Research Article

Family Networks of Mobile Money in Kenya

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Abstract

This research examines the interplay between social networks and mobile money remittances in Western Kenya. Research was conducted in Kenya's Bungoma and Trans-Nzoia counties in 2012, 2013, and 2014, involving 12 family networks of between 8–70 people. Using small and frequent digital money transfers, relatives provide for household and emergency needs, contribute to ceremonies, and help pay school fees and medical bills. We find that digital money transfers follow and reinforce preexisting forms of emotional support and social relationships. In these families, the transfers strengthen maternal kinship ties as well relationships among siblings and cousins. Money networks are reciprocal, such that senders are also receivers, and individuals have many connections through which to access resources. Some individuals are "central" in networks, having more connections; others broker flows of e-value from one group of relatives to another. Mobile money strengthens social bonds but can also disrupt social relationships as when hiding digital value and remittances from in-laws or spouses.

Introduction

Mobile money services in Kenya have enjoyed exceptional success (Mazer & McKay, 2014). Digital money transfer using mobile phones is a part of efforts toward financial inclusion—extending banking services to the unbanked (Mas & Radcliffe, 2011; Maurer, 2012). Although bill payment, e-commerce, and banking services are increasingly available over mobile phones in Kenya, money transfer to friends and relatives is by far the most often-used service. More than 80% of rural households use money transfer (McKay & Kaffenberger, 2013).

This research examines the social relationships created and revealed—or obscured—by mobile money using the social network analysis (SNA) methodology and ethnography. Overall, our research finds that digital money is a part of the web of kin and community support, both following and reinforcing preexisting forms of emotional support and social relationships.

Money transfer networks are diverse in the types of kin who participate, underlining the importance of siblings, cousins, and parents, often mothers and maternal kin. Money transfer networks are based on reciprocal ties and show many connections among individuals. Some individuals are "central" in networks, having more connections to others; some are brokers. The direct and private nature of mobile phone communication reinforces close bonds among mothers and siblings, as it excludes others such as spouses and in-laws. In Western Kenya, as reflected in this study, e-money is less a *creator* of social relationships than an *amplifier* of existing practices of connection and exclusion.

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Geographic and Cultural Background

Bungoma County and Trans-Nzoia County, located in Western Kenya, have a predominantly rural character. In 2009, most (93%) Bungoma County households had land under cultivation, which was the primary source of income for 58% of households. More than half of the households owned a mobile phone, while 17% owned a television and 1% owned a car (Government, 2009). A survey of 414 households in Bungoma County found that 25% of adults had completed secondary school and 70% earned less than 5,000 Kenya shillings (KSh, equivalent to US$60) per month (Kusimba & Wilson, 2007).

Luyia-speaking people predominate in our study area. Historically, the extended family has provided access to resources such as land, cattle, and other shared assets. Family relationships have been sustained over time through bridewealth[1] exchange and patrilineal inheritance of land (Makila, 1978; Wagner, 1975). A woman's use rights[2] are usually to the land of her husband and his family, polygyny is common, and half-siblings who have shared several "mothers" are brought together by rights of residency, inheritance, and seniority (Wagner, 1975). Many women still access land through a male relative and may lose their access through divorce, death, or land sale and transfer (Budlender & Alma, 2011; Ellis et al., 2007; Nasimiyu, 1997).

In East Africa, longstanding cultural practices of reciprocity are based on informal and flexible networks of support, communication, and interaction among friends, relatives, and community members (Bollig, 1989; Hyden, 1983; Shipton, 2007).

Wage labor migration to cities began in the early 20th century (Atieno-Odhiambo & Cohen, 1989; Kilbride & Kilbride, 1997; Wandibba, 1997). For decades, remittances and gifts have sustained the connection between urban and rural kin, as visiting is expensive and the roads unsafe. Long before the age of mobile money, migrants from Western Kenya living in Nairobi sent money home with a traveling relative or via post or telegraph (Ross & Weisner, 1977). Today rural Kenyan households often combine subsistence farming, trading, wage work, and remittances as part of a "multiplex livelihood" (Bryceson, 2002, p. 2).

Research Questions

In Safaricom's well-known "Send Money Home" advertisement, an urban worker in suit and tie sends 1,000 KSh (US$12) to his grateful rural parents via mobile phone. Indeed, mobile money was introduced in Kenya with the urban-to-rural remittance market in mind (Morawczynski, 2009). Initially, this research project sought to examine how money transfer creates social and cultural relationships between urban senders and rural receivers. However, we soon discovered that the urban-to-rural dynamic has become part of far more diverse practices.

In early interviews we found that e-money connected friends and family members across varying settings and distances (Kusimba, Chaggar, Gross, & Kunyu, 2013). People were not only senders or receivers, but rather, participants in groups who circulate value—groups of siblings who pool resources for a father's medical needs, seamstresses or vegetable sellers who form a savings group, or community members who contribute to funerals (Kusimba et al., 2013). We adjusted our research question to ask the following: What kinds of social groups and social relationships do digital value circulations create and reveal? In this article we focus on family groups as one kind of group formed by money transfer.

Social Network Analysis

To understand the kinds of social groups and social relationships money transfer creates and reveals, we use social network analysis (SNA). The SNA methodology reveals insights into how networks are structured. A social network consists of a set of nodes (individuals in this case) and the ties among them (e-money transactions in this case; Wasserman & Faust, 1994). SNA provides a visual display of money transfer pathways. Furthermore, SNA statistics can tell us which individuals are most important in structuring the network, how many ties

1. Valuables such as cattle given to the bride's family by the groom's at marriage.

2. Socially recognized access to resources.

connect individuals, and whether the ties are reciprocal or unidirectional (Newman, 2010; Prell, 2011; Wasserman & Faust, 1994).

Related Work in Mobile Phone Communication

Mobile phones and mobile money carry high hopes for development (Maurer, 2012; Sen, 2010; Smith, Spence, & Rashid, 2011). In this article, we focus on their use in shaping direct personal ties with others (Ling & Campbell, 2010). Moroccan businesspeople call the creative, phone-aided process of social networking *bricolage* (Ilahiane & Sherry, 2012); in Jamaica *link-up* describes the periodic renewal of social ties valued in and of themselves (Horst & Miller, 2006). Mobile phones can strengthen relationships among a small group of intimates; it can also increase the number of people in an individual's "core network" of close ties (Ling, 2008; Ling & Stald, 2010; Palackal et al., 2011; Pertierra, 2005). In Kenya specifically, this strengthening of weak ties has been accompanied by an increase in the size of individuals' core networks such that they can more frequently access ties that are "dormant . . . or structural," such as kinship (Shrum et al., 2011, p. 624).

Although it is an instrument of connection, the mobile phone can also exclude and disrupt relationships with others (Gergen, 2010). The mobile phone "allows . . . a direct and indeed a very individualized medium . . . [to] maintain social networks" (Ling, 2004, p. 184). These individualized, often personal and private ties are disruptive in many African settings (Archambault, 2013; McIntosh, 2010). Mobile phone use has brought marital tension, sexual harassment, and even violence against women in areas of unequal gender relations (Burrell, 2010; Munyua, 2009; Wakunuma, 2012).

Money Transfer as Communication

Like mobile phone use, the money transfer service can profitably be seen as a form of communication, a perspective we develop in this article. In all cultures, gifts create and sustain social bonds and communicate the emotional and social meaning of relationships (Mauss, 1969). In Kenya, the social meaning of mobile value transfers is revealed in the ubiquitous practice of airtime gifting. Kenyans avidly send small airtime gifts of just a few cents to encourage a return call or communicate a flirtation, affection, or support. Safaricom's advertising uses the image of a sliced cake to encourage people to use its *Sambaza* (in Kiswahili: to spread) menu item to "Send airtime to friends and family!" Internet advertisements aimed at Kenyans in the United States encourage them to "Surprise loved ones in Kenya: Recharge their mobile—fast and easy transfer!" (Kusimba et al., 2013, p. 5).

In airtime gifting, the social value of a relationship is highlighted through a gift of small economic value (Cliggett, 2003). In turn, airtime gifts are converted into calls and connections.

