

Social and Economic Network Science

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Reminder: two weeks ago

- ▶ Local network structures: isolates, dyads (reciprocity), triads (transitivity, clustering coefficient)
- ▶ Global network structures: cohesion (density, transitivity), connectivity (distance, diameter, average path length, components)
- ▶ Centrality (degree, betweenness, closeness)

Outline for today

Introduction

Theory

Personal networks: size

Personal networks:
composition

Personal networks: structure
Examples of applications

Methods

Personal network data
collection

References

Complete networks and personal networks

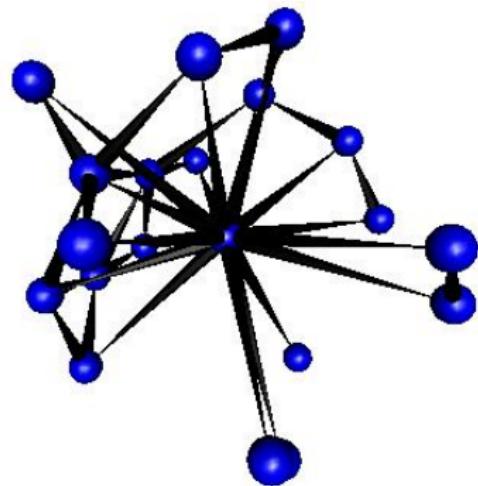
- ▶ Distinction between:
 - ▶ Complete network research designs
 - ▶ Personal network research designs
 - ▶ Ego-centred networks
- ▶ Ego-centred networks, in more detail
 - ▶ Size
 - ▶ Composition
 - ▶ Structure
- ▶ Applications

Complete networks

- ▶ All ties of a given type in a given social context
- ▶ No focus on any particular actor
- ▶ Narrow definition of relationships of interest
- ▶ Boundaries defined as clearly as possible
- ▶ Example: Lazega's lawyers

Personal network designs

- ▶ The social environment of a focal individual (*ego*) is its personal network
- ▶ The set of contacts and acquaintances (*alters*) of a person (or other entity) (*ego*)
- ▶ Usually includes *alters'* attributes and ties between *alters*
- ▶ Can be collected for a sample of *egos* (eg in a survey)



Why do we care about size? Human sociability

- ▶ Dunbar (1992): driven by evolution, human cognition allows maintaining a maximum of around 148 active contacts
- ▶ Each tie needs to be maintained – requiring time, memory, attention – whilst human capacity to do so is not unlimited
- ▶ Same result as in primates
- ▶ Figure is stable over time

Different estimates

- ▶ H. Russel Bernard, P. Killworth & colleagues: survey-based networks
- ▶ Testing a series of diverse definitions (USA 1990 - 2001)
- ▶ Average estimate : 290
- ▶ But may reach as many as 610 (McCormick et al., 2010)

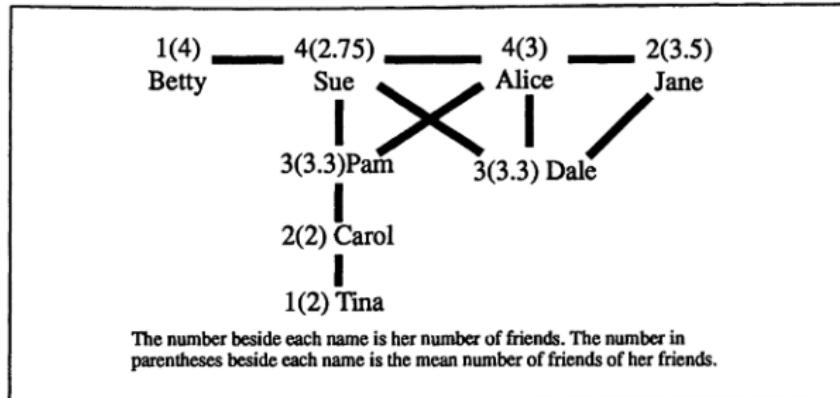
In general

- ▶ 1000 - 2000 known people (by name) on average throughout life
- ▶ 100 - 200 people can introduce us to someone we didn't know before
- ▶ 30 people with whom we have regular interactions
- ▶ 3 - 4 confidants

⇒ Regardless of definition, personal network size varies with social status (Bidart et al., 2011)

Why your friends have more friends than you do

- ▶ With heterogeneity in the size of personal networks, people with larger networks will appear in many other networks
- ▶ For example, someone with 40 friends will be in 40 personal networks
- ▶ Feeling of relative deprivation



Friendships among 8 girls at Marketville School. Source :Feld (1991)

Access to resources through relationships

- ▶ Nan Lin's bike
- ▶ Social capital



Network size and access to resources through relationships?

- ▶ More contacts, more resources?
- ▶ Personal network size as a predictor of access to resources, for example social support
- ▶ Support may have positive effects on health, eg with elderly people (Berkman & Glass, 2000)

Has the size of personal networks diminished over time?

- ▶ Putnam (2000) : decline of associative and civic life in USA
- ▶ Are ICTs a channel for growing individualization (Kraut et al., 1998) ?
- ▶ Growing trend toward social isolation in USA (McPherson et al., 2006) ?
- ▶ More nuanced positions today: personal networks may have changed very little over time (Fischer, 2011)

Effects of ICT

- ▶ ICT may facilitate maintenance of older and distant relationships
- ▶ This may thus slow down break of (especially weak) ties
- ▶ Do ICT users have larger personal networks?
- ▶ Positive correlation in some empirical studies, no correlation in others (Pollet et al., 2011)

Facebook users have many friends - but would trust just four in a crisis

Dunbar (2016):

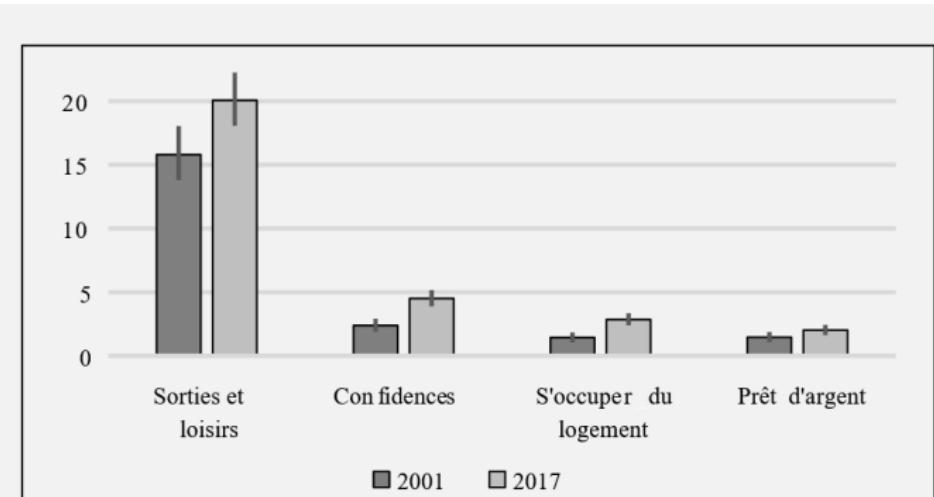
Social media certainly help to slow down the natural rate of decay in relationship quality that would set in once we cannot readily meet friends face-to-face.

But no amount of social media will prevent a friend eventually becoming 'just another acquaintance' if you don't meet face-to-face from time to time.

There is something paramount about face-to-face interactions that is crucial for maintaining friendships.

Seeing the white of their eyes from time to time seems to be crucial to the way we maintain friendships.

Personal network size in Toulouse, 2001-2017



Note : Ensemble des répondants (399 en 2001 et 709 en 2017).

Favre & Grossetti (2021)

Network composition

- ▶ Recent research: composition of a network as important as its size
- ▶ Composition = distribution of attributes of alters and relations
- ▶ Not all ties are equal for support – some bring more resources with them (Ellwardt et al., 2015)

Qualify alters

In a personal network...

- ▶ What male/female proportion?
- ▶ What distribution of age classes?
- ▶ What geographical distribution?
- ▶ What distribution of social groups (by income, level of education, profession etc.)?

