



Article

Socio-Developmental Network Analysis: Establishing a Research Method to Examine Socio-Contextual Dynamics of Children in the Mockingbird FamilyTM

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Abstract: In recent years, social network analysis has had its own distinctive theoretical and methodological underpinnings. This article proposes a novel method for the application of a fused mixed-methods approach and social network analyses that incorporates the critical aspects of numerous characteristics of children's social development in a statutory care setting. We collected data from children involved in the Mockingbird Family out-of-home care model, following its implementation in Australia. Our approach involves three steps: social-developmental network indicators, relational dynamics, and social-developmental network narrative. We contend that this approach has the potential to provide powerful data representation that facilitates the understanding of the complexities of children's social development, the links between different positions and roles of children, and their social network in the Mockingbird family. Using exemplars, we show the potential of the research method to unearth rich data for seeking to understand the system change important for strengthening children's safe and protective environments.

Keywords: Australia; Mockingbird Family; social network analysis; children; foster care; kinship care; out-of-home care



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1. Introduction

This article reports on the rationale for the design and testing of a research method used to examine socio-environmental dynamics from the perspective of children in statutory care, specifically children who become part of the Mockingbird Family. Our focus herewith is on the data collection tools and analysis that enabled the capture of the social networks of children, identified micro-system changes over time, and enabled interpretations of shifts in the protectiveness of their care environments. We draw examples from our much larger study of the Mockingbird Family in Australia, which tracked the model's early implementation by an NGO, Life Without Barriers, in Australia. Some specific examples of analytical interpretations are drawn from children's data to assist in elucidating the research approach, design, and analytical techniques. The data examples presented are not intended to be generalizable results or presentation of facts.

The Mockingbird Family is an innovative out-of-home care model initially from the United States. The goal is to create micro-communities of support for foster and kinship carers, children and young people in care, based on an extended family-like concept ([Mockingbird Society 2022](#)). The care model involves the development of semi-formal networks of 6–10 foster families that train together, provide respite to each other, and thereby take part in improving safety and stability in the care environments for children and young people ([McDermid et al. 2016](#); [Ott et al. 2020](#)). Each micro-community, known as a constellation, has an experienced carer at the helm, known as the hub home provider. Each home hub home is connected to the satellite homes, in which families variously consist of single-parent carers and couple carers, biological, foster and/or kinship children

and young people. The hub home provider is responsible for ensuring that the needs of children, young people, and carers in each of their own constellations are met.

Strengthening the care environment, such as via the Mockingbird Family, represents good and valid intentions to improve the human rights, in particular protective environments, of children and young people in care. However, examining the social networks of children and young people necessitates the application of different methods, measurements, and analyses, compared to adults. There is a need to incorporate critical features that generate information that has social relevance and developmental benefit, and contributes to network safety and sustainability.

In this article, we define “social development network analysis”, or SDNA, as the application of social network analysis that expands on the concept of children’s social development in their surroundings. Before delving into our SDNA methods, each component is briefly discussed.

1.1. Social Network Analysis

In a nutshell, social network analysis (SNA) is an analytical approach for measuring and mapping social connectivity. The core unit of SNA is “nodes”, which may be individuals, families, groups, or institutions. Nodes are the points of exchange for resources, connected by “links” between them (Zhang et al. 2018). Constituting sociology, mathematics, and graph theory, the basic proposition of SNA is that network structure and its attributes have substantial effects on the population of interest. Hanish and Rodkin (2007) refer to SNA as “the human side of network science”, in which its theoretical constructs can be traced back to early-19th-century sociologists. For example, Émile Durkheim held the premise that modern society developed out of the interaction between individuals with independent roles, and that such an interaction constructs a reality that cannot be accounted for in the properties or experiences of individual actors (Belvedere 2015; Carls 2022). Roger Brown, an anthropologist, first coined the term “social network” signifying that the social structure was analogous to a network (Scott 2000). In the 1930s, Jacob Moreno, the pioneer of sociometry, experimented with the structure and patterns of group interactions, heralding that humans are the social atoms in the social universe (Le Deuff 2018). These individuals, among others, have set the stage for taking a relational approach to understanding social structure and human development.

With advancements in computational intelligence, SNA has benefited from technologies that include data mining, machine learning, and the application of algorithmic tools. Recent developments include those by Bellotti et al. (2022), who developed an integrated criminological network analysis tool, and Haji et al. (2022), who designed a model for link prediction in undirected complex networks. SNA has been applied in the development and evaluation of multi-sector partnerships involving practitioners, researchers, organizations, and community leaders and to advance the implementation process (Schaller et al. 2021; Smit et al. 2021; Valente et al. 2015). Alternatively, SNA can also be used to identify discrete impacts of homophily and social influence, as well as other confounders. This is achievable via the statistical examination and theoretical interpretation of actor characteristics, social structure, and predictors of social network relationships.

SNA produces two types of output. The first is ‘numerical’ output that measures links, paths, length, distance, and centrality; the second is ‘visual’ output that displays data values as graphical attributes using node-link graphs as the most common method (Camacho et al. 2020; Li and Wang 2022; Preiner et al. 2020; Wang et al. 2021). In evaluating the links and nodes, network metrics are utilized to measure the position and centrality of each node, as well as other connected concepts. Network metrics indicate the connectors, influencers, leaders, bridges, and isolates in a network, as well as core and periphery nodes. The network measures developed by Freeman (1979) are perhaps the most well-known, using language to describe network metrics focused on degree centrality, betweenness centrality, and proximity centrality (Freeman et al. 1979). Degree centrality describes how central nodes are in relation to the number of nodes with which they are connected.

Closeness centrality is based on the distance from one node to all other nodes in the network. Betweenness centrality determines bridging nodes, i.e., nodes that are bridges between two other connected nodes. In the study of people, as nodes, these three fundamental notions imply that individual centrality may have an impact on group process and dynamics.

