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Distinct aspects of human connection associated with subjective well-being

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1. Introduction

Although it is well known that social relationships matter for physical and mental health outcomes (Thoits, 2011; Andersen et al., 2021; Holt-Lunstad et al., 2010; Kawachi and Berkman, 2001; Martire and Franks, 2014), current knowledge of how distinct personal network components are *causally* associated with subjective well-being (SWB) over time remains limited. Personal networks refer to the set of social relationships as defined by an individual, referred to as the ego. Objective personal network descriptions, which often refer to the number of connections (or ties) and types of relationships that egos have, have generally been positively associated with health. For instance, people who report more supportive social ties, as well as more ties overall, tend to present fewer symptoms of depression, anxiety, and unhappiness (Antonucci et al., 2010; Marini et al., 2020; Haller and Hadler, 2006; Ahmadi et al., 2019; Santini et al., 2015). However, uncertainty persists in the research literature about the *types* of connections that have the strongest effects on well-being (Dahlberg et al., 2021; Gariépy et al., 2016).

Additionally, while objective network descriptions undoubtedly have important health implications, well-being has typically been more strongly associated with individuals'

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Emily H. Ruppel: Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Stephanie Child:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Claude S. Fischer:** Conceptualization, Writing – original draft, Formal analysis, Supervision, Project administration, Funding acquisition. **Marian Botchway:** Conceptualization, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices A–E. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssmmh.2022.100143>.

evaluations of their network, such as whether they feel they can count on support from their ties, than with the objective descriptions of those ties (Maulik et al., 2011; Fuller-Iglesias, 2015; Chen and Feeley, 2014; Reid and Taylor, 2015; Santini et al., 2015; Taylor and Taylor, 2018; Yang and Park, 2019; Bui, 2020; Santini et al., 2020; cf. Carr et al., 2019; Erzen and Çikrikci, 2018). A few studies have found that such subjective evaluations fully mediate the association between network descriptions and well-being (e.g., Zhu et al., 2013). These evaluations are important to consider when conceptualizing causal pathways from network ties to SWB (Berkman and Glass, 2000; Thoits, 2011).

The majority of previous studies have found correlations between social connection and well-being across individuals (Lincoln et al., 2005; Fiori et al., 2006; Falci and McNeely, 2009; Perry and Pescosolido, 2015; Pachucki and Leal, 2020; Santini et al., 2020; Child and Lawton, 2020; Lee et al., 2021). Some studies have also found correlations *within* individuals over time, suggesting that network changes co-occur with changes in well-being (Durden et al., 2007; Cable et al., 2013; Huxhold et al., 2013; Cornwell and Laumann, 2013; Schwartz and Litwin, 2017; Yoon et al., 2018). Other studies of panel data have yielded conflicting or muddy results (Noteboom et al., 2016; Bilecen and Vacca, 2021; Gariépy et al., 2016). Additionally, these correlations are often conditional on traits of the ego (*i.e.*, the study respondent) such as age and gender, and on specific operationalizations, and they are typically small (Lin, 1992; Song et al., 2011).

In this paper, we utilize the UC Berkeley Social Network Study (UCNets), a rich and detailed data source, to more fully examine the types of ties that matter most for well-being, how subjective evaluations of networks may mediate these relationships, and whether these associations are causal in nature. The findings tend to replicate prior work on the multitude of ties affecting well-being and the greater relative weight of network evaluations, but notably suggest that many effects may be more correlational than causal.

2. Which kinds of human connection matter for subjective well-being?

We start by distinguishing people's *descriptions* from their *evaluations* of their social ties. Several ways of defining connection appear in the literature, but among the most common are the types of roles one fulfills, the kinds of resources that are exchanged between ties, whether ties are positive or negative, and social participation in groups.

2.1. Roles

Many studies conceptualize social relationships as normatively defined roles (Merton, 1957). Across a range of cultural contexts, well-being is most strongly associated with marriage (and, to a lesser extent, unmarried cohabitation and strength of partnership) (e.g., Wade and Pevalin, 2004; Hewitt et al., 2012; Tilburg and van der Pas, 2015; Rapp and Stauder, 2019; Yang and Park, 2019; Still, 2020; Zhang and Axinn, 2021; cf. Musick and Bumpass, 2012; Nicolini et al., 2021). Some studies have specifically found that spouses/partners matter more for well-being than other ties do (Schafer et al., 2021; Dahlberg et al., 2021, meta-analysis). Gariépy et al.'s (2016) meta-analysis concludes that the "source of social support most consistently associated with protection from depression in adults was spousal support (100% of studies reported a significant association)" (p. 286)—even though the benefits

of marriage can weaken over time and couple bonds are often fraught with ambivalence. Marriage and cohabitation also reduce contact with friends and family of origin, at least initially (Kalmijn, 2012; Musick and Bumpass, 2012; Rözer et al., 2015).

Researchers also often distinguish kin from non-kin ties. Studies have commonly found that kin ties are more critical to well-being than non-kin ties are (e.g., Cable et al., 2013; Lee and Szinovacz, 2016; Chopik, 2017; cf. Savage and Russell, 2005; Fiori et al., 2006). However, acquaintances and even strangers also affect people for good (e.g., Levin et al., 2011; Desmond, 2012; Small, 2017; Torres, 2019) or ill (Baller and Richardson, 2009). Ties to acquaintances matter because they are numerous, they connect otherwise-unconnected parts of the network (Granovetter, 1973), and they are less often ambivalent than “strong ties” to family or close friends (Huxhold et al., 2020).

2.2. Exchange content

Social ties are also measured by what people *do* for one another—provide companionship, money, consolation, etc. (e.g., Savage and Russell, 2005; Durden et al., 2007; Cornwell et al., 2009; Min et al., 2013). A few studies compare the well-being effects of one content to another, collectively registering social companionship, emergency help, health discussion partnerships, and difficulty of ties as predictors of well-being (Child and Lawton, 2020; Perry and Pescosolido, 2015; York Cornwell and Waite, 2012).

