Psychology and Aging

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Online First Publication, June 20, 2024. https://dx.doi.org/10.1037/pag0000831

AMERICAN PSYCHOLOGICAL ASSOCIATION

Psychology and Aging

ISSN: 0882-7974

https://doi.org/10.1037/pag0000831

Social and General Cognition Are Uniquely Associated With Social Connectedness in Later Life

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The mechanisms by which older adults maintain large, complex social networks are not well understood. Prior work has primarily focused on general cognitive ability (e.g., executive function, episodic memory), largely overlooking social cognition—the ability to process, store, and remember social information. Because social cognition plays a key role in navigating social interactions and is distinct from general cognition, we examined whether general and social cognition uniquely predicted the nature of older adults' personal social networks. Our study leveraged comprehensive measures of general cognition (executive function, episodic memory), social cognition (face memory and dynamic measures of cognitive and affective theory of mind), and a rigorous measure of personal social networks from 143 community-dwelling older adults. We found that, when modeled together and controlling for sociodemographic variables, only executive function and dynamic cognitive theory of mind positively predicted having social networks with relatively unfamiliar, loosely connected others, accounting for 17% of the unique variance in older adults' social connectedness. Interestingly, having a social network comprised primarily of close, tightly knit relationships was negatively associated with affective theory of mind performance. Findings are discussed in the context of the social–cognitive resource framework—which suggests that social cognition may be more engaged in relatively unfamiliar, versus close, interactions. Specifically, our results show that social–cognitive processes may be relatively automatic for individuals whose primary social relationships are very close but may be more strongly engaged for individuals whose interactions include at least some relatively less close relationships.

Public Significance Statement

The present study examines a novel potential mechanism associated with older adults' social connectedness: social–cognitive function, the ability to process, store, and remember social information. We find that social and general cognitive processes may be more strongly engaged for older adults, whose typical social interactions include at least some relatively less close relationships.

Keywords: social networks, social bridging, theory of mind, older adults, executive function

Supplemental materials: https://doi.org/10.1037/pag0000831.supp

Social connectedness, specifically having larger, more complex personal social networks, is a modifiable lifestyle factor that has been widely associated with promoting older adults' well-being (Barnes et al., 2004; Green et al., 2008; Holtzman et al., 2004). Research examining the potential mechanism underlying this relationship has primarily focused on cognitive ability (e.g., executive function, episodic memory), suggesting that it is necessary to maintain a larger, more complex social network (Cornwell, 2009a, 2009b; Iwase et al., 2012). However, this approach overlooks social cognition—the ability to process, store, and remember social

Denis Gerstorf served as action editor.
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This work was supported by Grant R01AG070931 (principal investigators: Anne C. Krendl, Brea L. Perry) from the National Institute on Aging. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The authors thank Amy Gourley, Samuel Rincón, Kate Gallagher, Sarah Nawar, and Mia Freeman for assistance with data collection.

The ideas and data appearing in the article have not been disseminated before. Processed data and code are available at https://osf.io/8j9hw/?view_only=390172df2a7540f397d94ea125a35048.

Anne C. Krendl played a lead role in conceptualization, methodology, project administration, supervision, and writing–original draft, a supporting role in data curation and formal analysis, and an equal role in resources. Siyun Peng played a lead role in formal analysis and visualization, a supporting role in methodology and writing–review and editing, and an equal role in data curation. Lucas J. Hamilton played a supporting role in formal analysis, writing–original draft, and writing–review and editing and an equal role in data curation. Brea L. Perry played a supporting role in formal analysis, supervision, and writing–review and editing and an equal role in conceptualization, funding acquisition, and methodology.

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information, but see (A. C. Krendl et al., 2022; Radecki et al., 2019; Stiller & Dunbar, 2007)—which plays a central role in navigating social interactions (Bishop-Fitzpatrick et al., 2017; Griffin et al., 2021; Henry et al., 2023; Hughes & Leekam, 2004; A. C. Krendl et al., 2022). Because social cognition is overlapping but distinct from general cognition (Grainger et al., 2023; Kong et al., 2022; D. A. Stanley & Adolphs, 2013), both may play unique roles in maintaining larger, more complex social networks. Developing a more comprehensive understanding of the mechanisms underlying social connectedness is important for understanding how it benefits well-being. The present study thus examines whether social and general cognitive function are uniquely associated with having larger, more complex social networks.

Extending the Social–Cognitive Resource Framework

A key prediction of the current work is that general and social cognition will both be uniquely associated with maintaining larger, more complex social relationships but less strongly associated with maintaining more familiar social relationships. This prediction stems from the social–cognitive resource framework (Henry et al., 2023), which posits that, much as well-practiced cognitive tasks require less cognitive effort (Hess et al., 2021), engaging in highly familiar social interactions may require less social–cognitive effort. In support of this framework, prior work has shown that viewing highly familiar faces elicits lower neural responses from perceivers than less familiar faces (Caharel et al., 2002), perceivers need fewer cues to accurately detect deception from familiar versus unfamiliar targets (Millar & Millar, 1995), and neuroimaging studies have shown that individuals relied more on previous experiences (vs. theory of mind) to infer mental states for familiar versus unfamiliar individuals (Rabin & Rosenbaum, 2012). Together, these studies suggest that more familiar social interactions may engage fewer social–cognitive resources (Baudouin et al., 2000; Caharel et al., 2002; Henry et al., 2023; Rabin & Rosenbaum, 2012).

An important limitation to these studies, however, is that they consider individual social relationships while overlooking the role of social cognition in older adults' everyday social interactions. In the present study, we thus extend the social–cognitive resource framework (Henry et al., 2023) by investigating whether older adults' social–cognitive function is associated with the types of social interactions in which they typically engage in everyday life. Older adults' personal social networks may be comprised primarily of individuals to whom older adults are very close and interact with frequently, whereas others may be relatively large and contain at least some weaker social connections (L. J. Hamilton et al., 2024; B. Perry et al., 2021). If, as the social–cognitive resource framework suggests, social cognition is typically engaged for relatively unfamiliar relationships, then being embedded in larger social networks with weaker connections should be more strongly associated with social–cognitive performance. Conversely, being embedded in social networks with close, frequently contacted connections should be less, or not at all, associated with social–cognitive performance.

An additional consideration is that poorer general cognitive function could constrain social–cognitive function. In other words, general cognitive function might account for the relationship between social cognition and having larger, more complex social networks. If that were the case, then, when measuring both general and social cognition, the former would be related to having larger, more complex social networks, but the latter would not. Alternatively, given that recent work has shown that general and social cognition are dissociable processes (Grainger et al., 2023; Kong et al., 2022), it is also possible that they work together to facilitate social connectedness. In this case, then both would be uniquely associated with having larger, more complex networks (as compared to having smaller, close networks). Determining whether general and social cognition uniquely relate to older adults' real-world personal social networks is important because it would provide insight into the potential mechanism by which some types of social connectedness confer well-being.

