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Research Article

Types of social networks and the transition to parenthood

Daniel Lois

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Daniel Lois[1]

BACKGROUND
A growing body of literature acknowledges the importance of social interaction and ideational factors for generative behavior. Building on this research, the present study identifies specific types of social network and gauges their value for predicting fertility behavior.

METHODS
Based on data from the German Family Panel (N = 3,104 respondents aged 20 to 42), four types of ego-centric social networks were identified using cluster analyses. Clusters were used to prospectively predict the transition to parenthood using a discrete-time event history analysis.

RESULTS
In the event history analyses, the highest propensity to start a family was found for 'family-centered' social networks, which were characterized primarily by a high share of persons with young children, a high amount of network support in case of parenthood, and a high proportion of strong ties to members of the nuclear family. By contrast, respondents who were embedded in 'family-remote' networks had the lowest transition rate to parenthood. Family-remote networks were characterized by a high share of friends and acquaintances, a high proportion of weak ties, and a low amount of social support and social pressure. Regarding selection effects, a comparison of cluster affiliation over time does not consistently confirm that persons who start a family select themselves into 'fertility-promoting' network types. In sum, the results enhance our understanding of how mechanisms of social influence and structural features of ego-centric social networks are interlinked.

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1. Introduction

Human beings are social actors embedded in a network of social relationships with kin and peers. A basic assumption of social interaction theory is that important decisions in the life course, such as the decision to become a parent, are not only driven by an individual's personal characteristics but are also influenced by the traits and the behavior of the people with whom individuals interact (Bongaarts and Watkins 1996; Kohler and Bühler 2001; Bernardi 2003). Consequently, a body of literature, growing since the 1980s, acknowledges the importance of social interaction and ideational factors for childbearing intentions and generative behavior (Kohler and Bühler 2001; Bernardi and Klärner 2014). This direction of research suggests that social interaction creates, diffuses, and transforms the value of children, support for parents, and social norms that regulate both the timing and quantum of fertility.

Much of the previous research into the effects of social networks on fertility has been undertaken in high-fertility contexts such as Eastern Asia and Africa (Montgomery and Casterline 1993; Kohler, Behrmann, and Watkins 2001; Rindfuss et al. 2004; Sear et al. 2009). The early focus of this literature was the implementation of state programs for birth control as well as the diffusion, acceptability, and use of modern contraception. Beginning in the early 2000s, however, the social network approach also received increasing attention as a means of explaining fertility changes in western, post-industrial societies. Examples are studies of the timing and postponement of births, the emergence of low fertility, and the diffusion of childlessness (Kohler 2001; Philipov and Kohler 2001; Kohler, Billari, and Ortega 2002).

Recent qualitative research suggests that the influence of social networks on fertility operates through the following four mechanisms (Bernardi 2003; Bernardi, Keim, and Lippe 2007; Keim 2011). First, 'social pressure' is the force that leads individuals to conform to social norms, such as their parents' wish for grandchildren, in order to gain approval or to avoid conflict. Second, 'social support' is the amount of emotional, instrumental, and material help parents can activate within their social network. Third, 'emotional contagion' is defined as the spontaneous pick-up of emotional states; for example, when someone feels emotional arousal when holding a friend's baby. Fourth, through 'social learning' individuals can acquire information about the costs and benefits involved with having children.

Several studies in the field of social network research strongly suggest that the effect of these four mechanisms depends on the characteristics of the parents' social network, including its structure, its composition, and the nature of its relational ties (Bernardi and Klärner 2014). For example, research has shown that the reliability of

Ego's[2] informer, which should be higher for strong ties, is crucial for effective social learning and actual adaption (Bühler and Kohler 2004).

Following this line of thought and building on qualitative research (Keim 2011), the main goal of the present study is to identify specific types of social network by variance in their structural characteristics as well as in their potential for social pressure, social support, emotional contagion, and social learning. Although studying the separate effects of each specific mechanism carries the advantage of higher analytical precision, the typological approach proposed here is more realistic because it identifies the multidimensional social configurations in which people are embedded. Moreover, a major strength of the network approach is the identification of patterns that moderate the effectiveness of each individual mechanism of social influence (cf. Keim 2011: 216).

Further, the present study gauges the predictive validity of network types with regard to the transition to parenthood. The analysis employs data from the German Family Panel Study (pairfam), which include repeated measurements of the characteristics of ego-centric social networks. This rich dataset allowed an estimation of the selection of individuals into network types over time and the impact of social networks on the transition to parenthood.

2. Background

2.1 Social networks and fertility: Theory and research

In the research on how social networks affect fertility, there is no theoretical or practical agreement on how many and which mechanisms are at work, but the four channels mentioned above, social pressure, social support, emotional contagion, and social learning, have been studied especially frequently (see Bernardi and Klärner 2014, for a comprehensive overview). The following section briefly describes each mechanism and its expected effects as suggested in the current empirical literature.

A well-known assumption in social psychology is that social pressure can make individuals conform to social norms in order to gain approval and avoid conflict (Festinger et al. 1950; Asch 1955). Social networks can serve as a medium for the enforcement of social norms, and this is especially true for strong ties in which significant others possess sufficient sanctioning power. Of particular importance for childbearing behavior is that social networks uphold age norms that define when, in life

[2] In the following, the terms "Ego" and "Alters" were used which refer to ego-centric social networks. These consist of a focal node ("Ego") and the nodes to whom Ego is directly connected to (these are called "Alters").

course transitions, the birth of the first child is 'due'. These norms have been labeled 'the social clock' (Neugarten 1979). Following this line of thought, Ego's compliance with these norms might be enforced by members of the social network.

Qualitative research has confirmed the notion that significant others, such as parents and friends, express their expectations regarding the timing of parenthood and childcare arrangements (Bernardi 2003; Bernardi, Keim, and Lippe 2007; Keim, Klärner, and Bernardi 2009; Keim 2011). Further, findings from quantitative research have substantiated the hypothesis that social pressure may affect childbearing intentions and childbearing behavior (Fried and Udry 1980; Udry 1982; Balbo and Mills 2011; Richter et al. 2012).