2.3. Positivity versus negativity

Researchers have increasingly recognized that relationships can impair well-being (e.g., Walen and Lachman, 2000; Durden et al., 2007; Offer, 2012; Chen and Feeley, 2014; Rook, 1984; Woods-Giscombé et al., 2015; Widmer et al., 2018; Stafford et al., 2019). Most ties have positive and negative elements, but negativity tends to have more consequences for well-being than does positivity (Offer, 2021: 185–86) such that having no relationship is usually better than having a difficult one (e.g., Bertera, 2005; Birditt et al., 2018; Offer, 2020).

2.4. Groups

Interest in “social capital” has stimulated assessment of group involvement. Activity in groups such as churches, clubs, hobby groups, etc., generally goes along with well-being (e.g., Li, 2007; Huxhold et al., 2013), but it may be that it is the personal ties that group activity generates rather than the groups themselves that matter (e.g., Lim and Putnam, 2010).

In summary, while researchers recognize that different aspects of human connection might affect well-being differently, they have typically made only limited distinctions among them, such as between just family and friends, and have often merged them into global indices (e.g., a “social disconnection” scale, Cornwell and Waite, 2009). Other studies, such as Fiori et al. (2006), Giannella and Fischer (2016), and Cheng et al. (2022) pool measures to discover clusters of ego networks inductively. It is somewhat rarer to decompose networks into their distinct components, then compare the effects of these components (with important exceptions, e.g., Nicolini et al., 2021). As such, we take a deductive approach in this paper

and test common network measures from the literature *against* one another to evaluate their relative effects on well-being. The UCNets data advance this research program through the range of network measures available with which to draw these comparisons.

3. Subjective evaluations of the network

Despite the vast literature on network characteristics and health, an ego's evaluation of their network is often more important than objective descriptions of their network. Some research even indicates that subjective evaluations of the network entirely mediate the relationship between network characteristics and SWB. One primary pathway through which this occurs is via perceived social support (Cohen and Wills, 1985). Social support is thought to promote SWB in two ways. First, actual received support may alleviate social isolation and loneliness, or help individuals cope with stressful situations. Second, the perception that one has, and therefore could activate, support when needed may contribute generally to a more confident and positive emotional outlook or psychological state. Notably, this second pathway suggests perceived social support may be important even in the absence of a particular stressor.

The challenge with more subjective assessments of the network is, of course, the causal direction of these relationships. That is, do happier people tend to view their relationships, and the potential for support received, in a more positive light (e.g., Schaefer et al., 2011; Elmer et al., 2017; Moore et al., 2018.)? Or is it that actual support and/or the knowledge of having a supportive network promotes well-being among those on the receiving end?

Further, although several studies have extensively documented positive evaluations of personal networks that matter for health, investigations of negative feelings about one's network may also be important for further unraveling the complex links between social ties and well-being. For instance, the "subjective experience of feeling alone or lonely" may be the result of changing personal networks, major life transitions, certain chronic health conditions, or personal and social factors, including income and marital status (Finlay and Kobayashi, 2018, p. 25; Stickley and Koyanagi, 2018). Loneliness has severe negative implications for well-being and is associated with early mortality as well as depression (Luo et al., 2012; Beller and Wagner, 2018). Additionally, recent unprecedented events, such as the COVID-19 pandemic, that require physical isolation for extensive periods have highlighted how detrimental loneliness is for health outcomes (Lee et al., 2020; Creese et al., 2021). Previous studies have examined loneliness as a mediator between networks and well-being (Chen and Feeley, 2014; Arslan, 2021), but longitudinal research of this psychological pathway is limited. Additionally, the ways in which individuals experience loneliness may differ across age groups (Franssen et al., 2020); therefore, the current study uses panel data to evaluate how loneliness may mediate links between social relationships and SWB in two distinct groups of adults over time.

4. Causality and modeling issues

The research summarized above has motivated clinical interventions to expand individuals' networks as a vehicle to improving well-being, although with mixed success (e.g., Hogan

et al., 2002; Berkman, 2003; Umberson and Montez, 2010; Latkin and Knowlton, 2015; Hunter et al., 2019; National Academies of Sciences, Engineering, and Medicine, 2020: S-6). Network interventions appear to have positive effects on some aspects of well-being (e.g., sexual health), but negligible effects on others (e.g., drug use). Meta-analyses criticize the varied quality of extant experiments, which have produced a range of contradictory results (Hogan et al., 2002; Hunter et al., 2019). The limited success of these clinical interventions may underline problems in establishing causality using observational data (e.g., Schaefer et al., 2011; Moore et al., 2018; Ruppel et al., 2022), though the failures of these interventions may also be related to their artificial character.

Additional methodological issues compromise causal claims. (1) As noted earlier, correlations between ties and SWB are often conditional on personal or relationship traits, a problem compounded by the disproportionate representation of older adults and students rather than of adults generally in research samples. The Convoy model (Antonucci and Akiyama, 1987) posits that networks change across the life cycle, but scholars have followed that up primarily by studying older adults (e.g., Fiori et al., 2006; Perkins et al., 2013; Levitt, 2005). (2) Untested third factors threaten causal inference. Panel data help eliminate these confounders but have so far yielded modest estimates of causality (e.g., Hajek et al., 2016; Yang and Park, 2019; Ruppel et al., 2022). Confounding variables which change between waves, such as genetic or childhood factors that unfold in later life or coincident events between waves, can muddle panel analyses. Experiments are powerful, but interventions in networks have so far yielded mixed results (see above).

The UCNets study mitigates a few of these challenges. Its data yield network correlations with SWB independent of egos' evaluations; its three waves of data provide estimates of both between- and withinperson effects; and it covers a broader age range than do most studies—young adults and late-middle-aged adults. Previous studies have also used UCNets (e.g., Child and Lawton, 2019, 2020; Offer, 2020; Bilecen and Vacca, 2021; K. Lee, 2021; Ruppel et al., 2022). Our work replicates these analyses to a degree, but expands on them in two ways: First, we use all three waves of the UCNets data, which few studies have done thus far, and which allows us to undertake more sophisticated causal analyses. Second, prior studies have not made full use of the multiple kinds of human connections measured in the data, which represents the main value-added of this study. We propose four new scales to assess network descriptions and introduce additional measures of network evaluations.