General and Social Cognition Are Positively Associated With Having Larger, More Complex Social Networks

In support of our predictions, prior work has shown that better cognitive ability is related to having large, heterogeneous social networks (Giles et al., 2005; Seeman et al., 2001), but declining cognition is associated with having smaller networks, poor social support, and/or low frequency of contact (Kuiper et al., 2016; Penninkilampi et al., 2018). One reason for this dissociation might be that more familiar social interactions, much like well-practiced cognitive tasks, require less cognitive effort (Hess et al., 2021). We test that prediction in the present study, focusing specifically on executive function and episodic memory. We focus on these because prior work has shown that navigating social interactions engages executive function (e.g., inhibition, cognitive flexibility, working memory) and episodic memory (Henry et al., 2009; Klein et al., 2009; Mano et al., 2011; Moriguchi, 2014; Spreng et al., 2016), thus making them suitable targets for investigation.

The few studies that have examined the potential relationship between social cognition and the size and structure of older adults' social networks have also found that better social cognition (theory of mind) predicts having larger social networks (Radecki et al., 2019; Stiller & Dunbar, 2007), higher quality relationships with friends (Lecce et al., 2017), and a social network with a wider range of social roles (A. C. Krendl et al., 2022). Despite this work, there are several key gaps in our understanding of the relationship between social and general cognition and social connectedness. First, though both social cognition and general cognition have been implicated in how older adults navigate and maintain social relationships (Baron-Cohen et al., 1997; Damasio et al., 1994; Hauck et al., 1998; Henry et al., 2009; Kéri, 2014; Spreng et al., 2016), this work has generally examined the two processes separately. Second, the few studies that have measured both general and social cognition typically use a single measure of general cognition (e.g., for memory) and/or social cognition (e.g., cognitive theory of mind), which limits the interpretability of these relationships (A. C. Krendl et al., 2022; Radecki et al., 2019; Stiller & Dunbar, 2007). Finally, social connectedness is operationalized in these studies by a single factor (e.g., its size, the presence of support functions; Huo et al., 2020; A. C. Krendl & Perry, 2022; Radecki et al., 2019; Stiller & Dunbar, 2007). This narrow focus fails to capture the multiple and complex factors that comprise a social network (B. L. Perry, McConnell, Coleman, et al., 2022; B. L. Perry, McConnell, Peng, et al., 2022), such as its overall closeness, supportiveness, and interconnectedness. This is important because prior work suggests that the relationship between social cognition and social connectedness may vary depending on the structure and function of the individual's network (A. C. Krendl et al., 2022; Lecce et al., 2017).

Social Bonding and Social Bridging Potential in Personal Social Networks

From a social network perspective, social networks can be characterized as either having social bonding or social bridging potential, respectively, for example (Berkman & Glass, 2000; J. S. Coleman, 1988; Cornwell, 2009b). Social networks with social bonding potential are relatively small, tight-knit, very close, and highly supportive, whereas social networks with social bridging potential are relatively large, less interconnected, have at least some less close relationships, and contain a diversity of social roles (B. L. Perry, McConnell, Coleman, et al., 2022; B. L. Perry, McConnell, Peng, et al., 2022). This dissociation is well-suited to extending the social–cognitive resource framework to real-world social interactions for several reasons. First, though there are unique benefits to each network type, for example (L. J. Hamilton et al., 2024; Simons et al., 2020), recent work has shown that general cognition is positively associated with having social bridging, but not social bonding, networks (L. J. Hamilton et al., 2024). Moreover, a recent longitudinal study demonstrated that higher cognitive ability predicted greater retention of network size over time (Casey et al., 2021). However, it is worth noting that this study also found that maintaining larger networks preserved cognition, suggesting a bidirectional relationship. Together, these findings provide some support for the prediction that higher cognitive function might be necessary for maintaining a larger, more complex social network. Second, because social bridging and bonding networks are dissociated, among other things, by their size and closeness, they are well-suited to disentangle whether general and social–cognitive performance are associated with engaging in more familiar (through bonding networks) versus less familiar (through bridging networks) everyday social interactions. Finally, despite the fact that some prior work has found a relationship between social cognition and network size (Radecki et al., 2019; Stiller & Dunbar, 2007) and structure (A. C. Krendl et al., 2022; Lecce et al., 2017), this work has not been examined in the context of more complex social network features (e.g., social bridging or bonding potential), nor has it been directly compared to comprehensive measures of general cognition. This is important because it can provide insights into whether older adults' everyday social interactions might stimulate general and social–cognitive function.

Numerous types of social cognition could be associated with social bridging. For example, navigating relatively novel (vs. more familiar) interactions may rely more on theory of mind. Understanding what others are thinking (cognitive theory of mind) and feeling (affective theory of mind) are foundational skills for navigating social interactions (Bishop-Fitzpatrick et al., 2017; Griffin et al., 2021; Henry et al., 2023; Hughes & Leekam, 2004; A. C. Krendl et al., 2022) and may be more strongly engaged for novel versus familiar interactions. Indeed, one study found that individuals relied more on theory of mind when inferring mental states of unfamiliar individuals but more on autobiographical memory when inferring mental states of familiar individuals (Rabin & Rosenbaum, 2012). However, it remains an open question whether either cognitive or affective theories of mind, or both, relate to social bridging. We explore both in the present study to determine whether understanding what people are feeling is more or less important than understanding what they are thinking when navigating less familiar interactions. We also considered face memory because poor face recognition is a hallmark feature of deficits in social comprehension (Griffin et al., 2021; Murashko & Shmukler, 2019). Because prior work has shown that highly familiar faces elicit lower neural responses from perceivers than less familiar faces (Caharel et al., 2002), we predicted that face memory would also be associated with social bridging.

The present study used comprehensive measures of executive function and episodic memory, multiple measures of core social–cognitive functions (social memory, affective theory of mind, and cognitive theory of mind), and a rigorous social network interview to determine whether general and social cognition uniquely predict social bridging, but not social bonding, in older adults' personal social network. The social network interview allowed us to collect the wide range of variables that comprise social bridging and bonding networks, which has not been done in previous work. However, because the network measures that comprise social bridging and bonding, respectively, are not independent and often intercorrelated, they were measured using a latent variable approach. This approach treats the variables as overlapping, but not mutually exclusive, dimensions of one mechanism (Peng et al., 2021; see also L. J. Hamilton et al., 2024). We tested two hypotheses: First, we predicted that general and social cognition would be uniquely related to social connectedness, defined as social networks with bridging or social bonding potential (Hypothesis 1); second, we predicted that general cognitive function (executive function, episodic memory) and social–cognitive function would not be strongly associated with social networks that are close and tightly knit (social bonding networks) but would be associated with social networks that contain more unfamiliar social relationships (social bridging networks; Hypothesis 2).

