people in this area spend their day, and the types of people with whom they have any contact.

marginally overestimate the proportion of interaction that is conducted with kin and village co-residents. But there should be even less effect on the gender breakdown of interactants.

A second limitation is that interactions between respondents and younger children, that is, those judged to be under 10 years of age, were not coded. This decision was rooted in two observations. First, this is a high fertility area so there are lots of children, some of whom invited interaction. Younger children, in particular, also follow visitors around the village, which would inflate estimates of interactions. Second, since the emphasis in the social networks literature is on interactions between adults or adolescents, allowing for interactions with younger children would artificially inflate the amount of interaction that occurred in households with small children.

A final potential source of concern is that the instrument missed new forms of interaction like mobile phone texting (SMS), though cost issues mean that in this setting texting is used more for sending specific pieces of information, reminders, and resources than for casual interaction (Cole-Lewis and Kershaw 2010; Vincent and Cull 2011). Finally, the observer's presence may have prevented the occurrence of any 'illicit' interaction, of the type that is infrequent but extremely meaningful in the person's own life, or as a determinant of behavior important to certain areas of research. An obvious example is secretly meeting a lover.

The only setting in which observers reported having problems using the interaction log was at the market. This directly resulted from our insistence that the observers include all interactions in the log, even greetings, much more difficult in highly crowded settings. For example, during a visit by the country's President (Bingu wa Mutharika), many people made their way to town. Of the 42 interactions observed in market settings during the two-week observation period, 28 of them occurred on that single day. Moreover, whereas visits to the market resulted in an average of 3.5 observed interactions on other days, the two people who went to the market on the day that the President visited averaged 14 interactions each at the market. This is in addition to interactions while traveling to and from the market.

4.5 Data quality

Since estimates from this project cannot be compared to those from any other project, there is no way to evaluate data quality directly. However, there are several indirect signs that overall data quality is high.

First, although observers made significant demands on respondents' time – shadowing them for nine hours – there was no resistance to participating in the research project, whether expressed overtly as an outright refusal, or more covertly by attempts

to avoid the observers or claiming to be too busy. Qualitative measures of respondents' satisfaction with their observers can also be seen in the food, fresh or cooked, that observers frequently brought to the debriefing at the end of the day. These were gifted by the respondent in addition to a 'free lunch', largely in return for having helped respondents with some task like shelling maize for the women and a building-related task for the men. Some of these tasks were quite demanding physically. One day I found one of the male observers, sweaty and shovel in hand. With his shirt and interaction log placed carefully to the side, he was helping his respondent dig a new pit latrine. Another day, the same observer came back caked in mud: he explained that his respondent was a brick-maker.

A second sign of data quality can be found in observers' reports that data collection in general made sense to respondents, both in terms of the overall aims of the project and in terms of the specific data points. This is not always the case in data collection projects in developing-country areas. On the contrary, there is considerable confusion about the exact function of many research questions (Stone and Campbell 1984; Weinreb 2006).

Third, the observers reported that the interaction log was generally easy to use. Consistent with this, the observer seldom asked how to code a particular piece of information or, more generally, how to resolve problems. Likewise, there were very few errors in the raw data (e.g., item non-response or missing codes), and, since data entry was conducted in the field, those few problems which did exist were caught early, making the data easy to 'clean' without having to make daring leaps of inference (Leahey et al. 2003).

Overall, then, the impressions that arise from field reports are overwhelmingly positive. The observers were accepted, the project made sense, and in all normal interactional settings the specific instrument was easy to use. More generally, these factors highlight one of the crucial differences between the observational approach used here and the standard survey interview format. Observers were able to make much more significant demands on respondents' time than standard interviewers. This not only stems from the fact that, while being observed, respondents did not have to sit and answer questions and do so privately – the confidentiality assurances used to reassure survey respondents were far less relevant in this observational study. It also stemmed from the fact that observers actually participated in their respondents' labor, enhancing solidarity. Far from being a burden, they were actually a help. This has larger implications for the way that survey-related fieldwork is conducted, particularly in non-western settings. It suggests that even if the type of questions that observers are able to ask are somewhat more limited than those of a survey interviewer with a completely structured instrument, it may be profitable for survey researchers to adopt some characteristics of the observational format.

5. Analyses

Analysis is divided into three main sections: describing the baseline frequencies of interactions across the gender, kin, and spatial dimensions; identifying the covariates of gender and non-kin heterophily; and exploring how types of interaction vary across the characteristics of interactants, setting, and the interaction itself.

