Networks and their surrounding contexts

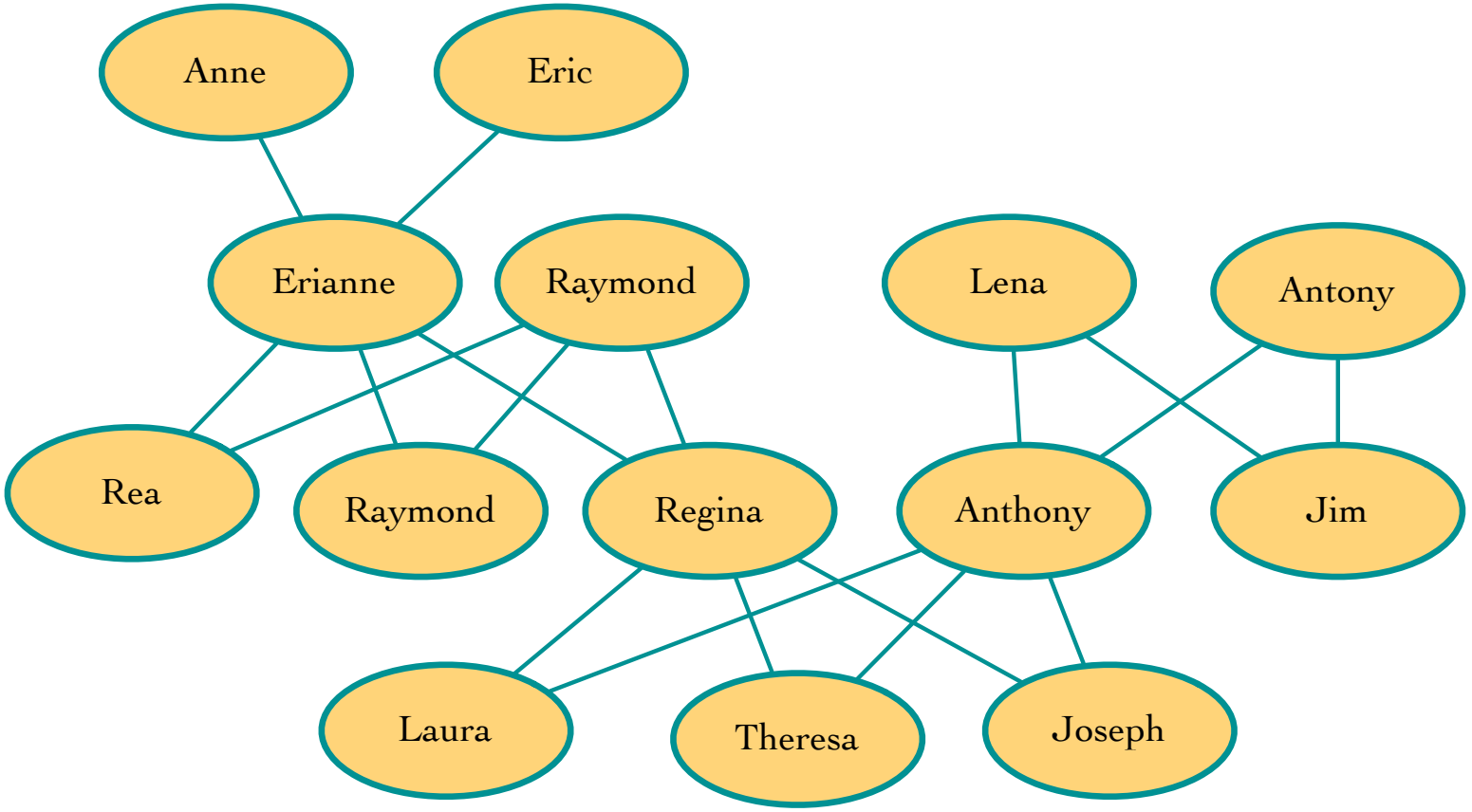
CMPS 17

Theresa Migler-VonDollen

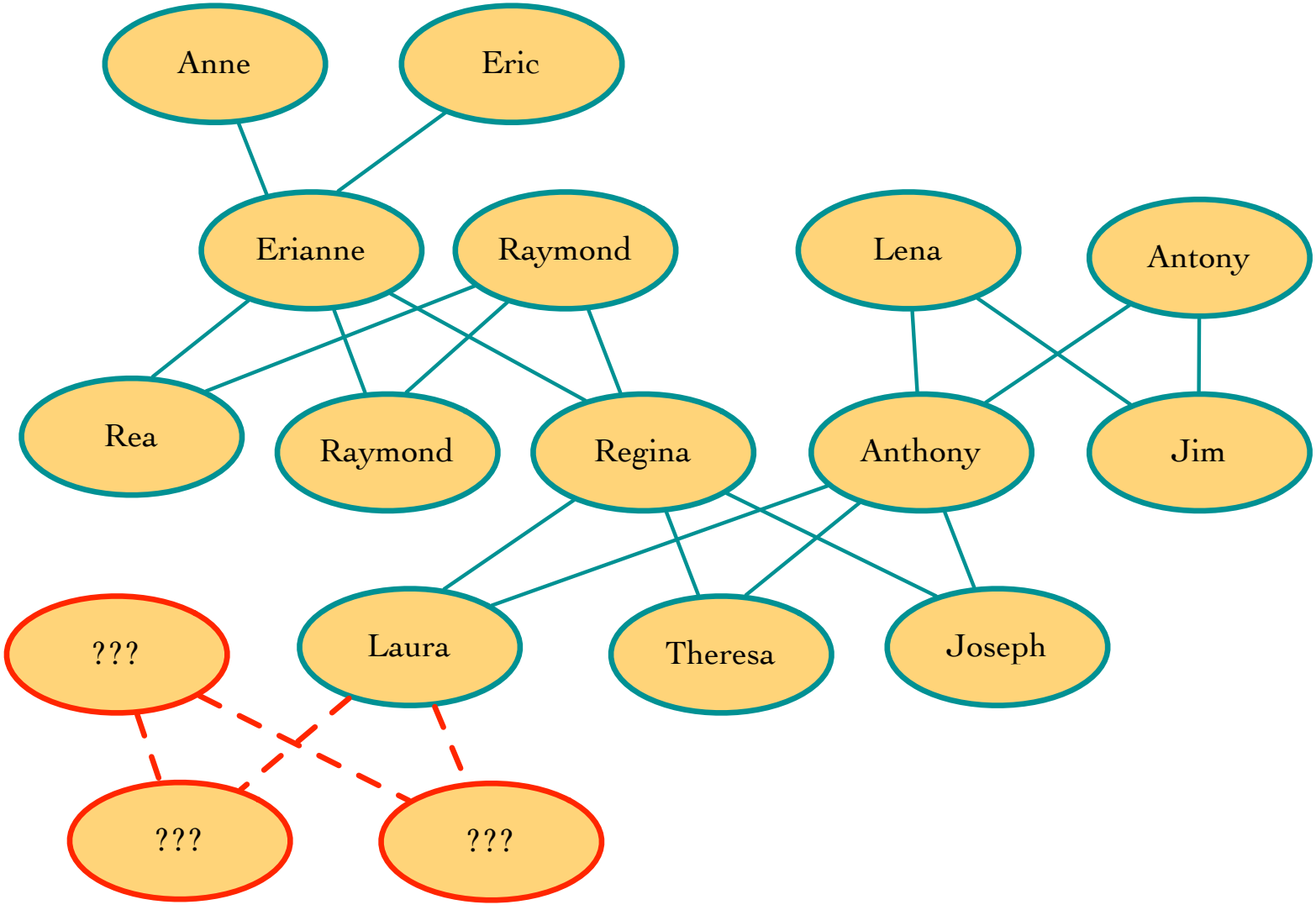
Networks in their surrounding context

A network's *surrounding context* means the factors that exist outside of the vertices and edges of a network but which affect how the network evolves.

