LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

MAY 26, 2025

NETWORKED MINDS:
OPINION DYNAMICS AND COLLECTIVE INTELLIGENCE IN SOCIAL NETWORKS

THE STRENGTH OF WEAK TIES

Adrian Haret
a.haret@lmu.de

In the late 1960s, a PhD student called Mark Granovetter interviewed people about how they learned about their job.

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MARK GRANOVETTER

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You'd think it's your closest friends who step in at times of need.

What gives?

Granovetter suggested that the reason had to do with *the structure* of people's social networks.

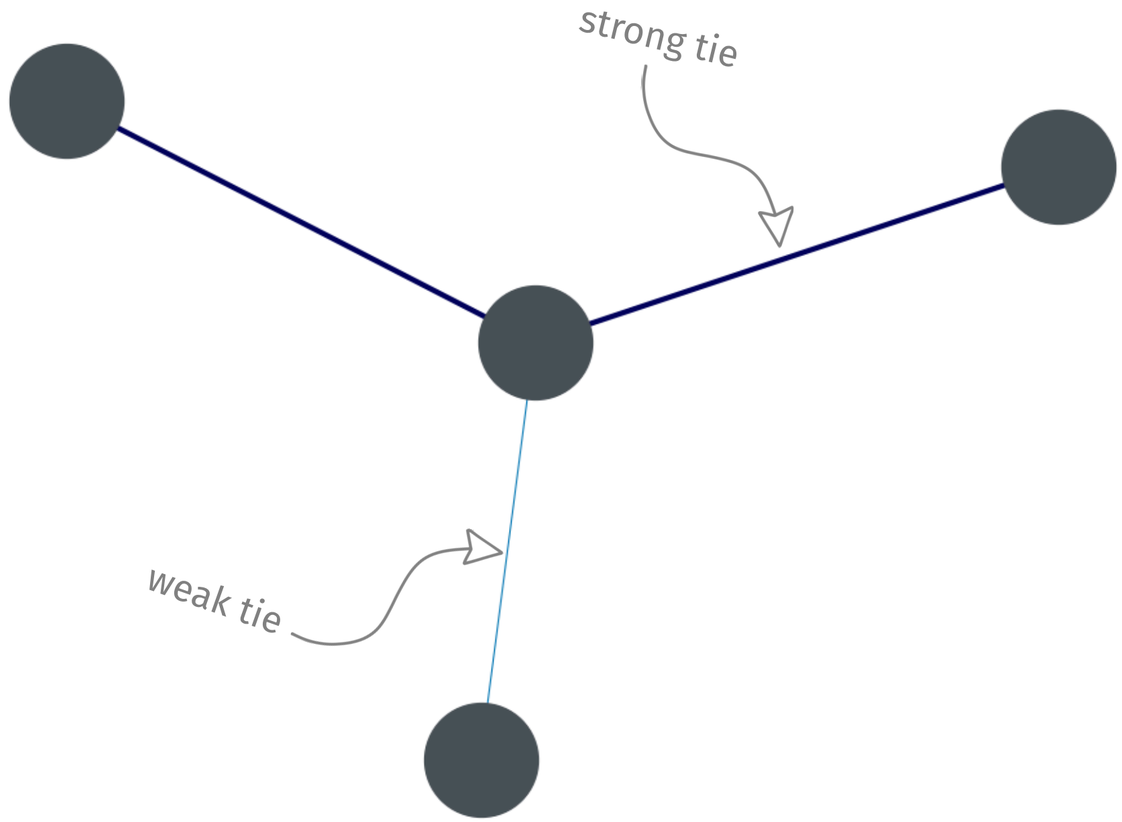
MARK GRANOVETTER

Let’s divide connections into two types: *strong* and *weak*.

Granovetter, M. S. (1973). The Strength of Weak Ties. *The American Journal of Sociology*, 78(6), 1360–1380.

STRONG AND WEAK TIES

Strong ties reflect closer relationships and more communication.



MARK GRANOVETTER

It’s reasonable to assume that strong connections beget more connections.

Granovetter, M. S. (1973). The Strength of Weak Ties. *The American Journal of Sociology*, 78(6), 1360–1380.

DEFINITION

Node *i* satisfies *strong triadic closure* if it does not hold that *i* has neighbors *j* and *k* such that (*i*, *j*) and (*i*, *k*) are strong ties, and there is no tie between *j* and *k*.

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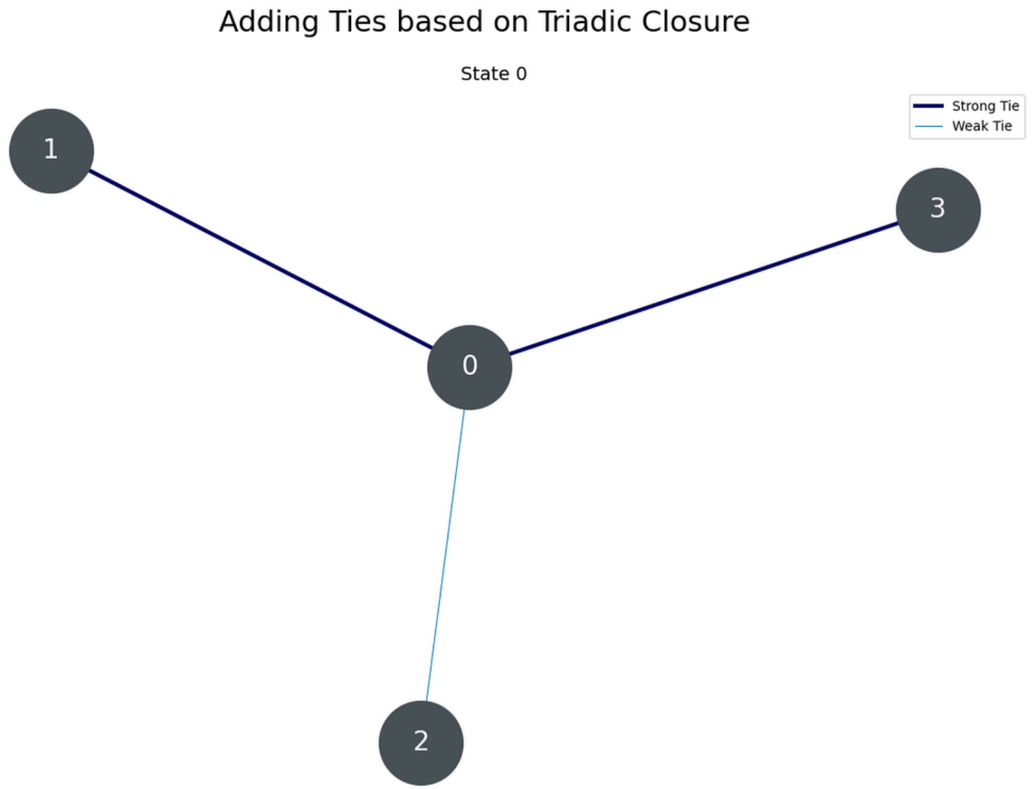
Let’s assume that each node satisfies strong triadic closure.

STRONG TRIADIC CLOSURE

Ties (0, 1) and (0, 3) are strong.

By strong triadic closure, there needs to be an edge between 1 and 3.



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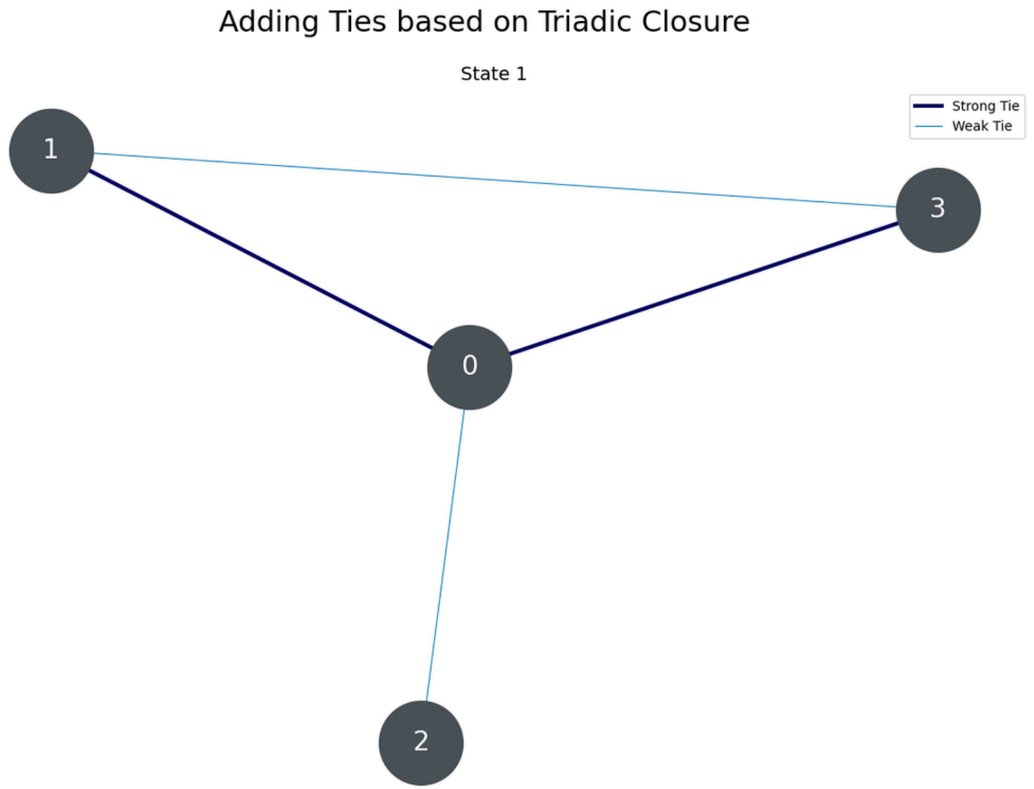

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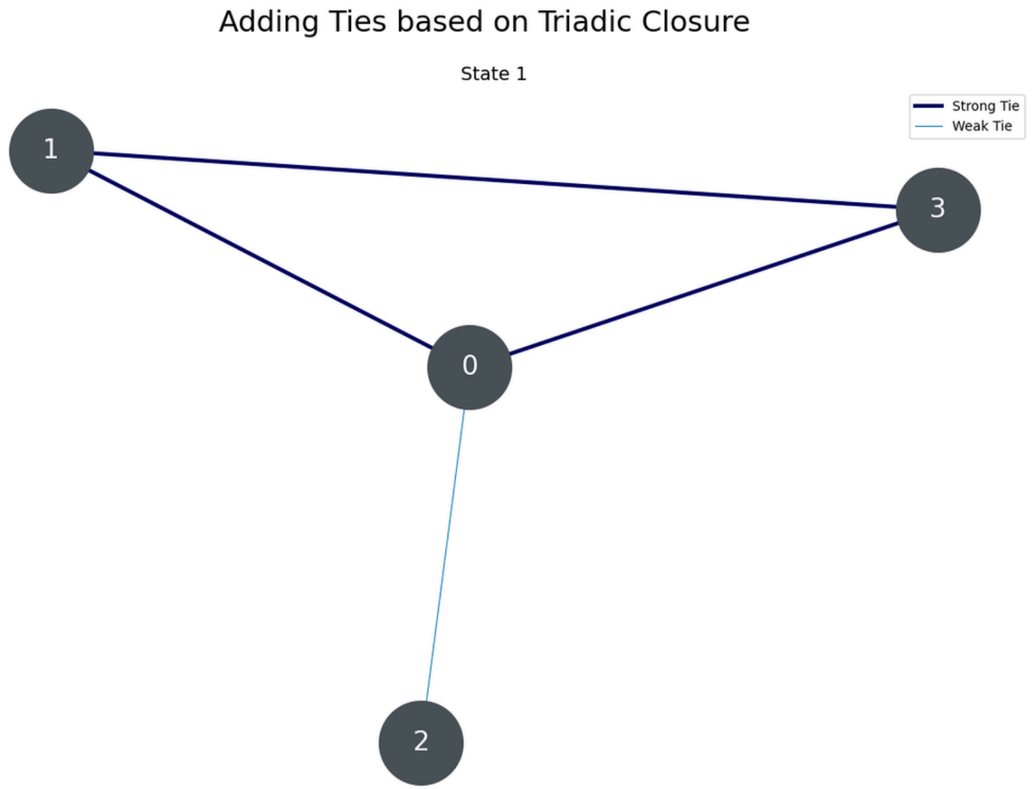

Strong triadic closure is a very strong assumption.