The second mechanism, social support, can be defined as the process of the exchange of goods and services between connected individuals. This is congruent with theories of social capital (Bourdieu 1986; Lin 1999), which state that individuals invest in social relationships in order to activate these resources in times of need. Three kinds of social support can be differentiated: material support (e.g., money), instrumental help (e.g., assistance with household work or childcare), and emotional support (Bernardi and Klärner 2014). Social capital as an asset facilitates individual action in that a high amount of social support reduces the direct monetary costs and opportunity costs of family formation.

The majority of studies have shown that support, most especially support from the social environment, has an impact on the transition to the second or subsequent children (Bühler and Fratczak 2007; Balbo and Mills 2011, 2012; Richter et al. 2012). Additionaly, Hank and Kreyenfeld (2003) and Arránz Becker, Lois, and Nauck (2010) reported that access to childcare by kin fosters family formation in Western Germany.

Further, qualitative research suggests that emotional contagion is an independent mechanism that affects childbearing intentions and fertility behavior (Bernardi 2003; Keim 2011: 181–190). Based on theories stemming from social psychology, it is assumed that individuals' emotional states can be altered through contact with network persons, that is, individuals can spontaneously pick up the emotional states of groups or other individuals (Hatfield, Cacioppo, and Rapson 1994). In line with this, respondents in a qualitative study (especially women) reported emotional arousal when coming into contact with babies in their social network (Keim 2011: 175ff). Possibly, these feelings strengthen their own motivation to start a family.

Contagion effects of demographic innovations within networks have typically only been studied in regard to the acceptance and use of contraceptives in non-western developing countries (e.g., Montgomery and Casterline 1996). However, there now exists a quite extensive quantitative literature on contagion effects in western, industrialized countries. Emotional contagion is not directly tested as a mechanism in this research, but several studies indicate that birth timing within social networks

correlates non-randomly. Richter et al. (2012) used data from the first three waves of the German Family Panel (pairfam) and reported a significant positive effect of the share of network members with young children on Ego's transition to second births. The effect on first births was positive but not significant. Strong cross-friend effects on the transition rate to parenthood were also found in analyses of data from the U.S. National Longitudinal Study of Adolescent Health (Balbo and Barban 2014). Pink, Leopold, and Engelhardt (2014) reported social interaction effects on fertility among women employed in the same firm. In the year after a colleague gave birth, transition rates to first pregnancy doubled. Lyngstad and Prskawetz (2010) found fertility-related contagion for sibling relations based on Norwegian register data comprising retrospective fertility biographies for a large, nationally representative sample of more than 100,000 sibling pairs. It turned out that in the first year after one sibling's transition to parenthood, the other sibling exhibited a much higher first birth rate than would be expected by chance, even after controlling for siblings' age similarity. This contagion effect was not found for second births. The results of Lois and Arránz Becker (2014) also confirmed the hypothesized positive association between the number of network members (friends, acquaintances, siblings) with young children and the respondents' transition rate into parenthood, particularly among younger couples.

The fourth mechanism, social learning, is based on the assumption that novel behaviors are often acquired via the observation of models (Bandura 1977). Observational learning helps Ego evaluate the implications of novel behavior without bearing the risk of negative consequences such as failure or social disapproval (cf. Burt 1987: 1289). In the context of the transition to parenthood, this means that the previously unknown joys and challenges of having a child may become salient only after other couples in the social network become parents and serve as potential behavioral models. This may be especially true for the socio-emotional value of children (Friedman, Hechter, and Kanazawa 1994), which is highly idiosyncratic and largely experiential in nature. Its acquisition may be especially dependent on observational learning (cf. Lois and Arránz Becker 2014).

Previous qualitative studies have yielded evidence of social learning processes. According to Keim (2011: 125), when respondents observe others in their network becoming parents, they can then imagine how their life would be after the transition to parenthood. For example, respondents state that they often discuss the compatibility of having children and other life goals with others in their network or that they use the network to gather information about the availability and quality of public childcare services. According to Lois and Arránz Becker (2014), the primary respondent's views

on children become more positive as the proportion of persons in their network with young children increases.[3]

As a general caveat, selection effects have to be disentangled from processes of mutual influence. The theoretical reasoning presented so far is based on the assumption that in terms of fertility intentions and generative behavior, individuals tend to adapt to their social environment (socialization). Yet the reverse causal direction may also be in effect, such that couples who are ready to start a family or who have already entered parenthood may generate new ties in their social networks to persons who are also parents (selection). Existing evidence suggests that the effects of the social network are unlikely to be attributable solely to selection, however. The study by Balbo and Barban (2014) is of special importance in this respect. Cross-friend effects concerning the transition to parenthood remained significant even in a simultaneous equation model controlling for the fact that having a child and befriending a particular person might be interrelated decisions.

So far, the discussion has focused on processes of social contagion and social learning in peer networks. However, the intergenerational transmission of fertility preferences is also possible. Numerous studies have demonstrated a correlation between the number of one's siblings and the number of one's children in different time periods and cultural contexts (e.g., Axinn, Clarkberg, and Thornton 1994, Murphy and Knudsen 2002, Kotte and Ludwig 2011, Murphy 2013). This connection is attributed primarily to socialization effects within the parental family, with the assumption that children adopt models of the preferred number of children and birth timing from their parents (Murphy and Knudsen 2002). A possible indirect explanation is that parental attitudes and values that can influence fertility behavior, such as religiosity or career orientation, are transmitted (Axinn, Clarkberg, and Thornton 1994).

2.2 Toward a typology of fertility-relevant social networks

This section presents theoretical arguments regarding the interaction of social network and the environment in which Ego is imbedded. Because of the explorative nature of

[3] In contrast to the differentiation between the four mechanisms described here, Lois and Arránz Becker (2014) have proposed an alternative framework which focuses more on the interrelation of the different mechanisms. They use the term "social contagion" (Burt 1987), which can be defined as a temporal synchronization of generative behaviors among network members, net of co-occurrences owing to the sociodemographic homogeneity that is typically found within networks. Instead of assuming a causal contagion effect, the synchronization of birth events within social networks is explained as an aggregated result of such mechanisms as social learning and social pressure. For example, as the number of parents in the network increases (that is, as the potential for social contagion increases), so do the opportunities for social learning and the pressure felt by childless network members to have children.

the research question, a set of preliminary assumptions is presented instead of a fully developed theory. The section concludes with a summary of a qualitative study by Keim (2011), who identified specific types of fertility-relevant social network.