1.2. Children's Social Development and Social Network Analysis

Since J.L. [Moreno \(1934\)](#), followed by Urie [Bronfenbrenner \(1943\)](#) and Muzafer [Sherif's \(1956\)](#), ties between social network science and the social aspects in children's health and social development have been substantial. Despite this, research in social developmental network science is out of sight. The neglect of social network science by child development researchers is due to both theoretical and methodological challenges. [Cairns et al. \(1998\)](#) argued that human development researchers focus on individual levels or dyadic constructs as they are simpler and more straightforward than social networks. Social networks are complex, and the network data are challenging to analyze. Different methodologies are required for assessing the networks of younger vs. older children, in different ecologies such as school, family, and community. Multiple-group members violate independence assumptions, and identifying the existence or lack of relational linkages might appear arbitrary ([Hanish and Rodkin 2007](#)). Supposedly, with the speedy advancement of computer software and apps, this can be resolved.

We conducted a rapid literature search using the Scopus database to retrieve the relevant literature from the last ten years. Keyword searching "social network analysis" and "child", limited to journal articles, retrieved 13 peer-reviewed articles. This included one scoping review exploring linkages, resources, and power to improve child mental health practice ([Bustos 2020](#)), and twelve original research articles. Five articles reported inter-stakeholder collaboration and informational resource networks supporting children's health and social care. For example, [Gurganus et al. \(2022\)](#) used a validated SNA survey to explore relationships between children's hospital community-oriented programs and community-based organizations, analyzed by statistical correlation. [Mukinda et al. \(2022\)](#) applied [Granovetter's \(1983\)](#) network theory to assess linkages in local maternal, newborn, and child health networks. A Gephi version 0.9.2 software was used to analyze Google-sourced data on the online information available for children suffering from Zika ([Gouvêa et al. 2022](#)), Social Network Questionnaires were analyzed with UCINET version 6.352 software in the context of child obesity prevention in long daycare centers ([Marks et al. 2013](#)), and a mixed-methods design made use of SNA to explore professional collaboration among workers ($n = 58$) in the child protection system ([Dávid 2013](#)). In this final study, each worker chose people from a list of 57 names with whom they have work relationships, and the data were analyzed using network metrics such as density, degree, centrality, and centralization.

We identified seven studies focused on social networks, in which children were the study participants. [Lira et al. \(2021\)](#) examined indigenous ($n = 21$, aged 2–13) and non-indigenous ($n = 61$, aged 9–10) Brazilian children's engagement in free playtime, specifically how this social context stimulated the generation of networks, group cohesiveness, and mitigation of interethnic avoidance in children. Two of the 3-h playtime videos were analyzed using Whitehead's SOCPROG ([Whitehead 2009](#)) to measure association matrices of children's behaviors and the number of dyads formed. The matrices were then exported to Gephi for network visualization and manipulation.

In another study, [Prochnow et al. \(2020\)](#) surveyed 8- to 12-year-olds ($n = 140$) during a summer program. They used a modified version of PlaySELF physical literacy assessment in which each child was asked to nominate up to five children with whom they played. Closeness centrality was calculated using UCINET software and multilevel modeling (SPSS V.25) to cluster data by cogitating ego- and alter-level data. [Oldenburg et al. \(2018\)](#) investigated 462 elementary school children's defense, friendship, and dislike of relationships using an online questionnaire. The Dutch version of the KiVa anti-bullying program was analyzed using XPNNet for bivariate exponential random graph estimation.

Salway et al. (2018) measured 1223 children's (aged 8–9) friendship networks by naming their four closest friends and recorded their physical activity by a waist-worn accelerometer and body mass index. The network model was generated by Moran scatter plots and Moran's I statistics. Cooc and Kim (2017) applied SNA to assess elementary school children's social networks ($n = 4215$) longitudinally for reading skill achievement. Children named five supportive classmates, and these data were analyzed by a regression model in Stata 14. Santos et al. (2017) studied children's interactions during cooperative and oppositional games. Data were collected using an accelerometer, stadiometer, and body scale and analyzed by SocNetV, version 1.9. Anderson et al. (2016) utilized the package *igraph* within the R analytical tool to examine the determinants of social connectedness for children, aged 5–12, with ($n = 182$) and without ($n = 152$) autism spectrum disorder.

This brief selection of studies offers SNA as a mechanism capable of identifying key individuals and uncovering the nature of relationships and collaborative dynamics. Each of them is capable of generating indicators and assumptions about network system strengths and weaknesses to inform effective policymaking, programs, and interventions. The application of SNA in children's social development research, however, remains scarce. Most of the selected studies employed a quantitative approach and software for data manipulation and visualization. Since relational data are challenging to collect and analyze via qualitative methods alone, quantitative SNA has become the preferred method and ideal choice for handling large datasets.

1.3. Socio-Developmental Network Analysis with Children in Statutory Care

Data from an Australian Mockingbird Family constellation has been used in our example of the approach and use of SDNA. Accordingly, the next section steps through our research strategy and the methods we used. We draw from a constellation that was created by Life Without Barriers by bringing together a group of foster carers with existing relationships, foster carers in need of assistance, and new foster carers. Since the purpose of this paper is to present our SDNA methods, limited demographic identifying features are provided. The following research questions guide our example:

1. What do the children's social networks in the Mockingbird family constellation look like in terms of size and composition?
2. What is the nature of children's links with others in relation to the different types of socialization or support they need across different contexts (i.e., people they live with, the Mockingbird network, other family and friends, and people from services)?

2. Methods and Materials, with Exemplars

Our approach to SDNA employed a fused mixed-methods design, with a dynamic back-and-forth analysis following the example of Yousefi Nooraie et al.'s methodological approach (Yousefi Nooraie et al. 2020). We also used Smith's (2014, 2016) three-step approach to capture a more nuanced understanding of each child's social network, considering the difficult journey through childhood that many children experience in the statutory care system. The use of mixed methods in social network analysis (SNA) is essential for gaining a comprehensive understanding of the structure and meaning of interactions in social networks.

The data used, as an exemplar to assist explaining SDNA, were collected from three children, aged <12 years, during a Mockingbird Family gathering. Other constellation members were present in the general vicinity. The methodological aim was to showcase data visualization with example, specifically how young children correspond with others within the Mockingbird Family constellation and support services. Since children <12 years would not be expected to know of many cross-links between people in their networks, outside of the immediate home or constellation, links between nodes takes an egocentric analysis. This approach focuses on the children's immediate interconnections and the centrality measures. The network analysis then provides useful information about the

roles people take on, who is important to them, and the kinds of interactions in their social networks, as identified by the children.

