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## NETWORK SCIENCE: Me & My Network. Activity guide for facilitators

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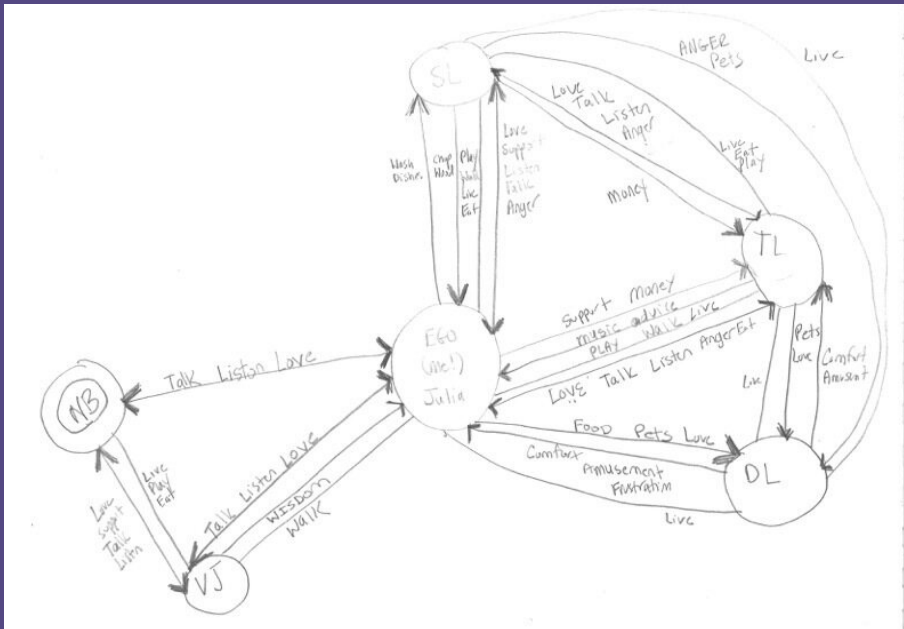
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# NETWORK SCIENCE

## Me & My Network

Activity guide for facilitators



**WORLDS OF CONNECTIONS**  
SCIENCE EDUCATION PARTNERSHIP AWARD  
SUPPORTED BY THE NATIONAL INSTITUTES OF HEALTH

UNIVERSITY OF  
**Nebraska**  
Lincoln

# ME & MY NETWORK

## Next Generation Science Standards

**Crosscutting Concept 4. Systems and system models.** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

\*Next Generation Science Standards is a registered trademark of WestEd. Neither WestEd nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and do not endorse it.

## Objective

**Youth will model** their social connections as systems related to their identities.

**Youth will be able to** understand the social relationships in their lives as part of social systems related to their identities and model these social systems as ego-networks.

## Materials

### Per youth

- Large sheets of paper (e.g., 17"x22")
- Pencil with eraser
- Coloring utensils

### Per club

- Whiteboard or classroom-sized sticky note pad
- Markers
- Example ego networks

## Anticipatory Set

Raise youth curiosity by leading a discussion based upon the following types of questions:

- *Think about those who are in your social world.*
- *Who sometimes helps you get through a day (e.g., getting meals, rides to where you need to go, someone to talk to)?*
- *Who do you sometimes help get through their day (e.g., prepare meals for, take care of, play with)?*
- *Who do you see at holidays and/or social gatherings?*



- *Who do you think about sometimes even if you do not see them in person (e.g., family members, friends, pets, classmates, teachers)?*

Example introduction: *Today you are going to make a model of your own social world. We can think of our relationships with others in our lives—for example, family members and friends—as a system. You are going to draw your social world as a system.*

## Procedure

**Note:** Exploring personal networks might bring up painful relationships for youth (e.g., death of someone close to them, alienation from family members), so facilitators should be aware when asking participants about their networks that these things might come up. Review mandatory reporting guidelines for child abuse and neglect (e.g., in Nebraska, alert the mandatory reporting hotline and the site director). **Do not force youth to share their networks with the whole group. This activity is not a competition, and it is okay to have any kind of network—large and dense, small and close-knit, one full of animals, one that includes people who died, or something else. If youth are struggling to find others to list, you might suggest listing teachers or club leaders.**

### Set-up

- Set out multiple sheets of paper, pencils with erasers, and coloring utensils for each participant.