Method

Transparency and Openness

The design and analyses were not preregistered; however, deidentified processed data and code are available at https://osf.io/8j9hw/?view_only=390172df2a7540f397d94ea125a35048. The materials are publicly available, including the adapted PhenX Social Networks Battery toolkit (C. M. Hamilton et al., 2011; B. L. Perry & Pescosolido, 2010) and Uniform Dataset 3.0 (Weintraub et al., 2018). The full list of questions, response options, and timecodes for clips for *The Office* and *Nathan for You* are publicly available (A. C. Krendl et al., 2024). For review, these materials are also available at https://osf.io/8j9hw/?view_only=390172df2a7540f397d94ea125a35048. In the Supplemental Materials, we also include the methods and results from the Reading the Mind in the Eyes test (Baron-Cohen et al., 2001) and the false belief tasks (Zaitchik, 1990), which were also completed by participants. These measures were collected to explore a separate question about the relationship between theory of mind stimulus type (static or dynamic) and social connectedness. We report how we determined our sample size and describe all data exclusions, manipulations, and measures in the study.

Participants

A preliminary power analysis was performed in G*power (Faul et al., 2007). Based on related work (A. C. Krendl et al., 2022), we used a medium effect size ($f^2 = 0.15$) and $a < 0.05$. For a regression analysis with 13 predictors (six covariates, two general cognitive measures, face memory, two dynamic theory of mind measures, and two static theory of mind measures)—the most examined—revealed that a target of $N = 131$ was required to achieve 80% power. A total of 153 cognitively normal adults aged over 60 were recruited from August 2021 to April 2022 from Bloomington, IN. Participants were recruited via community-based methods (i.e., outreach, ads) and were prescreened for cognitive impairment via telephone using a well-validated, six-item screener (Callahan et al., 2002). This study was approved by the institutional review board at Indiana University (2008106329: Social connectedness and well-being). Across two testing sessions, participants completed a face-to-face semistructured social network interview adapted from the PhenX Social Networks Battery toolkit (C. M. Hamilton et al., 2011; B. L. Perry & Pescosolido, 2010), a comprehensive neuropsychological battery (the Uniform Dataset 3.0; Weintraub et al., 2018), and a social–cognitive battery that assessed core social–cognitive skills (e.g., face memory, theory of mind). These measures are described in detail below. They also completed questionnaires related to sociodemographic factors (e.g., age, gender, race, ethnicity, education, socioeconomic status), mood, physical activity, social engagement, and health. Aside from the sociodemographic information, these measures were not considered for this study. The social network interview and neuropsychological battery were typically completed in the first session (in that order), whereas the social–cognitive battery was completed in the second session. On average, the two sessions were 9.5 days (SD = 9.8) apart. Out of 153 respondents, 10 were excluded due to missingness of key variables. Eight did not complete both testing sessions, and two did not complete key cognitive and social–cognitive outcomes due to time constraints. As a result, the final analytic sample included data from 143 older adults who were, on average, 74 years old, 64% women, 95% White, and 78% had a college education or higher (see Table 1).

Table 1
Descriptive Statistics (N = 143)

Demographic variable	*M*/Prop.	*SD*	Range
Age	73.85	6.88	60–91
Female	0.64		
Race	0.95		
Education			
High school	0.06		
Some college	0.16		
College grad	0.31		
Post college (17+ years)	0.47		
Annual household income			
Less than $50,000	0.21		
$50,000–$99,999	0.26		
$100,000+	0.34		
Prefer not to answer	0.20		
Face memory	0.48	0.19	0–.93
Episodic memory	0.16	0.65	−1.60–1.42
Dynamic theory of mind-affective	0.80	0.12	.36–1
Dynamic theory of mind-cognitive	0.84	0.15	.28–1
Executive function	0.03	11.64	−79.53–19.10

Note. All five cognitive outcomes were presented here before the final standardization. Prop. = Proportion.

Measures

Egocentric Social Network

Egocentric social network data were collected by trained interviewers using an expanded version of the PhenX Social Network Battery (C. M. Hamilton et al., 2011). In the social network interview, respondents provided the names of individuals in their social network with whom they had discussed important matters and/or health matters in the previous 6 months, as well as the names of family members, coworkers, volunteers, neighbors, or anyone else who they see or talk to regularly (B. L. Perry et al., 2018). After the full list of names was provided, the interviewer then asked a series of questions about each network member, including the type of relationship they shared (i.e., partner, child, friend), qualities of the relationship (i.e., strength, types and amount of support provided, frequency of contact), and emotional closeness between each network member to ascertain structural elements of interconnectedness. Ratings were aggregated across network members to create network-level measures, resulting in average values for each indicator.

A latent variable approach was used to estimate bridging and bonding (see L. J. Hamilton et al., 2024; Peng et al., 2021). The latent social bridging factor was derived from key structural measures including network size, diversity of social relationships, network density, minimum tie strength, effective size, and sole bridging status (Peng et al., 2021). Network size was captured by the number of people named (ranging from 4 to 54). Diversity of social relationships assessed the total number of social roles (e.g., spouse, parent, child, friend, coworker, neighbor) in a network (ranging from 2 to 10), whereas density was the average closeness between network members (ranging from 0, *do not know*, to 3, *very close*), where higher numbers indicate greater density. Because one aspect of social bridging is having more loosely connected networks, a lower density score would reflect more bridging potential. Minimum tie strength ranged from 1 (*weak*) to 10 (*very strong*) based on the strength of the weakest connection in the network. To capture whether the network contains at least some less close relationships, a lower score is reflective of more bridging potential. Effective size identified the number of nonredundant connections (i.e., network members who are not connected) by subtracting network size from the mean number of connections that each network member had to all other network members (ranging from 1 to 36). Here, higher numbers are indicative of more bridging potential. Finally, sole bridge status was a binary indicator of having a connection to an isolated network member (i.e., someone that no one else in the network knows), coded 1 if true (indicative of higher bridging potential) and 0 otherwise (indicative of lower bridging potential).

The latent social bonding factor comprised the average frequency of contact with network members, average support received from the network members, average relationship strength in the network, and average closeness to the network members. Contact frequency ranged from 1 (*hardly ever contact*) to 3 (*often contact*), with higher numbers indicating more contact. Because respondents could endorse up to five unique support functions offered by each network member, average support offered across the network ranged from

0 to 5. Average relationship strength across the network ranged from 1 to 10 and was calculated based on respondents' reported relationship strength to each network member, where 1 was the weakest and 10 was the strongest. Finally, average closeness over the network ranged from 1 to 3, where 3 was the closest.