Qualifying relationships

Tableau 2.1. — *Qualification des relations citées*

Désignation des relations	Enquête Toulouse (2001)	Enquête San Francisco (1982, p. 41)
Famille	40 %	42 %
Collègues	8 %	10 %
Voisins	4 %	10 %
Associations	5 %	6 %
Amis	28 %	23 %
Autres	15 %	6 %

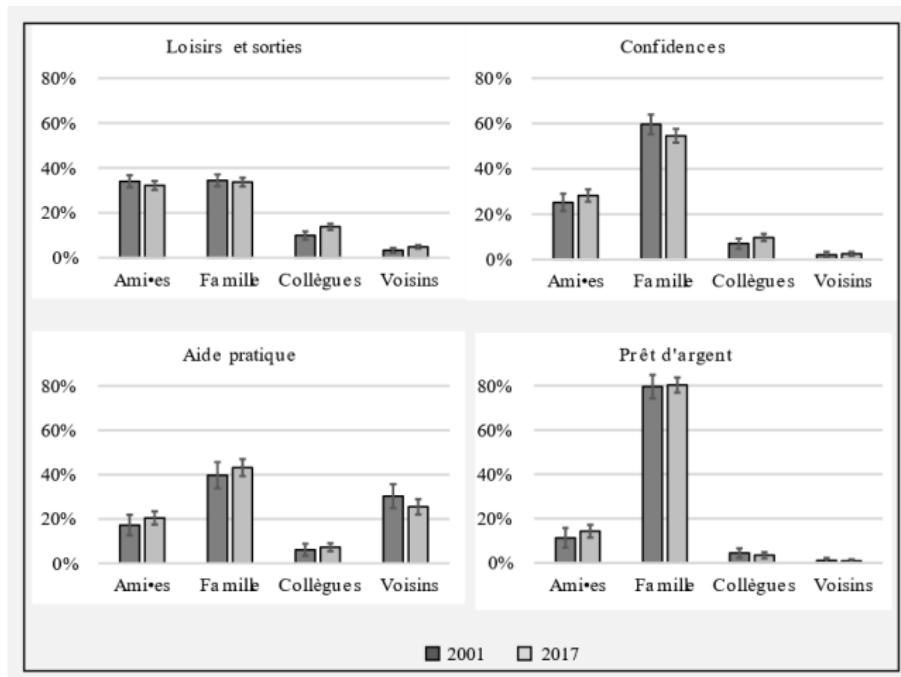
Lecture : Dans l'enquête de Toulouse, en moyenne 40 % de toutes les relations sont familiales.

(Bidart et al., 2011, p. 60)

Network composition depends on:

- ▶ age and life events (Bidart et al., 2011)
- ▶ political context (Völker & Flap, 1995)
- ▶ urban structure (neighbourhoods)

Personal network composition in Toulouse

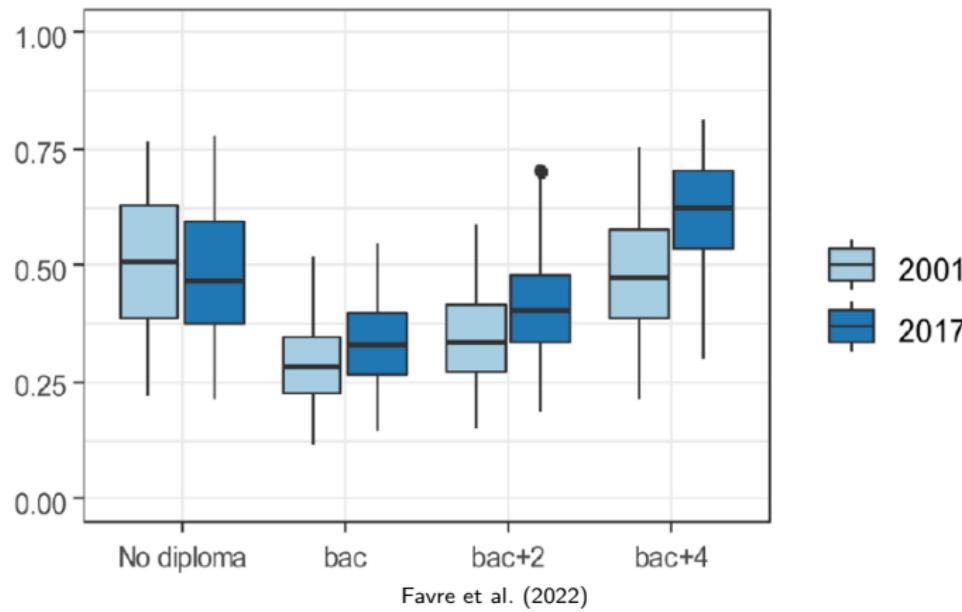


Favre & Grossetti (2021)

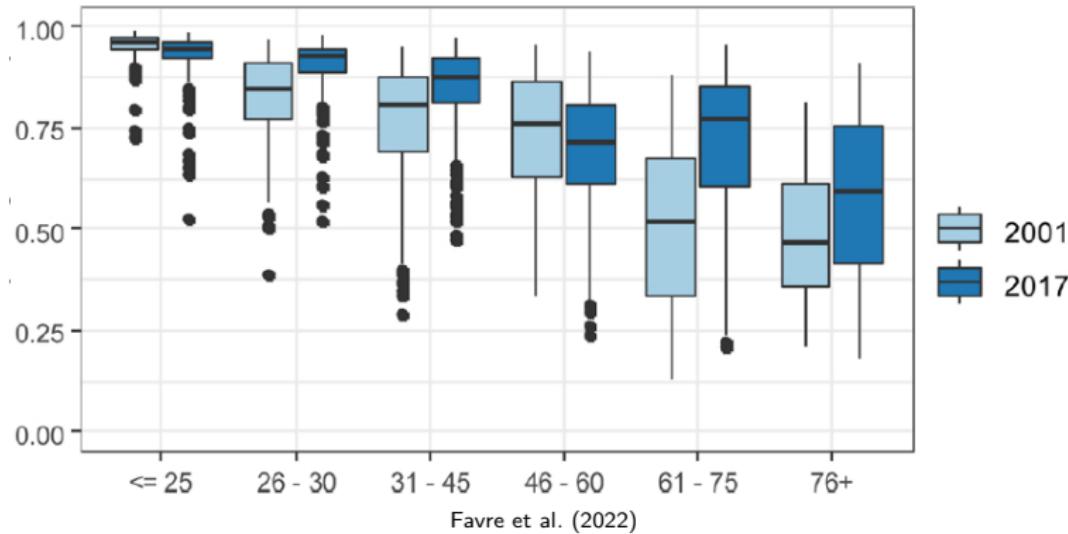
Homogeneity and diversity of networks

- ▶ Homogeneous personal networks: lack of social mixing/integration
- ▶ Homogeneity can be measured in relation to any relevant variable (age, gender, education, profession...)
- ▶ Similarity in personal networks observed in a variety of social contexts
- ▶ May result from contextual constraints ('opportunity structure') or from individuals' preferences for similar others ('homophily')
- ▶ Potentially, a factor of social segregation

Homogeneity of personal networks in Toulouse: education

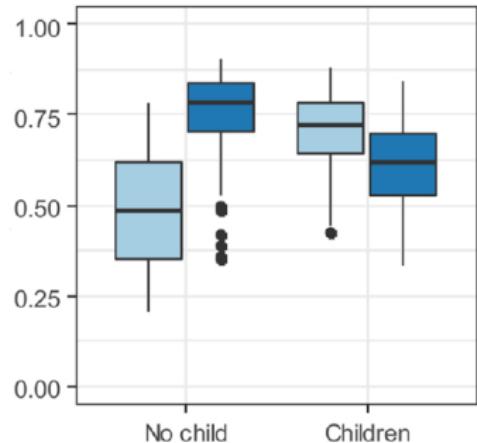


Homogeneity of personal networks in Toulouse: age

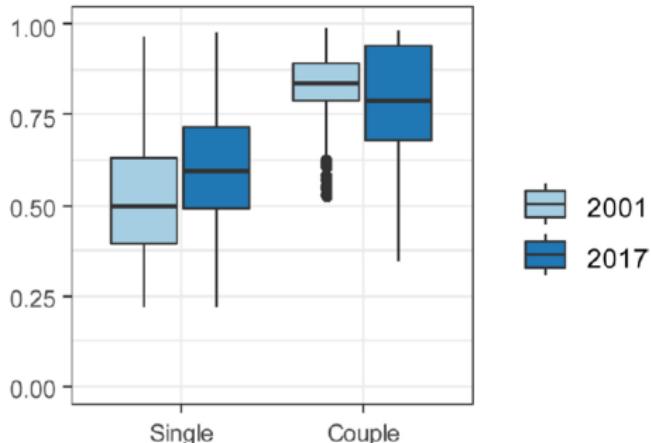


Homogeneity of personal networks in Toulouse: family situation

Living with children similarity



Single or Couple similarity



Favre et al. (2022)

