Psychological Bulletin
2013, Vol. 139, No. 1, 53–80

0033-2909/12/$12.00 DOI: 10.1037/a0028601

Social Network Changes and Life Events Across the Life Span: A Meta-Analysis

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For researchers and practitioners interested in social relationships, the question remains as to how large social networks typically are, and how their size and composition change across adulthood. On the basis of predictions of socioemotional selectivity theory and social convoy theory, we conducted a meta-analysis on age-related social network changes and the effects of life events on social networks using 277 studies with 177,635 participants from adolescence to old age. Cross-sectional as well as longitudinal studies consistently showed that (a) the global social network increased up until young adulthood and then decreased steadily, (b) both the personal network and the friendship network decreased throughout adulthood, (c) the family network was stable in size from adolescence to old age, and (d) other networks with coworkers or neighbors were important only in specific age ranges. Studies focusing on life events that occur at specific ages, such as transition to parenthood, job entry, or widowhood, demonstrated network changes similar to such age-related network changes. Moderator analyses detected that the type of network assessment affected the reported size of global, personal, and family networks. Period effects on network sizes occurred for personal and friendship networks, which have decreased in size over the last 35 years. Together the findings are consistent with the view that a portion of normative, age-related social network changes are due to normative, age-related life events. We discuss how these patterns of normative social network development inform research in social, evolutionary, cultural, and personality psychology.

Keywords: social network, life-span psychology, life event, cross-cultural, meta-analysis

"Network size is the most basic characteristic of friendship network structure, but we still do not have a clear sense of what the typical size of networks is, or of how it varies across adult age" (Ueno & Adams, 2006, p. 153). Ueno and Adams (2006) drew this conclusion about friendship networks. Yet, the typical size of other social networks and how they vary across adult age are also unclear, despite the importance to anybody interested in social relationships. Numerous studies state that social networks change across the life span. The two prevailing developmental theories, socioemotional selectivity and social convoy theory, predict similar network changes but attribute these to different causes. Using meta-analytical methods, we aim to quantify the size and composition of social networks as they change from adolescence to old age, and seek to explain normative network changes through the occurrence of normative life events.

Different Types of Social Networks

Social networks comprise a person's social relationships, that is, "the set of people with whom an individual is *directly involved* [emphasis added]" (C. S. Fischer, 1982, p. 2), such as family members, friends, and acquaintances. Direct involvement implies that there is a social relationship between the individual and the network partner that is characterized by repeated interactions between the dyad members and a mental representation of the relationship as such (Baumeister & Leary, 1995). Repeated interactions distinguish social relationships from single interactions and zero acquaintances (Baumeister & Leary, 1995; Duck, 1988; Hinde, 1979), whereas mental representations imply that the relationship partners view and report their association as a relationship (Baldwin, 1992). This definition distinguishes social networks in the current meta-analysis from approaches that focus on the maximum number of persons an individual knows at least by name (Hill & Dunbar, 2003; Killworth, Johnsen, Bernard, Shelley, & McCarty, 1990). Furthermore, the definition distinguishes social networks from social groups: Members of social groups can, but

This article was published Online First May 28, 2012.

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We thank Thomas Kessler, Kristin Mitte, and Margund Rohr for their valuable comments on earlier versions of this article. We are grateful to Julia Delius and Grace O'Malley for editorial assistance.

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do not have to, entertain social relationships (e.g., Asendorpf & Banse, 2000; Baumeister & Leary, 1995). Group belonging can occur without (repeated) interaction (see, e.g., research using the minimal group paradigm: Brewer, 1979; Tajfel, Billig, Bundy, & Flament, 1971). Finally, groups are often performance oriented and share goals (Sherif, 1966), whereas this does not necessarily characterize social networks such as friendship or family networks (Baumeister & Leary, 1995; Duck, 1988; Hinde, 1979).

There are different types of social networks that can be distinguished by the kinds of relationships they include. The term *global network*, or directly "social network," comprises all existing social relationships of an individual with family members, spouses, friends, coworkers, neighbors, society fellows, etc., and thus conceptualizes social networks most comprehensively (Allan, 2006; C. S. Fischer, 1982; Milardo, 1989). The *personal network* describes a subnetwork of closer, personal relationships in the global network such as family members, friends, and other close confidants (van der Poel, 1993). Personal networks are sometimes termed support networks, as they are often seen as a resource for people's health and well-being through the exchange of support among closer network members (Allan, 2006; Hammer, 1983). Other types of networks that also focus on subnetworks of the global network are the *friendship network*, the *family network* (e.g., siblings, parents, children, and spouse), and the *work-related network* (e.g., coworkers and supervisors). Studies focusing exclusively on more peripheral relationships within people's global networks, such as with neighbors or professional helpers, are scarce (Imamoğlu, Küller, Imamoğlu, & Küller, 1993; Tracy, 1990). More often peripheral relationships are studied as a part of global networks.

The size of social networks is an important characteristic because it indicates social resources. Social resources often bear beneficial effects for people's health, well-being, and accomplishment of life tasks (Bastani, 2007; Carstensen, 1991; Granovetter, 1973; Kahn & Antonucci, 1980; Pinquart & Sörensen, 2000). The assessed social network size can vary with the assessment method and several other methodological factors such as sample representativeness or gender distribution (Bien, Marbach, & Neyer, 1991; Cross & Madson, 1997; Kogovšek, & Ferligoj, 2005). The strength of meta-analyses is to incorporate studies with varying methods because these effects can be analyzed in moderator analyses (Rosenthal, 1991). We explain the included method effects in detail in the section The Present Meta-analysis.

In addition to the overall size of the global network, the number of relationships in specific subnetworks such as family or work-related networks is important because distinct relationships can fulfill different functions (e.g., Cronenwett, 1985a; Neyer, Wrzus, Wagner, & Lang, 2011). Individuals' global networks sometimes lack relationships in specific subnetworks. Whether coworkers or friends are part of global networks can vary between individuals and also within individuals over the life course. For example, if a person is active in the labor market, coworkers are more likely in his or her global network. Thus, personal circumstances are an influencing factor for social networks and their change (Lang, 2004). Two major theories address changes in social networks over the life course: socioemotional selectivity theory (Carstensen, 1991) and social convoy theory (Kahn & Antonucci, 1980).

Changes of Social Networks Over the Life Course

The two prevalent theories on the life-span development of social relationships, socioemotional selectivity and social convoy theory, predict similar changes but attribute these changes to different causes. Socioemotional selectivity theory describes how social goals, and with them social relationships, change over the entire life course due to shifts in perspectives on how much time one has left to live (Carstensen, 1991, 1992, 1995). During adolescence and young adulthood, when remaining life time seems unlimited, *information acquisition* goals are relatively more prevalent compared with other life periods. People focus on gathering knowledge and information from diverse relationships and sources, which is achieved best in large networks with diverse relationship partners. After young adulthood and throughout the rest of adult life, when remaining life time is perceived as increasingly limited, *emotion regulation* goals become increasingly important. People emphasize emotional aspects of relationships and focus on close relationships, such as those with family members, with expected pleasant interactions that most likely satisfy emotion regulation goals. Accompanying decreases in network size in older adulthood are assumed to be actively sought and not merely passively experienced because of deaths of network members (Carstensen, Isaacowitz, & Charles, 1999; Lang & Carstensen, 1994). Decreases especially in peripheral, but less in close and familial relationships support these assumptions (Lang, 2000; Lang, Staudinger, & Carstensen, 1998). For example, in a longitudinal study, Carstensen (1992) analyzed interviews conducted with 50 participants at the age of 18, 30, 40, and 52 years. Carstensen reported that interaction frequency with acquaintances and friends decreased starting from young adulthood onward, whereas interaction frequency with family members and closeness to family and friends increased once middle adulthood was reached. Apart from this study, the assumptions on social network changes over the life course have not been tested satisfactorily, as empirical support primarily exists for network changes in old age (Lang & Carstensen, 1994; Lang et al., 1998).

Social convoy theory holds that people maintain a network of social relationships that escorts them over the life course like a convoy, that is, like a group of fellow travelers on the road of life (Kahn & Antonucci, 1980). Relationships in this convoy differ in levels of closeness and dependency on social circumstances and are therefore differently affected by changes in a person's circumstances. That is, relationships with people in the innermost circle of the convoy, such as spouses and the core family, should be highly stable throughout the life span (Antonucci & Akiyama, 1987; Kahn & Antonucci, 1980). Relationships in the periphery of the convoy, such as acquaintances, coworkers, and neighbors, are assumed to be less stable. These relationships may end with changes in external circumstances such as changes in social roles or location (Kahn & Antonucci, 1980). For late adulthood, two studies provide first support for convoy theory: Close, core relationships remained stable, whereas peripheral relationships decreased in number and contact frequency (Antonucci & Akiyama, 1987; Guiaux, van Tilburg, & Broese van Groenou, 2007). Studies testing the life-span assumptions of the social convoy theory comprehensively are not available.

In sum, both theories concur that more peripheral, less close relationships continuously decrease in number during adulthood,

whereas close relationships with family and close friends persist throughout the life course. As a motivational theory, socioemotional selectivity theory predicts this pattern of decrease and stability on the basis of increased salience of emotion regulation goals due to a limited future time perspective. Social convoy theory predicts a similar pattern of network changes but attributes changes to altering circumstances, such as those induced by life events. Peripheral relationships are more vulnerable to changing circumstances, whereas family and other close relationships are mainly more enduring. Thus, both theories differ regarding the assumed underlying mechanisms of change and therefore the importance they attribute to situational circumstances. We argue that life events represent such altering circumstances that affect social relationships and work concurrently with, and in the same direction of, motivational changes.

Life Events Can Change Social Networks

Compared with daily incidents, life events are far-reaching occurrences that necessitate, or take place with, changes in behavioral patterns (Filipp, 1990; Holmes & Rahe, 1967). The diversity of biological, social, and physical events can be classified as *normative* (i.e., of high probability for most people at a certain age, such as marriage or entering the labor market) or *nonnormative* (i.e., experienced only by few, such as winning the lottery or a car accident, or of low probability, such as war). In addition, normative life events vary in time of occurrence during the life course (Brim & Ryff, 1980): Examples are school entry, puberty, marriage, parenthood, labor market entry, retirement, and widowhood.[1] Most research focuses on normative life events, and we also include nonnormative life events with a moderate occurrence probability, such as relocation, divorce, and death of a relative (Filipp, 1990). Since the effects of life events on social networks are heterogeneous, we next introduce the events addressed in this meta-analysis one by one.

Normative Life Events

Most researchers classify *puberty* as a life event involving major biological and social changes, whereas adolescence is defined as a period in life (Brim & Ryff, 1980; Filipp, 1990). During puberty, adolescents' emotional and behavioral autonomy from parents usually increases (Hofer & Pikowski, 2002; Kreppner, 1993). Establishing social ties outside their core family with friends and first romantic partners helps adolescents to accomplish this developmental task of achieving autonomy and satisfying emotional needs more independently of the core family. Furthermore, large and diverse social networks are assumed to better fulfill needs for information acquisition (Carstensen, 1995). Thus, during puberty, the global network of adolescents should expand due to an increasing number of relationships with peers and other nonrelatives (Feiring & Lewis, 1991; J. L. Fischer, Sollie, & Morrow, 1986).