Because the network variables are all interrelated, a latent variable approach best captures the underlying construct while statistically controlling underlying covariance between indicators. See (Peng et al., 2021) for details and (L. J. Hamilton et al., 2024) for a similar approach. We fit the two latent models using confirmatory factor analyses. Fit statistics for both models suggested excellent fit (model vs. saturated chi-square is insignificant at 0.05 level, comparative fit index and Tucker–Lewis index >0.95 cut-point, and root-mean-square error of approximation <0.08). These two variables were significantly negatively correlated ($r = -.45$, $p < .001$). As such, we regressed bridging onto bonding and used residual scores to eliminate all shared variance. This statistical treatment nullifies concerns regarding collinearity and limits spurious relationships caused by shared variance, allowing a better test of how bridging and bonding are separately predicted by general and social cognition.

General Cognitive Function

The measure of general cognitive function, the Uniform Data Set 3.0 (Kiselica et al., 2020), assesses five core domains of cognition: executive function, episodic memory, language, attention, and visuospatial skills. For the current investigation, we examined performance on two key general cognitive function domains: executive function and episodic memory (see Supplemental Methods for a description of the other tasks). Episodic memory was computed using the delayed recall trials from the Craft Story 21 (Craft et al., 1996), Rey Auditory Verbal Learning test (Schmidt, 1996), and the Benson Complex Figure Recall (Possin et al., 2011). Each test required participants to learn and remember details from a story, words, and an image, respectively. Using standardized scoring procedures (Weintraub et al., 2018), overall scores were standardized for each task, then averaged together, commensurate with past work (M. E. Coleman et al., 2023). Importantly, this method has been shown to connect to social bridging networks (L. J. Hamilton et al., 2024).

Executive function was measured using the Trail Making Tests A and B (Bowie & Harvey, 2006) and digit span backward (Weintraub et al., 2018) to capture processing speed, task switching, and working memory, respectively. The digit backward task was scored based on the maximum number of total digits that were correctly recalled without error. Trails A and B were scored as total completion time, which was then reflectively transformed such that higher scores reflected less time. However, due to the shared capturing of processing speed, we created an isolated task switching performance in Trail B by using linear regression to predict Part B from Part A completion time (see Salthouse, 2011, for similar approach). Differences between actual and predicted scores were calculated for each participant, which equals the error in prediction (i.e., residual variance), which was standardized. Thus, the final executive function composite included standardized scores on the digit backward task, reflectively transformed Trail A completion times, and residualized Trail B scores.

Participants also completed the Montreal Cognitive Assessment (Nasreddine et al., 2005). These scores were not used in the present analyses and are not discussed further (but see Supplemental Materials for additional details).

Social–Cognitive Function: Face Memory

Social–cognitive function was measured via face memory and theory of mind. For the face memory task, participants passively viewed 40 neutrally expressive faces, equally balanced across age and gender, from the PAL database (Minear & Park, 2004). Images were presented for 2 s each and in a random order across participants. Participants were told prior to the study phase that they would be asked to remember the faces later. The memory test took place after an approximate 10–15 min delay, during which participants completed other tasks that did not involve viewing images. During the memory task, participants made self-paced "old"/"new" recognition judgments on 80 faces: the 40 original faces and 40 age and gender-matched foils. The original faces and foils were matched for attractiveness and distinctiveness. The faces that were old and new were counterbalanced across participants. Performance was scored as corrected recognition: corrected hit rate (number of old faces correctly identified as "old" divided by the total number of old faces) minus the false alarm rate (number of new faces incorrectly identified as "old" divided by the total number of new faces).

As part of a separate research question, participants also completed a social–associative memory task. This task was not included in any of the current analyses, and results from this task are reported elsewhere (L. J. Hamilton & Krendl, 2024).

Social–Cognitive Function: Dynamic Theory of Memory

Participants watched approximately 12 min of Season 1, Episode 4 ("The Alliance") of *The Office*, edited to follow two key plotlines (an office "alliance" and a "birthday party"). The abridged episode was divided into 25 clips ranging from 9 to 55 s in length ($M_{\text{length}} =$ 29 s, $SD = 9$ s). Participants watched clips in sequential order and completed 1–5 self-paced questions about what they had just seen after each clip. Questions were presented in a fixed order, but answer options were randomized. For each of the 64 questions, there were three response options (one correct, two foils) with pictures of the characters referenced in the question and/or response options presented on the screen simultaneously.

Outside of 15 control questions (e.g., "When is Meredith's birthday?"), the task captured unique components of cognitive and affective theory of mind. The cognitive theory of mind measures included nine questions related to inferring beliefs (e.g., "What does Pam think about having a birthday party for Meredith?"), 10 involving detecting deception (e.g., "Is Jim telling Dwight the truth about why he was talking to Pam?"), and 10 questions related to inferring the motivations of others (e.g., "Why does Dwight want to keep the alliance secret?"). The affective theory of mind measure included 10 questions related to understanding the character's emotions (e.g., "After talking to Michael, how does Dwight feel about his job?") and 10 questions pertaining to detecting if a faux pas had occurred (e.g., "Was it inappropriate for Michael to suggest an ice cream cake?"). The full list of questions, as well as length and time codes of the clips, have been published in recent work

(A. C. Krendl et al., 2024). Prior work has used similar iterations of the task, though critically without the faux pas questions (A. C. Krendl et al., 2022, in press). At the end of the task, participants were asked if they had ever seen *The Office* before (response options: yes or no) and, if so, how familiar they were with the series.

Each aspect of cognitive and affective theory of mind was first scored as a percentage, whereby the number of correct responses in the category was divided by the number of total questions in that category. Consistent with prior work using this measure (L. J. Hamilton & Krendl, 2024), the cognitive theory of mind score was created by averaging together performance on the motivation, belief, and deception questions. These items showed a medium-to-large effect size (all rs ≥ .45). Conversely, the affective theory of mind score reflected the average performance score on the faux pas and emotion questions, which also had a medium-to-large effect size (r = .4). See (L. J. Hamilton & Krendl, 2024) for details. This approach is consistent with how these constructs are typically defined in theory of mind research (Henry et al., 2013).

Participants also completed the Reading the Mind in the Eyes test (Baron-Cohen et al., 2001) and the false belief tasks (Zaitchik, 1990) to explore a separate question exploring the relationship between theory of mind stimulus type (static or dynamic) and social connectedness. Additional information about these measures is presented in Supplemental Materials.

