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Order of recall and meaning of closeness in collecting affective network data

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ABSTRACT

The paper investigates how study participants handle the so-called "hierarchical mapping technique", an affective name generator developed by Antonucci (1986), which is accompanied by a diagram enabling respondents to compare alters with regard to different degrees of closeness. By applying the thinking-aloud method, we identified three patterns in the order of recalling alters: closeness as overarching schema (with either role relationships or relationship properties as subordinate schema), roles and foci as overarching schema, and a fraying schema. In addition, we investigated how study participants understand and interpret "closeness". The meanings of closeness can refer to various relationship properties, cultural framing, and relationship dynamics. Results show that specific meanings of closeness are related to different recall patterns. Furthermore, recall patterns vary according to the socio-economic status of the participants. Finally, implications for the construction of name generators and data collection are discussed.

1. Introduction

Collecting egocentric network data poses complex cognitive challenges for study participants. As in any question-based research, participants have to comprehend questions and instructions, retrieve memories, judge the completeness and sufficiency of memorized information, and select and report an answer (cf. Tourangeau et al., 2000). When collecting egocentric networks by means of a name generator, respondents have to understand the stimulus, activate cognitive patterns in order to remember and compare different alters, and finally elicit alters in a certain chronology (Marsden, 2011). In order to develop appropriate, valid, and reliable data collection instruments, it is necessary to understand how people store and recall information regarding their social relationships.

These issues are even more pressing when the number of alters that can be named by participants is limited, as is often the case in surveys or interviews (e.g., respondents are asked to name their three closest friends; Fischer, 1982; Laumann, 1973) mostly for research economic reasons (survey time) and in order to reduce interviewee burden. Therefore, whom participants name first, and whether they always enumerate their most important alters (with regard to the respective stimulus) first, are crucial questions. The order in which respondents recall alters is pivotal for determining whether a name generator always captures the core network, and thus is critical for the construction of name generators.

In this paper, we present results of an empirical study in which we investigated how people recall their social partners using the affective name generator developed by Antonucci (1986). This name generator is dedicated to grasping personal networks and asks for close and important alters. It is accompanied by a visual tool, the so-called 'method of concentric circles', that allows participants to compare alters according to different degrees of closeness. We investigate whether and how the possibility of comparing alters according to different categories influences recall patterns. We explore how participants proceed with this instrument, the order in which participants recall their alters, and how they understand the stimulus for closeness.

1.1. Free recall patterns

Name generators are widely used tools in social network research to elicit and describe egocentric networks (e.g., Campbell and Lee, 1991; Marin and Hampton, 2007; van der Poel, 1993). Usually, one distinguishes four kinds of approaches for constructing name generators: the role-relation approach (e.g., asking for friends, cf. Laumann, 1973), the

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exchange approach (e.g., asking for specific types of social support, cf. Wellman and Wortley, 1990), the interaction approach (e.g., asking for daily contacts, cf. Fu, 2005), and the affective approach that focuses on people who are personally important (e.g., asking for close persons, cf. Wellman, 1979).

In the past three decades, several studies explored free recall processes, mostly[1] focusing on specific populations such as college or graduate students (Brewer, 1993; Parks and Floyd, 1996; von der Lippe and Gamper, 2017) or specific research contexts such as religious communities (Brewer and Yang, 1994). Many studies uncovered recall patterns for different name generators (e.g., Bell et al., 2007; Bond et al., 1985; Brewer, 1993, 1995; Brewer et al., 2005; Brewer and Yang, 1994; Fiske, 1995; Marin, 2004). Results indicate that strong ties, intense interactions, and high-status alters are being recalled more often and earlier during data collection (e.g., Burt, 1986; Wellman, 1979; for a review see Brewer, 2000). Brewer (1995) asked participants in three studies to enumerate all members of certain communities they belonged to, i.e., a graduate program, a religious fellowship, and a section of a university. He shows that respondents tend to name alters first and foremost in the order of salience and social proximity, in addition to visibility and status. Similarly, Burt (1986) reports for the "important matters" generator in the General Social Survey that the maximum five named alters are elicited in order of declining tie strength and decreasing frequency of contact. After naming all alters, respondents were asked if they felt "equally close" to every enumerated alter or if the alters were "especially close" or "less close." Respondents show on average a continuous decline with regard to closeness, but a steeper decline within the first three recorded alters than across the fourth and the fifth alters. Furthermore, Burt (1986) reports the spouse being most likely to be named as first discussion partner. In his study on intimate networks of East Yorkers, Wellman (1979) asked respondents to name close alters outside the household in descending order (i.e., the closest person first). Respondents then were likely to name family members (especially children and parents) in the beginning and neighbors and co-workers at the end. In a study on the recall of kin, Hammel (1984) shows several serial order patterns for Serbian respondents. Among other patterns, the respondents recall close relatives before distant relatives, generationally close relatives before generationally distant relatives, and consanguines before affines.

Most research on free recall focuses on associative recall patterns, i.e., how alters that are recalled consecutively are related to one another. This research on the processes of social memory and information retrieval has shown that certain cognitive schemata underlie respondents' recall (i.e., mental structures; e.g., DiMaggio, 1997; Freeman, 1992; Krackhardt and Kilduff, 1999). Those schemata can be understood as "mental frameworks that organize the processing of information and influence its recall from memory" (Brashears, 2013, 1) and therewith "function as compression heuristics" (ibid.). Such schemata can be individual characteristics (e.g., gender), spatial location, or relational characteristics (e.g., interpersonal interaction). They help in clustering alters in recall (e.g., Brewer, 1993, 1995; Brewer et al., 2005; Fiske, 1995).

For enumerating social relations, social clustering – i.e., recalling alters in clusters of linked individuals – seemed to be the predominant schema for clustering alters (e.g., Bond et al., 1985; Brashears and Quintane, 2015; Brewer, 1995; Freeman, 1992). Brashears (2013) distinguishes two dominant kinds of social clustering: structural schemata (i.e., network-specific features such as reciprocity) and cultural schemata (i.e., culture-specific norms such as kinship systems). Recalled clusters indicate various network microstructures, such as triads or cliques (cf. Brashears and Quintane, 2015). Classifying alters into social clusters goes hand in hand with different search strategies people use to enumerate alters. In this respect researchers distinguish between categorical searching (i.e., people enumerate all alters belonging to a certain social category, such as the core family, before turning to other alters) and associative searching (i.e., searching for alters with a similar social proximity, e.g., knowing each other, independently of whether they belong to the same category; cf. Hills and Pachur, 2012). Other searching strategies are frequency (e.g., ties with a similar frequency of contact) or foci (e.g., ties among people who share the same interest, Feld, 1981).

Additionally, qualitative research has shown that name generators can activate different social and cognitive concepts that are meaningful for the recall (Bailey and Marsden, 1999; Bearman and Parigi, 2004; Small, 2017). Using a thinking-aloud approach, Bailey and Marsden (1999) investigated respondents' interpretations of the "important matters" name generator used in the General Social Survey (Burt, 1984). The authors observe a wide range of interpretative frames for discussing important matters, such as literal interpretations (e.g., losing a job), vague general interpretations as well as translations into the intimacy of a relationship, or the frequency of contact. Moreover, Bearman and Parigi (2004) found evidence for a statistically significant association between the discussed topic and the alter's role (e.g., discussing money issues most likely occurs with the spouse). There is also some evidence that the individual meaning of the concept varies by social status and gender (Bearman and Parigi, 2004).

1.2. The affective network approach

The affective network approach is often used when (egocentric) personal networks are studied. Depending on the stimulus, different subsets of a personal network can be cognitively activated and mobilized (cf. Menon and Smith, 2014; Shea et al., 2015; Small, 2017; Smith et al., 2012), such as close ties, intimate ties, or ties that are important in certain respects (e.g., van der Poel, 1993). Test-retest studies investigating the stability of networks and processes of forgetting and remembering alters (cf. Brewer, 2000) have shown that affective name generators have, with regard to network size and network stability, a relatively weak test-retest reliability in contrast to exchange name generators and role relation name generators (e.g., Bass and Stein, 1997; van Groenou et al., 1990). At the same time an affective name generator is the most suitable approach for eliciting strong ties (e.g., Marsden and Campbell, 1984; van Sonderen et al., 1990), especially first-degree relatives (van Groenou et al., 1990).

A special feature of dimensions such as closeness or importance is that participants themselves define what it means to them (cf. Kogovšek et al., 2018). In other words, what closeness means to people might vary between individuals, or within individuals, i.e., with regard to different alters or according to different phases in the life course (Carstensen, 1993). E.g., Park and Floyd (1996) investigated the meanings of closeness in friendship and found that people use various aspects for describing someone as close (cf. also Bellotti, 2008; Fischer, 1982). They found self-disclosure (e.g., "telling each other everything") to be the most frequent category for labeling someone as close, followed by help and support (e.g., emotional support), shared interests (e.g., activities), relational expression (e.g., expression of the value of the relationship), comfort and ease (e.g., interacting easily), trust (e.g., sharing and keeping secrets), acceptance (e.g., no need to impress the other), frequent interaction, global affect (e.g., liking), understanding (e.g., empathy), length of relationship (e.g., duration), advice and perspective (e.g., sharing viewpoints), and respect (Parks and Floyd, 1996). Furthermore, Parks and Floyd (1996) show that closeness is a multiplex concept, i.e., participants combine up to seven different meanings for describing someone as close.

1.2.1. The hierarchical mapping technique

The so-called 'hierarchical mapping technique' (or 'method of concentric circles') developed by Toni C. Antonucci (1986, cf. also Kahn and Antonucci, 1980) is a prominent affective name generator that is

[1] See Burt (1986) for an exception.

widely used in social psychology, gerontology, and social support research (e.g., Antonucci et al., 2004; Hollstein, 2002; Lang and Carstensen, 1994; van Sonderen et al., 1990; Wagner et al., 1999). This name generator asks for closeness and importance and accompanies a verbal stimulus with a visual stimulus in the form of a network map. The instrument uses a standardized model of three concentric circles depicting three different degrees of closeness. The three degrees of closeness represent components of the 'social convoy model' (Kahn and Antonucci, 1980). In this model, each circle is related to certain types of social support characterized by closeness, composition, and duration. Kahn and Antonucci (1980) assume the inner circle to comprise very stable, long-term, and strong supportive ties such as the spouse, close family, or close friends. The second circle consists of close and supportive relationships that are not necessarily role-dependent ties. Finally, the outer circle represents more distant, rather vulnerable, and uniplex role-dependent ties, e.g., neighbors, acquaintances, or professionals.