Data collection is best carried out with at least one adult who is close to the child being present, whenever possible, and in a place that is comfortable and familiar to the child. Indigenous children are overrepresented in the Australian statutory system; hence, researchers need to consider interviewing skills that build solid rapport using simple language and strategies for adapting questions for different age groups and characteristics and, if necessary, consult a highly qualified specialist with relevant Indigenous cultural expertise (Danby et al. 2021). Since there will always be power imbalance in research with children, Daelman et al. (2020) propose three critical concepts: listening, response-ability, and becoming with. In our example, the researchers had extensive experience working with children and young people about complex experiences and sensitive topics, including forensic child interviewing and collaboration with Indigenous groups. Participatory approaches are often used to guide data collection, as the connections between researchers and children require careful framing guided by ethical and practical principles.

Research involving children in foster care is a sensitive and complex issue that raises a range of ethical concerns. As a vulnerable population, foster children are at risk of being exploited or harmed in research, particularly given their history of trauma, neglect, and abuse (Seltzer et al. 2018). Researchers have a responsibility to ensure that their work is conducted in an ethical and responsible manner. This study and its methods were approved by Flinders University's Human Research Ethics Committee (Project ID 4781) and conformed to universally agreed research ethics standards. In addition, we sought research approval from the Department for Child Protection (DCP 2023) of South Australia as it is outlined in the Procedures for Human Research in South Australia, which states that decisions will only be valid if the child or young person, their carers or guardians and the DCP each accept them in writing.

The consent process for children required both carers' consent and the child's assent. Life Without Barriers, the foster care agency as a licensee of the Mockingbird Family in Australia, and the carers of the participating children served as the gatekeepers for gaining consent. Detailed information about the study was provided to the foster carers. Children were provided with age-appropriate information about the study prior to seeking their assent to participate. The right to withdraw from the study at any time was particularly important for child participants and, if children wandered away, that deemed the interviews over. To maintain the anonymity and privacy of the children, unique identification codes were assigned, and any identifying information was removed from data collected. Overall, the consent process was a collaborative effort between the relevant agencies and the research team, working together to protect the welfare of the children involved.

We keep in mind that the subsample population presented is part of a larger foster care and statutory child protection system. Populations that are part of these systems are classified as a tricky-to-access and this poses significant challenges for researchers (Smith 2014). While the Mockingbird Family is a well-defined constellation of hub homes and satellite families, its membership in foster care and statutory child protection systems is dynamic, unstable, and culturally sensitive by default. Smith (2016) formulated a three-step model for researching the social network of a tricky-to-access population: first, setting up the network parameters using a qualitative approach, then determining the relational dynamics by a quantitative method, and lastly, narrating the network findings in a qualitative manner.

2.1. Socio-Developmental Network Indicators

The perspectives of stakeholders are considered of great importance in conducting research focusing on children in care. While important, at the initial phase, empirical expertise is essential in formulating evidence-based concepts and frameworks for setting up the SDNA parameters. We selected valid and reliable instruments already available in the scientific literature to assess social networks that were child-friendly and modified

them accordingly for our target sample. Specifically, we adapted the social network map and grid developed by Tracy and Whittaker (1990), which were later modified and used in a study by Blakeslee (2015) for older youth in the statutory care population, to fit our target population. This included the use of appealing colors and simple language for younger children, aged or with cognitive capacity <12 years of age.

Referring to the results of our rapid review, some studies used instruments by asking children to nominate up to five friends (Prochnow et al. 2020; Salway et al. 2018). Cooc and Kim (2017) argue that limiting the number may encourage children to cite additional friends to reach the maximum or limit the true number of friends. Our adapted social network map consists of a rectangle divided into four compartments: people you live with; friends in the Mockingbird Family; other family and friends; and people from services (Figure 1). Cartoon-figure stickers were provided to help children identify people in their networks.