Mobile money is a payment and transfer service that is distinct from airtime. Unlike airtime, mobile money is easily converted to cash or used for diverse forms of payment. In our study, mobile money involved value amounts at least 10 times larger than airtime gifts. Like airtime gifts, however, digital money transfer often accompanies the talk through which people create common lives over time, sharing their troubles, aspirations, and plans. E-money gifts mediate and enhance the social and emotional connections that phones allow and have diverse social meanings that we examine below. Finally, as we develop in this article, our work finds further evidence that mobile payments, as a form of mobile communication, have a dual tendency to strengthen networks and disrupt relationships.

Methodology

Since 1990 the senior author has been an in-law to one of the 12 families in the study. Several visits to the Kenyan communities of Kimilili and Naitiri have been made over the years, ranging in length from several weeks to several months. During a Fulbright Fellowship in 2009–2010 the senior author lived in Kimilili and first made contact with some of the families who participated in this research. In July and August of 2012 our team conducted an intercept survey of 100 individuals, 25 in the rural market of Naitiri and 75 in Kimilili. Our survey collected information on amounts and intended purposes of e-money transfers and the social, family, and friendship relationships of senders and receivers.

We then asked interested individuals in Naitiri, Kimilili, and Bungoma towns to participate in ethnographic interviews and SNA. Social network drawings were created for families who transfer e-money using Safaricom's M-PESA and similar services. The individuals form 12 non-intersecting family groups. Participants were asked to name persons to whom they had sent mobile money or from whom they had received it in the past year. In each case, we verified every familial connection by phone or in person until no further connections could be contacted to participate in the research. As a result, the networks vary in size.

The 12 families described below and in the appendix are named in order based on sample size from smallest to largest. In the drawings below and in the appendix, individuals named and/or interviewed appear as nodes, with females shown as circles and males as triangles. The arrows connecting them are e-money transfers. The arrow indicates the direction of the remittance. Bidirectional arrows indicate that two people send money to each other.

We supplemented the sending and receiving information with ethnographic interviews when possible. In the rural outskirts of Kitale, we conducted ethnographic interviews with 33 women regarding family relationships and the perceived economic and social value of money transfer. Follow-up interviews with several families from the 2012 season were conducted in December of 2013 and in July and August of 2014.

Centrality Measurements

To identify important or "central" individuals in family social networks, we employ the centrality measurement called PageRank (Brin & Page, 1998). The PageRank metric originally modeled the probability that a web page would be visited by a random computer user. It is also frequently used to measure the prominence of nodes in directed social networks where ties can be bidirectional. The mathematical terms of this centrality are defined by

$$x_i = \alpha \sum_j A_{ij} \frac{x_j}{k_j} + \beta$$

where:

x_i is the PageRank centrality of node i (x_j is the PageRank centrality of node j);

A is the adjacency matrix of the network ($A_{ij} = 1$ if there is a link from j to i; $A_{ij} = 0$ if there is no link);

k_j is the degree of node j.

α is typically set as 0.85. β represents some intrinsic, nonnetwork contribution to the centrality for each node.

PageRank centrality is the most appropriate measure of centrality in networks that describe sending and receiving relationships, called directed networks (Gould, 1987; Newman, 2010). In Figures 1, 3, and 4, then, the size of a node is proportional to the size of the other nodes it connects to. Large nodes have many connections and/or connections to nodes with many connections.

The 12 Families

Below we profile three of the 12 families for which social networks were drawn (see the appendix for drawings and descriptions of the other nine families). These families include members with diverse levels of access to wealth or money, and include farmers, small-scale business owners such as shop owners and tailors, young people pursuing an education or looking for work, and employed professionals such as teachers, doctors, dentists, and civil servants. Many individuals in these families had several means of income. The families include individuals from urban areas such as Bungoma and Kimilili towns, rural areas in Bungoma County such as the hamlet of Naitiri, and urban migrants to Nairobi or Kisumu. Families 1, 3, 7, 9, and 10 (see figures 1 and 4 and the appendix) incorporate international remittances from the United Kingdom, the Netherlands, and the United States.

The 12 families are not necessarily representative of the millions of family social networks of mobile money in Kenya, but they nevertheless provide a preliminary examination of some aspects of e-money networks among a set of families in Western Kenya. The families who receive international remittances have greater

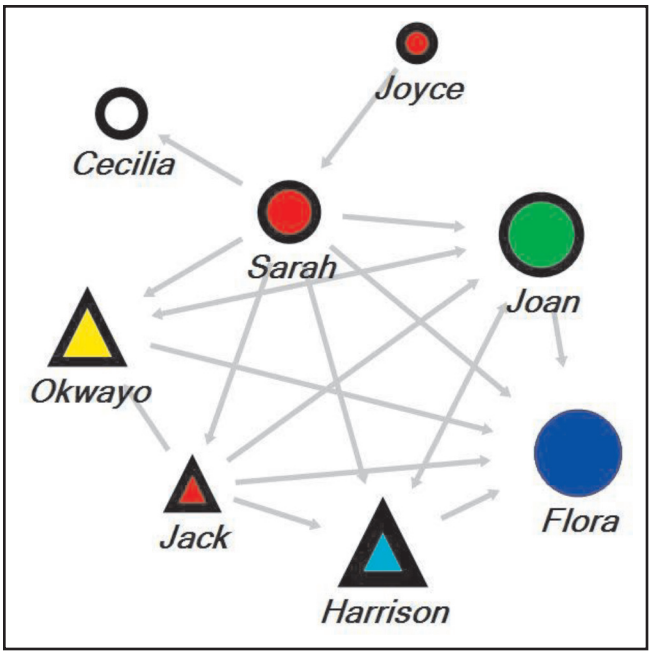

Figure 1. Family 1 social network graph of mobile money remittances of siblings Sarah, Jack, and Joyce; their cousin Okwayo; their maternal uncle Harrison; friend Cecilia; and Joan's daughter Flora. Family and friend relationships are shown in Figure 2.

amounts of wealth circulating via mobile money than the average family and represent the kinds of networks that form when transfer practices are significant and frequent.

Siblings are shown in a common color in the figures below and in the appendix, and generation is shown by the thickness of each node's outline, such that nodes of the youngest generation are shown with a thin border and the oldest generation with the thickest. Node size indicates centrality.

Consider the family of Sarah, Family 1 (Figure 1). Sarah is a Maragoli woman living in Kimilili, aged 36. Her mother, who is no longer living, was the third wife of a polygynous man. At his death, the other wives chased Sarah, her mother, and her siblings away from the homestead. They moved to Kimilili, where Sarah's older sister Joyce married a Dutch man she met while working as a secretary at an agricultural science institute. Joyce now lives in the Netherlands and sends Sarah US$200–300 a few times each year. She uses the funds to support her friend and fellow seamstress, Cecelia ("Like a sister to me," she explained), her brother, her mother's brother, and her mother's sisters' children. Her 20-year-old niece, Flora, attends an accounting college and has the most receiving ties in this network. Figure 2 shows the sibling and cousin relationships of this network.

The family with the largest sample size that we study (Figure 3) includes Alice, a widowed farmer and one of 12 cowives in a polygynous household. Four cowives (also in purple) are connected to her indirectly through e-money flows. The majority of connections in the network graph are among Alice's 12 children (in red) and 14 grandchildren.

Discussion

The 12 families reveal that family networks circulate digital value among many members. Important patterns that emerge across these networks are summarized next.

Density of Ties

Visually, several networks show many ties among nodes, what may be called "densely knit clumps of close [ties]" (Granovetter, 1983, p. 202). The networks show that many ties connect individuals (Prell, 2011). Table 1 provides statistics on density and reciprocity in the networks. Individuals have an average of 5.4 ties to others ("average degree" in Table 1). Furthermore, the clustering coefficient shows that for the average node, 62% of all possible ties among the node and its neighbors (the nodes connected to it) have been realized. Dense networks distribute resources evenly, are associated with information sharing and trust, and provide individuals with many paths to accessing the resources circulating in a network (Burt, 2005; Granovetter, 1983; Lin, 1999; Prell, 2011).