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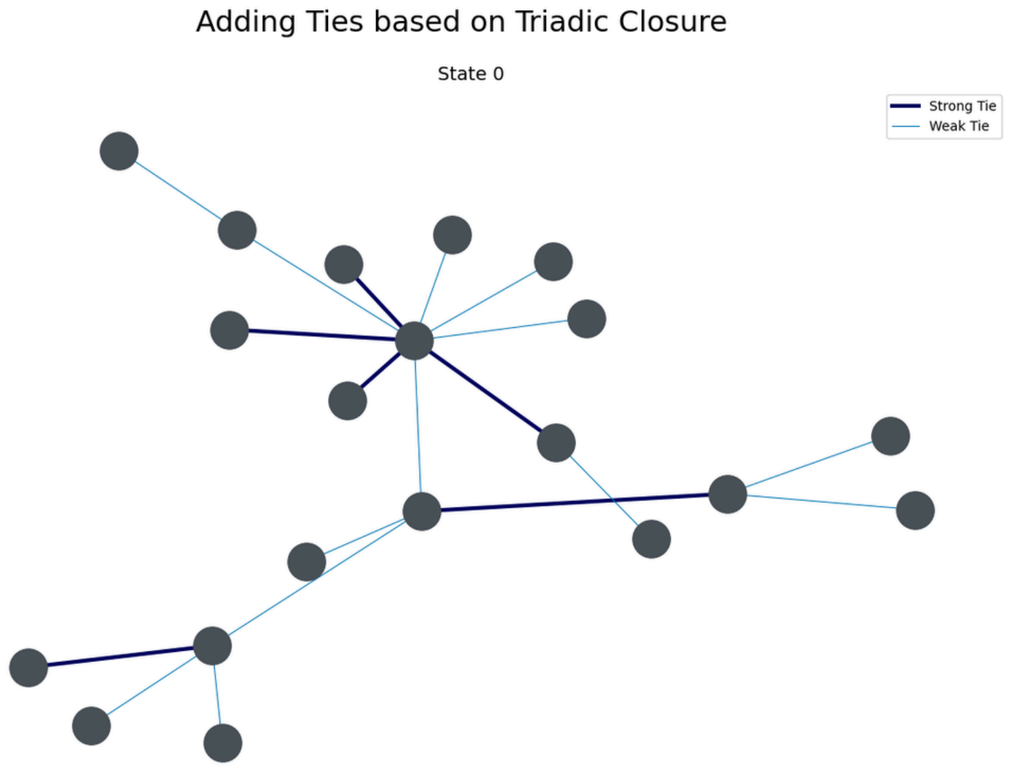
STRONG TRIADIC CLOSURE AS A DYNAMIC PROCESS

We can also think of triadic closure as a *dynamic* process.



STRONG TRIADIC CLOSURE AS A DYNAMIC PROCESS

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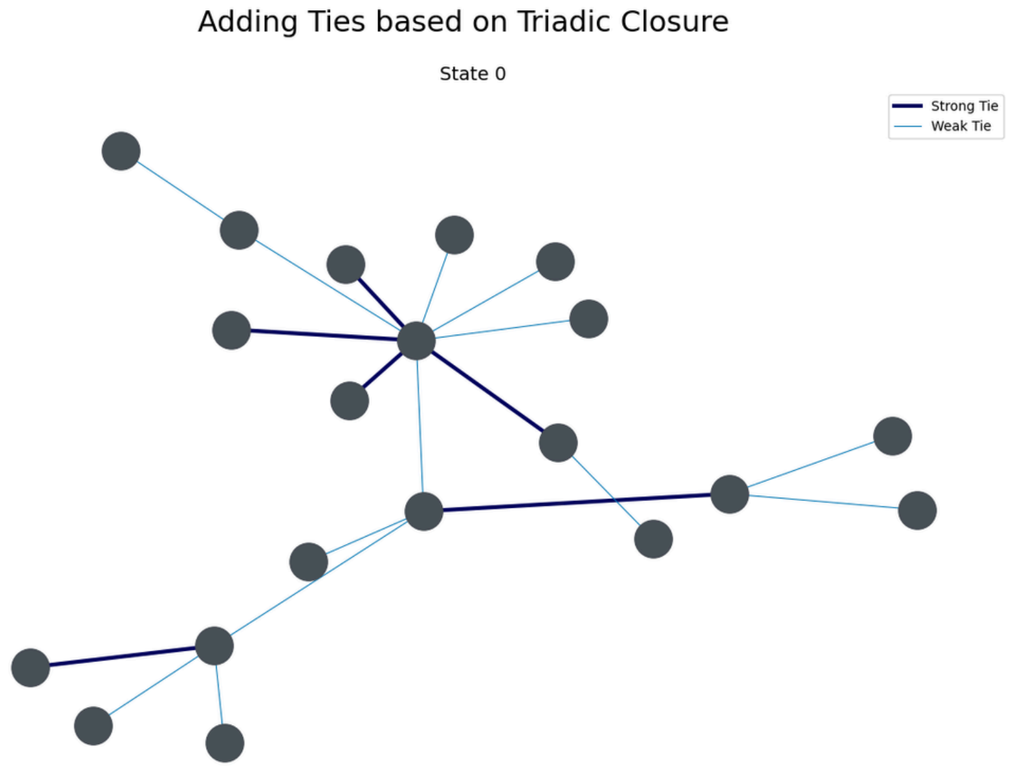
Start with a graph, and add edges according to the strong triadic closure assumption.



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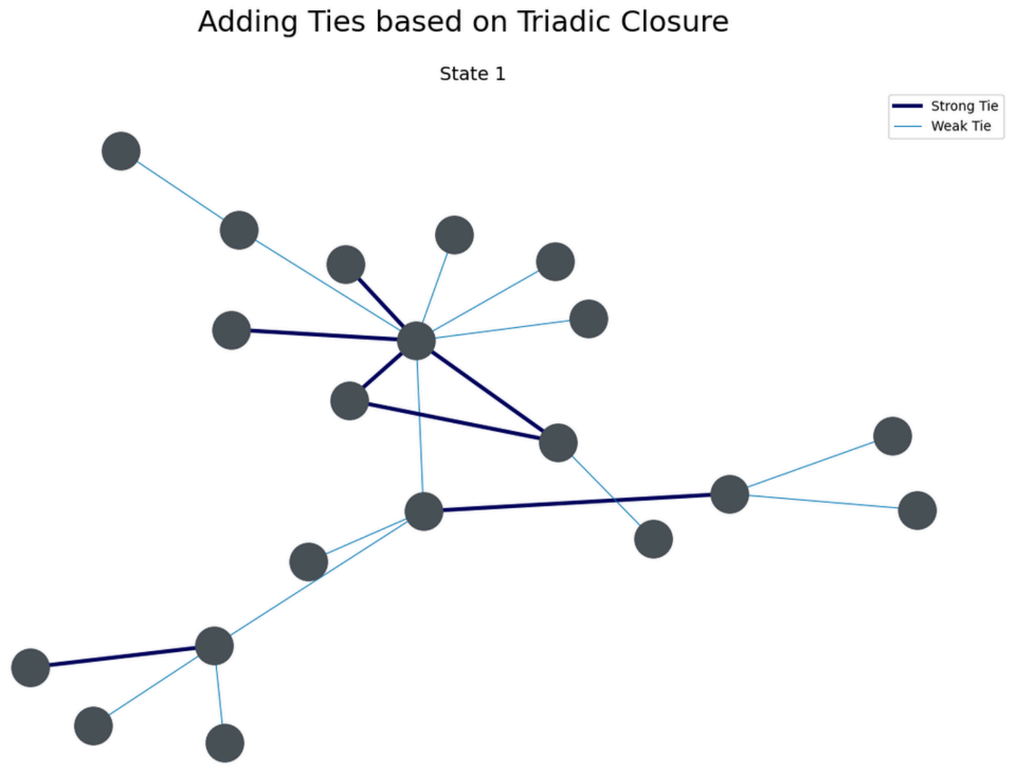

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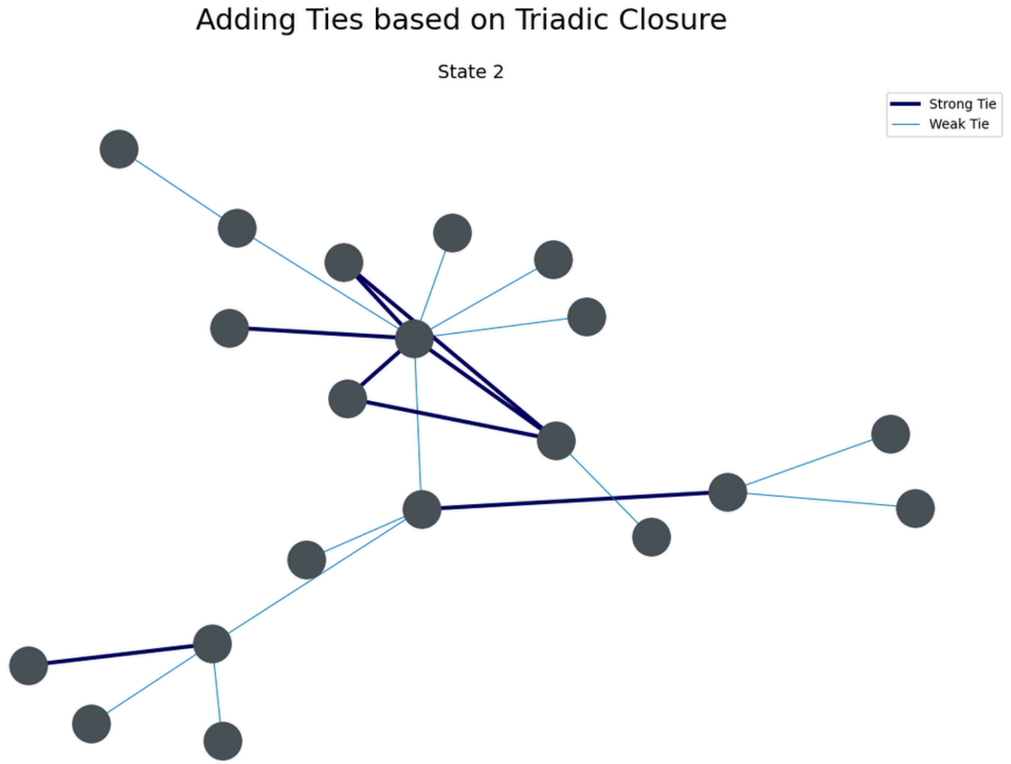

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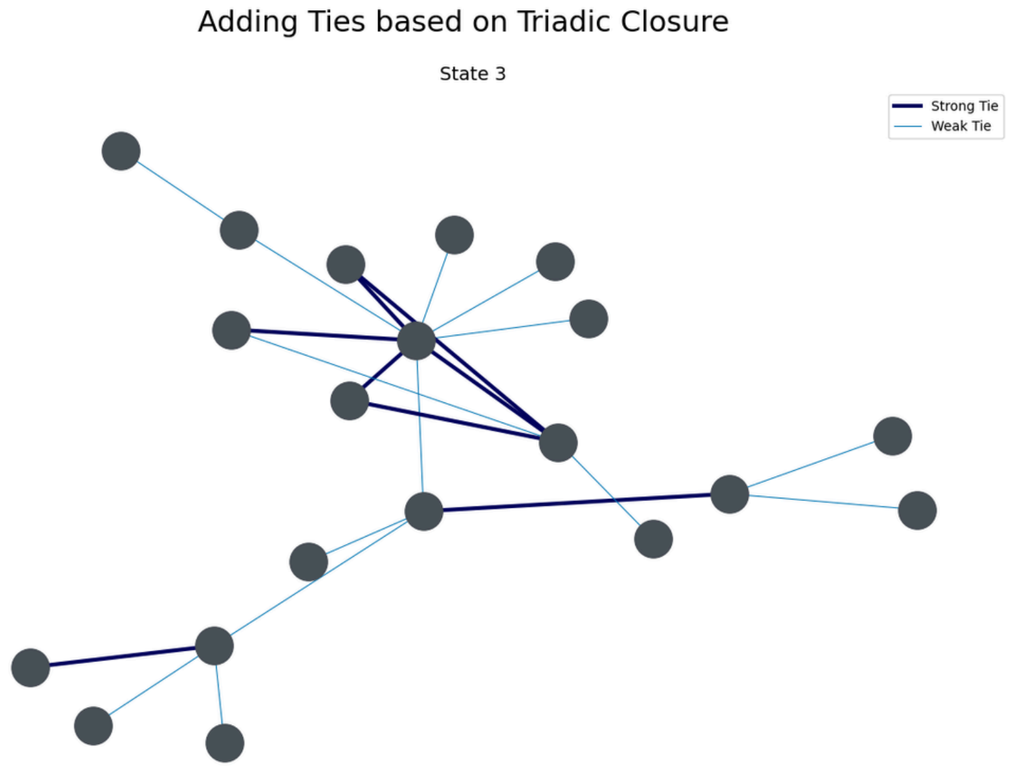

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MARK GRANOVETTER

The strength of ties has an effect on the global structure of the graph.