5.1 Baseline distributions

The unadjusted frequencies of different types of interaction across the three dimensions are presented in Table 2. Two main gender differences can be seen. First, across the 1,811 interactions there are considerably more interactions involving women (22%) than men (14%). Yet this pattern is inverted when we focus on the 744 unique interactants – to 14% and 19%, respectively. This suggests that women have more interaction in general, but men's pool of interactants is larger. Second, in sharp contrast to the overwhelming gender homophily in conversational networks data reported in Table 1, both men and women in this sample have more observed interaction across gender boundaries than within it. This is true whether one is looking at all interaction (63% crosses gender lines) or all interactants (66%).

Turning to interactions with kin or non-kin, the overall distribution of interactions is equally divided (50% and 49%, respectively). This pattern changes somewhat when the focus moves to the distribution of the 744 observed interactants: 59% are not kin.[9]

Finally, on the spatial dimension, 47% of the 1,811 observed interactions occurred while respondents were in their own compound, and another 40% while they were running an errand in the village. In addition, 87% of interactants were from the same village as the respondent. In other words, in terms of place of interaction and the interactant's own residential characteristics, social interaction remains largely village-centered. Only 14% of all interactions occurred outside the village (this includes the 2% observed while respondents were at the market). These distributions do not substantially change when the focus switches to interactants. If anything, the village's status as primary location of interaction is emphasized further.

[9] Although the limited sample size makes us wary of emphasizing differences across categories of kin, they are interesting. Across these categories, the five most common types of interaction occurred, respectively, with brothers or sisters-in-law (7.4%), own brothers or sisters (5.4%), own children older than 10 (4.5%), maternal uncle or aunt (4.2%), and spouse (3.5%). Interactions with other types of relative often deemed important – own parents, parents-in-law, paternal uncles and aunts, nephews, nieces, cousins – are less common. Likewise, slightly less than half of interaction with non-kin was with friends or confidants (as opposed to acquaintances).

Table 2: Number of interactions (N=1,811) and interactants (N=744), by selected dimension

	All interactions(1)		Interactants(2)	
	N	%	N	%
Respondent-interactant gender				
Female respondent, female interactant	400	22.1	109	14.1
Female respondent, male interactant	573	31.6	328	42.4
Male respondent, male interactant	256	14.1	149	19.3
Male respondent, female interactant	582	32.1	188	24.3
Respondent-interactant relationship				
Kin	914	50.5	316	40.7
Non-kin	897	49.5	458	59.2
Location interaction initiated				
in own compound	845	46.7	328	42.4
while running errand in village	716	39.5	355	45.9
while running errand out of village	208	11.5	71	9.2
while at the market	42	2.3	20	2.6
Interactant's village				
The same as the respondent's	1,570	86.7	671	86.7
Different to the respondent's	241	13.3	103	13.3

Notes: Percentages may not sum to 100 due to rounding

(1) Includes multiple interactions with the same person across the observation period.

(2) Each interactant is only counted the first time.

5.2 Covariates of gender and non-kin heterophily

Two sets of analyses are conducted. The first identifies the factors that are associated with heterophilous social interaction. That is, to what extent interaction with a person of the other gender or with non-kin is affected by both informants' and interactants' characteristics (for example, their gender, age, relationship to each other), and by the characteristics of the interaction itself (e.g., its length and location). A second analysis evaluates whether there is complex variation – for example, signaling heterogeneity in individual sociability – in these types of heterophilous interaction.

5.2.1 Crossing gender and kin boundaries

To identify the factors associated with the likelihood that a given interaction crosses gender and kin boundaries, a series of two-level mixed models were specified that differentiate the variance structures at the level of interaction and the level of the individual.[10] Initial variance components models confirm the validity of this approach. Although only 4% of the total variance (*rho* = .043) on "interaction with same gender" is at the level of the individual – that is, across the 48 individuals as opposed to their 1,811 interactions – that proportion leaps to 12% of total variance on "interaction with kin." Subsequent likelihood-ratio tests confirm that these two-level models provide a better fit than linear regression.

Results of the analysis are presented in Table 3. At the individual level, they confirm that there are some commonalities to both types of heterophilous interaction. For example, men are more likely to have been observed crossing both kin and gender boundaries. The estimated logits translate into increased odds ratios (OR) for men of, respectively, 1.22 and 1.08. A somewhat negative effect of age can also be seen (though it is only borderline significant in relation to non-kin interaction), and a negative effect of being separated or divorced.

