

Dynamic Networks and Behaviors

Selection and Influence of Violence in Adolescents

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Networks and Adolescent Violence

This project uses data from the **Belfast Youth Development Study (BYDS)** to examine the role of peer networks in adolescent violence

- **General Goal:** to examine the potential mechanisms that result in the same empirical pattern, i.e., similarity in violence among friends
 - **Alternative explanations:** Selection vs Influence
 - Differences over time and across schools
- Using **Stochastic Actor-Oriented Model (SAOM)**, e.g., SIENA

Some questions / hypotheses

1. Violent adolescents actively select each other as friends

- Attraction theory (Byrne & Griffitt 1973)
- Physically aggressive youth often direct their aggression outside their friendship (Grottpeter & Crick 1996)
- Bullies are connected largely with assistants in bullying and reinforcers (Collins 2008)

Some questions / hypotheses

2. **Adolescents with physically aggressive friends would become more physically aggressive**
 - **Social learning theory:** model of behavior and reinforcement (Akers 1985)
 - **Social status:** adolescents may imitate their friends' aggression to improve their status (Hawley et al. 2007)
 - **Norms:** adolescents engage in behaviors that match the norm of their social context
 - **Evidence of influence regarding aggression is not consistent across studies (Rulison et al. 2013)**

Some questions / hypotheses

3. Higher status (popular) peers are often more aggressive than less popular peers (Dijkstra et al. 2009)

- Bullies are not part of the elite, but rank in a middle (Collins 2008)
- Bullies are among the gregarious kids, but they use their social skills in a manipulative way. Not all aggressive youth are rejected and unpopular (Light & Dishion 2007)
- *Instrumental aggression: popular*
- *Overt aggression: unpopular*

Some questions / hypotheses

- **Girls** may be more likely to select aggressive boys as friends during *early adolescence* (Bukowski et al. 2000)
- **Girls** may be more susceptible to influence from physically aggressive friends
- Aggression is less normative among girls, girls with aggressive friends may be more vulnerable to influence from their friends (Hanish et al. 2005)

Some questions / hypotheses

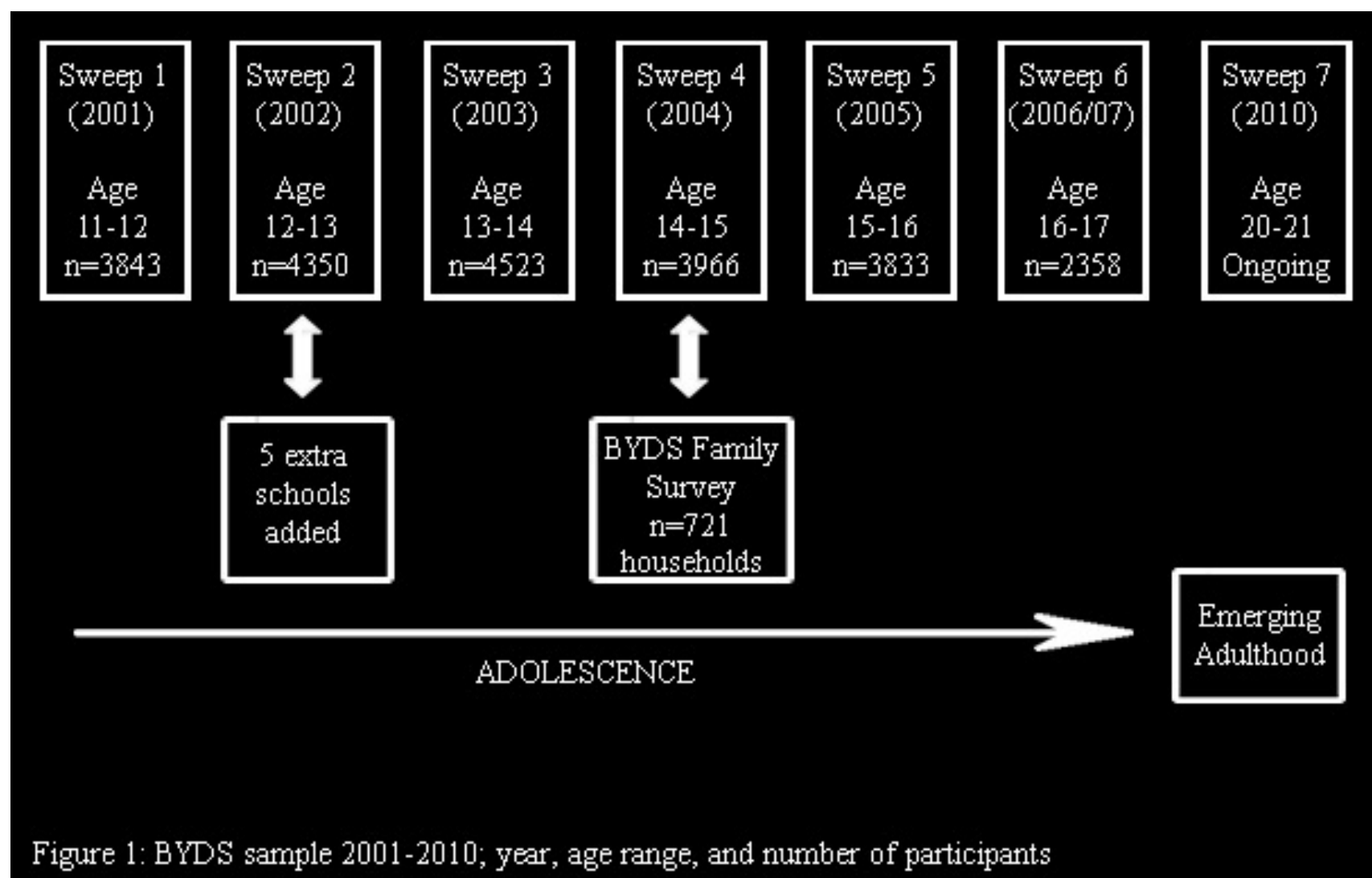
5. Low status (unpopular) adolescents are more likely to select violent friends