According to their theoretical assumptions, empirical studies find a declining number of different kinds of support from the inner to the outer circle, with the inner-circle alters providing multiple and crucial kinds of support, while many outer-circle alters provide only one type of support, such as respect (e.g., Takahashi, 2005). On average core family members are more likely to be placed in the first circle, friends are more likely to be in the second circle, and acquaintances are more likely to be in the third circle (Takahashi, 2005 similar Antonucci et al., 2004). In an evaluation study, van Sonderen et al. (1990) found that compared with exchange and role-relation approaches the method of concentric circles especially elicits "the long-term, more ascribed, and highly valued ties". Nadoh et al. (2004) show that participants use three criteria in order to place ties into the three circles: type of tie (i.e., role relation), quality of tie (i.e., degree of closeness), and formal properties (e.g., regular contact). According to these criteria, most respondents draw hierarchical distinctions in order to differentiate alters among the circles, and some participants mix several criteria (Nadoh et al., 2004).

A special characteristic of the hierarchical mapping technique is that it combines a verbal name generator with a visual stimulus (i.e., three concentric circles around ego). The concurrent visualization with a network map or network diagram is a feature increasingly employed in egocentric network data collection (e.g., Dobbie et al., 2018; Hogan et al., 2007; Maya Jariego and Cachia, 2019; McCarty et al., 2007; Ryan et al., 2014; Tubaro et al., 2016). Such a network visualization facilitates comparisons among network members and at the same time helps to maintain an overview of the relationships, thus functioning as a cognitive aid when recalling one's relationships (e.g., Dobbie et al., 2018; Ryan et al., 2014). Von der Lippe and Gamper (2017), comparing a classical non-visual name generator with an affective name generator asking for importance accompanied by a visual network map (similar to Antonucci's concentric circles), show that visual maps can – under certain conditions – function "as a motivational and cognitive scaffold" for eliciting alters (von der Lippe and Gamper, 2017, 436). Additionally, visual tools engage participants and reduce fatigue (Dobbie et al., 2018; Ryan et al., 2014). In qualitative settings, the map can serve as a narration generator when exploring practices and meanings of social relations (e.g., Bernardi, 2011; Hollstein, 2002; Ryan et al., 2014).

In contrast to the majority of name generators, the hierarchical mapping technique is special in certain respects. First, it distinguishes three degrees of closeness. Using these, respondents are challenged to compare different qualities of the stimulus criterion. Moreover, the stimulus does not preset a specific recall order (e.g., enumerating the closest alters first). Regarding such tools, it is unknown whether the serial order patterns that have been found for other name generators (e.g., strong ties are recalled earlier and more often than weak ties, cf. Brewer, 1995, Brewer, 2000; Burt, 1986; close relatives are named earlier than less close relatives, cf. Hammel, 1984; Wellman, 1979) can be transferred to instruments that display more than one layer. Secondly, the hierarchical mapping technique uses a verbal and a visual stimulus simultaneously. The increasing use of network maps has, so far, not found appropriate consideration within the research on recall patterns. Hence, evidence is scarce as to how the concurrency of verbal and visual stimuli might influence the serial order of recall in particular, i.e., how comparing three degrees of closeness and maintaining a visualization of the elicited network while data is being collected might influence how respondents compare and differentiate alters and in which order they recall names.

1.3. Research questions

Addressing these shortcomings, we investigate in the following how people recall their social relations using Antonucci's affective name generator (1986).

First, we ask how respondents order their alters. Do respondents always name their closest alters first? Which clustering schemata and search strategies do participants use when recalling alters? Which serial order patterns can be identified? Are there any indications, that ordering schemata influence the elicited network data?

Secondly, we want to explore the participants' understanding and concepts of closeness. Do participants make use of the possibility of comparing alters provided by the visual tool? Do they compare alters, and if so what criteria do they use to distinguish between very close, close, and less close network members? Is the order of recall or the placement of alters within the diagram linked to participants' concepts of closeness?

Thirdly, since most studies concentrate on specific social groups we want to explore whether socio-demographic differences (e.g., concerning gender, age, or socio-economic status) affect how respondents recall network members and /or their understanding of closeness. Where such differences exist in a group being studied, they might be quite consequential for both the construction and the implementation of network data collection instruments and the interpretation of network data.

2. Study design and methods

In order to address these questions and to investigate the order of recall and the meaning that social relationships have for participants, we conducted face-to-face interviews combining the ego network data collection with the thinking-aloud approach (Ericsson and Simon, 1993), i.e., asking participants to verbalize their thoughts during and after the data collection process.

2.1. The affective name generator

In this study, we employed the affective name generator based on Antonucci (1986), which is also known as the "hierarchical mapping technique" or "method of concentric circles." This instrument consists of a map with an inner circle representing ego and three concentric circles representing differing degrees of closeness (very close, close, and less close persons; cf. Fig. 1).

We employed the classic concentric circles map along with two modified maps that are shaped differently but also comprise three segments and the same name-generating questions. These modifications are two variants of the so-called funnel tool (Hollstein et al., 2013), a trapezoidal-shaped network map representing ego's view outward to the world, originally invented for use with touchscreen computers that lie flat on the table in front of the respondent.[2]

The affective name generator asking for close and important alters reads as follows (cf. Antonucci, 1986; adapted from Berlin Aging Study, Wagner et al., 1999):

[2] A study comparing the three different maps did not reveal any significant differences in network size or network composition among these three differently shaped tools (Hollstein et al., 2020).

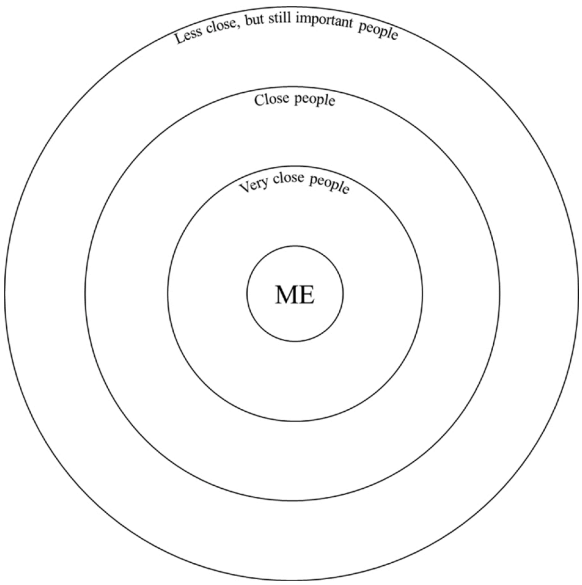


Fig. 1. Standardized network map based on Antonucci (1986).

"Please look at this sheet of paper. Imagine you are in the circle [or "field" for the variants of the funnel tool] labeled 'ME': In the first circle [field], you shall put all people to whom you feel very close, so close that it would be hard to imagine life without them. In the second circle [field], you shall put all people to whom you don't feel quite so close compared to those in the first circle [field]. In the third circle [field], you shall put all people to whom you feel less close, but who are still important."

For data collection, we applied a paper-and-pencil mode that can be used in order to avoid artifacts related to technological literacy (cf. Hogan et al., 2007). After reading the stimulus, we asked the participants to write the initials of the elicited alters on little sticky dots and place them on the map while thinking aloud. For the data collection, we set no limit on the number of alters in order to focus on the participants' relevance structures, notice processes of fatigue, and track whether participants also name important alters later in the interview.[3] Because of not limiting the number of alters, we were able to capture alter-alter relations by having respondents encircle alters belonging together on the network map, as in Hogan et al. (2007).

2.2. Thinking-aloud technique

The network data collection was combined with a semi-structured qualitative interview using a thinking-aloud approach. To familiarize participants with thinking aloud, we implemented a warm-up exercise, asking the respondents to think of the windows in their home and verbalize every thought and association on that subject. After this exercise, we asked participants to verbalize their thoughts and associations during the data collection (i.e., concurrent thinking aloud). After finishing the ego network data collection with its concurrent thinking aloud, we started a retrospective thinking aloud part. To take into account the possible ambiguity in meanings for close and important relationships, we asked participants to describe their understanding of "closeness" and "importance" (e.g., "What does it mean for you being close to someone?" "What is important about a social relation?" "What persons did you not enter?"). In order to understand the recall process, we asked respondents about their procedure during the data collection (e.g., "How did you proceed in retrieving persons and arranging them on the map?" "In which order did you record the persons?" "To what extent did you try to illustrate differences between persons?").

In general, participants handled the thinking-aloud task in quite different ways. Some participants offered very detailed associations and perceptions while recalling alters, while others were very reserved in thinking aloud. Despite gently encouraging attempts to think aloud concurrently, the retrospective thinking aloud about the participant's procedure and especially the meanings of closeness were, in general, more productive. In the retrospective part, some participants gave us very broad overarching statements on what closeness and importance means to them, while others reported very differentiated or multiple perceptions of single relationships, and differences in the meaning of several relationships when compared with each other.

2.3. Stratified sample

Many studies using network maps concentrate on specific populations only (e.g., students). In order to investigate the data collection process for a wider range of social groups, we systematically stratified the sample according to gender, age, and socio-economic status (see Table 1). Age is divided into three groups representing different stages of the life-course: "young adults" (18–30 years), "middle-agers" (40–50 years), and "young old" (60–75 years). Socio-economic status is also divided into three groups ("low", "middle", "high"). Criteria for operationalizing status were the highest educational achievement, training qualifications, and occupational status[4] . To enable group comparisons, we targeted even sample groups, i.e., every combination of the sampling criteria (i.e., gender, age, and socio-economic status) was supposed to be represented in the sample equally. In order to recruit participants, we placed ads online and offline (i.e., university research lab, eBay classifieds, municipal bulletin board). Afterwards, we sent an online questionnaire on socio-demographic data to all those interested in participating. Based on the information provided by the potential participants, we recruited as participants those who represented the different combinations of gender, status, and age we had envisioned for the stratified sample. The final sample consists of 54 cases with a balanced composition according to our sampling criteria (cf. Table 1).