Analytic Approach

All key variables were standardized to simplify interpretations and facilitate meaningful comparisons between predictors. We utilized association-based inferential statistics (i.e., correlation, linear regression) to examine how cognitive and social–cognitive function were related to social bridging and social bonding. First, pairwise correlations were used to establish baseline relationships between each predictor and social bridging and bonding. Second, multiple regression was used to examine the unique contribution of general and social cognition functions for predicting bridging and bonding networks. Covariates included age, race (0 = *non-White*; 1 = *White*), gender (0 = *man*; 1 = *woman*), and education (1 = *less than high school*; 2 = *high school*; 3 = *some college*; 4 = *college graduate*; 5 = *advanced degree or more*). Third, to explore disparities between baseline (i.e., pairwise correlations) and regression parameters, we conducted stepwise regressions akin to an indirect dominance analysis by including predictors one at a time to see which effects were responsible for removing statistical significance of others in the full model. A benefit of the dominance analysis is that it determines the dominance of one predictor over another by comparing their unique contributions across all subset models (Budescu, 1993). This analysis thus demonstrates the robustness of the predictors by accounting for potential concerns about predictor order. Missing data were handled by case-wise exclusion.

Results

Hypothesis 1: General and Social Cognition Are Uniquely Related Social Connectedness

Mean performance for the key social–cognitive and general cognitive measures can be found in Table 1. Bivariate associations were tested between social bridging, social bonding, and the general cognitive and social–cognitive variables of interest (face memory, dynamic affective theory of mind, dynamic cognitive theory of mind) using correlations (see Table 2 for full correlation matrix). As shown in red in Figure 1, these pairwise correlations were all in the expected direction and statistically significant (i.e., 95% confidence intervals did not cross zero) for bridging but not bonding. However, it should be noted that the weakest association was between face memory and social bridging (r = .19, p = .025), whereas both dynamic theory of mind tasks (r = .31 for affective; r = .40 for cognitive) and general cognition (r = .43 for executive function; r = .31 for episodic memory) were moderately correlated with bridging (all ps < .001). For social bonding, there was a significant, but negative, relationship between both dynamic theory of mind tasks (affective: r = −.32; cognitive: r = −.24, both ps < .005).

To examine independent associations between the social and general cognitive predictors and social bridging and bonding, we conducted separate linear regressions for both network outcomes (bridging and bonding) and included all five predictors in the model (executive function, episodic memory, face memory, dynamic affective theory of mind, dynamic cognitive theory of mind) while also adjusting for covariates (age, race, gender, and education). Figure 1 displays the parameter estimates derived from this analysis in blue (see Table 3 for the full regression table). After accounting for other functions, the overall model was significant for social bridging, explaining 17% of the unique variance in this variable (F = 5.70, p < .001, R^2 = .36). It was also significant for social bonding, though only explaining 8% of the unique variance (F = 4.31, p < .001, R^2 = .19). See Table 3 for full statistics. In support of Hypothesis 1, general cognition (executive function; β = .31, p < .001) and social cognition (dynamic cognitive theory of mind; β = .25, p = .023) were uniquely associated with social bridging potential.

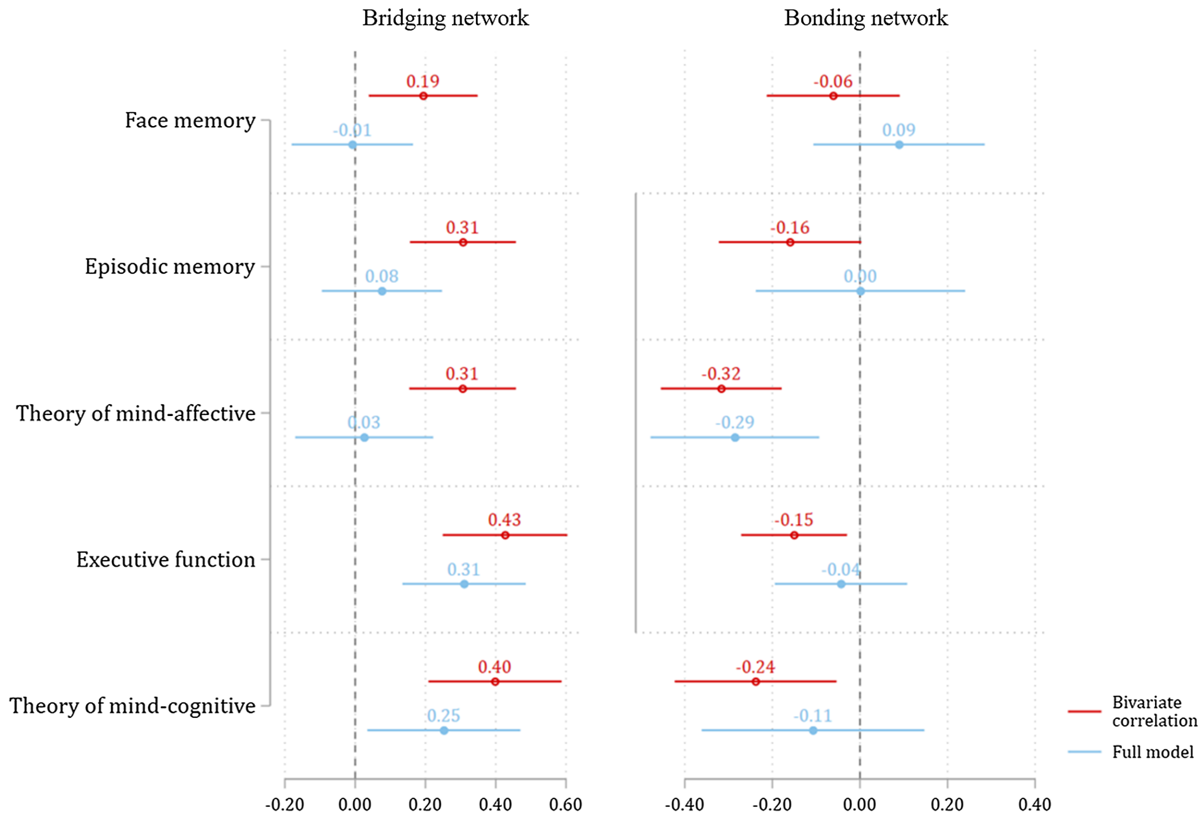
Table 2
Correlation Matrix

Variable	1	2	3	4	5	6	7
1. Bridging social capital	—						
2. Bonding social capital	−.35***	—					
3. Face memory	.19*	−.06	—				
4. Episodic memory	.31***	−.16	.50***	—			
5. Theory of mind-affective (dynamic)	.31***	−.32***	.42***	.49***	—		
6. Executive function	.43***	−.15	.14	.17*	.20*	—	
7. Theory of mind-cognitive (dynamic)	.40***	−.24**	.40***	.59***	.67***	.26**	—

* p < .05. ** p < .01. *** p < .001.