Other observed effects tend to be quite different across all types of explanatory variables. There is a negative association between estimated wealth and cross-gender interaction. There is also a notable difference in the average length of observed interaction. On one hand, it is negatively associated with having a non-kin interaction – implying that the more time someone spends with other people in general, the less time he or she has for non-kin. On the other hand, it is positively associated with having a cross-gender interaction – implying that the more time someone spends with other people in general, the more likely it is that he or she will have a cross-gender interaction.

[10] These two-level models are extensions of the variance components model, taking the general form

$$y_{ij} = \beta_0 + \beta Z_j + u_j + e_{ij} \quad (1)$$

where y is the dependent variable, β_0 the intercept, Z refers to a vector of explanatory variables, e and u level-specific residuals, and subscripts i and j index the interactions (N=1,811) and individuals (N=48), respectively. In this analysis, dependent variables are fit with a logit functional form.

Table 3: Predicted likelihood (logit) of interaction with unrelated individual (model 1) or person of different gender (model 2), by characteristics of individual, interactant, and interaction

	Not Kin (1)		Different gender (2)	
Individual's own characteristics				
Female	*reference*		*reference*	
Male	0.200***	(0.050)	0.077**	(0.038)
Age ≤27	*reference*		*reference*	
28-37	-0.035	(0.050)	-0.022	(0.038)
38+	-0.101*	(0.057)	-0.015	(0.043)
Never married	0.037	(0.100)	0.103	(0.077)
Currently married	0.074	(0.080)	0.119*	(0.062)
Divorced/separated	*reference*		*reference*	
Widowed	0.145	(0.168)	0.081	(0.132)
Wealth indicator	0.015	(0.027)	-0.044**	(0.020)
Number of observed interactions	-0.0005	(0.002)	0.0004	(0.002)
Interactant is				
from the same village	-0.346***	(0.034)	-0.034	(0.037)
a different gender	0.142***	(0.021)		
a spouse, parent, or child			-0.226***	(0.039)
a grandparent or grandchild			-0.152**	(0.065)
an in-law (parent of sibling)			0.036	(0.041)
an uncle, aunt, nephew, or niece			0.047	(0.044)
a sibling			-0.127***	(0.047)
a cousin			0.105**	(0.050)
an unrelated friend or confidant			0.233***	(0.031)
an unrelated acquaintance or uncoded	*reference*		*reference*	
Characteristics of the interaction				
in the individual's own compound	*reference*		*reference*	
errands in the village	0.308***	(0.023)	-0.022	(0.026)
errands outside the village/market	0.314***	(0.038)	0.025	(0.040)
Interaction length	-0.0012***	(0.001)	0.0011***	(0.001)
Constant	-0.256**	(0.127)	0.496***	(0.106)
Variance components				
Level-2 (individual) -- u_j	0.013	(0.004)	0.005**	(0.002)
Level-1 (interaction) -- e_ij	.175***	(0.006)	0.199***	(0.006)
Observations	1800		1800	
Number of groups	48		48	

Note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses

Interactants' characteristics and location of the interaction also affect these heterophilous interactions. Not surprisingly, non-kin interaction is much less likely to occur in one's own compound than in running errands in or out of one's village, and it is also much less likely to involve an interactant from one's own village (OR=0.71). On the other hand, non-kin interaction is also much more likely to cross gender boundaries (OR=1.15). Likewise, cross-gender interactions are, in relation to interactions with unrelated acquaintances (reference group), most likely to involve an unrelated friend or confidant (OR=1.26), and least likely to involve a close family member. Cross-gender interactions are not, however, affected by either the interactant's own place of residence or the location of the interaction.

5.2.2 Complex variation

To evaluate how much these effects on heterophilous interaction vary across individuals and across different combinations of interaction:interactant dyads, a secondary series of models was specified that explore 'complex variation'. Instead of assuming constant residual variances (as in Table 3), these models allow the residual variance to covary with one of four explanatory variables. The models build on results in Table 3. In model 1, for example, it was noted that the likelihood of having an interaction with non-kin was positively associated with whether the interactant was of a different gender and whether the interaction occurred outside the individual's compound. Specifying variable-specific residuals on this model allows us to evaluate how much these estimated effects (on non-kin interaction) vary across the 48 sampled individuals. Similarly, by estimating the covariance between these variable-specific residuals and the residual of the constant term we identify whether these effects vary across different values of those explanatory variables. This can be treated as a measure of the reliability of estimated effects across different values of the explanatory variable for given individuals.[11] Overall, we expect to find such differences, since interactional patterns and preferences are a function of both observed characteristics (e.g., age, wealth) and of heterogeneity in sociability, whether the latter arises from an individual's dispositional