From a theoretical point of view, deviating from social norms should be less likely in social networks characterized by high density and high homogeneity (Bott 1957: 60). Under these circumstances, social network members tend to reach consensus on collective norms. Moreover, in dense networks predominantly consisting of strong ties, network persons possess more sanctioning power and are better able to coordinate their sanctions. Hence, the effect of social pressure on fertility should be more effective in dense and homogenous social networks.

Regarding social support, a heterogeneous composition of the social network implies integration into several spheres of society, which can be assumed to be advantageous for the access to different types of social support (Granovetter 1973). However, networks with strong ties are likely to be better sources of valuable goods, and the social support provided in dense networks is likely to be more intense (Kohler and Bühler 2001). Examples of financial, instrumental, and emotional forms of support that are intense and valuable to young parents include housing, childcare, and emotional support during times of special need.

Further, the impact of emotional contagion and social learning should also be stronger in dense networks with homogenous composition and a high share of strong ties. Emotional contagion requires personal interaction to be effective, which is more frequent in the case of strong ties (Bernardi and Klärner 2014). In a similar vein, if contagion effects are interpreted as a cascading of events, this process cannot unfold its full potential in social networks with low density because network members are not in contact with each other as frequently (Keim 2011: 218). Moreover, the more complex and less dense the social environment, the less likely it is that social similarity will emerge via social learning. Additionally, the reliability of the informant is essential for effective learning and the adoption of behavior observed by Ego. In keeping with this argument, Bühler and Kohler (2004) showed that strong ties are more important than weak ties for the adoption of modern contraceptives. Further, the intergenerational transmission of fertility models is supposed to be more effective if the intergenerational relationship is characterized by frequent contact and a close emotional bond.

Based on the theoretical arguments presented so far, the question arises of whether specific types of fertility-relevant social network exist empirically. Based on a mixed-method approach covering 50 in-depth interviews with primary respondents aged 27 to 37 years who resided in the German city of Lübeck, Keim (2011: 205–216) identified six types of social network. First, the ‘family-centered’ network is characterized by a considerable amount of social support (especially with childcare), a very high network density stemming from a high share of kin as well as a high proportion of long-term

ties, and a high share of network members with young children. Second, the 'polarized' network is characterized by the existence of two different cliques: one clique of relatives, most of whom are already parents, and one clique of friends that includes many childless individuals. Both cliques exerted pressure on Ego to conform to their respective behaviors. Both the 'supportive' and 'non-supportive' networks (third and fourth) were relatively sparse and included few kin. Yet the amount of social support available was considerably higher in the supportive network. Fifth, the 'family-remote' network was sparse and contained very few relatives. The majority of network persons – mostly friends and colleagues interacting in different cliques – were childless and unmarried. Egos embedded in this type of social network discerned no potential for fertility-relevant social support in their social environment and also reported no instances of emotional contagion. Finally, the sparse 'child free by choice' network was characterized by the fact that parents and other kin exerted strong pressure to start a family soon, but respondents reported trying to escape this pressure by establishing relationships with network persons, predominantly colleagues and friends, who had voluntarily decided to stay childless.

The six network types outlined above were strongly correlated with fertility intentions and behavior (Keim 2011: 205). Respondents who had already started a family at the time of the interview typically had family-centered social networks. If Ego was ambivalent regarding fertility plans, in many cases the network was polarized. Respondents who felt ready for the transition to parenthood had family-centered or supportive networks. Moreover, family-remote and non-supportive networks were common among respondents who felt that parenthood was still far removed or who were very uncertain about the timing of parenthood. Finally, respondents who voluntarily had decided to stay childless typically were embedded in 'child free by choice' networks.

Despite its important contribution, Keim's (2011) study has two major limitations. First, the small sample size raises generalizability issues. Second, due to the cross-sectional design, it is difficult to disentangle processes of socialization from selection effects. To avoid these problems, the present study aims to identify fertility-relevant social networks based on a large sample employing quantitative methods. Additionally, family formations of initially childless persons are predicted prospectively by the type of social environment.

3. Method

3.1 Data and sample

The data for this study came from the German Family Panel Study, pairfam, a national interdisciplinary panel study on partnership and family arrangements in Germany (Nauck et al. 2012). Information about pairfam's conceptual background can be found in Huinink et al. (2011). The survey started in 2008 with an initial sample of 12,402 randomly selected persons from the three birth cohorts 1991–1993, 1981–1983, and 1971–1973. The panel is scheduled to run for 14 years. Currently, data covering the first six waves (2008–2014) are available.

The total sample was based on waves 2 through 6 and consisted of 3,104 respondents aged 20 to 42 who were initially childless in wave 2 (for specific subsamples, see below). The lower age limit derives from the fact that several questions concerning the influence of social network members on fertility (e.g., regarding social pressure and social support) were not asked of persons below the age of 20. Note that 6.7% of the anchors and/or the respective partners interviewed in wave 2 and 7.5% in wave 4 were classified as infertile. This group was excluded from the present analysis because they were not asked questions regarding social pressure or social support.

3.2 Measures

3.2.1 Dependent variable

In the event history analyses, the event indicator took on the value of 1 if either the primary respondent (or the female partner in case of male respondents) reported having given birth or having become pregnant. Using this definition, 332 events were observed between waves 2 and 6. Because of the limited number of occurrences, the event-history analysis was based on a combined sample of both female and male primary respondents.

3.2.2 Characteristics of the social network

The boundaries of the networks were determined via four name-generator queries that identified the names of persons with whom the anchor is in direct contact. The four questions were formulated as follows. 1) "With whom do you share personal thoughts and feelings or discuss things that you would not discuss with just anyone?" 2) "Which

persons do you meet regularly for activities, for example sports, or when you go out (cinema, dancing), or when you just want to talk to someone?" 3) "Who helps you whenever you need information or concrete advice in practical matters?" 4) "With whom do you occasionally have quarrels or conflicts?" The first generator identifies affective ties, questions 2) and 3) focus on specific exchanges, and the fourth name generator is aimed at detecting conflictual connections. This set of four different name generators should yield a multiplex set of ties (McAllister and Fischer 1978; Marsden 1990). The descriptive statistics in Table A1 show that the average network size was 4.5, ranging from 0 to 30 relationships.