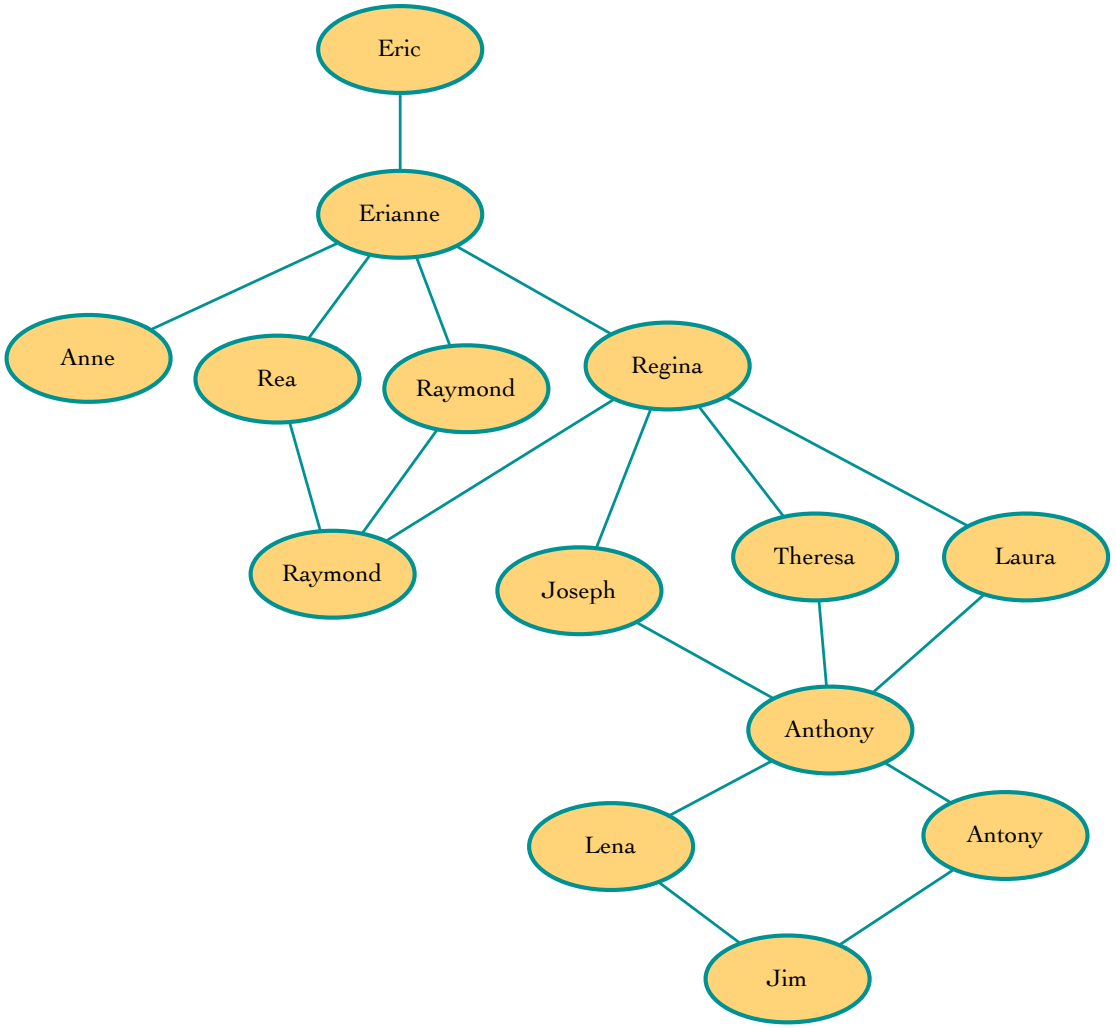
Networks in their surrounding context



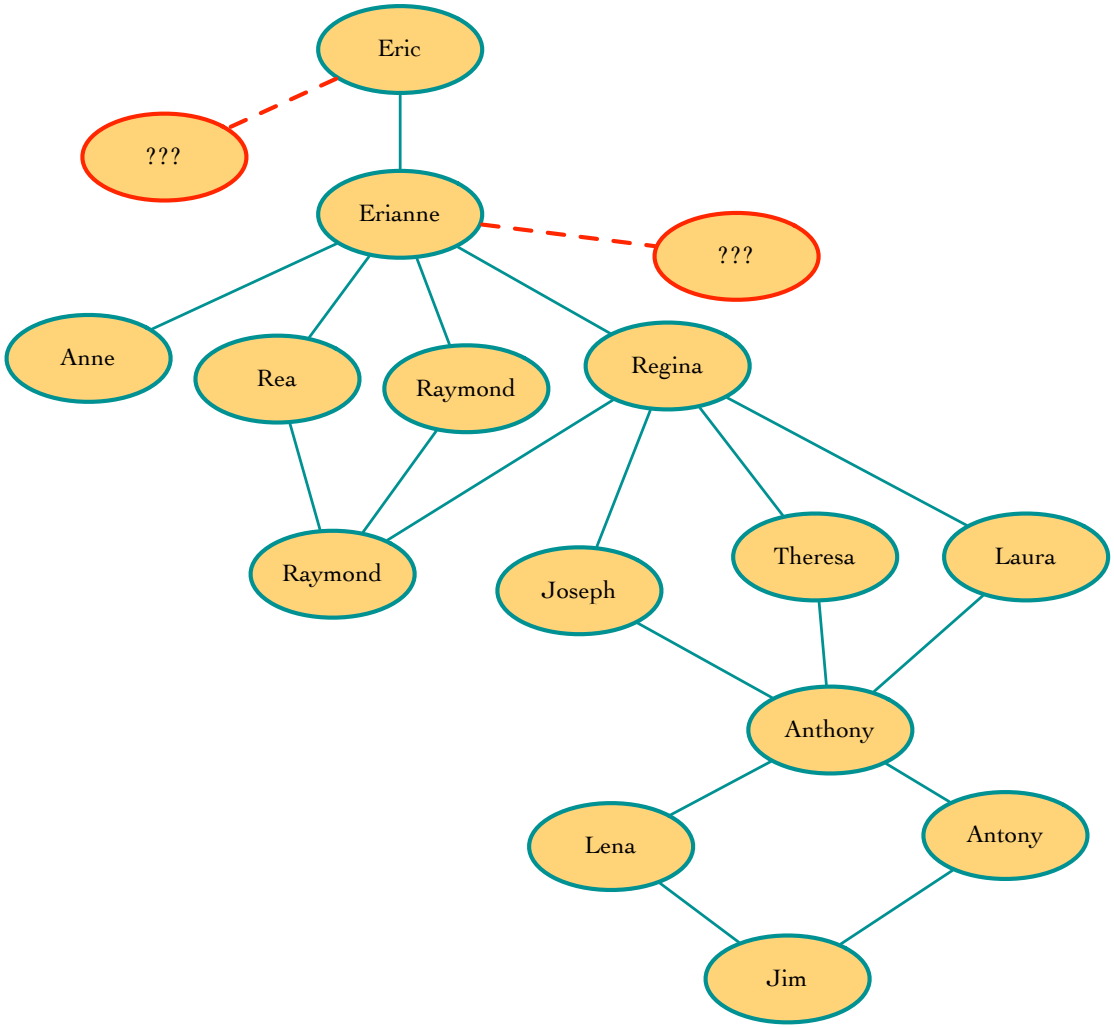
Networks in their surrounding context



Networks in their surrounding context



Networks in their surrounding context



Homophily

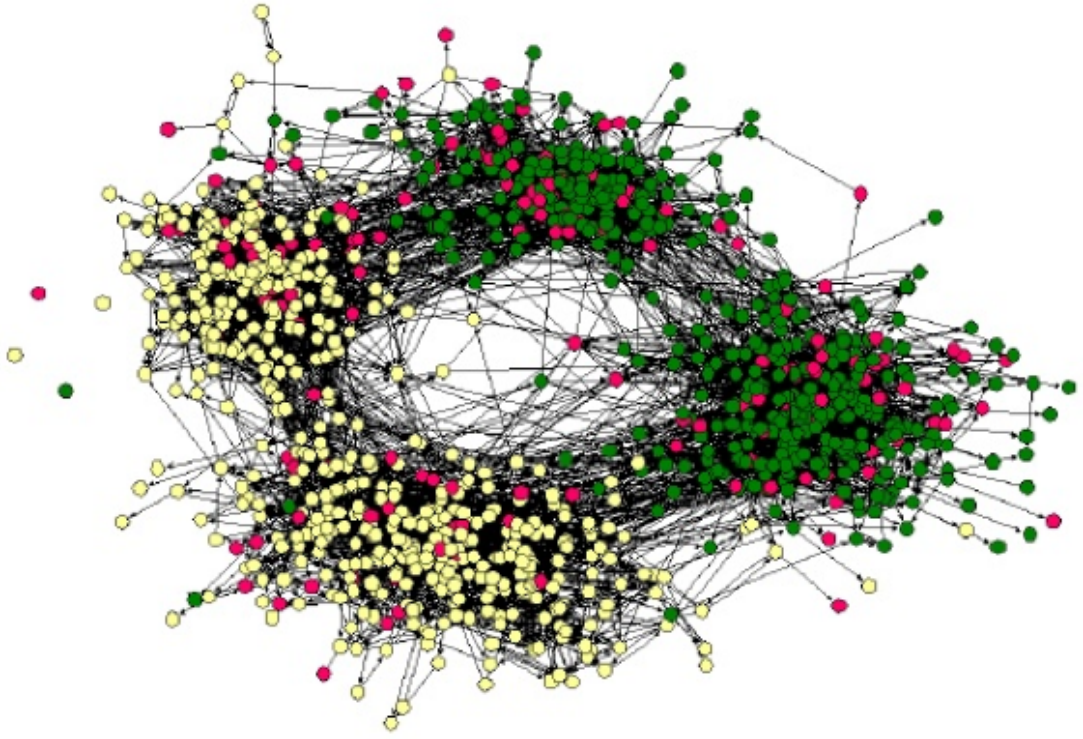