Measuring diversity

- ▶ Two families of measures :
 - ▶ proportion (or percentage) of a category on whole group
 - ▶ heterogeneity (variance, standard deviation, Blau index, IQV...)
- ▶ Correlated (but not linearly) with binary variables
- ▶ Independent with ordinal, nominal, interval variables

The diversity index of Blau (1977)

Especially useful if there are more than two categories:

$$B = 1 - (p_1^2 + p_2^2 + \dots + p_k^2)$$

where:

- ▶ each alter is in one of k categories
- ▶ the proportion of alters in category i ($i = 1, \dots, k$) is p_i
- ▶ B varies between 0 (if there is only one category) and $\frac{k-1}{k}$ (if all categories are equally represented)
- ▶ one index for each attribute of interest
- ▶ a variant of the Herfindahl-Hirschman index (HHI)

Index of qualitative variation, IQV

Normalized version of Blau's index:

$$IQV = \frac{k}{k-1} \left(1 - \sum_{i=1}^k (p_i)^2 \right) = \frac{k}{k-1} B$$

where:

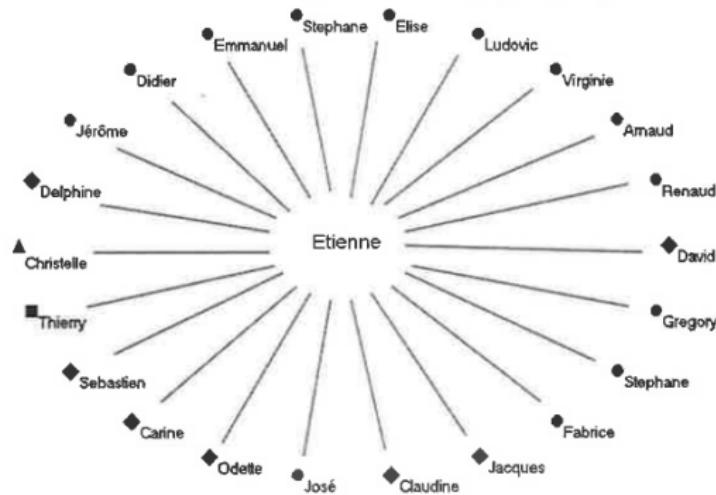
- ▶ each alter is in one of k categories
- ▶ the proportion of alters in category i ($i = 1, \dots, k$) is p_i
- ▶ IQV varies between 0 (if there is only one category) and 1 (if all categories are equally represented)
- ▶ one index for each attribute of interest

Structure of a personal network

- ▶ With size and composition, structure plays an important role
- ▶ For example, a dense personal network may offer more support, but may also constrain action

From size (and some composition)....

Figure 2.1. — *Le réseau personnel d'Étienne dans le panel de Caen (vague 1) : représentation en étoile*



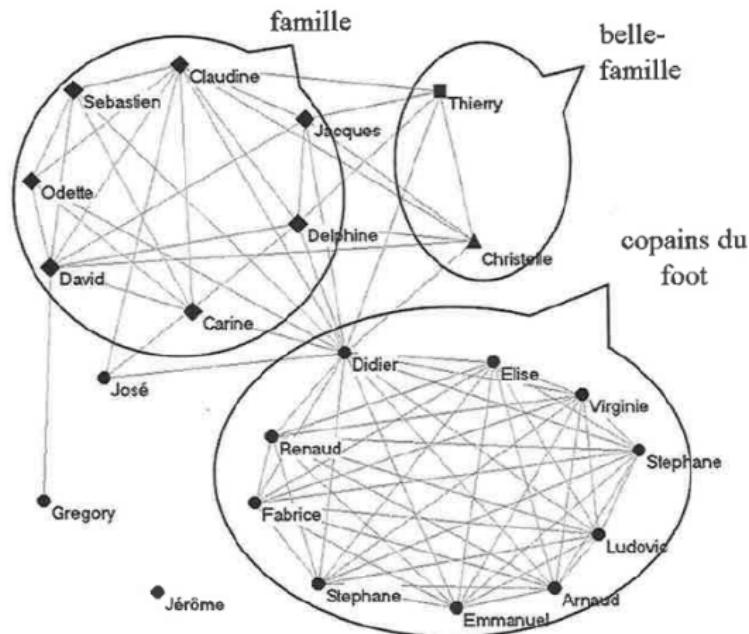
Légende:

◆	famille d'Ego
■	famille d'Alter-armour
▲	Alter-armour
●	copain, ami, autre

(Bidart et al., 2011, p. 54)

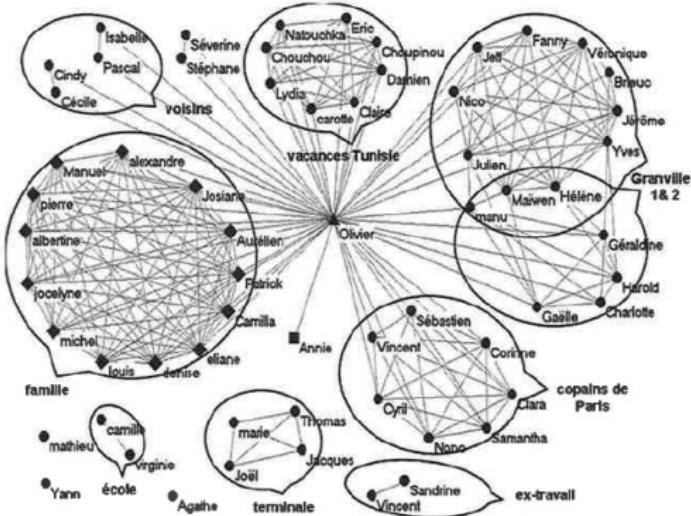
...to a complete structure

Figure 2.2. — *Le réseau personnel d'Étienne dans le panel de Caen (vague 1) : représentation en structure*



Size, structure and socio-economic status

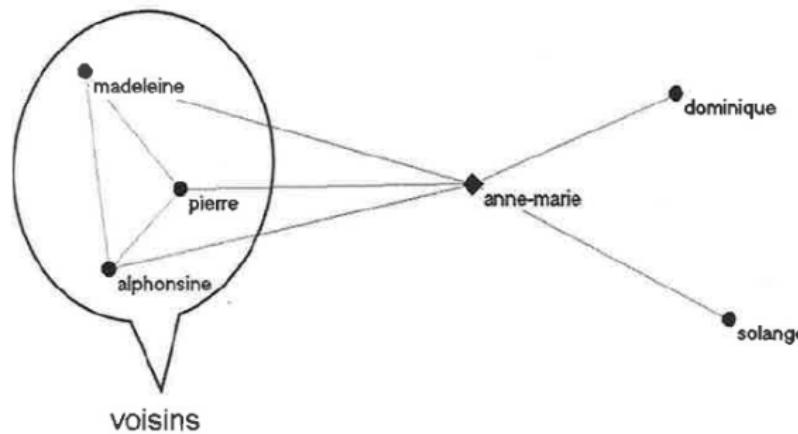
Figure 2.3. — *Le réseau d'Agnès dans le panel de Caen (vague 4)*



(Bidart et al., 2011, p. 58)

Size, structure and socio-economic status (cont.)