5. Subjective well-being, networks, and the life course

We pursue these analytical goals by analyzing SWB as our outcome, the most common type of well-being treated in the network literature. Ed Diener, a leading SWB researcher, defined it as “people’s appraisals and evaluations of their own lives” (Diener et al., 2018:253), encompassing happiness, positive self-evaluations, and the absence of depressive symptoms. Although sometimes usefully decomposed into these three major components of positive affect, negative affect, and life satisfaction (or other, more granular aspects of each of these dimensions), the broader SWB construct is robust (Keyes et al., 2002: Table 3). Using a broad construct is also supported by the statistical coherence among a dozen SWB indicators in the UCNets data (see online Supplement, Appendix A). We distinguish egos’ feeling

alone and their evaluations of their networks from both SWB and their descriptions of the networks. Feeling alone and evaluations of social support serve as intermediate variables in our analyses (see Methods section).

Finally, given the well-documented U-shaped curve in SWB research (Blanchflower and Oswald, 2008), as well as marked differences in the structure and functionality of social relationships across the life course (e.g., Marsden, 2018; Wrzus et al., 2013), we examine these associations in two distinct adult populations. As mentioned earlier, a main contribution of the UCNets data is the extension of network research to both young adults (ages 21–30 at study enrollment) and mid-to-older adulthood (ages 50–70 at study enrollment). These two age groups represent distinct phases of the life course in which transitions are likely to occur, such as entering and leaving the work force, marriage, the death of a spouse or parents, and the arrival of children or grandchildren, all of which may have consequences for SWB. For example, SWB is known to fluctuate around retirement, and in particular, research suggests these changes should be examined within the context of marriage (Kim and Moen, 2001). Distinct phases of the life course and accompanying transitions also have implications for the types of relationships that are formed or dissolved (Marsden, 2018), and therefore how individuals evaluate their networks (Lansford et al., 1998). For example, while younger adult networks are often transitory and expanding, with career and/or romantic partner transitions, previous research on socioemotional selectivity theory has indicated that older adults often begin to prune or reduce their networks to focus on kin and other long-term relationships (Wrzus et al., 2013; Lansford et al., 1998) – though research on the UCNets cohort in particular indicates there is little network churn associated with life transitions among older adults (Weiss et al., 2022).

Given these differences, we examine each age group separately to assess 1) which descriptive measures of the network matter most for SWB, 2) whether subjective evaluations mediate associations between network descriptions and SWB, 3) and specifically, whether these relationships are causal, *and for whom*, at two distinct life phases.

6. Methods

6.1. Sample

We draw on the publicly available UCNets survey of 1,159 respondents who were interviewed about their social ties and well-being in three waves between 2015–2018.¹ The researchers drew a sample of 21-to-30-year-olds and 50-to-70-year-olds (at Wave 1) from the six counties of the San Francisco Bay Area which, after post-stratification weighting for combinations of gender, age, race, Hispanic ethnicity, marital status, and education, represent those cohorts in the region. More details can be found in the Supplement, Appendix F.

¹Data and documentation are available at <http://ucnets.berkeley.edu/and> at <https://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/36975>.

6.2. Measures

We developed several novel measures to assess SWB, perceived network support, and, critically, multiple dimensions of networks.

1. Subjective Well-Being (SWB). UCNets provides many items that assess respondents' sense of well-being. Though heterogeneous in manifest content, 12 of these items *empirically* form a single scale with a high Cronbach's alpha of .87, a roughly normal distribution, similar patterns in both age cohorts, and a strong association with a criterion variable, suicide ideation. Six of the 12 items are from the Kessler depression scale. Four are comparable to the measures from the Kessler scale and adapted from similar preexisting scales. The final two items are reported frequency of feeling happy and whether the respondent reveals a clinical psychological problem. We scaled each item from 1 to 5 and took the average for each respondent-wave. (See Supplement, Appendix A, for details.)
2. Evaluations of Connectedness: Perceived Support and Feeling Alone. A pair of questions ask, "If you had a serious problem, like a life-threatening illness or possibly losing your home, do you feel that you have some relatives that you can rely on to help?" and "If you had a serious problem, like a life-threatening illness or possibly losing your home, do you feel that you have some friends that you can rely on to help?" Each question offers four answer options: "definitely have," "probably have," "might have," and "probably don't have." Positing that "definitely have" corresponds to a level of subjective confidence in networks with potential protective effects, we coded respondents who answered "definitely have" as 1 and all other respondents as 0. As a robustness test, we reran all models with this variable instead dichotomized as "definitely have" and "probably have" versus "might have" and "probably don't have"; this alternate version of the variable produced minor fluctuations, but most overall patterns were consistent. Roughly 75% of both age cohorts answered "definitely have" about kin and roughly 62% about friends. The third measure assesses feelings of being alone by combining answers to two questions, "How many days during the past 7 days have you felt isolated from other people?" and "How many days during the past 7 days have you felt lonely?" There are good reasons to distinguish feeling isolated from feeling lonely (Child and Lawton, 2019), but the two correlate strongly ($r = 0.75$ in the younger cohort, 0.67 in the older). Combining these variables draws on findings from Menec et al. (2020) about the overlap between loneliness and social isolation and analyzing these variables as predictors of SWB builds on the conceptualization of these variables' relationship to SWB in prior work (Hombrados-Mendieta et al., 2013; Mann et al., 2017).
3. Network Descriptions: Five Measures. We developed five scales that capture the volume of interpersonal support (or burden) respondents received or could expect from different domains of their networks. Central to most were several name-eliciting questions asking respondents to list the people from whom they

received companionship, advice, help, and so on. (Details are in Supplement, Appendix B). The final measures are:

- a. *Spouse/Partner Scale*: Although dominated by whether the respondent *has* a spouse or a live-in partner, this scale is higher the more often respondents named the spouse/partner in answer to several name-generator questions about who provides support, per studies showing the importance of having a *supportive* partner (see above).
- b. *Kin Support Scale*: This has two sub-components. (i) A “family census” counts how many living parents, siblings, and grown children the respondent reported. (ii) The number of relatives (other than spouses) whom the respondent named in answer to the several name-generator questions.
- c. *Non-kin Support Scale*: This scale sums up the number of non-relatives (other than live-in partners) who were named in the name-generator questions (or listed as co-residents).
- d. *Group Scale*: UCNeTs asked respondents (i) for the number of associations in which they were *active* (coded as 0, 1, or 2-plus); (ii) whether they participated in an informal group (0 versus 1); (iii) their rates of church attendance; and (iv) whether, if suffering a serious emergency, they would turn to a group for help. We summed these answers.
- e. *Difficult People*: The number of alters (*i.e.*, members of the network) the respondent listed in answer to the name-generator question asking for people whom respondents found “difficult” or “demanding” (Offer and Fischer, 2018; Offer, 2020). About 65 percent of respondent-waves named at least one person.

These five aggregated measures are *not* highly correlated and sometimes *inversely* correlated with one another indicating that they are distinct aspects of connection.

4. Control Variables. In hybrid models, all traits that are effectively constant are controlled when estimating within-individual effects, but we added three—gender, age, and dummies for ethnicity/race—to the models to get explicit effect estimates. The other control variables are ones that changed for at least some respondents: the mode of the survey—web versus in-person administration, educational attainment, household income, having moved out of the Bay Area, and the number of negative life events reported. We also control for wave.

6.3. Analysis

We first look at the tripartite relationships between descriptive network measures, evaluation measures, and SWB with simple OLS models which pool the three waves and do not use control variables. The results describe the basic and familiar association between aspects of networks and SWB. We then use hybrid fixed- and random-effects models—the “gold standard” for inference from panel data (Vaisey and Miles, 2017, p. 5)—to

estimate causal effects. These models control for unmeasured time-invariant characteristics by modeling the effects of within-individual changes between waves. Furthermore, Allison's (2009) hybrid procedure enables us to directly compare between-individual associations between networks and SWB to within-individual effects of network changes on SWB. The procedure treats the dependent variable as a function of wave-to-wave *deviations* from individuals' personal, multi-wave averages on each independent variable. Those resulting associations correspond to *within-individual* effects and they control for all individual characteristics, including unmeasured characteristics, reducing the risk of confounding. Associations between individuals' *averages across the waves* and the dependent variable correspond to the *between-individual* effects. Generally, between-individual effects are posited as correlational, not causal, whereas within-individual effects are more plausibly causal within the study period.

We supplement these models with mediation analyses and assessments of reciprocal causation. First, we use two sets of tests to evaluate the possibility of mediation. We use hybrid models to assess the direct effects of network descriptors on network evaluations to test whether these evaluations might operate as intermediate variables. Subsequently, we use the KHB method to evaluate whether network evaluations mediate the effects of network descriptions on health, or whether these variables' effects are independent. Second, we follow Vaisey and Miles (2017) to estimate reciprocal or reverse causation (see Supplement Appendix E). Such tests are sensitive to mis-specifying the lag period, so we cannot capture reciprocal or reverse effects over much shorter or much longer than the roughly one year between UCNets waves, making it one limitation of this paper. These analyses clarify the causal pathways linking networks and SWB.

7. Results

We examine how three evaluations and five descriptions of networks are each associated with SWB within the young adult and the middle-aged samples separately. Table 1 begins by presenting an OLS regression where the units of analysis are respondent-waves. We run two models for each age cohort, one including only the descriptive network variables, one including both descriptive and evaluative network variables. Three important findings emerge: First, respondents who reported higher numbers of positive network ties reported higher average SWB, and respondents who reported higher numbers of difficult network ties reported lower average SWB. Second, the associations are stronger for the older respondents. Third, each of the eight network variables—the spouse/partner, kin, non-kin, group, and demanding alters scales, and the evaluations of kin and non-kin supportiveness and feelings of aloneness—are *independently* associated with SWB. In nearly all cases, their beta coefficients equal or surpass their zero-order correlations with SWB.

In the younger cohort, feelings of aloneness were most strongly correlated with SWB ($b = -.67, p < .001$), followed by group involvement (in the reduced model, $b = 0.14, p < .001$; in the full model, $b = 0.09, p < .001$), the number of difficult people in the network (in the reduced model, $b = -0.13, p < .001$; in the full model, $b = -0.08, p < .01$), the kin scale (in the reduced model, $b = 0.09, p < .01$; in the full model, $b = -0.05, p < .05$), the non-kin scale (in the reduced model, $b = 0.07, p < .05$; in the full model, $b = 0.07, p < .01$), and reliance

on friends ($b = 0.05, p < .05$). The spouse/partner scale was statistically significant in the full model ($b = -0.07, p = .001$) but not in the reduced model ($b = 0.06, p < .1$), and reliance on family was not significant.

In the older cohort, feelings of aloneness were again the strongest predictor of SWB ($b = -0.58, p < .001$), followed by the number of difficult people (in the reduced model, $b = -0.22, p < .001$; in the full model, $-0.13, p < .001$), then the kin scale (in the reduced model, $b = 0.18, p < .001$; in the full model, $b = 0.07, p < .01$), the non-kin scale ($b = 0.13, p < .001$; in the full model, $b = 0.05, p < .05$), the group scale (in the reduced model, $b = 0.11, p < .001$; in the full model, $b = 0.08, p < .001$), and finally reliance on friends ($b = 0.06, p < .001$). The spouse/partner scale was statistically significant in the reduced model ($b = 0.20, p < .001$) but not the full model ($b = 0.03, p < .1$), and reliance on family was again not significant ($b = 0.03, p < .1$). These results support the argument for decomposing networks; the descriptive measures in particular measures are neither redundant with nor simple proxies for one another (see also Supplement Appendix B.) Fourth, and finally, the reduced size of the network description variables after the evaluation variables are added to the model suggests the possibility of mediation.