[11] These more complex variance structures are estimated by adding an explanatory variable β_{1ij} to (1). They allow us to differentiate the general residuals associated with the intercept from those that are specific to parameter $\beta_{1ij.}$ The specific model is:

$$y_{ij} = \beta_0 + \beta Z_j + \beta_{1ij} + u_j + e_{ij} \quad (2a)$$

where

$$\beta_{1ij} = \beta_1 + u_{1j} + e_{1ij} \quad (2b)$$

and terms u_1 and e_1 index residuals specific to the fixed parameter at the individual- and interaction-specific levels, respectively.

characteristics (e.g., Asendorpf 1990) or from prior experiences with social interaction (Stevenson-Hinde and Shouldice 1993).

Since the relatively small number of index individuals (N=48) means that there is insufficient statistical power to explore complex variation in the estimates associated with an individual's own characteristics (e.g., wealth, number of interactions in general),[12] effects are estimated in relation to three interaction- or interactant-specific variables, all of which, according to Table 4, are associated with heterophilous interaction. They are:

1. whether the interaction occurred outside the individual's own compound
2. whether the interactant is of a different gender (regressions on "interaction with non-kin")
3. whether the interactant is an unrelated friend (regressions on "interaction with different gender")

The random parameters from these models (estimated residual and covariance terms) are shown in Table 4. The fixed part of the model is not shown, since the parameters are almost identical to those shown in Table 3.

The top panel of Table 4 shows estimated random parameters from two discrete regressions on interaction with non-kin. Respectively, they show the residual of the constant term, a variable-specific residual, and the covariance between these two, on "place of interaction" and "interactant's gender" (models 1 and 2). The bottom panel of the table does the same in relation to two discrete regressions on "interactant is other gender". In this case, complex variation is specified in relation to "place of interaction" and "interactant is unrelated friend" (models 3 and 4). Since each of these models is nested in those shown in Table 3, χ^2 tests of the difference between the likelihood-ratios in these and baseline models are also shown. All four χ^2 tests confirm that adding complex variation enhances the explanatory power of these models in all four cases. That said, there are substantial differences across models in the range of variance terms that are significant. Specifically, the variable-specific parameter ("variance (X)") is only significant in three of the four models – both "place of interaction" models and the effect of "interaction is unrelated friend" on cross-gender interaction. And the covariance term is only significant in one.

[12] To confirm this, baseline models reported in Table 4 were replicated with complex variation in individual's wealth and sociability (i.e., number of interactions in total). As expected, none of the models formally converged, even allowing for 100 iterations and more restrictive assumptions associated with stable estimation strategies (maximum restricted likelihood versus maximum likelihood). Moreover, likelihood tests for difference between these unconverged models and the baseline models show that the addition of these random parameters does not improve model fit (results not shown but available from the author).

Table 4: Estimated levels of complex variation in selected explanatory variables. Base models are presented in Table 3

A. Dependent variable: Interaction with non-kin				
	Model 1		Model 2	
Random Effect (X) =	Place of interaction		Interactant's gender	
	Estimate	S.E.	Estimate	S.E.
variance (X)	0.029**	(0.010)	0.006	(0.006)
variance (constant)	0.012**	(0.005)	0.006	(0.004)
covariance	-.007	(0.005)	0.005	(0.004)
variance (residual)	0.169***	(0.006)	0.174***	(0.006)
Likelihood-ratio test (chi2)	32.3 (p>(chi2)=.0001)		6.30 (p>(chi2) = .043	
B. Dependent variable: Interactant is other gender				
	Model 3		Model 4	
Random Effect (X) =	Place of interaction		Interactant is unrelated friend	
	Estimate	S.E.	Estimate	S.E.
variance (X)	0.028**	(0.011)	0.017**	(0.009)
variance (constant)	0.012**	(0.005)	0.004	(0.004)
covariance	-0.015**	(0.007)	-0.004	(0.005)
variance (residual)	0.193***	(0.007)	0.196***	(0.007)
Likelihood-ratio test (chi2)	19.41 (p>(chi2)=.0001)		9.74 (p>(chi2)=.008)	

Notes: Likelihood-ratio test examines difference between this model and baseline 2-level model with no complex variation.