Marriage is assumed to extend the spouses' social networks because in-laws and partners' friends join the network (D. R. Brown & Gary, 1985; Hurlbert & Acock, 1990; M. P. Johnson & Leslie, 1982)—often already during the first months of romantic relationships. Yet, spouses' networks are seldom simply the sum of both partners' networks because selection occurs based on similarities with the new network partners (Sprecher & Felmlee, 2000). This takes place because of active assortment as predicted by similarity–attraction theory (Byrne, 1971; Byrne, Griffitt, & Stefaniak, 1967) as well as social homogamy (McPherson, Smith-Lovin, & Cook, 2001; Watson et al., 2004). Social homogamy ensures that we are more likely to meet other people of similar sociodemographic background, for instance, regarding education or age at work or during leisure activities. From these people, we actively select more similar relationship partners because interactions with them are assumed to be pleasant due to similar interests and activities as well as confirmation of one's own views (Byrne, 1971).

Becoming parents, that is, the *transition to parenthood*, often reduces social networks (Bost, Cox, Burchinal, & Payne, 2002). This occurs partly for structural reasons (e.g., less available free time, different daily routines) and partly due to psychological processes. These processes include, for example, an increased focus on the child and the romantic partner, as well as diverging interests with childless affiliates (Bernardi, 2003). Social comparison theory (Festinger, 1954) would predict that parents-to-be compare themselves with friends and others regarding attitudes toward children and continue relationships with agreement concerning children, but discontinue relationships where relationship partners disagree in relevant attitudes (Bernardi, 2003; Heider, 1958). Strongest reductions occur in less close, peripheral relationships, whereas family relationships are assumed to be stable, and contact with family members may even increase (Power & Parke, 1984).

Entering the labor market, that is, *job entry*, expands access to new persons who may eventually enter the global social network as coworkers or even as new friends (Morrison, 2002). Physical proximity, belonging to the same social group, and social homogamy—factors all fulfilled at work—have been shown to increase the chances of forming new relationships (Back, Schmukle, & Egloff, 2008; Festinger, Schachter, & Back, 1950; McPherson et al., 2001). In contrast, existing friendships can diminish due to decreasing (time) resources (Shaver, Furman, & Buhrmester, 1985; Sollie & Fischer, 1988) or social comparison processes that lead to discontinuation of dissimilar friendships (Festinger, 1954; Heider, 1958). In sum, the global social network should increase due to the inclusion of coworkers, whereas friendship networks are assumed to experience gains and losses simultaneously.

The *loss of a spouse* reduces the network not only on account of that loss, but also by losing acquaintances, friends, and family members, as mourning tends to be accompanied with some temporary social withdrawal (Antonucci et al., 2001; Zettel & Rook, 2004). This life event presumably exerts its strongest effects briefly after its occurrence, and after several months people usually regain a status similar to before the loss of the spouse (Zettel & Rook, 2004).

[1] In this meta-analysis we focus on changes in social networks starting from adolescence because children's networks are often not self-reported but are described by the parents instead. Since we focus on adolescence and beyond, we do not include school entry as a life event. In addition, we do not describe effects of retirement on social networks because we found only one study providing sufficient inclusion information.

Nonnormative Life Events

The loss of a spouse is expected at a certain age, whereas the *death of a relative*, such as a child or sibling, is a nonnormative life event that is often unexpected and can occur at any time during the life course (e.g., due to an accident or an illness). Research regarding effects of this life event on social networks is still scarce but generally suggests profound effects on all domains of personal and social functioning, among them social relationships (Lehman, Wortman, & Williams, 1987; Murphy, Lohan, Dimond, & Fan, 1998). Similar to the loss of a spouse, we expect a (temporary) decrease in acquaintances and friends when people withdraw from extended social contacts and focus on close relationships (Murphy et al., 1998).

Divorce is an especially stressful, nonnormative life event that reduces a person's social networks through the partial loss of in-laws and spouse's friends, but also through a focus on close, supportive relationships at the cost of more peripheral relationships (R. A. Caldwell, Bloom, & Hodges, 1983; Daniels-Mohring & Berger, 1984; Hughes, 1988; Rands & Milardo, 1988; Sprecher, Felmlee, Schmeeckle, & Shu, 2006).

Relocation strongly affects social networks because most extrafamilial relationships are maintained with people living and working within the same city or area (Bloem, van Tilburg, & Thomése, 2008). Contact with these people declines with increasing residential distance (M. A. Johnson, 1989; Neyer & Lang, 2003). Thus, social network size decreases when a person moves to a different area. Some of the existing relationships can no longer be maintained as before, since visits and shared activities are no longer easily achieved (Jerusalem, Hahn, & Schwarzer, 1996; South & Haynie, 2004).

In sum, normative life events differ in their effects on social networks. Whereas some events expand specific social networks, others decrease their size. In contrast, nonnormative life events seem to mainly reduce the size of social networks. Peripheral, less close relationships are among the first to dissolve, whereas close, long-lasting relationships such as those with family members are less likely to be affected (Lang, 2004).

The Present Meta-Analysis

We aim to integrate existing theories on social network changes across the life span by showing that age-related social network changes as proposed by socioemotional selectivity theory correspond to life-event-related social network changes as suggested by social convoy theory.

Thus, in Research Aim 1, we address the size of different types of social networks and their change at a certain age. We assume that the size of the global social network and the personal network first increase during adolescence and young adulthood by incorporating extrafamilial relationships to satisfy needs for information acquisition. During and after middle adulthood, people are assumed to focus less on large, diverse social networks and instead narrow their networks to relationships with close others, such as family members (Carstensen, 1995; Carstensen et al., 1999; Lang, 2004). These changes should be largely evident in changes of friendships and work relationships following the predictions of socioemotional selectivity theory on changes in peripheral relationships. For the family network, we assume high stability of size throughout the life span as proposed by social convoy theory.

With Research Aim 2, we want to test whether these network changes are related to normative and nonnormative life events. We assume that age-related network changes (i.e., changes unrelated to the occurrence of life events) are congruent with the effects of life events occurring normatively in these specific life periods. For instance, we hypothesize that puberty affects social networks in a way that is similar to what is observed in Research Aim 1 for the teenage period. Another example of what we expect to find is that the effect of losing a spouse, which mainly occurs in late adulthood, should be similar to the observed normative network changes (unrelated to life events) for people aged 60 and older.

In addition, we address three domains of moderator effects. Study results can be affected by biases regarding (a) the sample, (b) the measurements, and (c) the time of assessment (Nesselroade & Jones, 1991). We examine effects of the sample with regard to the gender distribution, the nationality, and the sample recruitment. We hypothesize that samples with larger proportions of women report larger network sizes because women often score higher on measures of communion and relationship orientation, which is also expressed in larger social networks (Cross & Madson, 1997; Diehl, Owen, & Youngblade, 2004; Moore, 1990). Furthermore, samples from countries with more pronounced individualistic values should report larger global networks compared with less individualistic countries. Individualism–collectivism is, among other things, related to being more or less open to persons outside the family (Hofstede, 1980; Oyserman, Coon, & Kemmelmeier, 2002; Triandis, Bontempo, Villareal, Asai, & Lucca, 1988). Being more open to extrafamilial persons should result in maintaining larger social networks in countries with more pronounced individualistic values. We therefore used individualism–collectivism scores published by Hofstede (1980) and Oyserman et al. (2002) to study how country differences in individualistic–collectivistic values affect average network sizes. In addition, we explore the differences between convenience samples, student samples, and more representative, general population-based samples. We exclude psychiatric samples because psychiatric disorders affect social relationships strongly but differently depending on the kind of disorder (Brugha, 2007; Goldberg, Rollins, & Lehman, 2003).

With regard to measurement effects of the network assessment, free-recall procedures are more cognitively demanding than recognition procedures (Anderson & Bower, 1972). We therefore assume that free-recall procedures lead to smaller networks than guided recall or recognition procedures, often employed in standardized interviews or quantitative instruments (Bernard et al., 1990; Sudman, 1985).

To study effects of time, we test whether social networks, particularly personal and family networks, decreased in size over recent decades as currently suggested (McPherson, Smith-Lovin, & Brashears, 2006, 2009; Phillipson, 1997). We also address whether longitudinal and cross-sectional studies differ in reported effect sizes of network change. Differences between both types of studies can occur because age effects in longitudinal studies stem from within-person change and possibly period effects, whereas age effects in cross-sectional studies stem from (unobserved) within-person change and possibly from cohort and period effects (Lindenberger, von Oertzen, Ghisletta, & Hertzog, 2011; Molenaar & Campbell, 2009; Nesselroade, Schaie, & Baltes, 1972). Among longitudinal studies, we propose that the study duration affects network changes differently. For age-related changes, we assume

that long-ranging studies capture larger changes in network size: Both increases early in life and decreases later in life cumulate over time, leading to larger increases or decreases of network size in longer studies, respectively. With respect to changes related to life events on the other hand, we assume that the largest effects can be observed shortly after the event. Over time, people's social network sizes likely return to the size maintained before the event occurred because old relationships are rekindled and people usually gain the functional status they held before the life event (Terhell, Broese van Groenou, & van Tilburg, 2007; Zettel & Rook, 2004).

Method

Study Selection

An extensive literature search was conducted in 2008–2009 and updated in 2012 using the databases PsycINFO, Web of Science/Social SciSearch, Science Direct, Psychology and Behavioral Science Collection (including Dissertation Abstracts via EBSCO), and also PSYNDEX to retrieve German publications. No restriction was set regarding the earliest year of publication. Furthermore, we searched in the journal *Social Networks* for studies from 1978 to 2012. We used a routine procedure of two steps. First, we looked for publications on social networks, excluding neurological networks. Keywords were *network*, *personal network*, and *social relationship* with exclusion terms *mind*, *brain*, *semantic*, and *neural*. Second, we searched for publications focusing on social networks and life events. For this search we combined keywords for networks (*network*, *personal network*, *social relationship*, and *close relationship*) and life events (*life-event*, *normative transition*, *transition*, *puberty*, *marriage*, *parenthood*, *entering work life*, *retirement*, *widowhood*, *death*, *divorce*, *relocation*, and *move*), yielding 48 combinations in all. English and German terms were used.

This search yielded 5,423 hits, from which we read abstracts to decide on the suitability for the aims of the meta-analyses. This preselection resulted in 916 articles, 68 books or book chapters, and 126 dissertations to read. From these, we excluded 702 articles, 65 books or book chapters, and 71 dissertations from the final analyses because

- they did not report statistics on either network size or age of sample ($k = 285$ articles, $k = 55$ books, $k = 18$ dissertations), or
- they did not assess any kind of social network because they focused, for example, on parent–child relationships ($k = 277$ articles, $k = 8$ books, $k = 30$ dissertations), or
- they focused on unsuitable samples, such as psychiatric patients or animal samples ($k = 140$ articles, $k = 2$ books, $k = 23$ dissertations).

For dissertations not retrievable through ProQuest or the Internet, we tried to contact the authors and found no contact information ($k = 18$) because the dissertations dated back to 1969, or did not receive an answer ($k = 28$). This left 214 articles, three books, and nine dissertations to code, which amounted to 277 studies. The number of studies slightly exceeded the number of sources because some articles and books reported on more than one study or sample. They were therefore included as separate studies.