### Activity 1 — Draw ego-network models

1. Select an example network (e.g., your own, a made up one, one for a fictional character such as Winnie the Pooh). Try to include non-humans (e.g., pets). Guide the youth through the following steps, displaying the example ego-network where all youth can see it. Walk youth through creating YOUR example network and ask them to follow along and make their own.

a. Draw one vertex (the ego) in the middle of the page. For this example, we are labeling the vertex "ME" for "my ego-network."

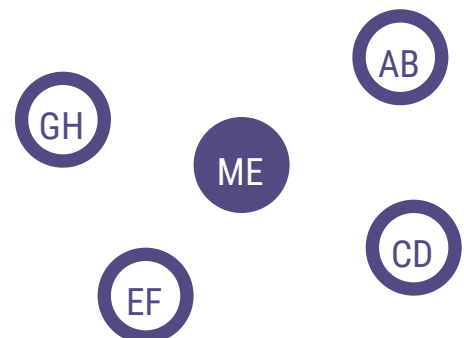
i. Example:



b. Next, draw vertices to represent the alters around the ego. Label the alters with names or initials.





i. Alters are those in one's social world, for example, those the ego communicates with, hangs out with, helps or gets help from.

ii. Example (see right):

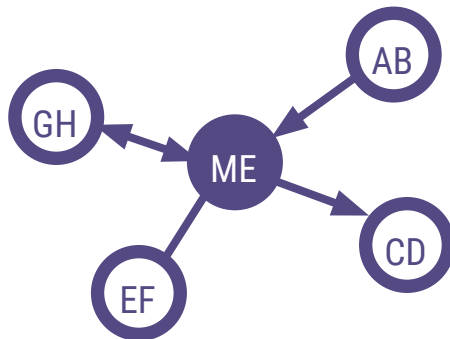


c. To show the connections in the ego-network, we'll draw lines and arrows. Arrows tell us if there is a direction in the relationship and if it is one-way (e.g., parents give their children rules, owners give their pets food) or two-way (e.g., friends send each other text messages). If there are no arrows, we know that the relationship involves only doing things together (e.g., playing). Relationships can involve many kinds of social interactions, such as talking, playing together, shopping together, helping, feeding, giving, receiving. Therefore, an alter and an ego can have up to four kinds of connections. Youth can decide how to represent the number and kinds of relationships for their ego and each alter.

i. It can be useful to put the following key where youth can see it, such as on the whiteboard:

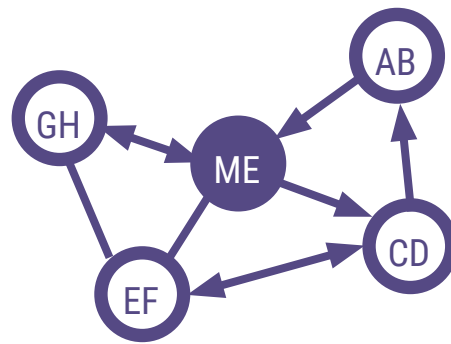
-  1. If only you give something to or do something for your alter (e.g., you feed them and fill their water bowl), draw a directed line from the ego to the alter with an arrow towards the alter.
-  2. If only your alter gives something to or does something for you (e.g., they give you a ride to school), draw a directed line from the alter with an arrow pointing at the ego.
-  3. If you and your alter BOTH give something to or do something for each other (e.g., you trade Pokémon cards), draw a bi-directional line.
-  4. If you do something together (e.g., play), draw an undirected line.

ii. Example:



d. Now think about how your alters might be connected to each other. If you think that they are, draw the appropriate lines and arrows (example on next page). (For informal purposes, it is okay if youth are not fully sure if/how their alters are connected. They can use their best guesses to create their ego-networks.)

i. Example:



2. After the youth draw their ego-networks, invite them to share them with a peer, if they are comfortable, or with a facilitator.

## Differentiation/Extension

### Extension 1

1. Explore ways to convey information about relationships in the ego-network social system drawings. For example:
  - a. Move the vertices to create clusters alters (e.g., friends together, those you live with together)
  - b. Put vertices closer together or farther away based on how often the ego and alters interact.
  - c. Make edges thicker or vertices smaller or larger to show the importance of the alters to the ego.
  - d. Label each line with what is “flowing” between ego/alter (e.g., food, information).
  - e. Explore color coding and adding symbols to represent attributes (e.g., age, species, role, skills) of each vertex or of each edge.
  - f. Use numbers to indicate are multiple ways that alters are important to the ego, for example helping with homework, preparing meals, watching TV, etc.
2. Draw a legend to explain how the different colors, sizes, and labels in the model convey information about the ego-network.

