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How to cite

MEHRPOUR, Anahita, WIDMER, Eric, STAERKLE, Christian. Social network analysis in social psychological ressearch (1990–2020): A scoping review. In: British journal of social psychology, 2025, vol. 64, n° 1. doi: 10.1111/bjso.12833

This publication URL: https://archive-ouverte.unige.ch/unige:186518
Publication DOI: 10.1111/bjso.12833

Received: 27 August 2024 | Accepted: 8 November 2024

DOI: 10.1111/bjso.12833

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ARTICLE

Social network analysis in social psychological ressearch (1990–2020): A scoping review

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Funding information
Swiss National Science Foundation, Grant/Award Number: 51NF40-185901

Abstract

Over the last two decades, Social Network Analysis (SNA) has become a standard tool in various social science disciplines. In social psychology, however, the use of SNA methodology remains scarce. This research identifies gaps in SNA use in Social Psychology and offers pathways for its further development. It reviews all empirical papers using SNA published in high-ranking social psychology journals over the last three decades. Findings reveal that SNA has been used across striking diversity of fields and subdomains central to the discipline, confirming its relevance for any field in Social Psychology in which the role of interpersonal or intergroup relationships is central to understand psychological and behavioural outcomes. However, the use of SNA in Social Psychology has been mostly limited to non-experimental and non-longitudinal studies, using student samples and with a focus on basic measurements of network structures such as density and centrality. The contributions of SNA to the understanding of psychosocial mechanisms have therefore remained modest. We propose several strategies by which such gaps can be filled in future research and the full potential of SNA for social psychology realized.

KEYWORDS

bibliometrics, interpersonal relationships, scoping review, social network analysis, social psychology

INTRODUCTION

Social Network Analysis is a formal method to investigate relationships in groups (Wang et al., 2023) that involves studying the system or structure constituted by links (edges) among interconnected individuals (nodes). Social psychology, in turn, has traditionally focused on studying relationships between individuals and groups, with an emphasis on individual-level characteristics and the inner workings of

the human mind (Postmes & Jetten, 2006). As such, it may have missed the opportunity to fully incorporate the fact that human behaviour is influenced by what takes place *between* people's minds through the study of structural dimensions of human interactions between multiple actors. Consequently, social psychology offers a valuable foundation for understanding social relationships and their implications, but there is room for further exploration and refinement regarding the structural dimensions of sets of social relationships (Repke & Benet-Martínez, 2019). Analytical methods such as SNA describe, analyse, and statistically model structures of sets of interpersonal relationships and as such, may fill a gap in social psychological research.

Although SNA has been introduced in the past decade to social psychologists as a new toolkit to expand hypothesis testing possibilities, some of its historical roots are to be found in social psychology. Early contributions by prominent social psychologists paved the way for understanding social interactions as belonging to sets with specific properties. Jacob Moreno's development of the sociogram visualization method played a pivotal role in mapping and analysing sets of social interactions, providing a foundation for understanding the interconnectedness of individuals belonging to a group (Moreno., 1934). This pioneering research laid the groundwork for the subsequent development of SNA. Building upon Moreno's early efforts, other luminaries in the field further advanced the application of SNA. Kurt Lewin's field theory and his work on group dynamics emphasized the importance of the impact of social structures on human thought and behaviour (Lewin, 1948). Lewin's work also catalysed a paradigm shift within social psychology by championing a holistic approach that acknowledged the reciprocal relationship between individuals and the social contexts in which they are embedded (Forsyth, 2019). Stanley Milgram's seminal study on the *Small World Problem* in 1967 later revealed the existence of relatively short social distances between individuals, highlighting the potential for interconnectivity across space (Milgram, 1967). Festinger and colleagues' research on social pressures in informal groups in 1974 shed light on the influence of social networks in shaping human behaviour within specific contexts (Festinger et al., 1974). These early contributions provided a solid foundation for the subsequent growth and application of SNA within the field of social psychology. Over the last decades, numerous studies have used SNA as a tool for investigating social psychological research questions (Clifton & Webster, 2017; Robins & Kashima, 2008; Wölfer & Hewstone, 2017). This renewed interest in SNA among social psychologists has been fueled by methodological advancements and increased data availability, leading to a rediscovery of this approach previously hindered by methodological obstacles such as lack of relevant data sets or the relative inaccessibility of adequate software (Neal, 2020; Wang et al., 2023).

The aim of this paper is to investigate and take stock of the scope and applications of existing SNA research in highly visible social psychology journals and propose further paths for the use and development of SNA in social psychological research on this basis. We propose a scoping review framework to comprehensively identify and examine the range of SNA evidence available in social psychology, as well as to delineate and classify the subdomains within social psychology that hold relevance within the context of SNA applications. This approach allows us to analyse the key social psychological concepts and network measures used in these studies, given the considerable heterogeneity observed in the field, which precluded a systematic review approach that typically focuses on specific outcomes (Peters et al., 2015).

FIELDS OF APPLICATION OF SNA IN SOCIAL PSYCHOLOGY

In studying human relationality, social psychology typically explores subjective perspectives on interpersonal relationships (e.g. Andersen & Chen, 2002) or group-based processes such as social conformity (Cialdini & Goldstein, 2004), ingroup identification and outgroup comparisons (Postmes & Jetten, 2006). SNA emerges as a valuable methodological toolkit that holds the potential to address these shared inquiries through an alternative and complementary lens that examines the structure and

composition of sets of ties and their dynamics (Robins & Kashima, 2008), as well as their influence on a variety of individual outcomes, including conformity to the expectations of the group or subgroups, thus offering an approach that evaluates the properties of a set of relationships different from specific dyads or groups and social categories as a whole.

Prior research suggested the use of SNA to improve the understanding of social relationships in different instances of intergroup contact and conflict (Wölfer & Hewstone, 2017), majority-minority studies (Robins & Kashima, 2008), and social contagion (Clifton & Webster, 2017). Several studies also reviewed the applications of SNA for understanding specific outcomes ranging from the interplay of group identifications and friendships (Leszczensky et al., 2019) to developmental benefits of adolescent intergroup relations (Kornienko & Rivas-Drake, 2021), and, beyond, childhood vulnerability (Nevard et al., 2020) and physical activity (Macdonald-Wallis et al., 2012). However, only Neal (2020) systematically analysed how SNA was applied within a clearly delineated domain of psychological research, that is, developmental psychology, highlighting how a social network approach focuses on a broad set of social relationships, allowing investigation of unique research questions. Neal's review identifies a focus in developmental social network studies on early adolescence and friendships. Additionally, it acknowledges research gaps and offers detailed guidelines for future studies at the intersection of SNA and developmental psychology.

Recent studies show that SNA contributes to bridging subjective measures of social identification with structural properties of sets of social relationships (Hoffman et al., 2023). Social network data further allows social psychologists to examine the match (or mismatch) between individuals' self-perception as leaders and their positions of centrality within small groups that indicate structural popularity (Emery et al., 2011). SNA also enables identifying subgroups within larger networks, providing a deeper understanding of the mechanisms that contribute to social integration and, conversely, to social isolation (Wölfer et al., 2012). Additionally, recent developments in the longitudinal analysis of network data facilitates investigations into the emergence (Neal et al., 2017) and dissolution (Cozijnsen et al., 2010) of social ties, as well as collaborative relationship patterns over time (Meeussen et al., 2018). In the context of cross-cultural psychology, SNA contributes to our understanding of minority-majority dynamics (Igarashi et al., 2008), and promotes cross-disciplinary approaches to key relational concepts such as social capital (Doucerain et al., 2021). Levitan and Visser (2009), in turn, applied SNA in research on political beliefs by measuring the association between network composition and belief strength with an index for attitudinal diversity in the social network. Overall, the integration of SNA as a method for hypothesis testing in social psychological research provides a set of tools and concepts for exploring the structural dimensions of a set of interpersonal relationships, thereby reaching a structural, higher-order level of analysis that goes beyond singular interpersonal relationships.

Clifton and Webster (2017) highlighted an increase in mentions of *social networks* in prominent social psychology journals over time indicating an *interest* in the field. Despite this surge in interest, a specific database search for 'SNA' yielded only a few studies published between 1990 and 2016. Nonetheless, the popularity of social network methods has been on the rise, primarily due to the availability of large-scale studies incorporating network data such as those from the U.S. General Social Survey (Wang et al., 2023) and advancements in longitudinal models (Neal, 2020). Figure 1 illustrates the upward trend of social network research within social psychology between 1990 and 2020. Despite an (unexplained) spike in 2003, there have been only a handful of studies before 2007. A clear upward trend emerges in 2008, with the highest number of publications in 2020, the last year of our analysis. Yet, there has been limited emphasis on critically analysing the approaches employed to collect and analyse social network data when testing social psychological hypotheses and constructs.