Definition

Homophily ("love of the same") is the tendency of individuals to associate and bond with similar others.

Consider your own social network. Are your friends mainly similar to you?

- age?
- gender?
- profession?
- location?

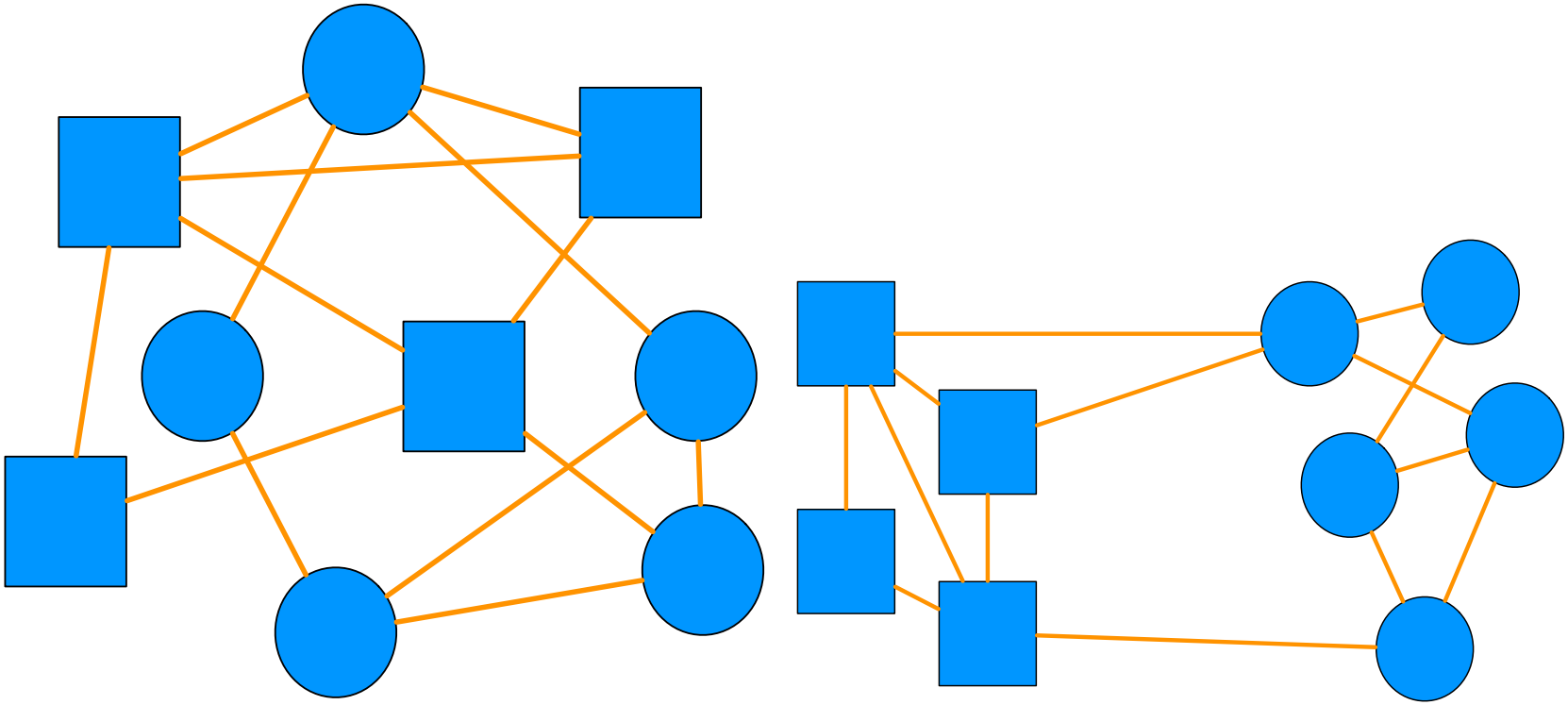
Homophily



Middle school and high school friendships separated by race and age. Different colors highlight different racial backgrounds, vertices are assorted according to age young on top to older at the bottom.

Measuring homophily

Does this graph exhibit homophily by shape?