The field phase, including six pre-test interviews, took place in 2014 and 2015 in Hamburg and Bremen, two large cities in northern Germany. Participants were on average 45.13 years old (sd 15.78), 44.4 percent had at least one child, and 18.5 percent had a migrational background (here operationalized by having at least one parent who was not born in Germany).

Table 1
Sample.

Socio-economic Status	Female			Male		
	Age			Age		
	18–30	40–50	60–75	18–30	40–50	60–75
Low	3	3	3	3	3	3
Medium	3	3	3	3	3	3
High	3	3	3	3	3	3

[3] In the data collection also specific and unspecific prompts (i.e., follow-up questions on adding further alters) were integrated (cf. Hollstein et al., 2020). In the current paper we only analyze networks stimulated by the initial name generator, i.e., without any further prompts.

[4] High socio-economic status typically represents persons with an academic degree working in a prestigious occupation. Medium status is typically a non academic person with a profession requiring an apprenticeship and finally, lower status is typically a person with a low or no education certificate and a low skilled profession.

Table 2
Role categories and degree of closeness.

Role Category		Very close	Close	Less close	Total
	Number	29	4	0	33
Partner	within role	87.9%	12.1%	0.0%	100.0%
	within segment	11.8%	1.8%	0.0%	4.9%
	Number	76	14	6	96
Children and Parents	within role	79.2%	14.6%	6.3%	100.0%
	within segment	31.0%	6.5%	2.8%	14.2%
	Number	74	59	35	168
Other relatives	within role	44.0%	35.1%	20.8%	100.0%
	within segment	30.2%	27.2%	16.5%	24.9%
	Number	60	112	78	250
Friends	within role	24.0%	44.8%	31.2%	100.0%
	within segment	24.5%	51.6%	36.8%	100.0%
	Number	1	12	35	48
Acquaintances	within role	2.1%	25.0%	72.9%	100.0%
	within segment	0.4%	5.5%	16.5%	7.1%
	Number	1	3	5	9
Neighbors	within role	11.1%	33.3%	55.6%	100.0%
	within segment	0.4%	1.6%	5.7%	2.6%
	Number	0	3	41	44
Colleagues	within role	0.0%	6.8%	93.2%	100.0%
	within segment	0.0%	1.4%	19.3%	6.5%
	Number	4	10	12	26
Others	within role	15.4%	38.5%	46.2%	100.0%
	within segment	1.6%	4.6%	5.7%	3.9%
	Total	245	217	212	674
Total	within role	36.4%	32.2%	31.4%	100.0%
	within segment	100.0%	100.0%	100.0%	100.0%

Note: missing values: role relation was not captured for 20 alters.

2.4. Data analysis

The thinking-aloud approach provided rich qualitative data that allowed us to grasp participants' perceptions and meanings during and after the data collection. Combined with the visualization of respondents' networks, it enabled us to capture fundamental parts of the collection processes (e.g., reasons for eliciting alters, the order of recall, perceptions of closeness, and interactions). The interview data were analyzed by means of inductive qualitative content analysis.[5] In a first step, we identified and categorized focal interview passages on the case level. In a second step, we compared cases in order to expose different concepts of closeness, the order of recall patterns, search strategies, and clustering schemata.[6] Therewith we were able to draw intra- and inter-individual comparisons and better understand individual data collection processes and network representations.

3. Results

We will present our results in three steps. First, we describe the composition of the elicited affective networks (3.1). Second, we present the findings regarding the order of recall when using a name generator that explicitly asks participants to compare alters; we describe three major patterns of recall and illustrate how participants organize, link, and compare their alters (3.2). Third, we elucidate how participants understand and interpret the affective name generator. We describe different concepts and dimensions of closeness, how participants assign alters to different degrees of closeness, and how this relates to the placement in the diagram and the order of recall patterns (3.3).

3.1. Configuration of affective networks

Before turning to the question of how participants proceed with the affective name generator, we start with the description of the elicited networks and their composition (see Table 2). The average network size in our sample is 12.9 (sd 6.2; range 2–34); out of these 4.8 (sd 2.6) are "very close" alters, 4.1 (sd 2.7) are "close" alters, and 4.1 (sd 3.5) are "less close" alters. With regard to role relation, the networks consist of 0.6 (sd 0.5) partners, 5.0 (sd 3.9) family members, 4.7 (sd 3.8) friends, 0.9 (sd 1.6) acquaintances, 0.2 (sd 0.5) neighbors, 0.8 (sd 1.4) colleagues, and 0.5 (sd 0.8) other ties (e.g., professionals).[7] With regard to degree of closeness, we see that partners and family members are most likely to be very close ties, while acquaintances, neighbors, or colleagues are most likely to be less close ties (see Table 2). Friends represent the most heterogeneous role relation, with the majority of friends being classified as "close."

In addition, t-tests for comparing network size based on socio-demographic variables were calculated (see Table 3). Interestingly, the networks of low-status respondents are significantly smaller compared to middle-status participants and especially compared to high-status respondents. The difference between low and high status is mainly marked by a smaller number of friends ($_{x1} = 2.83$ (se 0.36), $_{x2} = 6.47$ (se 0.80), $t(33) = 4.16$, $p = 0.000$), respectively significantly fewer alters in the second segment ($_{x1} = 3.00$ (se 0.39), $_{x2} = 5.72$ (se 0.75), $t(34) = 3.21$, $p = 0.003$) and the third segment ($_{x1} = 2.39$ (se 0.36), $_{x2} = 6.11$ (se

[5] All interview quotes are anonymized and translated from German.

[6] In order to better understand the order of recall as determined by participants' concepts of social relations and the procedure for eliciting names, we decided to focus primarily on qualitative data. Using this data, we can illustrate overarching patterns of the whole recall, as well as subordinate patterns within the order of recall. We decided against quantitative sequence analysis (cf. Brzinsky-Fay and Kohler, 2010; Pollock, 2007) because of the theoretical and methodological difficulties inherent in calculating the unstandardized (i.e., differing in length) and multidimensional (i.e., three degrees of closeness and different role relationships) sequences we were dealing with.

[7] Within the interview we gathered more detailed and differentiated data on role relations (e.g., cousin, best friend). For the most part, we summarized the data to superordinate role categories. The only exception is family members. Here we distinguish between partner, children and parents, and other relatives. In a few cases participants mentioned multiple roles for their alters. For calculations we always used the role that was mentioned first.

Table 3
Mean comparisons network size and sociodemographic variables.

Variable	Valu 1	$\overline{x_1}$ (SE)	Value 2	$\overline{x_2}$ (SE)	t-Test (p)
Age (N=18/18)	18–30	12.17 (1.41)	40–50	13.89 (1.54)	0.83 (0.727)
Age (N =18/18)	40–50	13.89 (1.54)	60–75	12.50 (1.50)	0.65 (0.523)
Age (N =18/18)	60–75	12.50 (1.50)	18–30	12.17 (1.41)	0.16 (0.872)
Status (N =18/18)	Low	9.22 (0.76)	Middle	12.83 (1.48)	2.17 (0.037)*
Status (N =18/18)	Middle	12.83 (1.48)	High	16.50 (1.54)	1.71 (0.095)
Status (N=18/18)	High	16.50 (1.54)	Low	9.22 (0.76)	4.25 (0.000)***
Gender (N=27/27)	Male	12.78 (1.21)	Female	12.93 (1.21)	0.87 (0.841)

Note: p-value levels for t-tests: *** = 0.001, ** = 0.01, * = 0.05.

0.96), t(34) = 3.64, p = 0.001). With regard to age, we see a tendency for a reverse u-shaped distribution, but this was not proven as significant. Networks of men and women do not differ significantly in size.

3.2. Order of recall and cognitive schemata

The stimulus of the Antonucci name generator mentions very close persons first, but it does not ask participants to record the alters in a specific order. The map depicts all categories simultaneously and participants are free to start with whatever category they like. One might assume that participants would just follow the sequence of the stimulus, i.e., that they would start with the very close people. However, it would also be reasonable to assume that participants would start with the category that was named last, i.e., with the less close but still important people. Furthermore, the visual instrument enables respondents to compare their alters with regard to closeness and also to jump between very close, close, and less close alters. We know from previous literature that people tend to recall network members in clusters, i.e., according to role categories, foci, or relationship properties. Therefore, we want to know whether – and if so, how – this kind of clustering plays a role in the order participants recall and depict their network members in the Antonucci instrument: Are these ordering principles (role relationships, foci, relationship properties other than degree of closeness) more important than the degree of closeness, or is it the degree of closeness that structures the order of recall, or – a third possibility – do both principles somehow work together when participants are fulfilling the task?

In the following, we present three serial recall patterns that indicate different ordering schemata. We distinguish between *overarching ordering schemata* and *subordinate ordering schemata* that respondents use when recalling their networks. Overarching ordering schemata represent the primary ordering principle of the recall, while subordinate ordering schemata (or second-order principles) refer to the microstructure of recall and guide the sequencing of alters within the overall structure. In general, we see that the recall mostly consists of sequences of clusters, e.g., based on role categories or relationship properties. These clusters can be of different sizes, e.g., a befriended couple or a large group of friends, thus representing different network microstructures such as triads or cliques. Respondents often introduce alters by verbally clustering them, e.g., "my four friends," "my children, I have three of them," before then naming the single alters within these clusters.

We identified three overarching ordering schemata: ordering according to the degree of closeness, ordering according to roles and foci, and a mixed ordering pattern referring to the degree of closeness followed by a fraying schema.

3.2.1. Degree of closeness as overarching schema

Overwhelmingly, participants start by naming very close network members (inner segment). Respondents comment on this by designating their closest and first-named alters as being "obvious", "intuitive", "the first that came to my mind", and "easy to remember". About two-thirds of all participants (37 out of 54) even name alters consecutively, following the chronology of the instrument: First, they name all very close alters, then all close alters, and finally all less close alters. This pattern – following the order of the stimulus and proceeding consecutively segment by segment – has the shape of a stairway (see Fig. 2).