For a random sample of up to 8 network persons, additional data were obtained via name interpreter items. Concerning the properties of the relationship between the anchor and the persons in his or her network, aggregated measures of type of relationship, emotional closeness, and relationship duration were used. Relationship networks were described by measuring the relative proportions of three relationship types: 1) Alters representing the nuclear family (biological parents and siblings), 2) other kin (parents-in-law, stepparents, grandparents, aunts and uncles, cousins, nephews and nieces, siblings of the partner and grandparents of the partner, other relatives), and 3) friends and acquaintances. The partner was not considered a part of the social network because a serious consideration of partner characteristics would have taken the inquiry into a wholly different research area.

As can be seen in Table A1, the nuclear family and other relatives accounted for 21% and 5% of ties, respectively. The majority of ties (67%) were friends and acquaintances. The three categories did not sum to 100% – and therefore were not linearly dependent – because 10.7% of the anchors did not mention any network person. The type of relationship was additionally used as a proxy for network density because networks with a high share of kin typically are relatively dense (Keim 2011: 194). Direct indicators of network density were not available in the pairfam data.

Furthermore, an index of qualitative variation (Gibbs and Poston Jr. 1975, M2) was computed that indicates the variability of network composition in terms of relationship type. The index ranges between 0 and 1. If the index equals 0, one of the three categories (share of nuclear family, share of other kin, and share of friends and acquaintances) dominates completely. If the index takes on the value 1, all three types are represented in exactly equal proportions.

Emotional closeness was measured by the question, "How close do you feel to [name of Alters]?" Responses could range from 1 (not close) through 5 (very close). The duration of the relationship between Ego and the Alters was assessed in years by the question, "How long have you known [name of Alters]?" Because relationship duration is directly age-dependent, this variable was weighted by the age of the primary respondent in the cluster analyses (see below).

The age of persons in the network and the existence of young children were also considered. The average age of the social network was measured in years. To capture the potential for emotional contagion and social learning, the share of network persons who live with children younger than 3 years in the household was computed. The set of network persons considered here consists of friends, acquaintances, and relatives between 14 and 45 years old. Because the share of network persons with young children is age-dependent, this variable was also weighted by the age of the primary respondent in the cluster analyses.

Regarding social support and social pressure exerted by members of the social networks, global questions were used in the pairfam survey instead of name interpreter items. The amount of social support was measured by the following three questions: "To what extent would your social environment support you 1) in terms of finances, 2) with chores and babysitting, and 3) with emotional needs if/when you have a child?" Responses ranged from 1 (not at all) to 5 (very strongly). Items measuring social pressure were: "Most of my friends think that I should have a child" and "My parents think that I should have a child" with responses from 1 = not at all to 5 = absolutely. In both cases, an unweighted additive score was computed by averaging the respective indicators. The reliability of the scales in terms of Cronbach's α was sufficient (α = .78 for social support and α = .66 for social pressure).

3.2.3 Characteristics of the primary respondent

Basic demographic information on the primary respondent included gender (1 = male, 0 = female), age (in years), and level of education (years of enrollment in the educational system) and enrollment in school or vocational qualification at the time of interview (1 = yes, 0 = no). Because a high level of education is expected to have a negative effect on the transition rate to parenthood, especially for women (Blossfeld and Huinink 1991), an interaction term 'male × level of education' was considered in the multivariate analyses. Further, the anchor's migration status was covered by a dichotomous indicator with responses 1 = migration background (either mother or father was not born in Germany) and 0 = no migration background (mother and father are both born in Germany). Current place of residence was differentiated between 1 = Eastern Germany and 0 = Western Germany to reflect cultural differences arising from the post-war division of Germany. Relationship status was measured by a categorical variable distinguishing between 0 = single (the respondent currently is not in a partnership), 1 = marriage, 2 = non-marital cohabitation, and 3 = separate households ('living apart together'). Finally, the number of biological siblings is included as an additional variable in order to model the intergenerational transmission of fertility

preferences (Kotte and Ludwig 2011). Age, level of education, enrollment in school, current place of residence, and relationship status were measured at multiple time points.

Missing values on the independent variables were imputed using a single imputation procedure. The proportions of missing values were mostly lower than 10% and never exceeded 14% (relationship duration).

Most control variables are expected to have an effect on family formation as well as on the composition of the social network. Following descriptive results reported by Wolf (2010: 477) and Marsden (1987), the size of ego-centric social networks decreased with increasing age of the primary respondent, whereas the share of kin increased. Ego's educational level correlated positively with the size of the social network and negatively with the share of kin. At the same time, level of education and enrollment in the educational system are well-established indicators predicting fertility behavior (e.g., Blossfeld and Huinink, 1991). Concerning relationship status, previous research has showed that the personal networks of individuals who have lived in a partnership for a while tend to shrink, because couples become more focused on each other (Kalmijn 2003). Additionally, it is well known that courtship and the transition to parenthood are strongly interlinked processes (e.g., Blossfeld et al. 1999). Further, Diewald and Lüdicke (2006: 191) argue that in comparison to the Federal Republic of Germany, personal social networks in the German Democratic Republic were more similar to traditional networks in pre-modern societies. East German networks were less dependent on choice and were more often close-knit communities formed on the basis of ascribed characteristics. Regarding fertility behavior, recent research documented that women born in East Germany after 1971 had children earlier than their Western German counterparts, despite the fact that for the most part their fertile period spans the years after German reunification in 1990 (Arránz Becker, Lois, and Nauck 2010).

3.3 Analytical approach

The first step of the empirical analysis was to identify several types of social network using cluster analysis (Everitt et al. 2011). This approach aims at identifying homogenous groups of people (clusters) out of a heterogeneous quantity of elementary units (primary respondents). Because the number of clusters is not fixed a priori, cluster analyses are explorative in nature. Nevertheless, a theoretical judgment has to be made about which variables to include in the clustering procedure. For reasons discussed above, z-standardized indicators for the main channels of social network effects on fertility (social pressure, social support, social learning, and emotional contagion) and

several structural characteristics of the social network (e.g., size and share of kin) were used (see Table 1).