- Rejected youth may befriend popular and potentially aggressive peers to raise their own social status (Dijkstra et al. 2013)
- Rejected aggressive youth may lack the social skills to develop friendships with prosocial peers (Bierman 2004)

Data: Belfast Youth Development Study

- **BYDS** is a longitudinal study of young people's lives and experiences in **Northern Ireland**.
- **BYDS** has followed a cohort of approximately 4000 young people from 2001 to 2010: **44 schools**.
- Participants were aged 11-12 upon entry to the study.
- Adolescents completed the survey on 6 occasions on a yearly basis from 2001-2005 and again in 2007

Data: Belfast Youth Development Study



Data: Belfast Youth Development Study

Some limitations

- We have access to **waves 1-5**
- We have access to a **limited set of variables** (e.g., delinquency, relationship with parents, leisure time, network)
- Not good communication with the research team in charge of the study
- Bad documentation

Data: Belfast Youth Development Study

Network data

- Up to **10 friend** nominations

Violence data

- Self-reported

1. In the last 12 months, have you hit, kicked or punched to hurt or injure someone?

How many times? (1-2, 3-5, 6-9, 10+)

2. Since the start of the current school year, have you been in a fight with someone in school grounds?

How many times? (1-2, 3-5, 6-9, 10+)

Data: Belfast Youth Development Study

Other variables

- Gender (18 schools out of 44 are co-educational)
- Economic Disadvantage / Meal eligibility
- Educational aspirations
- Family structure

Some issues

- **Attrition: important differences across schools**
- **Compositional change: joiners and leavers imputation**
- **Missing data**

SAOM Model (beyond this presentation)

- **Stochastic Actor-Oriented Model (SAOM)**
- **SIENA:** Snijders, Van de Bunt and Steglich (2010)
- Model for longitudinal network analysis
- Multivariate co-evolution model in which the feedback between network change and behavior change is explicitly incorporated
- Network and behavior (dependent individual characteristic) are endogenously changing

SAOM Model (beyond this presentation)

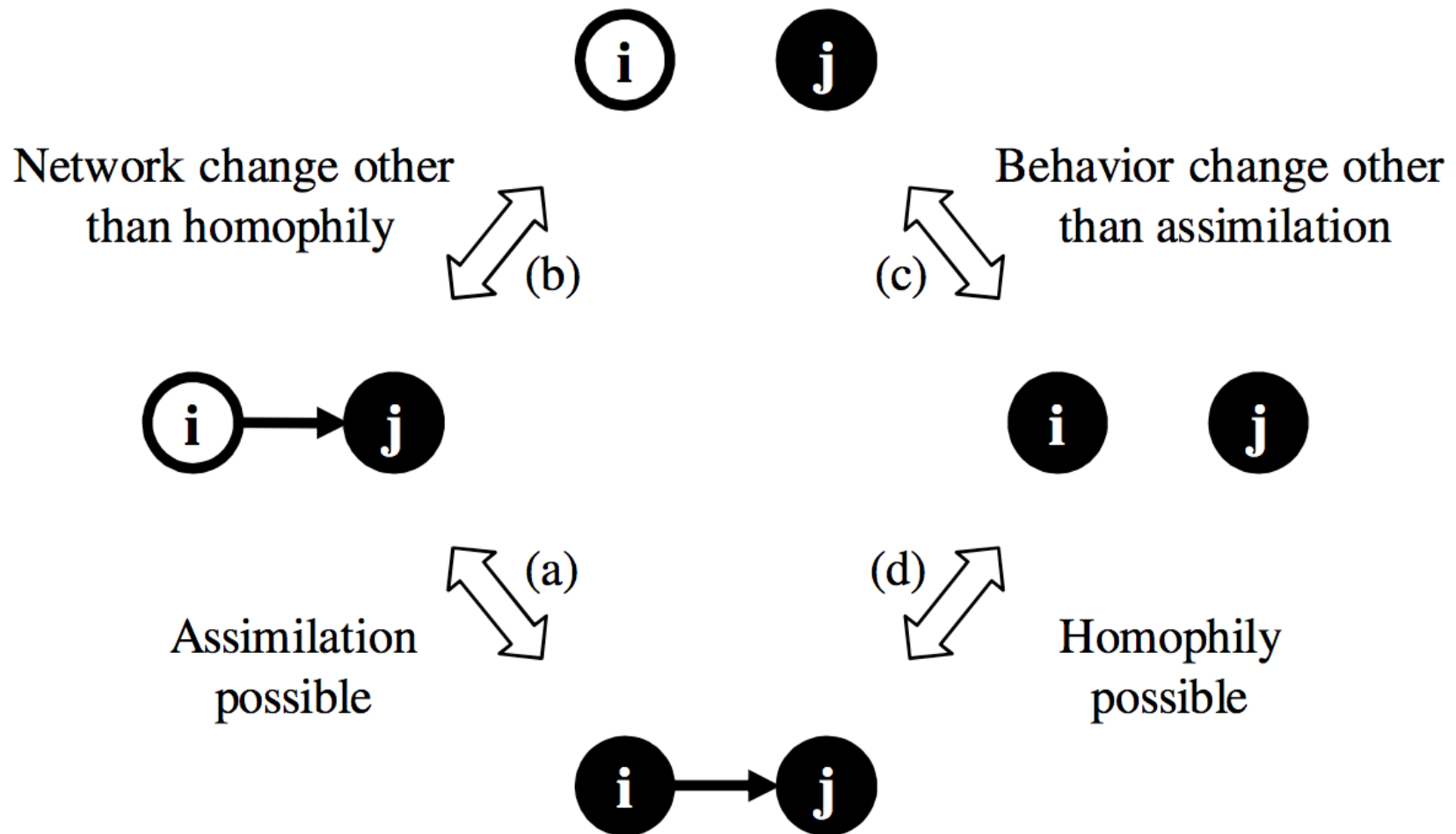
- Longitudinal data
- Complete network data