Within the overall framework of following the differing degrees of emotional closeness, there are two subpatterns.[8] One group of participants (10 participants) follows a rather strict order based on role relation, beginning with the partner (if existing), the core family (children and/or parents), and then continuing with friends, before turning to other roles such as acquaintances, colleagues, or neighbors. Here, closeness is tightly intertwined with a hierarchy in role relations. We find in most cases an at least implicit reference to family as a normative concept. For many participants, it appears to be obvious and self-evident that family members are the closest alters. As they put it, "First, one thinks *or* I think of family", "family in any case," "of course, my family", "family is by far the most beloved". Some participants express a very strong normative orientation towards the family and stress its categorical distinction from other relationships, as in "blood is thicker than water". Family ties are in fact often backtraced with regard to the succession of generations or the birth order of children.

Another group (25 participants) connects the closest alters more strongly to relationship properties often independently of roles, indicating, for example, whether the alters belong to a clique, or if there is mutual support or not. We give an illustration of one case representing this subpattern in the following.

The participant (male, middle age, high status) illustrated in Fig. 2, states the following during the recall process:

> "P.: Well, initially there are my four friends, that I know for very long. To them, I have a very long and a very intense relation … without them, I could, umm, imagine a life, but that would be a big loss regarding life quality. (…) Those are my friends … beside my [two] sisters, and of course my [two] daughters. They are the people I feel very close to. Umm … let's see how you adapt this non-compliance to rules. There is one person, that I … umm … That is my … [sets one dot on the border between inner and second circle]
>
> I.: so, setting in between?

[8] Interestingly, most participants in this group ("closeness as overarching schema") used either one or the other subpattern. Only two respondents mixed role and relationship properties.

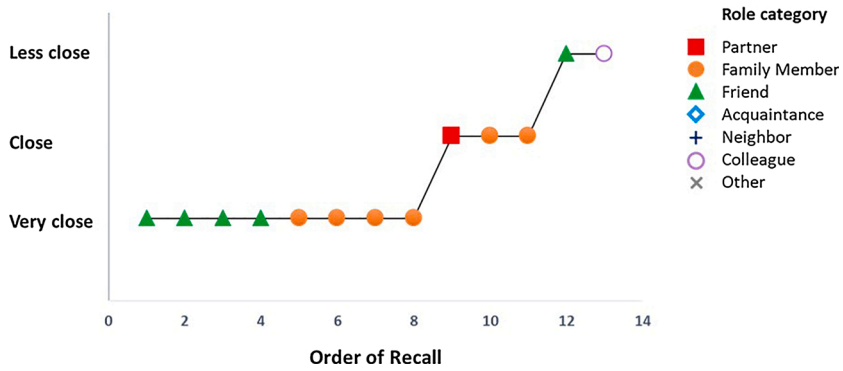


Fig. 2. Order of recall - example for closeness as overarching ordering schema and relationship properties as subordinate ordering schema.

P.: Yes, exactly. That is my girlfriend, with whom I am together not so long, yet. Therefore, I'd label her as closely related person, with a strong tendency to the inner circle. You've to decide, how to handle that. Otherwise, if it's so categorical, in case of doubt rather here [second circle] (…) Closely related persons, that's certainly my mother. Umm, and now the extended family circle, yes? Nephews, brothers-in-law, … that's a lot. I would place them, let's say here [second circle]. Yes? I summarize them [to one node as a group] (…) And here outside … the extended circle of friends and (…) former colleagues … they were very important until lately. (…) Umm, family, friends, colleagues … neighbors are immaterial. Umm, yes I think basically, so rapidly scrolling, that would have to be it." [Emphasis by interviewee]

Reflecting on what he has done on the diagram, the participant describes his very close ties: "They are stable … it is clear … it is distinct."

Here we observe some interesting patterns. The first eight very close alters belong to three clusters. Together with the first four friends, the respondent forms a clique of people who have known each other since their school days, and then there are his two sisters, and "of course" his two daughters. The respondent first uses role relation categories in order to entitle the clique of friends and the two pairs (sisters, daughters) without explicitly naming or distinguishing the individual persons (though setting a node for each alter). In addition to the categorical description of these alters the respondent enriched their meaning with further aspects of the relationship, i.e., the long duration of the relationship, its emotional intensity, and the fact that the persons are a significant part of his life. Although noting his four friends first and before his daughters, the respondent retrospectively clarifies: "both of my daughters are surely the closest." The participant makes clear that the sequence (friends first) within a segment does not indicate an emotional hierarchy, i.e., the very close alteri mentioned first are not necessarily the closest ones. However, across segments the degree of closeness appears to be the primary guiding schema for eliciting alters. The interviewee refers to compliance with regard to categorizing alters into the three segments, and reports the uniqueness of his new partner as somehow being between "very close" and "close," but noting she is supposed to enter the inner circle. Later in the interview, he comments on this issue: "Yes, but [laughs] there is also the thought, how much of it [placing the partner in a certain position] is a wish and how much is (…) actually more of a sober prediction."

The dynamics of relationships are very prominent aspects here and are used in different perspectives for describing and differentiating alters in the first (very "stable" alters), second (girlfriend that is likely to enter the first circle sometime), and third segment (colleague that was closer once). In contrast to the very close alters, the participant groups the extended family into one node.[9] In this case that could be an indicator of fatigue (e.g., "that's a lot"), but perhaps also an indicator that he views these family members as something of a collective actor.

This example, which is typical for this subpattern, shows that the procedure comprises multiple dimensions and aspects of closeness, with different justifications for naming certain alters, yet the normative order of declining closeness is predominant – at least across segments, though not necessarily across alters within one segment. Thus the construction of the instrument marks out rather broad categories of the close relations that many participants may deal with. Another participant vividly expresses his method of proceeding segment by segment as follows: "I scanned my circle. [inner circle]. I have, like a sifting screen. First are these [very close alters] … those fallen through are next."

In section 3.3 we provide a systematic overview of the relationship properties participants refer to when they elaborate on the meaning of closeness and the characteristics of very close and close people.

3.2.2. *Role relationships and foci as overarching schema*

In contrast to the first overarching schema, two participants proceed in a sort of 'zigzag', not ordering the recall strictly by the degree of closeness and often switching among the three segments. These participants use role relationships and foci[10] (e.g., a hobby that is shared across role relationships) as overarching schema (see Fig. 3). Alters belonging to a certain group or category are recalled sequentially.

In this example, we see a participant (male, young age, high status) clustering his alters predominantly with regard to different role relationships and foci, not closeness. Not all very close alters are always

[9] Although we asked for single persons, participants sometimes named groups as a single actor (node). Since we were interested in participants' relevance structures and wanted to capture their cognitive schemata as triggered by the instrument, we didn't intervene when someone named a group. Rather, we asked participants what they meant by grouping alters. We recognize that grouping people can indicate fatigue, but it can also be part of a cognitive structure that has a specific meaning, e.g., a sports group that is perceived as group regardless of the specific individual members (cf. Hollstein et al., 2020).

[10] In contrast to Scott Feld's very broad concept of foci, referring to "any social, psychological or physical entity around which joint activities of individuals are organized" (Feld, 1981, 1025), we use the term "foci" in a narrow sense as shared activities (e.g., playing chess) or thematic groups (e.g., the literature circle). In Feld's understanding, family could also be a focus. However, since we wanted to describe the ordering patterns with as much detail as possible, this narrower use of the term proved more useful.

Fig. 3. Order of recall - example for role relationship and foci as overarching ordering schema.

elicited at the beginning. This participant starts "of course" with family, naming his separated parents first, followed by the new partners of his parents (who are closely connected to the parents) and by three very close grandparents. Then he states: "If I had to complete family. Why do I have to? That would be suitable; umm, then I have my three aunts (…)." The participant finally completes providing family members by naming one less close uncle and a less close cousin. This sequence represents an order that adheres to differences within the family (core vs. extended family) and includes differences in the frequency of contact. Afterwards, he recalls three flatmates and his "best friend". The participant then breaks off and says, "And, yes, it's of course always difficult to make gradations among friends. But since they don't know it, it makes it a little easier [laughs]. Otherwise, I'd have to put them all in the same circle, of course. Umm, then let's continue here and make it systematic." He continues within the group of friends and adds one "good friend" and two other friends before turning to three fellow students and three work colleagues. The last three alters are connected via a shared hobby (playing chess) but are not connected among themselves. This focus induces the respondent to name his chess apprentice, an older friend he got to know through playing chess, and his very important chess teacher. The participant later retrospectively states that he "categorized" the alters by role relation or other foci:

> "Of course I started with family. It would seem the thing to do. Then I thought, what is next after family? I took friends for now. I don't know whether they – unconsciously – seem to be more important to me than colleagues. Yes, and suggested by language. One speaks always of 'family and friends' and so one perhaps first tries recording family and then friends. (…) As long as you try doing it systematically, it goes fine recording people. That you take such spheres, ok I start now with family, then I take friends, then I take work, then I take people with whom I do something during leisure time or with whom I am in an association. Then you can always look, is there [within a sphere] people who are important to me, where I would say I feel close to them or not. But if I'd just let things cross my mind simply like in a brainstorming, who could come to my mind, there would be only whooshing emptiness. (…) If you pursue thematic fields, it goes pretty well."

Here the overarching ordering schema contains alters that cognitively somehow belong together and are stored together without regard to how close they are to the participant. Within these categories, closeness within some subgroups (e.g., differentiation with regard to closeness between parents and step-parents) seems to be just one subordinate ordering strategy among other subordinate ordering strategies such as, for example, contact frequency.

This principle of role relation and foci as overarching ordering schema is also visible in the spatial organization of the same respondent's network map: Alters who cognitively belong together are located next to each other across the three segments (see Fig. 4).

Cognitive clusters (here illustrated by role relation as the primary organizer) are transformed into two-dimensional space.[11] This also exemplifies that the visualization allows participants to spatially group alters across different degrees of closeness.

3.2.3. *Degree of closeness as initial overarching schema followed by fraying schema*

Most of the participants first enumerate their very close alters. But with ongoing data collection, a substantive number of respondents encountered difficulties in differentiating among the segments, especially between the second and the third segments. After proceeding segment by segment for a certain time, about a quarter of the respondents (14 participants) start jumping back and forth between these segments. At a certain point, the degree of closeness is replaced by other principles, which we coined as "fraying."