Figure 1

Predicting Bridging and Bonding Social Networks Using General Cognition and Social Cognition



Note. Bivariate correlation: Pairwise correlation between general and social–cognitive function and bridging/bonding; full model: linear regression with all five cognitive functions in the model with covariates. All coefficients (predictors and outcomes) are standardized. See the online article for the color version of this figure.

Hypothesis 2: General and Social–Cognitive Function Will Be Associated With Social Bridging, but Not Social Bonding, Networks

Hypothesis 2 predicted that general and social cognition would be related to social bridging, but not social bonding, potential. As seen in Table 3, the results supported this prediction. Specifically, when controlling for covariates, dynamic cognitive theory of mind ($\beta = .25$, $p = .023$) and executive function ($\beta = .31$, $p < .001$) were independently related to social bridging. However, for social bonding, only dynamic affective theory of mind was independently related to this variable, but this relationship was negative ($\beta = -.29$, $p = .004$). Neither executive function nor episodic memory was related to social bonding (both βs $< -.04$).

We next examined why episodic memory and affective theory of mind did not predict social bridging in the full model, despite being correlated with this network variable (Table 2). The fact that executive function and cognitive theory of mind predicted social bridging but episodic memory and dynamic affective theory of mind did not suggests that the former contributed unique variance to social bridging that was unaccounted for by the latter. However, it was unclear which was responsible for reducing the significant pairwise associations between bridging and face memory, episodic memory, and affective theory of mind. We used an informal dominance analysis to answer this question.

First, a baseline model with covariates was constructed for each cognitive outcome (see Supplemental Table S2; see Supplemental Table S3 for social bonding model). While episodic memory and dynamic affective theory of mind retained their significant association with social bridging ($\beta = .21$, $p = .010$; $\beta = .20$, $p = .023$, respectively), the pairwise association between face memory and bridging was greatly reduced and nullified by the addition of covariates ($\beta = .07$, $p = .416$; Supplemental Table S2). Thus, the association between bridging and face memory was not robust to sociodemographic correction in the regression model.

Second, we added executive function and cognitive theory of mind in separate models to examine whether their contributions were independent of the other measures. As seen in Table 4, the addition of executive function did not substantially change the parameter estimates from the baseline model for episodic memory or dynamic affective theory of mind ($\beta = .18$, $p = .024$; $\beta = .17$, $p = .043$, respectively), suggesting that these variables do not have shared variance. However, adding cognitive theory of mind reduced these estimates to nonsignificant values for episodic memory ($\beta = .08$, $p = .382$) and affective theory of mind ($\beta = .03$, $p = .770$). Thus, cognitive theory of mind likely has shared variance with episodic

Table 3
Deconstructing the Contributions of Executive Function and Cognitive Theory of Mind When Predicting Social Bridging and Social Bonding Networks

	Bridging network		Bonding network	
	Covariate only	Full model	Covariate only	Full model
Predictor	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
Age	−.03* (.01)	.01 (.01)	0.02 (0.01)	−0.01 (0.01)
Women	.08 (.16)	.04 (.16)	0.23 (0.18)	0.25 (0.18)
White	.47 (.25)	.29 (.29)	−0.84*** (0.18)	−0.71** (0.24)
Education				
Some college	.11 (.54)	−.01 (.51)	−0.07 (0.41)	0.23 (0.44)
College graduate	.70 (.51)	.36 (.50)	−0.67 (0.39)	−0.33 (0.44)
Advanced degree	1.03* (.50)	.70 (.50)	−0.58 (0.38)	−0.24 (0.43)
Face memory		−.01 (.09)		0.09 (0.10)
Episodic memory		.08 (.09)		0.00 (0.12)
Affective TOM		.03 (.10)		−0.29** (0.10)
Executive function		.31*** (.09)		−0.04 (0.08)
Cognitive TOM		.25* (.11)		−0.11 (0.13)
N	143	143	143	143
R^2	.19	.36	0.11	0.19
F	4.73***	5.70***	4.76***	4.31***

Note. Education was entered as a categorical variable, with the base condition being completing high school. *SE* = standard error; TOM = theory of mind.
* $p < .05$. ** $p < .01$. *** $p < .001$.

memory and affective theory of mind that contributes to social bridging. However, it also retains unique variance that is associated with social bridging. See Table 5 for similar analysis for social bonding.

Discussion

The present study demonstrated that general cognition and social cognition were each uniquely associated with older adults' social connectedness, supporting Hypothesis 1. Specifically, we found that older adults' executive function ability and their dynamic cognitive theory of mind were each uniquely and positively associated with social bridging. Moreover, though general and social cognition were associated with social bridging, they were not associated with social bonding, supporting Hypothesis 2. Indeed, our results also revealed that older adults' dynamic affective theory of mind was negatively related to social bonding, but general cognition did not relate to bonding. Together, these findings suggest that general and social cognition are related to having social networks that contain at least some weaker connections (e.g., social networks with bridging

Table 4
Deconstructing the Contributions of Executive Function (First and Third Columns) and Cognitive Theory of Mind (Second and Fourth Columns), Respectively, on Episodic Memory (Left Two Columns) and Affective Theory of Mind (Right Two Columns) When Predicting Social Bridging Networks

	Social bridging		Social bridging	
Predictor	β (*SE*)	β (*SE*)	β (*SE*)	β (*SE*)
Age	−.00 (.01)	.00 (.01)	−.00 (.01)	.00 (.01)
Women	.08 (.16)	−.05 (.16)	.12 (.16)	−.03 (.16)
White	.28 (.28)	.33 (.26)	.31 (.29)	.37 (.26)
Education				
Some college	.10 (.51)	−.18 (.55)	.09 (.49)	−.15 (.54)
College graduate	.45 (.49)	.36 (.52)	.48 (.49)	.41 (.51)
Advanced degree	.81 (.10)	.70 (−.18)	.81 (.09)	.74 (−.15)
Episodic memory	.18* (.08)	.08 (.09)		
Affective TOM			.17* (.08)	.03 (.10)
Executive function	.34*** (.10)		.34*** (.09)	
Cognitive TOM		.32** (.12)		.34** (.12)
N	143	143	143	143
R^2	.32	.28	.32	.27
F	6.31***	5.37***	6.66***	5.36***

Note. Education was entered as a categorical variable, with the base condition being completing high school. *SE* = standard error; TOM = theory of mind.
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5
Deconstructing the Contributions of Executive Function and Affective Theory of Mind on Cognitive Theory of Mind When Predicting Bonding Social Networks

Predictor	β (*SE*)	β (*SE*)
Age	−.00 (.01)	−.01 (.01)
Women	.30 (.18)	.30 (.17)
White	−.78*** (.18)	−.64** (.20)
Education		
Some college	.07 (.42)	.27 (.42)
College graduate	−.49 (.41)	−.31 (.42)
Advanced degree	−.40 (.40)	−.22 (.41)
Cognitive TOM	−.24* (.10)	−.11 (.11)
Executive function	−.04 (.08)	
Affective TOM		−.27** (.09)
N	143	143
R^2	.15	.18
F	5.17***	5.94***

Note. Education was entered as a categorical variable, with the base condition being completing high school. *SE* = standard error; TOM = theory of mind.
* $p < .05$. ** $p < .01$. *** $p < .001$.

potential), but they are not related to maintaining smaller, more tightly knit networks (e.g., social networks with bonding potential).

