

# Connecting the dots: Student social networks in introductory physics labs

Cole Walsh, Daniyar Kushaliev and N.G. Holmes  
*Laboratory of Atomic & Solid State Physics, Cornell University, Ithaca, NY, 14853*

## Study Goals

Investigate best ways to analyze video data to extract  
social network information from undergraduate physics labs

### Context

We evaluated two methods of video coding for capturing student interactions:  
**scan** method and **skip** method

Data come from undergraduate physics labs at Cornell University.

**Node sizes** are proportional to **number** of edges connected to the node

**Node colors** denote students that worked in the same group

**Edges** denote student interactions, defined differently for the two methods

### Reliability

Two independent coders coded a  
single lab session using both methods.

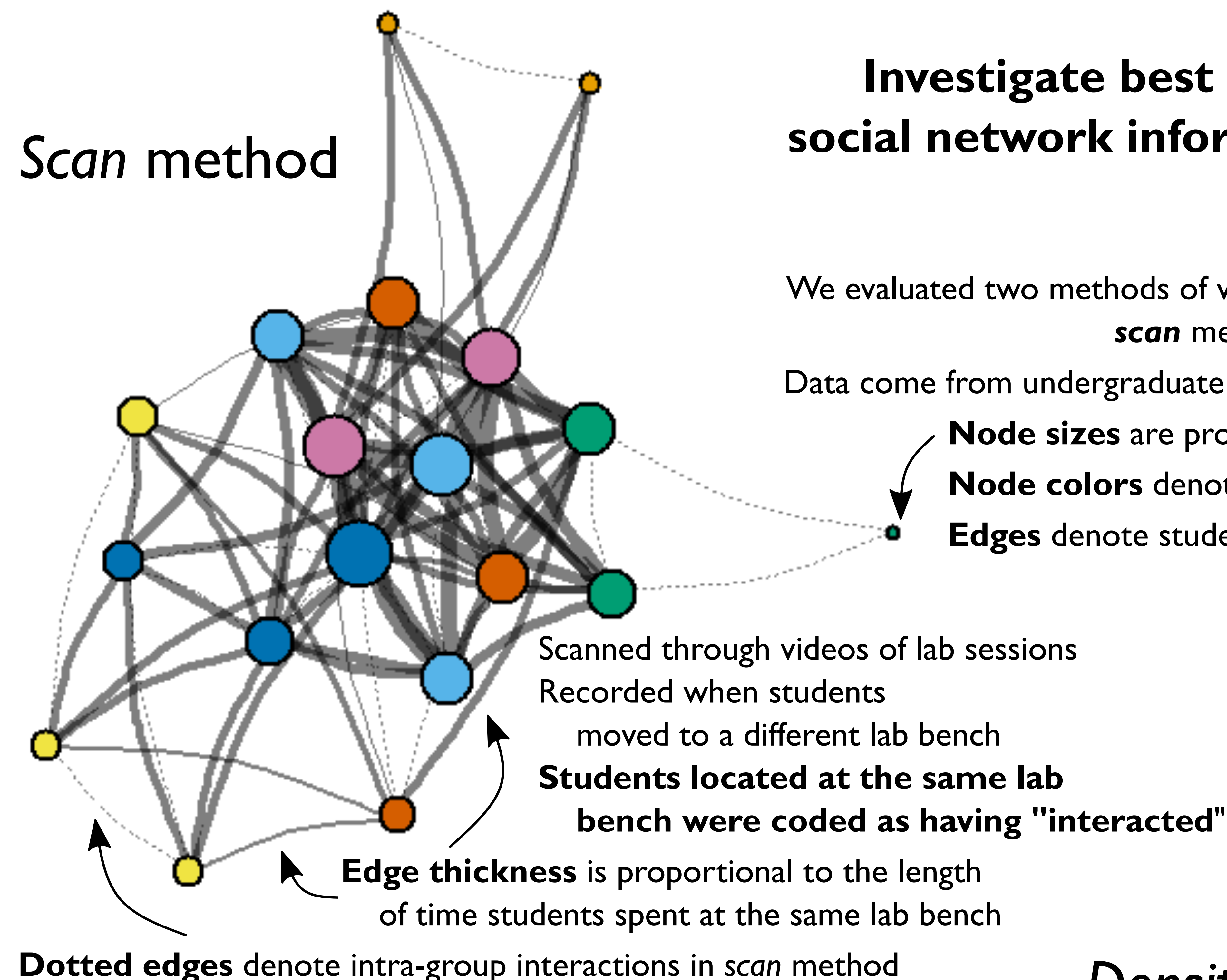
**Scan:** coders agreed on existence of 93% of edges  
and 85% of total edge weights