For example, a woman (old age, high status) whose ordering pattern is depicted in Fig. 5, starts recalling two very close friends and her "only family" member, a cousin. Then she names "one of my best friends" who died 14 years previously. Afterwards she adds a former neighbor in the second segment and another acquaintance. Then she starts switching with regard to the degree of closeness and remembers acquaintances from very different contexts (e.g., a hiking group, a coaching group, a choir) and also her "second very best friend of yore". They had a "very intense friendship" between the ages of 16 and 37, but have not had any contact now for more than 20 years. But still, she sets this former friend as very close. Interestingly, the respondent adds two more alters with whom she has no contact anymore and arranges all "past" relations in the outer ring of the map. The switching between degrees of closeness within this network might be a result of this network being very individualized, i.e., most alters are not related to each other and belong to different contexts.

In this example, we see that after eliciting alters with regard to declining closeness for a certain time, participants leave this overarching ordering schema and start using different schemata for naming further alters. Some participants explicitly speak of their procedure as "association chains". This strategy is accompanied by additional search and ordering schemata respondents use, sometimes switching from one to another. In one case we found clustering with regard to role relations, e.g., people that all belong to the extended family are elicited in a sequence, but are assigned to different degrees of closeness. Other respondents use different kinds of foci, i.e., topics, hobbies, places, and

[11] Across all cases and order patterns we see that alters are often arranged visually in lines like a bead chain (for concentric circles) or in layers (for funnel tools). Since most of the alters are retrieved in certain types of clusters (e.g., couples, cliques, groups that share one focus, alters belonging to the same role) most alters that are recalled one after another are arranged spatially next to each other. For one-sixth of the sample, we see images with a quite differentiated and extensive segmentation of alters on the map (cf. Fig. 4). We find more extensively differentiated network maps especially in participants with high socio-economic status.

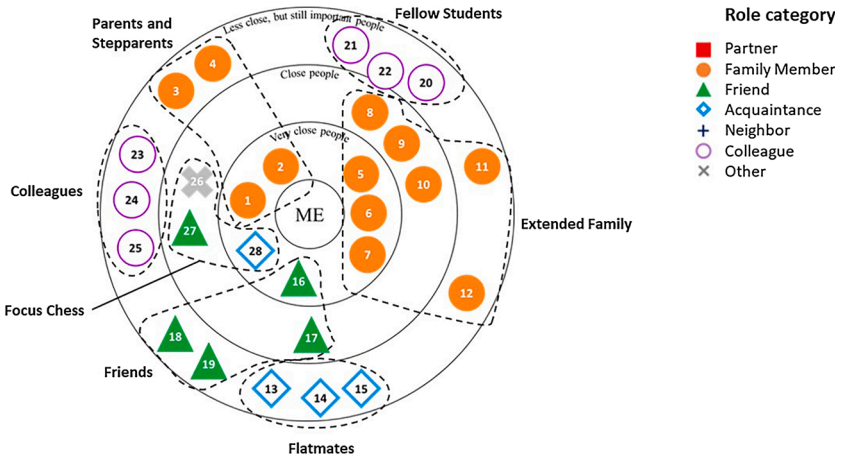


Fig. 4. Network map example.

Fig. 5. Order of recall - example for closeness as initial overarching ordering schema followed by fraying schema.

opportunity structures that people share (e.g., playing volleyball). Respondents also refer to contact frequency ("Who do I see more often?"), spatial proximity (e.g., "she lives close (…), she lives a little further away") or alters to whom they are connected through someone else (e.g., friends of the partner). Several participants also mention the duration of relationships and the originating context (e.g., "my friends from school") as criteria for differentiating between more close or less close network members.

3.2.4. *Recall patterns, network characteristics, and participants attributes*

The represented recall patterns, i.e., 'stairway' with subpattern one (closeness combined with family relations) and subpattern two (closeness combined with relationship properties), 'zigzag' (roles and foci) and 'fraying' (closeness followed by fraying) might have consequences for size and configuration of the elicited networks. One might assume that the two 'stairway' subpatterns could come with different networks, e.g., regarding differences in family size. The networks of participants who use the two subpatterns are - on average - of similar size ($_{x1}$ = 12.75 (se 2.35), $_{x2}$ = 12.76 (se 1.09), t(35) = 0.004, p = 0.996). There is a tendency for participants of subpattern 1 (closeness combined with family relations) to also name more family ties than respondents of subpattern 2 (closeness combined with relationship properties), but the difference is not significant ($_{x1}$ = 6.25 (se 1.61), $_{x2}$ = 4.38 (se 0.66), t(34) = 1.275, p = 0.211). Further, the networks of participants who predominantly refer to closeness as an overarching ordering schema ('stairway' and 'fraying' pattern) do not differ significantly in size ($_{x1}$ = 12.76 (se 1.04), $_{x2}$ = 12.29 (se 1.38), t(49) = 0.25, p = 0.805) or in composition. In comparison, the 'zigzag' pattern (i.e., recalling alters by foci and roles) seems to generate a much larger size (21.00; se 7.00), displaying mostly less close, but still important alters (outer segment). However, since only two participants make use of this pattern, this result must be treated with caution.

With regard to socio-demographic characteristics, we find no differences between men and women in the use of the different patterns and subpatterns. With regard to socio-economic status, the fraying ordering schema is mostly used by respondents of high status. On the other hand, closeness as an overarching schema in conjunction with a strict orientation towards role relations as a subordinate ordering schema ('stairway,' subpattern closeness combined with family relations) is found primarily in respondents of lower and middle status, less often in high-status participants (8:2). Within the second 'stairway' subpattern (i.e., closeness combined with relationship properties), we observe no status differences. The two respondents employing the 'zigzag' pattern (i.e., role relationships and foci as overarching ordering schema) are of middle and high socio-economic status.

3.3. *Comparing alters, placement of alters, and the meaning of closeness*

Interestingly, most participants use closeness as a multidimensional concept. They express their understanding of closeness by sticking to various aspects of social relationships. As one respondent puts it: "Well, an emotional closeness, a connection that is characterized by appreciation, a deep mutual understanding and trust." During the concurrent and retrospective thinking aloud procedure respondents referred to a multitude of aspects of relationships when commenting on the placement of alters in the diagram. In the following, we will systematize the different dimensions and meaning of closeness and will relate them to the ordering patterns and placement of alteri we described in the last section. Before doing this, we will address how respondents got along with the task of comparing alters and allocating them according to

Table 4
Dimensions, aspects and examples of closeness.

Dimension	Aspect	Example
Relationship properties	Affective proximity (e.g., degree of intimacy, acceptance, relational expression)	"Lots of … uhm, love. Lots of closeness" "That is … the ease and the satisfaction when I am together with this person. I feel secure and I don't have to play-act. … I feel strongly connected."
	Functions (e.g., social support, sociability, multiplexity)	"Talking with a person about, well, all problems. Talking about good things (…) simply being there for each other, having fun with another, … Yes, but also asking for help sometimes, too, right?"
	Reciprocity (e.g., mutual support, mutual contact initiatives)	"I can approach her and she can approach me." "Am I always the one who's calling?"
	Homophily (e.g., shared interests, similar educational background)	"Same interests (…) sharing an attitude to life"
	Contact mode	"Seeing each other (…) instead of just chatting [online] one has a real personal contact (…). I pay attention on that."
	Contact frequency	"With whom do I have contact most often?"
Relationship dynamics	Relationship duration and history (e.g., experiences of stability)	"It is sort of a clarified history. It is so grown together that there rather happens a lot concerning the structure of the relationship. One is grown together with each other."
Cultural/normative frames	Role relation	"Blood is thicker than water" "Close is friendship, it is timeless"

differing degrees of closeness.

3.3.1. *Comparing alters according to degrees of closeness*

Comparing one's alters according to different degrees of closeness appears to be a not always easy task. For some participants it was challenging to compare the meanings of many alters with each other, and later in the interview they report either that it was difficult ordering people in a hierarchical order, or that they didn't like ordering their relationships in that way. But many also report that this task was fun and that they also had "aha moments" (similar Ryan et al., 2014). Some participants distinguish very clearly among the three segments with regard to whom to allocate and how. One older respondent describes his ties in the closest segments as "totally intimate (…) persons I share my life with," while the middle segment represents people "where I participate very intensively in their lives, but that's a little filtered for my part (…). It's stronger, my affinity to their lives, than if I would share my life with them" [Emphasis by interviewee]. Finally, alters in the outer segment are more "issue-specific (…), very theme-centered", with an "exchange [that] referred to this issue." Another participant describes her perception of very close persons as follows: "One always cares. Because one is adviser, consoler, everything together." She stresses a "responsibility" towards very close persons, while close alters are persons "one doesn't think of every day and one doesn't have so much responsibility. But one is glad when seeing each other, doing something together. Yes, and that they think of one and motivate one, too. Yes? Do they comment critically, when something doesn't work well? That one can swap ideas on something. Yes, that one … instead of just chatting [online] one has a real personal contact (…). I pay attention to that … my circle of friends … that we see each other once in a while." The participant continues: "and less close … that's more about functions, for example school. Parents' council: one would like to achieve a certain goal. That is sometimes a little exhausting, but sometimes also nice. But one has to be there always to achieve something. (…) Yes, with the after-work get-together (…) one can exchange views among equals. Also get some tips." Another participant describes very close alters as "core family" where "one thinks of another" and people "share good and bad emotions." People in the second segment are "family and friends." The respondent distinguishes between alters in the first and second segments with two questions: "How intense is our relationship?" "How long have I known someone?" Alters in the outer circle are, finally, "important through a certain function, for example colleagues."

Since the stimulus for the third segment of the data collection instrument asks for less close but still important people, we also asked the participants about differences in closeness and importance. As one participant put it, important alters can be persons "without whom my life would have another quality. So, these are ones that essentially contribute to my life's quality. For better or for worse." While some participants encounter difficulties in distinguishing between closeness and importance, one respondent exemplifies his view on the difference very vividly: "My neighbor … I am not closely related, but he is an important person because he has my spare key." In order to elaborate on the boundaries of closeness, we additionally asked the participants which alters who "didn't make it to the map" would be placed outside of the outer segment. Some participants point to professionals, e.g., "Certainly, the woman that transfers my money every month is important. Yes, but I have no close relation to her." In this understanding, importance is often related to an instrumental function that has no (strong) emotional attachment. Another participant points to "related persons" with whom she mainly stays in touch via Facebook.