Most of the families are characterized by significant income inequality. Some individuals have regular salaries or income from farming, shops, or rental housing; others are urban or international migrants. Others are

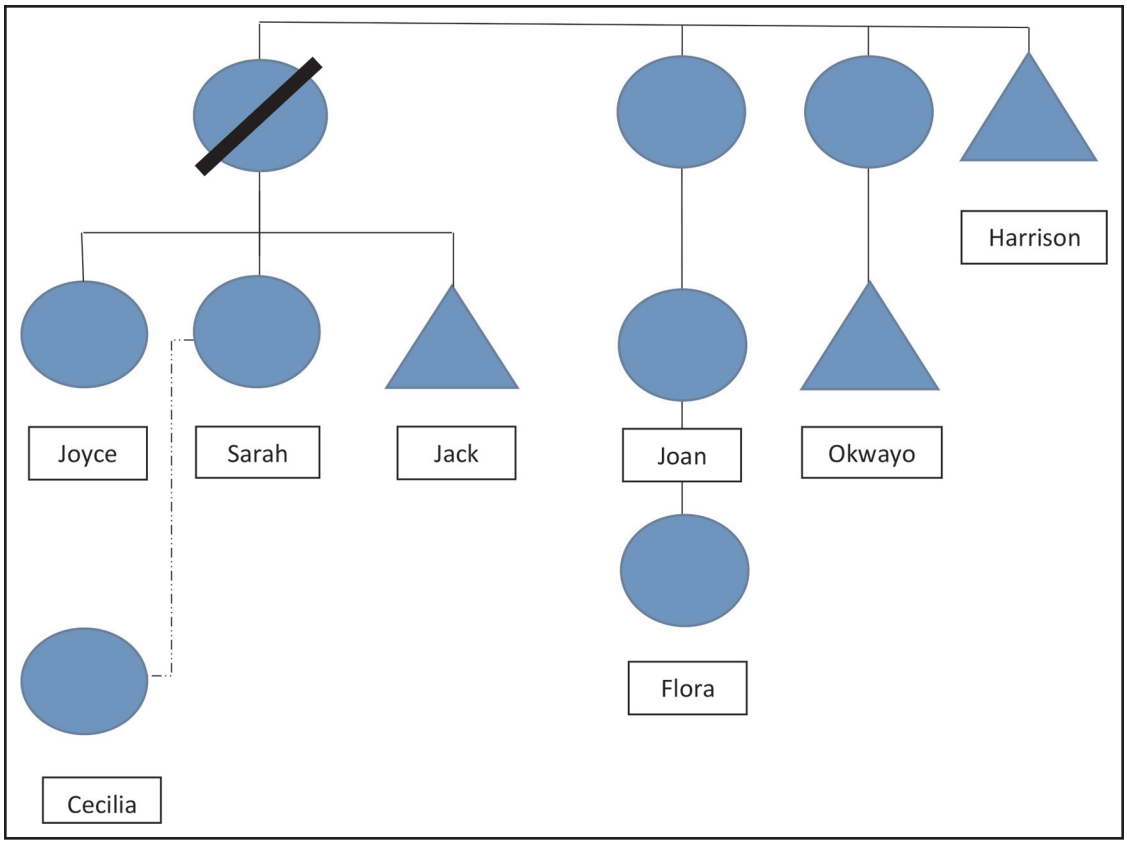

Figure 2. Family 1 relationship diagram. Horizontal lines indicate sibling relationships and vertical lines indicate child relationships. Dashed line is friendship. Joyce, Sarah, and Jack's mother is deceased.

unemployed, seek schooling, or limited to farming. Mobile money circulation is an equalizing mechanism whereby individuals have a greater number of potential paths by which they can access an extended family's resources. Family members often know, or think they know, who among them sends money to whom. For example, they may specifically seek assistance from a sibling whom they know has recently received a remittance.

Reciprocity in Networks

The reciprocal relationship Z-score statistic in Table 1 measures reciprocity (the extent to which network ties are bidirectional). This Z-score statistic compares each network with a random network graph of the same structure, which might have a mix of unidirectional ($a \rightarrow b$ and $b \rightarrow a$) and reciprocal ties ($a \leftrightarrow b$). The Z-score statistic for reciprocity measures the extent to which each network differs from a network of identical structure with randomly generated bidirectional and unidirectional ties. It is normally considered significant when the Z-score is greater than 1.96. This statistic is best measured with sample sizes of 20 or more nodes (Garlaschelli & Loffredo, 2004; Zlatic & Stefancic, 2009). Only families 6–12 are of this size or greater, and these families might be considered the most reliable statistical assessments of reciprocity in the sample.

In Table 1, families 6–12 show significant evidence of reciprocity, and they are the largest in terms of sample size. Although further measurement with more and larger networks is necessary, this preliminary work indicates that reciprocity seems to be a strong pattern in many family networks. In these families, senders are also receivers. In fact, the networks with a sample size of 20 or more nodes show overall reciprocity despite the fact

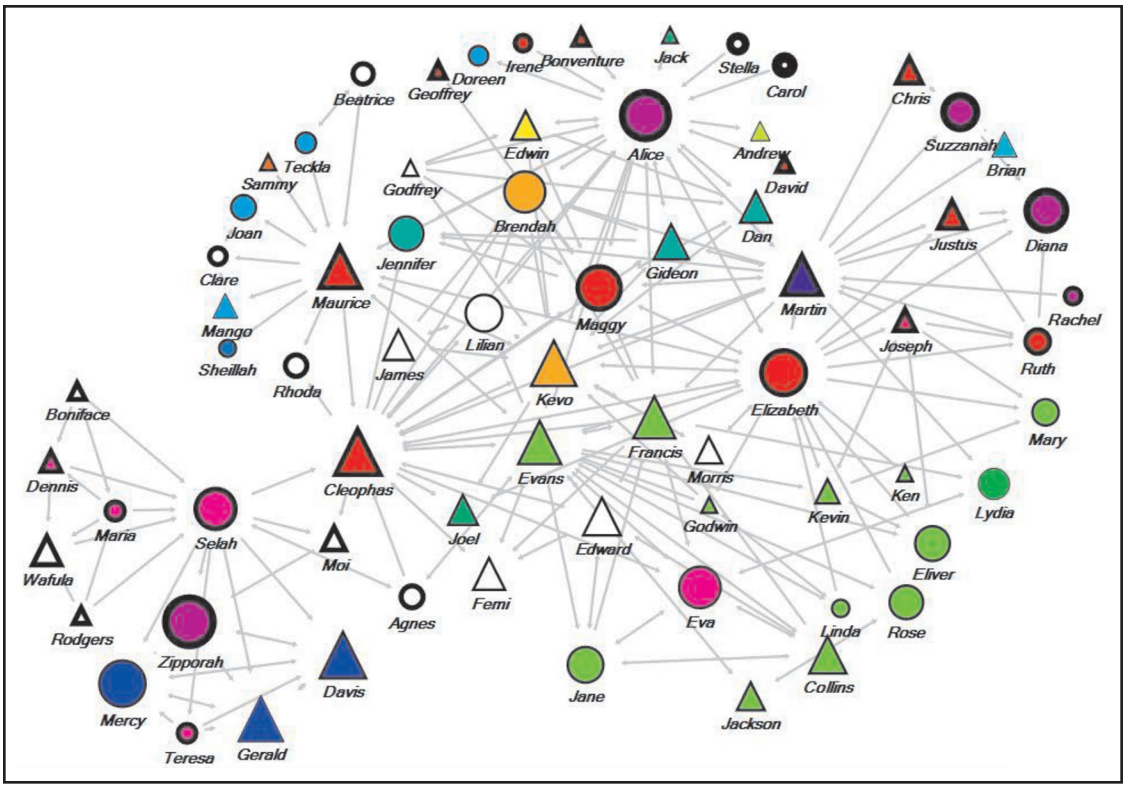

Figure 3. Family 12 social network graph of mobile money remittances. This graph centers around Alice and her cowives Suzzanah, Diana, Rachel, and Zipporah (in purple). Alice's children (in red) are Maurice, Cleophas, Elizabeth, Joseph, Justus, Chris, Ruth, Sammy, Godfrey, Bonventure, and Irene. Alice's grandchildren are in green, orange, light blue, and yellow and are drawn with thin borders. In-laws and friends are in white.

that some nodes are only senders. These sender nodes are always urban workers or international migrants, as in the case of Joyce in Family 1 (Figure 1), Rose in Family 2, George and Grandon in Family 7, Fatuma and Melissa in Family 9, or Chapurukha, Veronica, and Kristin in Family 10 (Figure 4).