However, the OLS models do not control adequately for other respondent attributes. Therefore, for causal inference, we turn to hybrid models. Table 2 displays two hybrid models for each cohort. The first presents effect estimates for the five descriptive measures – the spouse/partner scale, the kin scale, the non-kin scale, the group scale, and the number of difficult people in the network – while controlling for important time-varying covariates and for a few time-fixed covariates. For each time-varying measure, the analysis distinguishes the covariation with SWB that is associated with *between-respondent* differences from those associated with *within-respondent* changes. Significant coefficients for the latter imply a plausible causal effect.

In Model 1, network descriptors have strong associations with SWB at the between-individual level but weak or nonexistent associations at the within-individual level. In the younger cohort, all five descriptive variables predicted SWB at the between-individual level (b 's from 0.02 to $-0.13, p < .01$, to $.03, p < .05$), but none did so at the within-individual level. The same pattern held in the older cohort, but the statistical significance of these effects was even stronger (b 's from 0.02 to $-0.17, p < .001$, to $.05, p < .01$). These correlations mirror findings of OLS models but indicate that associations between network descriptions and SWB may not be causal within the study period.

Adding the three evaluative measures to Model 2 reduces the effect sizes of the descriptive measures, suggesting the possibility of mediation. Of the network descriptors, only the kin scale ($b = 0.02, p < .01$) remained significant at the between-individual level in the younger cohort, though network descriptors except the spouse/partner scale remained significant (if less so) at the between-individual level in the older cohort. However, the network evaluation variables emerge as important predictors of well-being. Most crucially, feeling alone predicted SWB at both between- and within-individual levels in both cohorts. In the younger cohort, $b = -0.11 (p < .01)$ at the between-individual level and $b = -0.07 (p < .01)$ at the within-individual level. In the older cohort, $b = -0.11 (p < .01)$ at the

between-individual level and $b = -0.05$ ($p < .01$) at the within-individual level. Reliance on relatives also approached significance in the younger cohort (at the between-individual level, $b = 0.14$, $p < .1$; at the within-individual level, $b = -0.12$, $p < .1$), while reliance on friends approached significance at the within-individual level in the older cohort ($b = 0.05$, $p < .1$). These emergent within-individual effects suggest a potential causal pathway between evaluations of networks and SWB.

We turn to mediation analyses to assess whether network descriptors might influence network evaluations, which then influence SWB. Table 3 assesses the possibility that network descriptions influence SWB *through* effects on respondents' evaluations, especially their feeling alone. Each of the intermediate measures is regressed in a hybrid FE model on the personal network components and controls, within each cohort. (The two dichotomous mediating measures are regressed in a binary logistic hybrid FE model.)

There are many robust between-respondent associations, but fewer within-respondent effects. Respondents who reported feeling alone tended, other factors held constant, to also be un- or weakly partnered, less involved with kin (older respondents only), less involved with non-kin, and tied to more difficult alters (older respondents only). The single within-respondent effect is that 50-to-72-year-olds who increased their non-kin involvement reduced their reports of feeling alone ($b = -0.06$, $p < .05$).

The measures of confidence in support from kin and from friends, we recall, are weakly associated with SWB. They are, in turn, associated with the network components almost exclusively between rather than within respondents. Among the young, having confidence in kin support, other things being equal, tended to accompany a more supportive partner, kin, and non-kin involvement, and naming fewer difficult alters. (We discuss group activities below.) One robust within-respondent effect emerged: young respondents reporting more difficult alters tended to also report less confidence in kin ($b = -.75$, $p < .001$), not surprising given that most difficult alters were kin (Offer and Fischer, 2018). Older respondents displayed only two positive associations with confidence in kin: reporting many kin and reporting few difficult alters, both between-individual effects. Confidence in friends' support was likelier if respondents were involved with many non-kin, and there is suggestion that this is a causal effect among the older respondents (within-individual $b = 0.07$, $p < .05$). Reports of more difficult alters accompanied reports of less confidence in friends, with a suggestion of a causal effect among the younger respondents (within-individual $b = -0.38$, $p < .05$).

The group scale yielded a pair of unexpected *negative* within-respondent associations: with confidence in kin among the young ($b = -.36$, $p < .05$) and with confidence in friends among the old ($b = -0.31$, $p < .01$). These imply that increasing growing group involvement accompanied *shrinking* confidence in alters' help. Perhaps respondents who became more active in church or other groups consequently reduced their reliance on specific alters. Or, if one assumes reversed causality (as other analyses suggest; see Supplement Appendix E), respondents who lost confidence in alters subsequently turned to groups.

To supplement these analyses, we used the KHB method to evaluate whether network evaluations mediated the effects of network descriptions on SWB or whether these effects were independent. The KHB method finds limited evidence of mediation. While the coefficients of some network descriptions are reduced in the full model, the KHB method finds that only the between-individual effects of the number of difficult people were reduced to a statistically significant degree. The effects of this variable may thus be mediated by network evaluations, but other description and evaluation variables appear to operate independently.

In sum, we found that: (1) each aspect of individuals' connectedness—the five described components—correlates independently with SWB in cross-sectional analysis; (2) SWB most strongly correlates with subjective evaluations of ties, especially reports of feeling alone; and most critically, (3) the overall associations largely reflect between-individual differences rather than within-individual differences. Of particular interest, the effect of spouse/partners, so prominent in the literature, is muted in within-individual analyses. These data seem not to pick up the effects of changing one's partnering circumstances, just the difference between those who were and were not partnered. We did find a handful of noteworthy within-individual and presumably causal associations: Respondents whose sense of aloneness grew tended to report worsening SWB; those who engaged more with non-kin expressed less sense of being alone; and younger respondents who added difficult alters to their lists then had less confidence in getting support. While we did not formally test interactions with age, we found distinctions by stage in the lifecycle with some literature (Alwin et al., 2018). Some network measures tested in this study mattered more for SWB among mature adults than among young ones. Our broadest conclusion is that, with a few exceptions—critically, the effect of *subjective* isolation—the network-SWB connection is modest, largely between individuals, and about change within individuals.