### Extension 2

1. Draw a new ego-network based upon a different connection. Rather than “who is important in your life,” pick another reason for connections. Below are a few ideas:
  - a. *Whom do you go to for ADVICE?*
  - b. *Who gives you INFORMATION?*
  - c. *With whom do you have FUN?*
  - d. *Who tells the STORIES that you enjoy?*
  - e. *Who helps you to take care of your HEALTH?*

## Reflection Questions for Discussion/Debrief

Questions for a debrief discussion to connect the activity to network science and health.

*Today we have explored social systems by drawing our ego-network models.*

- *What did you notice about your social world by drawing your ego network?*
- *Did drawing the relationships in your social world change how you think about your relationships?*
- *How can our relationships with others be systems?*
- *How is modeling our relationships with a network map useful? Who might it be useful to?*
- *What kinds of things connected you to the people in your network?*
- *Is it better to have more or fewer connections in your ego network? Why?*
- *How do the people in our network help us take care of our health?*
- *How can scientists use information about our social connections to improve public health?*
- *How could gathering information about people's social networks help communities? (Examples: meeting needs for affordable housing, access to jobs, recreational clubs; recruiting players for sports teams; making sure people have social support; planning parks; etc.)*

## Career/Future Application

**Public health workers** use ego-networks to do contact tracing (to stop the spread of infectious diseases) and interventions (e.g., making sure that people who are sick have care, that people in crises have support).

**Epidemiologists** who study the spread of diseases (such as influenza) and/or addiction get information from ego-networks to try to help people stay healthy.

**Psychologists and social workers** work with ego-networks to ensure that people have enough social support to prevent health-damaging loneliness.

**Sociologists** who study social relationships and the impacts on getting help during disasters such as a heatwave or earthquake, health, job opportunities, and more. Sociologists can also work with social media companies to make sure that people's privacy is protected.



## Background

### So what?

Scientists think of families and friends as forming people's social systems. Therefore, scientists want to understand people's social connections because they help us understand the sources of people's identities, support they have if they need help, risk of catching certain illnesses, and combined with other people's social connections, how resources, information, help, diseases, and more can spread through communities.

### How do sociologists use social networks for health outcomes?

Scan the code to watch the video by Nicholas Christakis "The Hidden Influence of Social Networks," one of the best short descriptions of social networks and health.



Sociologists use data on ego-networks to understand many phenomena such as starting or stopping smoking (Collins 2005); the quality of relationships among LGBTQ folks and their kin (Thor 2020); surviving heat waves and earthquakes (Klinenberg 2015), loneliness and associated health effects (CDC 2021); helping smaller towns thrive (Emery and Flora 2006); and illicit drug use (Gauthier et al 2022). (See **References**, pp. 9–11, to learn more about these studies.) Public health officials use network science to understand the spread of contagious diseases and to try and understand where they start (by tracing back) and how they spread.

A **social network** is a theoretical construct used to study individuals, groups, organizations, and/or societies. Social networks are often useful in the social sciences. In a social network graph, the vertices/nodes represent people, and the edges/ties represent the social connections among them. Social network analysis involves studying network characteristics, for example:

- Size (How many nodes? How many connections?)
- Relationship strength
- Density (what percent of possible connections actually exist?)
- Centrality (is a node near the center with lots of connections or near the edge with just a few?)
- Prestige (e.g. many people claim someone as a friend but they do not claim many, or many people go to them for advice = more prestige)



Social network analysts also study roles, such as:

- Isolates (nodes with no connections)
- Bridges (nodes that, if removed, would disconnect components in a network)
- Liaisons (nodes that relay from one group to the other, the people who are “go-between” for groups that are otherwise disconnected)

Scan the QR codes below for activities that explore these network characteristics:



## Vocabulary

**Note:** The vocabulary terms are helpful for the activity facilitator to learn the scientific language used in the activity and within the network science community. You can decide if you want to emphasize vocabulary or not.

### Network

1) A set of relationships; 2) can be visualized as models to show how things are connected; 3) when mapped, reveal hidden information.

### Network model

A representation of a real-world network.

### Vertex (vertices)

Also called a node, usually drawn as a circle; can represent different things in a network (e.g., people, animals, cells in the body, organizations, etc.). For example, vertices or nodes in our immediate family can include siblings, guardians, and even pets.