Reciprocity in money transfer networks reveals its importance as a cultural practice. Sending value is a way to save through others until the gift is returned, perhaps as a remittance or even in a different form. E-money is sent to cover specific economic needs such as school fees, medical care, or household needs, especially food. Often the need is considered an "emergency": a child sent home from school for lack of fees or a friend stranded without transport home. Even those known to have fewer resources reciprocate in some way. Mothers reciprocate to the children who send them money through other means, for example, by providing foodstuffs to children who visit them or even sending such foodstuffs through other kin. For their part, many adolescents or young adults begin by sending small gifts of airtime or digital money to aunts, uncles, and grandmothers shortly after they receive their first phones. To save airtime, they use free SMS to send "please call" messages to relatives to rekindle relationships.

Central Individuals

Individuals of varying age and gender may become central in their networks, having more connections and/or connections to other well-connected nodes (Newman, 2010; Prell, 2011). They are designated by larger nodes in the diagrams. For example, Flora can rely on her mother, mother's siblings, and mother's sisters' children for assistance; Party in Family 7 (Appendix) is the youngest son who, unlike his siblings, bears his father's second family no ill will and is connected both emotionally and through e-ties to his half-siblings. Mothers such as

Table 1. Density and Reciprocity Statistics for the 12-Family Mobile Money Networks.

Family	Sample size	Average degree	Clustering coefficient	Reciprocal relationship Z score statistic
1	8	5.4	0.62	
2	12	4.7	0.67	
3	12	4.8	0.71	
4	15	6.9	0.72	
5	17	2.7	0.40	
6	20	6.5	0.78	4.303***[1]
7	23	5.0	0.44	2.201*
8	25	4.8	0.58	4.301***
9	40	5.0	0.63	5.303***
10	42	5.4	0.62	5.590***
11	54	7.0	0.60	5.854***
12	70	6.9	0.72	5.020***
Average		5.4	0.62	

[1]*One asterisk and three asterisks indicate different levels of significance. If the absolute value of the Z score statistic is equal to or larger than 1.96 (one asterisk significance level), there is a 68% chance that the network from which this sample was drawn is reciprocal (in this case, a hypothetical universal mobile money network). For three asterisk significance level (Z-score of 3.30 or above), there is a greater than 99% chance that the network from which the sample was drawn is reciprocal.*

Mary in Family 4, Mary in Family 8, Naima in Family 9 (Appendix), and Joy and Dorcas in Family 10 (Figure 4) connect to brothers, children, and grandchildren, as do some fathers such as George and Bernard in Family 5 (Appendix). Money is often sent to a parent at the family farm to pay for fertilizer, seeds, weeding or harvesting, or to provide for children who are frequently fostered at a grandparent's home, especially if the parents are unmarried or deceased (Nyambedha, Wandibba, & Aargard-Hansen, 2003).

A sociable, generous, and outgoing spirit was often attributed to people with many connections, either as senders or receivers. These "entrepreneurs" of social capital reach out frequently to their social contacts. Young people like Flora in Family 1 (Figure 1) are in frequent contact with parents, aunts, and uncles. They may politely explain their needs when adult family members return a "please call" SMS. By nurturing contacts to important relatives through her mother, Flora cobbles together her school fees.

Brokerage

Besides centrality, another position usually considered advantageous in social networks is brokerage (Burt, 2005; Stovel & Shaw, 2012). A *broker* is an individual who acts as a unique tie between two groups of nodes who presumably can control the flow of resources from one part of a network to another and bring important new resources to a group (Granovetter, 1983). In Family 10 (Figure 4), Dorcas is a 67-year-old grandmother, farmer, and seamstress whose husband has two other wives. Her network includes most of her nine children, including daughters Jane and Joy, and some of her 44 grandchildren. She receives e-money from Kristin, a daughter-in-law who works in Nairobi, and her children. She also receives about US$100 several times a year from her daughter Veronica who lives in Chicago. Dorcas' node is shaped like a hexagon to denote that she is a broker (a unique tie) to her deceased sister's eldest daughter, Elizabeth. In turn, Elizabeth circulates the value to her own siblings (in blue) and their children (in yellow).

Edward in Family 3 (Appendix) is a conduit of e-value from his children to his siblings (his daughter also creates a tie). In general, brokerage is uncommon in the 12 networks because the networks are dense and brokerage implies a "structural hole" or unconnected nodes (Burt, 1992). Brokerage may be a risky or undesirable position in non-Western settings where communalism and reciprocity are valued (Peeples & Haas, 2013). In such settings a broker tries to close the structural hole by creating more ties. Indeed, since the collection of

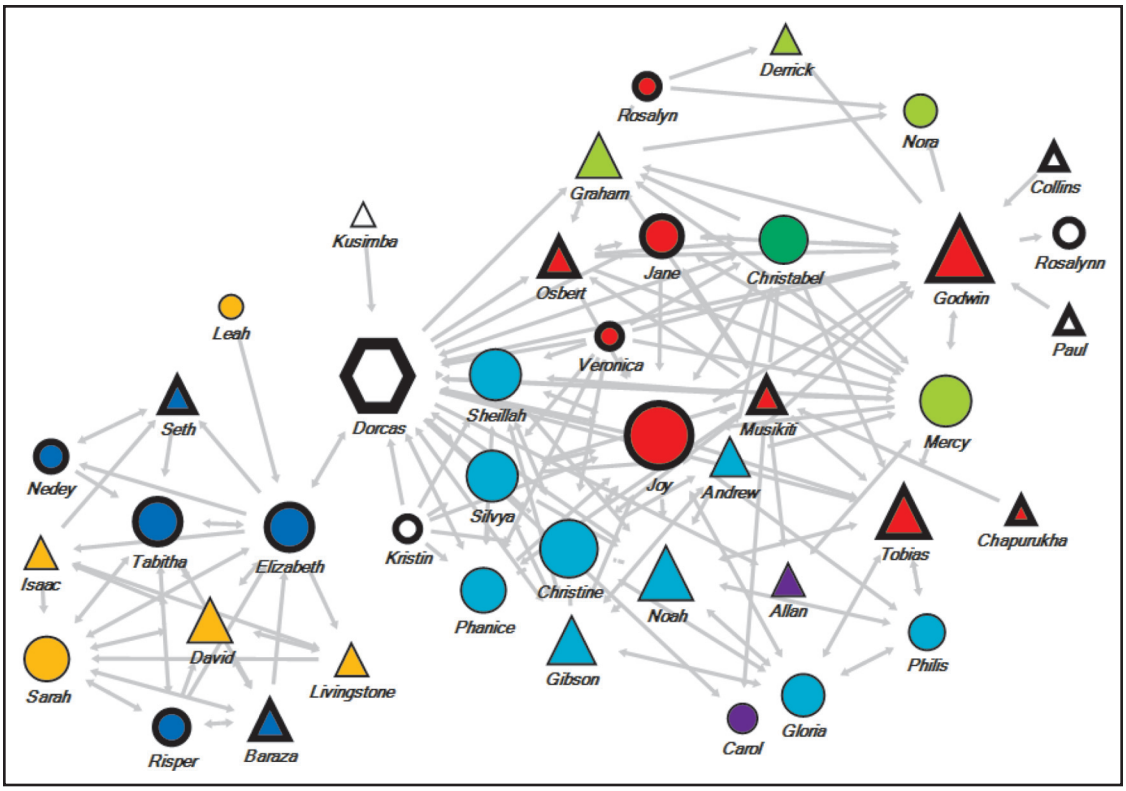

Figure 4. Family 10 social network of mobile money remittances. Dorcas (hexagon) is a 67-year-old grandmother who is a broker (a unique tie) in a group that includes some of Dorcas' nine children and 44 grandchildren (to the right of Dorcas) to her deceased sister's oldest daughter Elizabeth and Elizabeth's siblings (in blue) and their children (in yellow).

Family 10's network data in 2012, the children of Dorcas and her deceased sister have created a savings group for school fees, where contributions of 1,000 KSh are collected at a monthly social event. The savings group has effectively closed the structural hole.

Networks of Siblings

All 12 networks show the importance of siblings who are identified by color on the graphs. In many families the money-sending relationship among siblings is reflected in the next generation (the children of the siblings), who circulate money among themselves as siblings and as cousins. Ties among the children of siblings, followed by ties among siblings, are the most common relationship type in the largest family, Family 12 (Table 2).