**Skip:** coders agreed on existence of 86% of edges  
and 83% of total edge weights

### Skip method

Recorded which students spoke  
to each other in 15 second window  
Skipped ahead two minutes and repeated coding  
**Only coded instances where students  
both spoke to each other as "interactions"**

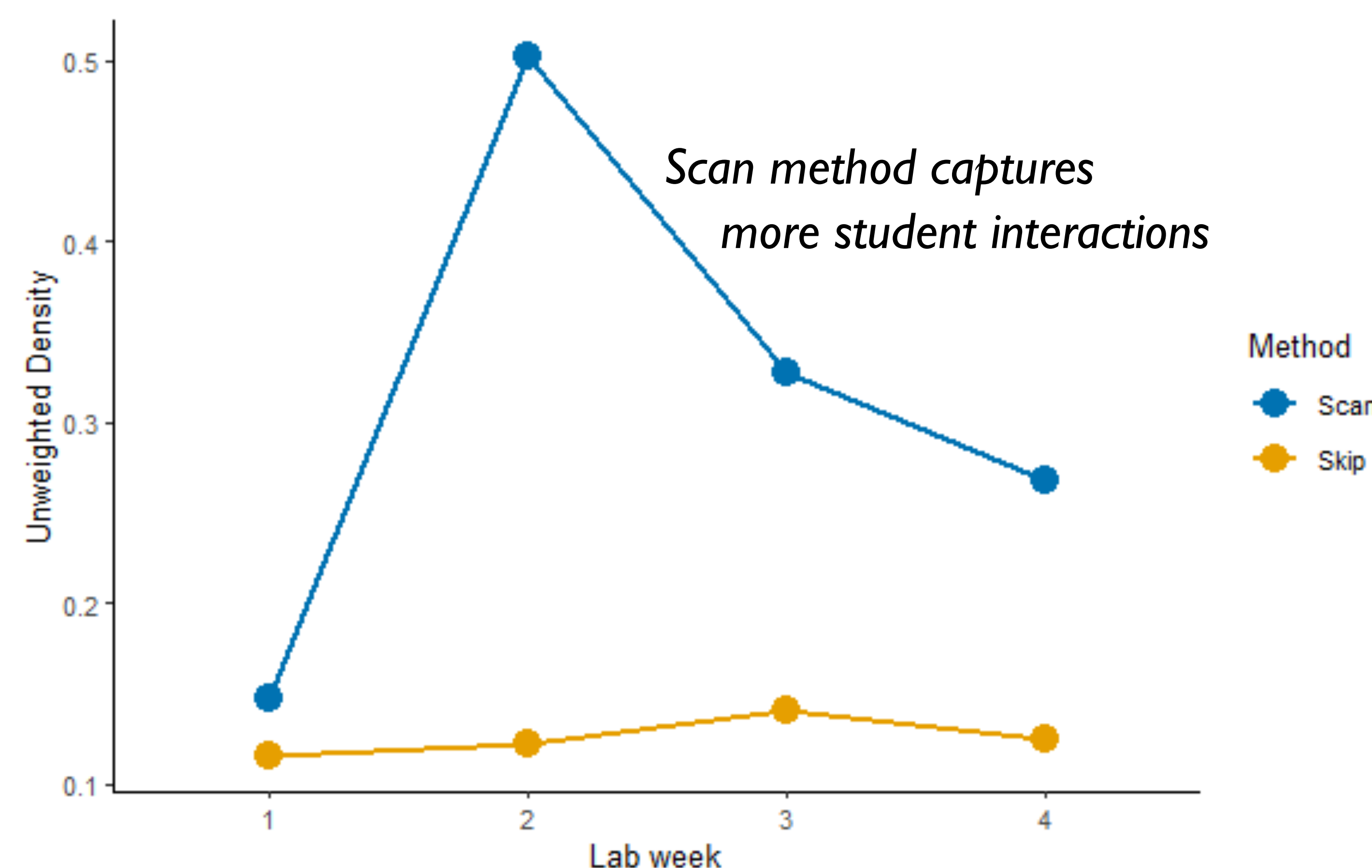
**Edge thickness** is proportional to the  
number of times two students interacted



### Density

$$\text{Unweighted density} = \frac{\text{number of present edges}}{\text{number of possible edges}}$$