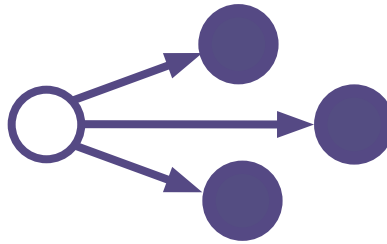
### Edges

The lines connecting vertices in a network that represent a relationship. Arrows can indicate the direction of the relationship. The first example below shows an undirected edge; the second example shows a directed edge; the third example shows a bidirectional edge.



## Degree

The number of lines a vertex has connected to it. The leftmost vertex pictured below has a degree of three:



## In-degree

The number of directed edges that are coming to a vertex/node.

## Out-degree

The number of directed edges that are leaving a vertex/node.

## Ego

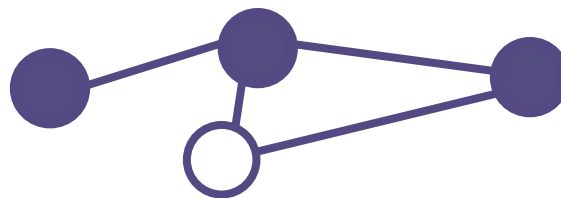
The focal vertex of an ego-network. In the example below, the white vertex is the ego. The network is made from the perspective of the ego, also called the nominator (the one listing others, which are called alters).

## Alter

A vertex connected to the ego; a neighbor vertex in an ego-network. In the example below, the three solid purple vertices are alters. (An ego-network includes the edges between the ego and its alters, PLUS the edges, if any, between the alters.)

## Ego-network

A social network drawn to describe an individual's social world based only on direct social relationships between the ego (i.e., the focal vertex) and their alters (those they are connected to). For example, the network graph below depicts the ego-network of the white vertex with its alters the purple vertices and their connections to the ego. The alters can also be called "neighbors" and can have connections with the other alters.



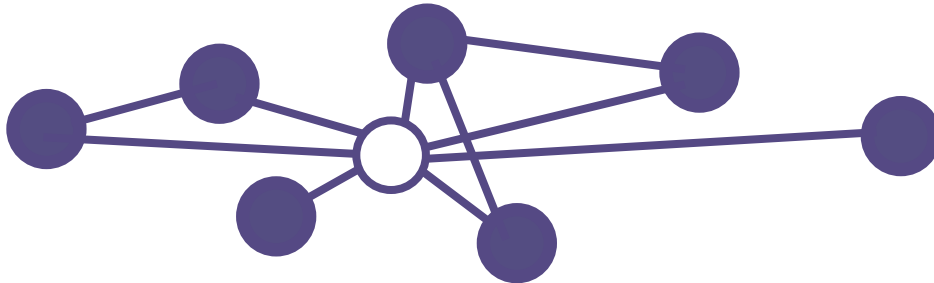
## Attribute

A characteristic of a vertex. For example, for people an attribute can be age, gender, role, political party, or grade.



## Hub

A node that has a lot more connections than the rest. In other words, it has a much higher degree compared to the other vertices. The center (white) vertex pictured below is a hub:



## System

"A system is a group of interacting, interrelated, and interdependent components that form a complex and unified whole. Systems are everywhere—for example... the circulatory system in your body, the predator/prey relationships in nature, the ignition system in your car, and so on" (Benson and Jost 2019). The Next Generation Science Standards Cross Cutting Concepts defines systems as: "an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.....Models are limited in that they only represent certain aspects of the system under study" (NGSS Lead States 2013).

## References

### Next Generation Science Standards crosscutting concepts

NGSS Lead States. (2013). APPENDIX G: Crosscutting concepts in the Next Generation Science Standards. In *Next Generation Science Standards: For States, By States*. Washington, DC: National Academies Press.

### Simple explanation of ego-networks

Borgatti, Steve. (1998). Ego networks. *Social Network Analysis Instructional Website*, 5 Aug 1998, <http://www.analytictech.com/networks/egonet.htm>. Accessed 22 Aug 2023.