In most East African languages, there is no commonly used word for *cousin,* the words *brother* and *sister* are instead preferred. Informants explained that when brothers and sisters have a close relationship, their children also have a close relationship. In some cases sibling networks are connected through in-law ties to other sets of siblings, as in families 4 and 5.

The importance of siblings in e-money transfer networks reflects longstanding practices of sibling closeness in sub-Saharan Africa (Hsu, 1971; Thelen, Coe, & Alber, 2013). In East Africa these relationships derive from shared childhood experiences, relationships of fostering and caregiving based on seniority, and exchange and mutual assistance throughout life that often extend to siblings' children (Lijembe, Apoko, & Nzioki, 1967; Wagner, 1975). Transfers among siblings demonstrate that both men and women use e-money to exchange resources with their birth homes. E-money sent to children of siblings extends these relationships to the next generation; indeed, fostering and other kinds of assistance with childrearing are common among siblings in these families.

Table 2. Kin Relationships of Recipients to Senders in Family 12 Social Network Graph (Shown in Figure 3).

Relationship of recipient to sender	Number of ties in social network graph
Cousin	39
Brother	30
Nephew	22
Sister	22
Mother	16
Son	14
Daughter	13
Niece	9
Other	93
Total ties	258

Siblings, Mothers, and Others: Connection and Disruption with Mobile Money

As a form of communication, digital gifts have social meaning. Our participants spoke of the social and emotional value of transfers as much as their economic impact. For many, e-money expresses a kinship role, especially in "being useful," a behavior particularly valued among siblings and children. Many urban migrants send money home in lieu of traveling to attend a wedding or funeral, feeling the money to be more "useful" to relatives at home (see also Ross & Weisner, 1977). A 62-year-old woman, whose oldest son has lived in the United States for 12 years, described his ongoing presence in her life, saying, "He is very useful around here, very useful. He bought me a gas cooker . . . and pays my workers" (personal interview, Chesamisi, Kenya, June 2012).

Others said (paraphrasing), I send money [to my grandmother] because I love her, or made similar expressions of emotional closeness as the reason for sending money. A young woman is known to be particularly close to the grandmother who raised her; her cousins assume she receives large remittances, but she cheerfully confided that she does not. To avoid conflicts, a man sending money to his mother, intended to support the family farm, must balance that with e-gifts to his wife so she can purchase something for herself.

As mobile communication creates connections, demonstrating closeness and trust, it can also exclude certain relationships. Kenyan popular culture frequently satirizes the uncomfortable effects of mobile communication: disruption and exclusion. In a Safaricom television advertisement, a businessman appears to furtively sweet-talk several women via mobile phone while his secretary looks on suspiciously; the females are revealed to be egg-laying hens on his farm. Among the families above and among other interviewees, the connections of digital money sometimes exclude others such as half-siblings, the polygynous father, cowives, spouses, and in-laws. A woman farmer in her 50s highlights the disruptive role of illicit money connections:

> Mostly marriages are breaking with this service. A man may send 1,000 without you noticing. . . . There is a bond that begins when you have sent the 1,000 to the other lady. It goes on until the marriage breaks. I wish it would be just for women. Or sometimes the SMS may get in; you find and say a certain amount has been sent to so and so. If you tried to inquire, that person is not related to him, not sister or cousin. How come you send money to her? It is really destroying marriages. (personal interview, Bungoma, Kenya, June 2012)

Sending money among half-siblings in Western Kenya happens less often in the families in this study, where most transfers involve full siblings. Sometimes only one or two siblings, such as Party in Family 7, reach out to "the other house." Often a sense of family obligation rather than emotional closeness connects half-siblings. The *simakulu*—the oldest son—in a polygynous household sought contributions from his 23 siblings and half-siblings for his father's prostrate operation, which cost around 200,000 KSh (US$3,000). He accepted

contributions proportional to his siblings' means; but even students or the unemployed were expected to give "at least 1,000" (US$15). One of the younger sisters explained her ambivalence, although she said that in the end, her obligation to her siblings led her to contribute:

> My father had four wives. Mother is number two. We are 22 altogether. In our family the cowives did not work together. . . . In our family we were sidelined by our father. It was my mom who used to support us with her farming. . . . So us, we were dependent on our mother until our first-born brother, second in the family, joined the university and started paying our school fees with the university boom. . . . [Father] was unfair to us. Since we were his children, we didn't take it kindly. Sometimes there is an occasion—right now Dad is on treatment. . . . When you call people to come together . . . we are so bitter. . . . He didn't help us. (personal interview, Bungoma, Kenya, July 2012)

In some families, fathers are prominent in network graphs. Edward in Family 3 is a widower and devout Christian who eschewed polygyny against his brothers' wishes. To maintain his connection to his children, he built them a house on his property to encourage their visits; he is also raising two of his grandchildren. His urban children provide for child care needs and farming costs for his 50 acres, which he has segmented into 10 equal parts for his 10 children.

Edward may be an exception; most children indicated they send their mothers more money than they send their fathers. The children explained that mothers are often responsible for the farm, while fathers spend time at a *baraza* (drinking party). Mothers also foster children and grandchildren supported by remittances. Although men participate equally in mobile money networks, they may be brothers and maternal uncles more often than fathers or paternal uncles, especially in polygynous families such as families 10, 11, and 12, where ties to fathers and husbands are rare. In the largest family, Family 12, only three connections of the 258 ties were to fathers, compared to 16 to mothers (Table 2). In the second-largest family, Family 11, there are 15 ties to mothers and only four ties to fathers. In both these families there are more ties to mothers' relatives than to fathers' relatives. From Family 11, Julia's son Gabriel explained, "I see my [patrilineal relatives] at funerals . . . those who have helped me with fees and other investments in my future have been my [maternal] uncles. . . . My maternal uncles have been more meaningful to me" (personal interview, Bungoma, Kenya, July 2012).

Thirty-three women farmers in the rural outskirts of Kitale and Bungoma towns created ties with blood relatives via e-money, often unbeknownst to husbands and in-laws. The 33 women we interviewed connect via digital transfers to the homes of their birth, assisted by the privacy of mobile communication and the digital money account. These women hide money from their husbands and privately send money to their mothers and sisters to educate nieces and nephews. Women also reach out to siblings when polygyny and widowhood fail them. A retired policewoman described "a lot of wrangles over money" with her two cowives. She explained that before e-money her husband would forcibly take her cash to support his favorite cowife. She relies on secret transfers from her brother and son to support her farm activities.

Indeed, men also support secret wives and siblings without their wives' knowledge. A 52-year-old widow was forced off her husband's land at his death; she returned to her father's land where she assists her brother and his wife. Her brother remits her children's school fees unbeknownst to his wife "who despises my presence here. With this M-PESA account I have been able to educate my children with my brother's help without his wife discovering."

Conclusion

The empowerment potential of individualized "networking" is often celebrated as a benefit of ICTs, and they are certainly at play as individuals use personal communication to shape their networks (Ilahiane & Sherry, 2008; Rainie & Wellman, 2012). At the same time, ICTs and mobiles have important capabilities in shaping the sociability of groups (Ling & Stald, 2010).

Using SNA, this study of electronic money transfer captures the way that mobile communication facilitates the social cohesion of groups: dimensions that go beyond the individual perspective of questionnaire data and the urban sender/rural receiver dynamic of the "send money home" view. The SNA methodology may

have broad applications to the ICT for development field, where the network is often an appropriate unit of analysis (Burrell, 2009).

In Western Kenya, e-money circulates along relatively dense and reciprocal pathways, entwining siblings and cousins in bonds of reciprocity, long important in Western Kenyan families. The exclusion and privacy typical of digital gifts also reinforce these bonds. Digital money is easily hidden and protected; its security allows men and women to send secret remittances, usually in preference to their siblings over other relatives.