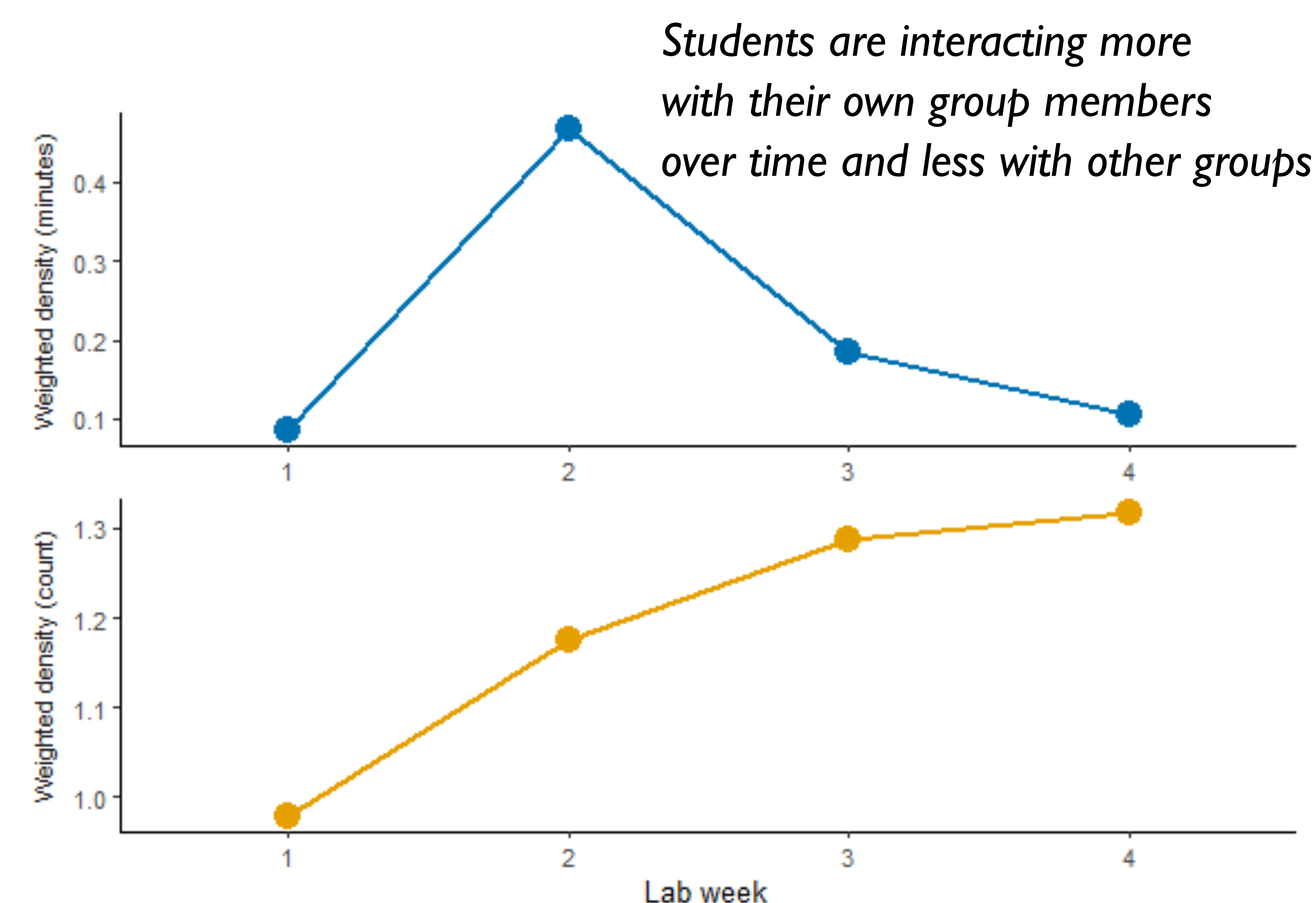
**Interpretation of unweighted density:** average  
fraction of students that each student interacted with



$$\text{Weighted density} = \frac{\sum \text{weight}(u, v)}{\text{number of possible edges}}, \text{ where we sum over all pairs of nodes, } u \text{ and } v.$$

**Interpretation of weighted density (scan):** average amount  
of time that a student interacted with each other student

**Interpretation of weighted density (skip):** average  
number of time that a student interacted with each other student



## Conclusions

The scan method is advantageous for capturing interactions between  
different groups, but loses information about who talks to who.

The skip method is advantageous for capturing who talks to who,  
but misses many short interactions between different groups

## Future Work

Focusing on using scan method and hybrids of this method  
due to efficiency and ability to capture larger social structure

Evaluating the development of network topologies over time

Examining students' positions in the network related to other  
measures, including attitudes, identity, and critical thinking ability