Cluster analyses were based on a pooled wave 2 and wave 4 dataset (N=3,104 respondents and N=4,329 observations). The sample consisted primarily of respondents who were childless at the time of the interview in waves 2 and 4 and who additionally did not expect a child at those times. In order to capture selection effects, N = 160 respondents who started a family between wave 2 and wave 4 were also included. For respondents who did not drop out of the panel and either stayed childless or who had children between wave 2 and wave 4, repeated measures of the network type were available. This information was used for the selection analyses.

Following a recommendation by Backhaus et al. (2006: 512–514), the clustering procedure consisted of two steps. First, a hierarchical cluster analysis based on the Ward method (Everitt et al. 2011: 77) was conducted. Second, the typology was optimized using the k-means algorithm (Everitt et al. 2011: 124–126). The starting partition of the k-means analyses was based on the results of the hierarchical cluster analysis. Regarding dissimilarity measures, squared Euclidean distance (hierarchical cluster analysis) and maximum value distance (k-means analysis) were used.

The optimal number of clusters was determined by the pseudo-F index stopping rule (Calinski and Harabasz 1974) and an evaluation of different solutions. The pseudo-F index takes on the following values: 592 (2 clusters), 598 (3 clusters), 602 (4 clusters), and 567 (5 clusters). Higher values indicate more distinct clustering. Hence, the four-cluster solution seems most appropriate.

Looking at longitudinal analyses, note that the sample is left-truncated. A subject is left-truncated when the time of observation starts after the subject had been exposed to the risk of an event for some time. Left-truncated subjects tend to have lower risks at shorter durations because high-risk subjects tend to drop out before reaching the time point at which observation starts (cf. Guo 1993). In the present analysis, a discrete-time event history analysis is applied, which handles left-truncation adequately (Singer and Willett 2003: 451–460). A multi-spell model was used in which subjects were defined to be at risk until the dependent event or right-censoring occurs. The birth of the first child in year *t* was predicted by the network relationship types and the control variables measured in wave *t-1*. This lagged independent-variables approach aims at avoiding bias due to the establishment of new ties in the social network following the transition to parenthood (reverse causation).

A logistic regression model was applied in order to estimate the effects of the covariates on the transition rate. In order to model the typically bell-shaped gradient of the transition rate, the age of the primary respondent was entered into the equation as a linear and a squared term. The linear term additionally was centered on its mean. The

event history analyses were based on a longitudinal sample comprising N=2,938 respondents who participated in at least one subsequent assessment after wave 2.

In the event history models shown in Table 4, no weights are applied. However, additional analyses have been carried out in which the recommended weighting procedure was used (Brüderl et al. 2013: 48). Because the weighted models differ only marginally from the unweighted ones, the decision was made to forgo weights. An additional justification for this decision comes from a recent study by Müller and Castiglioni (2015), which shows that the pairfam study is not subject to considerable selection via panel attrition.

4. Results

4.1 Four types of fertility-relevant social network

The results of the cluster analyses are summarized in Table 1. The cluster described in the first column clearly corresponds to the 'family-remote' network characterized by Keim (2011: 205), so her label for this type of network is adopted. Social networks of this type are small and consist predominantly and homogenously of friends and acquaintances. Both the duration of the relationship with Ego (M = -0.46) and the tie strength (M = -0.67) are below average. Additionally, members of the social network do not strengthen Ego's propensity to start a family by pressuring Ego to have a child or by providing social support. The potential for social contagion is comparatively low, as the proportion of network members with young children is low (M = -0.33).

The 'polarized' cluster, which also corresponds to the homonymous type described by Keim (2011: 205), is mainly characterized by a high network size (M = 0.71) and a heterogeneous composition regarding the types of Ego-Alter relationship (nuclear family, other kin, and friends). The value of the index of qualitative variation is 0.65 standard deviations above the mean. The levels of perceived social pressure and anticipated social support as well as the share of parents are only average. This is a first indication that different network influences on fertility processes are less effective in heterogeneous networks.

The third network type ('disintegrated') is characterized by a very small size of personal social networks (M=-0.99). Across the entire sample, an average of 10.5% of respondents indicated having not one single network person who met the network generator criteria. Detailed analyses show that this number jumps to 56.8% in the 'disintegrated' type, and when network persons are noted at all they are mostly parents, siblings, or other relatives – that is, obligatory rather than elective relationships. This explains the much higher average relationship duration (M=1.78) in this cluster.

Generally speaking, this third and relatively seldom (N=426 observations) type encompasses persons who are poorly integrated socially and can activate few resources within their networks (M=-0.59 for social support). This type did not show up in Keim's qualitative study (2011) and thus enriches the discussion.

Table 1: Four types of social network identified by cluster analyses (N=3,104 respondents)

	Family-remote		Polarized		Disintegrated		Family-centered	
	M	SD	M	SD	M	SD	M	SD
Channels of network influences								
Social pressure (scale)	-0.53	0.77	0.02	1.01	-0.17	0.91	0.25	1.00
Social support (scale)	-0.41	0.92	0.05	0.93	-0.59	1.35	0.27	0.87
Proportion of parents with children < 3 years[#]	-0.33	0.23	-0.12	0.75	-0.36	0.54	0.31	1.28
Structural features of the social network								
Size	-0.15	0.65	0.71	1.18	-0.99	0.47	-0.26	0.64
Share of nuclear family	-0.55	0.49	0.06	0.72	-0.56	0.61	0.32	1.24
Share of other kin	-0.33	0.23	0.61	1.48	-0.24	0.67	-0.29	0.39
Share of friends & acquaintances	0.78	0.40	-0.09	0.73	-1.35	1.09	0.06	1.00
Variability of network composition (IQV)	-0.60	0.72	0.65	0.83	-0.69	0.74	-0.10	0.97
Relationship duration with primary respondent[#]	-0.46	0.69	-0.31	0.72	1.78	0.92	0.03	0.86
Average closeness with primary respondent	-0.67	1.02	-0.26	0.93	-0.01	0.66	0.49	0.85
Average age[#]	-0.41	0.56	0.23	1.07	1.39	1.37	-0.33	0.55
N (observations)	775		1,451		426		1,836	

Note: Cluster analyses were based on the pooled wave 2 and wave 4 data. All variables were z-standardized. [#] Weighted by age of primary respondent.