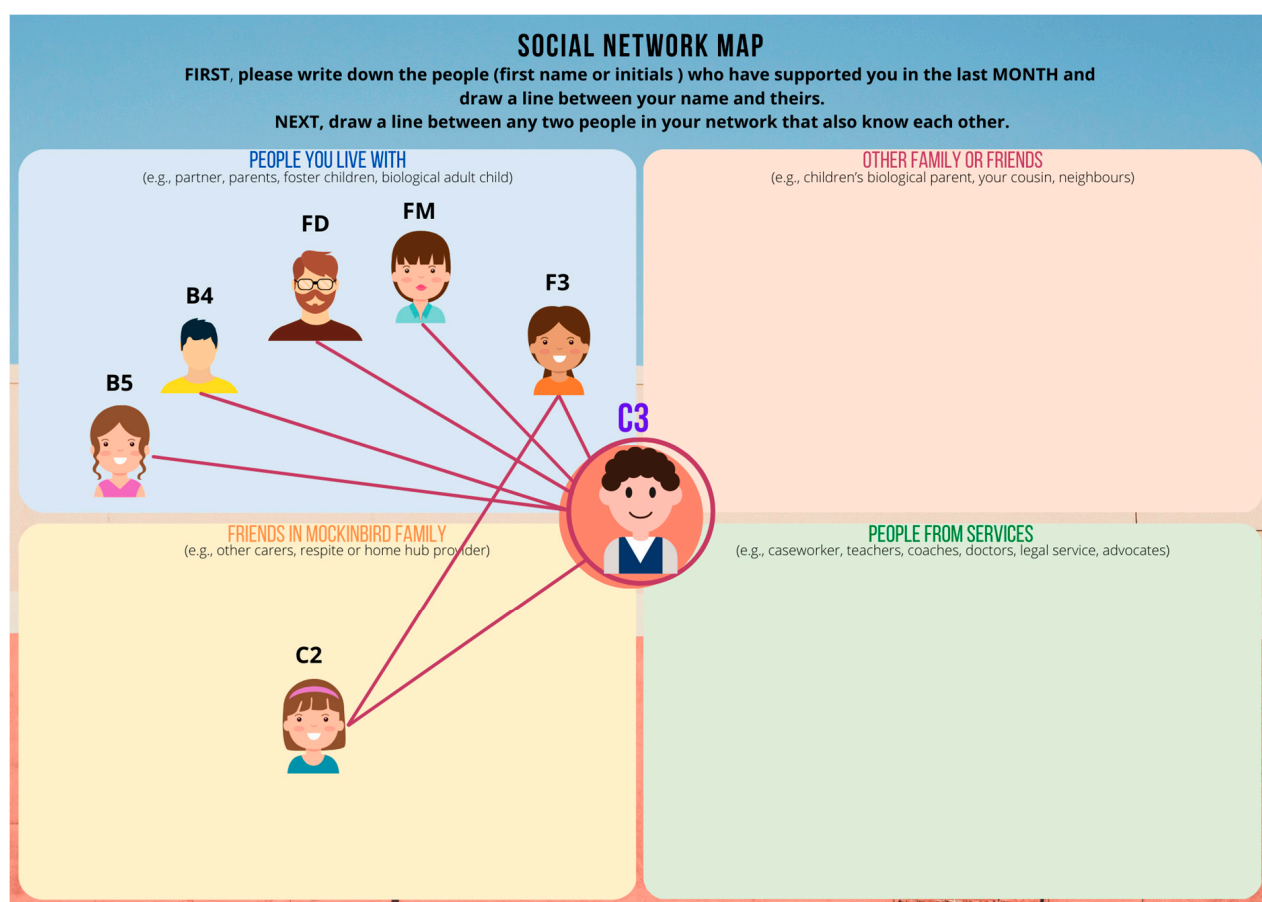


Figure 1. Example of a completed social network map.

As the children identified figures to represent people in their lives, they were guided to choose and place an image of themselves in the middle, then images of others, which they placed into relevant sections of their network map at a distance according to how close or important these people were to them. Alternatively, some children drew their own pictures. As this activity took place, the children and researchers talked about each person to keep track of everyone's involvement in the children's lives. The children were guided to draw lines linking the people to them (older children, not reported here, were able to draw cross-group links between people as known or perceived by them).

The researchers led conversation and activity with the children to enable transferring people located in the network map to a network grid, with some of the children choosing to use the same stickers to represent people in both the map and the grid. The network grid

details the social roles of each individual and the quality of their relationships (Figure 2). Some of the older children could follow the instructions without much support.

SOCIAL NETWORK GRID

1 Write down the people from your network map who support you at least monthly, and say what role they have in your life (mother, brother, aunt, etc.).

2 Within each of the coloured columns, circle any of the type(s) of support that person provides—for example, they may give you school/study support by offering advice or giving you social support by listening when you talk about things that are important to you, or help with extra-curricular activities by offering you a ride to footy training. (Note that some people may only support you in one or two ways in one or two columns.)

3 Circle how often they support you (for example, you see them every day, or they call you once a week, or meet with you each month), how close you feel to them, and how long you've known them.

1	2	3	4	5	6	7	8	9
First name or initials (as in your social network map)	Person's role in your life (as in your social network map)	People you live with	Other family or friends	Friends in Mockingbird Family	People from other services	How often do you connect?	How close are you?	How long have you known them?
FM	Foster mom	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
B4	Foster brother	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
B5	Foster sister	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
F3	Foster sister	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
FD	Foster dad	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
C2	MF friend	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
		Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
		Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
		Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months
		Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Talk to them Get info/guidance Ask for favours	Daily Weekly Monthly	Not close Close Very close	Less than a month 2-6 months Over 6 months

Figure 2. Example of a completed network support network grid.

In designing these instruments, the network parameters, including who should be included or excluded, were discussed during regular meetings with experts and a research advisory committee. This committee was constituted by employees from Life Without Barriers, from across Australia, and statutory child protection professionals. The instruments were reviewed for suitability by experts and the research advisory committee, followed by finetuning. We tested the final instruments with a sample of university student volunteers and children in the extended families of the researchers ($n = 5$).

2.2. Relational Dynamics

Data was collected through the paper-based map and grid, while the researchers also communicated with the children and made reflective notes. As part of data triangulation for cross-verification, we used other sources of data, such as the fidelity report about the children's profiles from the foster care agency, to increase the consistency and validity of our findings (not reported to preserve confidentiality). The network map and grid data were processed and coded using Microsoft Excel and then analyzed using an online software for social network analysis called Kumu (<https://kumu.io>, accessed 2 December 2022), created in 2011 by Jeff and Ryan Mohr.

Kumu is a powerful and flexible mapping tool that can be used to organize and visualize data and information from simple to complex social networks. Kumu produced a social network map consisting of elements, connections, and loops. Elements were represented by different shapes such as circles, triangles, or rectangles that represented children and their immediate family members who support them; connections were lines that linked the

elements; and loops were clusters of two or more connections. Prior to introducing development perspectives, the SNA metrics function was used to identify key individuals who perform significant or not-so-significant roles in the children's social networks. A graph manipulation was executed, and selected metrics measures were retrieved in accordance with the most informative attributes for understanding the networks of children in the Mockingbird Family constellations.

Figure 3 shows a KUMU visualization of the social network of three children in one of the Mockingbird Family constellations. There are 28 individuals in total, inclusive of the three children. In Figure 3, children 1 (C1), 2 (C2), and 3 (C3), represent the three children surveyed. C1, who is the eldest child, identified 16 people in their network (Figure 3a), C2 identified 11 people (Figure 3b), and the youngest child, C3, identified 6 people (Figure 3c).