**The book *Linked* by Albert-László Barabási offers a deeper understanding of networks and hubs. The introductory chapter and Chapter 5 on hubs and connections are particularly relevant for this activity.**

László-Barabási, Albert. (2002). The first link: Introduction. In *Linked: The New Science of Networks*, pp. 1–8. Perseus: Cambridge, MA. <https://barabasi.com/f/631.pdf>

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## **The basic ideas for this activity came from the work of G. Robin Gauthier’s dissertation.**

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Thor, E. (2020). Relationship quality in kina and chosen kin familial networks. [Master’s thesis, Department of Sociology, University of Nebraska–Lincoln, Nebraska]. <https://digitalcommons.unl.edu/sociologydiss/61/>

### **Description of how networks inform public health measures**

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## Example sociology articles that use social networks to understand identities

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McPherson, Miller, Lynn Smith-Lovin, and James Cook. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology* 27, 415–444. <https://doi.org/10.1146/annurev.soc.27.1.415>

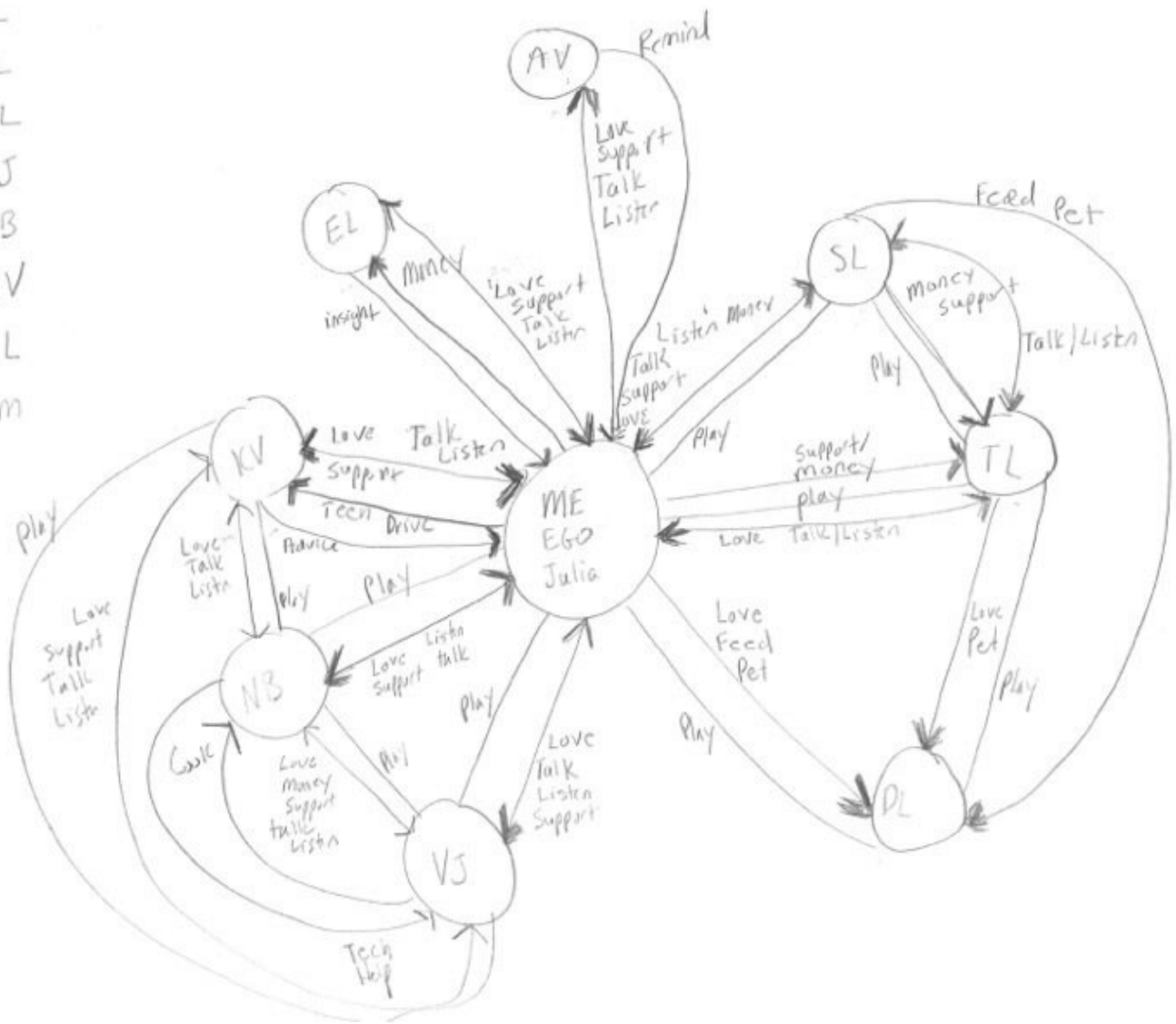
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# Example 1

1. ME
2. SL
3. TL
4. DL
5. VS
6. NB
7. KV
8. EL
9. SM



# Example 2