Coding of Effect Sizes and Study Characteristics

For each study we coded study characteristics (see Table 1) and effect sizes related to the size and change of specific social networks. For example, if a study reported having interviewed college students once before they entered the labor market and again 3 months later and asked them to name people that would provide emotional and/or functional support, we coded the study as longitudinal with two measurement points, as employing a student sample and using an interview procedure for the assessment of a

Table 1
Coded Study Characteristics

Variable	Description and coding options
General information	
Author and reference	Full reference recorded
Type of publication	1 = journal article, 2 = book, 3 = dissertation
Sample size	Number of participants
Predictors	
Sample age	Mean, standard deviation, minimum, maximum, 1 = 11–18 years, 2 = 18–30 years; 3 = 30–45 years, 4 = 45–60 years, 5 = 60–80 years, 6 = older than 80 years
Life event	1 = puberty, 2 = marriage, 3 = parenthood, 4 = job entry, 5 = loss of a spouse, 6 = death of a relative, 7 = divorce, 8 = relocation, 9 = no life event
Network type	1 = global network, 2 = personal network, 3 = family, 4 = friends, 5 = coworker, 6 = other acquaintances
Moderators	
Percentage of male participants	1 = less than 5%, 2 = between 5% and 40%, 3 = between 40% and 60%, 4 = between 60% and 95%, 5 = more than 95%
Sample type	1 = general population based, 2 = convenience (recruited from homes for elderly, counseling offices, etc.), 3 = students
Country of sample	Country name recorded
Network assessment	1 = interview, 2 = standardized instrument (e.g., questionnaire), 3 = using free recall (e.g., request to name up to 20 friends)
Design type	1 = cross-sectional, 2 = longitudinal (for longitudinal studies, the number of assessment points and the total time span were coded)

personal network. In addition, we noted all further available information describing the study and the sample and recorded the observed effect sizes at the first measurement occasion as well as those reflecting the change accompanying the life event job entry. Some studies did not apply longitudinal designs to study effects of life events on network change, but rather compared a group of participants who had recently experienced this life event with a control group that had not. The groups were matched in age and further study-relevant variables. In the meta-analytic procedure section, we describe how those effect sizes and longitudinal effect sizes were integrated.

Procedures to assess social networks differed in the involvement of the interviewer and the cues provided for the participant to remember relevant persons. We thus distinguished three categories: (a) In interviews, the interviewer asked participants about relationships related to the study purpose, such as positive as well as ambivalent relationships. The interviewer often prompted the participants to think of different relationship categories such as family, friends, and neighbors. (b) In standardized instruments, participants answered questionnaires, where they had to name people they engage with in specific activities (e.g., having meals, doing sports, talking to at work), for example. Alternatively, participants imagined themselves in the middle of three concentric circles that represented relationships differing in closeness and categorized their relationship partners into the circles (Antonucci, 1986). (c) In free-recall procedures, participants were not given cues but asked either to name people who belonged to a specific relationship category or to count the number of people they have contact with, they could rely on for help, or who are important to them. All these operationalizations have in common that people name relationship partners they are directly involved with and whom they represent as relationship partners because they are explicitly asked for these—thus, they match the definition of social relationships, which together constitute a social network.

We developed a precise coding manual with examples and coded all studies using the manual. Studies often included information on different subnetworks; for instance, on family as well as friendship networks (see theoretical background on Different Types of Social Networks and Table 1). The different networks were included as individual effect sizes for the same study and analyzed separately.

Coding of effect sizes: Size of social networks and change in size. We coded three types of effect sizes related to social network size: average network size, change in network size, and change in network size related to a life event. First, average network size was coded as the average number of people reported for a certain network unrelated to life events. If a study focused on longitudinal change, the size at the first measurement occasion was used. Furthermore, a few additional effect sizes were derived from quasi-experimental studies that compared two groups with only one experiencing a life event. Here the average network size of the control group, which was matched in age and other study-relevant characteristics, was used to code the average network size. Second, longitudinal change in network size unrelated to life events was either directly extracted from the text (either as Cohen's *d* or as unstandardized mean difference) or computed from network sizes reported for two time points. When the study contained more than two time points, the first and the last assessment were used for computing the network change and total study duration, and the number of assessments was recorded. Third, change in network size related to life events was coded either as Cohen's *d* or as an unstandardized mean difference. This change could either be a pre–post test change associated with a life event or mean differences in network sizes between a control group and a subgroup that experienced the life event. Together with mean differences, we recorded standard deviations and the size of subsamples for cross-sectional studies, or standard deviations, stability coefficients, number of assessments, and time between the assessments for longitudinal studies.

Some cross-sectional studies ($k = 24$) reported a correlation between age and network size. We transformed the correlation into Cohen's *d* using the formula $d = 2r/\sqrt{(1 - r^2}$ (Rosenthal, 1991) and recorded the age range of the sample.

Double coding. We double-coded 10% of the articles to assess coding quality. The average interrater reliability of .90 suggested a high agreement on recorded variables. Disagreements observed during double coding and unclear information found during coding of the remaining studies were resolved after the computation of the interrater reliability.

Missing data. Seventy-five studies did not report the average age but only minimum and maximum age of the sample. The minimum and the maximum age allowed us to code the appropriate age category (see Table 1), if the age range did not exceed the range of the category by more than 5 years. The mean of the age category was used to replace missing average sample age. When studies did not report standard deviations (43%) or stability coefficients of network sizes (73% of longitudinal studies), these values were imputed with multiple regression (Allison, 2000; Lipsey & Wilson, 2001; Lüdtke, Robitzsch, Trautwein, & Köller, 2007).[2] Missing data for moderators were coded as missing.

Meta-Analytic Procedure

The primary effect sizes in this meta-analysis were, first, the arithmetic mean indicating an average network size and, second, Cohen's *d* as the standardized mean difference of network sizes due to age-related change or to change related to the occurrence of life events. In total, there were 491 arithmetic means on network sizes and 134 Cohen's *d* effect sizes relating to change associated with either age or life events. Both required different statistical procedures, as explained next.

Average network size: Arithmetic mean. Although the arithmetic mean is seldom used in meta-analyses, it is a valid effect size that can be aggregated if the arithmetic means measure effects on a common metric (Hunter & Schmidt, 2004; Lipsey & Wilson, 2001). This applied to the average network size because the common metric was the number of people.

We analyzed how average network sizes varied with the age of the sample (Research Aim 1) using metaregression with random

[2] Missing standard deviations and stability coefficients were imputed through multiple regression based on network type and sample age. Additional predictors, such as sample size and assessment type, did not enhance the quality of the imputation. Regression-based imputation was preferred over replacing missing values with average values because descriptive statistics of imputed values are more similar to descriptive statistics of "original" values containing missing values.

effects, applying the formulas and macros provided by Lipsey and Wilson (2001) for SPSS. Regression weights were computed from sample size and standard deviations of network size (Lipsey & Wilson, 2001, p. 72). To test the predicted nonlinear increase–decrease course of both global and personal networks, we applied a combined exponential growth-and-decline formula as it is used in research on cognitive development over the life span (Buchwald, 2007; Cerella & Hale, 1994; Li et al., 2004). Specifically, we first estimated regression parameters using the formula network size $= a * e^{(-b * \text{age})} + c * e^{(d * \text{age}-1)} + 1$ in nonlinear regression models separately for each network type. The regression parameters are a, b, c, and d, and e stands for the exponential function. The first summand of the regression formula describes nonlinear growth as a function of age, and the second summand describes nonlinear decline as a function of age. After estimating the regression parameters a, b, c, and d, we then transformed the age variable by computing a new age variable using these parameters obtained from the nonlinear regression. This enabled us to continue within the linear model of metaregression (J. Cohen, Cohen, West, & Aiken, 2003; Lipsey & Wilson, 2001). We did not fit quadratic change models because those results strongly depend on the age range of the sample (Fjell et al., 2010). Linear age effects were preferred to nonlinear age effects for reasons of parsimony if the model provided a similar or better model fit compared with the model including the nonlinear age effect.

Effects of moderators were tested by stepwise inclusion. The independence assumption of effect sizes was met because subnetworks, such as family networks and friendship networks, which partly stemmed from the same studies, were analyzed in separate regression models.

Change in social networks. First, Cohen's d was computed as $\text{ES} = (M_2 - M_1)/SD_{\text{pooled}}$, where M_2 and M_1 are either the means at two assessment points in a single-sample pre–post contrast or the means of a two-group contrast, and SD_{pooled} is the pooled standard deviation (Lipsey & Wilson, 2001). We computed unbiased effect sizes that account for heightened effect sizes in small samples (Hedges, 1981) using the formula $\text{ES}_{unbaised} = [1 - 3 / (4df - 1)] * \text{d}$. Standard errors and weights (i.e., inverse of the squared standard error) were computed with formulas provided by Lipsey and Wilson (2001). As in previous meta-analyses (e.g., Lim & Dinges, 2010), we finally converted effect sizes from between-person studies using the formula $\text{ES}_{\text{WP}} = \text{ES}_{\text{BP}}/\sqrt{2(1 - r)}$ to combine them with effect sizes from within-person studies (Morris & DeShon, 2002). The test–retest correlation in longitudinal studies ranged from .30 to .62. The transformed effect sizes were highly similar to the observed effect sizes ($r = .97$, $p < .01$).

For the general analyses of network changes related to age (Research Aim 1) or to life events (Research Aim 2), as well as for later moderator analyses, we chose a mixed-effects model. This model assumes that the variance of effect sizes is due to fixed (e.g., age, moderators) and random effects. It was preferred to the fixed-effects model, which postulates that only independent variables, moderators, and sampling error contribute to variability in effect sizes. Since the mixed-effects model has been criticized for being overly strict under some conditions (Overton, 1998), we additionally analyzed all data with fixed-effects models; we draw attention to those cases where findings diverged in the Results section. We computed Cochran's Q statistic, which tests the heterogeneity or variance between studies relative to the overall variance, in SPSS using the formulas by Lipsey and Wilson (2001). Significant values of Q indicate that effect sizes differ significantly, and these differences might be explained by moderators. In addition, we computed I^2, which describes the percentage of overall variance arising from heterogeneity between studies (Higgins, Thompson, Deeks, & Altman, 2003; Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006).

Publication Bias

To rule out that the findings are skewed due to selective study inclusion (i.e., publication bias), we followed a twofold procedure suggested by Ferguson and Brannick (2012). First, for analyses on network change, we report critical k (see Tables 3 and 5), which is the number of studies with null findings necessary to reduce the observed effect size to $|0.10|$, that is, an effect size with negligible practical relevance. This approach is stricter than a conventional file-drawer analysis because fewer studies are needed to reduce an effect to a specified small size compared with reducing an effect to 0.00 (Hunter & Schmidt, 2004). Table 3 shows that for social network changes related to age, findings were more robust for effects found in old age compared with young adulthood. This is attributable to the relatively larger number of studies in late life, whereas for the smaller number of studies in young adulthood only three to seven studies with null findings were needed to reduce the size of the observed effects to a Cohen's d of $|0.10|$. For average social network size, we did not expect a publication bias because network size was not tested for statistical significance per se, and thus study publication was rather independent of the reported social network sizes. Furthermore, it seemed implausible to compute critical ks, that is, the number of studies reporting network sizes of 0 to reduce the observed average network to a trivial magnitude.

As a second approach, we computed Egger's test, which is a statistical analogue to a funnel plot to test whether effect sizes depend on the study's sample size, for instance, with smaller studies reporting larger effects (Sterne, Egger, & Smith, 2001). The test is a weighted regression of the effect size on the standard error, weighted by the inverse variance (Egger, Smith, Schneider, & Minder, 1997; Sterne, Gavaghan, & Egger, 2000). We observed no significant bias for studies on age-related network changes (bias = 0.15, $p = .91$, 95% CI [−2.63, 2.94] or for studies on life-event-related network changes (bias = 1.84, $p = .11$, 95% CI [−0.44, 4.12]).

In sum, publication bias seemed to be absent in the current meta-analysis. We deliberately did not include gray articles (i.e., unpublished work other than dissertations) because including these has been shown to possibly enhance publication bias (Ferguson & Brannick, 2012). This seems to occur because unpublished work is often not representative regarding both quality and results. Unpublished work can even be prone to selection bias if it mainly comes from the research group conducting the meta-analysis or a related research group (Ferguson & Brannick, 2012).