These modest results—in contrast to bold claims in popular discourse—are consistent with prior research that employed strong causal inference methods (e.g., Santini et al., 2020; see also literature review above). In UCNeTs, the reason may be that the observed person-to-person variation in network measures was much greater than observed period-to-period variation in those measures (see Supplement Appendix C and stability estimates in Appendix B). The kin and the spouse/partner scales were, as one would expect, quite stable across the few years, especially among older people; they varied much more across respondents. One exception is the difficult alters scale: the between-person and the between-period variances were similar; respondents changed their answers between waves much more than for other scales. Thus, stability in most aspects of networks² may explain why we observed a couple of significant, presumably causal, within-respondent effects for the number of difficult others but not much for other network components.

We compared our hybrid fixed-effects models to lagged dependent variable models (Supplement Appendix D). Although inferentially less powerful than FE analysis (Vaisey and Miles, 2017), LDV does offer us an additional angle. We summarize the LDV results

²Whom network survey respondents name changes a lot from one wave to the next, but the number and composition of the *set* of alters are quite stable (e.g., Bidart et al., 2020; Fischer and Offer, 2020; Cornwell et al., 2022).

here, *italicizing* those consistent with the *within-individual* FE effects estimates reported above.

- For both cohorts, *reduced feelings of being alone accompanied improvements in SWB.*
- For the 21-to-32-year-olds, improving SWB coincided with increasing confidence in friends' support. Growing confidence in friends, in turn, went along with increasing non-kin involvement, with having a supportive spouse or partner, and *with having fewer difficult ties.*
- For the 50-to-72-year-olds: improving SWB coincided with growing confidence in kin support. Moving backward, *reduced feelings of aloneness accompanied increases in non-kin involvement*; greater confidence in kin support went along with increasing kin involvement and fewer difficult alters.

Summarized yet more concisely, the hybrid and the LDV approaches together suggest that improving SWB accompanied a lessening sense of aloneness, more involvement with non-kin, and having fewer alters who were difficult. But, aside from SWB's association with aloneness, the effects were modest.

Lastly, we tested for reciprocal causation (Vaisey and Miles, 2017; see Supplement, Appendix E). The results suggest additional threats to causal inference, including among the few associations observed at within-individual levels. In the younger cohort, directionality cannot be ascertained for several associations, most notably between SWB and feeling alone and between SWB and difficult alters. It cannot be determined whether feeling alone and difficult alters impaired SWB or impaired SWB led to feeling alone and listing difficult alters—or both. In the older sample, directionality is also ambiguous in several instances, including for SWB with non-kin involvement and confidence in friends and for the association between confidence in kin support and kin involvement. These findings call into question the causal direction of most of the within-individual associations found for the older cohort. Overall, these findings highlight the intertwining of evaluative and descriptive measures of networks and further caution us against causal assertions.

8. Discussion

It is widely accepted that human connection promotes SWB; certainly, extreme isolation is damaging. But previous work has raised questions about whether variation in the normal range of connectedness changes SWB. The UCNets data set allowed us to address a few of these concerns, such as separating descriptions from evaluations of social ties, analyzing young as well as older adults, and addressing threats to causal inference. Critically, it allowed us to decompose “human connection.” We distinguished five aspects of social connection: spouse (or live-in partner) involvement, engagement with relatives, engagement with non-relatives, group activity, and the presence of difficult relationships. And we measured three subjective evaluations: feeling alone, confidence in family support, and confidence in friends' support.

We found substantive and independent associations between each of the components and SWB (Table 1), affirming the importance of the multidimensional approach. And we found stronger associations among the mature than among the young adults, affirming the importance of life stage differences. However, using hybrid FE models showed that most of the associations between network descriptions and SWB operated primarily between persons. The between-person results (that is, across individuals) point to relatively stable individual attributes that predict both larger and more supportive networks and better SWB, but these attributes have not yet been specified.

In contrast to the limited effects of network descriptions, findings highlight the importance of subjective evaluations of networks. At the within-individual level (that is, across time), among both younger and older respondents, improved SWB accompanied fewer feelings of being alone (Table 2), and among the older, fewer feelings of being alone went along with more non-kin involvement (Table 3). Thus, evaluations of networks appear more determinative of well-being than descriptions of them are. The KHB method suggests that evaluations of networks exercise independent effects on SWB; they do not purely mediate the relationship between network descriptions and SWB. Other researchers, too, have found few, small, or ambiguous causal effects of “objective” network traits on SWB in panel studies (Santini et al., 2020; Bui, 2020; Ruppel et al., 2022; see Gariépy et al., 2016). Yet even the effects of subjective evaluations may have been produced in part by reciprocal effects (Supplement, Appendix E).

While stronger causal estimates might have appeared had UCNets’ intervals between surveys exceeded roughly 1.5 years (Supplement Appendix C), the results suggest looking for antecedents that make some people both happier and more sociable, antecedents perhaps in childhood experiences or personality (e.g., Fang and Johnson, 2020). The modest effect estimates may also reflect the ambivalent nature of so many social ties which are both supportive *and* draining. (The measure, number of demanding alters, may capture some of that.)

The associations of network components with SWB were somewhat greater for the older respondents, perhaps because so much was occurring so quickly for the twenty-something cohort. New social contexts can affect processes of network construction and maintenance (e.g., Mollenhorst et al., 2014; Martin et al., in press) and the turbulence may have overwhelmed the effects of the network dynamics. These findings call for further attention to life stage differences in a literature predominantly addressing older adults. This study split the sample by age cohort but did not directly test interactions between age and network variables; future research might do so.

We note limitations of this study. Panel data require decisions about waves and intervals. UCNets’ may have been too brief to capture some effects (Supplement, Appendix C), but perhaps too extended to capture other effects. What is an appropriate lag for which network effects deserves more focused investigation. UCNets’ two distinct age groups widen the lifecycle range of the networks literature, but UCNets lacks mid-life and late-life adults. Additionally, we may not be able to generalize from the Bay Area sample to the rest of the

U.S. For instance, network dynamics may differ between urban and rural areas (Beggs et al., 1996; Roth et al., 2022); the present analysis is limited to an urban sample.