In addition...

- Models assume a continuous time process
- Why?

Discrete snapshots → Unobserved changes → Bias ?

Elementary Change Configurations of Similarity and Friendship in a Dyad



SAOM Model

(beyond this presentation)

- So... discrete data is a **cumulative result of an unobserved sequence** of elementary changes (micro steps) resulting from decision taken by the actors between observations
- Unobserved change process can only be inferred by modeling and simulation => imputation of the unobserved trajectory of changes between observations
- **Beware: simulation-model-based inference!**
- **Model Components**

Schematic Overview of the Model Components

	Occurrence	Rule of Change
Network changes	Network rate function	Network objective function
Behavioral changes	Behavioral rate function	Behavioral objective function

Example for Network Evolution $t_0 \rightarrow t_1$

- Simulation starts out at the network observed at t_0
- Waiting time is sample according to the **rate function** for all actors
- The actor with the shortest waiting time is identified and get the opportunity to set a micro step
 - What change will be made depends on his/her **objective function**
 - How attractive is the network state \mathbf{x} to actor \mathbf{i} (computed for a focal actor)

network statistic x parameter

- ***Actors are moving toward a high (low) score on the corresponding network statistic***

Example for Network Evolution $t_0 \rightarrow t_1$

- The simulation finished when $(t_0 + \text{waiting time}) > t_1$
- **Parameters are iteratively updated** \rightarrow expected value over simulations must equal the observed values of the statistic (convergence)
- Expression of the behavioral rules that are likely to be followed by actors **given the observed data**

Assumptions

- Is it reasonable to assume that only one tie may change at time based on a rate-of-change function? **Yes**
- Is it reasonable that all actors share the same objective function? **Too restrictive?**
- Is it reasonable to assume that all actors are fully aware of the topology of the network when choosing how to change a tie?
Yes (size of the network)
- Do we have a reason to think behavior co-evolves nearly simultaneously with the micro-steps of the network? **Yes**

Model Specification

- Theories or hypotheses about the mechanisms might operate
- These mechanisms can be expressed in terms of SIENA parameters and the hypotheses can be restated in terms of the corresponding model parameters
- By estimating the parameters and calculating significant tests for them, the theories / hypothesis can be tested
- Mechanisms can be controlled for each other, that is, they can be statistically separated!

Two previous studies using SAOM for violence

1. Dijkstra et al. (2011)

- Sample of 274 Chilean students (5th and 6th grades) from two schools, followed over one year.
- Only two waves; friends nominations up to 6
- **Aggression:** physical (*who starts fights*) and relational (*who ignores other*). Not self-reported violence.
- **Conclusions**
 - Selection disappears when network effects, gender, and social status are considered
 - Influence only found for relational aggression

Two previous studies using SAOM for violence

2. Rulison et al. (2013)

- Sample of 480 students (6th grade) from one school (rural school district in the US), followed over 4 semesters (4 waves).
- Friends nominations: as many friends as they wanted.
- **Aggression:** only physical (*who starts fights or hit / pick on other*). No self-reported violence.
- **Conclusions**
 - Aggressive students were more likely to select aggressive friends
 - There was a peer influence effect, but no difference by gender and social status