And this affects how news (like a job posting) travels.

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DIFFUSION OF INFORMATION

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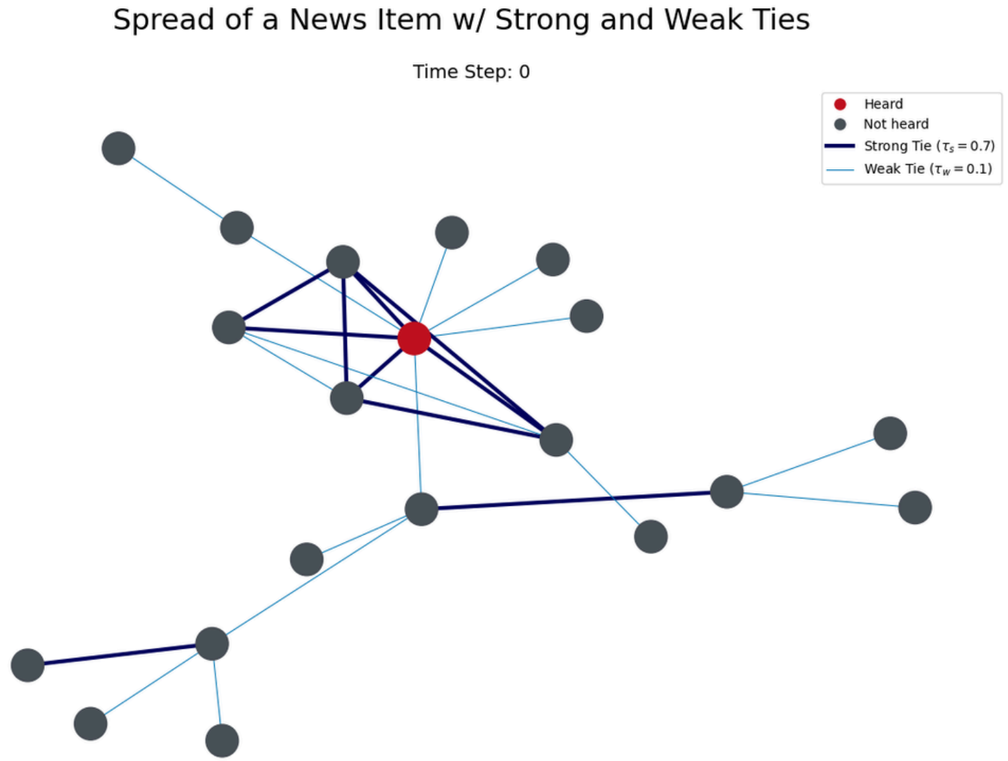

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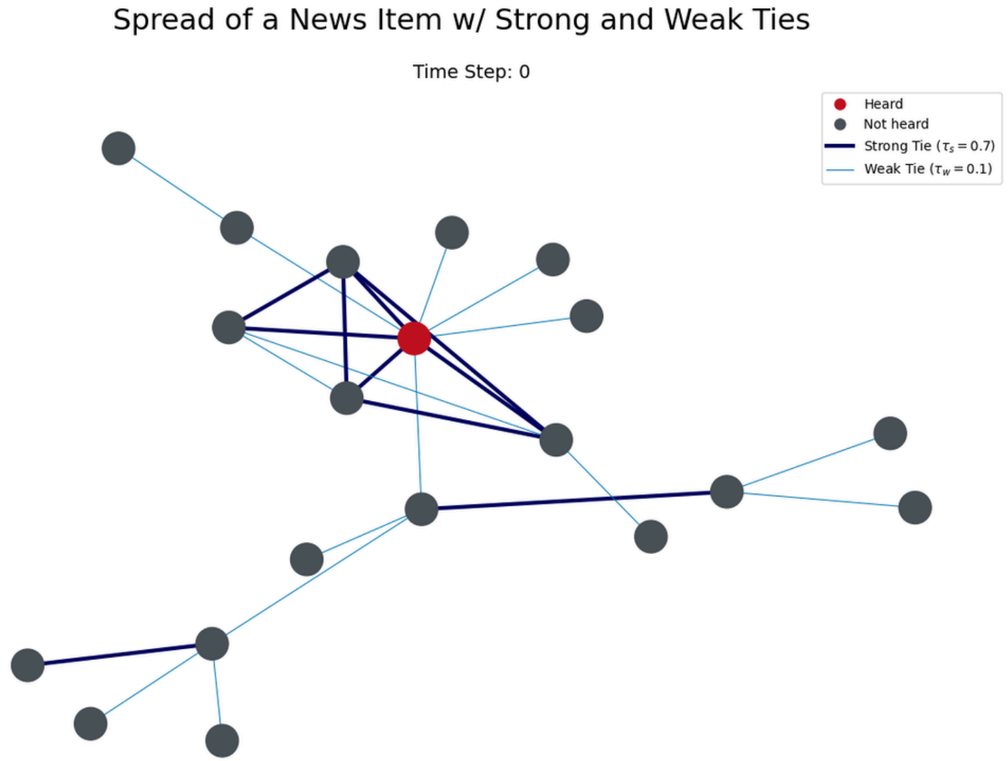

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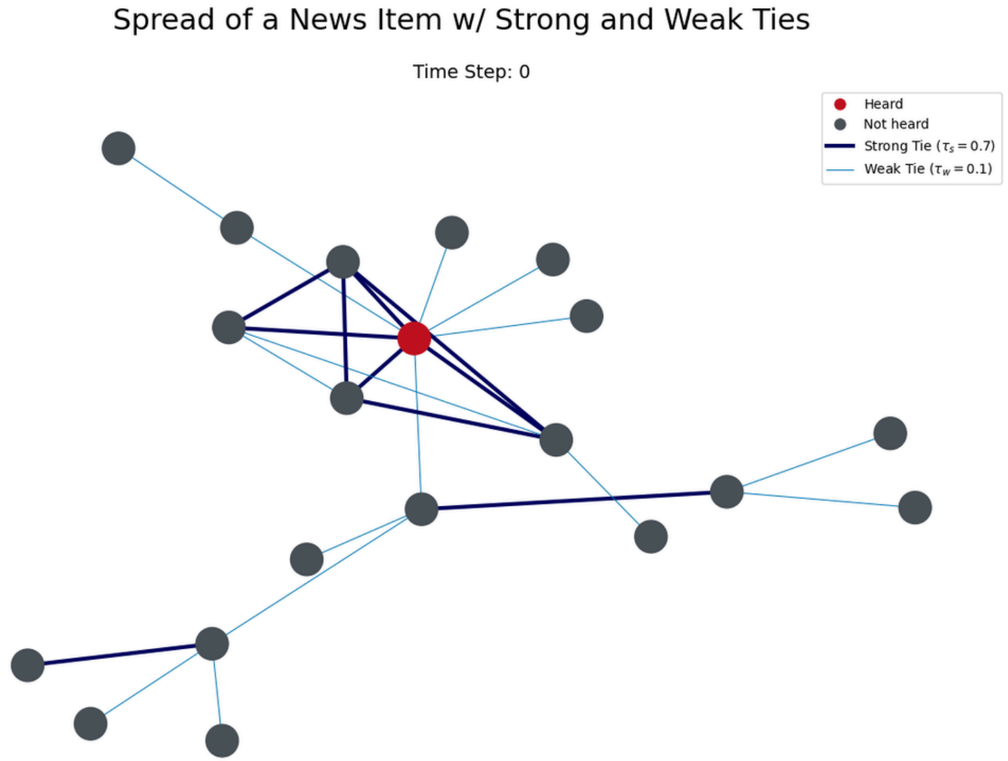

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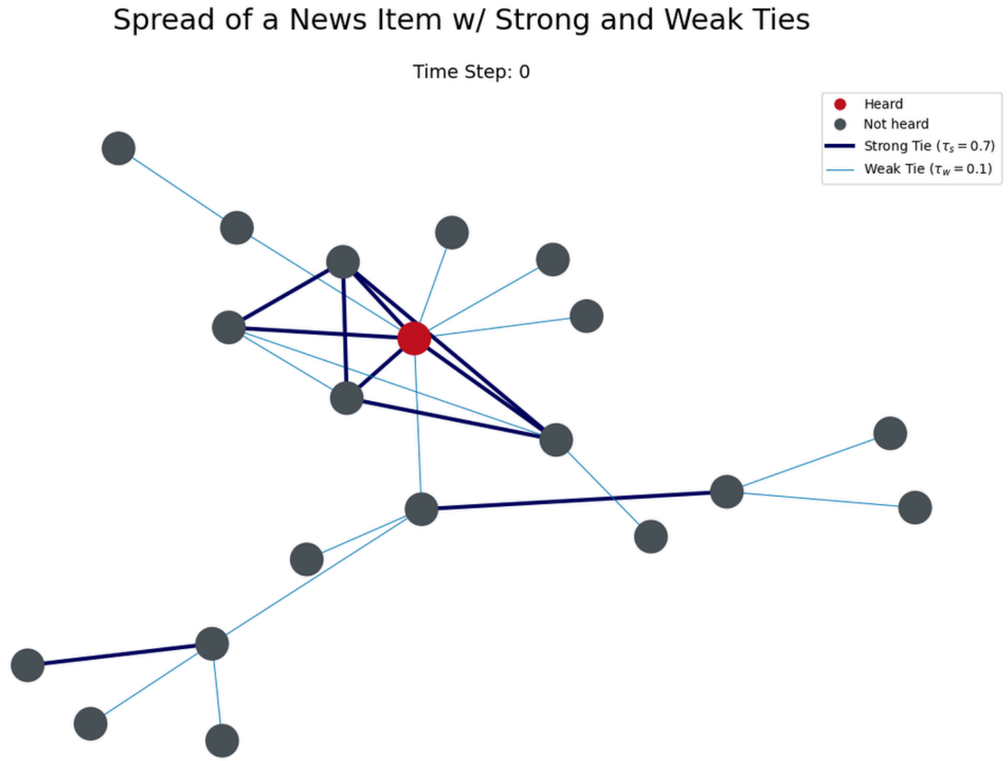

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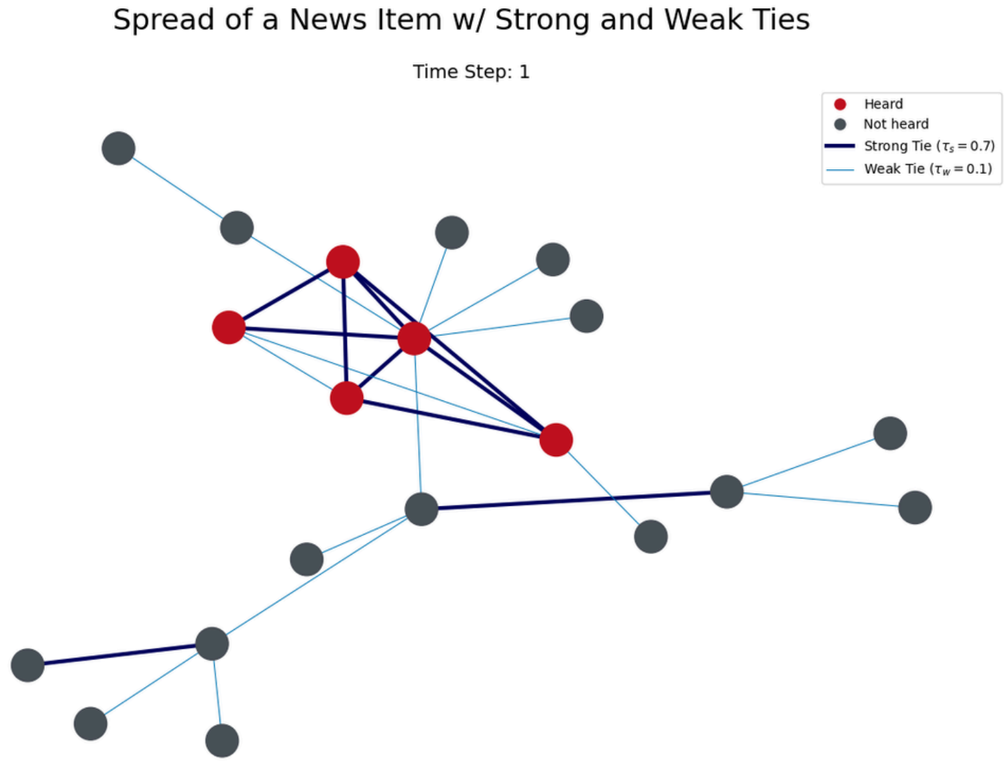