Results

Description of Included Studies

The total number of participants was 177,635, with on average 641.3 participants per study (SD = 1,685.1).[3] The number of participants and the number of studies both varied by age of participants. Figure 1 shows that relatively few studies (k = 25) were conducted with participants aged 45–60 years; however, many studies were carried out with participants older than 60 years (k = 98). Additionally, studies with participants older than 60 years were, on average, of larger sample size (M = 813.7, SD = 1,206.9) than studies from any other age group, $F(4, 257) = 5.99$, $p < .01$ (all post hoc comparisons with Tukey ps $< .05$).

The average age of the samples ranged from 10.3 to 85.9 years (M = 46.8, SD = 22.9). Most samples were about equally distributed on gender: Fifty-five percent of the studies included 40%–60% men. Also, 59% of all studies recruited participants from the general population, 27% were convenience samples (e.g., from retirement homes), and 14% of all studies drew on student samples. The majority of studies were conducted with either North American (53%) or European samples from diverse countries (34%).[4] Also, studies adopted different methods to assess networks: Forty percent of all studies used interviews, 35% employed standardized instruments such as the Social Convoy Questionnaire (Kahn & Antonucci, 1980), 25% used a free-recall procedure (e.g., participants "named up to 20 friends"), and one study was not codable because of missing information. Finally, 28% of all studies had a longitudinal design, whereas the remaining 72% were cross-sectional. The longitudinal studies consisted of 3.2 measurement points on average (SD = 1.6; range: 2–10) and lasted on average 3.1 years (SD = 3.5; range: 0.1–17).

Age-Related Differences and Change in Social Networks

To address Research Aim 1, we first analyzed age differences in the average sizes of global social networks and subnetworks, and then compared age-related longitudinal change in social networks by age groups.

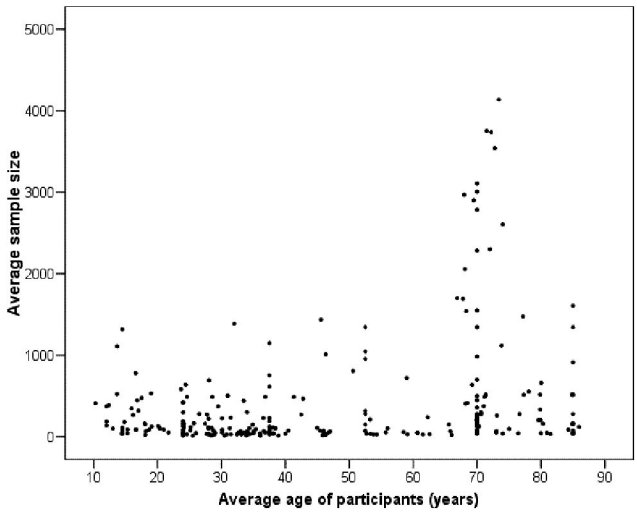

Figure 1. Distribution of sample size by average sample age of studies.

Linear and nonlinear age differences. The reported average network size per study was regressed on the average sample age separately for each network type. We analyzed the assumed increase during adolescence and young adulthood and decrease in the period leading to old age of the global and the personal network using a combined exponential growth-and-decline function (Cerella & Haie, 1994). For each network type, we compared whether the combined growth-and-decline function fitted the age differences in network sizes better than a model assuming a linear association between sample age and average network size.

Table 2 shows that regarding the global networks, the combined exponential growth-and-decline function described the age-related differences in network size somewhat better than the linear model (Δ Akaike information criterion (AIC) = −3.31, 4% more explained variance). The nonlinear function illustrates that adolescents named fewer social network partners than young adults with an estimated change point of 24.6 years. Beyond that age, the global network became smaller. The decrease slowed down beginning around 60–65 years (see Figure 2A).

The change in size of personal networks and friendship networks was more parsimoniously and slightly better described by models assuming a linear association between sample age and average network size ($\Delta AIC_{\text{personal network}} = 3.66$; $\Delta AIC_{\text{friend}} = 0.63$; see Table 2 and Figures 2B and 2D). The two types of networks showed moderately strong negative associations with participants' average age: Both personal and friendship networks became smaller by almost one person per age decade (unstandardized regression coefficients for change per year $b_{\text{personal}} = -0.09$, $SE = 0.02$, $p < .001$; $b_{\text{friend}} = -0.08$, $SE = 0.01$, $p < .001$).

As expected, the size of family networks showed no significant age differences across the life span (see Table 2 and Figure 2C). This result is especially noteworthy because of the large number of studies (k = 106). This could have produced quite a heterogeneous pattern, but in fact all reported average network sizes ranged between about two and 11 persons (M = 6.1, SD = 3.4), with only two studies reporting more than 15 people in family networks.

Few studies addressed work-related networks and networks of other acquaintances (e.g., neighbors, professional helpers), and they were spread unevenly over the life course (see Figures 2E and 2F). The illustration of average network sizes shows that coworkers were almost exclusively studied when participants were be-

[3] Three studies contained more than 10,000 participants (Kramer & Vaquera, 2011; South & Haynie, 2004; Stansfeld, Fuhrer, & Shipley, 1998). The average number of participants was still 475.5 when these three large studies were excluded, and 34 studies included more than 1,000 participants each.

[4] The following countries provided studies (number of studies in parentheses, in descending order): United States (131); the Netherlands (34); Germany (30); United Kingdom (10); Canada (9); Japan (7); China and Israel (6); France (5); Australia, Austria, and India (4); Mexico, Norway, and Turkey (3); Indonesia, Korea, Mali, Sweden, and Switzerland (2); Bangladesh, Cameroon, Finland, Ireland, Italy, Portugal, Tanzania, and Vietnam (1).

Table 2
Prediction of Network Size Change Over the Life Span Using a Linear Change Model (Model 1) and a Nonlinear Change Model (Model 2) for Different Social Networks

		Sample age			Model 1: Linear decline		Model 2: Combined exponential growth-and-decline function	
Network	*k*	*M*	*SD*	Range	Model fit	Age β	Model fit	Change point (years)
Global	99	51.67	23.87	12–86	$Q(1, 97) = 26.64$, $p < .001$, $R^2 = .10$	$-.32^{**}$	$Q(1, 97) = 32.78$, $p < .001$, $R^2 = .14$	24.6
Personal	125	48.95	22.25	12–86	$Q(1, 123) = 28.53$, $p < .001$, $R^2 = .09$	$-.29^{**}$	$Q(1, 123) = 30.43$, $p < .001$, $R^2 = .09$	none
Family	113	45.67	21.67	12–85	$Q(1, 111) = 0.83$, $p = .363$, $R^2 = .005$	$-.07$	$Q(1, 111) = 0.80$, $p = .372$, $R^2 = .005$	none
Friends	103	38.51	22.50	10–85	$Q(1, 101) = 48.59$, $p < .001$, $R^2 = .14$	$-.37^{**}$	$Q(1, 101) = 49.51$, $p < .001$, $R^2 = .14$	none
Coworkers	14	40.86	15.10	24–70	$Q(1, 12) = 0.15$, $p = .702$, $R^2 = .01$	.10	$Q(1, 12) = 0.12$, $p = .725$, $R^2 = .01$	none
Other acquaintances	24	45.38	21.38	19–80	$Q(1, 22) = 5.19$, $p = .023$, $R^2 = .08$	$-.29^{*}$	$Q(1, 22) = 12.04$, $p = .001$, $R^2 = .18$	54.0

Note. k = number of studies included.
$^{*}p < .05$. $^{**}p < .01$.

tween 30 and 40 years of age.[5] Other acquaintances were important (or were studied more often) in young and old adulthood. No significant linear or nonlinear age effects were observed for work-related networks (see Table 2). For networks of other acquaintances, age differences in network size were somewhat better described by a nonlinear, U-shaped function compared with a linear regression ($\Delta AIC = -1.44$, 10% more explained variance). However, the low number of studies has to be kept in mind when interpreting these results.

Age-related change in social networks. Studies on changes in network size were almost exclusively carried out in two age groups: young and old adulthood. Eight studies were conducted with adolescents and young adults, with an average sample age of 22.9 years; 24 studies focused on old adulthood with an average sample age of 74.6 years; and two studies used samples with an average age of 34.2 and 38.2 years. We therefore compared network changes separately for these three age groups: We computed average effect sizes, tests of significance, and tests for heterogeneity of effect sizes per age group and network type. In Table 3, we combined cross-sectional ($k = 23$) and longitudinal ($k = 30$) effect sizes on network changes with age. Preliminary analyses showed that effect sizes did not differ significantly between longitudinal and cross-sectional studies (see also Moderator Analyses). The nonsignificant values for Q and the mostly small or even 0 values for I^2 in Table 3 already suggested high homogeneity of effect sizes within each network type and age group, with effect sizes for personal networks in old age being the only exception.

In adolescence and young adulthood, global, personal, and friendship networks expanded significantly by about a quarter of a standard deviation, whereas these networks shrank for people older than 65 years (see Table 3). As expected, the size of the family network did not change significantly in either age group. The change of the global and personal network in two studies with participants in their early 30s was not significantly different from 0. This could suggest a plateau comparable to the nonlinear change found for global networks in the cross-sectional analyses before. Figure 3 shows the observed effect sizes for all longitudinal studies in adolescence and young adulthood and old age included in the meta-analysis.

Taken together, the cross-sectional regression analyses and the analyses of network changes in young, middle, and old adulthood largely supported our assumptions and draw a coherent picture of the global network increasing in adolescence and young adulthood, reaching a plateau in the mid-20s to early 30s, and shrinking thereafter together with the number of named friends. Both approaches found no significant changes in the size of the family network.

We now turn to the second aim of the study, examining how life events relate to changes in social networks and whether these changes are similar to age-related changes.

Life-Event-Related Change in Social Networks

Altogether, 41 studies provided information on network changes related to life events. Table 4 shows that specific life events have been studied more often in some age periods than in others, $\chi^2(35) = 242.06$, $p < .001$ (Fischer–Yates exact test for asymmetric distributions $p < .001$; Agresti & Wackerly, 1977). For instance, the loss of a spouse was studied with participants older than 60 years on average. Even nonnormative life events have been connected to specific times in life; for example, effects of divorce on social networks have been studied only with samples ranging in average age from 30 to 45. Only relocation was studied in several age periods. In addition, compared with other life stages with one life event, young adulthood and early midlife both appeared to be rather unstable, with several events, such as job entry, marriage, parenthood, and divorce, taking place at the same time (see Table 4).

Longitudinal studies provided 74% of the effect sizes on life-event-related network changes, whereas the remaining 26% (21 effect sizes) are the result of two-group contrasts. In these studies, one group of participants had experienced the life event, whereas the control group had not. Effect sizes were transformed as described in the Method section to make them comparable. The effect of the study design is addressed in Moderator Analyses.

Effect sizes of change in social networks differed with life events (see Table 5). (1) During puberty the size of the personal networks increased. The number of friends also slightly increased,

[5] One article focused on coworker networks before retirement (Imamoğlu et al., 1993).