The present scoping review aims to assess and scrutinize the methodologies employed in analysing social networks, thereby taking stock of existing constructs, emerging areas, methods, metrics, and research gaps within the field of social psychology. As the network metrics have a specific theoretical meaning in the context of social psychological research (Widmer et al., 2013), we will assess network data collection and network design in the published studies. It has indeed been argued that in order to ensure the validity of network data, the selected network metrics and designs

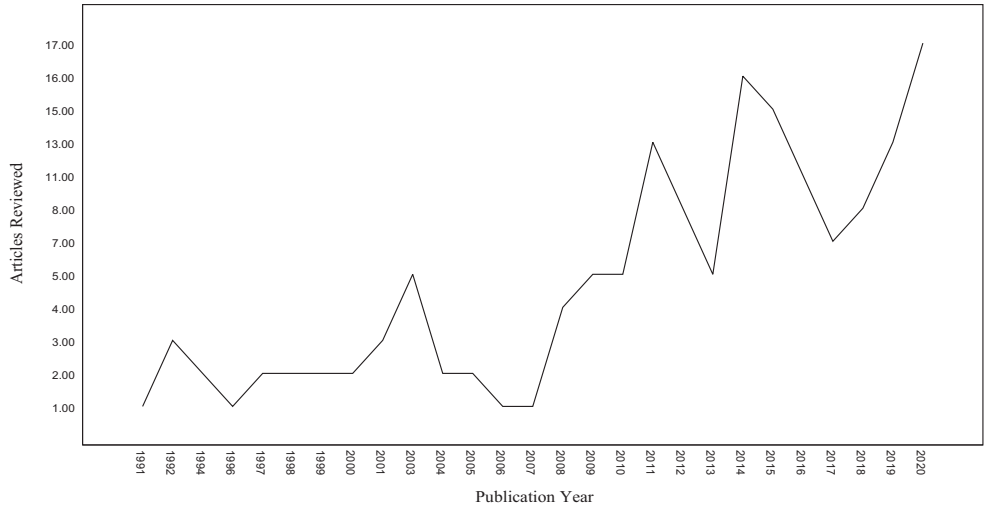

FIGURE 1 Articles using social network analysis published in social psychology journals, by year. Annual growth rate 10.48%.

need to be aligned with the social psychological research questions (Neal, 2020). Adapting and extending Neal's (2020) framework, we investigate major social psychological constructs that have been examined in conjunction with, or through, SNA, while also identifying how network data has been collected, analysed, and operationalized in highly visible social psychology journals. While other reviews have explored the link between social network methods and particular psychosocial outcomes (Kornienko & Rivas-Drake, 2021; Leszczensky et al., 2019; Macdonald-Wallis et al., 2012; Nevard et al., 2020), our review offers a comprehensive overview of the diversity of social network applications within social psychology.

We first describe the social psychological constructs and domains that were studied by or in association with social network measures (see supplementary materials for details). We further descriptively analyse the selected articles to identify prominent data collection methods, populations and social ties, and the network settings and types concerned. We also provide a detailed description of the social network measures that are operationalized in social psychology. Adopting a scientometric approach, we then provide an analysis of the conceptual trends over time, as well as journal impacts to have a better understanding of the actors shaping social network research in social psychology.

METHOD

Our scoping review examines the applications of social network methods used in social psychological research, following the procedures and recommendations outlined by the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA; Moher et al., 2009). To ensure transparency and rigour, we adhered to the PRISMA extension for scoping review reporting (PRISMA-ScR) that requires detailed information on search strategy, inclusion criteria, screening process, and data extraction methods (Tricco et al., 2018). Furthermore, to enhance the comprehensiveness and robustness of our analysis, we supplemented our review with the use of BibliometriX, an R statistical programming package designed to quantitatively analyse bibliometric and scientometric data (Aria & Cuccurullo, 2017). Bibliometric analysis also served as a tool to quantitatively validate the qualitative conceptual analysis of psychological constructs.

Search strategy

A total of 740 articles were screened from a systematic search of 47 high impact journals (see Table 1), out of which 156 empirical articles were selected that unambiguously utilized SNA. We focused our search on high-impact journals within the field of social psychology. Following the Scimago Q-ranking (Guerrero-Bote & Moya-Anegón, 2012) that assigns journals to one of four quartiles (Q1 being the highest and Q4 the lowest), we targeted journals categorized as Q1 or Q2.

Peer-reviewed empirical studies were retrieved from electronic databases that index the selected journals.[1] Table 1 provides a list of the journals included in this systematic review. These journals represent the most prominent outlets for publishing social psychological research across various subdisciplines. Out of the 51 journals initially identified, we excluded *Network Science* and *Cyberpsychology, Behaviour, and Social Networking* due to their focus extending beyond social psychology. Furthermore, *Social Psychology Quarterly* and *Journal of Health and Social Behaviour* were excluded as their affiliation with the American Sociological Association surpasses the scope of social psychological research. Additionally, the *Journal for the Theory of Social Behaviour* was excluded due to its primary emphasis on theoretical rather than empirical research.

For the search process, we used indexing databases including PsycINFO, Sage Journals, Wiley, and Taylor and Francis. Each of the 46 selected journals was independently searched for abstracts containing terms based on the following syntax: "social network" OR "social networks" OR "Personal network" OR "personal networks" OR "peer network" OR "peer networks" OR "friendship network" OR "friendship networks" OR "egocentric" OR "ego network" OR "sociocentric" OR "full network". By using specific search terms, we aimed to exclude articles that employed various operationalizations of each term (e.g. 'social networking sites' or 'egocentric biases'), ensuring a more focused and streamlined dataset that specifically addresses applications of social network methodology. Our searches were initially conducted over a two-week period in July 2021 and subsequently updated over a four-week period in October–November 2022.

Journal impacts: Key players in publishing SNA research

As indicated in Table 1, the most prominent social psychology journals have featured articles centered on structural analyses of social relationships. Only one journal did not yield any relevant articles during our screening process. Among those with retrieved articles, 12 journals yielded no articles that met our inclusion criteria. Consequently, we examined records from 35 journals, demonstrating a keen interest among social psychology publishers in disseminating SNA research.

Considering the great interest in the field, we performed bibliometric analyses[2] to identify key actors in publishing social network research in the world of social psychology. Merely considering the number of included articles (see Table 1), the *American Journal of Community Psychology* ($n = 26$) overtakes the other journals, followed by *Journal of Social and Personal Relationships* ($n = 12$), *Journal of Personality and Social Psychology* ($n = 11$), and *Social Development* ($n = 11$). Taking into account the sources' local impact as calculated by H-Index[3] changes the order, but not the presence of prominent journals. Interestingly, among the general (versus subject-specific) social psychology journals, only *Journal of Personality and Social Psychology* is shown on the top of the leading journals of the field. The highest H-factor was found for American Journal of Community Psychology (17), followed by Journal of Personality and Social Psychology (13), Journal of Social and Personal Relationships (10), and Social Development (9).[4]

[1]Detailed lists and search terms can all be found in the Supplementary Materials.

[2]Bibliometric analyses performed using BibliometriX and Biblioshiny webapp, detailed descriptions are available in the methods section.

[3]A source's local impact calculated by the H-Index assesses its influence within a specific field based on the number of publications and citations each receives (Aria & Cuccurullo, 2017; Fraumann & Mutz, 2021).

[4]Bibliometric analysis performed by the Biblioshiny webapp, a BibliometriX (Aria & Cuccurullo, 2017) subfunction.

TABLE 1 Journals included in search.

	Journal name	2022 ISI impact factor	Articles identified	Number of articles included
1	Personality and Social Psychology Review	16.16	4	1
2	Social Issues and Policy Review	9.86	1	0
3	Journal of Personality and Social Psychology	8.46	50	11
4	British Journal of Social Psychology	6.92	9	1
5	European Review of Social Psychology	5.65	0	0
6	Organizational psychology review	5.60	2	1
7	Journal of Social Issues	5.42	18	2
8	Social Psychological and Personality Science	5.32	7	5
9	Political psychology	4.80*	13	1
10	Psychosocial intervention	4.58	13	9
11	Personality and Social Psychology Bulletin	4.56	34	8
12	Social Psychiatry And Psychiatric Epidemiology	4.52	75	2
13	Family process	4.32	9	0
14	International Review of Social Psychology	4.20	1	1
15	Motivation and Emotion	4.14	5	2
16	Cultural Diversity and Ethnic Minority Psychology	4.04	9	0
17	American Journal of Community Psychology	4.02	65	27
18	European Journal of Social Psychology	3.93	11	2
19	Social and Personality Psychology Compass	3.80	6	0
20	Group Dynamics: Theory, Research, and Practice	3.71*	8	5
21	Journal of Experimental Social Psychology	3.53	31	3
22	Social Psychology Hogrefe	3.44	5	0
23	Journal of Family Psychology	3.30	6	1
24	Journal of- Community & Applied Social Psychology	2.97	19	4
25	International Journal of Intercultural Relations	2.94	30	7
26	The Journal of Social Psychology	2.77*	17	2
27	Group Processes & Intergroup Relations	2.71	13	7
28	Journal of Social and Personal Relationships	2.68	67	12
29	Journal of Applied Social Psychology	2.65	10	1
30	Social Psychology of Education	2.61	7	5
31	Journal of cross-cultural psychology	2.58	16	5
32	Small Group Research	2.50	10	7
33	Social Development	2.46	28	13
34	Self and Identity	2.41	6	2
35	Asian Journal of Social Psychology	2.14	17	2
36	Journal of Language and Social Psychology	2.10	11	1
37	Journal of Social and Clinical Psychology	1.84	19	2
38	Journal for the Theory of Social Behaviour	1.73	6	0
39	Social cognition	1.64	7	2
40	Journal of social inclusion	1.54*	9	0
41	Personal Relationships	1.53	34	5

TABLE 1 (Continued)

	Journal name	2022 ISI impact factor	Articles identified	Number of articles included
42	Basic and Applied Social Psychology	1.52	8	0
43	Social Influence	0.59	4	3
44	Journal of Family Communication	NA	2	0
45	Comprehensive results in social psychology	NA	1	0
46	Journal of Social and Political Psychology	NA	1	0
47	Social Identities: Journal for the Study of Race, Nation and Culture	NA	10	1

Note: Journals arranged based on the retrieved 2022 ISI impact factors.