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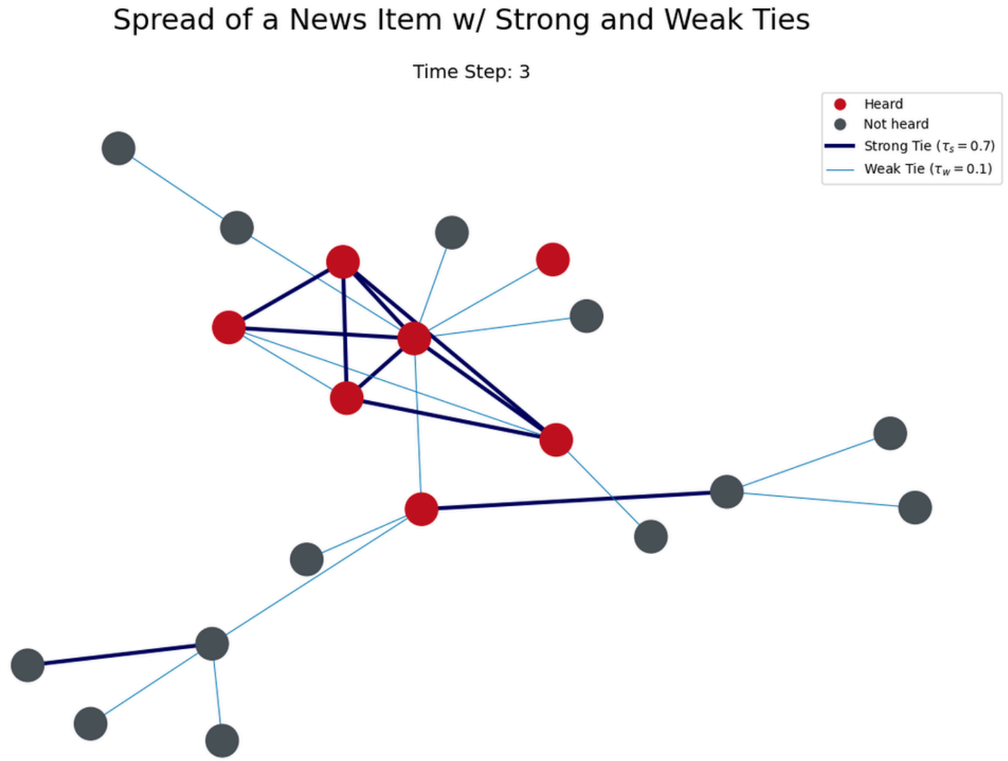

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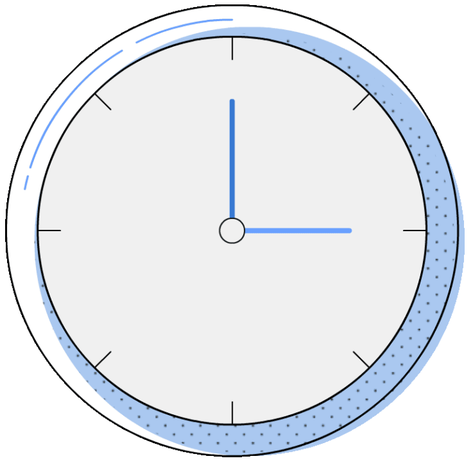

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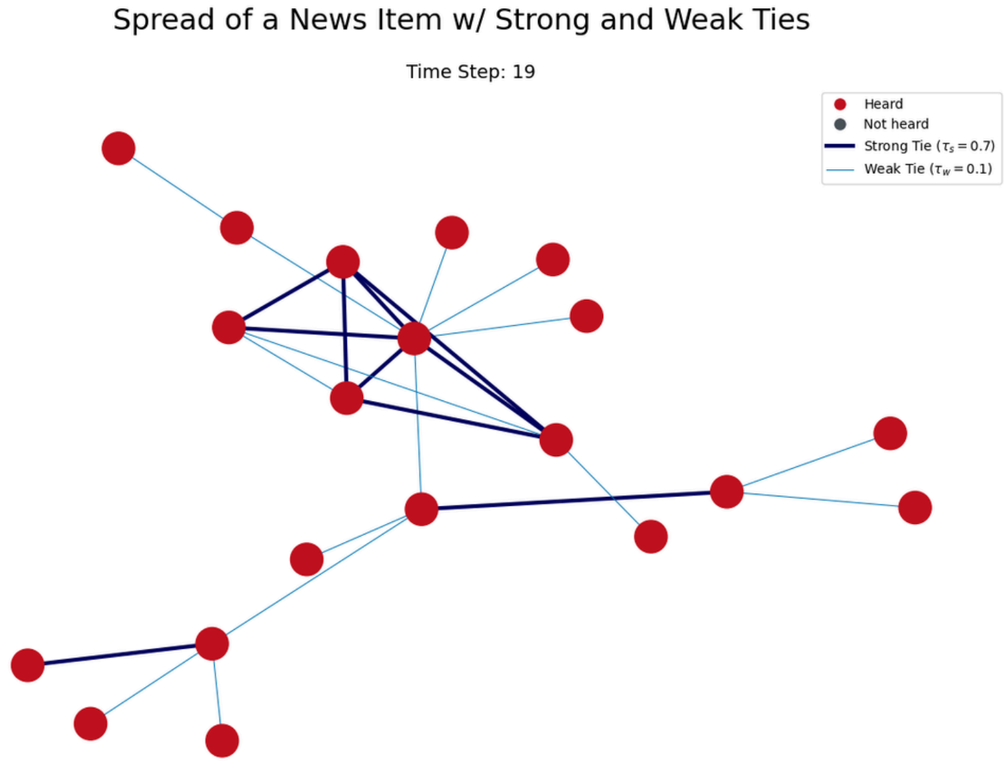
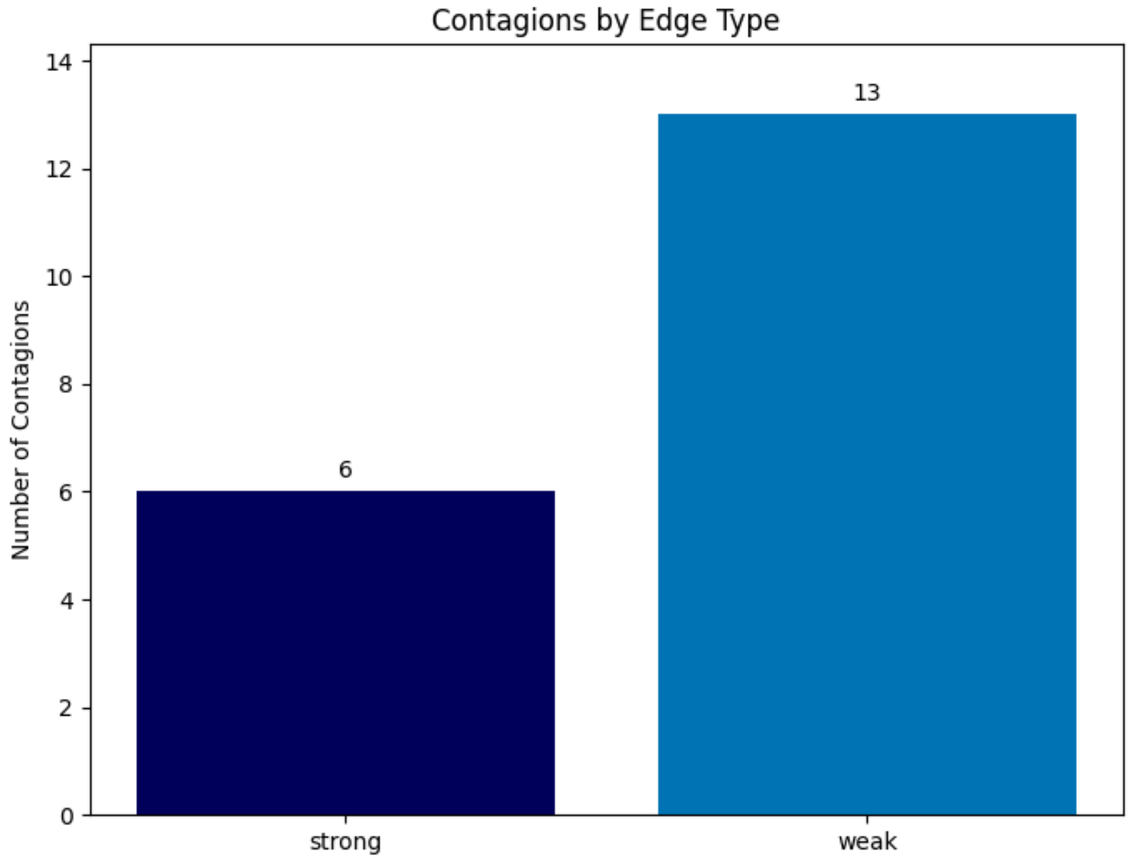


How do people hear about the news?

DIFFUSION OF INFORMATION

If we keep track of how people heard about the news, we see that most of the time it was through a weak link.

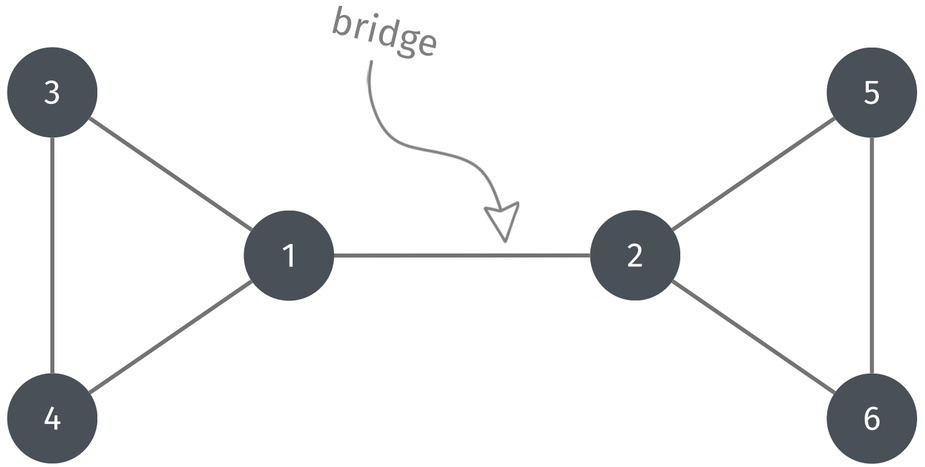
Even though the probability of transmission through a weak link is lower!



One reason this happens is because information has to travel along bridges.