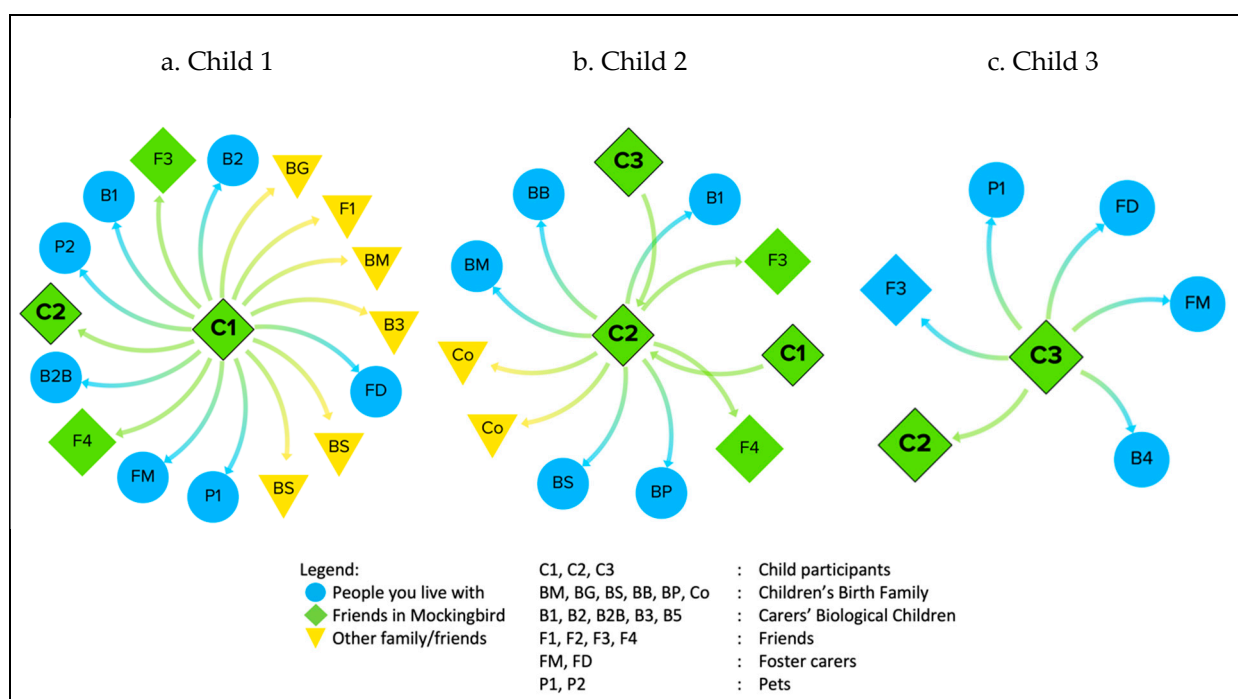


Figure 3. Individual networks for each of the three children.

The number of people in each of the children's networks positively correlated with age. Each child could identify "people you live with" (circles), "friends in Mockingbird" (diamonds), and "other family/friends" (triangles). None were able to identify "people from services" (Figure 3). For "people you live with", C1 and C3 mentioned foster mom (FM) and foster dad (FD) whereas C2 identified her biological family members. Incidentally, we observed in the broader study that children in the Mockingbird Family were more likely to identify as living with biological family when they had experienced multiple, frequent placement changes. The eldest child (C1) included pets (P1 and P2) as "people you live with", showing that pets were meaningful to him/her.

In Figure 4, we bring together the three children's networks. Figure 4 shows the "in-group" network of these three children in a single Mockingbird Family constellation. There were five children, inclusive of the child participants, represented by interconnecting nodes in the in-group network diagram.

Kumu provides twelve metrics features for SNA to identify key individuals within a network based on their relationships. In this article, we present four important features based on betweenness, closeness, degree, and indegree centrality (Table 1).

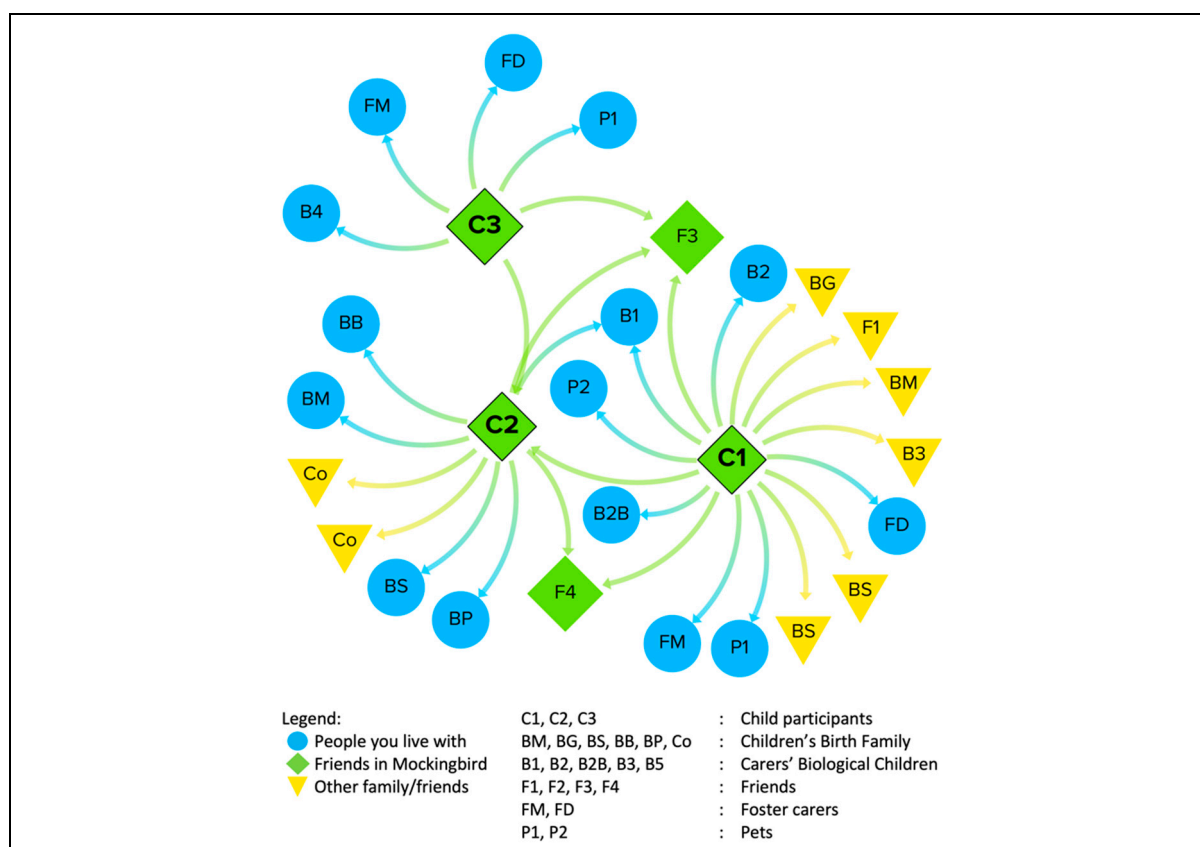


Figure 4. In-group network of three children in one Mockingbird Family constellation.