Abbreviation: NA, available neither on WoS, nor on the journal website.

*Impact factor found on publisher's website.

Eligibility criteria and screening

We scanned the articles retrieved in the search and included only those that met the following criteria: (a) they reported on an empirical study, (b) the study involved quantitative social network data, and (c) social network methodology was used for data analysis or hypothesis testing. Review papers, commentaries, and methodological papers were excluded from our search. We also excluded grey literature and conference proceedings, theses, and dissertations. In addition, the inclusion of articles required a more advanced form of network analysis beyond simply providing a name generator or counting the number of alters or social ties. Thus, articles without any clear structural or compositional analyses were not included in the final database (i.e. papers measuring network size as a mere network indicator). The searches were limited to the timespan between 1 January 1990 to 31 December 2020 which marks 31 years of social network research in social psychological science. 1990 was selected as the baseline for our search, as SNA gained momentum in the 1990s due to methodological advances and increased data availability (Wang et al., 2023).

The screening process consisted of two steps: first, the abstracts of all articles were reviewed to ensure they met the inclusion criteria. If the information contained in the abstract was insufficient, the full article was reviewed for further evaluation of the inclusion criteria. Following PRISMA guidelines, the data collection process comprised four stages, as shown in Figure 2. One researcher conducted searches using prespecified criteria to identify relevant studies. The initial search was completed on July 1st, 2021, and all duplicate records were removed. Two other researchers (first author and a student assistant) independently screened the remaining titles and abstracts to ensure they met the eligibility criteria. Articles deemed relevant by either researcher were retrieved in full text. One researcher (first author) independently assessed the eligibility of the retrieved articles, recording any exclusions along with their reasons, while the second author oversaw the final screening and selection process.

Searching bibliographic databases yielded 740 records for screening, of which 724 full-text papers were retrieved. During the early screening phase, 16 duplicates were removed together with 43 theoretical or review papers. We further excluded 69 papers using qualitative research. By screening the full articles in the next step, 456 articles were excluded due to non-sociometric network mentions ($n = 400$), considering social networking sites as social networks ($n = 21$), or different operationalization ($n = 35$) of the search terms (as in egocentric bias). Out of the 47 journals, 12 journals did not result in any articles that met the inclusion criteria. The final dataset contained 156 articles from 35 journals.[5]

[5]Due to absence of six articles from Web of Science (WoS), we could not include them in the scientometric quantitative analyses using BibliometriX. The list of these articles can be found in the supplementary materials.

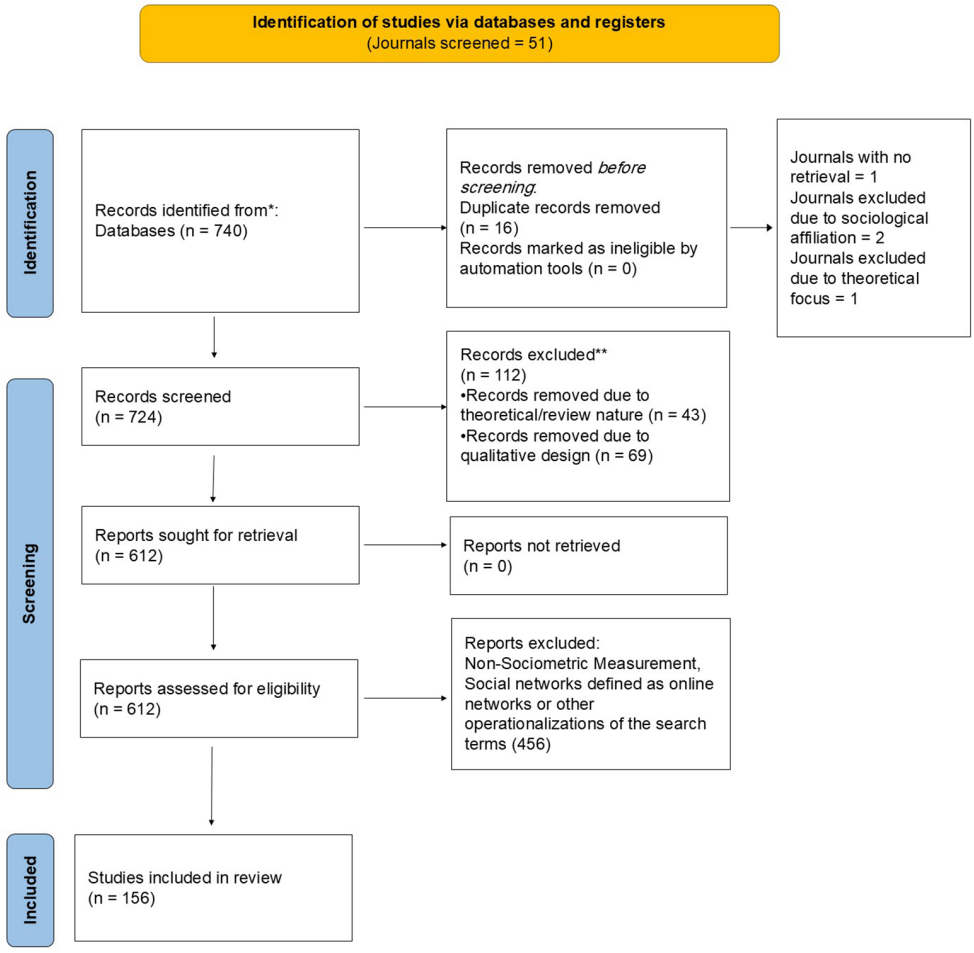

FIGURE 2 Prisma flow diagram for scoping reviews (Page et al., 2021).

Data extraction and synthesis

For each article meeting the inclusion criteria, we coded (a) network data collection settings and boundaries (e.g. classroom/grade, university, teams, and small groups); (b) participants and age range (e.g. children, university students, adults, general population); (c) tie types (e.g. friendship, communication, care/support); (d) data collection method and study design (e.g. cross-sectional or longitudinal surveys, experimental designs, data mining methods); (e) network types (full or ego-centered networks); and (f) social network measures (e.g. centrality, density). We also provided (g) the thematic synthesis of social psychological domains and constructs analysed in relation to, or through, SNA using qualitative content analysis (Guest et al., 2012), complemented with a description of topic trend, word frequency, and thematic network analysis (Aria & Cuccurullo, 2017), as quantitative tools to validate the insights derived from qualitative analyses.

RESULTS

Social network data collection, measures and designs

Several publications introduced SNA to social psychologists by describing the network boundaries, data collection methods, and analytical tools (Butts, 2008; Clifton & Webster, 2017). Additionally,

researchers suggested the applications of SNA in studying social groups and intergroup contact research (Wölfer et al., 2015; Wölfer & Hewstone, 2017). SNA is also introduced as a toolkit for family (Widmer, 2021; Widmer & La Farga, 2000) and organizational research (Brass, 2022). A recent psychological research handbook chapter introduced social network methods, models, and recent advancements while acknowledging that these analytical tools may be beyond the reach of many psychologists (Wang et al., 2023). Social network research enables an in-depth analysis of social relationships while allowing flexibility in data collection of ego-centered (e.g. Green et al., 2001) or full networks (e.g. Cacioppo et al., 2009), types of ties (e.g. Andrews et al., 2018; Betts & Stiller, 2014), social network settings (e.g. Cappella et al., 2013), network functions (e.g. Copeland et al., 2008), as well as structural (e.g. Gest et al., 2001) and compositional measures (e.g. Visser & Mirabile, 2004).

Table 2 presents a descriptive analysis of network settings, participants, data collection methods, type of ties, and network types present in the extracted dataset. Many social network studies involved participants in schools or classrooms. Adding the university settings, almost half of the studies recruited participants in schools or universities, followed by teams and small groups, communities, and general populations. The age range of participants varied from 3 to over 100, showing the great potential of SNA for capturing social relationships over the life span. The articles captured roughly equally childhood and school years (28%), university students and participants in transition to adulthood (27%),

TABLE 2 Summary of social network data collection in social psychology articles ($N = 156$).

Social network setting		Types of social network relationships	
Classroom/grade/school	23.7%	Friendship	25.6%
University	19.9%	Contact	15.3%
Ego/personal	13.4%	Care/support	11.0%
Teams and small groups	9.0%	Advice and collaboration	9.0%
Community	7.7%	Core social relations	6.4%
General population	4.5%	Peer relations/nominations	5.7%
Online social networks	3.8%	Organizational	3.8%
Organization	3.8%	Trust relationships	3.8%
Family	1.9%	Conversation/communication	3.2%
Other	16.0%	Negative ties/dislike	2.5%
Participants (age range 3–103)		Family/kinship	2.5%
Childhood and school years	28.2%	Cultural/interethnic	2.5%
University students (17–55)/ Participants in transition to adulthood	27.0%	Online	1.9%
Adults and general population	20.5%	Political	1.9%
Not clearly specified	16.6%	Learning	1.9%
Not applicable	1.9%	Perceived roles	1.9%
Data collection method		Neighbour	1.3%
Cross-sectional survey	56.4%	Team membership	1.3%
Longitudinal	27.5%	Liking	0.6%
Experimental	8.3%	Other	5.1%
Text and data mining/simulation	1.9%	Network type	
Observational	0.7%	Conceptual network	0.6%
Interview	0.7%	Full network	50.6%
		Ego/personal network	50.0%

Note: Codes are not mutually exclusive. The same article can include social network data collected in multiple settings, populations and/or with multiple data collection methods. Therefore, percentage within categories do not necessarily sum up to 100. 6.4% of the studies used online data collection methods.

and adults and general populations (21%). In some studies (about 17%), population descriptions were ambiguous and could not be easily classified.