The present study provides support for the social–cognitive resource framework (Henry et al., 2023). Specifically, the framework suggests that the types of interactions in which older adults are embedded in everyday life may be associated with the extent to which their social cognition is engaged. Our finding that general and social–cognitive function were not related to having a social network with bonding potential but were related to having social networks with bridging potential suggests that interacting with large, complex social networks that contain at least some relatively unfamiliar relationships in everyday life is associated with higher general and social–cognitive function. Conversely, neither general nor social–cognitive function was positively associated with social bonding networks, which generally comprised closer and more familiar relationships. Consistent with the social–cognitive resource framework, our findings suggest that engaging in highly familiar social interactions in everyday life may require less social–cognitive effort, whereas engaging in at least some unfamiliar interactions could engage social cognition. Moreover, our findings are consistent with framework's assertion that general cognition does not necessarily constrain social cognition in social interactions (see Henry et al., 2023, for discussion on cognitive determinants of social cognition). Rather, navigating larger, more complex social interactions may require both general cognitive abilities (because the cognitive demands in these situations are higher) as well as social–cognitive abilities (because the social–cognitive demands are higher).

Our findings that general cognitive function is uniquely related to social bridging networks are also consistent with prior work. Specifically, longitudinal and cross-sectional studies have shown that general cognitive ability predicts the size and structure of older adults' personal social networks (Giles et al., 2005; Seeman et al., 2001). Moreover, better general cognitive function is also associated with having expansive, heterogeneous social networks that include a mix of close relationships and acquaintances (Cornwell, 2009a, 2009b; Iwase et al., 2012). The current work extends these findings by demonstrating that maintaining certain types of social networks may stimulate social–cognitive function. Future longitudinal research is needed to investigate this possibility.

The relationship between general and social cognition and social bridging networks also extends theoretical models exploring the potential benefits conferred through social networks (Iwase et al., 2012; B. Perry et al., 2021; Simons et al., 2020, 2023). Though social bonding networks may allow for more rapid diffusion of information, social bridging networks may provide greater access to novel or stimulating information, which might be more cognitively engaging (L. J. Hamilton et al., 2024; B. Perry et al., 2021). Our results support and extend these models by suggesting that social bridging networks may be stimulating for general and social cognition, though future longitudinal work is needed to examine whether this is the case.

Our finding that executive function was related to factors associated with social bridging (e.g., larger networks; Giles et al., 2005) is consistent with prior work (Casey et al., 2021; Gross et al., 2016; Johnson et al., 2007), including work showing that executive function is engaged during social interactions (Moriguchi, 2014). For example, a longitudinal study found that having higher executive function was related to having larger than expected social networks over time for older adults (Casey et al., 2021). Moreover, our finding that executive function accounted for nearly 10% of the unique variance in social bridging implicates this as an important pathway to maintaining social connections. An important consideration here is that though executive function, not episodic memory, predicted more social bridging in older adults' social networks when accounting for sociodemographic variables, the two are strongly interrelated (Duff et al., 2005). Indeed, the two were correlated in the present study, albeit modestly ($r = .17$). One potential reason as to why the relationship between executive function and social bridging did not overlap with the relationship between episodic memory and executive function is that some theories suggest that executive function decline may precede declines in memory (West, 1996). Because older adults in this study were recruited on the basis of being cognitively normal (as measured by a prescreener), they may not have sufficient decline in either executive function or episodic memory for there to be measurable overlap in the domain of social bridging. Future work with a lifespan, longitudinal, or cognitively impaired samples could disentangle these possibilities.

It is important to note that dynamic affective theory of mind and episodic memory were each uniquely related to social bridging, but these relationships were driven by shared variance with dynamic cognitive theory of mind. When modeled together, the unique variance associated with dynamic cognitive theory of mind was the only remaining significant predictor of social bridging. This is perhaps unsurprising given that prior work has shown that theory of mind requires that individuals be able to maintain multiple pieces of information in working memory, inhibit incorrect predictions, and/or engage episodic memory to retrieve past experiences to inform judgments (Bottiroli et al., 2016; Fernandes et al., 2021; Laillier et al., 2019; Leslie et al., 2004; Scholl & Leslie, 2001). In the present sample, episodic memory and dynamic cognitive theory of mind were highly correlated ($r = .59$). The only stronger relationship between variables was between our measure of dynamic cognitive and affective theory of mind ($r = .67$). Given that dynamic cognitive and affective theories of mind were measured in the same task, this is to be expected. However, the fact that the relationship between social bridging and dynamic affective theory of mind as well as episodic memory was no longer significant when accounting for dynamic cognitive theory of mind suggests that cognitive theory of mind may best capture constructs associated with social bridging. One reason for this might be that successfully navigating relatively unfamiliar social interactions may require individuals to accurately understand the intentions, infer the beliefs, and detect deception of others in real-time. Indeed, prior work has shown that perceivers need fewer cues to accurately detect deception from familiar versus unfamiliar targets (Millar & Millar, 1995), and neuroimaging studies have shown that individuals relied more on previous experiences (vs. theory of mind) to infer mental states for familiar versus unfamiliar individuals (Rabin & Rosenbaum, 2012). Thus, memory in and of itself may not be related to maintaining social bridging networks, whereas engaging in theory of mind specifically might. However, executive function (which includes the ability to inhibit, task-switch, and make decisions) may predict bridging because it captures unique constructs necessary for navigating social interactions, including regulating behavior and avoiding social gaffes (A. C. Krendl et al., 2009; von Hippel et al., 2000).