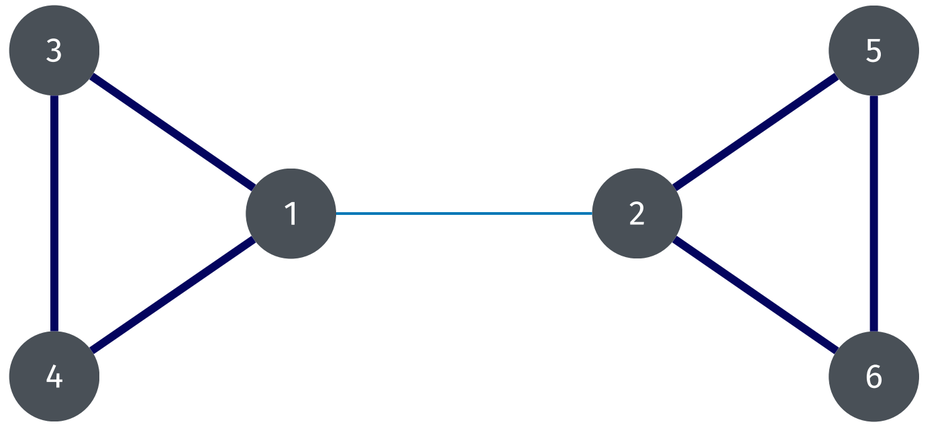
DEFINITION

An edge is a *bridge* if removing it results in the network being disconnected.



WEAK TIES AS BRIDGES

Bridges are much more likely to be weak ties.



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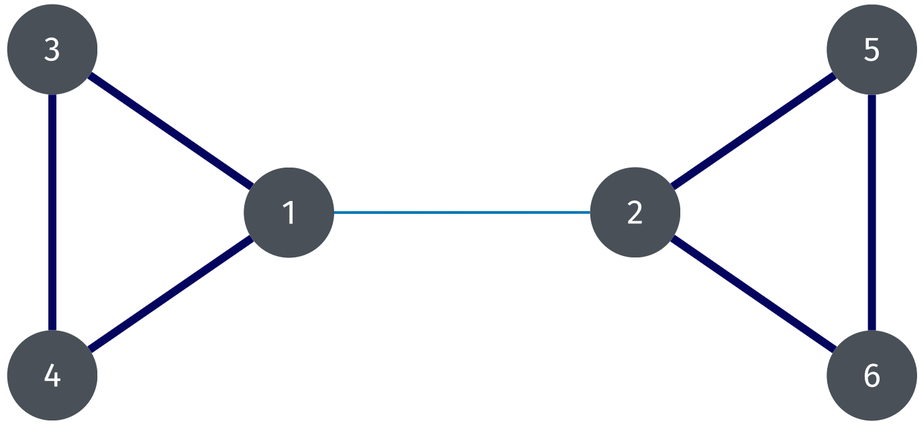
In fact, under the assumption of strong triadic closure, if the (1, 2) edge is a bridge, then it must be a weak tie.



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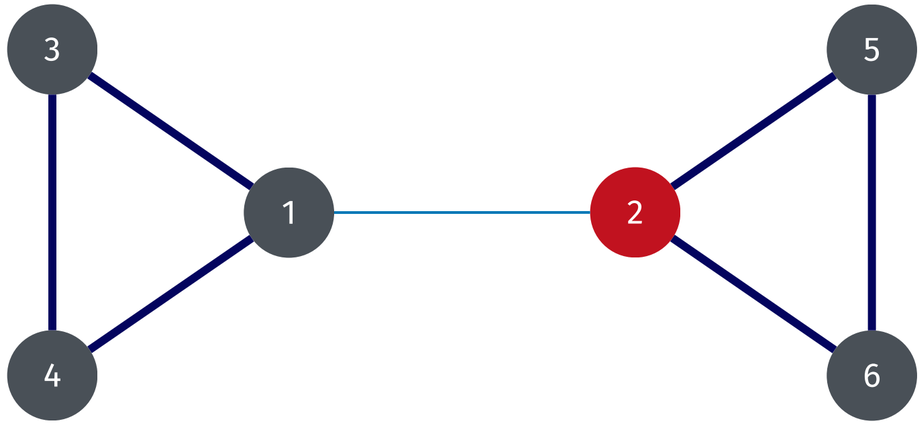
In fact, under the assumption of strong triadic closure, if the (1, 2) edge is a bridge, then it must be a weak tie.

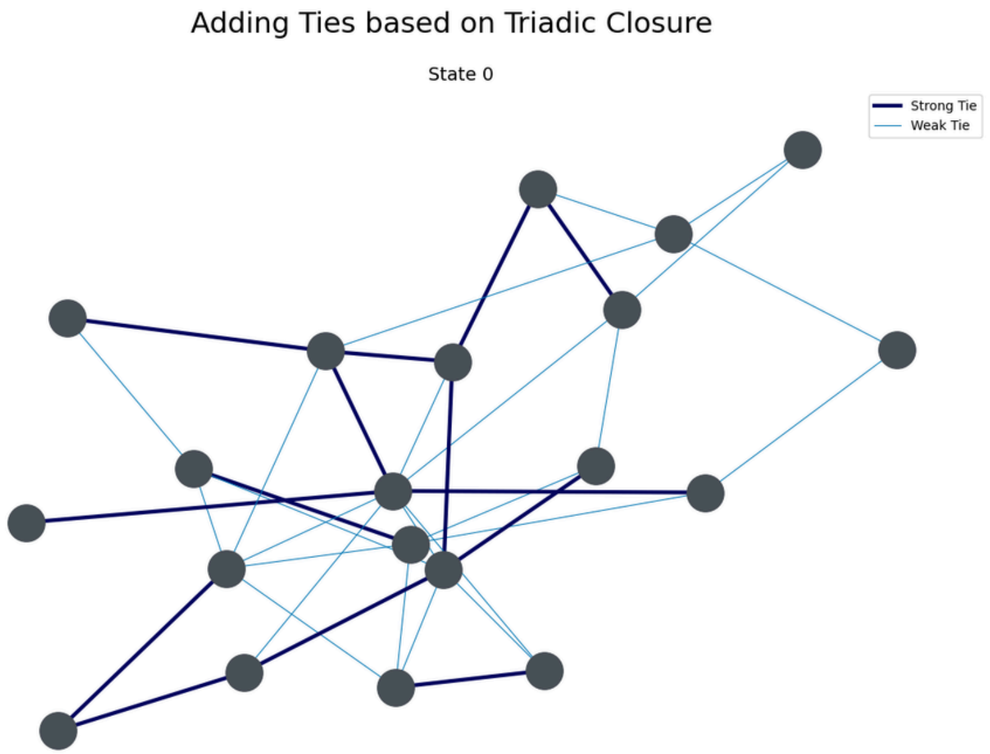
So if information starts in one component of the graph, it has to travel along a weak edge to reach other components.



Note that this effect seems to depend on the starting structure of the network.

TAKE A DIFFERENT NETWORK

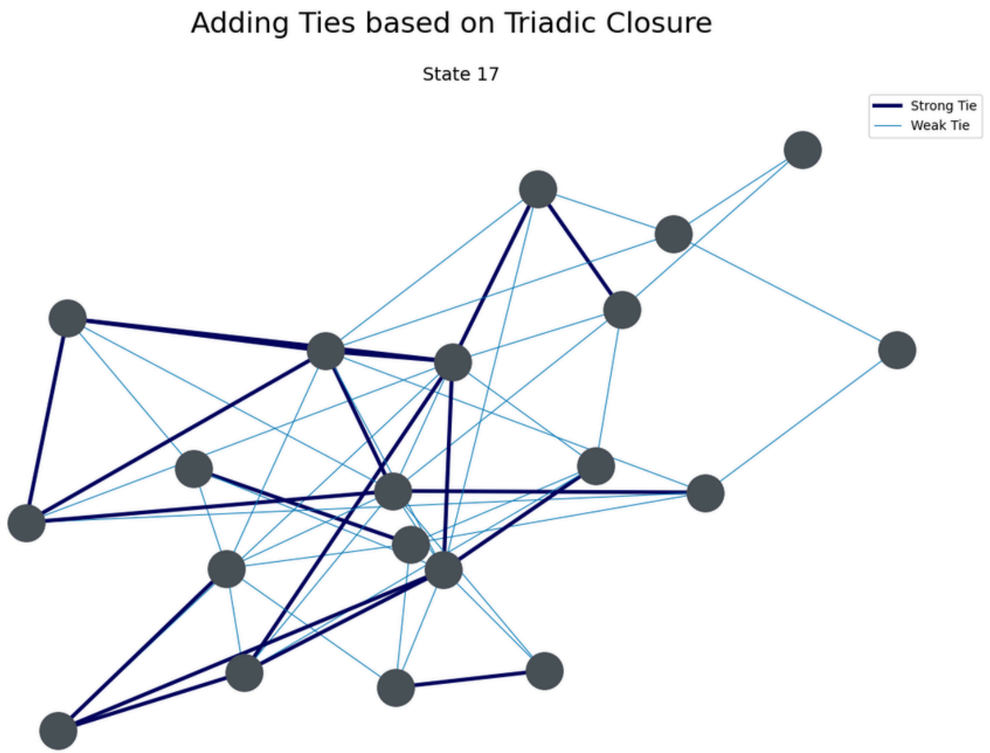
Take a random graph.



TAKE A DIFFERENT NETWORK

Take a random graph.

Close the triangles.

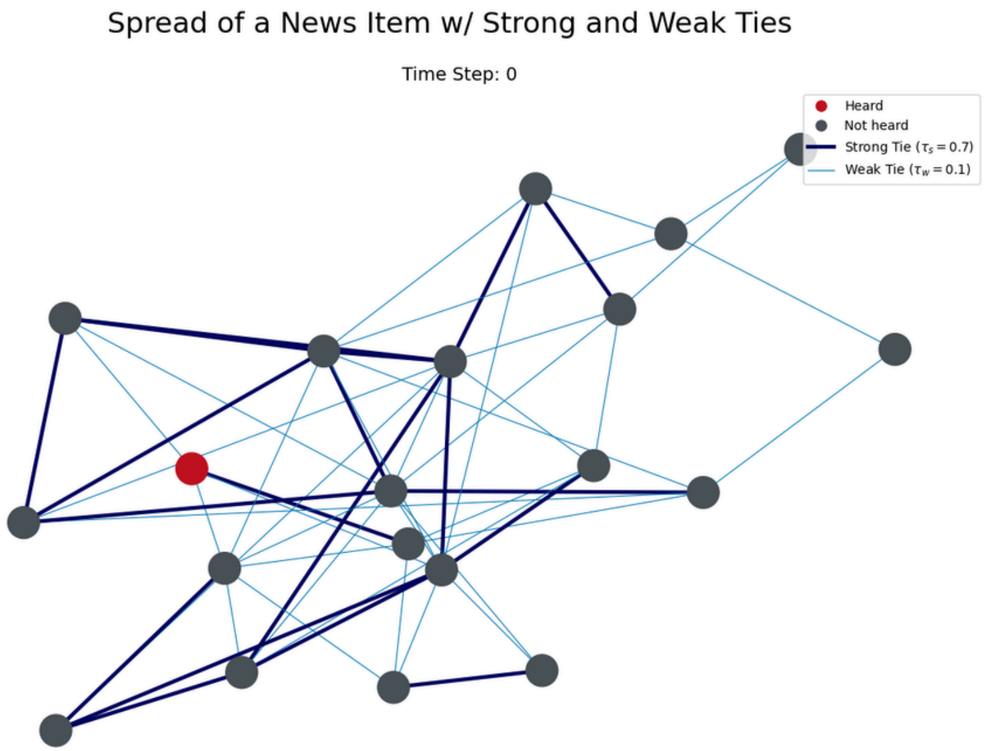


TAKE A DIFFERENT NETWORK

Take a random graph.

Close the triangles.

Let information travel along the edges.