With respect to constraints on generality of our analysis, we note that over half of the studies were carried out either in various educational contexts or with young participants in community or sports activities (mostly in the U.S and in Western European countries), whereas only 27% of the studies were done with adults. For participants under 16 years, we assume that the samples were relatively representative of the respective national, regional, or local contexts, given that they were enrolled in mandatory schooling (including substantial numbers minority and immigrant participants). For those in higher education institutions, a bias towards more educated participants is, however, likely. Nevertheless, we assume that the considerable variety of study settings offers a reasonable guarantee that our conclusions can be generalized (at least) to children, youth, and young adults in Western countries, and should be not limited to specific subsections of the populations.

Cross-sectional surveys are the prominent method of network data collection in social psychology (56.41%), followed by longitudinal (27.56%) and experimental (8.33%) studies. Interestingly, the more recent methods of data mining (e.g. Montiel et al., 2019) and simulation (e.g. Muthukrishna & Schaller, 2020) are also present which suggests emerging methodological advancements involving network methodology. Analytical methods extended from correlational and regression models to longitudinal, experimental designs and exponential random graph models (ERGM). Social networks were collected and measured generally using friendship (26.54%) and contact (15.38%) nominations. A variety of social ties were captured in these studies, including care and support, advice and collaboration, family and core social relationships, and organizational ties. Researchers showed an equal interest in studying full (50.64%) or personal/ego (50%) networks.

Early screening of the retrieved articles resulted in a large number of articles that took network size as the only network measure for hypothesis testing. As mentioned before, such records were excluded from our analyses. Apart from network size, we identified centrality (degree, betweenness, and indegree/outdegree) as the most frequent network measure (used in 43% of studies), followed by measures of density (32.7%), composition (27%), and clique/substructure identification (21%).

Table 3 includes samples of articles that used each social network measure and concept (proportionate to their frequency in the dataset) together with their underlying psychosocial dimension and research design. The analysis of the use of social network measures in conjunction with social psychological theory (also see Table 4) provides information about the theoretical significance of social network measures for psychosocial research. All centrality measures (degree, in-degree, out-degree, betweenness, closeness centrality), for example, are tied to identifying the key actors in a social system (Freeman, 1978), including their power and prestige within that system (Knoke & Yang, 2020). But there are significant variations in how they are calculated, and consequently, how they are measured and interpreted. As a case in point, degree centrality (the direct one-hop connections to each node in the network), the simplest measure of node connectivity (Freeman, 1978), is mostly interpreted as an importance score. Yet, eigenvector centrality (as a variation of degree centrality) implies social influence through further links that allow to investigate how well-connected a node is (the degree to which a node is connected to other influential nodes) (Knoke & Yang, 2020).

In directed networks, in-degree and out-degree centrality (representing variations of degree centrality) reflect the flow of information, support, or conflict towards a node or from one node to another. Indegree centrality is defined as the number of in-coming links from any node, and out-degree is considered the number of out-going links (Knoke & Yang, 2020). Betweenness centrality concerns the number of times a node lies on the shortest path between other nodes. It, in turn, reflects a node's social influence, brokerage, or bridging capital (Everett & Valente, 2016) in the system. Closeness centrality assigns scores to each node based on their proximity to all other nodes in the network, calculated through the sum of the shortest paths to each node. This metric highlights a social influence process by gauging the speed of communication across the network (Knoke & Yang, 2020). It further shows how quickly information and resources can spread through the network based on nodes of interest (i.e. for discovering network broadcasters).[6]

[6]For detailed mathematical description of important network measures, Wang et al. (2023) provide insightful tables and instructional materials.

Our analysis shows that almost half of the social network studies in social psychology applied at least one centrality measure in the formulation of the research questions, with degree centrality being the most frequently used centrality measure (see Table 3). Degree centrality is widely used in social psychological studies due to its simplicity in calculation and its more straightforward theoretical meaning in comparison with other centrality measures. Moreover, degree centrality tends to align closely with network size, making it an accessible and convenient metric for analysing social networks in various research contexts. In addition, degree centrality is generally considered a measure tied to *open* personality characteristics (Fang et al., 2015) such as agreeableness and extraversion (e.g. Thiele et al., 2018), thereby representing an individual's willingness and motivation to build and maintain relationships. While such conceptualizations fit well with a social and personality psychology research agenda, other centrality metrics possess more nuanced theoretical significance. The directed variations of centrality, namely indegree centrality, which denotes the quantity of incoming ties, and outdegree centrality, indicating the number of outgoing ties, are particularly relevant for small group and team research where the role of an individual in the network can be studied through their structural network position (Kwok et al., 2018). Indegree centrality signals prominence and a central position within the network, for example in studies on popularity in school settings (e.g. Kreutzmann et al., 2018) and on college sports club teams where it was shown to be positively associated with team identification (Graupensperger et al., 2020). As another example, the study of Kreutzmann et al. (2018) implemented indegree centrality as a proxy of active acceptance of others and outdegree centrality as a proxy for passive acceptance of others and showed that both measures account for students' sense of belonging to their classroom.

Betweenness centrality, that is, the number of times a node lies on the shortest path between other nodes, describes the capacity for social influence of an individual within the network. From the perspective of social capital theory (Granovetter, 1977), it signals the *bridging potential* of that node between different actors or different network substructures (e.g. Girardin & Widmer, 2015). In our sample, however, only a few papers operationalized betweenness centrality to capture social influence (e.g. Zingora et al., 2019). Other standard measures of centrality such as eigenvector (e.g. Chi & Suthers, 2015) or closeness centrality (e.g. Rana & Allen, 2015) have been fully overlooked in social psychological research.

We found density to be the second most important network measure used by social psychologists. Assessing network cohesion and interrelatedness (Burt, 2000), density represents the number of actualized ties proportionate to the number of possible ties (Borgatti et al., 2018). In our dataset, density was used as a measure for interconnectivity between alters (e.g. Zou et al., 2015), social connectedness (e.g. Stark, 2016), and closeness of social relationships (e.g. Liu et al., 2018). Although density is generally viewed as a measure of relationship quality (Liu et al., 2018), its theoretical meaning differs depending on the composition of ties and the functionality of the network. As an example, in conflict or dislike networks, density is operationalized as an index of conflict or annoyance (Widmer et al., 2018), which fully changes its interpretation compared to the density of positive ties.

Closely related to density, reciprocity and transitivity are other network measures operationalizing interconnectedness within a social network (Knoke & Yang, 2020). As a measure of dyadic relationships, reciprocity represents mutual relationships such as being in contact or reciprocal liking or disliking, mostly used in friendship (i.e. Betts & Stiller, 2014; Gest et al., 2001; Pijl et al., 2011) and team studies (i.e. Lusher et al., 2014). Transitivity is a measure of extended relationships to third parties within triads. Transitivity is especially important for studying friendship formation (the principle of a *friend of my friend becomes my friend*; Knoke & Yang, 2020). In the sampled articles, reciprocity and transitivity were used to ascertain the extent to which groups showed cohesion. For instance, reciprocity was utilized to operationalize the mutual affirmations of social relationships (Gallagher, 2019), and transitivity was used to represent the extent to which friends of an individual know each other (Chung et al., 2011). Akin to reciprocity and transitivity measures, cliques were the most representative measures of relational subsets in the sampled research. Cliques represent small, yet cohesive subgroups among members embedded in a network. Cliques include mutual relations among at least three actors that enable members to share information, create solidarity, and

TABLE 3 Summary of social network measures and concepts used in social psychology articles ($N = 156$).

Network measurements	%	Sample papers		Design
Centrality	42.9%	Farmer & Rodkin, 1996	Classroom popularity	Cross-sectional
		Kameda et al., 1997	Higher reception of shared information in a group (higher social influence)	Experimental
		Gest et al., 2001	The number of times children are named by classmates as members of informal peer groups	Cross-sectional
		Brands & Rattan, 2020	Central advice network positions	Cross-sectional/ Experimental
		Graupensperger et al., 2020	Outdegree centrality: self-reported connections with teammates Indegree centrality: nominations from others	Cross-sectional
Density	32.7%	Zou et al., 2015	Cohesion The degree of interconnectedness among a person's social contacts	Cross-sectional
		Stark, 2016	The proportion of the members of a person's social network that are also related to each other	Cross-sectional
		Liu et al., 2018	Representation of how closely members in a social network are connected to each other	Cross-sectional
Network composition measures	27.0%	Visser & Mirabile, 2004	The presence of attitudinally congruent versus attitudinally heterogeneous social networks	Cross-sectional/ Experimental
		Cozijnsen et al., 2010	Personal network data including information on work-related personal ties	Longitudinal
		Zheng & Wei, 2018	Ethnic composition defined as minority ratio, the proportion of non-Han (Chinese) members in a group	Cross-sectional
Clique and substructure identification	21.1%	Ennett & Bauman, 1994	Cliques as peer groups, clique liaisons, and isolates	Cross-sectional
		Zingora et al., 2019	Identifying clique leaders as a social influence indicator	Longitudinal
Proportion of homophilous ties	12.1%	Titzmann et al., 2016	Ethnic homophily: the tendency for minority group members to have predominantly intra-ethnic social contacts	Cross-sectional
Heterogeneity measures	11.5%	Smith, 2013	The presence of host, ingroup, and outgroup (host) ties and interactions in personal networks	Cross-sectional
Reciprocity	11.5%	Gallagher, 2019	Mutual affirmation of a social relationship	Cross-sectional

TABLE 3 (Continued)

Network measurements	%	Sample papers		Design
Transitivity	8.3%	Chung et al., 2011	The extent to which the friends of each focal individual (ego) were connected to each other, indicating mutuality of ties and presence of potential cliques	Cross-sectional
Network dynamics	5.1%	Czarna, Leifeld, Smieja, et al., 2016	Psychological constructs as predictors of structural popularity over time	Temporal exponential random graph modelling, TERGM
Contagion	3.8%	Delhove & Greitemeyer, 2019	Transmission of video game-related aggression to others	Experimental
Multiplexity	3.2%	Gillath et al., 2017	The extent to which network members are called upon to fulfil various social and emotional functions	Cross-sectional/ Experimental

Note: Codes are not mutually exclusive. The same article can include social network data collected in multiple settings, populations and/or with multiple data collection methods. Therefore, percentages do not sum up to 100.

act collectively (Knoke & Yang, 2020). Clique identification methods were commonly employed in community studies (Maya-Jariego & Holgado, 2015), as well as in developmental studies on children's social preferences (Chisholm & Pitcairn, 1998) and on adolescents' risk behaviour (Ennett & Bauman, 1994).