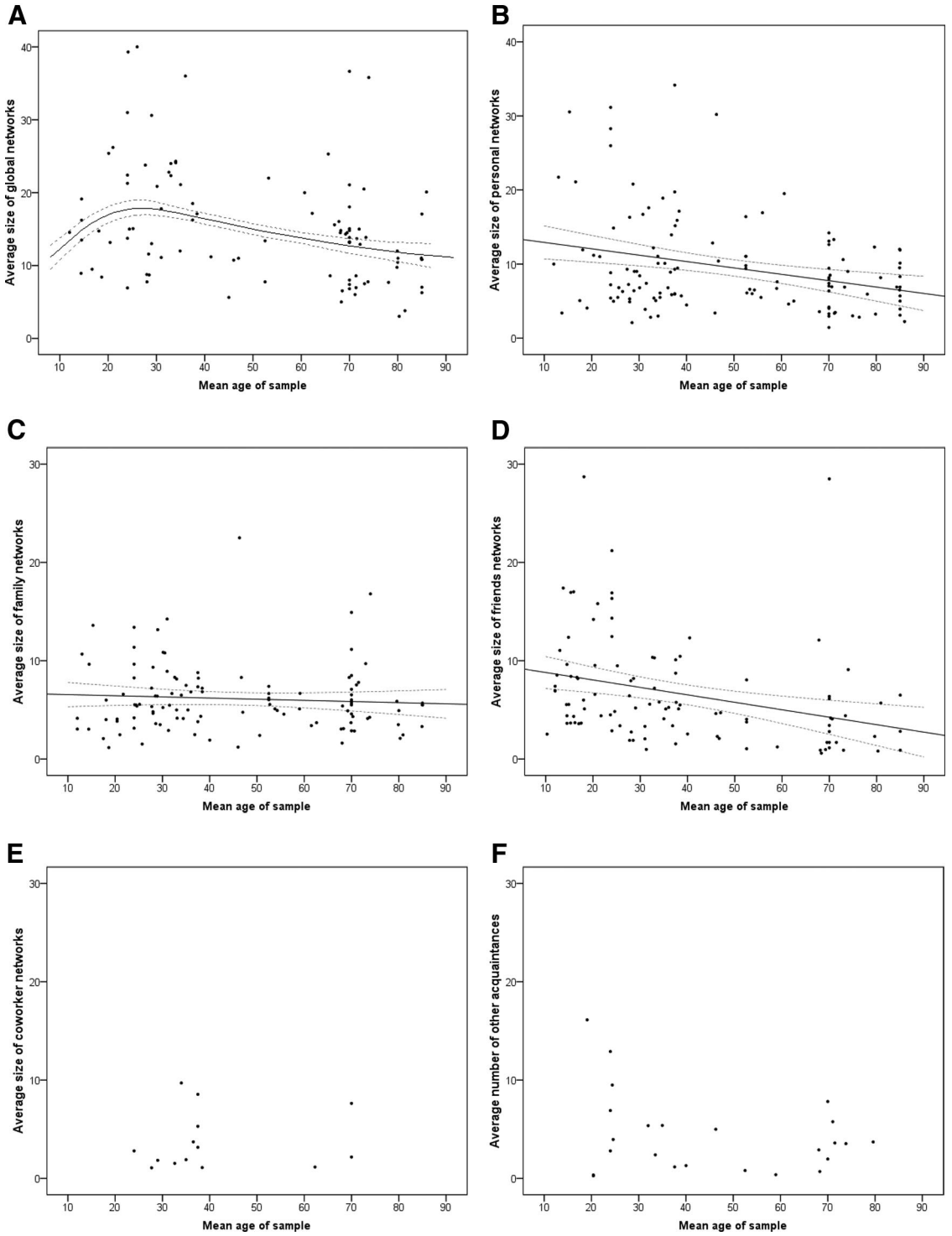

Figure 2. Average observed network sizes by average sample age: global network (A), personal network (B), family network (C), friendship network (D), coworker network (E), other acquaintances (F). Regression lines and the corresponding 95% confidence intervals are depicted for networks with sufficient data points (A–D).

Table 3
Average Network Changes in Specific Social Networks

Network	*k*	*d*	*SE*	95% CI	*Q*	I^2	$k_{critical}$
Global							
Younger than 30	4	0.235*	0.11	[0.02, 0.44]	4.26	29.6	5
Middle age	1	−0.408	0.31	[−1.03, 0.21]			
Older than 65	15	−0.354**	0.06	[−0.48, −0.23]	15.24	8.1	38
Personal							
Younger than 30	3	0.250*	0.12	[0.01, 0.49]	2.97	32.7	5
Middle age	1	−0.161	0.37	[−0.53, 0.21]			
Older than 65	6	−0.337**	0.09	[−0.52, −0.16]	13.71*	63.5	15
Family							
Younger than 30	4	0.067	0.10	[−0.12, 0.26]	1.90	0	
Older than 65	7	−0.031	0.08	[−0.19, 0.13]	4.83	0	
Friendship							
Younger than 30	5	0.245**	0.10	[0.05, 0.44]	1.78	0	7
Older than 65	4	−0.193*	0.10	[−0.39, −0.00]	0.55	0	4
Other acquaintances							
Younger than 30	1	0.370**	0.05	[0.32, 0.42]			3
Older than 65	2	−0.513**	0.19	[−0.89, −0.14]	0.01	0	8

Note. *k* = number of studies included; CI = confidence interval; *Q* = Cochran's *Q* test of heterogeneity between studies; I^2 = percentage of overall variance that is attributable to heterogeneity between studies (values smaller than 0 were set to 0; Higgins et al., 2003); $k_{critical}$ = number of studies with null findings necessary to reduce the observed effect size to |0.10|.
* $p < .05$. ** $p < .01$.

under assumptions of a fixed-effects model. Closer examination of studies showed that four longitudinal studies found increases in friendship network sizes, whereas one cross-sectional study and one longitudinal study looking at opposite-sex friendships found slight decreases in network sizes. Importantly, the size of the family network did not change significantly. (2) All effects of marriage were statistically significant only under the assumptions of a fixed-effects model, but not under the assumptions of a mixed-effects model. Closer inspection of the three studies on changes in friendship networks showed that two studies found larger networks for married participants as compared with single participants, but one study reported the opposite effect. Since all studies were cross-sectional, rather balanced in gender composition, and moderately large (>150 participants), no clear prioritization of effect sizes was possible. (3) A number of longitudinal studies focused on people experiencing the transition to parenthood and found significant decreases in the sizes of personal, family, and friendship networks. The decrease of friendship networks was significantly different from 0 only under the assumptions of a fixed-effects model. (4) Entering the job market increased the number of coworkers strongly. Increases in global networks, friendship networks, and networks of other acquaintances were statistically significant under the assumptions of a fixed-effects model. (5) Experiencing the loss of a spouse significantly decreased the personal network and also slightly reduced the family network, this effect being significant under the assumptions of a fixed-effects model.

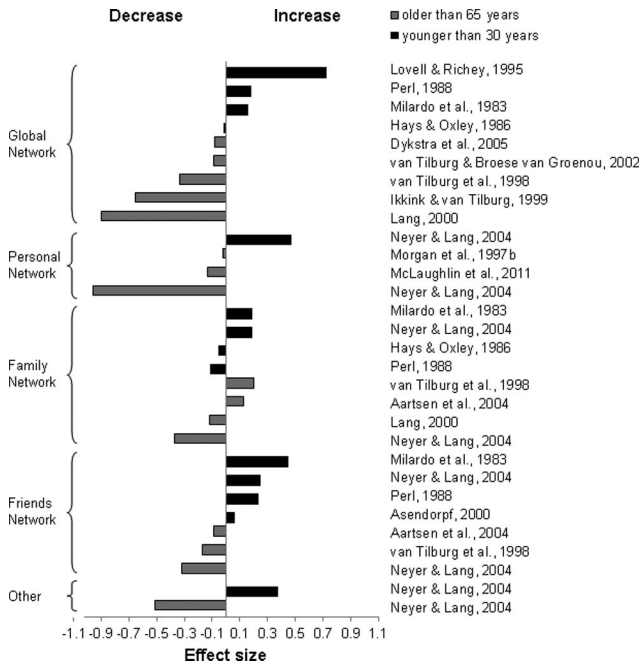

Figure 3. Observed effect sizes for longitudinal, age-related change in social networks.

Table 4
Number of Effect Sizes for Network Changes Associated With Life Events in Different Age Groups

Life event	11–18	18–30	30–45	45–60	60–80	80+
Puberty	10					
Marriage		4	2			
Parenthood		5	4			
Job entry		14	1			
Loss of a spouse					9	3
Death of a relative				2		
Divorce			19			
Relocation	1	1	4	1		

Note. If no number is given, there were no available effect sizes for this life event in this age group.

Table 5
Change in Different Social Networks Associated With Life Events

Life event	*k*	*d*	*SE*	95% CI	*Q*	I^2	$k_{critical}$
Puberty							
Personal	2	0.436*	0.20	[0.04, 0.83]	3.31	69.8	7
Family	2	−0.013	0.20	[−0.41, 0.38]	0.95	0	
Friend	6	0.199[a]	0.12	[−0.03, 0.43]	4.87	0	6
Marriage							
Personal	1	−0.323[a]	0.84	[−1.97, 1.33]			3
Family	2	0.136	0.59	[−1.03, 1.30]	0.02	0	
Friend	3	0.383[a]	0.49	[−0.57, 1.34]	3.82	47.7	8
Parenthood							
Global	2	0.316	0.27	[−0.22, 0.85]	4.47*	55.3	
Personal	3	−0.442*	0.21	[−0.85, −0.03]	2.39	0	16
Family	2	−0.501*	0.25	[−1.00, −0.00]	0.25	0	12
Friend	2	−0.236[a]	0.26	[−0.75, 0.26]	0.01	0	7
Job entry							
Global	3	0.324[a]	0.55	[−0.76, 1.41]	1.53	0	7
Personal	1	−0.127	0.94	[−1.96, 1.71]			
Family	3	0.081	0.55	[−0.99, 1.15]	0.17	0	
Coworker	2	2.998**	0.70	[1.63, 4.37]	2.68	62.7	58
Friend	4	0.214[a]	0.48	[−0.73, 1.16]	9.99	70.0	5
Other	2	0.315[a]	0.68	[−1.02, 1.65]	1.34	25.6	4
Loss of a spouse							
Global	2	−0.057	0.21	[−0.47, 0.36]	0.95	0	
Personal	6	−0.345**	0.13	[−0.59, −0.10]	5.82	14.0	15
Family	2	−0.175[a]	0.21	[−0.58, 0.23]	0.64	0	2
Friend	1	0.053	0.29	[−0.51, 0.61]			
Other	1	0.276[a]	0.31	[−0.33, 0.88]			2
Death							
Global	1	−0.606**	0.08	[−0.77, −0.45]			5
Personal	1	0.693**	0.11	[0.48, 0.91]			6
Divorce							
Global	5	−0.080	0.17	[−0.42, 0.26]	5.68	29.6	
Personal	4	−0.030	0.20	[−0.41, 0.35]	6.82	56.0	
Family	3	−0.429**	0.21	[−0.85, −0.01]	0.56	0	10
Coworker	1	−0.022	0.38	[−0.77, 0.73]			
Friend	5	−0.107	0.18	[−0.45, 0.24]	3.27	0	
Other	1	0.119	0.39	[−0.64, 0.88]			
Relocation							
Personal	1	−0.397[a]	0.89	[−2.13, 1.34]			3
Family	1	−0.026		[−1.78, 1.73]			
Friend	5	−1.263**	0.40	[−2.05, −0.48]	5.12	2.3	58

Note. *k* = number of studies included; CI = confidence interval; *Q* = Cochran's *Q* test of heterogeneity between studies; I^2 = percentage of overall variance that is attributable to heterogeneity between studies (values smaller than 0 were set to 0; Higgins et al., 2003); $k_{critical}$ = number of studies with null findings necessary to reduce the observed effect size to |0.10|.
[a] Effect size is significantly different from 0 under fixed-effects model assumptions.
* $p < .05$. ** $p < .01$.