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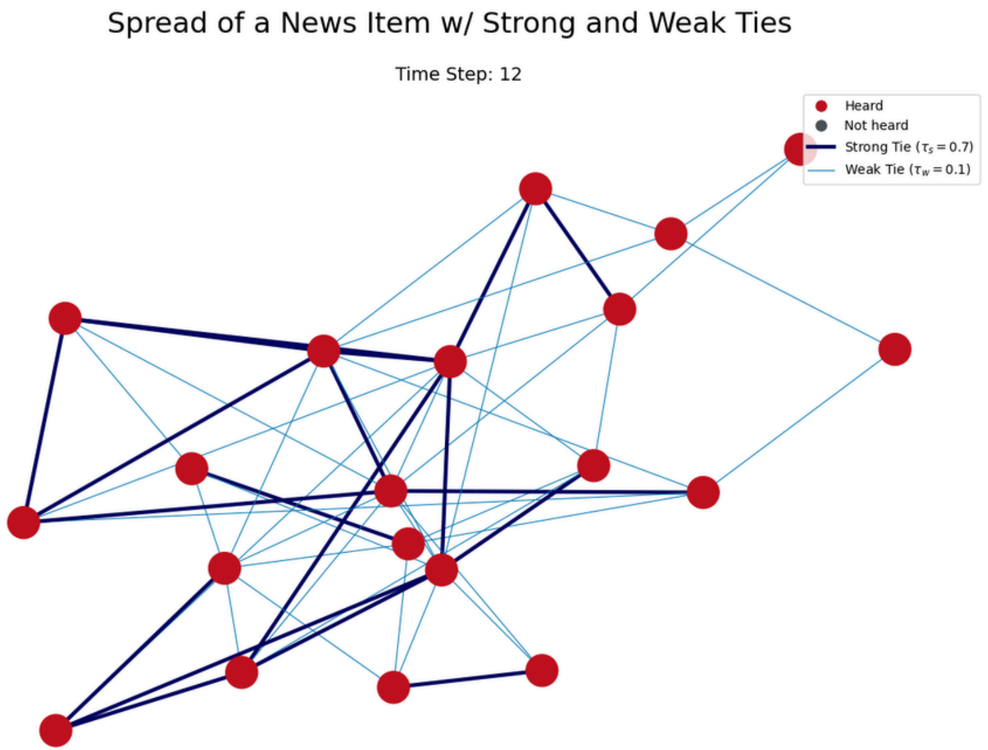
Close the triangles.

Let information travel along the edges.

Weak ties are no longer as important.



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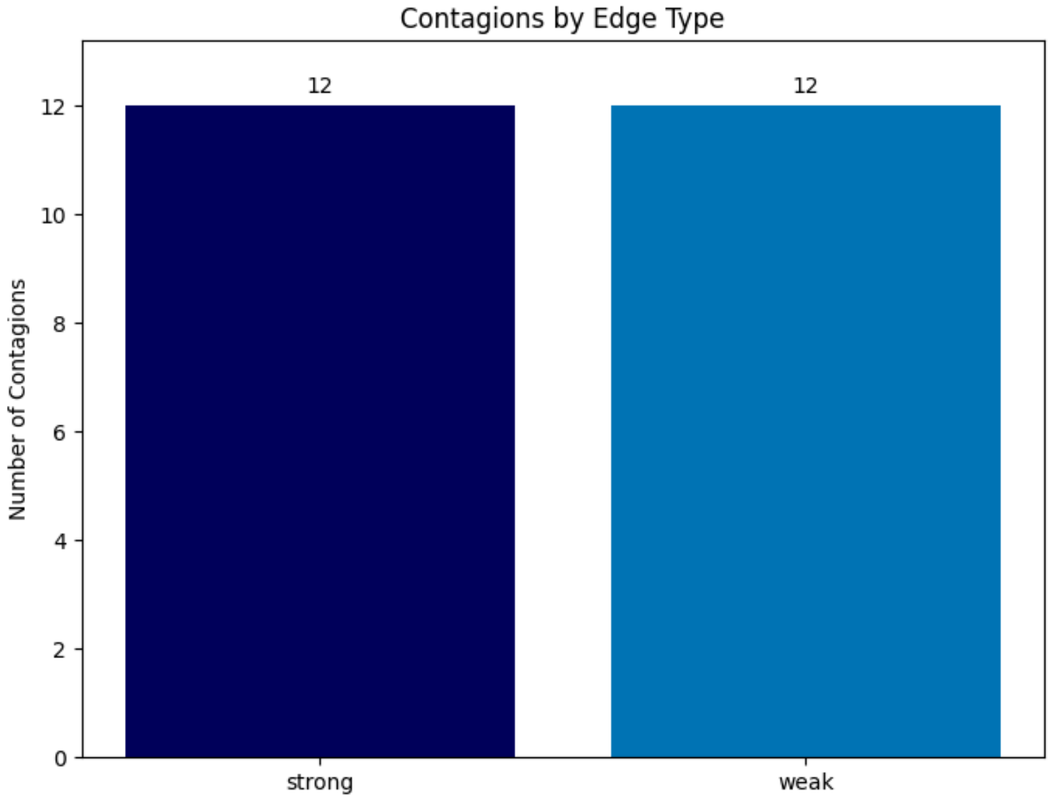
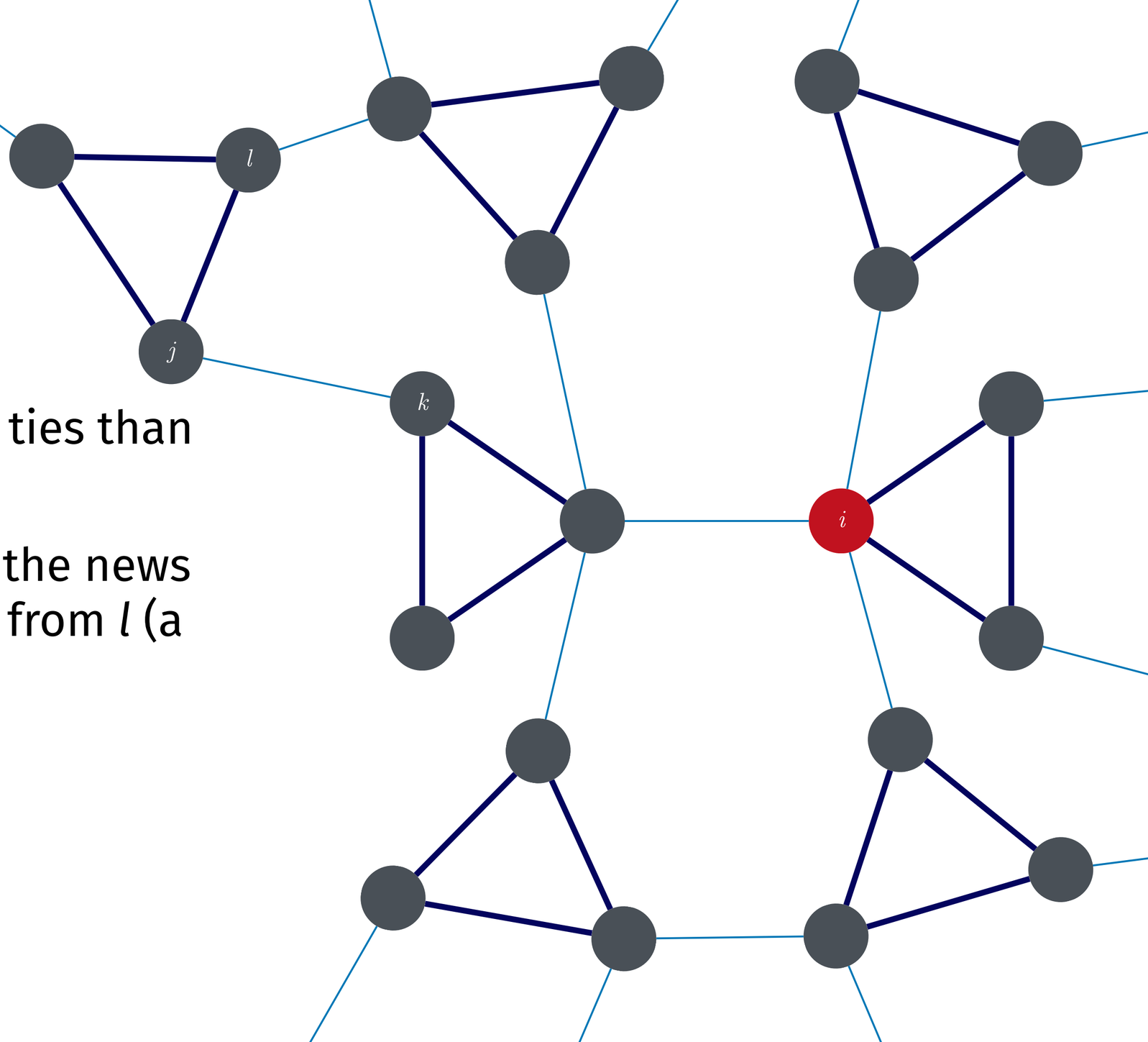


A conjecture is that weak ties need to outnumber the number of strong ties.

CONJECTURE

There need to be more weak ties than strong ties (?).

Node *j* is more likely to hear the news first from *k* (a weak tie) than from *l* (a strong tie).



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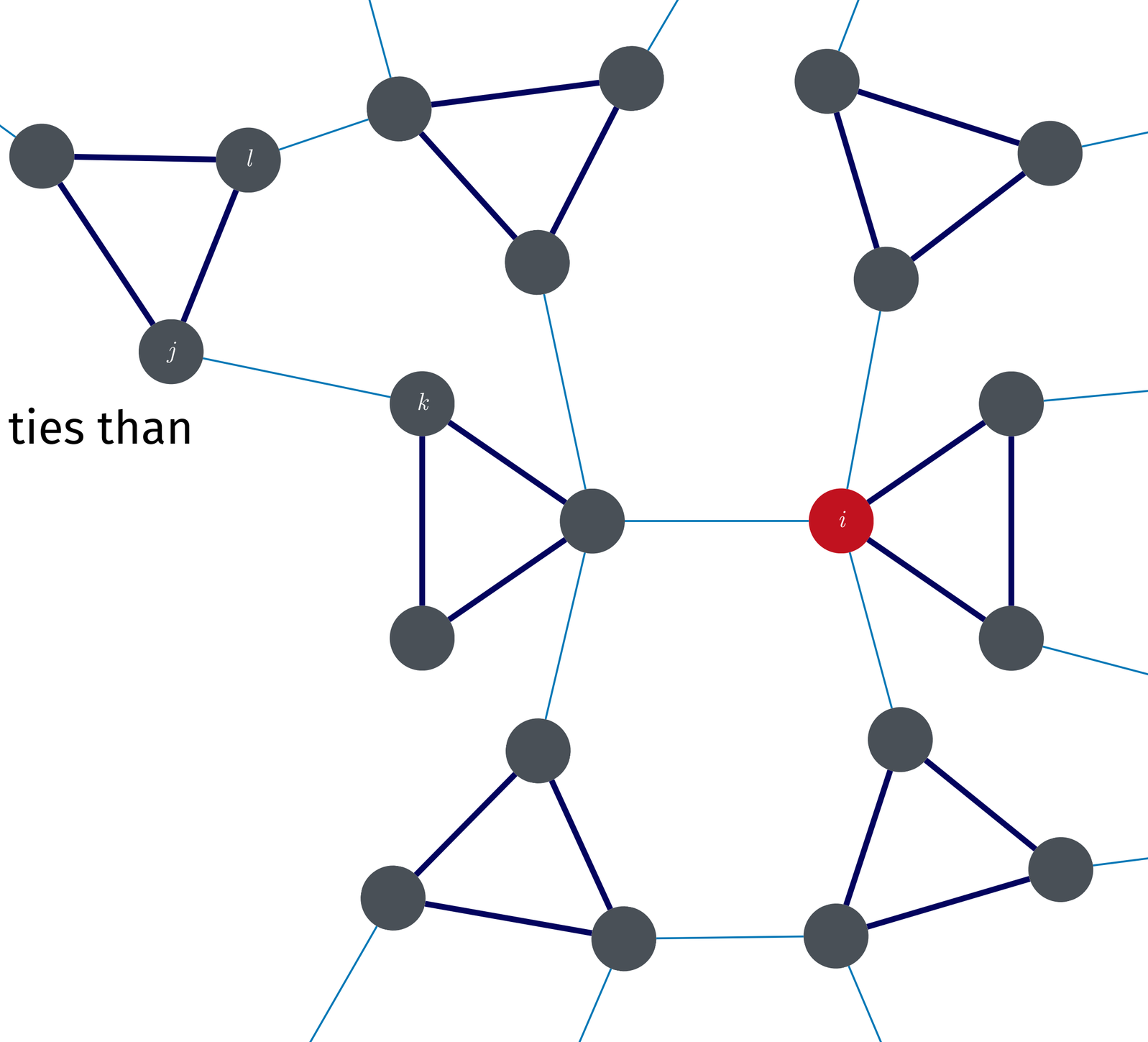

Is there any more empirical evidence for the strength of weak ties?

EYTAN BAKSHY

How do social ties influence the spread of information on social networks?

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LADA ADAMIC

We have to be careful because *homophily* could be a confounding factor.