Table 1. Values on selected metrics.

	Label	Name	Value
Betweenness centrality	C2	Child 2	0.020
Closeness centrality	C1	Child 1	0.704
	C3	Child 3	0.370
	C2	Child 2	0.333
Degree centrality	C1	Child 1	16
	C2	Child 2	11
	C3	Child 3	6
Indegree centrality	F3	Mockingbird friend	3
	C2	Child 2	2
	B1	Foster carers' bio-child	2
	F4	Mockingbird friend	2

Betweenness represents the frequency with which an individual lies on the shortest path between two other individuals. C2 is the only child that has betweenness centrality (value = 0.020), which implies that C2 acts as a vital linker and is the key to the information flow within the network (Figure 5a). Without C2 present in the network, the group dynamics among children during Mockingbird Family gatherings may be unsettled. Alternatively, closeness centrality represents the proximate distance with all other people in the network, as shown in Figure 5b, C1 has the highest value of closeness centrality (0.704). C1 is regarded as an effective communicator and usually has high visibility into what is happening across the network (Figure 5b).

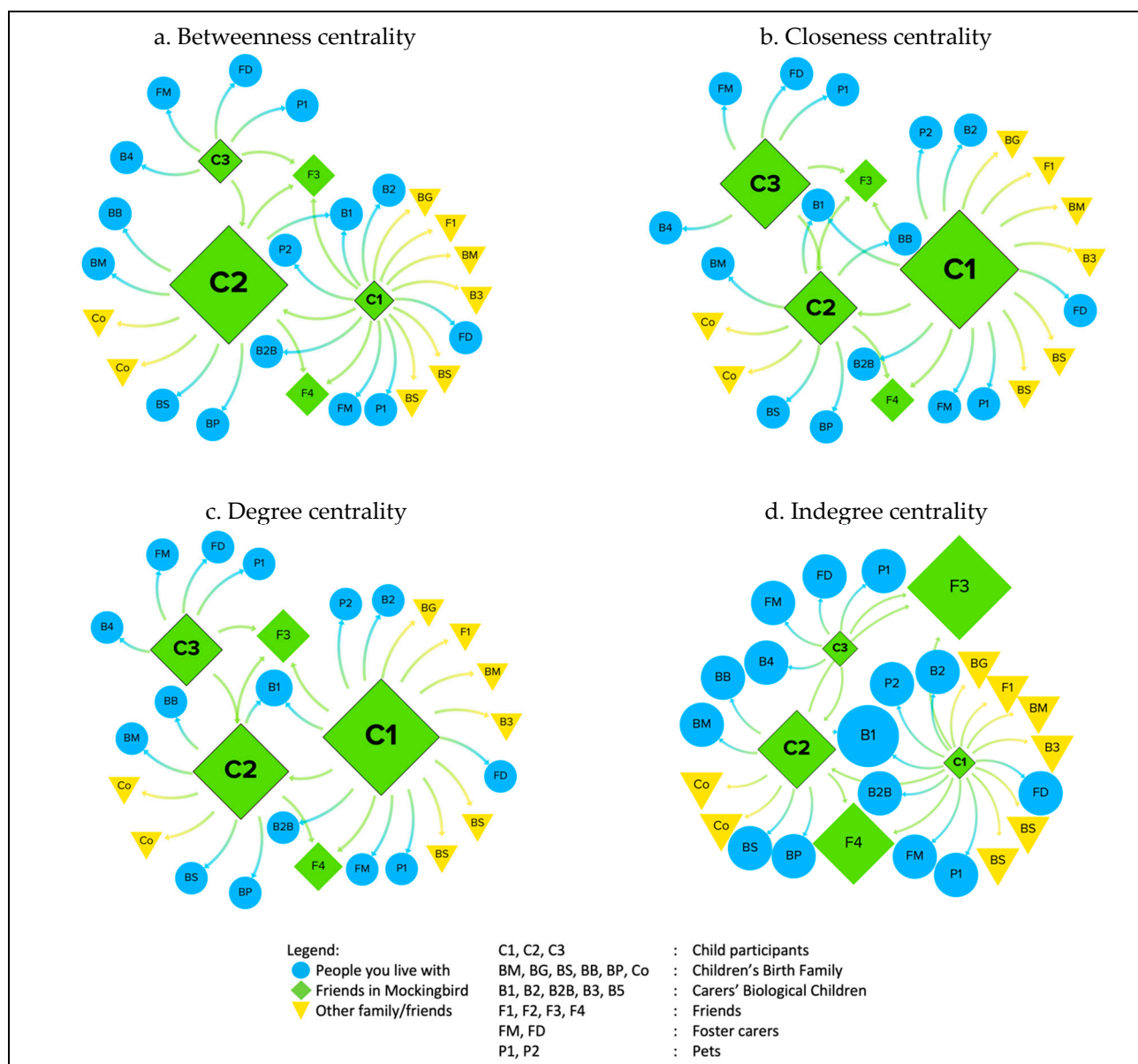


Figure 5. Visualization of selected metrics.

Degree and indegree are measured by the number of connections a child has. For example, degree is calculated based on the total number of an individual's links, and indegree is based on the number of nominations an individual has received. The highest value of degree centrality observed is for C1 (16), which implies that C1 has the highest number of connections. This may indicate C1 as the best individual networker, although the child is not necessarily the best connected to the network being examined (Figure 5c). Figure 5d shows that F3 has the most value, or indegree centrality, which is calculated based on the number of incoming connections. The role of F3 among these three children is considered crucial as it represents the leader of the children's support network, and a top influencer among other children.