An additional methodological limitation of this study is the risk of confounding between the network evaluation questions used as independent variables and the SWB scale used as the dependent variable. Prior literature indicates that network evaluation measures may overlap with SWB measures, for example, how positive respondents feel about their friends and how positive they feel about themselves. Some network evaluation measures used in this study may be better understood as aspects of SWB in and of themselves, not only as predictors of SWB. For example, this study collapsed reported feelings of isolation and feelings of aloneness, but some researchers consider it worthwhile to separate these variables, potentially categorizing loneliness as an aspect of well-being rather than an aspect of the network (Child and Lawton, 2019; De Jong Gierveld and Van Tilburg, 2006). Our choice to treat feelings of aloneness as a network variable predicting SWB is in line with prior work (Menec et al., 2020), but future research might instead use this variable as a measure of well-being. This study develops a new SWB scale; while this composite measure is supported by prior research (Diener et al., 2018; Keyes et al., 2002) and tests suggest that it is robust (see Appendix A), it may contain unexamined confounders and its novelty may hinder comparisons with other research.

Despite these caveats, the UCNets data provide some advantages in addressing the effects of human connections on well-being. The findings temper claims of strong effects, especially of networks as global constructs. As prior research decomposing network support into its component parts has suggested, different aspects of individuals' networks matter differently (and may matter differently for different people.) Subjective evaluations of networks emerge as especially important, not primarily as mediators but rather as independent predictors of well-being. The findings suggest the need for more modesty and a more nuanced approach in future research as well as in interventions that wish to target social relationships to improve well-being.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Subjective Well-Being correlated with and regressed on personal network measures in cross-sectional analysis, pooling cases across waves.

	Age 21–32		Age 50–72	
	n = 1208 Resp-waves		n = 1890 Resp-waves	
	Model 1 ^a	Model 2 ^a	Model 1 ^a	Model 2 ^a
	r	beta	r	beta
<i>Descriptive Measures</i>				
Spouse/partner scale (0–7)	.02...	.06 [†]	.20 ^{***}	.20 ^{***}
Total kin scale (0–41)	.02	.07 [*]	.11 ^{***}	.13 ^{***}
Total non-kin scale (0–32)	.07 ^{**}	.09 ^{**}	.14 ^{***}	.18 ^{***}
Group activities scale (0–5)	.16 ^{***}	.14 ^{***}	.17 ^{***}	.11 ^{***}
Number of difficult people (0–3.3)	-.11 ^{***}	-.13 ^{***}	-.15 ^{***}	-.22 ^{***}
<i>Evaluative Measures</i>				
Feels alone scale (0–14 scale)	-.68 ^{***}	-.67 ^{***}	-.64 ^{***}	-.58 ^{***}
Can rely on relatives (no/yes)	.19 ^{***}	.03	.18 ^{***}	.03 [†]
Can rely on friends (no/yes)	.21 ^{***}	.05 [*]	.17 ^{***}	.06 ^{***}
Adjusted R-squared		.04 ^{***}		.13 ^{***}

[†] p < .10.

* p < .05.

** p < .01.

*** p < .001.

Notes:

^a Model 1 includes only the descriptive measures, while Model 2 includes both descriptive and evaluative measures.

Table 2Hybrid fixed-effects models for Subjective Well-Being scale (0–5): *un*standardized b-coefficients.

	Age 21–32		Age 50–72	
	Model 1 ^a	Model 2 ^a	Model 1 ^a	Model 2 ^a
	N _{inds} = 480	N _{inds} = 480	N _{inds} = 668	N _{inds} = 667
	N _{obs} = 1261	N _{obs} = 1258	N _{obs} = 1808	N _{obs} = 1788
<u>Descriptive Measures</u>				
Spouse/partner Scale (0–7)				
between individuals	.03 [*]	–.01	.02 ^{***}	.00
within individuals	.00	–.01	.00	.01
Total kin scale (0–41)				
between individuals	.02 ^{**}	.02 ^{**}	.02 ^{***}	.01 ^{**}
within individuals	.00	.01	.00	.00
Total non-kin scale (0–32)				
between individuals	.02 ^{**}	–.00	.02 ^{***}	.01 [*]
within individuals	.00	–.00	.00	.00
Group scale (0–5)				
between individuals	.05 ^{**}	.03	.05 ^{**}	.04 ^{**}
within individuals	.04	.03	.00	.01
Number of difficult people (0–3.3)				
between individuals	–.13 ^{**}	–.07 [†]	–.17 ^{***}	–.09 ^{***}
within individuals	–.02	–.03	–.01	–.01
<u>Evaluative Measures</u>				
Feels alone scale (0–14 scale)				
between individuals		–.11 ^{***}		–.11 ^{***}
within individuals		–.07 ^{***}		–.05 ^{***}
Can rely on relatives (no/yes)				
between individuals		.14 [†]		.04
within individuals		–.12 [†]		–.01
Can rely on friends (no/yes)				
between individuals		.10		.07
within individuals		.07		.05 [†]
<u>Time-varying control variables</u>				
On the web (vs. in-person) ^b				
between individuals	–.02	–.02	.01	.01
within individuals	–.03	–.02	–.02	–.01
Education (3-point scale)				
between individuals	.06	.01	–.02	–.01
within individuals	.07	.07	.20 [†]	.12

	Age 21–32		Age 50–72	
	Model 1 ^a	Model 2 ^a	Model 1 ^a	Model 2 ^a
	N _{inds} = 480	N _{inds} = 480	N _{inds} = 668	N _{inds} = 667
	N _{obs} = 1261	N _{obs} = 1258	N _{obs} = 1808	N _{obs} = 1788
Household income (1–13 scale)				
between individuals	.03 ^{**}	.02 [*]	.03 ^{***}	.01 [*]
within individuals	.00	–.00	.00	–.01
Age				
between individuals	.00	.00	.01 ^{***}	.01 [†]
within individuals ^c	.09	.07	.05	.03
Moved out of Bay Area ^b				
between individuals	–.08	.15	.21	–.11
within individuals	.01	–.03	.29 ^{**}	.36 ^{***}
Negative life events (0/1/2+)				
between individuals	–.39 ^{***}	–.20 ^{***}	–.36 ^{***}	–.20 ^{***}
within individuals	–.06 [†]	–.03	–.04	–.03
Time-invariant control measures				
Female	–.06	–.07 [†]	.00	–.08 [*]
Black	.06	–.02	.16 [†]	.13 [†]
Latinx	.13 [†]	.05	.03	.01
Asian	–.08	–.07	–.17 ^{**}	–.12 [*]
Wave = 2 ^c	–.21 [*]	–.15 [*]	–.10 [†]	–.06
Wave = 3 ^c	–.27 [†]	–.23 [†]	–.11	–.06
Constant	3.70 ^{***}	3.88 ^{***}	3.12 ^{***}	3.96 ^{***}
Log pseudolikelihood	–893.5 ^{***}	–653.1 ^{***}	–892.25 ^{***}	–654.5 ^{***}