Overall, the money transfer service in our region of study may best be thought of as an amplifier (Toyama, 2015) of enduring practices around reciprocity, obligation, belonging, and exclusion. However "new" a technology is, people's intentions with it will probably adjust slowly, if at all. As Conrad Kottack put it, "People usually change just enough to keep what they have" (1999, p. 34). ■

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Appendix: Description of Family Networks of Mobile Money in Kenya

Descriptions and social networks of Families 2 through 9 and 11 are included in this appendix. Families 1, 10, and 12 are discussed in the main body of the paper. In the drawings in this appendix, individuals named and/or interviewed appear as nodes, with females identified as circles and males as triangles. The arrows connecting individuals are mobile money remittances. The direction of the remittance is indicated by an arrow. Bi-directional arrows indicate that two people send money to each other. The size of the node is proportional to its centrality; that is, the influence it has on the overall network due to its number of connections to other nodes. More central, larger nodes indicate individuals who have more connections than others. Siblings are shown in a common color, and generation is shown by the thickness of the node's outline, such that nodes of the youngest generation have a thin border and the oldest generation has the thickest.

Family 2

Wilson, a polygynous farmer from Naitiri, lives with his second wife Sophia and their son Wanyama. His first wife Maximilla lives about 30 km away; she is 47 years old and a tailor. Maximilla's children Alumasi, Peters, and Esther are supported by their parents and their mother's siblings Jane, Peter, and Naomi.

Family 3

Edward Asige is in his 80s. His living siblings are Naomi, Lydia, and Albert. He receives remittances from six of his 10 children: David, Janet, Joshua, John, Rose, and Peter. Rose and her daughter Mercy live in the United States. Rose sends several hundred dollars two to three times a year. Edward recently remarried Jane after his first wife died.

Family 4

Mary Onyango is a trader of Luo ethnicity living in Naitiri. Her network includes her husband Omondi, who lives in Homa Bay, her three brothers who trade in Bungoma and Siaya counties, eight children, and one grandchild.

Family 5

George is a 62-year-old retired medical doctor in Bungoma town. His siblings are Benard, 53, an artisan; Rose, 46, a businesswoman; Nanjala, 43, a shopowner; Fred, 38, an artisan; and his youngest brother, David. This network connects these siblings through many ties to their children, spouses, and relatives.

Family 6

Titus, a man in his 70s, is married to Agnes. His siblings are Martin, Morgan, Lidya, Julliet, and Stacy. Titus and Agnes have seven children. Jacinta, the eldest, is a 56-year-old farmer and trader in Bungoma. Her younger siblings are Joseph, Joan, Metrine, Francis, Caleb, and Jacob. Jacinta and Job have one child, Jacktone. Agnes and her brother Gideon are the third set of siblings in this network. Jacinta receives remittances from all three of these sets of siblings and is central in the network.

Family 7

Fred, 62, is a polygynous farmer near Bungoma; Antonio, Linah, Annette, and Jacktone are his children with his second wife Fridah. His first wife Eva, 56, is a retired high school teacher and mother of George, Bramwell, Maureen, Melisah, Martha, Godfrey, Ronald, and Party. Party has two wives, Maria and Lisah. George and his son Grandon reside in the United Kingdom and send remittances to many of Eva's children and grandchildren. The youngest son, Party, is highly central in this network and the only connection—besides Fred—to the two homes in this polygynous family.

Family 8

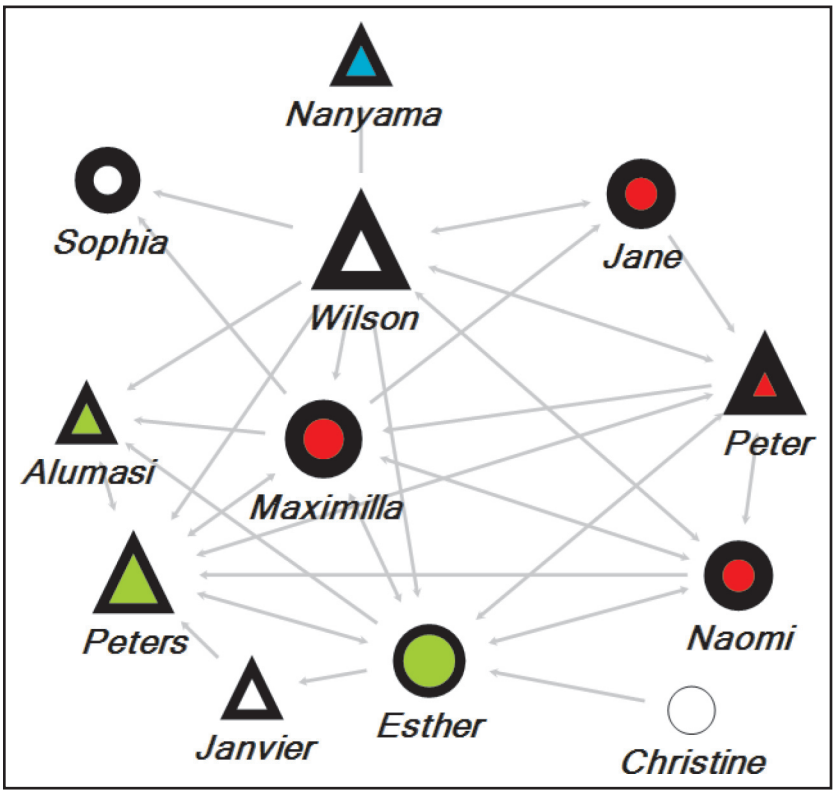
Mary is a 68-year-old farmer near Bungoma whose husband has two other wives. She has two brothers Shibika and Saisi; they are connected to her and to her children Stephen, Johnny, and Flossy and to her daughters-in-law Susanna and Grace. Mary sends and receives money from her other children Job, Betty, Lyn, Dorothy, and Peter, her grandchildren Beryl, Faith, and Charity, and her cousin Stella.

Family 9

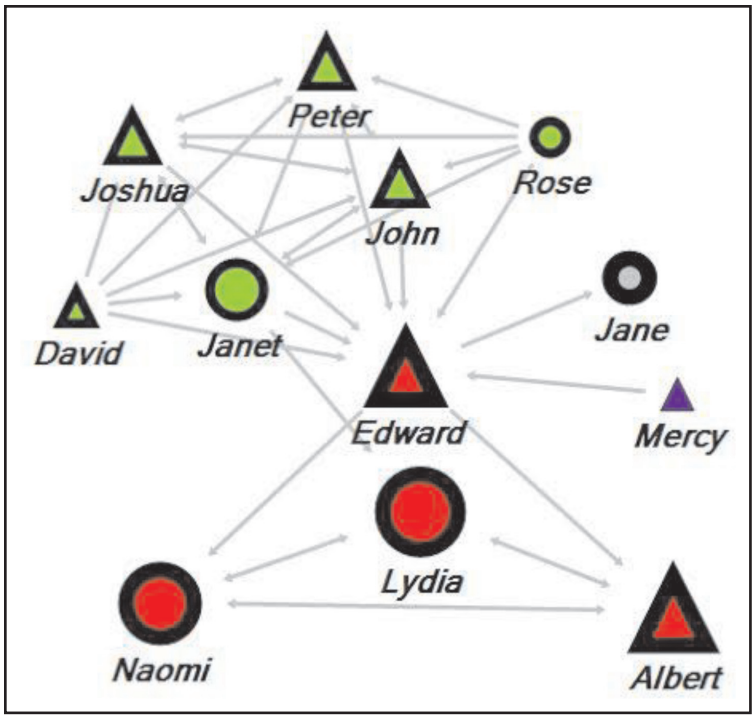
Naima is a farmer. Her children with husband Kingi include Brian, Faith, and Brendah who all live in Nairobi. Naima is highly central in the graph, receiving remittances from her sister Fatuma and Fatuma's friend Melissa who live in the United States, and Kingi's siblings Taabu, Safari, Evelyn, Mariamu, Racheal, Marure, John, and Rehema. Children of Kingi's siblings are Chai, Tokali, Katana, Diana, Mercy, and Michael.