Finally, the family-centered network described by Keim (2011: 205) was also observable in the data. The share of nuclear family members (parents, siblings) is highest in this cluster (M=0.32), which likely also explains why emotional closeness (M=0.49) is strongest in this cluster. Further, friends and acquaintances are present to an average extent (M=0.06): in contrast to the 'family-remote' type, these would appear to be especially close relationships, given the high degree of emotional closeness in the cluster. In aggregate, the composition variables as measured allow the conclusion that the cluster is made up of dense networks with a large share of strong ties. It had been expected for this kind of case that all mechanisms of network influence would be

especially strong, and the empirical results corroborate this assumption. Persons in the 'family-centered' cluster perceive more social pressure than average (M=0.25), count on the greatest amount of social support (M=0.27), and include in sum the highest proportion of network persons with small children (M=0.31). Given these characteristics, one expects this cluster to be associated with the highest rate of transition to family formation.

Based on the results of the hierarchical cluster analysis, alternative cluster solutions were considered and rejected, as follows. The polarized and the family-centered networks can be merged in a three-cluster solution. Nevertheless, because of clear-cut differences between these clusters in terms of composition homogeneity, the three-cluster solution is less appropriate. A five-cluster solution is possible but necessitates splitting the family-centered network into two new clusters that differ primarily in their composition. In the first, very small cluster (N=194 observations), the only network persons represented are from the nuclear family. In the second, the share of friends is higher. Because the five-cluster solution performs relatively poorly on the pseudo-F index, the four-cluster solution is preferable.

4.2 Stability of network types over time

As mentioned above, the correlation between network type and the propensity to start a family is potentially caused by two distinct mechanisms. On the one hand, the social environment in which Ego is embedded could have an impact on the transition to parenthood. On the other hand, persons could structure their networks based on childbearing intentions over time. With the analyses shown in Table 2 and Table 3, an attempt was made to analyze such selection effects. The tables show cross-tabulations of Ego's cluster memberships in waves 2 and 4. Two groups were compared: persons who are still childless in wave 4 (Table 2, N=1,224) and persons who had children between waves 2 and 4 (Table 3, N=160). Observed frequencies, expected frequencies (in parentheses), and marginal distributions are shown.

Concerning both groups, the observed frequencies in the main diagonal are considerably higher than the expected frequencies, suggesting stability of network types over time. However, the strength of the association between network types in waves 2 and wave 4 is only moderate because Cramer's V takes on the value of .22 for childless respondents and .25 for persons who started a family.

From a theoretical point of view, the nature of the selection effect should be that persons who stay childless have a higher probability of changing into network types that are expected to be associated with a low propensity to start a family; that is, into the family-remote network. By contrast, persons who are ready to start a family should

have a higher propensity to change into 'fertility-promoting' network types such as the family-centered network.

Table 2: Cross-tabulation of network types in wave 2 and wave 4 (respondents who have stayed childless)

	Family-remote (w_4)	Polarized (w_4)	Disintegrated (w_4)	Family-centered (w_4)	
Family-remote (w_2)	65	64	14	65	208
	(33.6)	(72.1)	(18.5)	(83.8)	
Polarized (w_2)	46	194	22	93	355
	(57.4)	(123.0)	(31.6)	(143.0)	
Disintegrated (w_2)	17	20	32	54	123
	(19.9)	(42.6)	(11.0)	(49.5)	
Family-centered (w_2)	70	146	41	281	538
	(87.0)	(186.4)	(47.9)	(216.7)	
	198	424	109	493	1,224

Note: Displayed are observed frequencies and expected frequencies in parentheses. Cramer's V: .22.

Table 3: Cross-tabulation of network types in wave 2 and wave 4 (respondents who have started a family)

	Family-remote (w_4)	Polarized (w_4)	Disintegrated (w_4)	Family-centered (w_4)	
Family-remote (w_2)	4	3	3	6	16
	(2.2)	(5.2)	(1.7)	(6.9)	
Polarized (w_2)	7	21	1	19	48
	(6.6)	(15.6)	(5.1)	(20.7)	
Disintegrated (w_2)	1	5	8	5	19
	(2.6)	(6.2)	(2.0)	(8.2)	
Family-centered (w_2)	10	23	5	39	77
	(10.6)	(25.0)	(8.2)	(33.2)	
	22	52	17	69	160

Note: Displayed are observed frequencies and expected frequencies in parentheses. Cramer's V: .25.

According to the Cochran-Mantel-Haenszel statistic (Mantel 1963, STATA command 'emh'), the bivariate distributions shown in Table 2 and Table 3 significantly differ from each other ($p < .01$). Looking at the distributions in wave 2, the proportion of the family-centered network is slightly higher for respondents starting a family (48.1%) compared to respondents who remain childless during the entire observation

period (43.9%). Concerning changes over time, the share of the polarized network type increases in the childless group (from 29% to 35%). This tendency might simply be due to an age effect because the share of kin, which is quite high in polarized networks, is positively age-dependent (Wolf 2010: 477). With respect to respondents who have started a family, no systematic changes in the marginal distributions can be observed.

To sum up, despite the significant differences between groups, there is no consistent evidence supporting the expected selection effect.

4.3 Predicting the transition to parenthood by type of social network

Finally, in extension of previous research, the transition rate to parenthood until right-censoring in wave 6 was predicted by the four network types and various control variables (see Table 4). Network types as well as control variables were measured across time. In Model 1, the process-time indicators (age and age squared) were entered together with the average network age and the network type (with family-remote network being the reference category). Despite a correlation of r = .73 between the age of the primary respondent and the mean age of the social network, the latter was also considered. This decision was made in order to rule out the possibility that the effects of network types are only coincidental, that is, a synchronization of birth events that can be solely traced back to the age homophily in social networks. Controlling for age, primary respondents embedded in polarized, disintegrated, and family-centered social networks have a higher transition rate to parenthood than primary respondents embedded in family-remote networks (reference category). The fact that the transition rate is highest in the 'family-centered' type and takes on a mid-level value in the 'polarized' type corroborates theoretical expectations.[4] However, the relatively high transition rate in the 'disintegrated' type is surprising and is addressed in the discussion below.

Model 1 was specified as a proportional hazard model (Singer and Willett 2003: 451–460), which assumes that the effect of the different types of social network on the transition rate is equal across age. In order to detect timing effects, interaction effects between the process time indicators (age and age squared) and the network types were entered in the equation (results not shown). However, no significant interactions emerged. Additionally, gender-specific differences were tested by the entering of interaction terms 'network type × gender'. Again, the interaction terms were not significant.