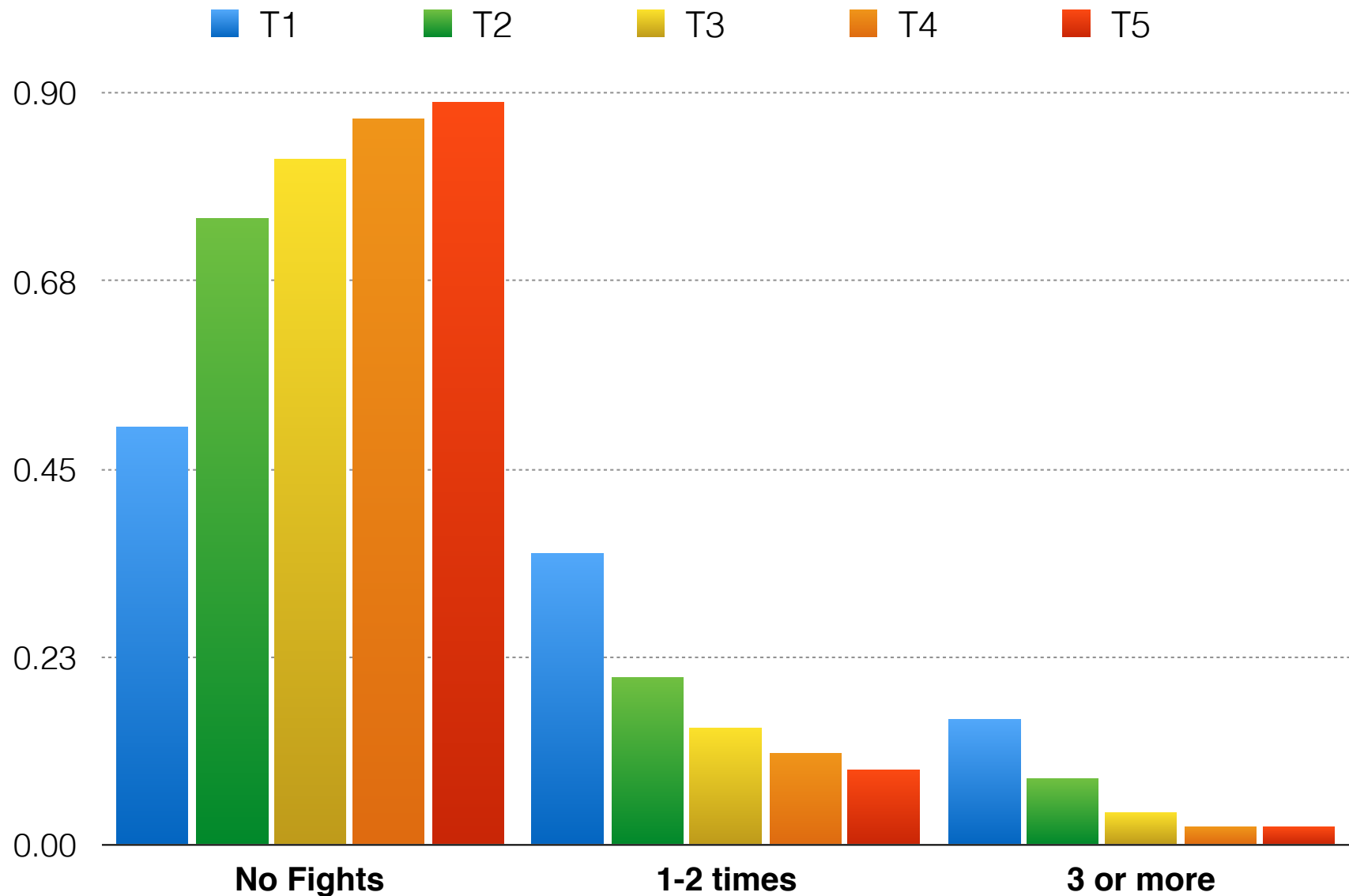
My example using a school from BYDS

- **One network variable:** friendship
- **Co-evolving behavior:** fighting at school
- **Other actor variables:** gender (59%), meal eligibility
- 5 waves in year intervals (4 periods)

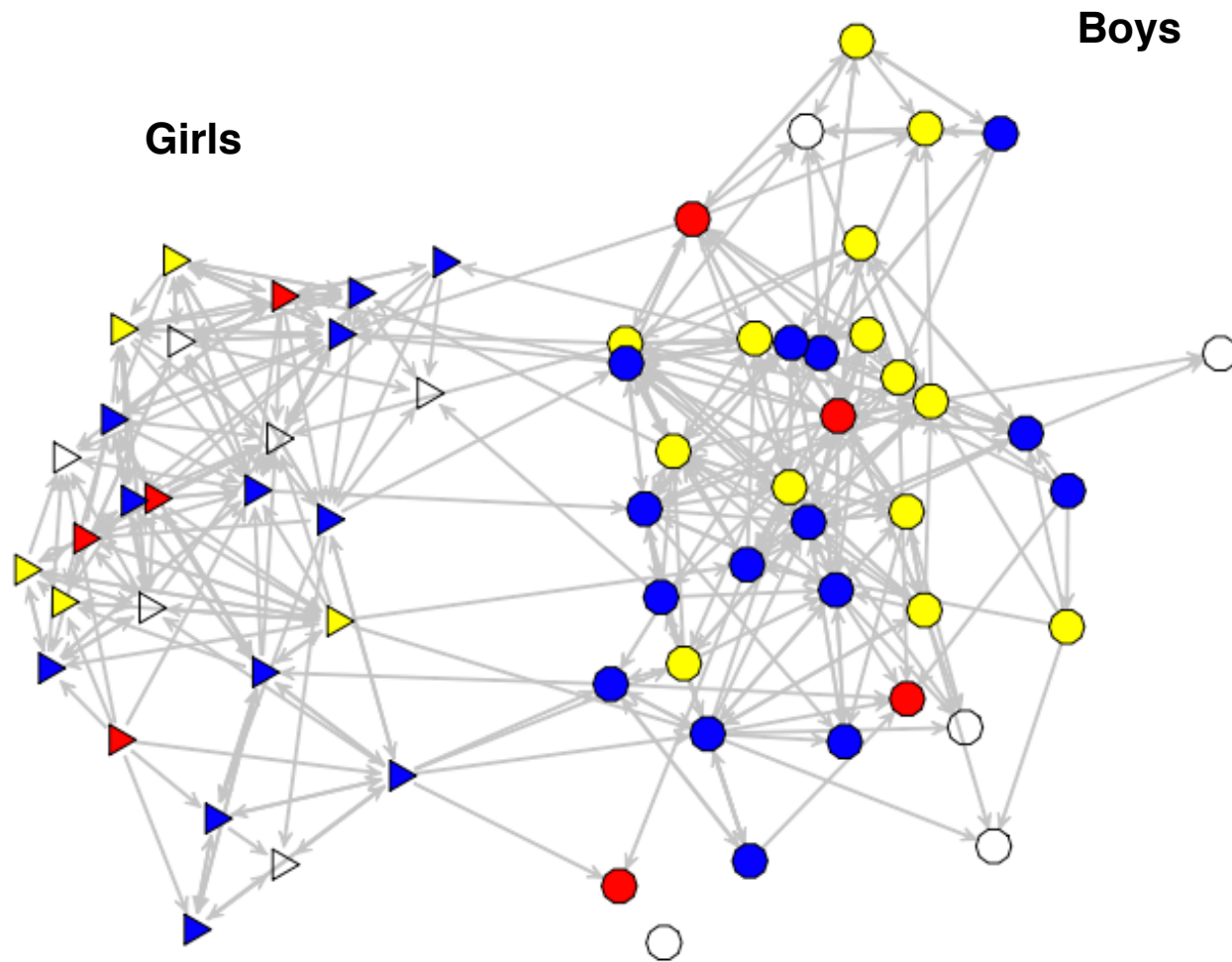
Cohort Size				
w1	w2	w3	w4	w5
56	51	59	55	57