[†] p < .10,

* p < .05,

** p < .01,

*** p < .001.

Notes:

^a Model 1 includes only the descriptive measures, while Model 2 includes both evaluative and descriptive measures.

^b Mode (in-person versus web) and moved out of the Bay Area are necessarily correlated because in waves 2 and 3 all out-of-the-area respondents completed the survey online.

^c Age and wave are necessarily correlated because respondents are older in later waves.

Table 3

Hybrid fixed-effects models of intermediate subjective network evaluation variables: Unstandardized b-coefficients.

		Logistic Models					
		Feels alone scale (0–14)	Can rely on kin (0/1)	Can rely on friends (0/1)			
		Age 21–32 N _{inds} = 480	Age 50–72 N _{inds} = 668	Age 21–32 N _{inds} = 483	Age 50–72 N _{inds} = 668	Age 21–32 N _{inds} = 480	Age 50–72 N _{inds} = 668
		N _{obs} = 1270	N _{obs} = 1808	N _{obs} = 1270	N _{obs} = 1807	N _{obs} = 1270	N _{obs} = 1808
Descriptive Measures							
Spouse/Partner Scale (0–7)							
between individuals		-.30***	-.22***	.36***	-.02	.28***	-.04
within individuals		-.17	.07	-.06	.07	-.04	.04
Total kin scale (0–41)							
between individuals		-.04	-.08***	.21***	.20***	.03	.04*
within individuals		.07	-.01	.02	.03	-.01	.02
Total non-kin scale (0–32)							
between individuals		-.13***	-.09***	.23***	.06 [†]	.39***	.24***
within individuals		-.07	-.06*	.05	.01	.04	.07*
Group scale (0–5)							
between individuals		-.14	-.16 [†]	.10	.13	-.16	.09
within individuals		-.27	.03	-.36*	.12	-.05	-.31**
Number of difficult people (0–3.3)							
between individuals		.34	.70***	-.98***	-1.10***	-.61**	-.51***
within individuals		-.08	-.18	-.75***	-.20	-.38*	.05
Time-varying control variables							
On the web (vs. in-person) ^d							
between individuals		-.04	-.01	-.23	.28 [†]	-.37*	-.44***
within individuals		.03	.15	.55	-.48*	-.33	-.23
Education (3-point scale)							

Logistic Models						
	Feels alone scale (0–14)		Can rely on kin (0/1)		Can rely on friends (0/1)	
	Age 21–32	Age 50–72	Age 21–32	Age 50–72	Age 21–32	Age 50–72
	<i>N</i> _{inds} = 480	<i>N</i> _{inds} = 668	<i>N</i> _{inds} = 483	<i>N</i> _{inds} = 668	<i>N</i> _{inds} = 480	<i>N</i> _{inds} = 668
	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1808	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1807	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1808
between individuals	-.17	.05	.74*	-.14	.01	-.31*
within individuals	.10	-1.08	-1.20***	.11	-.44	-.82
Household income (1–13 scale)						
between individuals	-.13 [†]	-.17***	.03	.15**	.09	.01
within individuals	.00	-.08	.01	-.05	.00	-.05
Age						
between individuals	.09	-.06***	-.19**	-.01	-.17**	.00
within individuals ^b	-.15	-.37 [†]	-.67*	.52*	.41 [†]	.14
Moved out of Bay Area ^a						
between individuals	1.87 [†]	.85	-2.60*	-4.17**	1.34	.66
within individuals	-.53	1.36 [†]	-.47	1.10	.33	-1.08
Negative life events (0/1,2+)						
between individuals	1.81***	1.47***	-.56 [†]	-.69**	-.12	-.50**
within individuals	.48*	.21	.23	.05	.17	-.09
Time-invariant control measures						
Female	-.07	-.66**	.26	.73**	-.05	.15
Black	-.71	-.57	.95	.01	2.17***	-.04
Latinx	-.88 [†]	-.28	.04	-.29	.31	.32
Asian	-.09	.39	-.66	.45	-.09	-.08
Wave = 2 ^b	.49	.62 [†]	.80 [†]	-.05	-.36	.15
Wave = 3 ^b	.13	.77	1.74*	-.86	-.37	-.11
Constant	3.53 [†]	8.62***	1.92	-.74	1.98	-.20

Logistic Models						
Feels alone scale (0–14)		Can rely on kin (0/1)		Can rely on friends (0/1)		
Age 21–32	Age 50–72	Age 21–32	Age 50–72	Age 21–32	Age 50–72	Age 50–72
<i>N</i> _{inds} = 480	<i>N</i> _{inds} = 668	<i>N</i> _{inds} = 483	<i>N</i> _{inds} = 668	<i>N</i> _{inds} = 480	<i>N</i> _{inds} = 668	<i>N</i> _{inds} = 668
<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1808	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1807	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1270	<i>N</i> _{obs} = 1808
-3214.7***		-4415.9***		-491.4***		
-861.4***		-636.4***			-1034.0***	

Log pseudolikelihood

- [†] p < .10,
- * p < .05,
- ** p < .01,
- *** p < .001.

Notes:

^a Mode and moved out of the Bay Area are necessarily correlated because all out-of-the-area respondents completed the survey online.

^b Age and wave are necessarily correlated because respondents are older in later waves.