[4] In an additional model the 'polarized' type was used as the reference category. Taking alpha-error accumulation into account, the difference between the 'family centered' and 'polarized' types in this analysis was insignificant.

Table 4: Summary of discrete-time survival analysis for variables predicting transition to parenthood by type of social network, controlling for background variables (N=2,938 respondents)

	Model 1		Model 2		Model 3	
	B	**SE B**	***B***	**SE B**	***B***	**SE B**
Type of social network						
(ref.: family-remote)						
Polarized	0.70**	0.23	0.55*	0.24	0.72	0.50
Disintegrated	0.68*	0.28	0.65*	0.29	1.13†	0.60
Family-centered	0.91**	0.22	0.78**	0.22	1.18*	0.48
Process time						
Age centered	0.06**	0.02	0.03	0.03	0.12*	0.05
Age squared	-0.02**	0.003	-0.01**	0.003	-0.02**	0.01
Controls						
Average age of network centered	0.06**	0.02	0.04*	0.02	0.04†	0.02
Average age of network squared	-0.002*	0.001	-0.002*	0.001	-0.003†	0.001
Male			0.76	0.60	1.20†	0.69
Migration background			-0.01	0.17	-0.06	0.19
Currently enrolled in education			-0.40*	0.18	-0.25	0.20
Years of education			0.03	0.03	0.05	0.03
Place of residence: East Germany			0.84**	0.16	0.89**	0.18
Relationship status (ref.: LAT)						
Marriage			1.75**	0.19	1.77**	0.22
Non-marital cohabitation			0.81**	0.17	0.85**	0.20
Single			-1.47**	0.25	-1.46**	0.28
Number of full siblings			0.12**	0.05	0.11*	0.05
Instability of network type (w_2-w_4)					0.43	0.53
Interaction effects						
Years of education × male			-0.04	0.04	-0.07	0.05
East Germany × married			-1.57**	0.44	-1.39**	0.46
Polarized × instability					-0.06	0.58
Disintegrated × instability					-0.77	0.71
Family-centered × instability					-0.46	0.57
Constant	-3.29		-4.26		-4.92	
R Square (McFadden)	0.054		0.173		0.158	
N (observations)	6,768				4,519	
N (events)	332				276	

Note: Age of respondent and average age of social network are centered on their mean values. All covariates are entered time-lagged (t-1). † $p \leq .10$. * $p \leq .05$. ** $p \leq .01$ (two-tailed).

Furthermore, the possibility had to be taken into account that the effects of the network types are spurious due to unobserved heterogeneity. Therefore, control variables were added to the equation in Model 2. The respective effects largely corroborated previous research. For example, the risk of a first birth strongly increases in more committing union types. However, as the interaction 'East Germany × married' shows, the interrelation of being married and starting a family is significantly weaker in Eastern Germany. At the same time, anchors living in the eastern states of Germany have a higher transition rate to parenthood.

Being enrolled in an educational institution tends to inhibit the propensity to start a family, whereas no additional effect could be observed for the level of education. In the multivariate model, the likelihood of family formation did not differ among respondents with and without migration background. Also, the analyses corroborate the expected positive effect of the number of siblings on the rate of transition to family formation.

When the control variables were entered, the positive effects of family-centered, disintegrated, and polarized networks, compared to family-remote networks, remain stable. The fact that the positive effect of family-centered networks on the transition rate does not lose its significance after controlling for the number of siblings suggests that what is being acquired here is not simply fertility models learned from the parents alone. The results lend greater support to the interpretation that the high transition rate in this cluster has multiple causes working through various mechanisms (social pressure, social support, social contagion). Finally, Model 3 is based on the fact that, for some respondents, a repeated measure of the network type is available. Accordingly, it is possible to test whether the effects of the network type differ between respondents who either change their network type between wave 2 and wave 4 or whose social environment remains stable. Technically, interaction effects between the network types and a dummy variable 'instability of network type' were entered. The fact that the network type remains stable can be interpreted in different ways. First, stability means that there are no selection effects within the observational period of about two years. Second, one can expect network effects to get stronger with the amount of time Ego is 'treated' by a specific social environment.

Empirically, the conditional main effects of the network types in Model 3, together with the negative signs of the respective interaction effects, show that the difference between family-remote networks and the other network types is more pronounced if the network type remains stable over time. However, due to the limited sample size and low statistical power, almost none of the conditional main effects (except the family-centered network) and no interaction effects reach significance at the 5% level.

5. Discussion

The present study introduces a new way of looking at the social network effects on fertility. Instead of analyzing mechanisms as social support separately, as has been done by the majority of previous studies, types of social environment were identified using cluster analyses. These environments differ with respect to their composition (e.g., share of kin) and the degree to which the main channels of social influence – social pressure, social support, emotional contagion, and social learning – are at work. The predictive validity of this typology is expressed by the fact that the types of social network are interrelated with the transition rate to parenthood.

The first network type, labeled 'family-remote,' consists mainly of friends and acquaintances. Both the relationship duration and the emotional closeness with Ego are low. Members of the social network are not expected to provide social support in the case that Ego makes the transition to parenthood, and they do not pressure Ego to start a family early on. Moreover, there are few opportunities for emotional contagion or social learning because the majority of network members are not yet living with small children. In sum, this type of network provides neither information nor resources that would encourage Ego to start a family. Hence, primary respondents embedded in this type of social environment are most likely to abstain from family formation.

The 'polarized' network is relatively large and is also heterogeneous in that the number of relatives and friends/acquaintances is roughly similar. Theoretically, the process of social learning should be less effective in this kind of network, as Ego is confronted with contrasting values and lifestyles in the immediate social environment. Moreover, Ego might be confronted with different behavioral expectations in a heterogeneous network and thus feel torn between subgroups with conflicting expectations. Empirically, it was observed that perceived social pressure per family formation and the share of persons living with children in the network reached only average levels. Respondents in this type also took up a middle position in terms of the transition rate to family formation,.