2.3. Socio-Developmental Network Narrative

Following the quantitative analysis, outlined in the previous stage, an explanatory contribution is needed to integrate an understanding of development, assumptions, and interpretation into the social network. It is this final phase of SDNA that involves combining all the data and "meaning" generation, which Yousefi Nooraie et al. (2020) infer

as a “qualitization or qualitative profiling process”. [Dahler-Larsen \(2019\)](#) suggests that qualitization is not merely narrating the measurement but also making assumptions about what makes measurements trustworthy and what repercussions the resultant idea of quality should have for different groups. Hence, qualitization should contain normative and prescriptive elements.

Using these three Mockingbird Family children as exemplars, we could assume that as children grow older, their perception of support from friends and adults may increase across contexts. Based on Erikson’s eight stages of psychosocial development, children in our study are categorized into industry vs. inferiority or competency stages (aged 5–12 years). During this stage, children begin to take an interest in the given skills and tasks, or “the tool world”, and start to develop work ethics through sturdy attentiveness and determination ([Erikson 1950](#)). Children who are supported and affirmed for their initiative start to feel competent and confident. If their initiatives are not supported, they develop a sense of inferiority. Each developmental stage is a crisis, in which the children can progress, regress, or become stuck, and the resolution of each stage is thought to be a prerequisite for the resolution of the next stage. In consideration that most, if not all, of the children in the Mockingbird Family have experienced trauma in their early lives, multiple separations, and transitions, knowing how to best support these children to adaptively accomplish their developmental skills and tasks is challenging. Studies indicate that early exposure to trauma is not significantly associated with competency ([Hubbard 1997](#)), coping skills ([Vaughn-Coaxum et al. 2018](#)), or adaptive functioning skills ([Cassell 2013](#)). In fact, the level of system support is statistically related to adaptive functioning skills ([Cassell 2013](#)). An SDNA approach has the capacity to shed light on the importance of strengthening children’s social support to develop behavioral adaptations to encounter transitional stress. Applied longitudinally, SDNA can show intervention effects.

At the time of data collection, the Mockingbird Family in Australia was in its early implementation stage. This meant that the children and members of the constellations were adjusting to their new families, system processes, and environments. As the model diffuses, scales up, and constellations are sustained, a longitudinal analysis using SDNA has the potential to show associations between the strengthening of children’s social support systems and improvements in their development and behavioral adaptations related to transitional stress. As a newly developed group, according to Schutz’s FIRO (Fundamental Interpersonal Relation Orientation) theory, children go through a three-stage group development, i.e., inclusion, control, and affection ([Schutz 1966](#)). These three things constitute individuals’ interpersonal, group, or social needs that can explain and predict interpersonal phenomena. The unfulfillment of these needs leads to prolonged dissatisfaction and can cause illness and death ([Schutz 1966](#)). A recent study by [Lin and Roan \(2022\)](#) applied this theory to identify the stages of development of virtual teams in young-people groups to assist organizations in improving performance.

The inclusion stage is characterized by the need to create and sustain a satisfactory relationship with people by initiating interaction with all people and being able to establish and maintain reciprocal interest with other people. During this stage, children begin their group life and are apprehensive about whether the group will accept them as members. Children need to feel that they are significant and worthwhile. In the control stage, children begin to focus on their roles and group dynamics. Children play the role of leader and try to influence the opinions of others. In the last stage, affection, children comfortably know each other, engage in group activities, and establish emotions.

In offering our example of SDNA methods with three children in the Mockingbird Family, we locate them in the inclusion stage. They have started to build and maintain interpersonal relationships with both peers and adults in the Mockingbird Family. Child 2 has stand-out features, referring to all four metrics (#1 betweenness, #3 closeness, #2 degree, and #2 indegree). Child 2 was the only one to have both degree and indegree values (see Table 1). This may suggest that Child 2 has been able to build reciprocity with his or her peers. We cannot yet conclude that the children are in the control stage. However,

our analyses predict the power and control structure of the network of these children in the Mockingbird Family, forecasting who will act as a leader, influencer, facilitator, or communicator in the group.

3. Discussion

This study provides important insight into the theoretical, methodological, ethical, and practical considerations of social-developmental network analysis (SDNA). The theoretical component is based on an intersection of social network analysis and children's social development-related theories. SDNA adopts a fused mix-methods approach, comprising a three-step model for researching the social network of vulnerable populations. From an ethical perspective, this research emphasizes the collaboration between the research team, foster care, agency, and statutory department to ensure the children are protected and their safety and welfare is not compromised by their participation in research. Lastly, this study provides practical contributions that can be applied in the realms of practice, policy, and research.

The theoretical stance of SDNA was established by integrating two distinct fields: social network analysis and children's social development. This integration allowed for a deeper understanding of the complex nature of social networks in the context of children's development. Erikson's psychosocial development theory explains that children in our sample are situated in one of the eight stages, each of which presents a unique psychological crisis that must be effectively resolved for individuals to advance to the next stage (Erikson 1950). Other theories, including social learning theory, attachment theory, and ecological systems theory, may also offer a valuable theoretical foundation for understanding the social developmental network of children in care and the factors that contribute to their social development (Bandura 1977; Houston 2017; Tavecchio and van Ijzendoorn 1987). Social learning theory highlights the role of modeling and reinforcement in children's social behavior, while attachment theory stresses the importance of early attachment relationships with caregivers for healthy social and emotional development. Additionally, ecological systems theory underscores the significance of considering multiple contexts in which children develop and how they interact and influence each other across various system levels. Schutz's three stages group development theory consisting of inclusion, control, and affection provides useful paths in the development of children's social network. By understanding where children are in terms of their group development, carers, agencies, and statutory departments can better support their social and emotional needs. Efforts can be made to support the formation of connections, fair power dynamics, and close relationships between children in care and their peers, as well as their carers and extended family.