Models 1 and 3 – each of which incorporates complex variation in the effect of "place of interaction" – are the big winners in this model specification. In both, not only does the likelihood of interaction with non-kin (model 1) or the other gender (model 3) vary significantly across individuals, but also the effect of "place of interaction" on that likelihood varies significantly across individuals. In addition, the significant negative covariance between the two sets of residuals in model 3 indicates that the variance in the sum of random variables is partly contingent on the interaction between whether the interactant is another gender and the place in which the interaction occurred. Thus, where interaction did not occur in the respondent's own compound, the variance in cross-gender interaction is higher than where it occurred in the compound. In other words, estimates at higher values of the explanatory variable are somewhat less reliable.

The other substantively interesting case that emerges from Table 4 is in the final model. This shows that there is no general relationship between the two dichotomous variables – whether the interactant is a different gender and/or an unrelated friend – that cuts across all sampled individuals. Rather, the relationship between these two variables varies significantly across individuals.

6. Conclusions

Some of the interactional patterns observed in this analysis are consistent with initial expectations. Most notably, consistent with impressions gleaned from local ethnographic journals, people have a lot more cross-gender interaction than we would think based on conversational network data collected in nearby settings. Moreover, consistent with patterns of sociability in general, the more time people spend with other people in general, the greater the likelihood of cross-gender interaction; and the more time they spend outside their own compound, the greater the variance in cross-gender interaction.

Other results are less consistent with expectations, including other gender-related aspects of interaction. First, not only is interaction across gender lines much more frequent than interaction with someone of the same gender, in sharp contrast to the impression given by conversational network data. More surprising, interaction across gender lines occurs more frequently among the poor, and it also tends to last longer than interaction between people of the same gender, irrespective of age and marital status. Is this because the poor are less inclined to enforce gender boundaries? Or because they embrace a wider range of free pleasures? It is not possible to say with these data, but it is clear that the frequency and intensity of cross-gender interaction has implications for a wide range of demographic outcomes, especially those related to gender, marriage, fertility, and support networks. Equally important, if replicated in other settings it also suggests another source of gender differences in development outcomes. Put simply, if longer conversations allow more information about innovations or new opportunities to spread, then male conversational cultures in this setting are better suited to that information flow. Men, in other words, may have somewhat fewer interactions than women. But they talk to more people and their conversations are longer, allowing more time for the transmission of information.

In summary, the results reported here are informative in two distinct ways. They serve as a useful way to validate interactional claims inferred from other literature, in particular social networks literature. In so doing they raise questions about either the content validity of conversational network data as an indicator of social interaction in general, or the construct validity of those network data – little is known about how respondents choose which network partners to mention. Either one of these validity problems takes us back to the idea, asserted in the introduction, that we should make an empirical distinction between social networks and social interaction in general.

Important questions arise from this distinction. First and foremost, how much variation in fertility- and health-related behavior can be explained using measures of social interaction identified here, or other types of heterophilous interaction not examined in this paper – for example, heterophilous in terms of wealth, religion, or

ethnicity? Used alone, can measures of actual social interaction substitute analytically for the conversational network data? Or is there a particular type of conversational network partner who is both more behaviorally influential and more likely to be reported in network data, but who is seen too infrequently to appear in an observational log? If that is the case, then perhaps there is an interaction effect between influential conversational network partners and everyday interactants. For example, perhaps the strength of a conversational network effect covaries with the amount of social interaction, the length of conversations, or the frequency of different types of heterophily? If any of these are true, we can reasonably worry that estimated network effects are biased by omitting actual measures of social interaction.

None of these important questions can be answered using the data in this paper. But that was never the intent. The data used here were collected to demonstrate the feasibility of gathering usable data on actual social interaction. As models of behavior change in demography and related disciplines embrace more relational paradigms and analytic approaches, it may be time to consider incorporating small panels of observational data on actual social interaction. These need not mimic the simple instrument used here – which ignored the content of interactions, interactions with under-10s, interactions across new communication technologies, and almost certainly missed infrequent but deeply meaningful illicit interaction. But some version of an interactional log is eminently doable in terms of fieldwork. And, most important, by closing the gap between how we theorize social interaction and how we measure its effects analytically, documenting actual social interaction would further our collective substantive goals.

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