Family 11

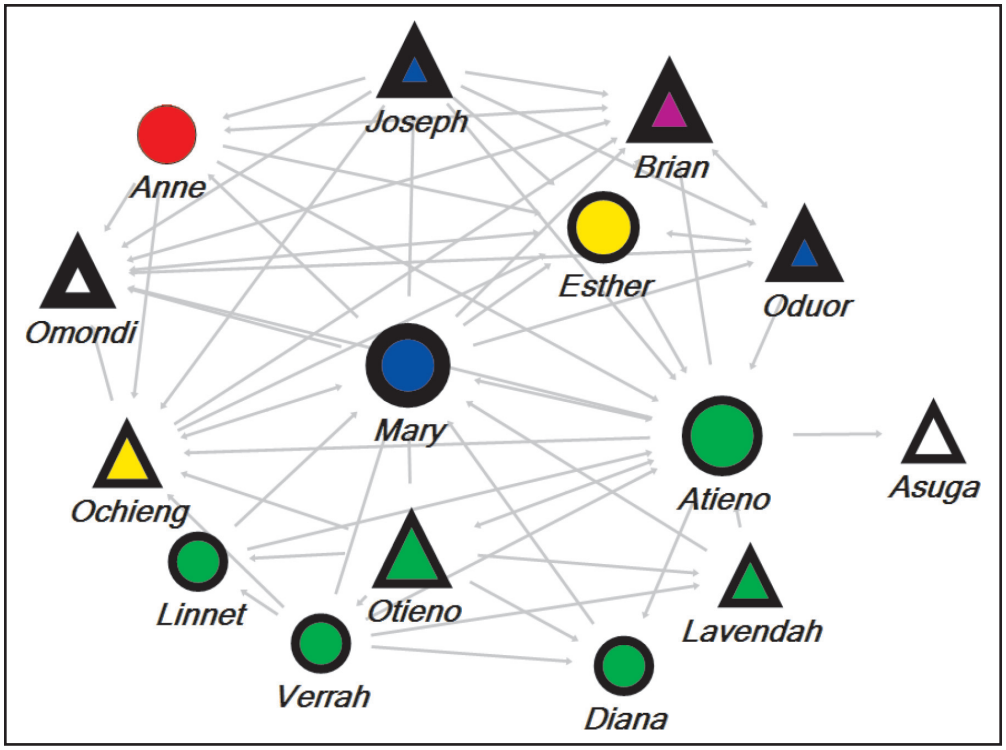
Julia, Juma, Agnes, Vincent, Rodgers, and Augustine are siblings. Julia is a widowed farmer; her deceased polygynous husband recognized another family, including his son Johnstone, as the rightful heirs to the family plot of land. Julia lives on less than an acre, which she purchased gradually by selling her own farm produce. She, her siblings, and her children Gabriel, Evelyn, Esther, Ben, and Carolyn share many connections to each other and to the children of Julia's siblings. Julia does not have a phone, but borrows one from her children or siblings. Gerald is the brother of Julia's deceased husband, and his wife Janet and children are connected to the central group through a smaller number of ties. Augustine, Rodgers, and Vincent send and receive from both their wives and children on the perimeter of the network and their siblings in the center of the network.



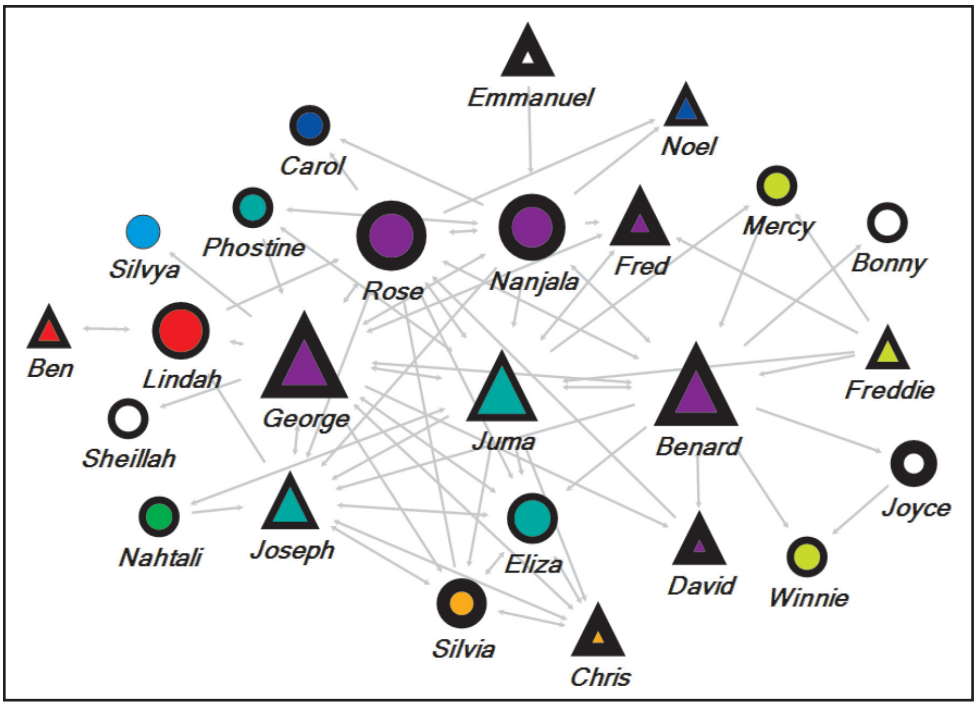
Family 2.



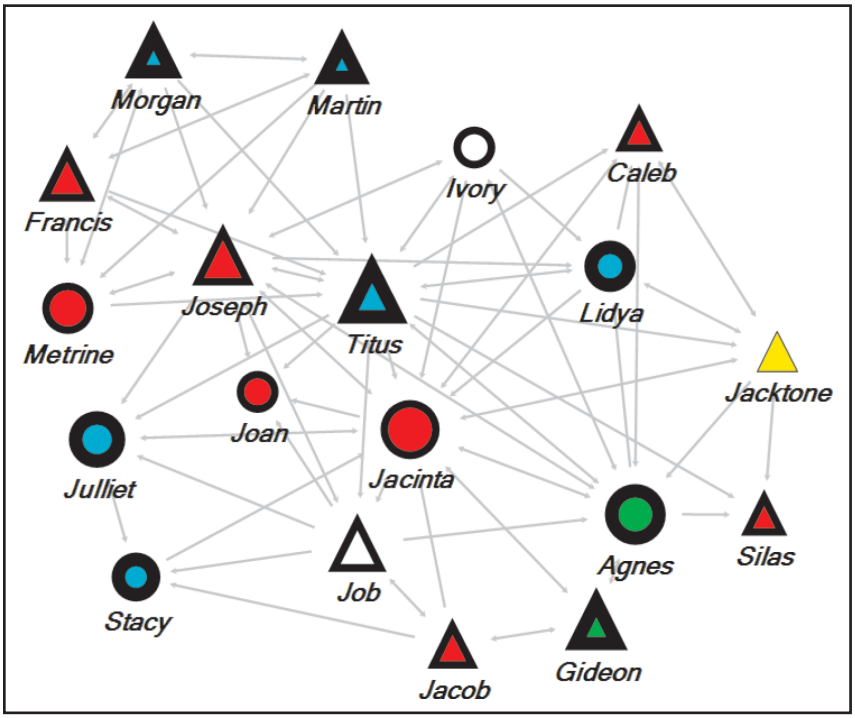
Family 3.



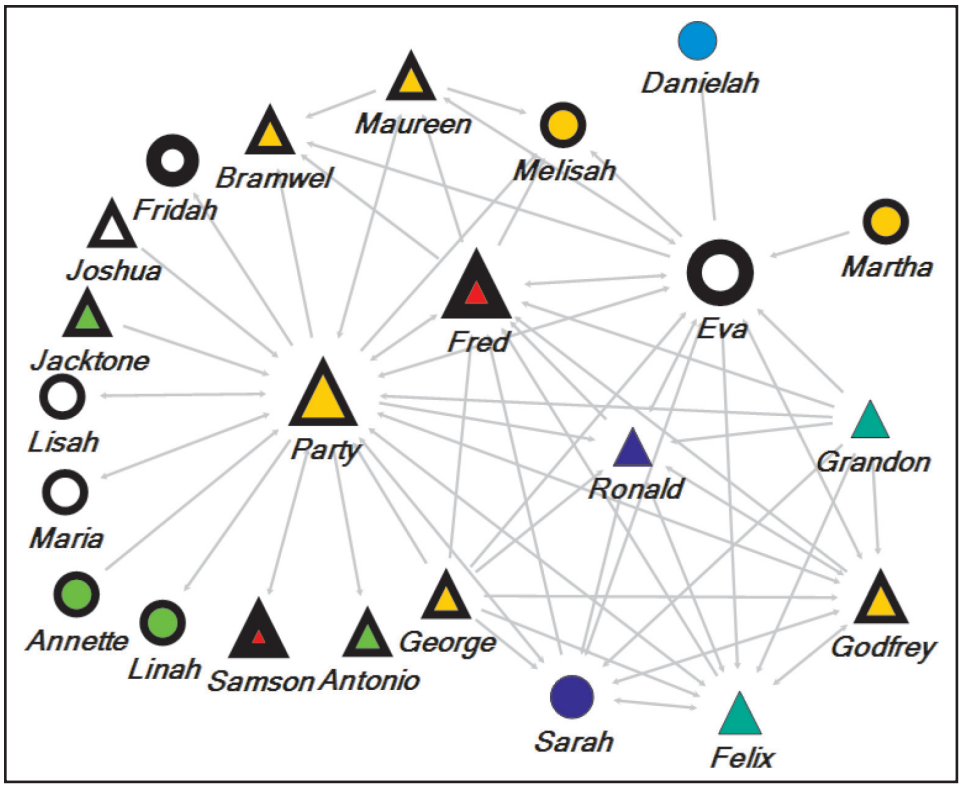
Family 4.