Figure 2.4. — *Le réseau de Sonia dans le panel de Caen (vague 4)*

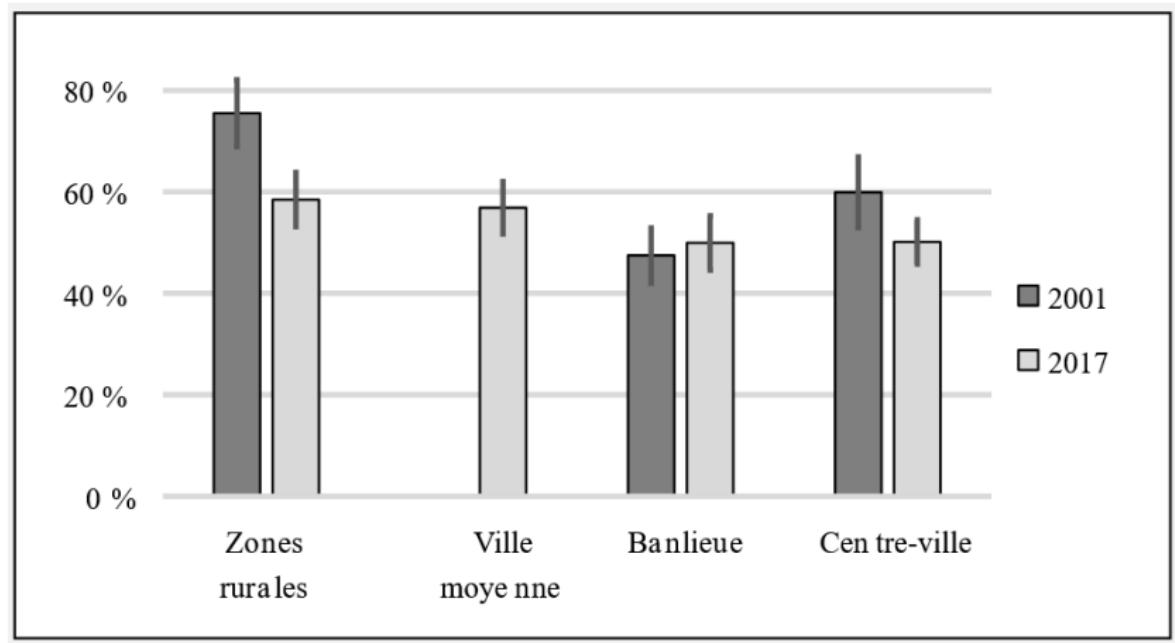


(Bidart et al., 2011, p. 59)

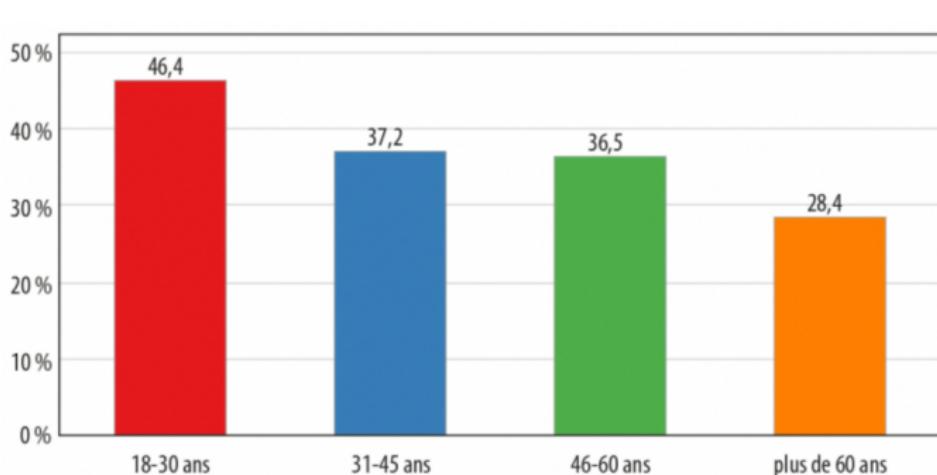
Structure of personal networks and urban/rural context

- ▶ Indicator of diversity of social contexts associated with relationships
- ▶ Low density networks when belonging to several disconnected social circles
- ▶ Rural areas traditionally characterised by more interconnected spheres of activity, urban areas by more fragmented networks

Density of personal networks in Toulouse, by zone



Life in lockdown: contact losses



Original (jpeg, 139k)

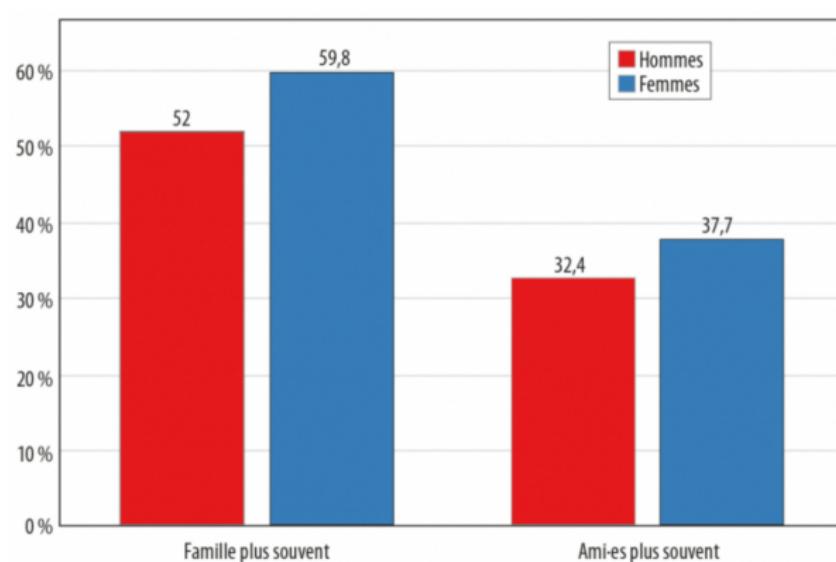
Graphique 1. Proportion des enquêté·es qui font état de pertes de contact

Champ : ensemble des réponses (N = 16 228).

Lecture : 46,4 % des enquêté·es âgé·es de 18 à 30 ans déclarent avoir perdu au moins une relation durant le confinement.

(Grossetti et al., 2021)

Life in lockdown: gender differences



Original (jpeg, 177k) [Download](#)

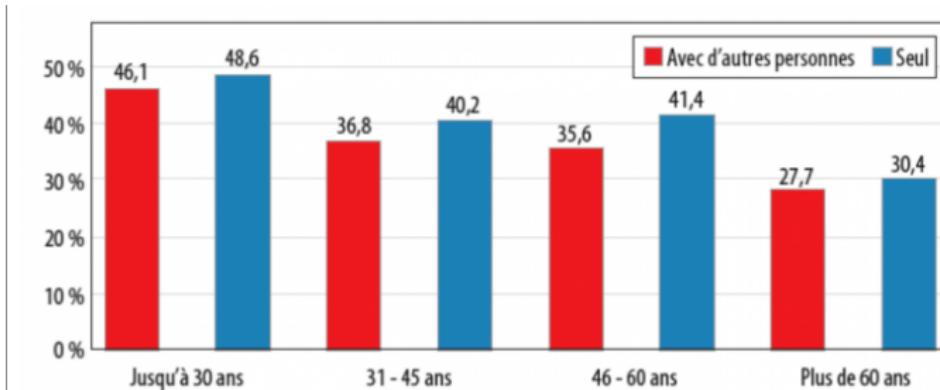
Graphique 2. Différences hommes-femmes concernant l'évolution des contacts avec la famille et les ami·es durant le confinement

Champ : ensemble des réponses (N = 16 228).

Lecture : 52,0 % des hommes déclarent avoir eu plus de contacts avec un membre de leur famille durant le confinement.

(Grossetti et al., 2021)

Life in lockdown: persons living alone



Original (png, 19k) [↓](#)

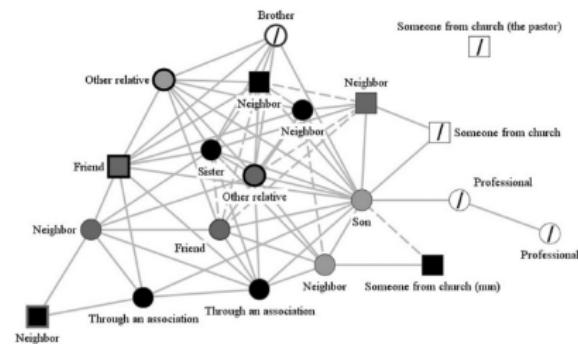
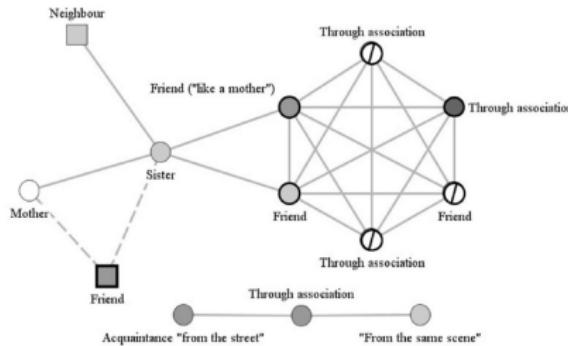
Graphique 3. Part des contacts perdus de vue selon les catégories d'âge et les conditions de confinement

Champ : ensemble des réponses (N = 16 228).