Beyond their relational properties, social networks differ in terms of their composition, qualified with measures of homophily or homogeneity that appear in a number of studies (see Table 3). Homophily[7] refers to a principle of similarity between network members according to which the number of ties between similar people is higher than the number of ties among dissimilar people (Knoke & Yang, 2020). In other words, a homophile network is composed mainly of members of the same social category, the ingroup. The converse concept, heterophily, assesses the relative presence of ties with dissimilar (outgroup) members within a network and thus designates group diversity (Knoke & Yang, 2020). In social psychology, network composition was studied in instances of (group-based) difference: as an antecedent of majority–minority information brokerage and group performance (Zheng & Wei, 2018), through the presence of family members in social networks (Girardin & Widmer, 2015), and as an antecedent of attitude strength (Visser & Mirabile, 2004). Closely related, we found homophily as a measure of interest for cross-cultural psychologists, where ethnic homophily (i.e. Titzmann et al., 2016) and heterogeneity (i.e. Meeussen et al., 2018; Repke & Benet-Martinez, 2018) in immigrant networks are central research questions. These measures were also present in developmental (J. W. Neal, 2010), community (Z. P. Neal & Neal, 2014; Stivala et al., 2016), and friendship (Gibbons & Olk, 2003) research.

Thanks to the software and methodological advancements of the past decade, testing hypotheses about network change and causal models has become increasingly feasible, although still quite rare in social psychology (5.12% of studies in our dataset). For instance, Stochastic Actor-Oriented (SAO) models (Snijders, 2005), such as those implemented in SIENA,[8] are particularly powerful for modelling the co-evolution of social networks and individual behaviours, attitudes, and beliefs. This capability is highly pertinent to social psychological research, which often centers on understanding reciprocal influence processes (Snijders et al., 2010). Additionally, ERGM (Lusher et al., 2012) facilitates the longitudinal analysis of social network structures by modelling the formation and dissolution of ties based on specific individual, dyadic, or structural attributes.

Furthermore, other methods operating within the framework of stochastic actor-based models (SIENA) capture the emergence and dissolution of social ties based on relational or individual characteristics. Although less comprehensive for co-evolutionary processes compared to SIENA, Temporal Exponential Random Graph Models (TERGM; Hanneke et al., 2010) remains a valuable tool for modelling temporal dependencies within network structures. The advances in both SIENA and TERGM highlight the growing potential for more dynamic, longitudinal research approaches within social psychology. Czarna et al. (2016), for example, tested a longitudinal model on the effects of narcissism and emotional intelligence on popularity measurements in social networks, demonstrating a negative role of narcissism and a positive role of emotional intelligence for the emergence of friendship ties and long-term popularity. In contrast, multiplexity—referring to a relationship between two actors defined by several dimensions at the same time (e.g. support and conflict, or instrumental and emotional support)—is a classical concept in network research but does not appear to play an important role for social psychologists (3.20%). In our dataset, multiplexity is operationalized as the extent to which a network member is called upon to fulfil various social and emotional functions rather than a single one for the same alter. Multiplexity has been shown to be correlated with attachment styles such that avoidant attachment style negatively predicted perceptions of tie multiplexity (Gillath et al., 2017).

[7]Historically, the concept of similarity-attraction has been well established in psychology, referring to individuals being attracted to others with similar attitudes or characteristics (Byrne, 1971). This concept underlies the principle of homophily in social networks, where the tendency for similar individuals to form connections results in higher numbers of ties between similar people compared to dissimilar people. However, similarity-attraction has not traditionally been conceptualized explicitly in social network terms.

[8]http://www.stats.ox.ac.uk/snijders/siena/.

TABLE 4 Summary of social psychological constructs analysed in conjunction or through SNA.

Subdomain	Articles
Aggression	*Aggressive behaviours and norms* Sijtsema et al., 2010; Sijtsema et al., 2013; Neal, 2014; Jackson et al., 2015; Andrews et al., 2018; Delhove & Greitemeyer, 2019; Greitemeyer & Sagioglou, 2019. *Harassment, bullying, and crime* Knecht et al., 2010; Paluck & Shepherd, 2012; Bolden, 2014; Difonzo et al., 2014; Birkett & Espelage, 2015; Dworkin et al., 2016.
Cross-Cultural Psychology and Acculturation	*Ethnic diversity and difference* Na et al., 2015; Stivala et al., 2016; Liu et al., 2018; Meeussen et al., 2018; Park et al., 2019; Muthukrishna & Schaller, 2020. *Cultural dynamics* Mok et al., 2007; Igarashi et al., 2008; Smith, 2013; Chi & Suthers, 2015; González Motos, 2016; Titzmann et al., 2016; Kauff et al., 2017; Zheng & Wei, 2018; Gallagher, 2019; Pozzo & Nerghes, 2020. *Acculturation and cultural adjustment* Domínguez & Maya-Jariego, 2008; Rienties & Nolan, 2014; Repke & Benet-Martínez, 2018; Sadewo et al., 2020; Shu et al., 2020.
Community Psychology	*Social support* Bowling & Farquhar, 1991; Felton & Berry, 1992; Tausig, 1992; Uehara, 1994; Lowe & Willis, 2015; Xue, 2015; Pokhrel et al., 2016; Todd et al., 2020. *Community dynamics* Haines et al., 2011; Boessen et al., 2014; Jason et al., 2014; Langhout et al., 2014; Neal & Neal, 2014; Todd et al., 2015; Maya-Jariego & Holgado, 2015; Menger et al., 2015; Flórez et al., 2016; Lu et al., 2017; Maya-Jariego et al., 2018; Lee, 2020.
Health and Well-being	*Physical and perceived health* Bowling & Farquhar, 1991; Cozijnsen et al., 2010; Amar-Amar et al., 2014; Girardin & Widmer, 2015; Kauff et al., 2017; Wyngaerden et al., 2019. *Physical and cognitive capacity and decline* Felton & Berry, 1992; Aartsen et al., 2004. *Life satisfaction and well-being* Xu & Palmer, 2011; Carboni & Gilman, 2012; Zou et al., 2015; O'Connell et al., 2018; Cramer & Cappella, 2019; Zhang, Ding, et al., 2020. *Psychopathology* Green et al., 2001; Cacioppo et al., 2009; Mercer & DeRosier, 2010; Perry, 2014; Mikami & Mercer, 2017; Wyngaerden et al., 2019. *Health Behaviours* Ennett & Bauman, 1994; Reifman et al., 2006; Phua, 2011; Philip et al., 2016.
Intergroup Research	Chisholm & Pitcairn, 1998; Page-Gould, 2012; Munniksma et al., 2013; Grütter & Meyer, 2014; Stark, 2016; Wölfer et al., 2017; Geana et al., 2019; Wölfer et al., 2019; Pfister et al., 2020; Stark, 2020.
Organizational Psychology	Kilduff, 1992; Gibbons & Olk, 2003; Nowell, 2009; Freedman & Bess, 2011; Evans et al., 2014; Bess, 2015; Corlew et al., 2015; Rana & Allen, 2015.
Personality and Individual Differences	*Personality characteristics and traits* Kilduff, 1992; Pierro et al., 2003; Janicik & Larrick, 2005; Emery et al., 2011; Emery et al., 2013; Czarna, Leifeld, Śmieja, et al., 2016; Neal et al., 2017; van Zalk et al., 2020. *Individual differences* Casciaro et al., 1999; Landers-Potts & Grant, 1999; Lang, 2000; Xie et al., 2001; Langhout, 2003; Rizzuto et al., 2009; Roberts & Dunbar, 2011; Stevens & Van Tilburg, 2011; Eckles & Stradley, 2012; Wölfer et al., 2012; Zou et al., 2015; Gillath et al., 2017; Zhang, Li, & Schutte, 2020.