Response Rates				
W1-2	W2-3	W3-4	W4-5	W1-5
0.82	0.88	0.90	0.93	0.89

Distribution *fighting* at this school

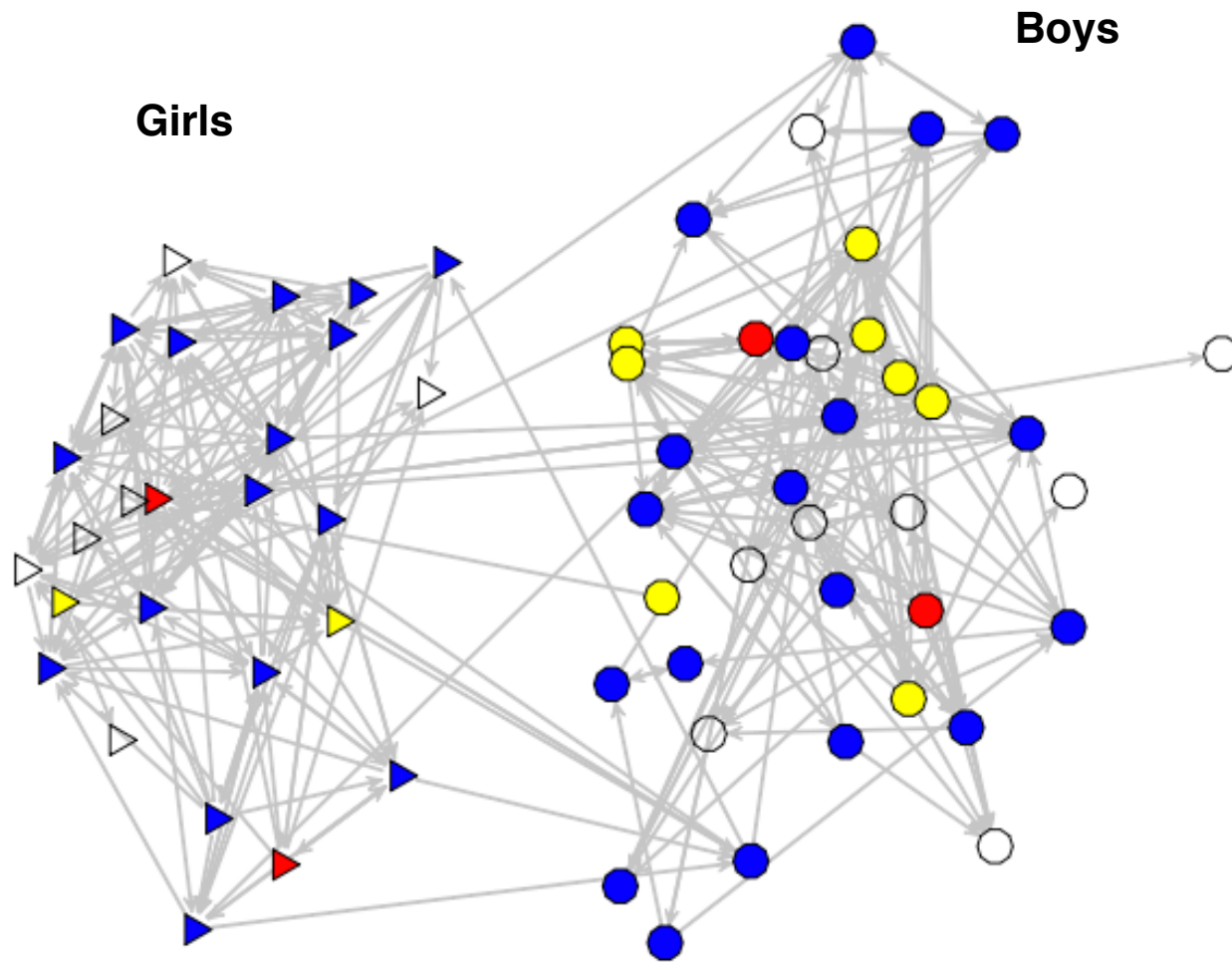


Wave 1 (11-12)