Some participants state that there are fluid boundaries between the first and second segment, or even more so between the second and third segment. Some participants have difficulty assigning certain alters and sometimes reassign their positions. E.g., one respondent later moves the daughter's partner from the second to the outer segment, arguing, "I like him, he is important to me, but not so close." Another respondent reassigns one friend from the outer to the middle circle, while retrospectively reflecting on what closeness is, and especially what "less close" means. She describes having at first set the friend in the outer circle because they do not see each other very often and mainly have contact via Facebook. But when thinking about what "less close" means and reflecting on how much this friend had helped her and her husband, she adjusted the position to the middle segment. Although some participants reassign positions of alters, even more consider doing so but finally do not adjust the dimensions and type of classifications. E.g., one respondent, sets the boundary between the inner and the middle segments according to whether or not "for welcoming them, I give them a hug." The respondent states he does not hug alters in the second circle "except Sigrid [a friend] sometimes (…) but it is not so comfortable." Later, while reflecting on the procedure, the respondent notes: "Sigrid actually could be in the first segment, or between the first and the second segments," but ultimately did not re-assign Sigrid's position. Such cases, where participants are not sure to which degree of closeness they should assign certain alters (boundary cases) and sometimes even reassign alters, exemplify respondents' comparing different alters with regard to the meaning the alters have for them.

Observing how respondents look at the meaning of specific ties and compare ties with each other, we could see that not only are multiple criteria being used to express the meaning of a tie, but also that different criteria are often used for alters representing the same degree of closeness. As one participant puts it, within the same circle, relations can have "different qualities." Furthermore, diverse criteria can be employed for alters representing different degrees of closeness. Thus, the meaning of closeness not only differs among individuals (inter-individually), but also within individuals (intra-individually), i.e., the

reasoning for each alter-relationship can even be different. Finally, it should be noted that although all relations that are elicited are close in some way, they do not necessarily have to be solely positive. Many participants describe relationships as important, but "ambivalent" (as for example a conflictual or one-sided relationship).

In general, within our sample *very close* alters are characterized by multiple aspects of closeness, such as strong degrees of intimacy, trust, and ease. They represent important functional interrelations such as emotional or/and cognitive support, and are long-running, often reciprocal, and stable ties (mostly partners, core family, or close friends). *Close* alters in the second segment (mostly family members and friends) are often described by similar aspects, but with less intensity and intimacy, providing less or no emotional support and accomplishing fewer functions. The mutual involvement of ego and alter in these cases is less marked. *Less close* alters in the third circle are described as mostly uniplex (i.e., providing merely instrumental support), loose contacts and issue-specific ties such as a shared interest. Overall, we can observe a tendency for placement in the outer segments to involve more variable criteria than placement in the very close and close segments (e.g., "To whom would I write a postcard?"). Across all cases, we find that high-status respondents have more differentiated concepts of closeness, using more criteria for setting and comparing alters regarding their degree of closeness.

3.3.2. Dimensions of closeness

The various dimensions participants referred to when describing their relationships and distinguishing among different degrees of closeness can be assigned to three analytical dimensions[12] : relationship properties, cultural frames, and relationship dynamics (cf. Table 4). Relationship properties encompass aspects of affective proximity (such as degree of intimacy, acceptance, and relational expression), functions (such as social support and multiplexity), reciprocity (such as mutual support and mutual contact initiatives), homophily (such as shared interests and similar educational background), contact mode, and contact frequency. Cultural or normative frames encompass aspects relating to role relations. Relationship dynamics comprise relationship duration and history (e.g., experiences of stability), as well as an understanding of the actuality of a relationship.

In the following we describe the different concepts of closeness respondents elaborated on during the concurrent and retrospective thinking-aloud. We describe how participants compare alters within and across different degrees of closeness and how they refer to relationship properties, normative frames, and dynamics of relationships. As it turned out, there are also interesting relationships between the use of these dimensions, the placement of alteri, and the ordering patterns we described in section 3.2.

3.3.2.1. Relationship properties. Participants bring up several relationship properties in order to compare and differentiate alters with regard to closeness. Notably, participants often refer to different aspects of affective proximity such as intimacy and acceptance. In addition, reciprocity is an important criterion for many participants in distinguishing between the first and the second segments (e.g.,"I can approach her and she can approach me") and between the second and third segments (e.g., "Am I always the one who is calling?"). Moreover, respondents refer to different modes of interaction and communication: e.g., for differentiating between very close and close ties ("Who do I hug when welcoming him?"), or for including an alter to the outer segment ("Who would I call for birthday?", "To whom would I write a postcard?"). Different kinds of social support (e.g., "Who else would I call for problems?"), homophily (e.g., "we are sitting in the same boat"), contact frequency (e.g., "With whom do I have contact most often?"), sociability (e.g.,"With whom do I do something together?") or shared foci (e.g., "the literature circle," "the theatre group") are also criteria often used for eliciting and comparing alters, with the latter criteria referring to less close network members. One respondent even cites Theodor Adorno's Minima Moralia: "Love you will find only where you may show yourself weak without provoking strength" (Adorno, 1974, 192) and sets this as the criterion that transects all three degrees of closeness.

Especially for larger networks we find strategies participants use in striving "not to forget anyone."[13] Others draw scenarios such as "Who would I miss most? or "If I travel these are the ones I'd invite."

Differences in closeness can be described in terms of differences (hierarchies) regarding specific manifestations of a relationship property (e.g., seeing A more often than B) or by referring to additional aspects or criteria (e.g., sharing a foci such as a specific hobby with A that I don't share with B). One respondent illustrates how alters in the same segment can have different qualities. He talks extensively about his very close relationship to his wife, who is the one he can talk to about everything. Then the respondent compares the meaning she has for him to that of other very close alters: "And it is so, this very strong closeness, … because of that I set her [his wife] in first position. And the others from this category [i.e., very close alters], I'd rather put them on the second step, umm, with them I can also talk about everything. But they are not there for me daily, right?" Here, the special quality of the spousal relationship is characterised by the combination of closeness and frequency compared to other alters in the same segment.

Some relationship properties can be related to the degree of closeness in different ways: e.g., for some respondents frequent contact is an important criterion in defining someone as being very close; for others it is not necessarily relevant in considering someone as very close (e.g., a very good friend you just talk to once or twice a year). Frequency of contact is usually mentioned in conjunction with other aspects (i.e., it is not a sufficient criterion for closeness) and can have different meanings in different role relationships (e.g., one doesn't necessarily need to interact very often with a friend to set him or her as very close, and also one can interact often with a colleague without assigning him or her as especially close). This means that people are able to use aspects of closeness in a very differentiated way that represents the cognitive complexity of categorizing social relations.

Relationship properties are used by most participants in some way, either to distinguish among different circles (very close, close, or less close alters) or to differentiate among alters within a certain circle. However, it is especially respondents using the second 'stairway' subpattern and the 'fraying' schema who predominantly refer to relationship properties when distinguishing between degrees of closeness (cf. section 3.2).

[12] It should be noted that the distinction among these three dimensions is first and foremost an analytical one. Empirically, dimensions and sub-dimensions are partly linked to one another: For example, a long common history with someone (dynamic aspect) may result in a lot of shared experiences and attitudes and a lot of trust (relationship properties). Besides, cultural frames such as "blood is thicker than water" indicate specific relationship properties, including functional aspects and support (relationship properties).

[13] Beside that, some participants report being eager to please alters, therefore not wanting to forget anyone, or asking themselves if the alter would have mentioned them in that way, too. We see here a sort of anticipated reciprocity. One respondent expresses this in a lively way: "And there is a feeling, preferably do justice to everybody. Means, what would they [the alters] say, if they'd see all these people, where I arrange them [on the map] … That would mean the need of doing justice to everybody, right? And forgetting no one, that resonates a little." Others express that their alters would expect another categorization, e.g., "If [my friend] would know that, she'd be disappointed (…), she had to be closer, but it doesn't feel like that." Since the data collection is unobservable for the alters, it is a suitable instrument for some participants to express unbalanced or non-reciprocal ties, e.g., "I am important to my father, but he is not important to me."

3.3.2.2. Normative frames. When recalling alters, some participants do not refer to certain relationship properties, but rather describe an alter with regard to a role relationship, such as a family member or a friend. Here, specific concepts with regard to role relations become distinct as *normative frames*.[14] Family in particular appears to be a strong normative concept that most respondents address in some respect.[15] However, there are marked differences in how respondents refer to this normative frame and whether it is relevant for placing alters in the circles, i.e., the degree of closeness: Respondents using a hierarchical order of role relations ('stairway' subpattern one in section 3.2) typically recall family members first and as closest alters. Interestingly, participants across all three overarching patterns of recall refer to family as a normative frame, even if they do not refer to family members first or locate them in the closest segments or on the map at all. Respondents seem to have normative concepts of how close family members *should* be or how one needs to elicit family members. One respondent mentions having set her parents "automatically" in the closest segment, although reflecting on not having such a close relationship with them.

Participants who, in their own view, seem to deviate from such incorporated family norms often immediately start justifying and legitimizing their choice. E.g., one participant with four grown children describes having very different relationships to them and says it is "morally severe" to place two children as "very close" and two children as "close." After continuing the interview for a while, the respondent turns back to the classification of his children and changes the position of one child he had set as close. He labels this child as "boundary child" and sets it between "very close" and "close." Besides positioning alters in certain segments, participants also reflect on the serial order of recall, especially with regard to core family members (e.g., children, partner). One respondent elicited her children as fifth and sixth alter, and later reflected on that: "Actually I should have named my children first." Such examples illustrate that the serial order within one segment does not always represent a declining order with regard to emotional attachment, but can be an order of alters resulting from "the way they come to mind" or the way they "pop up." Respondents also offer justifications when they do not place certain family members in the diagram at all. One woman explains not inserting her sister, who has dementia, on the map because they are not able to communicate anymore: "she is no close relation person, although she's from the family." We see similar examples for not adding parents to the map, e.g., "My father is actually close, but I exclude him because we haven't gotten along well with each other since I was 12 years old."