(Continues)

TABLE 4 (Continued)

Subdomain	Articles
Political Ideology and Participation	Chung et al., 2011; Cullum et al., 2011; Xu & Palmer, 2011; Erisen & Erisen, 2012; Kornbluh et al., 2016; Montiel et al., 2019.
Pro- and Anti-social Behaviours and Styles	Farmer & Rodkin, 1996; Gest et al., 2001; Rodkin & Ahn, 2009; Long et al., 2014; Roblain et al., 2020.
Social Cognition and Attitudes	*Self and identity* Mok et al., 2007; Copeland et al., 2008; Johnson & Ashburn-Nardo, 2014; Cheung & Gardner, 2016; Lynch et al., 2019; Cork et al., 2020; Graupensperger et al., 2020; Light & Goldberg, 2020. *Attitudes and attitude change* Visser & Mirabile, 2004; Levitan & Visser, 2009; Brands & Rattan, 2020.
Social and Interpersonal Relationships	Neyer, 1997; Barone et al., 1998; Magdol, 2000; Gee & Rhodes, 2003; Lease et al., 2003; Cozijnsen et al., 2010; Neal, 2010; Pijl et al., 2011; Geurts et al., 2012; Mesch et al., 2012; Girardin & Widmer, 2015; Rosenbusch et al., 2019; Zingora et al., 2019.
Small Group and School Research	*Small group research* Kameda et al., 1997; Igarashi et al., 2005; Emery et al., 2011; Huang & Cummings, 2011; Igarashi & Kashima, 2011; Lusher et al., 2014; Tirado-Morueta et al., 2017; McLaren & Spink, 2020; Yu & Kilduff, 2020; Zhang, Li, & Schutte, 2020. *School Research* Pittinsky & Carolan, 2008; Neal et al., 2011; Cappella et al., 2013; Betts & Stiller, 2014; Kreutzmann et al., 2018.

Note: Table includes all studies, some appear in multiple categories, all studies in subcategories are ordered by ascending publication date.

Social psychological constructs

Based on the set of measurements described in the previous section, we began with a two-stage content analysis (Guest et al., 2012), which included an examination of titles, abstracts, and methodologies with the purposes of categorizing papers into themes. We used an inductive data reduction approach (Namey et al., 2007), initially extracting all psychosocial variables from the articles and organizing them into detailed subcategories. In the second stage, the first and third authors independently reviewed and classified these variables in order to ensure alignment with both psychosocial concepts and the journals' publication domains, where applicable. Table 4 presents the final classification of these variables (detailed table available in the supplementary materials). Additionally, we employed thematic network analysis, implemented through BibliometriX, to quantitatively validate our content analysis results and extract the most prominent dimensions of social psychology research related to SNA.

The content analysis revealed that SNA was employed alongside a diverse range of social psychological concepts and domains, showcasing the heterogeneous nature of its potential applications. Taking a structural viewpoint, the position of an individual within a network reveals her opportunities for interpersonal interaction and communication within that network, thereby shaping psychological and behavioural outcomes. Therefore, determining an individual's (a node's) position (i.e. betweenness or degree centrality), as well as the properties of the network the node belongs to (i.e. density, cliques, etc.) are crucial for forecasting outcomes related to their performance, behaviour, or beliefs. An *explanatory* approach uses network variables as predictors of a wide range of outcome variables (Wang et al., 2023). The findings indicate that SNA was utilized in various ways, including as a means to operationalize (e.g. Levitan & Visser, 2009), complement (e.g. Wölfer et al., 2017), or predict social psychological constructs (e.g. Lee, 2020). A second approach that focuses on the psychosocial antecedents of social networks (Wang et al., 2023) examines psychological constructs as predictors of network characteristics such as tie emergence, tie presence, and homophily. There are fewer cases that fall under this second approach (e.g. Czarna et al., 2016; Kwok et al., 2018).

Table 4 shows that there is an established history of examining particular constructs, including social support (such as Bowling & Farquhar, 1991; Felton & Berry, 1992; Tausig, 1992), that persists to this day. Whereas for other constructs, such as individual differences, the timespan evolves slowly (Casciaro et al., 1999; Langhout, 2003; Rizzuto et al., 2009; Zhang, Li, & Schutte, 2020). To better capture the conceptual evolution of the field, bibliometric analyses using Biblioshiny web app.[9] were performed.[10]

Keyword frequency analysis (performed on authors' keywords).[11] revealed friendship (e.g. Munniksma et al., 2013), intergroup contact (e.g. Stark, 2016), social support (e.g. Felton & Berry, 1992), social influence (e.g. Sijtsema et al., 2010), acculturation (e.g. Repke & Benet-Martínez, 2018), and aggression (e.g. Greitemeyer & Sagioglou, 2019) as most the frequent keywords in the dataset. The same analysis performed on the more encompassing keywords plus[12] feature of WoS resulted in the following terms: health (i.e. Bowling & Farquhar, 1991), behaviour (i.e. Andrews et al., 2018; Chung et al., 2011; Phua, 2011), support (i.e. Uehara, 1994), performance (i.e. Mclaren & Spink, 2020; Rizzuto et al., 2009), and attitudes (i.e. Levitan & Visser, 2009). Trend topic analysis[13] was also performed to showcase the trends over time. Figure 3 represents the trends of each year based on keywords plus[14] (Word minimum frequency was set to 5, and number of words per year was set to 3)

Aligned with the results of qualitative content analysis (Table 4) identity (e.g. Graupensperger et al., 2020) centrality (e.g. Brands & Rattan, 2020) communication (e.g. Roberts & Dunbar, 2011) prejudice (e.g. Zingora et al., 2019) personality (e.g. Czarna et al., 2016; Neal et al., 2017) and health (e.g. Mikami & Mercer, 2017; Philip et al., 2016) represent the most recent trends (2015–2020) whereas support (e.g. C. Gee & Rhodes, 2003) children (e.g. Lease et al., 2003) adjustment (e.g. Gee & Rhodes, 2003) gender (e.g. Igarashi et al., 2005) and friendship (e.g. Gibbons & Olk, 2003) were most trending in the early 2000s.

Figure 4 presents the results of a semantic network analysis.[15] of the social psychological constructs performed, which supports findings from the content, keyword frequency and trend topic analyses. The keyword co-occurrence graph across papers is based on the Keywords plus feature in BibliometriX. The resulting network was generated through the Fruchterman-Reingold algorithm (Fruchterman & Reingold, 1991) under NetworkX (Hagberg et al., 2008) in Python. The edge widths were set according to the number of keyword co-occurrence between any two papers. The semantic network analysis was conducted both to validate the outcomes of our qualitative content analysis and to serve as a dimension reduction technique, illustrating the primary constructs of interest alongside their associated concepts.[16]

The semantic network analysis reveals six clusters[17] of social constructs along with their associated concepts. As aligned with Table 3, (1) health and support play significant roles in shaping the conceptual framework of the extracted dataset, predominantly followed by developmental aspects such as (2) behaviour and school research (for an extensive analysis see Neal, 2020). Research areas

[9]Referred to as 'BibliometriX' in the article.

[10]There is a list of excluded terms available in the supplementary materials.

[11]Based on authors' keywords (figures available in the supplementary materials).

[12]The data in KeyWords Plus are words or phrases that frequently appear in the titles of an article's references, but do not appear in the title of the article itself. Based upon an algorithm unique to Clarivate databases, KeyWords Plus enhances the power of cited-reference searching by searching across disciplines for all the articles that have cited references in common.

[13]Trend Topic Analysis typically involves techniques such as topic modelling, clustering, or a combination of both, to automatically identify patterns in the content of the publications. By examining the prevalence of different topics across time periods, researchers can gain insights into the evolution of research trends within a particular field or subject area. It is known to be the analysis of *future* (Jovanović, 2021).

[14]Complementary conceptual analyses are available in the supplementary materials.

[15]Semantic network analysis (Segev, 2022) involves mapping relationships between concepts or terms within a body of text or knowledge domain. Concepts are represented as nodes, and relationships as edges in a network. This method offers insights into the structure of knowledge and facilitates understanding of textual data.

[16]Additional analyses by the Biblioshiny webapp on the keywords plus feature available in the supplementary materials. BibliometriX takes into account three types of centrality measures (Betweenness, Closeness, and PageRank) to cluster the semantic concepts. In this case, edge betweenness was used as the clustering algorithm and normalization was configured to 'association'. The findings revealed the same clusters and confirmed our analyses.

[17]We permitted 5 nodes per subcategory (which means a maximum of 60 nodes concerning 12 subcategories represented in Table 4).

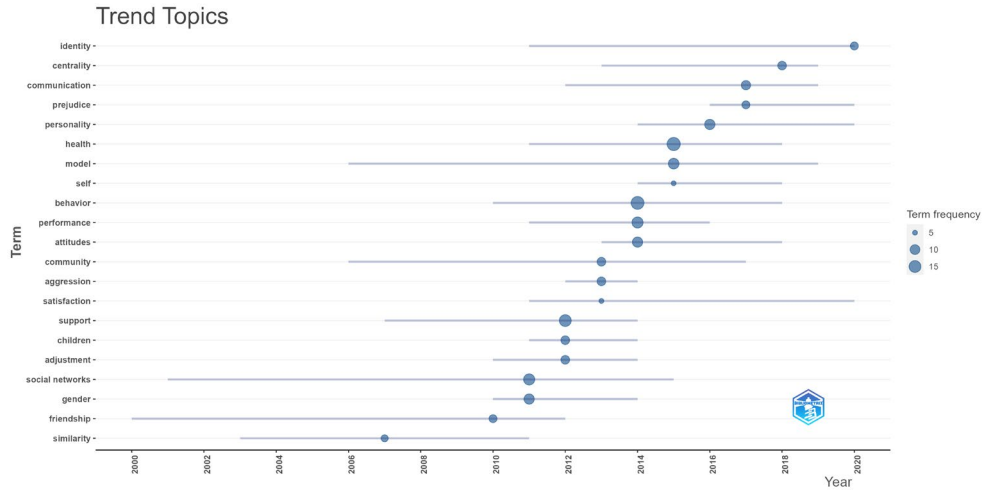

FIGURE 3 Analysis of trend topics (1991–2020). Bibliometric analysis performed by the Biblioshiny webapp, a BibliometriX (Aria & Cuccurullo, 2017) subfunction.

such as (3) personality, (4) communication and information, and (5) attitudes and intergroup research serve as connecting elements between these two well-established areas of research, revealing their status as evolving fields of research. Additionally, emerging areas such as (6) self and identity, are also appearing as the later trends that may shape the future of SNA research in social psychology.