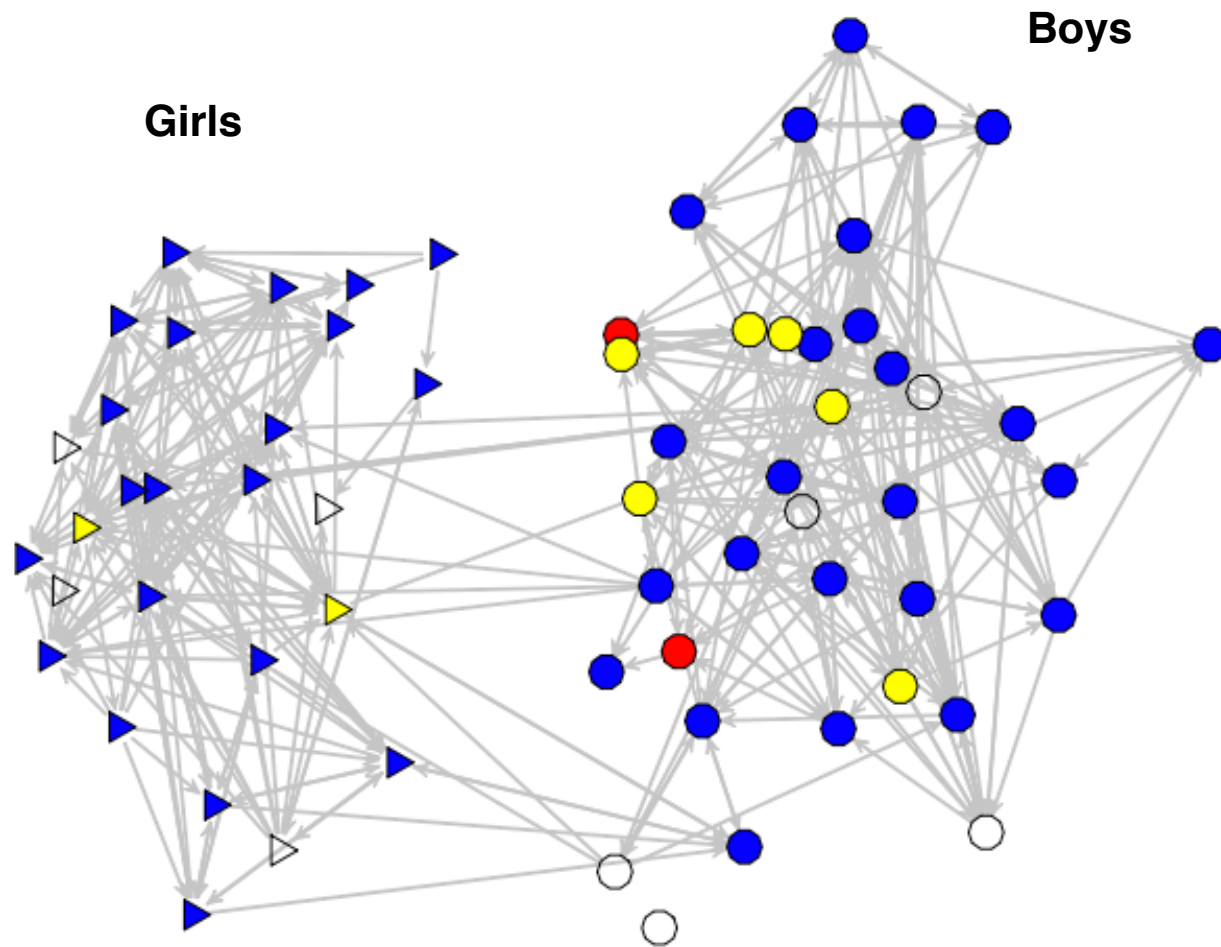
Density: 0.11; Average Out-degree: 6.15

Wave 2 (12-13)