Beside legitimations for not setting family members first, or not as very close, or not as close as other alters, or not including them at all, we find references to the concept that family is a criterion for finally including an alter into the map, e.g., I.: "What clinched it for you, mapping them [two sisters-in-law], still?" P.: Yes, because, however, they finally belong to the family." For some participants there is a norm of eliciting and completing family. One participant reflects on that as follows: "You don't choose family, you belong to it (…), there's a duty to map them here, because they belong to family … because you can't exclude them. That wouldn't do justice to them."

3.3.2.3. Dynamics of affective relationships. The question of how close a network member is perceived as also depends on dynamic aspects of social relations. Across all ordering schemata (3.2), participants talk about dynamic processes and changes of meanings with respect to certain relationships[16], and describe how these (experienced or anticipated) dynamics create difficulties in assigning network members to a specific segment and degree of closeness. Here, relationship dynamics indicate that respondents waver in their decisions about placing alters. E.g., one participant struggles in his decisions between close and less close but still important people as follows:

> "Is there a frequent exchange? Now, do we live the relationship? Is it lived? Umm, how often, and is it very present at the moment? (…) There are people who are important to me, who are important or perhaps were important. But with whom I have few to no relations at the moment, anymore. Umm, and perhaps also a gradation in the intensity of the emotional attachment (…). But what we've experienced together is still so impactful that they are still important. But they are not closely connected to me and we communicate little if at all."

Although there might be no present or actualized relationship at the moment, this person can still be very important to the respondent. We observe this, for example, for alters that were significant with respect to primary or secondary socialization (e.g., parents, ex-partners, or others who provided relevant support to the interviewees). Some participants even name deceased alters or persons with whom they are no longer in touch, arguing that they often think of them or ponder what advice they'd give in certain situations.[17] In addition to dynamics in meanings related to the past, participants also refer to anticipated changes in closeness in the future. We already mentioned the participant stating that it had been difficult to assign a place to his new partner, whom he finally places in the second circle on the border to the inner circle because he assumes she will soon slip into that closest circle (cf. 'stairway' subpattern 2, section 3.2). While very close relations are usually characterized by stability, relationship dynamics are especially addressed when placing alters in the close and less close segments. Here respondents refer to relationship dynamics especially with regard to actuality of a relation, e.g., "With whom do I do more, lately?" "With whom would I like to spend more time?" "Who was once very close, but there isn't a close relationship now?"

As we have pointed out, the different order of recall patterns vary by the meaning of closeness. In Table 5 these relationships are depicted along with the participants' socio-economic status.

4. Discussion and conclusions

In this paper, we investigated the order of recall and the meaning of closeness when using the so-called "hierarchical mapping technique" developed by Toni C. Antonucci (1986). This instrument is a widely used affective name generator, which combines a verbal and a visual stimulus, the latter consisting of a three-segment diagram enabling

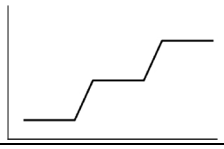
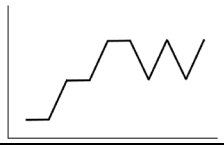
[14] Role relationships can be considered as cultural frames that may differ between social groups and contexts. When role relationships are connected to specific expectations and are used to justify or legitimize recall decisions, we speak of normative frames.

[15] Compared with family norms, friendship is a concept that is brought forward less frequently as a normative frame, mostly by pointing to normative expectations regarding reciprocity (cf. example on anticipated reciprocity mentioned in section 3.2 with respect to the 'zigzag' pattern). Furthermore, reference to friendship is employed to set boundaries of closeness, e.g., one respondent remarks on whom he didn't elicit in the following example: "My dentist is outstanding. With him I have an amicable relationship, but it is no close friendship."

[16] In general we observe duration, stability, and history of a relation as being factors for closeness that are brought forward more often and more vigorously by the older respondents in our sample. Since older respondents have on average more long-lasting relationships, relation duration and relation history seem to become for them more important criteria for describing relationships. Furthermore, some older respondents report not getting acquainted with new people so often or so easily, e.g., "I am over 50 and then the contacts, when I look back, there are rarely new contacts or that happens not so easily."

[17] Within the setting of this study, naming deceased alters is an interesting phenomenon since it reflects an aspect of respondents' relevance structure (cf. Hollstein et al., 2020). It gives fruitful insights into the range and dynamics of what closeness means. In other studies, depending on the research interests, it can of course be appropriate to restrict naming to alters who are still alive.

Table 5
Recall patterns, concepts of closeness, and participant attributes.

Recall pattern	'Stairway'		'Zigzag'	'Fraying'
				
Overarching ordering schema	Degrees of closeness		Role relationships and foci	Degrees of closeness followed by fraying schemata
	Subpattern 1	***Subpattern 2***		
	Hierarchy of roles	Relationship properties		
Meaning of closeness/ dominant aspect	Normative frames re. role relationships	Relationship properties	Combination of role relationships and relationship properties	– (no consistent pattern)
Participant's SES	+ Low + Middle	Mixed	+ Middle + High	+ High

Note: + more frequent occurrence.

participants to map 'very close', 'close', and 'less close but still important' alters. Since the diagram allows comparisons among alters according to different degrees of closeness, and because participants are free to start with whatever category they like, it seemed worthwhile to examine how respondents deal with this instrument, and in doing so further investigate the cognitive maps of participants with regard to close network members, specifically the order of recalling alters. Additionally, we wanted to know whether recall strategies influence the elicited networks, and whether they are related to participants' concepts of closeness or socio-demographic characteristics. In order to target the respondents' procedure and understanding of closeness, we employed the thinking-aloud method. To be able to address socio-demographic characteristics of study participants even with a small N-study, we made use of a sample stratified according to gender, age, and socio-economic status.

4.1. Order of recall

The personal network data generated by the data collection tool are generally in line with the theoretical assumptions by Kahn and Antonucci (1980) and empirical studies on network composition in personal networks, showing partner, close family, and close friends predominantly in the first segment ("very close" alters), friends predominantly in the second segment ("close" alters), and acquaintances or weak ties prevailing in the third segment ("less close" alters) (e.g., Antonucci et al., 2004; Takahashi, 2005).

As in previous studies on the order of recall (e.g., Brashears, 2013; Brashears and Quintane, 2015; Brewer, 1995; Hills and Pachur, 2012), we found that recalling alters is not something that happens at random, but instead seems to follow certain cognitive maps. Moreover, there is always some sort of clustering of alters involved. Participants often introduce alters as part of a microstructure (e.g., triads, cliques). Alters belonging to clusters can be linked via role relations (e.g., "my children"), can form a natural group (e.g., a clique of friends), and can share the same focus (opportunity structure or interest, such as playing chess) or other relationship properties, such as social proximity (similar Brashears and Quintane, 2015; Freeman, 1992; Hills and Pachur, 2012).

With respect to the order of recall of alters, we identified three major ordering patterns when collecting data with the hierarchical mapping technique. Most respondents began the data collection as it was implied by the sequence of the verbal stimulus, that is, according to degrees of closeness. This suggests that just following the sequence of the verbal stimulus might provide orientation for participants. However, participants also commented on the closest persons being the ones that are self-evident and easy to recall, a finding in line with the study of Burt (1986: 4). Two thirds of the study participants entered alteri into the diagram according to degrees of closeness consistently throughout the data collection process, i.e., starting by naming all 'very close' alters, followed by all 'close' alters, and finally all 'less close' alters ('stairway' pattern'). Within "closeness" as the overarching pattern we found two subpatterns: one subpattern with participants recalling their alters according to role relationships and another subpattern with participants recalling their network members according to specific relationship properties that they consider relevant in close relationships (e.g., reciprocity, type of support). When role relationships are the subordinate schema, participants mostly follow a surprisingly strict and uniform hierarchy among roles, starting with partner and children, followed by other family members, then friends and acquaintances (similarly Hammel, 1984; Wellman, 1979).

Nevertheless, a third of the participants deviated from this pattern and did not follow the sequence of the verbal and visual stimuli. In some cases, participants started to recall alters according to closeness, but after a while changed to other principles, jumping between the closeness segments ('fraying') and using role relationships, foci, and relationship properties (spatial proximity, reciprocity, duration, frequency of contact) as clustering criteria. In two cases, participants recalled alters according to roles combined with foci as the overarching schema and then sorted network members with respect to their closeness or other relationship properties within these groups ('zigzag' pattern). It has to be noted that the term "foci" in this study refers to shared activities (e.g., playing chess) or thematic groups (e.g., the literature circle), i.e., it differs from the term as introduced by Feld (1981). However, this rather narrow use of the term proved most useful in describing the ordering pattern as precisely as possible.

Although these clustering principles (closeness, relationships, foci, and relationship properties) as such have been described elsewhere, we found it remarkable that, faced with a tool that verbally and visually focuses on closeness, one third of the participants did not follow the different degrees of closeness, but either followed role relationships, foci, or relationship properties. In this regard, results of studies suggesting that strong ties are recalled earlier and more often than weak ties (e.g., Brewer, 1995, Brewer, 2000; Burt, 1986), and that close relatives are named earlier than less close relatives (e.g., Hammel, 1984; Wellman, 1979) are only partially supported by our study.

Looking at whether the different response strategies and ordering schemata might be related to the size and composition of the elicited networks, we did not find significant differences, a result that could be caused by the small sample size. The first 'stairway' pattern with closeness as an overarching schema, in conjunction with a strict orientation towards role relations as a subordinate ordering schema, seems to be related to a somewhat higher proportion of family ties, compared to the other 'stairway' pattern (closeness combined with relationship properties), at the same time there being no differences in network size. Interestingly, there is a tendency towards much larger networks among those participants who employ the 'zigzag' recall pattern (relations and foci as overarching ordering schema), along with a comparatively large

proportion of less close ties. The 'zigzag' pattern is the response strategy most independent of the closeness schema. Going through different foci or role relationships, as a strategy might lead to the elicitation of more alters, a result that may be supported by the design of the instrument that visually depicts the three degrees of closeness simultaneously, allowing participants to compare different alters across multiple segments. However, we can only speculate whether this particular orientation regarding social relationships does result in bigger and perhaps more complete networks, or whether the causality works the other way around, i.e., larger networks facilitating or even requiring a different pattern of recall. Since this observation is based on two cases only, this interpretation should be treated with caution and further research on the issue seems worthwhile. Nevertheless, the results seem to indicate that participants employing different ordering patterns might be prone to different 'blind spots' in free recall. As other studies have shown, both nonspecific and specific prompts trigger roles that participants might not have considered, e.g., neighbors or colleagues, on the one hand resulting in larger networks, on the other hand leveling differences between tools (Hollstein et al., 2020). Combining the hierarchical mapping technique with additional prompts could be a possibility to deal with those perhaps biased response patterns.