The experience of a nonnormative life event, such as death of a relative, divorce, or relocation, almost exclusively reduced the size of social networks (see Table 5). (6) Two longitudinal studies analyzed network changes 2 years after the unexpected death of a relative. On the one hand, the global network size decreased, and on the other hand, the closer personal network increased in size. (7) After experiencing a divorce, the size of the family network decreased substantially. Other networks did not change significantly in relation to this life event. (8) Experiencing relocation had strong effects on friendship networks: The number of friends decreased irrespective of age. One study on the personal network also found a small decrease in size, yet it was only significant under the assumption of a fixed-effects model. Again, the family network did not change significantly when relocation occurred.

Comparing Age-Related and Life-Event-Related Network Change

Age-related social network changes did not differ significantly from life-event-related social network change, $Q(1) = 2.75$, $p = .10$ (see Figure 4). We compared both kinds of effect sizes on network changes irrespective of the network type because significant effect sizes for one age group or life event in that age group were nearly always in the same direction. Furthermore, we found no evidence that effect sizes on age-related and life-event-related change differed in specific age groups (all comparisons $p > .15$). Figure 4 illustrates that, in general, networks increased in size during adolescence and young adulthood, no reliable change was observed during middle adulthood, and networks decreased sig-

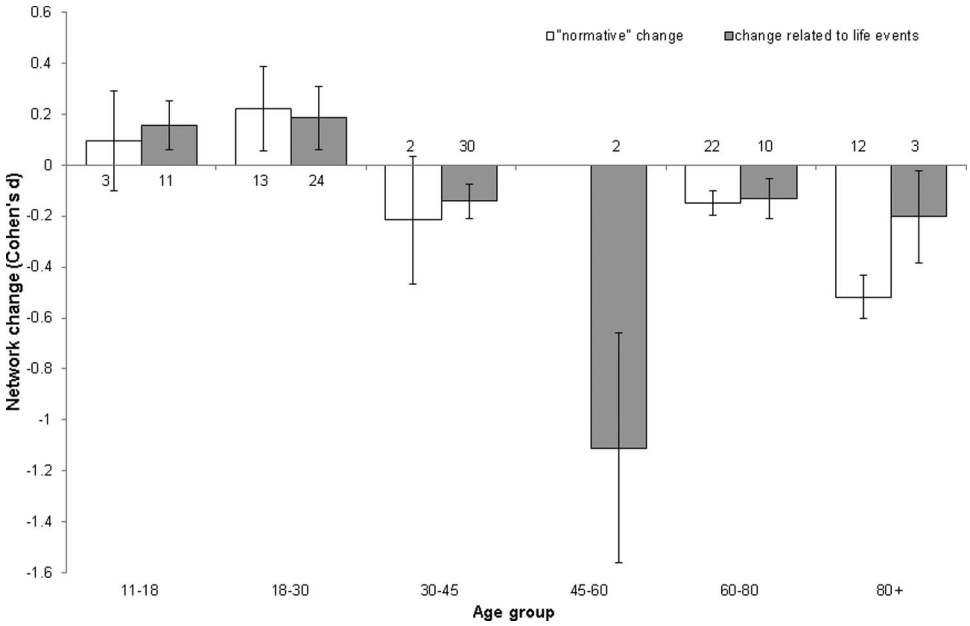

Figure 4. Comparison of normative network changes and change related to life events per age group. Numbers in bars represent the number of studies. Error bars indicate ±1 standard error.

nificantly during old age. Furthermore, for all age groups, Q statistics were not significant, indicating homogeneity of effect sizes on network changes, although the number of studies was not too small and ranged between 13 and 35. An exception was effect sizes during young adulthood with significant heterogeneity, $Q(35) = 106.82$, $p < .01$.

Moderator Analyses

We assumed that the size of social networks differs with characteristics of the sample, the type of the network assessment, and the year the study was conducted. First, we tested whether these study characteristics varied with the average age of the sample. In other words, we addressed the question whether certain types of studies were more prevalent in specific age groups.

Studies with different gender distributions or with different types of assessment did not vary significantly from one another regarding the average age of the sample. The overall tests suggested small effects for assessment type, $F(2, 271) = 3.19$, $p = .043$, but all post hoc tests were nonsignificant with $p > .10$. As expected, student samples were significantly younger ($M = 23.5$, $SD = 10.4$, $k = 38$) than convenience ($M = 43.4$, $SD = 18.5$, $k = 75$) or general population-based samples ($M = 53.7$, $SD = 22.9$, $k = 159$), and convenience and general population-based samples also differed by average sample age, $F(2, 269) = 34.68$, $p < .001$, with all post hoc tests significant with $p < .001$. Samples from countries varying in collectivistic value orientation did not significantly differ in average sample age ($r_{age} = -.02$, $p = .75$).

Longitudinal studies were conducted with slightly younger samples ($M = 42.0$, $SD = 21.2$, $k = 78$) compared with cross-sectional samples ($M = 48.7$, $SD = 23.3$, $k = 197$), $t(273) = 2.20$, $p = .03$. Among longitudinal studies, study duration was longer with higher age of the sample ($r = .26$, $p = .01$). Finally, more recent studies (i.e., published in later years) often addressed older samples ($r = .11$, $p = .04$). Perhaps this is attributable to an increased interest in life-span psychology and old age over the last 2 decades. Together these findings necessitated moderator analyses on effect sizes under control for age effects.

Moderator effects on the size of social networks. We tested moderator effects separately for each network type to ensure independence of effect sizes. We included moderators in regression models after accounting for effects of the average sample age (see Table 6). In this way, we achieved information on how the size of the different networks varied with different methodological factors after the age effects were taken into account. In addition, we tested for interaction effects between the average age of the sample and each moderator. For work-related networks and networks of other acquaintances, we do not report moderation analyses because there were too few studies. Preliminary analyses showed no significant moderation effects.

Network sizes were largely robust to sample differences, and we observed only scattered effects (see Table 6). As expected, samples from countries with higher scores in collectivistic value orientation reported smaller global and personal networks. Personal and friendship network sizes were larger in student samples, and friendship network sizes were also larger in convenience samples than in general population-based samples. No further significant effects of sample type, country of origin, or gender distribution occurred.

The type of assessment made a difference for the average reported global, personal, and family network sizes (see Table 6). When studies used interview techniques rather than standardized questionnaires, larger networks were obtained. Interview methods elicited 5.3 and 1.7 additional people from the global and personal networks, respectively, and 1.6 additional family members. No

Table 6
Overview on Moderator Effects of Network Size

Variable	*k*	Effect on network size		*Q*	ΔR^2
		b	*SE*		
		Global network ($k = 101$)			
Gender distribution	97	0.18	0.67	35.12**	.01
Sample type[a]					
Student	13	−0.18	1.86	33.89**	.00
Convenience	21	1.57	1.39		
Country's collectivism[b]	99	−3.07*	1.29	38.22**	.02
Assessment[c]					
Interview	57	5.28**	1.11	55.48**	.09
Free recall	9	3.37	2.10		
Year of publication[d]	98	0.63	0.44	34.08**	.01
		Personal network ($k = 125$)			
Gender distribution	120	0.15	0.35	29.72**	.00
Sample type[a]					
Student	15	3.81**	1.24	38.18**	.03
Convenience	38	−0.21	0.83		
Country's collectivism[b]	123	−3.80**	0.66	59.92**	.10
Assessment[c]					
Interview	46	1.65*	0.82	34.71**	.01
Free recall	36	0.01	0.88		
Year of publication[d]	125	−1.47**	0.46	98.66**	.21
Age × Year of Publication		0.05**	0.01		
		Family network ($k = 115$)			
Gender distribution	112	−0.53	0.29	4.50	.01
Sample type[a]					
Student	18	0.22	0.90	0.88	.00
Convenience	24	0.08	0.72		
Country's collectivism[b]	113	−0.66	0.52	2.47	.01
Assessment[c]					
Interview	62	1.63**	0.58	9.69*	.04
Free recall	22	0.52	0.74		
Year of publication[d]	113	−0.33	0.18	4.77	.01
		Friends network ($k = 104$)			
Gender distribution	101	0.51	0.33	46.47**	.00
Sample type[a]					
Student	24	4.80**	0.68	102.81**	.13
Convenience	24	1.32*	0.60		
Country's collectivism[b]	103	−0.09	0.60	49.33**	.00
Assessment[c]					
Interview	39	0.90	0.64	49.36**	.01
Free recall	32	−0.01	0.65		
Year of publication[d]	103	−0.94**	0.19	71.99**	.06

Note. *k* = number of studies included; *b* = unstandardized regression coefficient; *Q* = model fit comparable to *F* statistic in linear regression (Lipsey & Wilson, 2001, p. 123); ΔR^2 = explained variance by the moderator.
[a] Reference category = general population sample. [b] Collectivism scores based on *z*-standardized, averaged country scores published in Hofstede (1980) and Oyserman et al. (2002). [c] Reference category = standardized instrument method. [d] Recoded into 5-year categories; there were no further significant interactions with average age of the sample.
* $p < .05$. ** $p < .01$.

significant effects were observed for friendship networks, yet effects pointed in the same direction.

The year of publication was related to the average size of personal and friendship networks, but to no other network type (see Table 6). For personal networks, with every 5-year period the average network size decreased by 1.6 people. This means that on average participants in studies conducted between 1980 and 1985 reported about 6.3 more people than participants in studies conducted between 2000 and 2005. The significant interaction with average sample age showed that age differences in average personal network size were more pronounced during the 1980s ($r_{age} = -.60$, $p = .01$) and early 1990s ($r_{age} = -.38$, $p = .07$), compared with more recent years (average $r_{age} = -.07$, $p > .30$). For friendship networks, with every 5-year period the average network size shrank by 0.9 people. Hence, studies conducted between 1980 and 1985 reported on

average about 3.6 more friends than recent studies from 2000 to 2005.

There were no further interaction effects with the average age of the sample. All reported effects remained significant when controlling for the other moderating variables simultaneously.

Moderator effects on social network change. Significant Q statistics and large I^2 values indicate heterogeneity between effect sizes that might be explained by moderating study characteristics. Effect sizes on age-related and life-event-related social network changes were largely not significantly heterogeneous between studies (see Tables 3 and 5, respectively). This could be attributable to effect sizes already being homogeneous within network types, age groups, and life events or to the limited number of studies per network type, age group, and life event. To test whether certain study characteristics tended to produce larger effects than other studies irrespective of the direction of change and of the network type, we used the absolute magnitude of standardized network change as the dependent variable in multilevel models. Multilevel models took the dependencies among effect sizes of different social networks from the same study into account. Also, they allowed us to test effects of moderators with sufficient power while controlling for age effects simultaneously.[6] On average, 1.5 and 1.8 effect sizes were obtained per study focusing on age-related and life-event-related change, respectively ($k = 34$ and $k = 45$).

For age-related network change, effect sizes only varied significantly with the type of the sample. Studies with convenience samples reported larger network changes compared with studies with population-based samples ($b = 0.39$, $SE = 0.19$, $p = .05$). Effect sizes from student samples did not diverge significantly from population-based samples ($b = 0.04$, $SE = 0.15$, $p = .79$). Effect sizes did not vary significantly among studies with different gender distributions, from different countries, with different network assessment methods, or conducted in different years. Also, effect sizes did not differ significantly between cross-sectional and longitudinal studies ($b = -0.04$, $SE = 0.10$, $p = .70$) or with longitudinal study duration ($b = -0.03$, $SE = 0.03$, $p = .42$). No interactions between moderators and age of the sample remained significant in the follow-up analyses.