Our finding that dynamic cognitive theory of mind is positively related to social bridging is consistent with evidence showing that theory of mind plays a key role in facilitating successful social interactions (Bishop-Fitzpatrick et al., 2017; Watson et al., 1999), particularly for less close social relationships, including friendships (Lecce et al., 2017; see also Henry et al., 2023). For example, cognitive theory of mind has been associated with the quality of older adults' relationships with friends but not relationships with relatives (Lecce et al., 2017), overall network size (Stiller & Dunbar, 2007), and having a diverse range of social relationships in the network (A. C. Krendl et al., 2022). The relationships characterized in these networks likely require more complex social–cognitive processing (e.g., reading nonverbal cues of a less familiar network member) than closer, more well-known relationships; for discussion, see (Henry et al., 2023). Cognitive theory of mind has been implicated in myriad facets that support social relationships, including engaging in more prosocial behavior (Caputi et al., 2012), reducing misunderstandings (Hughes & Leekam, 2004), and social intelligence (Yeh, 2013), all of which may play important roles in maintaining social relationships. However, an important caveat to this interpretation is that deficits in cognitive theory of mind could be a reflection of other social–cognitive deficits, such as impaired emotion recognition, and these deficits have downstream consequences for theory of mind; for discussion, see (Henry et al., 2023). Future work should explore this possibility.

The fact that dynamic theory of mind measures were related to social bridging potential is also consistent with prior work suggesting that using dynamic measures may better capture how older adults engage theory of mind in real-world scenarios (Grainger et al., 2019; A. C. Krendl et al., 2022, in press; Laillier et al., 2019). One potential explanation for this relationship might be that the dynamic stimuli in the present study were based on an ongoing narrative. In other words, successful theory of mind performance in this task required individuals to accurately update their inferences as they learned more about the characters and related contexts. Such judgments may more closely align with how individuals engaged theory of mind in real-world interactions. Though not directly tested in the present study, some support for this assertion can be derived from the fact that the same participants' performance on standard, static theory of mind tasks (the Reading the Mind in the Eyes and the false belief tasks) did not predict social bridging potential and was negatively related to social bonding potential (see Supplemental Materials for details). Alternatively, these differences could be due to the fact that the dynamic theory of mind tasks measured multiple domains of theory of mind. That is, the dynamic cognitive theory of mind task measured participants' ability to understand intentions, infer beliefs, and detect deception, but the false belief task only measures belief inference. Prior work has shown that unique subcomponents of the cognitive theory of mind play distinct roles in navigating social interactions (Moran, 2013; Moran et al., 2012). For example, understanding intentions predicts moral judgments (Moran, 2013), and inferring beliefs facilitates social interactions (Frith & Frith, 2005). Moreover, individuals may have impairments in one domain (e.g., inferring intentions) but not others (e.g., inferring beliefs; Moran et al., 2012). Future research should attempt to disentangle these possibilities.

At first glance, our finding that social bonding was negatively related to dynamic affective theory of mind was unexpected given that prior work has shown that age-related deficits in emotion perception are attenuated when evaluating close, familiar others (J. T. Stanley & Isaacowitz, 2015; see also Henry et al., 2023). Though speculative, one possibility for these findings is that the ability to recognize emotions in close others may not necessarily translate to recognizing emotions in strangers (e.g., on the dynamic affective theory of mind task). In other words, older adults may rely on previous experiences with close others to identify their emotions, which could facilitate accuracy, but this accuracy would not necessarily translate to accuracy for nonclose targets. Indeed, within-subject measures of emotion recognition accuracy have found deficits for unfamiliar, but not familiar, targets (J. T. Stanley & Isaacowitz, 2015).

An additional implication of this work is that it further demonstrates that age-related declines in general cognitive function do not fully explain older adults' social–cognitive deficits (Grainger et al., 2023; Kong et al., 2022). Prior work has found that general cognitive function is related to declines in numerous social functions, including avoiding social gaffes (Henry et al., 2009), regulating behavior and reducing prejudice (A. C. Krendl et al., 2009; von Hippel et al., 2000), identifying deception (Spreng et al., 2016), emotion recognition (A. C. Krendl & Ambady, 2010; but see Kong et al., 2022), and theory of mind (Bottiroli et al., 2016; Fernandes et al., 2021; Laillier et al., 2019; Leslie et al., 2004; Scholl & Leslie, 2001). However, though we found that executive function and episodic memory were related to cognitive theory of mind, they did not fully explain the relationship between cognitive theory of mind and bridging. Thus, these findings contribute to the growing behavioral and neuroimaging evidence that, in addition to overlapping with general cognition, social cognition also engages mechanisms that are distinct from general cognition (Grainger et al., 2023; Kong et al., 2022; D. A. Stanley & Adolphs, 2013).

There are several important limitations in the current work. First, the sample was predominantly White and well-educated, which limits the potential generalizability of this work. Future work should extend these findings to a sample that is more racially and socioeconomically diverse; for discussion, see (L. J. Hamilton et al., 2022). Second, though we found consistent patterns between social cognition and social bridging, we cannot disentangle the causal role between them. Our analyses were designed to test the prediction that social–cognitive function would be associated with having weaker connected social relationships in the real world (through bridging networks). This approach is consistent with the social–cognitive resource framework that posits that older adults may rely less on social cognition in very familiar, highly close social relationships because navigating such relationships may be relatively automatic; for discussion, see (Henry et al., 2023). However, an alternate possibility is that having bridging networks improves social cognition. Indeed, though a recent longitudinal study found that higher cognitive ability predicted greater retention of network size over time, it also found that maintaining larger networks preserved cognition (Casey et al., 2021). This is important because, if there is a similar bidirectional effect on social cognition, then social bridging could also provide resilience for social cognition. Because recent cross-sectional and longitudinal work has demonstrated that social bridging confers cognitive resilience in samples at high risk for Alzheimer's disease (L. J. Hamilton et al., 2024; B. Perry et al., 2021), future work using longitudinal approaches should examine this possibility. This work may also include a lifespan sample to determine whether the relationships identified in the present study are unique to older adults or generalize to social connections across age groups. Finally, though we did not consider lifespan differences in social bridging or bonding networks, we did find that age was negatively related to having social bridging networks. However, this relationship was no longer significant when general and social cognition were included in the model (see Table 3). Future work may consider the potential moderating effects of age and cognitive decline on social connectedness.

Together, the results from the present study suggest that social and general cognition are distinct but overlapping processes, and each uniquely is positively associated with social bridging but unrelated or negatively associated with social bonding relationships. These findings provide support for the social–cognitive resource framework and suggest that the types of social networks in which older adults are embedded may have long-term implications for the cognitive and social–cognitive function. Given the myriad benefits of social connectedness on older adults' well-being and longevity (Boss et al., 2015; Coyle & Dugan, 2012; Kuiper et al., 2015; Michael et al., 1999; Shankar et al., 2011), understanding the mechanisms underlying these benefits will require examining both social and general cognitive function in future work.

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Received August 11, 2023
Revision received March 29, 2024
Accepted May 6, 2024 ■