Quantitative approaches have long been the preferred method in SNA. Qualitative methods are useful in conjunction with quantitative approaches in social network research to create in-depth understandings of the structure and meaning of interactions, as well as the diversity of social networks (Froehlich et al. 2020). In this sense, SNA is located in an array of fusion between quantitative and qualitative data, analysis, and interpretation and, hence, is deemed to be part of a mixed-methods inquiry (Creswell 2018; Yousefi Nooraie et al. 2020). In SNA, researchers used a mix of traditional and novel philosophical paradigms of mixed-methods methodology. For instance, Cooray (2021) introduced the term "fusion of horizons" by infusing researchers' subjectivity into SNA; and Verd (2022) used a single "hybrid" (quantitative and qualitative) data collection tool in SNA. As we stated at the beginning of this paper, social networks are complex, and different methods are of value for assessing the networks of children in different contexts and with relevance to their purposes. The endeavor of strengthening children's safe, protective, and supportive environments warrants a development adage for SNA.

A child welfare system is intended to serve vulnerable children who are at high risk of poor growth and development outcomes. Within the system, public and private institutions in their localities work collaboratively to improve children's well-being by ensuring

safety, attaining permanence, and strengthening families to satisfactorily look after their children. Children have a complex spectrum of behavioral and emotional symptoms due to prior and/or past trauma, which neither the children nor the adults working with them have attributed to this earlier trauma exposure (Stevenson 2022). As a result, children may receive inadequate and disjointed responses that could potentially be re-traumatizing (Hood 2014; Moss and Lee 2019). Professionals who work with children, young people, and families need a shared understanding of the ongoing effects of childhood trauma and should treat high-risk children with consistent trauma-informed and child-centered approaches that are developed collaboratively, including with children (Driscoll et al. 2020; Montgomerie et al. 2022; Truter and Fouché 2021). To introduce a further element of vulnerability, the fact that children who are in statutory care are from diverse backgrounds requires the adults working with them to also practice socio-cultural sensitivity. In joining the dots in the research, it is crucial to find methods for the children that enable understanding what is happening, in association with strategies implemented to protect them.

Research that is concerned with vulnerable children who experience early life adversities can be ethically and methodologically challenging. However, children are viewed as active and engaged participants in research as well as experts in their own worlds, and hence are a prime source of knowledge production (McTavish et al. 2012; Stafford 2017). The UN Convention on the Rights of the Child embodies a view of children as competent knowledge producers who are carriers of their own rights. While there has been a growing recognition of children's participation in research, much remains highly managed by adults and heavily instilled with power relationships (Spyrou 2017). Reasons can be attributed to researchers, institutional factors, the research project itself, and the child's characteristics and circumstances (Powell et al. 2020).

The ethical and legal considerations surrounding research involving children in statutory care are of paramount importance. Based on our study, the following step-by-step guide provides an overview of how researchers can potentially navigate the ethical challenges of conducting research with foster care children: First, understand the legal and regulatory framework: before beginning any research, it is essential to understand the legal and regulatory framework that governs research involving children in foster care. Second, build a collaborative relationship with stakeholders, which includes working closely with foster care agency, carers, and advocacy groups to gain their input and support, and engage with children and their carers to build trust and establish a rapport. Participatory methods provide opportunities for children to express their experiences and allow the exploration of unanticipated aspects of their experiences, and their own language can be used comfortably and subjectively. Third, obtain informed consent: this can be challenging for children in statutory care, as they may have a limited understanding of the research process or may be hesitant to participate due to fear of retribution or negative consequences. Fourth, ensure participant protection by minimizing harm and protect the privacy and confidentiality of participants. Fifth, monitor and evaluate the research process by regularly assessing the potential for harm, and take steps to mitigate risks as necessary.

The potential benefits of the study exploring the social support network for children in the Mockingbird Family are manifold. It can help improve the social support network available to children in care, boosting their well-being and stability. Furthermore, it can identify any gaps in the social support network and provide insight into ways to better support foster families and carers. Professionals, such as social workers and social welfare and health staff, can use the study findings to develop better policies and practices that support the social network needs of children in foster care and their foster families. Finally, researchers and academics can use the study to contribute to the existing body of knowledge on foster care and social support networks, informing future research in this area.

We hope that by sharing our methods used to engage, understand, and analyze the social and developmental experiences of children in the Mockingbird Family, this will fill some gaps and inform researchers of new ways of conceptualizing and approaching research with children in the context of statutory care.

4. Conclusions

The inclusion of children in research is dependent on the researchers' understanding and application of appropriate research methods. SDNA can be used to assist researchers in comprehending the children's relational structure. Using a three-technique approach, our method for SDNA is consistent with a fused mixed-methods design. Mixing both qualitative and quantitative data within one inquiry allows for a more comprehensive and synergetic use of children's network data. The KUMU software application has been shown to be user-friendly and advantageous for children's network data representation. Applied longitudinally, it can unearth rich understanding, to enable the visualization of micro-system change over time. While we drew exemplars from our broader study of the Mockingbird Family in Australia to explain SDNA as a method, it has valuable applications in the static and longitudinal mapping of the social networks of children associated with other social, developmental, and environmental system interventions. This study highlights the crucial role of measuring and evaluating social support networks for foster children, which can have significant practical and policy implications for the fostering community. Enhancing and improving these networks can provide better support to foster children and foster positive outcomes for their well-being and developmental journey.

Research with children is complex, with the validity of results reliant on many internal and external factors. A limitation of research methods involving children is that results may be influenced by cognitive ability and concentration span. The professional expertise of the researchers in being able to assess the cognitive age of participants, to ensure the suitability of data collection tools and methods, is needed. The analysis of exemplars in this article does not have generalizability to other foster care settings or cultural contexts, as it was conducted in a specific location, at a specific time and with a specific population. We acknowledge that the children may have had difficulty accurately recalling specific events or experiences. Without a control group, it would be difficult to determine whether the observed effects of the exemplars represent program outcomes or if they are simply due to other factors such as individual differences or external events. Further, SDNA may not be able to capture the full scope of the social networks and developmental contexts of children as it may be difficult to measure the level of interaction between different family members and the wider social networks of the children.

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