Changes in social networks related to life events also differed between different types of samples. Again, studies with convenience samples reported larger network changes than studies with population-based samples ($b = 0.44$, $SE = 0.21$, $p = .03$), whereas effect sizes from student samples were not significantly different ($b = 0.24$, $SE = 0.26$, $p = .35$). Effect sizes did not vary significantly with gender distribution, country of origin, type of network assessment, or publication year. The amount of network change did not vary between cross-sectional and longitudinal studies ($b = -0.25$, $SE = 0.32$, $p = .44$). However, among longitudinal studies effects of network change were more pronounced in shorter studies ($b = -0.03$, $SE = 0.01$, $p = .02$). That means that studies assessing social networks sooner after the life event and comparing it to the baseline size found larger absolute changes compared with studies that assessed social networks after a longer period. Visual inspection revealed that network changes up to 2 years after the life event were on average larger ($d = 0.62$, $SE = 0.10$, $k = 38$) than network changes observed over a longer period ($d = 0.32$, $SE = 0.06$, $k = 21$), $t(57) = 2.67$, $p = .01$. There were no further significant effects or interactions with age of the sample.

In sum, changes in social network sizes seemed to be rather robust to differences in samples or methods. Only studies conducted with convenience samples reported larger network changes as compared with other studies. Also, studies on network changes related to life events observed larger changes soon after the event.

Discussion

The meta-analysis provides the first comprehensive evidence of how the size of social networks changes from adolescence to old age by summarizing the current available social relationships literature, including Western and non-Western populations: The size of family networks remains stable throughout the life span, whereas global, personal, and friendship networks expand during adolescence and young adulthood and shrink during later adulthood, respectively. Innovatively, we showed that these age-related network changes are congruent to life-event-related network changes occurring at the same age. This suggests that social network development follows an age-graded path and age-related life events accompany, and maybe even prompt, these specific network changes. We first explain these main findings and place them in the context of current literature on the development of social relationships. We then provide a theoretical integration of social relationship development with social, evolutionary, cultural, and personality psychological perspectives and highlight how the current findings might inform future research in these fields.

Social Networks Change With Life Events Across the Life Span

Both cross-sectional and longitudinal analyses support our assumptions that the increase of the global network size during adolescence and young adulthood is followed by a plateau between mid-20s and early 30s and a continuous decrease throughout adulthood and old age. The personal network, which is a selected network of close and supportive family members and friends, offers a less clear picture for adolescence and young adulthood. The only available longitudinal study reports an increase in size (Neyer & Lang, 2004); however, the cross-sectional analyses suggest a continuous shrinking from adolescence to old age. It is possible that a slight increase in personal network size occurs as assumed during adolescence and young adulthood and that the limited number of studies hindered the detection of an increase. In general, findings agree that personal networks become smaller in late adulthood. Decreases in the size of friendship networks

[6] We specified random coefficients models in Mplus separately for age-related and life-event-related effect sizes of absolute network change. Effect sizes from the same study regarding different social networks were predicted with the following equations:

$$\text{Effect size level (Level 1)}, ES_{ij} = \beta_{0j} + r_{ij},$$

$$\text{Study level (Level 2)}, \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{age}) + \gamma_{02}(\text{moderator}) + \gamma_{03}(\text{age}\times\text{moderator}) + \mu_{oj}.$$

Age and continuous moderators were entered as centered predictors. Categorical variables were entered as dummy-coded variables.

throughout adulthood were also observed cross-sectionally and longitudinally. These patterns match predictions made by socioemotional selectivity theory, where increasing social networks during adolescence and young adulthood may satisfy informational goals while decreasing social networks during adulthood and older age mirror a termination of peripheral relationships and a focus on close and pleasant relationships to satisfy emotional goals.

Results on family networks were highly consistent across cross-sectional and longitudinal approaches and fully supported our expectations: No significant change in network size with age was observed. This concurs with assumptions of social convoy theory that family relationships are the stable convoy escorting people on their life course (Kahn & Antonucci, 1980). Social convoy theory further states that changes in social networks result from changes in circumstances. We argued that life events constitute such changing circumstances that necessitate adaptation of social relationships.

The meta-analysis showed that certain major life events have been studied more often in specific age periods. This supports the assumption that normative life events, such as puberty, marriage, parenthood, and job entry, occur at a specific age during the life course and, thus, outline a "normative course of life" that most people follow (Heckhausen, 1999). Changes in social networks that were associated with these life events closely mirrored the age-related network changes observed for these particular life phases. Puberty as a life event was related to an increase in the size of the personal network, whereas no effects on the size of the family network were observed. During the bustling period of young adulthood, effects of marriage, parenthood, and job entry overlapped and countervailed one another. This could contribute to an apparent plateau, where gains and losses balanced one another in the global and friendship networks. The loss of a spouse decreased the size of the personal network and, naturally, the family network. Effects on the global and friendship networks were negligible, which concurs with studies that show active replacement and rekindling efforts on relationships after the loss of a spouse (Zettel & Rook, 2004). The direct comparison of age-related and life-event-related network changes showed no significant differences in overall network changes. This further supports our assumption that age-related network changes are congruent with life-event-related network changes occurring at the same age. One interpretation of this congruency could be that life events guide and maybe even prompt changes in social networks so that network changes happen in an age-graded manner.

Finally, nonnormative life events such as divorce or relocation did not follow the pattern of age-graded network changes outlined before. These life events do not occur for everybody and are not necessarily typical at specific ages, and thus are not congruent with age-related change. For divorce, we observed a decrease in the size of the family network. This is likely due to the departure of the spouse and discontinued contact with in-laws (Terhell, Broese van Groenou, & van Tilburg, 2004). Two studies focused on network changes after the death of a relative, both over a span of 2 years. One study observed a decrease in the global network size, whereas the other found an increase in the size of the personal network. This seemingly opposing pattern is consistent with our definition of the global and personal networks (cf. Different Types of Social Networks section). Previous research shows an increase in importance of close and supportive relationships when facing stressful times (Guiaux et al., 2007; Morgan, Neal, & Carder, 1997a). At the same time, people withdraw from more peripheral, less close relationships, which results in an overall shrinking of the global network (Carstensen et al., 1999). Finally, relocation most strongly reduced the size of friendship networks, irrespective of age. At the same time, family networks were not significantly affected when experiencing any life event, apart from the effects of divorce. This further supports the high stability of family relationships, even when facing adversity (Lang, 2000).

In sum, the findings suggest that social network changes follow an age-graded path and that age-related life events accompany and perhaps even initiate these specific network changes. Hence we assume that network changes will be less pronounced or even absent for an individual if certain life events, such as job entry or transition to parenthood, have not (yet) occurred.

Moderators of Social Network Size and Change

We further addressed the question whether characteristics of the sample, measurement, or time of assessment affected the average network sizes or network change. Average network sizes and network changes were largely robust to such factors with singular effects for few network types. We observed that global, personal, and family networks were larger when they were assessed in interviews as compared with standardized instruments. Since social network interviews mostly use cued-recall techniques, and because standardized instruments mostly rely on free-recall procedures, this result can be attributed to memory bias as shown by Bernard et al. (1990) and Sudman (1985).

Friendship and personal networks were larger if they were studied with student samples compared with general population-based samples, whereas other networks were similar for different sample types. Since the analyses statistically controlled for the age of participants, we conclude that student samples may overestimate friendship networks, but otherwise provide a picture of global and family networks similar to that observed in general population samples. In contrast, age-related and life-event-related changes were more pronounced in convenience samples compared with population-based samples. Possibly, convenience samples were specific groups, since they were often recruited from homes for elderly or counseling offices. Due to their living environment or effects of counseling, their networks might change more strongly compared with the general population. Previously reported gender differences in the size of friendship or family networks (Moore, 1990) were not observed in this meta-analysis. Since only few social network studies report gender differences, our findings suggest that gender differences could be more important for relationship processes (M. A. Caldwell & Peplau, 1982; Impett & Peplau, 2006).

The assessment of social networks in countries with more versus less pronounced collectivistic values affected the size of the global and personal network, but not the size of family and friendship networks, or changes in network sizes. We discuss these findings and their meaning for generalizability of social network development in detail when addressing societal factors.

We observed effects of the year of publication on the size of personal and friendship networks but not for family networks. This pattern contradicts contemporary concerns on the dissolution of

the family (Phillipson, 1997). We relate these findings to the predicted period effects in the section on Theoretical Implications With Related Fields Addressing Social Relationships. In contrast to our expectations, changes in network sizes did not differ between cross-sectional and longitudinal studies. Results of cross-sectional and longitudinal studies can differ if age differences (i.e., age measured cross-sectionally between persons) are distinct from age-related changes (i.e., age measured longitudinally within persons; Lindenberger et al., 2011; Molenaar & Campbell, 2009; Nesselroade et al., 1972). For example, older people may report fewer friends than younger people because they belong to different cohorts with diverging concepts of friendship and thus use the term *friend* differently (Wrzus, Wagner, & Neyer, 2011). At the same time, it is possible that when both younger and older people are observed over time, their number of friends remains stable—resulting in different findings for longitudinal as compared with cross-sectional studies. In this meta-analysis, longitudinal and cross-sectional results converged. In addition, most studies on both age-related and life-event-related network changes followed a longitudinal design, thus enabling the study of true within-person change and therefore development. In longitudinal studies on effects of life events, social networks changed more strongly shortly after the event. When a longer period had passed between life event and second assessment, effects were less pronounced, which suggests a consolidation and reestablishment of social relationships.

In sum, both social network size and change were largely robust to variations in sample type, assessment method, or year of study publication. We observed single important effects of the country of origin and the publication year, which we further discuss next. Also, global and family networks assessed with interviews were larger than networks obtained by using standardized questionnaires or free recall. This suggests that social networks based on standardized instruments or free recall may underestimate the available social resources of individuals (Bernard et al., 1990; Sudman, 1985).

Theoretical Integration With Related Fields Addressing Social Relationships

We propose a general framework that structures the most important questions on social network development and integrates the developmental perspectives represented by socioemotional selectivity and social convoy theory with perspectives from social, personality, cultural, and evolutionary psychology.

Which social relationships and periods of the life course are addressed? Social networks can comprise very diverse relationships such as with different family members, friends, and acquaintances that are comprehensively addressed in both socioemotional selectivity and social convoy theory. Some other (than developmental) approaches have primarily focused on nonfamilial relationships and classified relationships mainly on a quantitative basis, that is, either with regard to relationship stability (e.g., personality psychology) or based on the level of acquaintanceship or commitment (e.g., social psychology; Back et al., 2011; Hogg & Tindale, 2001; Hogg & Vaugan, 2011). In contrast, evolutionary and cultural-psychological perspectives are more explicit about the qualitative distinctiveness of relationships and distinguish between cross-culturally invariant relationships based on their differential significance for genetic reproduction and continuity, namely different degrees of kin (i.e., lineal and collateral relatives), nonkin (i.e., cooperative and noncooperative partners), and sexual relationships (i.e., short-term and long-term partners; e.g., Bugental, 2000; Buss, 1999; Neyer et al., 2011). Comparing these diverse relationships might reveal new insights for established personality or social theories. For example, M. S. Clark and Mills (1979) showed that exchange and equity behavior, which was assumed to be a universal characteristic of social relationships (Thibaut & Kelley, 1959), can be less important in so-called communal relationships, which are often kin and kin-like relationships. Thus, from a meta-theoretical perspective, cultural and evolutionary psychology may add to our understanding of how relationships differ and are similar as well as why some types of relationships are stable and others change over the life course.