Lecture : 46,1 % des enquêté·es de moins de 30 ans et confiné·es avec d'autres personnes déclarent avoir perdu de vue certaines relations.

(Grossetti et al., 2021)

Poverty and social support



(Lubbers et al., 2020)

Now you know:

- ▶ Distinction between complete network and personal network research designs
- ▶ Key ego-centred network indicators: size, composition and structure

Collecting (personal) network data

- ▶ Networks are built from nodes and the ties between them
- ▶ Who are the nodes
- ▶ What are the ties –what is the relationship of interest
- ▶ Both aspects are essential
- ▶ Once this has been defined: how can we elicit information on ties from nodes?

How to identify nodes

- ▶ Ego-network data collections often included in larger surveys
- ▶ Nodes are respondents
- ▶ Sampling may follow different principles (representative, convenience, snowballing...)

How to identify relevant relationships

It depends on your research questions, however in general:

- ▶ Ego-network data: usually broad definitions:
people with whom you discuss important matters; people you have been in touch with over the last six months; etc.
- ▶ For specific (eg support-related) information, you may adopt narrower definitions:
people from whom you would borrow money, people who could look after your home while you are away etc.

Collecting network data through surveys: name generators and interpreters

Name generators are questions to elicit respondents' alters, for example:

From time to time, most people discuss important matters with other people. Looking back of the last six months, who are the people with whom you discussed matters important to you. Just tell me their names or initials.

(General Social Survey, 1985)

Can be accompanied by name interpreters to report alter characteristics and identify ties between alters.

Multiple name generators

- ▶ Reconstitute a person's entourage from several questions
- ▶ Participants are asked to indicate the first names or nicknames of the people with whom they have certain types of relationships (discuss their hobbies, share personal problems, etc.)
- ▶ Example: the Toulouse survey of 2001 and 2017 (Favre & Grossetti, 2021)
- ▶ Example: ELIPSS survey 2019

Name generators and interpreters with real-time visualization

- ▶ Appeal of visual depictions of relationships in social network analysis is known;
- ▶ Recent tendency to exploit its advantages during data gathering;
- ▶ Improves participants' survey experience as they may gain insight into their social connectivity.

(Hogan et al., 2007; Tubaro et al., 2014, 2016)

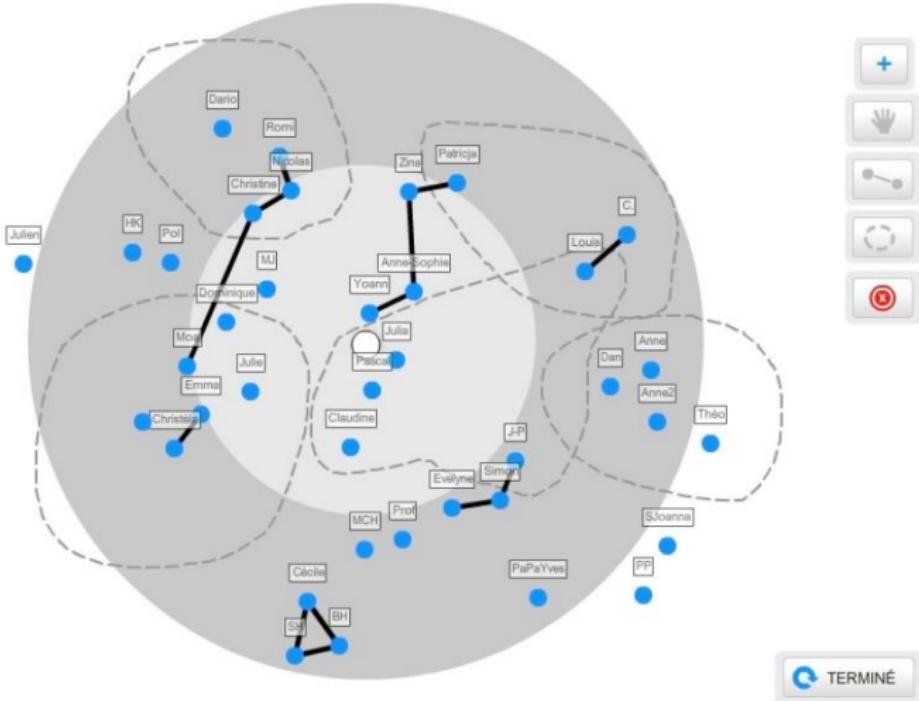
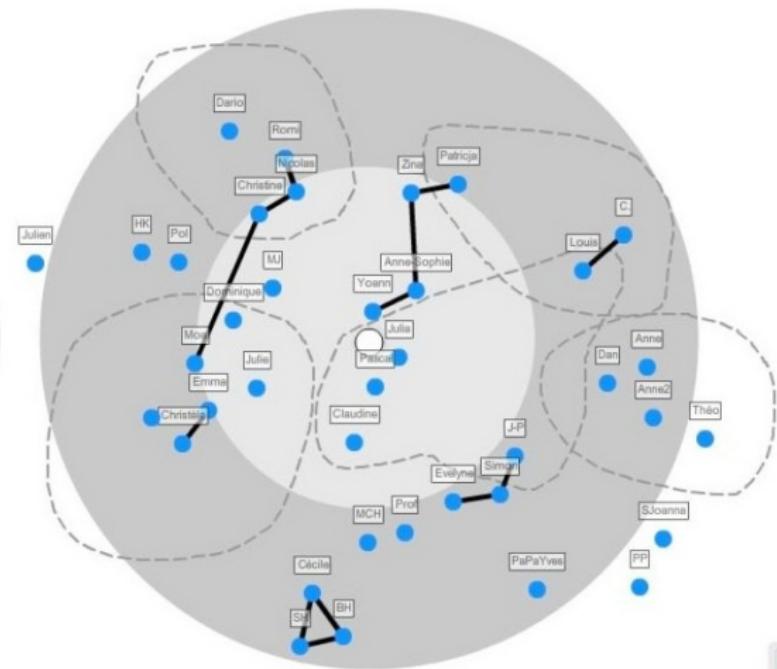
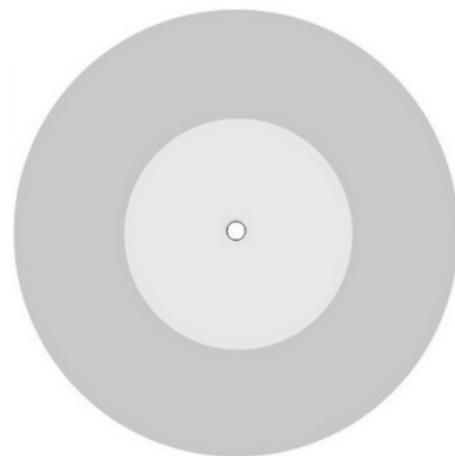


Figure: A name generator with real-time visualisation in a web-based survey. Research project ANR ANAMIA

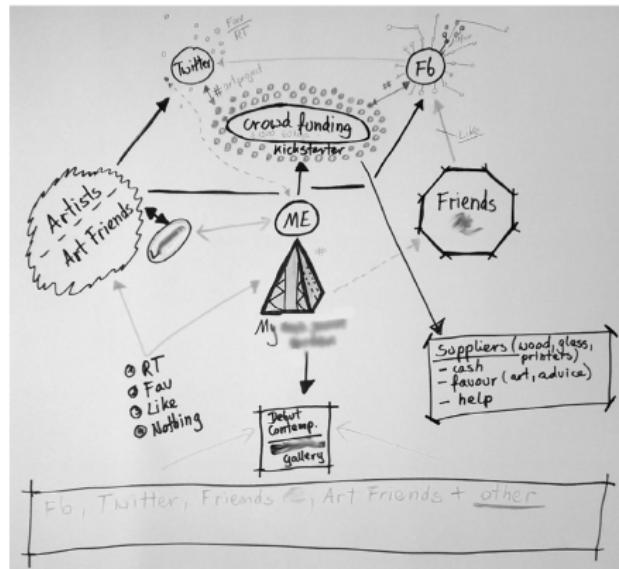
Participants draw their personal network