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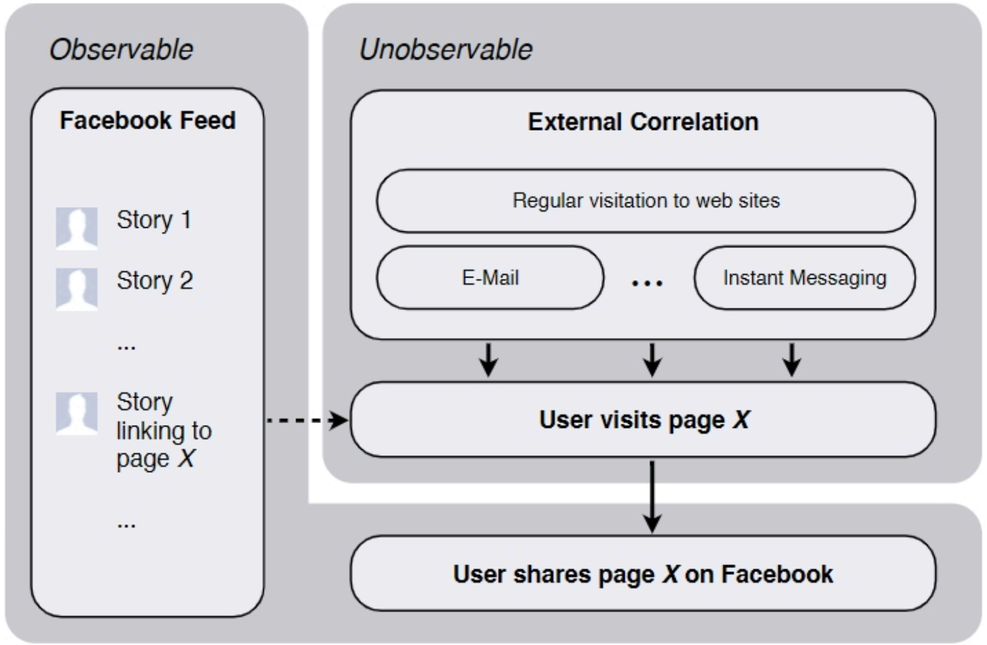
HOMOPHILY

Homophily is the tendency of individuals to behave similarly to others who share similar attributes.



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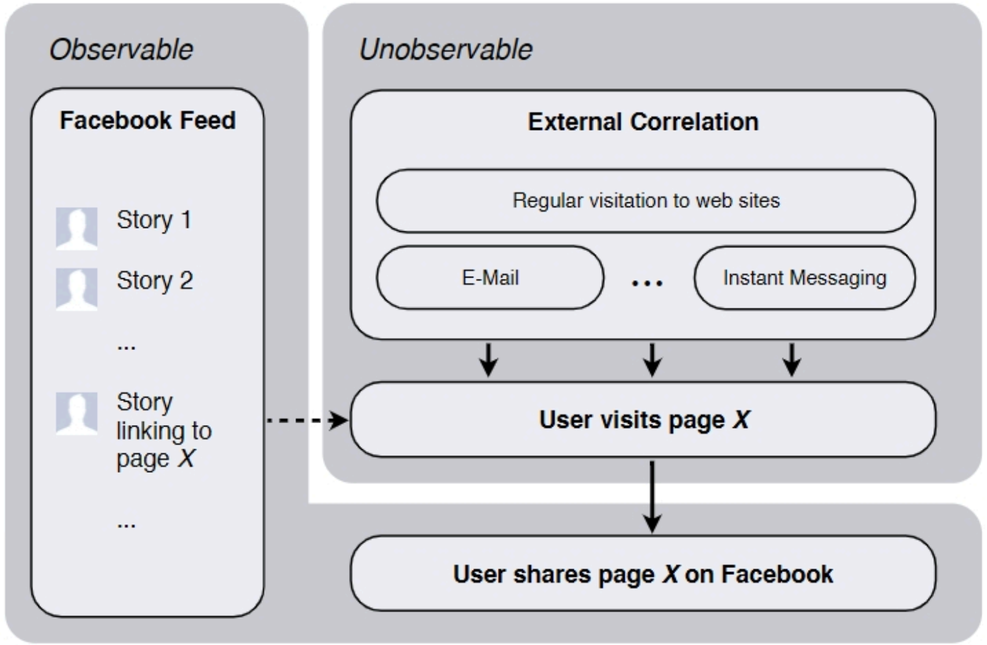

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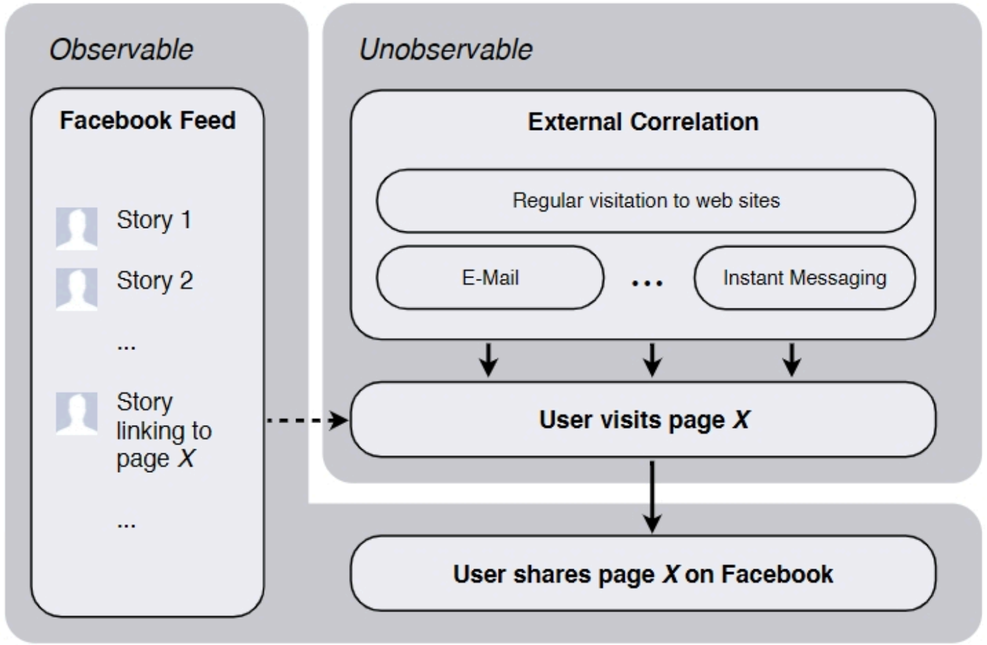

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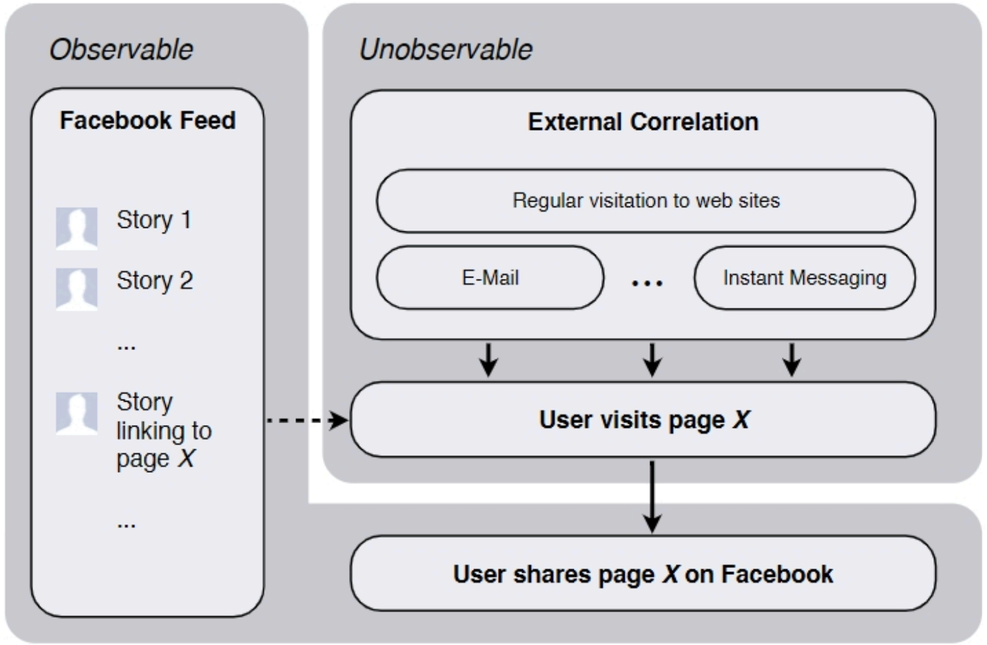
Not because you and your friend happened to read the same news site.



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METHODOLOGY

Randomized experiment on Facebook.

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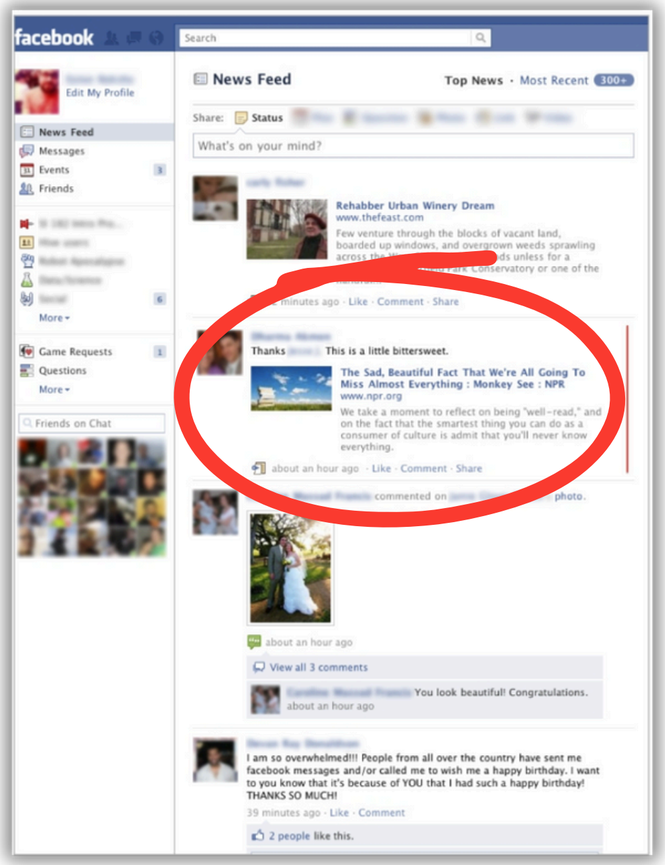

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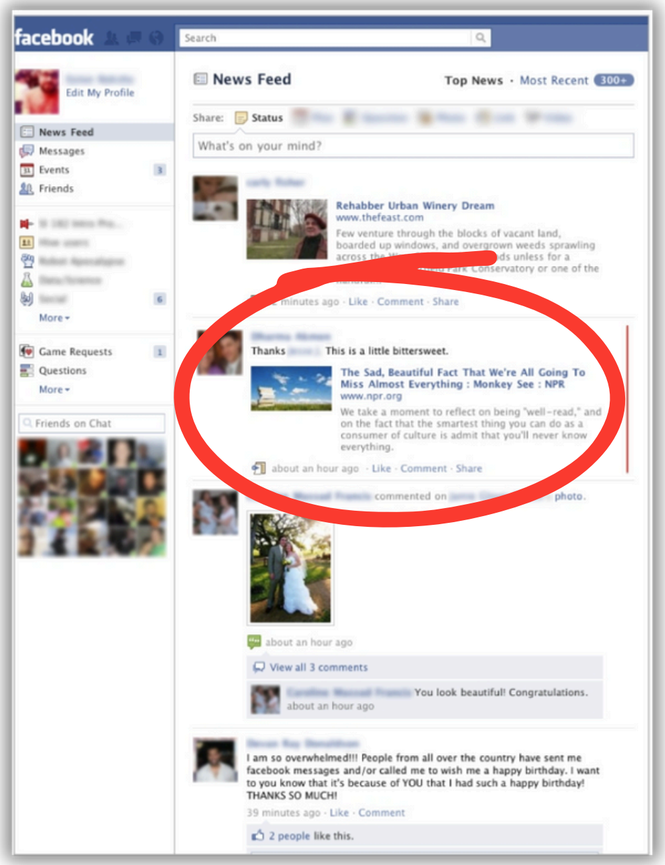
Users' feeds were manipulated to show/not show a particular URL.