In particular, so-called life history approaches emphasize the age-graded significance of different relationships regarding mating (adolescence and young adulthood), parental investment (young adulthood), and kin investment (throughout adulthood; Buss, 1999; Harvey & Wenzel, 2006; Kenrick, Ackerman, & Ledlow, 2003). For example, friends and peers are assumed to be more important during adolescence as well as young adulthood and somewhat less important during later adulthood because of their relevance for mating, which is anchored mainly in adolescence and young adulthood. This is supported by our current findings on decreases of friendship networks with age and could be informative for personality and social psychological research, which largely addresses friendships in young adulthood. Our finding that family network size is surprisingly stable across adulthood is also very much consistent with evolutionary theorizing regarding kin and parental investment, which are both thought of as indirect means to increase the inclusive fitness throughout the life span (Hamilton, 1964). This leads to the question of causes and processes of social network changes.

What are assumed reasons and psychological processes for social network stability and change? Individual development always occurs under multiple internal and external influences (Bronfenbrenner, 1989). In the current meta-analysis we focused on age-related network changes and changes related to life events. In short, we observed high stability of family network sizes and changes in global, personal, and friendship networks throughout the life course that were mirrored by life-event-related changes. Furthermore, this pattern of stability and change was similar across the diverse countries. Evolutionary theories on kinship preference concur with these findings and provide an ultimate explanation: By maintaining relationships with and helping kin, such as children, siblings, or nieces and nephews, individuals increase the likelihood of passing on genes to the next generation (Hamilton, 1964). Relationships with nonkin are less stable in contrast because they are mainly based on exchange and cooperation and are more likely dissolved when exchange becomes unbalanced (Ikkink, & van Tilburg, 1998).

These ultimate causes of relationship stability are solely based on reproductive success, but they have no psychological meaning unless they are not complemented by the proximate processes that affect behavior more directly. For example, the proximate cause for why kin care for one another is not that they expect reproductive benefits, but that they experience a sense of emotional closeness (Neyer & Lang, 2003). Social and personality psychology

offers a variety of theories that may further substantiate such proximate mechanisms. For example, attraction theories (Byrne, 1971; Festinger et al., 1950) state that liking in new relationships forms under conditions of proximity and similarity. Maintenance and ending of relationships depend on perceptions of dissimilarity (e.g., balance theories; Heider, 1958), perceived balance of exchange (exchange theories; Kelley & Thibaut, 1978; Thibaut & Kelley, 1959), and sometimes spatial distance. For instance, neighbor relationships among older adults were more likely to dissolve if they had been imbalanced (Ikkink & van Tilburg, 1998) or if people moved to a different area (Thomése, van Tilburg, & Knipscheer, 2003). Personality psychology emphasizes the role of social dispositions (e.g., affiliative needs, extraversion, conscientiousness) and personality–relationship transactions (e.g., active selection, passive evocation) for explaining stability and change of social networks (Asendorpf & Wilpers, 1998; Baumeister & Leary, 1995; Neyer & Asendorpf, 2001). In addition, personality psychology would predict increasing stability of (certain) relationships with higher age as personality traits and self-concepts consolidate and relationships are shaped accordingly (B. W. Roberts & DelVecchio, 2000; Robins & Trzesniewski, 2005). Finally, cultural psychology states that cultural norms such as collectivism–individualism predict stability and change of relationships (Hofstede, 1980; Triandis, 1993, 1995).

In the current meta-analyses we could not directly address the underlying psychological processes, but we can conclude that the observed age-related network changes were neither mere fluctuations, because the changes were observable over periods of several months and years, nor predetermined, system-inherent alterations (Leik & Chalkley, 1997), because the shifts occurred in the same direction as life-event-related change. We assume that all previously outlined influences work in accordance: Major changes in people's lives and resources, such as job entry, divorce, or illness, necessitate modifications in behavioral patterns (Filipp, 1990; Holmes & Rahe, 1967). At that moment, social motives and exchange and similarity considerations of relationships help to decide which relationships are emphasized or ended. Finally, stable personal dispositions (i.e., traits) moderate how behavioral pattern and relationships are changed.

How do societal structure factors such as epoch and culture affect social network change? A recurring concern is that modernization and urbanization lead to declines of family ties and increased social isolation and loneliness (Allan, 2008; Bott, 1957; C. S. Fischer, 1982; McPherson et al., 2006; Phillipson, 1997). Here we observed no associations between the year of study publication, which usually takes place a few months or years after the study conduction, and the size of the global or the family network. Personal and friendship networks, however, were significantly smaller in more recent studies. These results are consistent with the observed decrease in Americans' personal networks over the last 20 years (McPherson et al., 2006), yet this result is still under debate (e.g., C. S. Fischer, 2009; McPherson et al., 2009).

This finding is unlikely explained by cohort effects because of the joint analysis of cross-sectional age effects and effects of the publication year. The cross-sectional age effect alone can be due to cohort, period, and "true" age effects. Once cross-sectional age differences are statistically controlled, differences between publication years can be interpreted as effects related to societal changes. One possible explanation is that higher mobility in recent years specifically decreased the number of people considered as belonging to the personal network because they are supportive, close, and live close by. The observed effect of relocation as the life event that most strongly decreases friendship and personal networks supports this explanation. Assessment instruments for personal networks often ask for people with whom important matters are discussed or who would provide support when needed (Marsden, 1987; van der Poel, 1993). The number of such confidants living nearby decreases, as people do not live in the same place for years. At the same time, the number of family members does not decrease because contact is maintained over long distances (Finchum, 2005). This is also supported by the current finding that relocation did not change the size of family networks. The global network, on the other hand, could possibly remain stable in size because more peripheral acquaintances are included nowadays. All in all, dissolution of family ties and increasing social isolation were not observed—judging by network sizes. This is in line with contemporary views of relationship changes in late modernity: Although individual differences or diversity in how people maintain relationships exists, there is no general trend of a decreasing importance of family ties (Allan, 2008; Neyer et al., 2011; Wrzus et al., 2011).

The importance of family ties is further highlighted by findings that average family networks did not significantly differ between countries with varying collectivistic values. The available studies from non-Western countries are too scarce to warrant comprehensive conclusions. However, warnings that individualistic societies dissolve family relationships and social ties in general (McPherson et al., 2006; Parsons, 1955) seem too far-reaching. Evolutionary psychological perspectives also suggest that the observed stability of family networks over the life course might be similar in diverse cultural settings (Buss, 1999). As expected, global and personal networks were larger in more individualistic countries as compared with more collectivistic countries because individualism places—among other things—less emphasis on the in-group and attributes more importance to persons outside the family (Hofstede, 1980; Oyserman et al., 2002; Triandis et al., 1988). Global and personal networks comprise support providers and confidants to discuss important matters with. In more collectivistic countries, family members very often fulfill this role (Avogo & Agadjanian, 2008), whereas both intra- and extrafamilial persons frequently satisfy such functions in more individualistic countries. Also, the described life events largely are equally common in more collectivistic countries, and social motives as described by socioemotional selectivity theory are likely equally generalizable to a certain extent (Yeung, Fung, & Lang, 2008). All this supports assumptions that social network development follows similar patterns in both Western and non-Western countries (Antonucci et al., 2002, 2001; Fiori, Antonucci, & Akiyama, 2008; Fung, Stoeber, Yeung, & Lang, 2008; Yeung et al., 2008).

In sum, socioemotional selectivity and social convoy theory focus on the long-term changes of social networks, which are ascribed to changing motivational and situational factors. Other psychological disciplines show considerable consistency with the two theories. For example, social convoy theory and social psychology both highlight the importance of situational factors, and socioemotional selectivity theory focuses on motivational characteristics, where personality psychology would predict individual differences. Both theories are consistent with cultural psychology,

as the social motives and most important age-graded life events occur across cultures. Both theories are also consistent with evolutionary psychology, as motivational processes can be qualified by evolutionary predictions: Flexible relationship maintenance or dissolution, depending on situational circumstances, can be viewed as conditional developmental strategies, such as grandparental investment, depending on availability and certainty of grandchildren (Coall & Hertwig, 2010). Furthermore, other psychological perspectives can complement socioemotional selectivity and social convoy theory by addressing short-term processes and moderating dispositional or societal factors. It is important to emphasize that such a framework cannot be viewed as a theory of social network development because more specificity on the exact interplay of short-term and long-term processes as well as personality and societal factors would be needed. Instead, it outlines the most important questions on social network development and how psychological disciplines can contribute to answer them more comprehensively.

Limitations and Future Directions

Despite the comprehensive nature of this meta-analysis, which spans several decades of cross-sectional and longitudinal social network research, a few issues limit the generalizability of the findings. First, we focused on studies from adolescence onward because social relationships of children are almost exclusively assessed through parents' reports, and we wanted to avoid a confounding of age and method effects. Future reviews could focus exclusively on social networks assessed by methods other than self-report and include younger samples. We included studies from all countries examined; yet it has to be noted that the majority of studies came from U.S. samples and only a handful were from Asian or African countries. Further research on the generalizability of network sizes and network composition across the life span is clearly needed. Importantly, we observed a research gap for studies in middle adulthood. In comparison to young and late adulthood, few cross-sectional and hardly any longitudinal studies were conducted for middle adulthood. More studies on this life period are certainly needed to establish how and why social relationships change during this age period (Fingerman & Hay, 2002).

Most studies incorporated in this meta-analytical review focused on friendships and family relationships, especially in association with effects of life events. There are two directions for new studies. First, peripheral relationships at work, at church, in the neighborhood, or at voluntary services might be most important when encountering specific life events such as retirement, or during specific age periods. These peripheral relationships might even gain importance as people's life expectation and time in good health increase (Cornwell, Laumann, & Schumm, 2008; Granovetter, 1973; Phillipson, 1997). Second, e-quaintances—that is, relationships with others only known over the Internet—have increased in importance over the last few years and now constitute a significant part of some people's social networks (Lewis, Kaufman, Gonzalez, Wimmer, & Christakis, 2008; Mesch & Talmud, 2006; Wang & Wellman, 2010). Changes and processes of these e-networks surely constitute a promising field for researchers of social relationships (for a review on research regarding online social networks, see Wilson, Gosling, & Graham, in press).

Finally, future studies on the effects of life events on social network changes should adopt prospective designs because changes can often precede the occurrence of a life event. This was shown for a decrease in life satisfaction even before life events such as divorce occurred (Lucas, Clark, Georgellis, & Diener, 2003). Such studies could also focus not only on average network sizes but also on the stability of specific relationships. Few of the reviewed studies reported change in specific relationships, whereas the overall network size hardly changed (Morgan et al., 1997b; Zettel & Rook, 2004). Therefore, the current study might slightly underestimate change in specific relationships, and focuses on changes in availability of relationship domains instead. Although difficult to apply (Suitor, Wellman, & Morgan, 1997), studying the processes of how social relationships change while they are embedded in changing social networks would provide insight into relationship dynamics and how they are influenced by the (social) environment.

In conclusion, the current meta-analysis shows that people's networks of social relationships change from adolescence to adulthood to old age, and these changes are similar to changes related to experiencing age-specific life events. At the same time, a stable convoy of family relationships and few close confidants accompanies people through positive and negative life events and as they grow older. The study should equip the reader with two things: (a) an answer on the initial questions of what the typical size of networks is and how it changes over the life span, and (b) first insights into how social network development relates to and informs other disciplines.

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Received February 15, 2011
Revision received March 19, 2012
Accepted March 26, 2012 ■