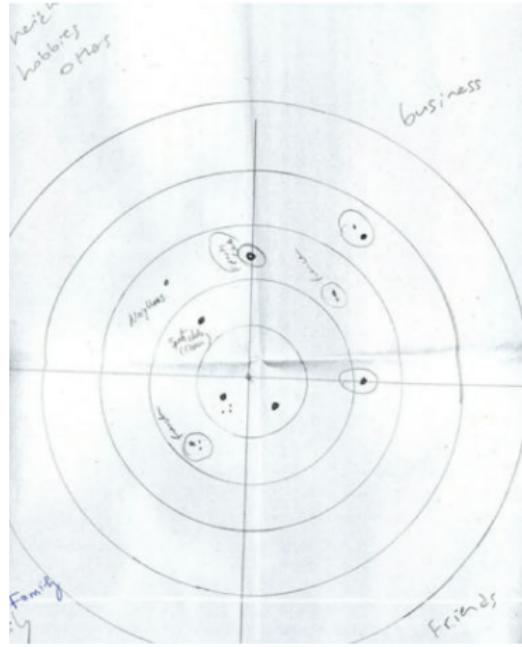
Usefulness of visualization

- ▶ Concentric-circles scheme for network visualisation in data collection not new – earlier successful experiences though on paper (Hogan et al., 2007)
- ▶ Used with various types of respondents, mostly excited about the opportunity to describe the visualisation and talk about their network
- ▶ More playful and user-friendly than having to fully list alters and their attributes
- ▶ A useful prompt to elicit memories and support reflection

'Visual Network Research'

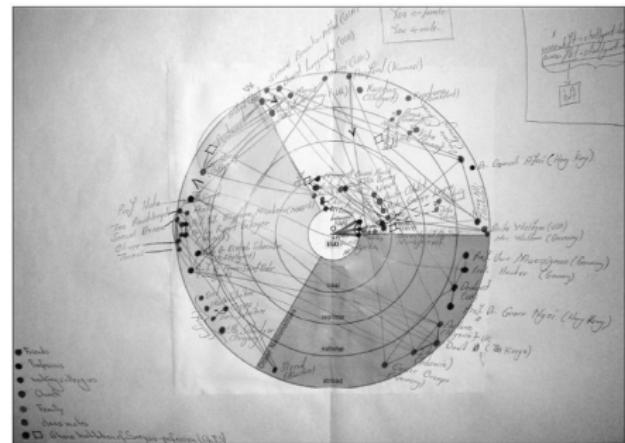


Reyes (2016)



Ryan et al. (2014)

'Visual Network Research' (cont.)

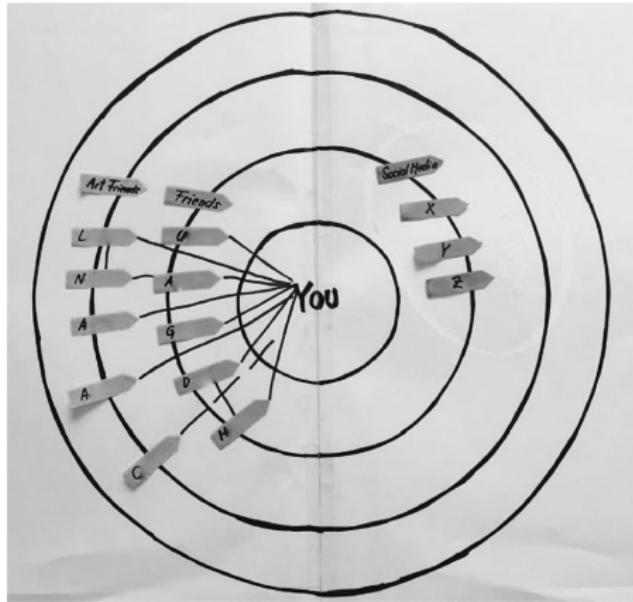


Gamper & Schönhuth (2020)

'Visual Network Research' (cont.)



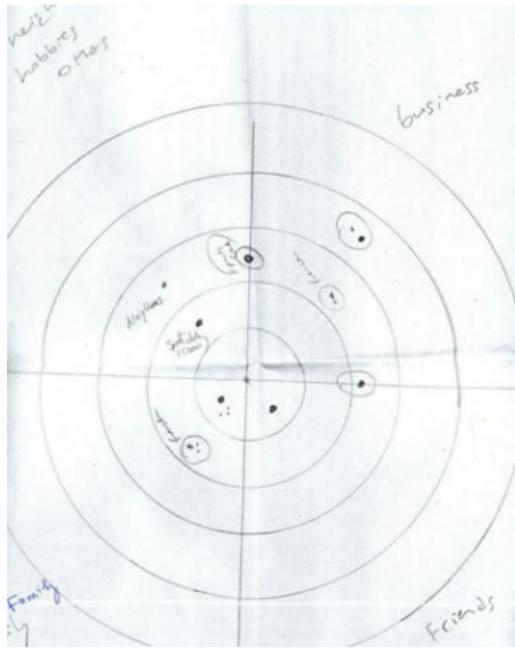
Altissimo (2016)



Reyes (2016)

Sociograms in interviews

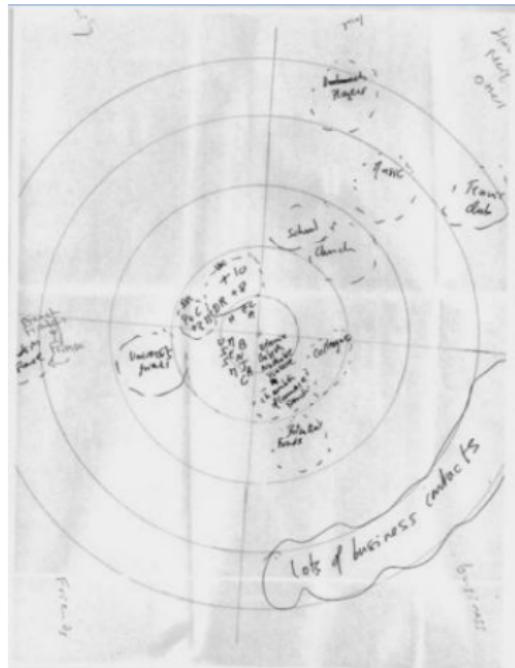
- ▶ Ryan et al. (2014) found helpful to accompany participants in the construction of their network
- ▶ However, some participants with many contacts found the tool time consuming and frustrating
- ▶ Some could not understand the point of mapping and were quite unsure how to use the tool
- ▶ Guess that the overly intuitive/ emotional character of the exercises did not fit well with participants' occupational and educational backgrounds



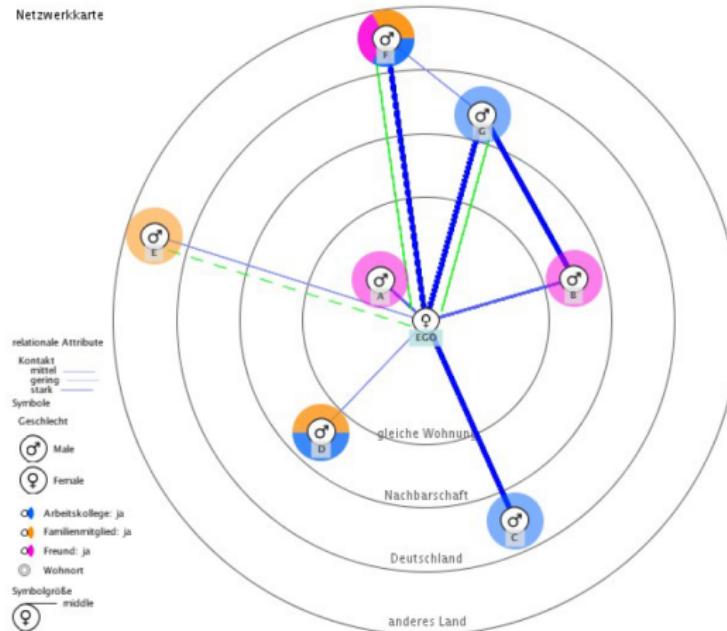
<http://www.socresonline.org.uk/19/2/16.html>

Sociograms in interviews (cont.)