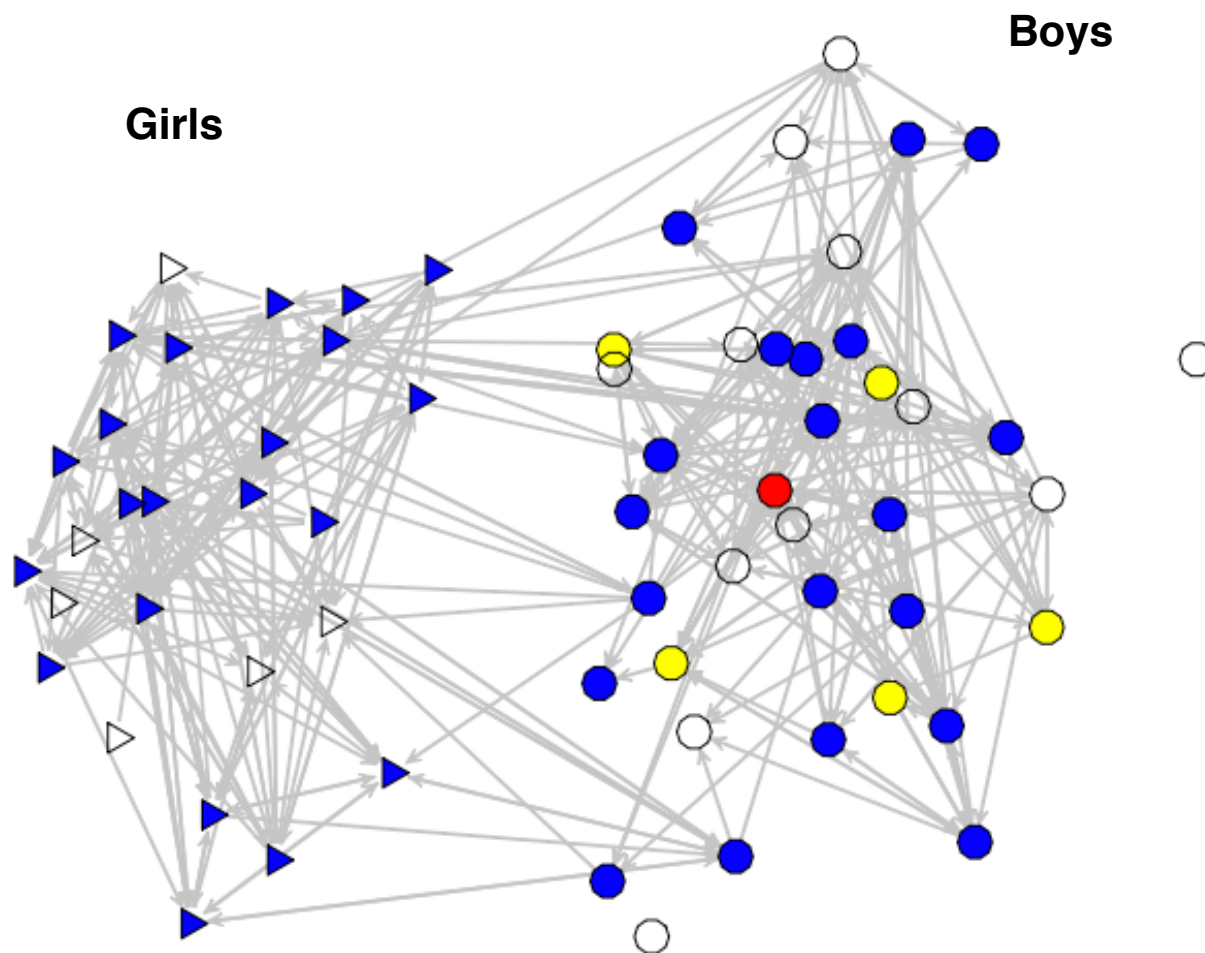
Density: 0.11, Average Out-degree: 5.72

Wave 3 (13-14)