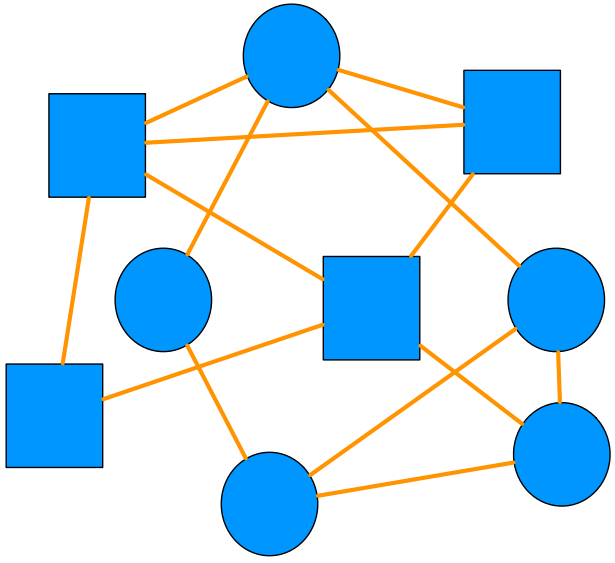
Measuring homophily

Suppose we have a network where a fraction p of the vertices are square and a fraction q are circles.
Consider an edge in this network.
Suppose we relabel all vertices randomly: pn vertices will be squares and qn vertices will be circles.
What is the probability that a given edge has both endpoints as square?: p^2
What is the probability that a given edge has both endpoints as circle?: q^2
What is the probability that a given edge has one square endpoint and one circle endpoint?: $2pq$

Measuring homophily

Homophily test

If the fraction of cross-shape edges is significantly less than $2pq$, then there is evidence of homophily.



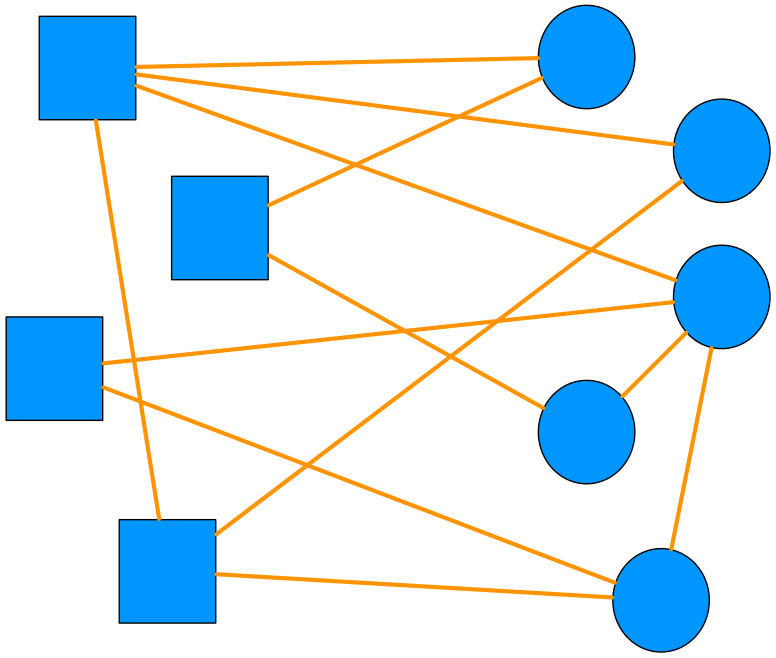
$p = 4/9$, $q = 5/9$, $2pq = 40/81 \approx .49$.
Actual fraction of cross shape edges: $3/14 \approx .21$
We conclude that there is some evidence of homophily.

Measuring homophily

Inverse homophily?

Homophily test

If the fraction of cross-shape edges is significantly more than $2pq$, then there is evidence of inverse homophily.



Selection and social influence

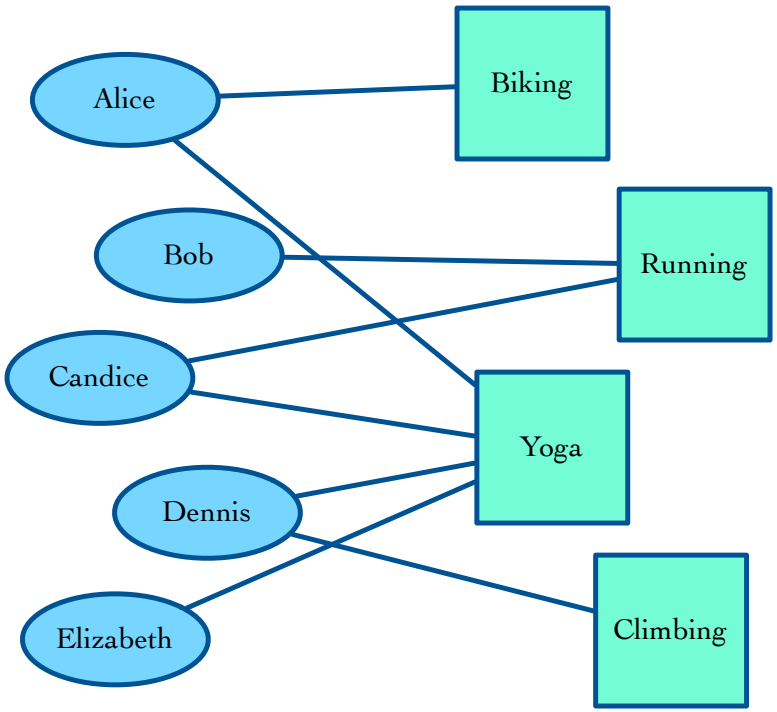
Why does homophily exist?