- ▶ Some participants expressed discomfort about the discrepancy between the position they assigned to some one on the sociogram, and the placing that person might expect to receive
- ▶ The tool induces participants to reflect in a novel way about their relational environment

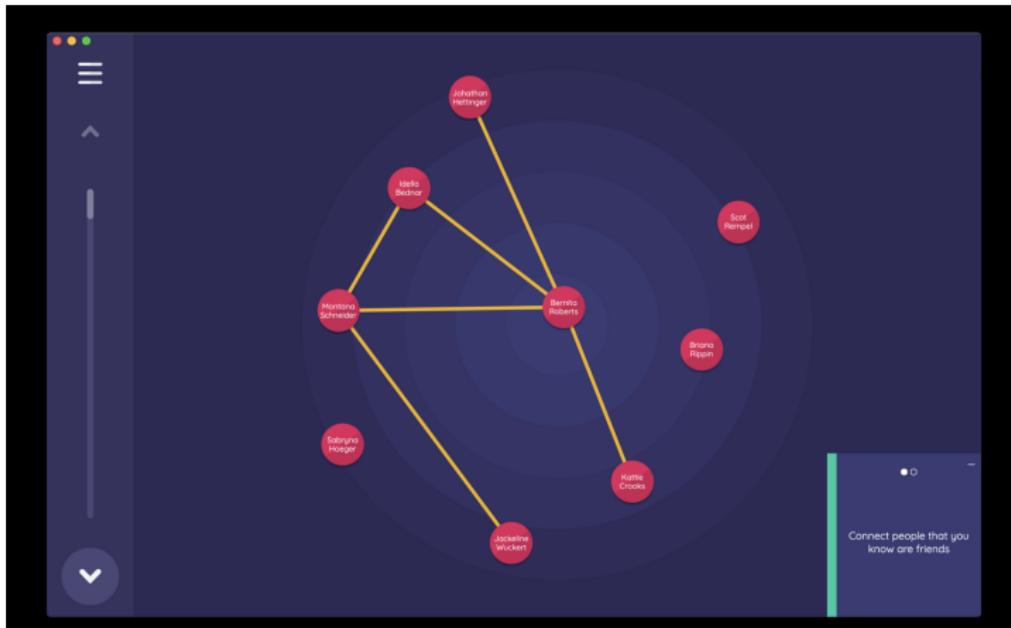


Today: Vennmaker



<http://www.vennmaker.com/>

Today: Network Canvas



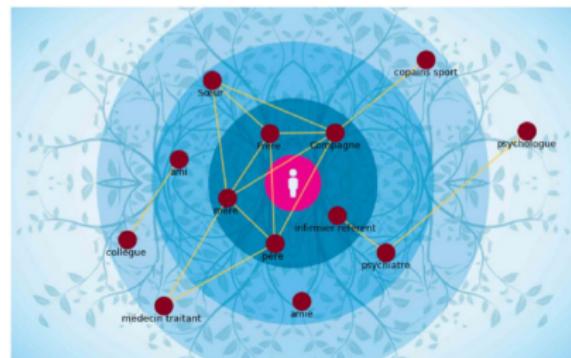
<https://networkcanvas.com/>

Example: the Egonet study

L'intervention Egonet



① Premier entretien: récolte de données et cartographie du réseau de support social, grâce à Network Canvas



Example: the Egonet study (cont.)

Session : Clotte

Informations et questions Personnes soutenantes Accès à l'ordre du jour Lecture Résultats Notes

Afficher les modifications Afficher les notes

Préviews

Nom	Genre	Groupe	Salle du groupe	Nbde (sex)	Domiciles de soutien	Vie résidentiel	Soutiens en cas de crise	Importance du soutien
Les malades	✓	4	Hypothérapie	2	✓	✓	✓	1
Thérèse	✓	2	Île de France	-	-	✓	✓	2
Jean-François	♂	-	1	Réel	✓	✓	✓	2

Interventions psycho-médico-sociales

Nom	Genre	Groupe	Salle du groupe	Nbde (sexe)	Soutien	Domiciles de soutien	Vie résidentiel	Soutiens en cas de crise	Importance du soutien
Infirmières	✓	10	Infirmières et infirmiers	-	Service hospitalier de Nantes Doms	✓	✓	✓	3

Informations et questions Personnes soutenantes Accès à l'ordre du jour Lecture Résultats Notes

Style : Kamala Kassi

Prénom : Type (pratiche, profession...)

Couleur : Soutien en cas de crise

Saturation des couleurs : /

Labels : Aide (hors fonction) ✓

Afficher les relations conflictuelles :

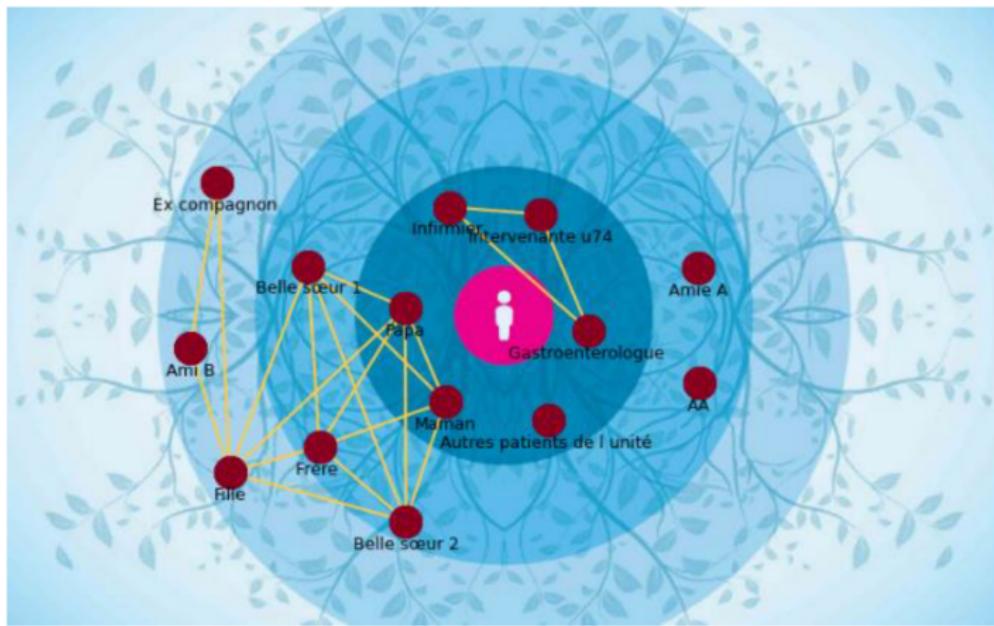
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    graph TD
        N1[Thérèse] --> N2[Jean-François]
        N1 --> N3[Psychologue]
        N1 --> N4[Administratrice]
        N1 --> N5[Medecin]
        N1 --> N6[Infirmiere]
        N1 --> N7[Psychiatre]
        N1 --> N8[Assistante sociale]
        N1 --> N9[Psychiatre]
        N1 --> N10[Psychologue]
        N2 --> N3
        N2 --> N4
        N2 --> N5
        N2 --> N6
        N2 --> N7
        N2 --> N8
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        N2 --> N10
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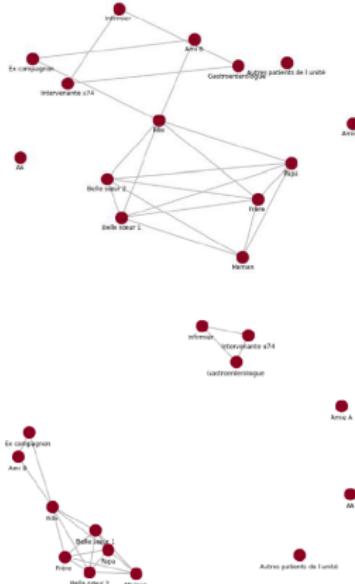
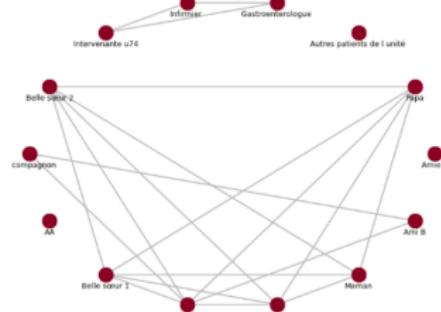
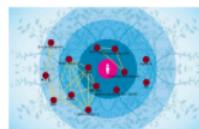
② Second entretien : échange en équipe et avec le/la bénéficiaire, avec l'assistance de l'application web de feedback

Example: the Egonet study (cont.)



(Nicaise et al., 2022)

Example: the Egonet study (cont.)