DISCUSSION

During the 1990s, methods derived from SNA were largely considered to be outside of social psychology and thus used only by a small minority of researchers in the discipline. Yet, over the past two decades these methods have become increasingly popular and today represent a regular, albeit still rare methodological approach in social psychological research. Our scoping review revealed a striking diversity of fields and subdomains central to the discipline in which these methods have been used: aggression and violence, cross-cultural psychology and acculturation, community psychology, health and well-being, organizational and community psychology, intergroup relations, personality psychology, political ideology, social cognition and attitudes, interpersonal relationship, and small group research (cf. Table 1). This diversity of applications suggests that SNA methods are potentially useful for any field in social psychology in which the role of interpersonal or intergroup relationships is relevant to understand a given psychological or behavioural outcome. SNA indeed implies a relational level of explanation, and, more fundamentally, a relational epistemology: a given phenomenon or outcome is accounted for through the ties that link individuals together in groups. These ties are organized into a system—a network—that describes the number of other individuals ("alters") with which a person is in regular interaction (centrality), the characteristics of those alters in terms of similarity and dissimilarity (composition), and the extent and nature of ties between members of the network (density). Each of these fundamental network characteristics can be further qualified with additional indicators, for example (directed) indegree and outdegree centrality, homogeneous and heterogeneous composition, transitive and reciprocal ties, or positive, negative, and ambivalent ties. While these fundamental network dimensions are intercorrelated (Wasserman & Faust, 1994), each of them may nonetheless exert a specific influence on the phenomenon under scrutiny.

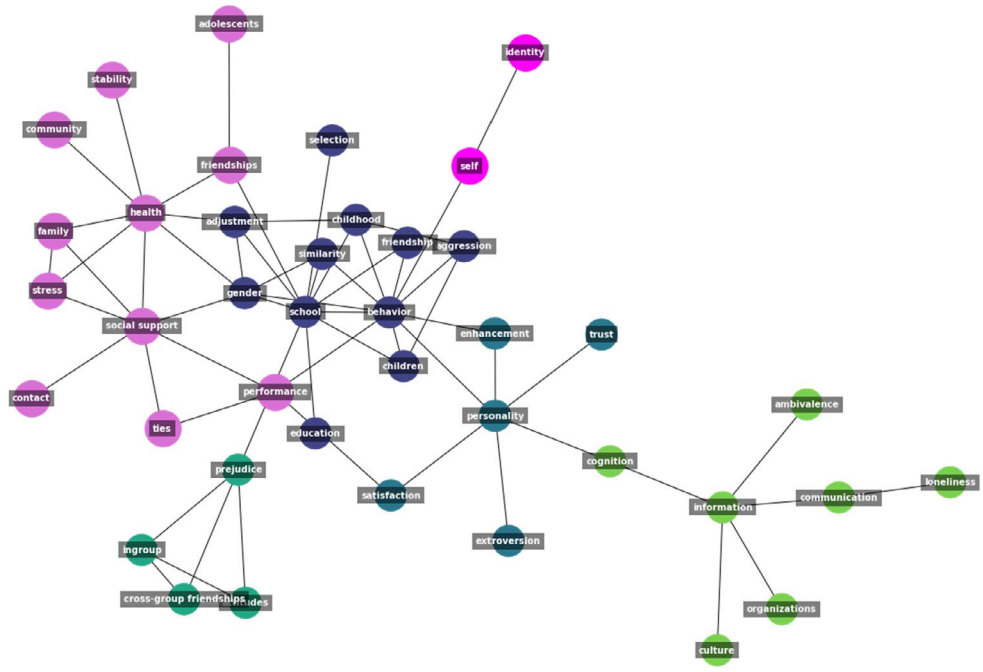

FIGURE 4 Semantic network of keywords. Centrality of nodes indicates their importance, and clusters of interconnected nodes, which represent thematic groupings. Weights or frequencies associated with edges reflect strength of relationships between concepts, offering insights into the structure and dynamics of knowledge within the studied domain.

SNA methodology for social psychology

In social psychology, network methodology (SNA) can be seen as a general research strategy to measure and quantify the impact of relations with significant others (alters) on thoughts and behaviours. Network research in social psychology is faced with a tension between a more descriptive and data-driven vs. a more explanatory and theory-driven approach. SNA studies in the social sciences are traditionally based on more diversified samples that are described in greater detail. In contrast, and in line with a more deductive and theory-driven research tradition, this scoping review has revealed that network studies in social psychology use more homogeneous and young samples such as high school and university students. While sociological approaches emphasize social characteristics of the target population, as well as the diversity of groups and social situations, social psychological research highlights the psychological processes at work in social networks. Reaching an adequate balance between these two strategies is one of the key stakes in future network research in social psychology.

The growing attractiveness of network analysis in social psychology has been built essentially on the most established measures in SNA. Size, centralization and density of networks, reciprocity of dyads and transitivity of triads, along with some measures of cliques, make up most relational measures and notions used in social psychology work to date. For centrality measures, degree centrality dominates the field, while other measures of centrality, such as betweenness centrality, are more marginally used. Future network research in social psychology should take greater advantage of the large pool of relational measures developed by SNA such as alternative centrality measures, structural equivalence measures, and sub-group measures relating to sparse networks (Wasserman & Faust, 1994). The same applies to network composition for which various indices of network homophily or heterogeneity are now available for research in social psychology.

There are several features of SNA that make it attractive for researchers in social psychology. Probably the most significant upside lies in its flexibility, both in terms of potential domains of applications and

concerning its methodological and data analytic opportunities. The scoping review revealed the large and diverse array of subfields in social psychology in which SNA has been put to test. These subdomains cover a large variety of central issues in social psychology, their shared characteristic being that the phenomenon of interest is hypothesized to be related to the (stable and continuous) relations people have with other people. This flexibility also means that SNA is applicable at different levels of analysis, from individual (e.g. personality) to interpersonal (e.g. small groups) to intergroup (e.g. cultural diversity) approaches.

SNA is also methodologically flexible. Our review has shown that most of the SNA studies in social psychology use cross-sectional data (56%), followed by a substantial proportion of longitudinal studies (28%), and to a lesser extent experimental approaches (8%). This diversity nevertheless suggests that SNA can be associated with any quantitative data collection strategy within social psychology. It allows to formalize and to quantify, with a significant degree of precision, people's network, and is thus amenable to creative hypothesis testing in virtually any domain in social psychology.

One reason SNA methods have not yet become more prevalent in social psychology relates to the emphasis on collecting data from all or most members within a network, often referred to as the "full network approach" (Wasserman & Faust, 1994). This approach, which requires high response rates (commonly around 80% of network members) to accurately describe the overall structure, has traditionally posed significant challenges, particularly in settings like schools or community groups. Collecting such comprehensive data presents logistical difficulties, especially compared to typical psychological methods that often prioritize individual-level measures, such as attitudes, mental states, and theoretical constructs.

Relatedly, these methodological challenges also explain why most of the data in this field comes from educational settings. Schools, and to a lesser extent universities, provide a clear network boundary that is necessary for sociometric network data collection, especially for studying friendship networks. In such contexts, most of the friendships are likely to fall within the network boundary, making data collection feasible. This boundary clarity is harder to achieve in other settings, thus making schools one of the few accessible avenues for sociometric data collection (Neal, 2020).

However, in the past decade, alternative empirical approaches, such as personal or egocentric network methods (Perry et al., 2018) and cognitive social structures (Brands, 2013), have gained traction. These methods allow researchers to gather network data based on individuals' perceptions of their ties and the relationships among their close associates ("alter-alter ties"). By enabling data collection from single individuals, these approaches alleviate the necessity of interviewing everyone within a network boundary, making SNA more feasible for psychologists. Such developments also address the enduring issue of network boundary specification, offering flexible solutions that are more suitable for social psychological research (McCarty et al., 2019).

These methodological advancements make SNA methods increasingly compatible with the typical research designs in social psychology, facilitating the integration of structural analysis alongside traditional psychological constructs. This evolution is promising, as it allows researchers to capture the relational context within which individual behaviours and attitudes emerge, while also mitigating the extensive requirements of full network analysis.

Theoretical advancements and new research avenues through network methodology

Our review suggests that the most established areas of research covered so far are studies on interpersonal relationships and friendship, social support and care relations, organizational and school psychology as well as personality and individual differences. Emerging areas of research are studies in social cognition and attitudes, communication, stigma and prejudice, intergroup relations, health and well-being. In these various domains, an SNA approach may provide new insights and an innovative understanding of well-known processes, for example by connecting personality to

network types, or by framing attitude formation and attitude change as an interactive and dynamic process that occurs as a function of knowledge and information circulation within networks. Yet, an SNA approach in social psychology has the potential to spark new horizons and lead to innovative research questions, offering substantive opportunities for both theoretical and methodological developments. In this last section, we outline four key domains in social psychology in which SNA is poised to move the field forward: identity development, group perception, inequality management, and conflict situations.