- Selection - tend to chose friends similar to you.
- Social Influence - peer pressure

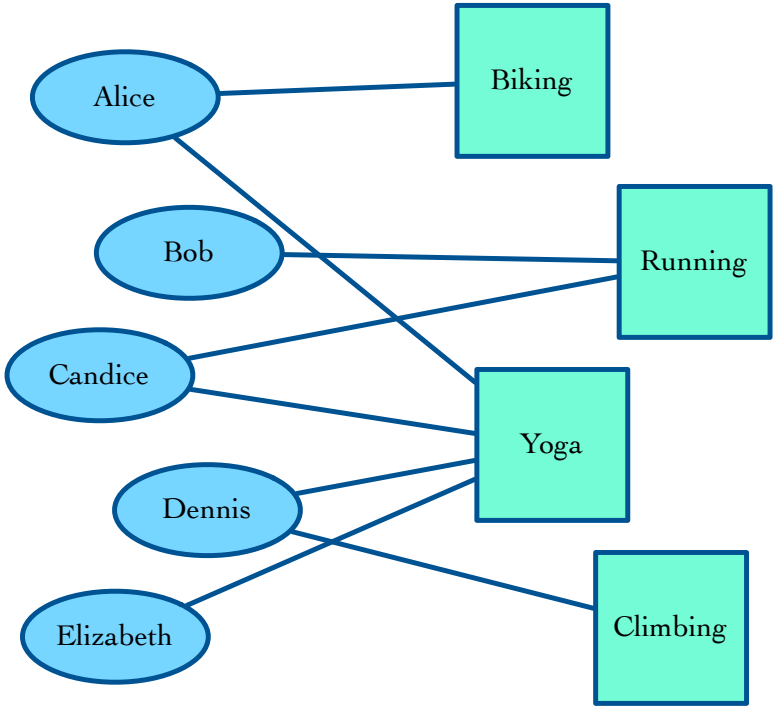
Affiliation networks

New type of network with two distinct types of vertices:

- People vertices
- Group (focus) vertices



Affiliation networks



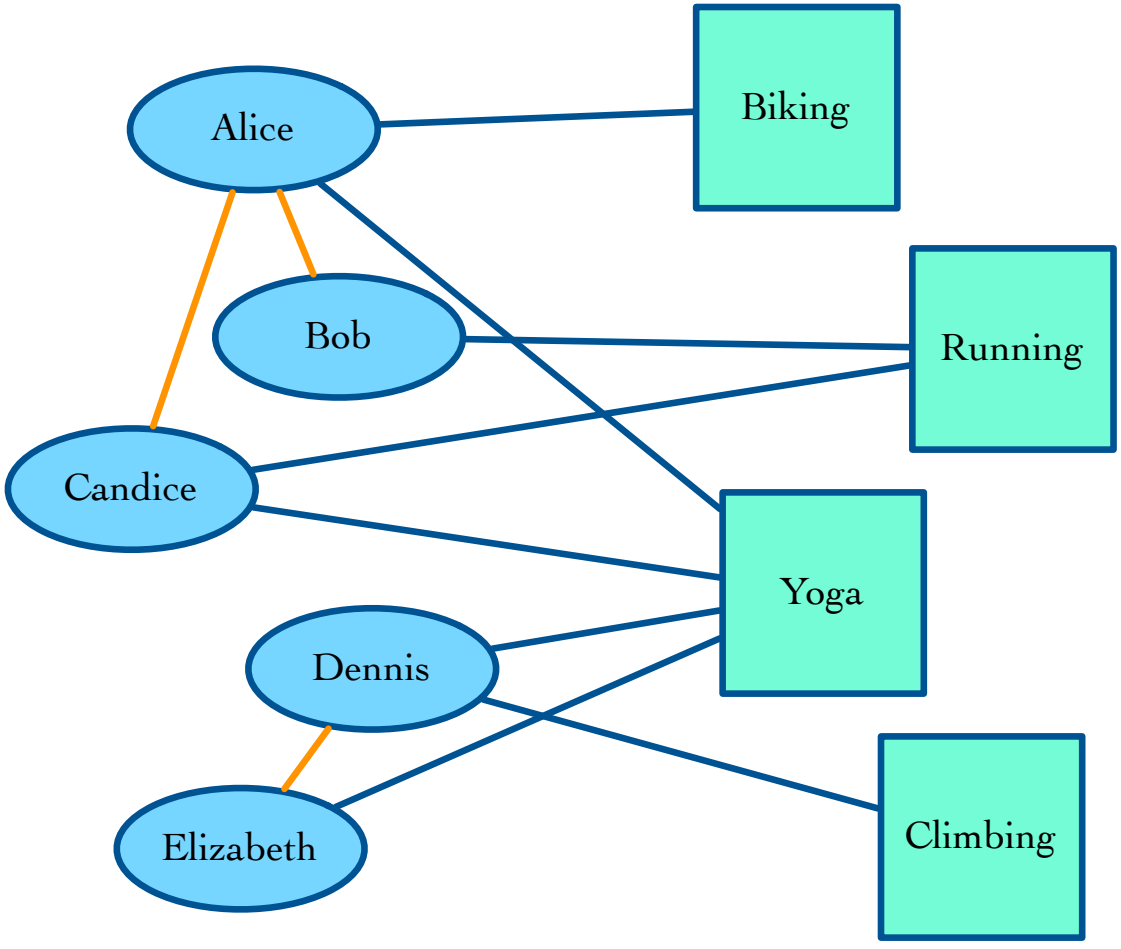
Definition

A graph is *bipartite* if its vertices can be divided into two sets such that the only edges present connect one set to the other.

Social-affiliation networks

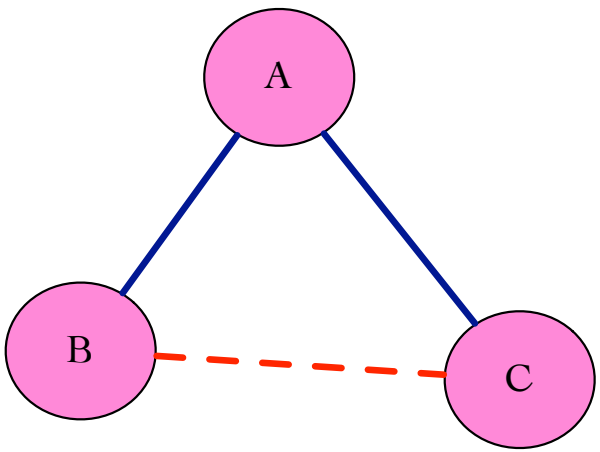
Notice that affiliation networks are not social networks.