The 'disintegrated' network type is new, in the sense that no qualitative study has as yet identified it. It is composed of persons who are poorly integrated socially, who often indicate having no or only few network persons, and who thus are not able to activate much potential support in their proximate social environments. However, the transition rate to family formation in this type is significantly higher than in the 'family-remote' cluster. At first glance, this result is surprising. Yet we must keep in mind that the absence or near absence of network influences, as in the 'disintegrated' cluster, is not the same thing as the presence of negative network influences ('family-remote'). Probably, behavioral models and norms predominate in the 'family-remote' cluster that encourage late family formation or its total avoidance.

Finally, 'family-centered' networks are rather small and are characterized by a high share of long-term and close ties to members of the nuclear family (siblings and parents). Persons who are embedded in this kind of network perceive more social pressure regarding family formation, anticipate strong network support in case of parenthood, and, because of the high share of parents in the network, have many opportunities for emotional contagion and social learning. The family-centered network corresponds to similar network types described in the literature as 'close-knit' (Bott 1957: 59), 'community-saved' (Wellman 1979), and 'core discussion' (Marsden 1987) networks.

As expected, primary respondents embedded in family-centered networks have the highest transition rate to parenthood. In multivariate analyses controlling for the number of siblings, it was shown that the high transition rate in this type can not be explained by intergenerational transmission processes alone.

Even if the sample is restricted to respondents who do not change their network type over time, the difference between family-centered and family-remote networks remains significant. In sum, these results corroborate the theoretical assumption that the mechanisms of social pressure, social support, emotional contagion, and social learning are stronger in dense networks consisting of strong ties.

Despite the fact that the typology of social networks seemed to have predictive validity, alternative explanations for the correlations between network type and Ego's propensity to start a family must be considered. First, it is well known that social networks typically are homophilic with respect to age, such that the synchronization of birth events within social networks might simply be coincidental. In order to address this issue, the age of the primary respondent and the mean age of the social network were controlled. This approach might be insufficient in that the average network age is only imperfectly correlated with the unobserved life course transitions of persons in the network (e.g., graduating from school or entering the workforce). Nevertheless, empirical findings did not consistently confirm that social networks with the highest average age had the strongest positive impact on Ego's propensity to start a family. For example, primary respondents embedded in family-centered networks are shown to have the highest transition rate to parenthood despite the fact that this network type is the second youngest in the sample.

Second, the correlation between Ego's fertility behavior and the respective social environment could be caused by selection effects rather than social influence. This might be the case if Ego chooses to establish or to intensify ties with network persons who are perceived to be similar. In order to address this issue, the stability of network types over time was analyzed. If selection effects are occurring, respondents who start a family should select themselves into fertility-promoting network types such as the 'family-centered' network, whereas respondents who stay childless should have a

higher propensity to change into 'family-remote' social environments. However, selection effects of this kind were not observed. Regarding change in network type over time, the only clear-cut difference between respondents who start a family and childless respondents was that the latter had a tendency to change into polarized networks whereas the former had no such tendency. Additionally, in the event history analyses, the effects of network type were even stronger in the group of respondents who did not change their social environment over time, which is to say that selection effects are absent. However, an important limitation of this kind of analysis is that selection was suspended only for a period of observation covering approximately two years. Accordingly, the possibility cannot be ruled out that people had structured their networks based on childbearing intentions before the time of the first interview.

The present study has several additional restrictions. Even though pairfam is probably the best data source for the issues discussed in this text, it is not perfect. First, it was not possible to disentangle social learning and emotional contagion, because the share of network persons living with young children was used as a proxy for both mechanisms. Second, network density was also measured by a proxy (share of kin). Third, it was not possible to answer the question about the extent to which fertility-relevant social networks overlap within couple relationships (Milardo 1982). Fourth, for the present analysis, 'only' ego-centric network data were available. In order to fully disentangle processes of selection and mutual influence, longitudinal data of complete networks would be necessary (Steglich, Snijders, and Pearson 2010). Using this approach, it would be possible to take into account the reciprocal nature of interaction processes within social networks.

The present study observes network types within a limited historical time period, so, if we consider desiderata for future research, we would ask to what extent the relative distribution of different network types has changed and will continue to change in the course of modernization. This question is related to an older study by Wellman (1979), who studied the consequences of modernization on social networks. A first hypothesis, which Wellman labeled 'community lost', was that processes of modernization are responsible for the weakening of solidarity in communities, which was assumed to lead to social isolation, a lack of social support, and the dissolution of traditional living arrangements such as family and neighborhood. According to this hypothesis, modern networks are rather sparse, primarily include weak ties, and provide little support. The family-remote network identified in the present study can be considered community lost. By contrast, the second hypothesis ('community saved') stated that solidarity in communities and kinship continues to exist. According to this, networks are dense, contain a high proportion of relatives and many strong ties, and are supportive. This characterization fits the family-centered network well. Finally, the third hypothesis suggests that communities are affected by structural change

('community liberated'). Similar to the polarized network identified in this study, personal networks were described to be heterogeneously composed in this case, that is, they contain both strong and weak ties and are spatially dispersed. Building on the Wellman hypotheses, historical and international comparisons of fertility regimes that take the social network perspective into account would likely prove fruitful. For example, the global decline of birth rates in most industrialized countries since 1960 might be partially due to changes in the distribution of network types.

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Appendix

Table A1: Descriptive statistics for variables used in the analyses

	M	SD	Min	Max
Channels of network influence				
Social pressure (scale)	2.75	1.42	1	5
Social support (scale)	3.67	0.84	1	5
Proportion of parents with children < 3 years	0.12	0.23	0	1
Characteristics of the social network				
Size	4.48	3.52	0	30
Share of nuclear family	0.21	0.26	0	1
Share of other kin	0.05	0.13	0	1
Share of friends & acquaintances	0.67	0.34	0	1
Variability of network composition (IQV)	0.38	0.35	0	1
Relationship duration with respondent	9.89	5.97	0	38
Closeness with primary respondent	3.84	0.67	1	5
Age	30.10	7.76	13	81
Characteristics of the primary respondents				
Age	28.71	5.79	20	42
Male	0.57		0	1
Migration background	0.17		0	1
Currently enrolled in education	0.30		0	1
Years of education	13.34	2.72	1.5	20
Place of residence: East Germany	0.18		0	1
Relationship status				
Marriage	0.11		0	1
Non-marital cohabitation	0.23		0	1
Living apart together	0.23		0	1
Single	0.43		0	1
Number of full siblings	1.36	1.22	0	14