The first outlook on promising future research concerns the complex reciprocal relationship between interpersonal networks and social identities.[18] To our knowledge, no research has yet comprehensively investigated the key issue of when and how personal networks generate[19] social identities and shared realities (see Haslam et al., 1998), and, conversely, how social identities shape networks. The interactive model of social identity formation (Postmes et al., 2005) has addressed how interpersonal interdependencies and interactions provide the basis for the emergence of a sense of social identity, a process described as an inductive, bottom-up process of identity formation whereby interaction partners infer commonalities from each other's behaviour and perspectives. Empirically, however, this research is limited as it relies on small group communication (typically 3 to 4 persons) and on interpersonal communication (communicator-audience effects). An SNA approach could provide a more comprehensive strategy to understanding how individuals derive meaningful social identities from their personal networks. It could thereby demonstrate how social identities are the crucial link between interaction (i.e. network ties) and cognition (i.e. thinking about one's place in society, defining goals, coping with adversities).

A second avenue of innovative research concerns the links between group perception and within-group interaction. Extensive research on group perception has examined the role of group member similarity, interaction, and interdependence, of group boundary, structure, and size, of common goals and outcomes, and of the longevity of the group, as criteria for judgements of group entitativity (that is, perceived "groupness" of a social category) (Blanchard et al., 2020; Campbell, 2007; Lickel et al., 2000). Somewhat surprisingly, however, there is no research that has linked such perceptions (from in- and outgroup members) to actual networks and interactions within those groups.

Social network research has the potential to extend our understanding of both tight-knit (entitative) and loose-knit (non-entitative) groups. Entitative groups are defined through *bonding structures* derived from densely connected personal networks, where most network members are linked to each other by strong and durable ties (as in relations of love, friendships, business, confidence, etc.), involving frequent interactions and an intense emotional dimension (Bidart et al., 2018; Maya-Jariego, 2021; Vacca, 2020; Widmer, 2006). Such a personal network generates collective support as well as trust and solidarity with ingroup members that are reinforced by binding social norms, made possible by direct links between all members of the network. At the same time, individual behaviours and choices are more likely to be controlled and restricted, especially in the family and educational domains, by the collective nature of normative control and conformity pressure (Coleman, 1988).

In contrast to bonding structures, *bridging structures* are characterized by a network organized around the individual, made up of social ties from various fields of activity such as work (colleagues), training (classmates, coaches, teachers), leisure and community environments (playmates, friends, and acquaintances), and family (partner, siblings, parents, other kin) (Bidart et al., 2018; Giannella & Fischer, 2016; Lubbers et al., 2007). In such structures, the links between network subgroups are

[18]While there is some research on the link between ethnic identities and social networks, particularly in sociology and developmental psychology, it was not the primary focus of our review. In this vein, Neal's (2020) review provides insights from developmental psychology, and Leszczensky et al. (2019) review on the interplay of group identifications and friendships offers relevant contributions, although our focus was specifically on social psychological literature.

[19]More recent efforts have begun to address these issues (e.g. Bracegirdle et al., 2023), including examining how friendship networks generate shared realities of perceived discrimination among members of ethnic minority groups. However, these studies fall outside the scope and timeframe of our scoping review.

either weak or inexistent, except for this individual, and the configuration of ties provides new and nonredundant resources (Burt, 2021; Granovetter, 1973; Kwon et al., 2020). Bridging ties thus may contribute substantially to multiple (instead of single) identities, suggesting that in such structures interpersonal ties are a source of informational rather than normative influence (as in bonding structures).

A third opportunity to develop the field with SNA methodology concerns the ways interpersonal networks are shaped through group-based power differentials. Gender, age, education, ethnicity, and citizenship are the bases of unequal social categories that position individuals in network structures as a function of their position in the social hierarchy. Social categories shape people's participation in personal networks by creating opportunities to form relationships with similar others (Brechwald & Prinstein, 2011; Leszczensky & Pink, 2019; McFarland et al., 2014). SNA methodology would for example allow to establish the network characteristics that are best suited to deal with stigmatized and discriminated minority identities. For example, does perceived discrimination generate more dense groups that provide support for its members, or do threatened identities lead to pressures to changes in personal networks, through disaffiliation or increased ties with majority members? The fine-grained analytic possibilities of SNA thus offer a promising path to research that examines how intergroup animosity dynamically shapes interpersonal relations and modalities of social support through reconfigurations of personal networks.

A fourth and final opportunity concerns a greater attention to the negative dimensions of social interactions, such as interpersonal conflict or relational ambivalence (Girardin & Widmer, 2015). While network research has to date mainly examined the effects of positive ties on individual outcomes (e.g. well-being, health, and performance), as this review shows (with only 2.5% of the reviewed papers addressing negative ties), an interest in negative ties has recently emerged (Harrigan et al., 2020; Offer, 2021; Song et al., 2021). Negative ties are related to psychological distress and low well-being (Newsom et al., 2008; Pietromonaco & Collins, 2017; Walen & Lachman, 2000), and may also derive from hostile intergroup contact signalling unfriendly and discriminatory treatment (Graf et al., 2014). SNA methodology has a significant potential for innovative analyses of conflict situations, both within groups and between groups. A political environment characterized by strong affective polarization between partisan groups, for example, is a case in point where SNA could show how and to what extent interpersonal everyday networks are organized around negative views of the alleged rival group.

Despite the comprehensive approach of our study, several limitations should be noted. First, we were unable to include some papers in our bibliometric analysis due to software and indexing constraints. While we ensured that this exclusion did not significantly impact the relevance and appropriateness of our results, it is a limitation that hampers the comprehensiveness of our database. Second, our review was restricted to journals ranked in Scimago quartiles 1 or 2, which may have excluded relevant research published in lower ranked journals. Third, our analysis relied on keywords that fall under the broad umbrella of SNA, potentially missing studies that employed SNA without explicitly stating so in their titles or abstracts. These limitations suggest that while our findings are robust, there may be additional insights to be gained from a more inclusive and exhaustive review. We also acknowledge that the scope of our review did not allow for a detailed analysis of dataset reuse, such as the Children of Immigrants Longitudinal Study (CILS; Portes & Rumbaut, 2005), which remains a potential area for future research.

CONCLUSION

In any human group, people have links with other people, giving rise to relational networks that both shape and reflect who they are, what they do, and what they think. The relational epistemology underlying SNA contributes to the welcome move away from a static and individualistic view of inherently dynamic, collective, and relational phenomena (see Power et al., 2023). Yet, it is ironic and surprising

to discover that social psychology—whose key competence as a discipline is to integrate relationships in explanations of human behaviour—has not made greater use of network methodology. Network dynamics are dialectic since they constrain and limit people's actions through processes of social control and conformity, but they also provide opportunities and resources for action, through social support as well as informational and normative influence processes. This dual function of networks offers significant opportunities for groundbreaking future research. Given the recent developments outlined in our review, it may reasonably be expected that we are currently on the cusp of a durable trend to integrate network analytic methods in social psychological research and theorizing.

AUTHOR CONTRIBUTIONS

Anahita Mehrpour: Conceptualization; investigation; writing – original draft; methodology; validation; visualization; software; formal analysis; data curation; project administration. **Eric D. Widmer:** Conceptualization; funding acquisition; writing – review and editing; software; supervision; resources; visualization. **Christian Staerklé:** Supervision; resources; funding acquisition; writing – review and editing; validation; formal analysis; methodology.

ACKNOWLEDGEMENTS

The authors would like to thank Johanna L. A. Henry, who worked as a student assistant, for her support with data collection, organization, and coding. We also thank Laure Sandoz for her valuable insights on the qualitative analyses and the members of NCCR Lives (now Centre Lives) for their helpful suggestions on earlier versions of this paper.

CONFLICT OF INTEREST STATEMENT

The authors have no known conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The syntax and material used for data retrieval and dataset construction are available in the supplementary materials of the paper. This study's design and its analysis were not pre-registered.

ETHICS STATEMENT

The authors confirm that the manuscript adheres to ethical guidelines specified in the APA Code of Conduct as well as authors' national ethics guidelines.

CONSENT

This study was not conducted with human participants. Thus, it is not subject to informed consent requirements.

CITATIONS STATEMENT

In conducting this scoping review, we adhered to clear inclusion and exclusion criteria to ensure an objective and comprehensive examination of Social Network Analysis (SNA) in social psychology. The studies we reviewed encompass a wide range of topics and methodologies, showcasing the field's depth and breadth. However, it is noteworthy that this research area is predominantly Euro-American, which may influence the perspectives and findings in the literature. Despite this concentration, our stringent criteria enabled us to include studies from North America, Europe (including the Netherlands, Germany, Spain, and Poland), Japan, and China. The corresponding authorship reflects even greater diversity, as illustrated in the accompanying figure. Expanding the geographical and cultural diversity of researchers in social psychology using SNA will enrich the field, making the research more inclusive and representative of global populations, and better addressing the complexities of human relationships and social dynamics across different cultural contexts. By recognizing this limitation and introducing SNA as an effective tool for hypothesis testing, we encourage scholars from diverse regions and backgrounds to engage with and contribute to this research.

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How to cite this article: Mehrpour, A., Widmer, E. D., & Staerklé, C. (2025). Social network analysis in social psychological ressearch (1990–2020): A scoping review. *British Journal of Social Psychology*, *64*, e12833. https://doi.org/10.1111/bjso.12833