But we can combine the two ideas with a *social-affiliation network*:



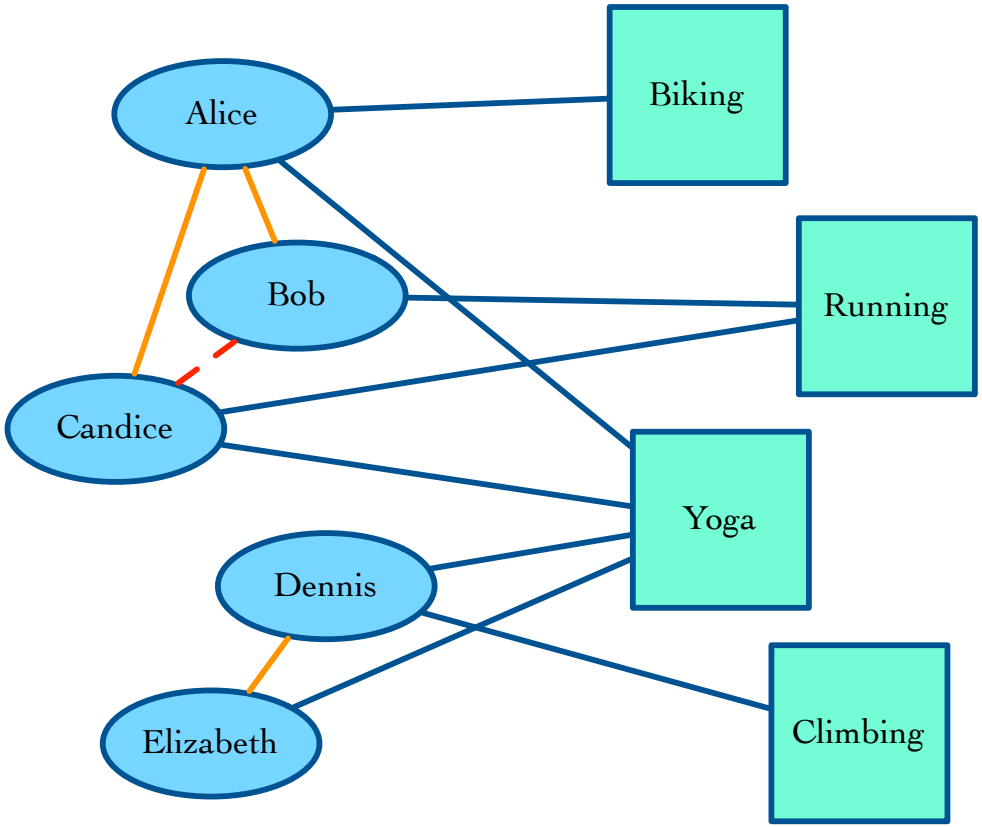
Closure processes

Suppose that A is neighbors with B and C. The edge BC may form, but it takes on different meaning based on what types of vertices A, B, and C are.



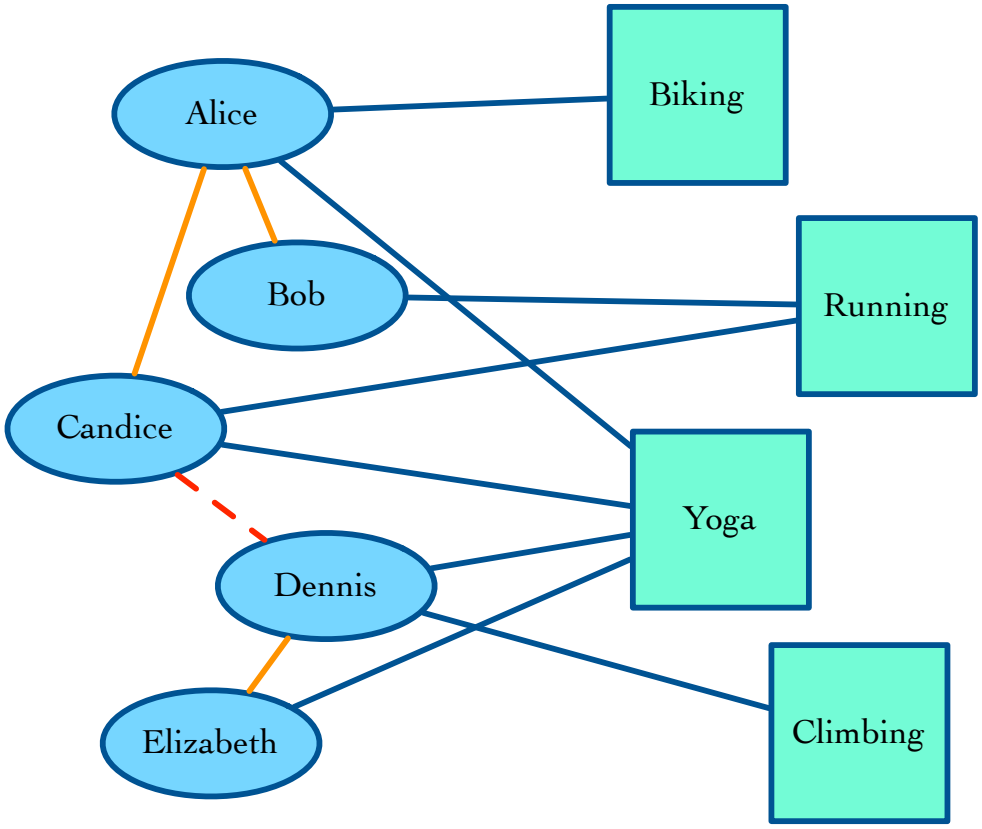
Closure processes

If A, B, and C are all people vertices, then this is just triadic closure.