With regard to socio-demographic characteristics of the participants we observed a tendency for the first 'stairway' subpattern (closeness combined with family relationships) to be found primarily in respondents of lower and middle status, less often in high-status participants. In contrast, the 'fraying' schema (closeness followed by fraying) is mostly used by respondents of high status, and the two respondents with larger networks employing the 'zigzag' pattern (i.e., role relationships and foci as overarching ordering schema) are of middle and high socio-economic status. We did not find differences between men and women in the use of the different patterns and subpatterns.

4.2. Order of recall and concepts of closeness

The interview data collected with the thinking-aloud technique allowed detailed insights into the concepts of closeness and the meaning closeness has for participants and led to a better understanding of the recall patterns. This approach enables us not only to examine how participants respond to network questions, but also how they represent network aspects cognitively and which perceptions are associated with them (cf. also Brashears and Brashears, 2016; Brashears and Quintane, 2015). In general, very close alters were characterized by a strong degree of intimacy, trust, multiplexity, and reciprocity, whereas less close alters are described as more uniplex and looser contacts, generally supporting the conceptualization by Kahn and Antonucci (1980) as well as empirical results (e.g., Takahashi, 2005).

The interview data suggest that people use aspects of closeness in a way that is very differentiated and represents the cognitive complexity of organizing social relations. The aspects addressed by the participants that seem to be especially salient in defining a relationship as close or very close can be assigned to relationship properties, cultural or normative frames about role relationships, and relationship dynamics, with the first ones closely related to the response strategies and order of recall.

Relationship properties encompass affective aspects (such as a feeling of being accepted, secure, connected), functional aspects (social support, sociability), reciprocity, homophily (e.g., shared interests, experiences, and educational background), and modes and frequency of contact, which are in line with results from previous, mostly quantitative studies (Antonucci et al., 2004; Bellotti, 2008; Hills and Pachur, 2012; Parks and Floyd, 1996; Takahashi, 2005). Most often it is not just one, but several aspects that seem to be important in individual conceptions and understanding of closeness (similarly, Parks and Floyd, 1996). In our study, participants usually referred to two or three, or even as many as five different aspects, emphasising the multidimensionality of closeness. It might not come as a surprise that it is mostly participants using the second 'stairway' subpattern (closeness combined with relationship properties as a subordinate pattern) and the 'fraying' pattern (closeness followed by fraying) who express closeness in particular through the differentiated use of relationship properties.

In contrast, we were surprised by how strictly several participants, especially of the other 'stairway' subpattern (closeness combined with role relationships as subordinate pattern) aligned their order of recall with a hierarchy of roles (similar to what has been found in earlier studies; Hammel, 1984; Wellman, 1979). Normative frames regarding role relationships seemed to strongly influence individual meanings of closeness as well as the order of recall. In much the same vein, participants expressed strong opinions about how close family members should be. However, the qualitative data also demonstrate that respondents who use other response strategies and who differentiate within the same role relationship regarding closeness (e.g., placing children in different segments) often struggle and immediately start legitimizing their decision. This holds true especially concerning members of the core family, i.e., partners and children. We consider this as an indicator of the power of cultural and normative frames that are operative even if they do not seem to determine the placement of alters. In addition, we observe a sort of emotional involvement in the classification of alteri in many respondents, by anticipating how alteri would react to a classification or whether a classification would be reciprocal (similar Hogan et al., 2007; Ryan et al., 2014).

Finally, regardless of the particular recall patterns, relationship dynamics such as stability and duration are structural features that seem to be especially salient in defining a relationship as close or very close (cf. also Parks and Floyd, 1996; Takahashi, 2005). This finding is also expressed in the fact that participants are most likely to encounter problems in assigning network members to closer segments when there are dynamic aspects of relationships involved, for example, when an alter is currently very important, but has been known only for a short period of time, or when there has recently been little contact with a formerly good friend, similarly to what Pahl (2000) coined 'fossil friendships' or what is conceptualized as 'dormant ties' by Levin et al. (2011). It is not only this 'shadow of the past' that looms large in the current positioning of network members, but also the 'shadow of the future', e.g., when one anticipates that a tie might eventually lose significance–as one participant put it, "how much of it is a wish, and how much is (…) actually more of a sober prediction?" On the one hand, these difficulties encountered by the participants reflect the significance of life course and biography for the meaning of closeness; on the other hand, these same difficulties also indicate the conceptual and methodological challenges of network data collection.

The qualitative accounts of normative frames and relationship properties shed light also on the tendencies regarding *socio-demographic aspects* of the ordering-of-recall patterns. We find it remarkable that most participants followed a recall pattern either according to role relationships *or* according to specific relationship properties. Based on our stratified sample covering a broad range of socio-demographic groups[18], our results suggest that these differences partially correspond to socio-economic status. It is especially participants with higher socio-economic status (better education, higher professional status) who express search and cluster strategies that are more differentiated, and they are the ones with more multidimensional concepts of closeness

[18] In this study we stratified the sample according to socio-demographic characteristics that are known to have an impact on the size and composition of personal networks (age, gender, socio-economic status). We consider the fact that our results regarding differences in network size among socio-demographic groups are generally in line with findings on personal networks (e.g., Antonucci et al., 2004; McPherson et al., 2006; Wrzus et al., 2013) as an indicator of the quality of the sample – a sample which is not limited to a specific group (e.g., undergraduates), but covers a broad range of socio-demographic characteristics in the general population.

(similarly, Hollstein, 2002). As we said, the 'fraying' ordering schema (closeness followed by fraying) and the 'zigzag' schema (roles and foci) prevail especially among respondents of this group. At the same time, the recall pattern that follows a strict hierarchy in roles is less common with participants of high socio-economic status compared to participants of lower and middle socio-economic status. These different cognitive ordering schemata seem to point to different structures of relevance and experience that accompany status differences, affecting both network size and composition according to role relationships, with larger networks and more friendships in higher status groups, and smaller and more family-dominated networks in lower status groups (similarly, Ajrouch et al., 2001; Hollstein, 2002). However, these are tendencies that must be confirmed and perhaps differentiated based on larger samples.

4.3. Implications for data collection

Based on our results, we can delineate some recommendations for the collection of network data:

- Respondents use different concepts for recalling alters, and are likely to change positions when making the comparisons. If researchers are interested in multilayered concepts, such as closeness, it seems wise to use *visual tools that simultaneously present the different layers/gradients* to enable participants to compare positioning of their alters with regard to different aspects of the respective concepts.
- In such multilayered instruments there should be the *possibility of revising* or changing the positions of alters with both the paper-pencil and the digital tools. For paper-pencil-based modes we recommend using tools that enable changes, e.g., removable sticky dots.
- Respondents sometimes express uncertainty whether it is okay to change the positions of alters. This possibility should be addressed by interviewers or – in self-administered approaches – by accompanying *instructions*.
- Limiting the number of alters: Since respondents employ different recall patterns when using the Antonucci questionnaire, one should be aware that *limiting the number of alters* may influence the results: i. e., a reduced core network of very close alters or fewer alters for certain role relationships. These biases are not distributed at random, but differ for respondents with higher/lower socio-economic status. For instance, limiting the number of alters might lead to a lower proportion of very close ties for high status respondents.

4.4. Limitations and further research

In this study we examined the collection of affective networks with a verbal and visual name generator. Such a setting is also conceivable for name generators of an exchange approach, role approach, or interaction approach, but might evoke different recall patterns. Additionally, cultural contexts and normative frameworks shape social networks, recall strategies, and respondents' justifications. Since the participants in our study come from bigger cities in Germany, it might be worthwhile to consider possible cultural differences in future studies.

The thinking-aloud approach gave us extensive insights into how interviewees deal with a specific method of data collection and which concepts are the basis for decisions to enter and compare alters. However, due to the differences in how much thinking aloud was used by the participants, we cannot draw any conclusions about the efficiency of the instrument. Further, one could assume that the hierarchical mapping technique increases the validity of the collected network data, since some participants using this instrument changed the position of an alter after comparing it with other alters. Of course, one might argue that spontaneously placing alters brings more valid results, but considering the complexity and multidimensionality of social networks, this can be debated. In this regard comparisons of tools that allow simultaneous comparisons among different grades of closeness on the one hand, and sequential name generators on the other hand, would be worthwhile. In such studies, not only should the sizes of networks and their composition be compared, but also density measures, which were not available in our study. Also, more knowledge about the impact of visualizations would be valuable (cf. Maya Jariego and Cachia, 2019). Previous studies suggest that visual support by means of maps or diagrams can function as a cognitive aid as well as sustaining the attention of interviewees and spurring reflection (e.g., Dobbie et al., 2018; Hollstein et al., 2020; Maya Jariego and Cachia, 2019; Ryan et al., 2014; Tubaro et al., 2016). Such tools might even result in larger and more complete networks compared to questionnaire-based approaches (von der Lippe and Gamper, 2017), but evidence is mixed (von der Lippe and Gamper, 2017). There is some evidence that the shape of the visualization (circles, funnel, etc.) seems not to impact the network size (Hollstein et al., 2020). Recently, more software applications (e.g., VennMaker, cf. Gamper et al., 2012; OpenEddi, cf. Fagan and Eddens, 2015; Network Canvas, cf. Hogan et al., 2016, 2020), as well as visual network surveys (e.g., Tubaro et al., 2014), are being developed that support the data collection with digitized network maps. Hogan et al. (2016) suggest that digital tools are more satisfying for participants and more efficient than analogue ones without generating different networks. It would be valuable to compare different visual modes of data collection (e.g., paper-pencil vs. digital, interviewer guided vs. self-administered) and their implications more systematically. In particular, the implementation of self-administered surveys has hardly been researched. Finally, future research should examine the impacts of visualization in qualitative, quantitative, and mixed methods settings and differences between tools that make use of visualizations, as in the method of concentric circles, and those that do not.

Declarations of Competing Interest

None.

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