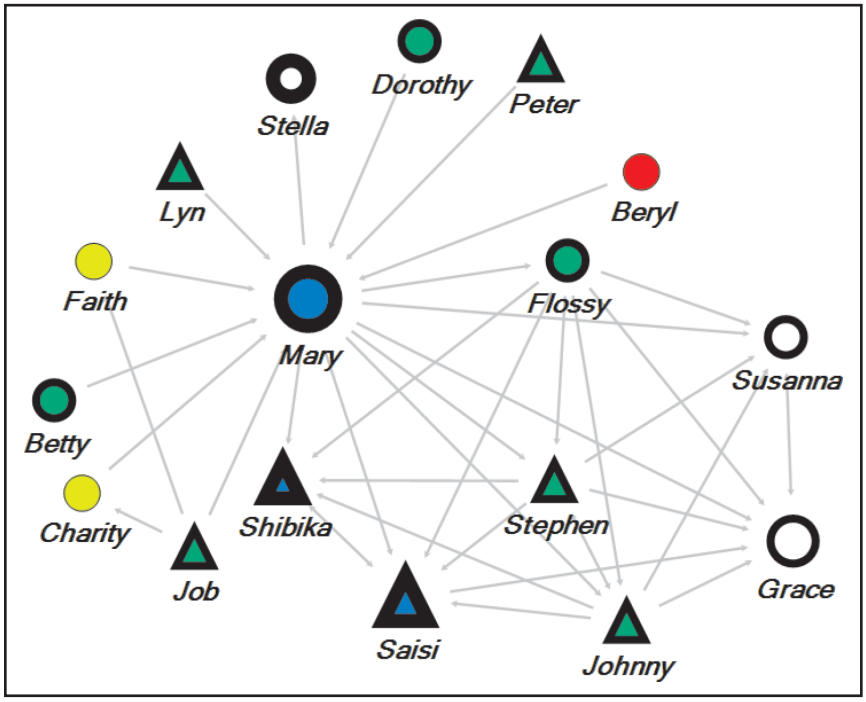
Family 5.



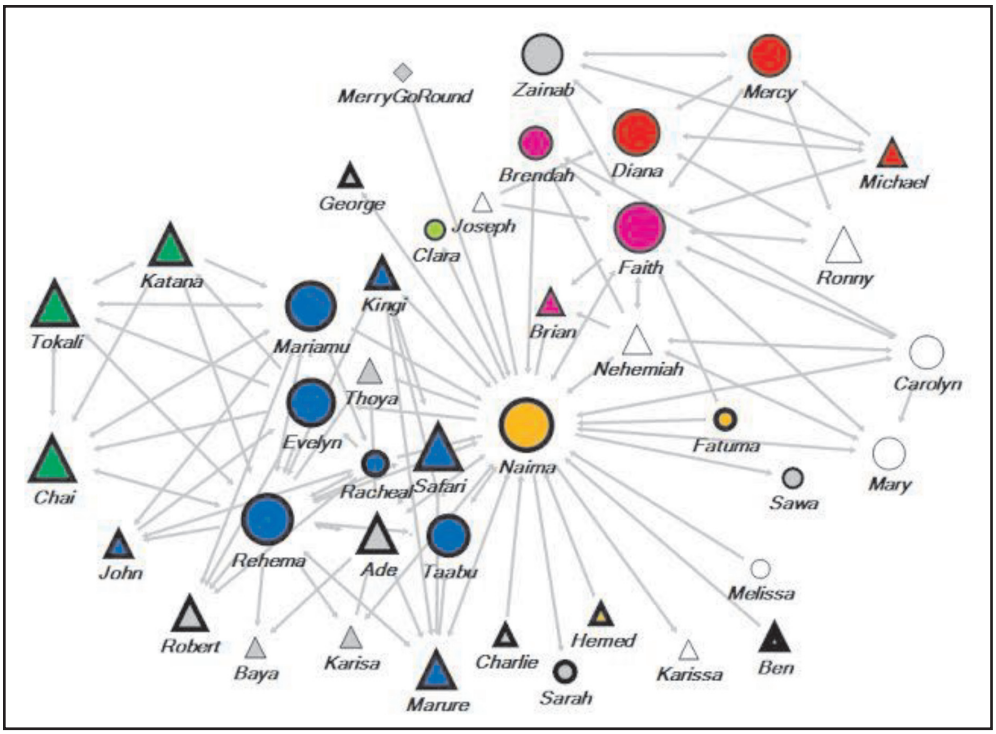
Family 6.



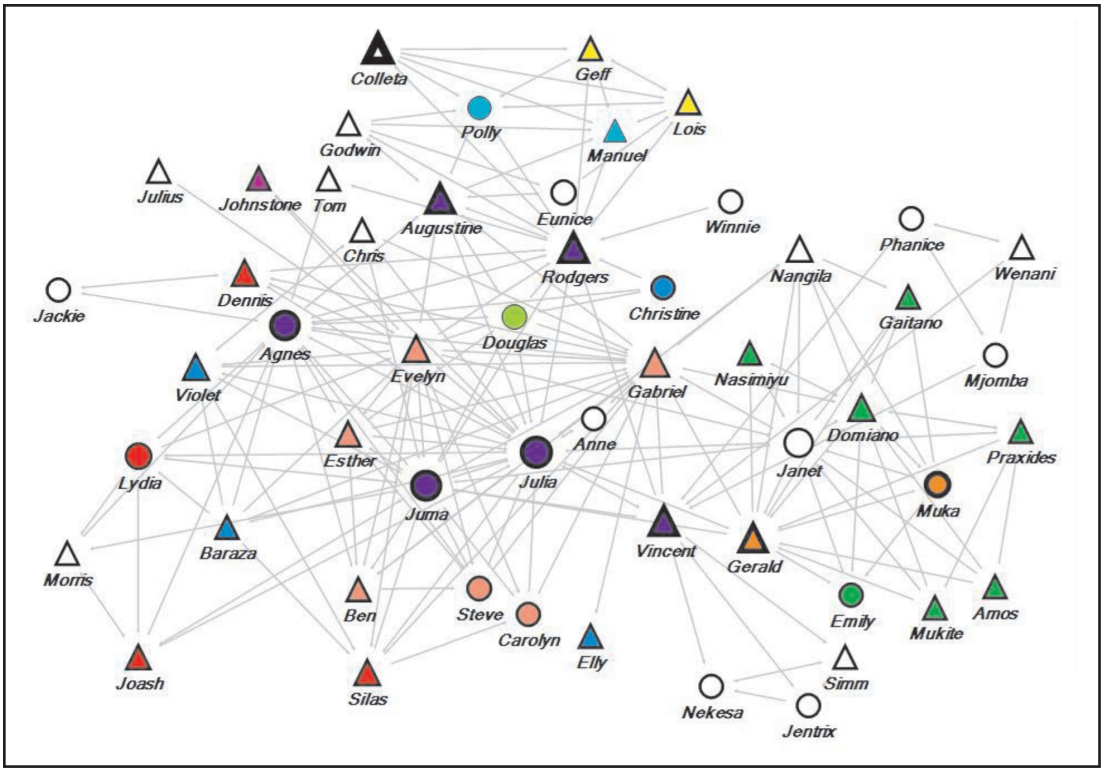
Family 7.



Family 8.



Family 9.



Family 11.