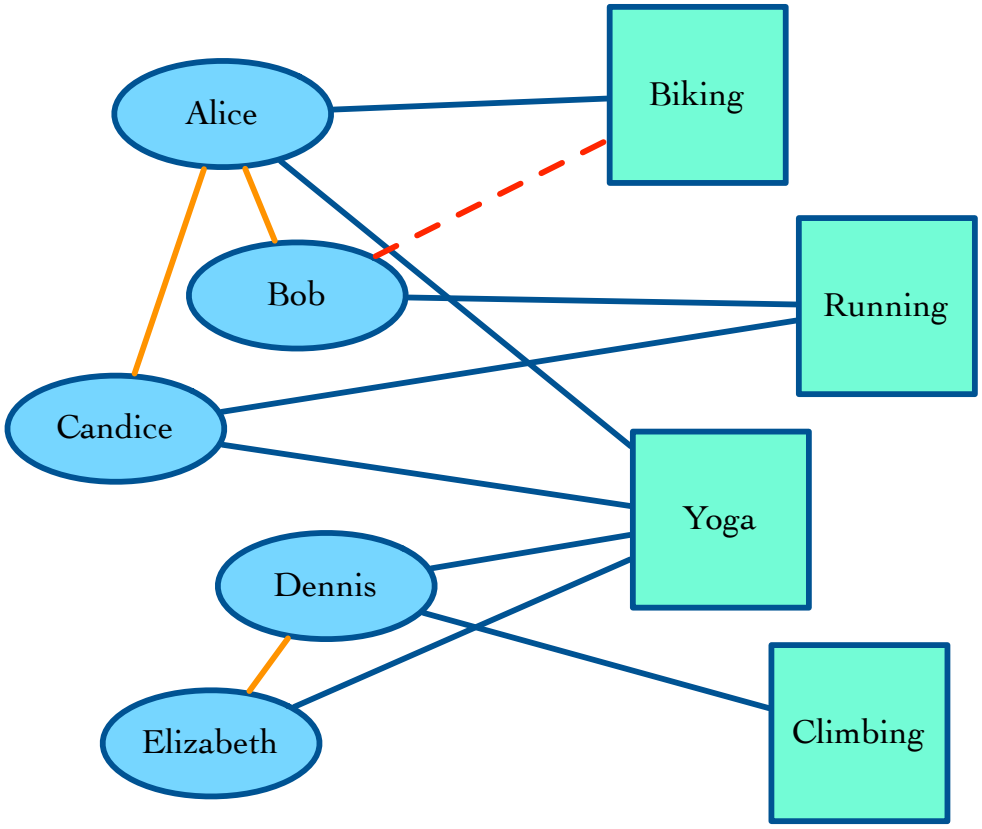
Closure processes

If B, and C are people vertices and A is an activity (focus), then this models the tendency for two people to connect if they have an activity in common (selection). We call this *focal closure*.

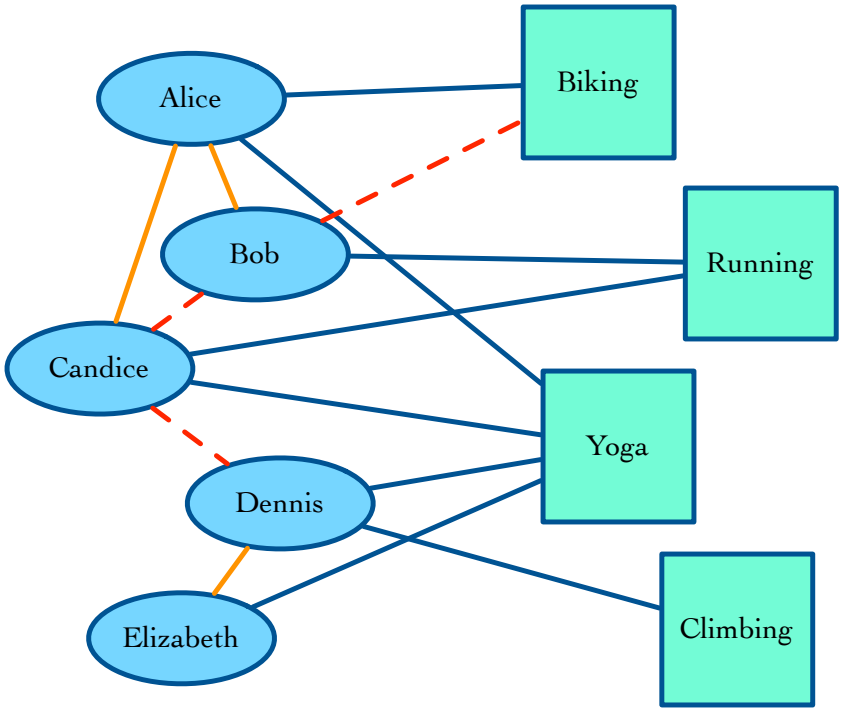


Closure processes

If A, and B are people vertices and C is an activity (focus), then this models social influence (B's behavior is coming into closer alignment with A's). We call this *membership closure*.



Closure processes



- Alice introduces Bob and Candice. (triadic closure)
- Yoga introduces Candice and Dennis. (focal closure)
- Alice introduces Bob to biking. (membership closure)