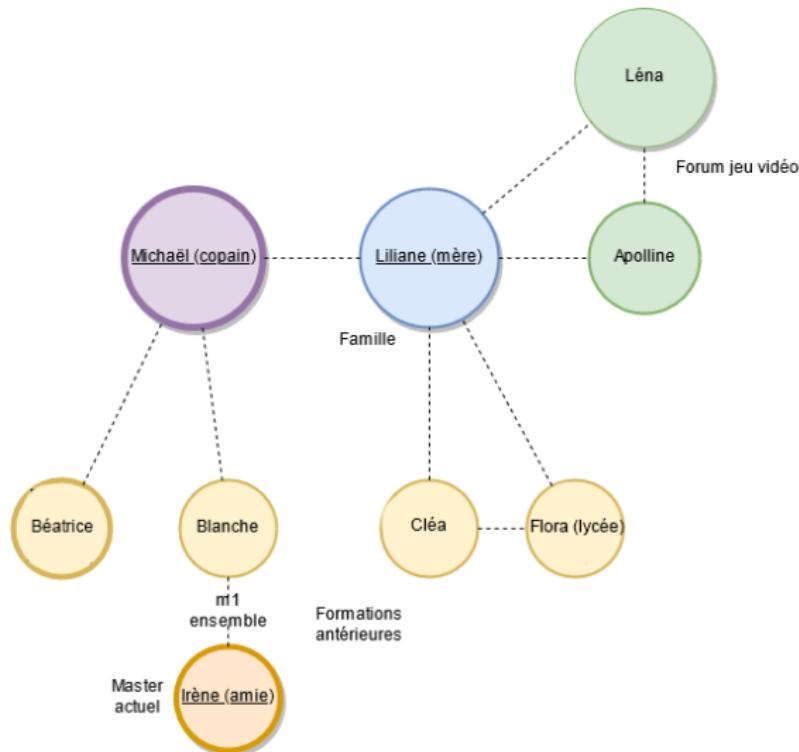
(Nicaise et al., 2022)

Other tools to draw sociograms in interviews



DiagramEditor

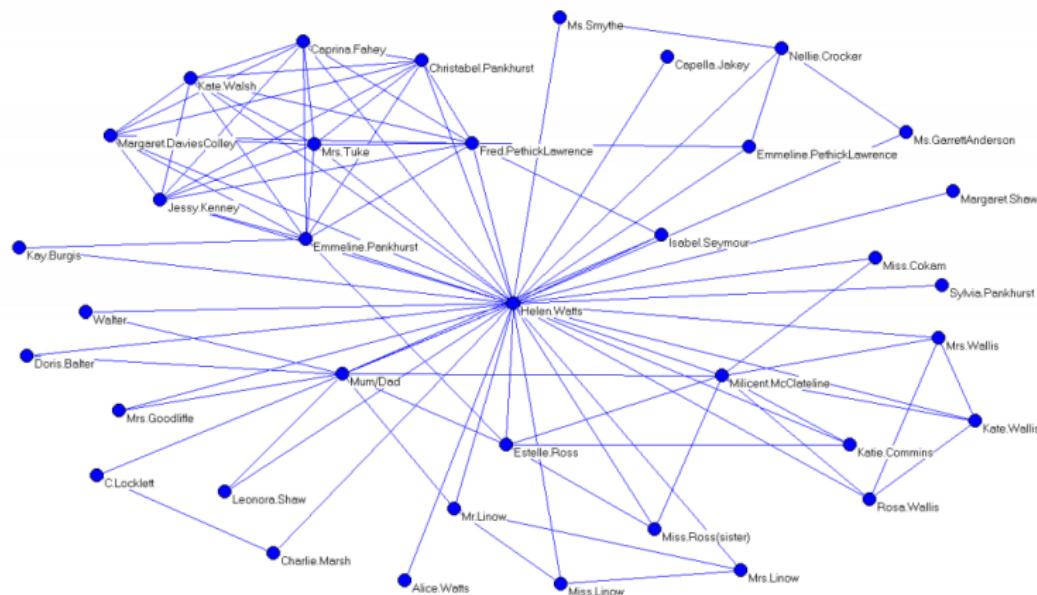
Chantel (2021)



Secondary data

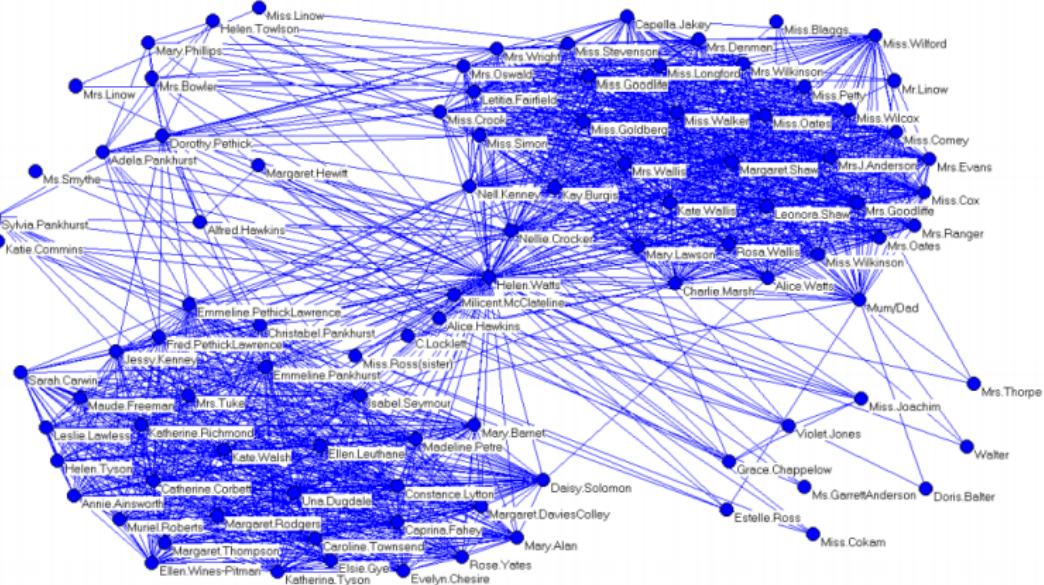
- ▶ UCNets
- ▶ SHARE Wave 4, 2011; SHARE Corona, 2020-21
- ▶ GSOEP 2006, 2011, 2016
- ▶ ISSP 1986, 2001, 2017
- ▶ ELIPSS 2019
- ▶ Occasionally other studies (for ex. survey *Proches et parents*, INED 1990)

Reconstituting personal networks from historical archives



The personal network of suffragette Helen Watts and its evolution (Edwards & Crossley, 2009)

Reconstituting personal networks from historical archives

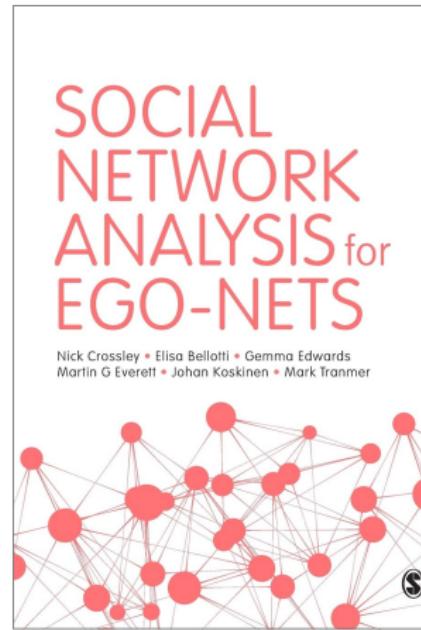
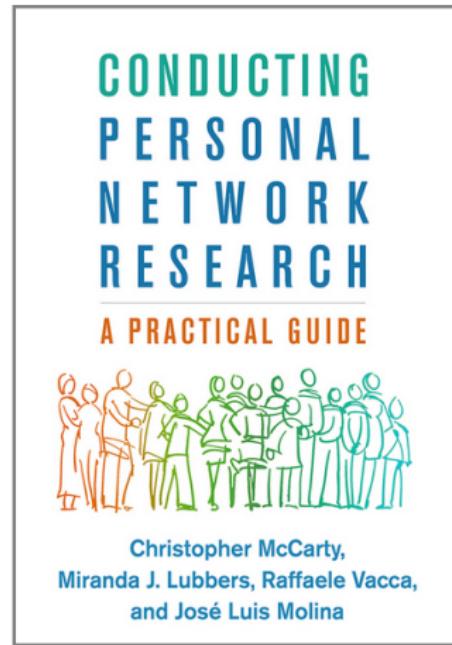


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Now you know:

- ▶ Different ways of collecting network data: surveys (with/without visual tools, online/offline etc), archives, API calls (and other data mining tools)
- ▶ All have advantages and disadvantages
- ▶ Choice depends on research questions, context, legal framework and expected outcomes

For more information



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Thank you!

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