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This was during a time when Facebook showed content only from your friends.

RESULTS

Users often share the same link as a friend shortly after their friend does. Even in the NO FEED condition.

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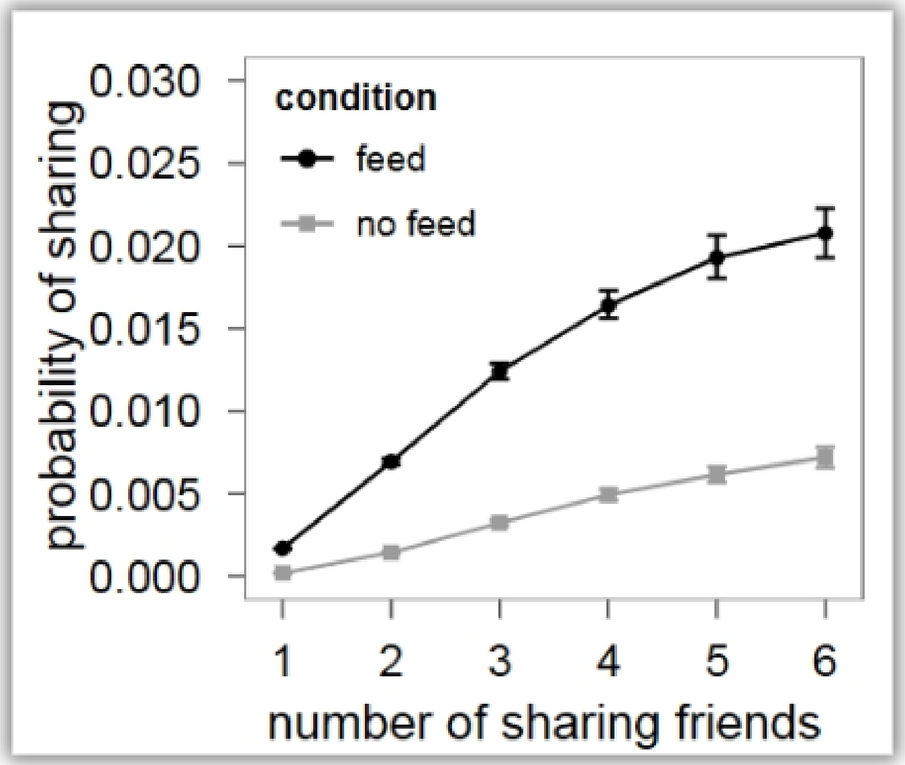
RESULTS

Users often share the same link as a friend shortly after their friend does. Even in the NO FEED condition.

But individuals in the FEED condition are ~7.4 times more likely to share.

The likelihood of sharing increases with the number of friends sharing a link.



Bakshy, E., Rosenn, I., Marlow, C., & Adamic, L. (2012). The role of social networks in information diffusion. *Proceedings of WWW 2012*.

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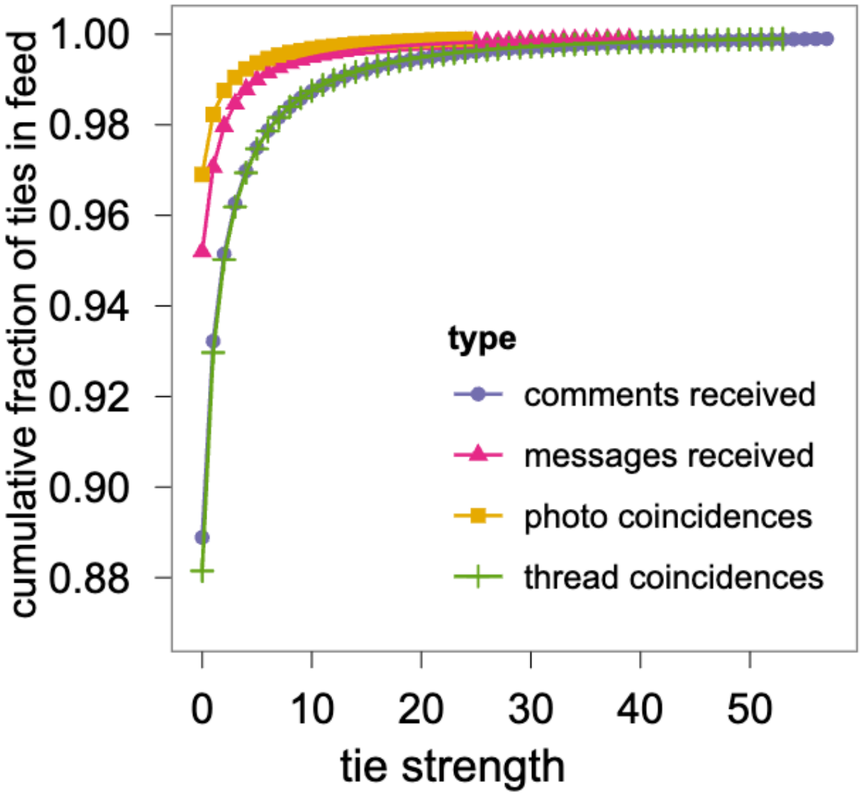
What about weak and strong ties?

TIE STRENGTH

Tie strength measured through:

- frequency of private messages
- commenting on each other's posts
- being tagged in same photo
- commenting on same thread



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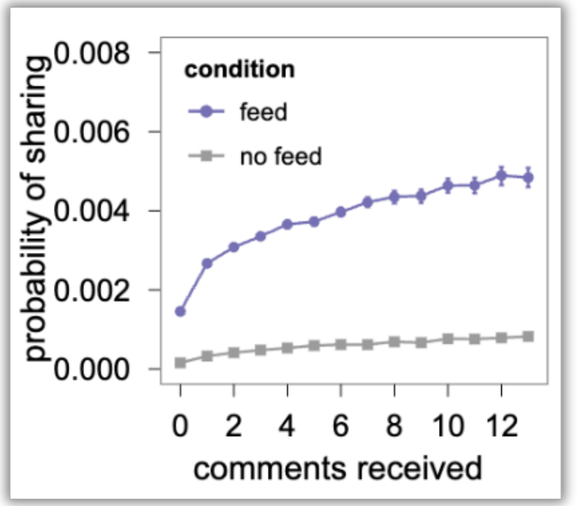
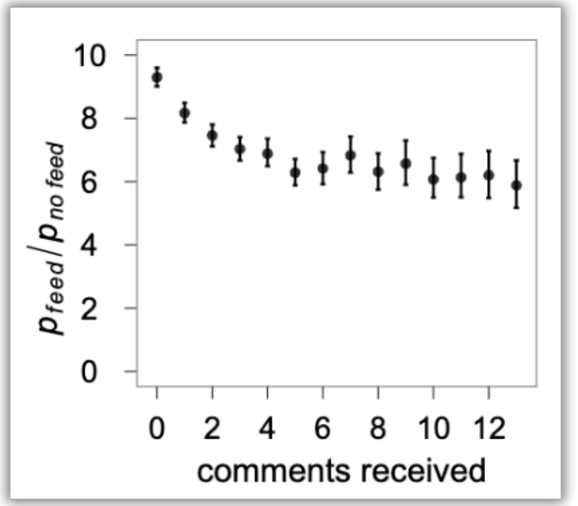
RESULTS

Stronger ties do result in more transmission.





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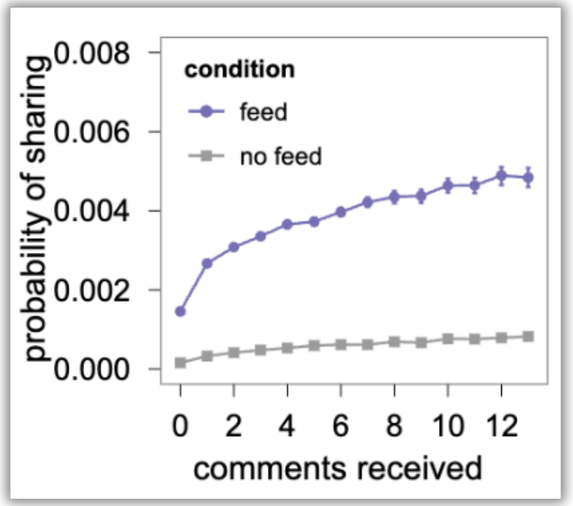

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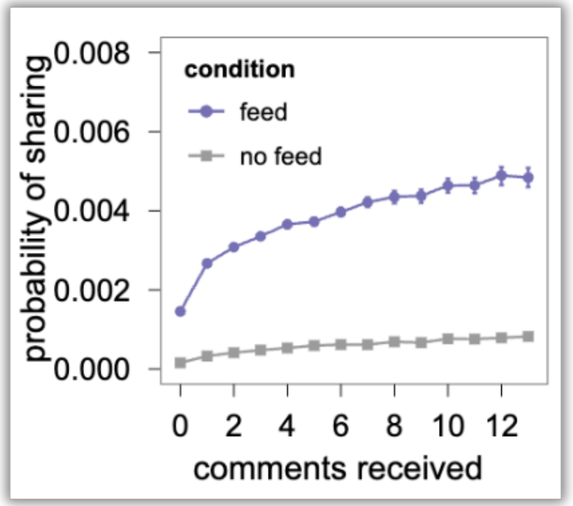

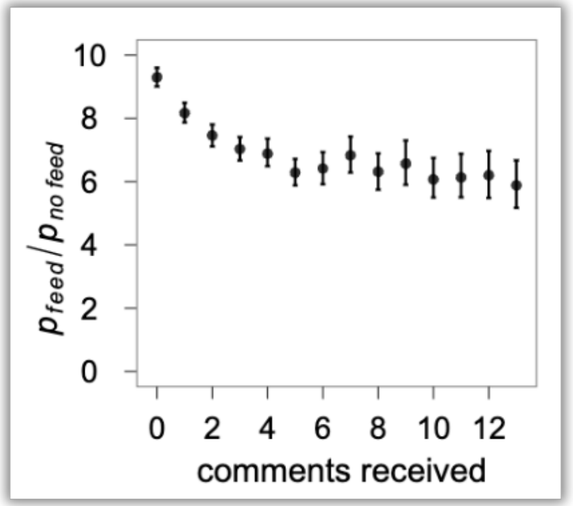

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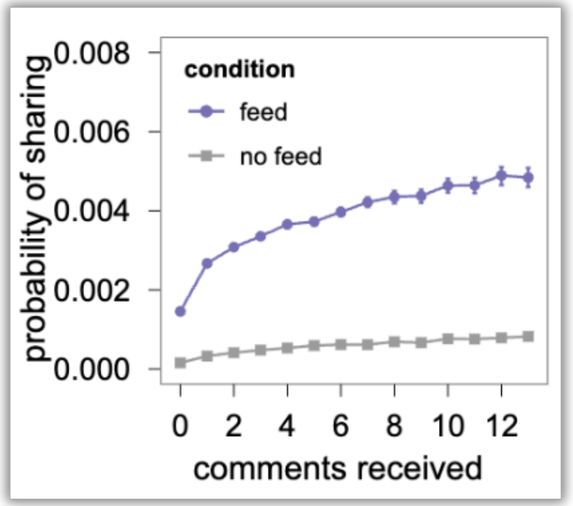
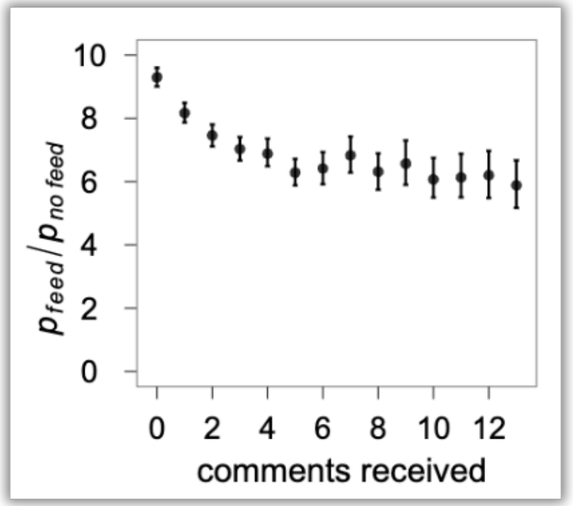
This means that if a weak tie shares something, and you see it, you're more likely to spread it because you wouldn't have seen it otherwise.





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LADA ADAMIC

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So I was right!