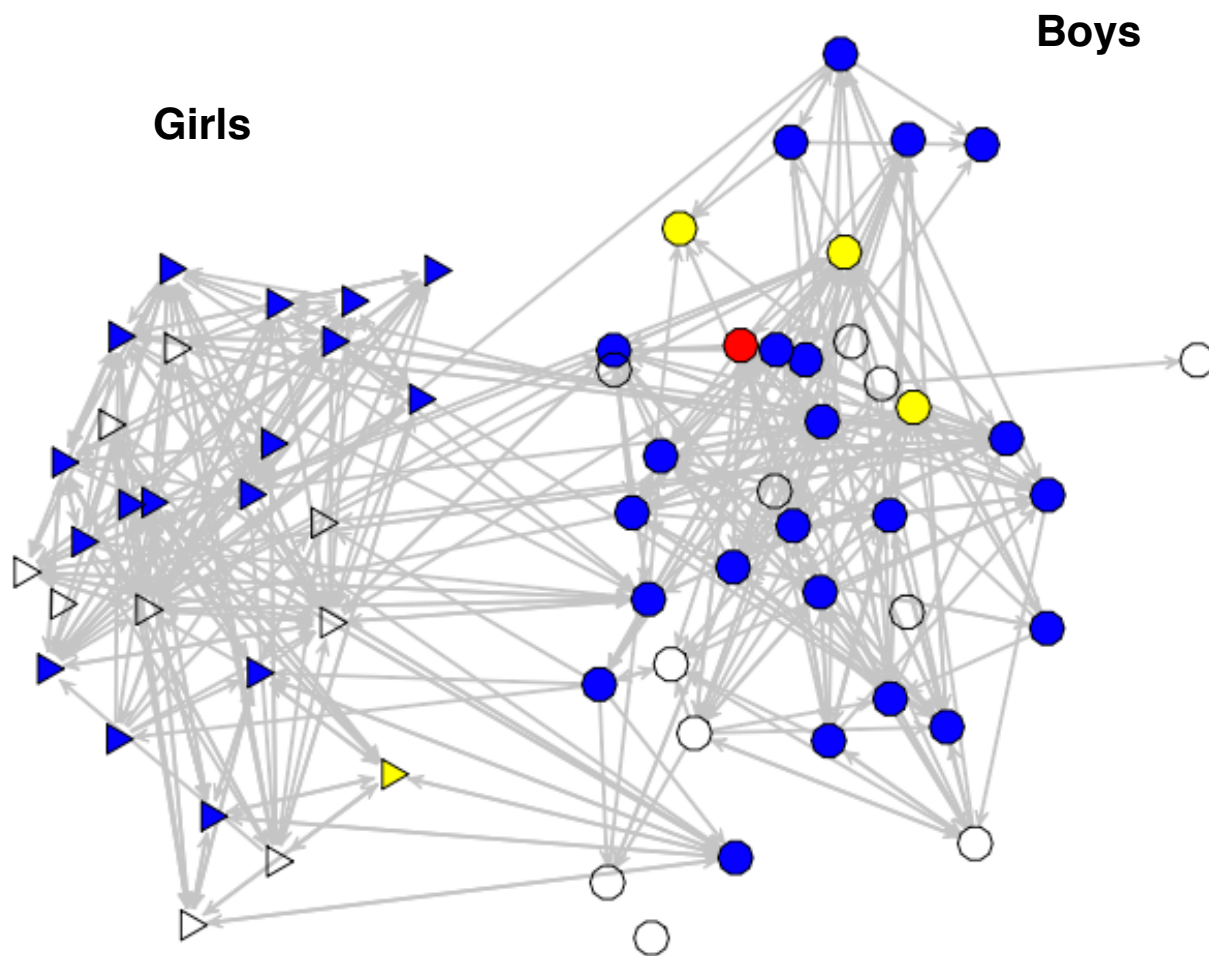
Density: 0.12; Average Out-degree: 6.52

Wave 4 (14-15)



Density: 0.12; Average Out-degree: 6.45

Wave 5 (15-16)




Density: 0.13; Average Out-degree: 6.66

Simple Questions

1. **Social Selection:** Violent adolescents actively select each other as friends
2. **Assimilation:** Adolescents with physically aggressive friends would become more physically aggressive
3. Fighters are attractive as friends?
4. Gender differences?

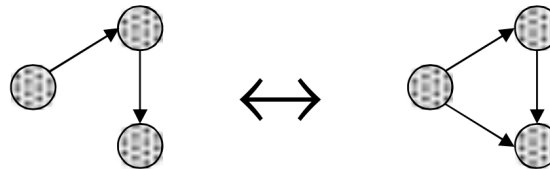
Model Specification: Friendship

1. Dyadic effect models

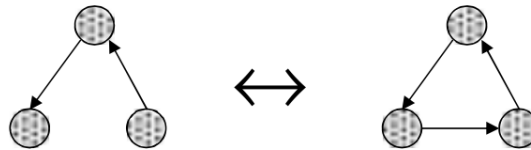
- Reciprocity 

2. Triad effect models

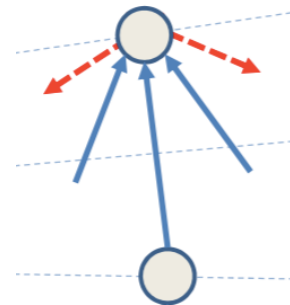
- Transitive triplets



- 3-cycles



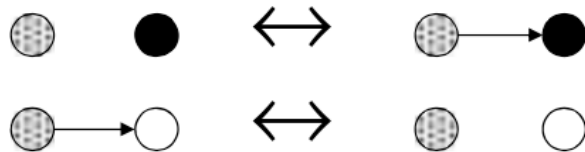
- In-degree activity



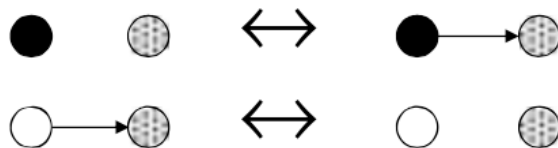
Model Specification: Friendship

3. Covariate effects

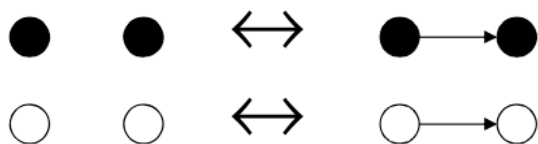
- Covariate alter



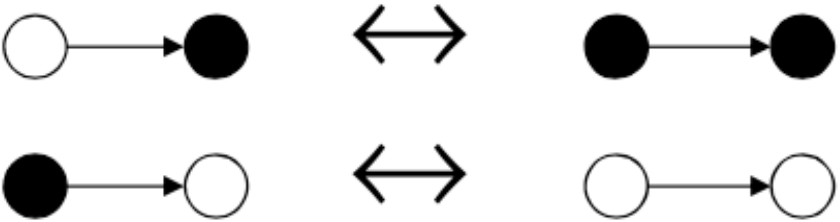
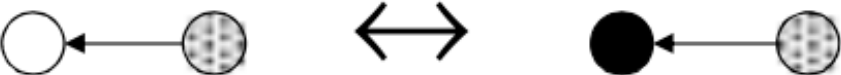
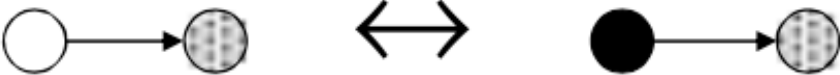
- Covariate ego



- Covariate similarity

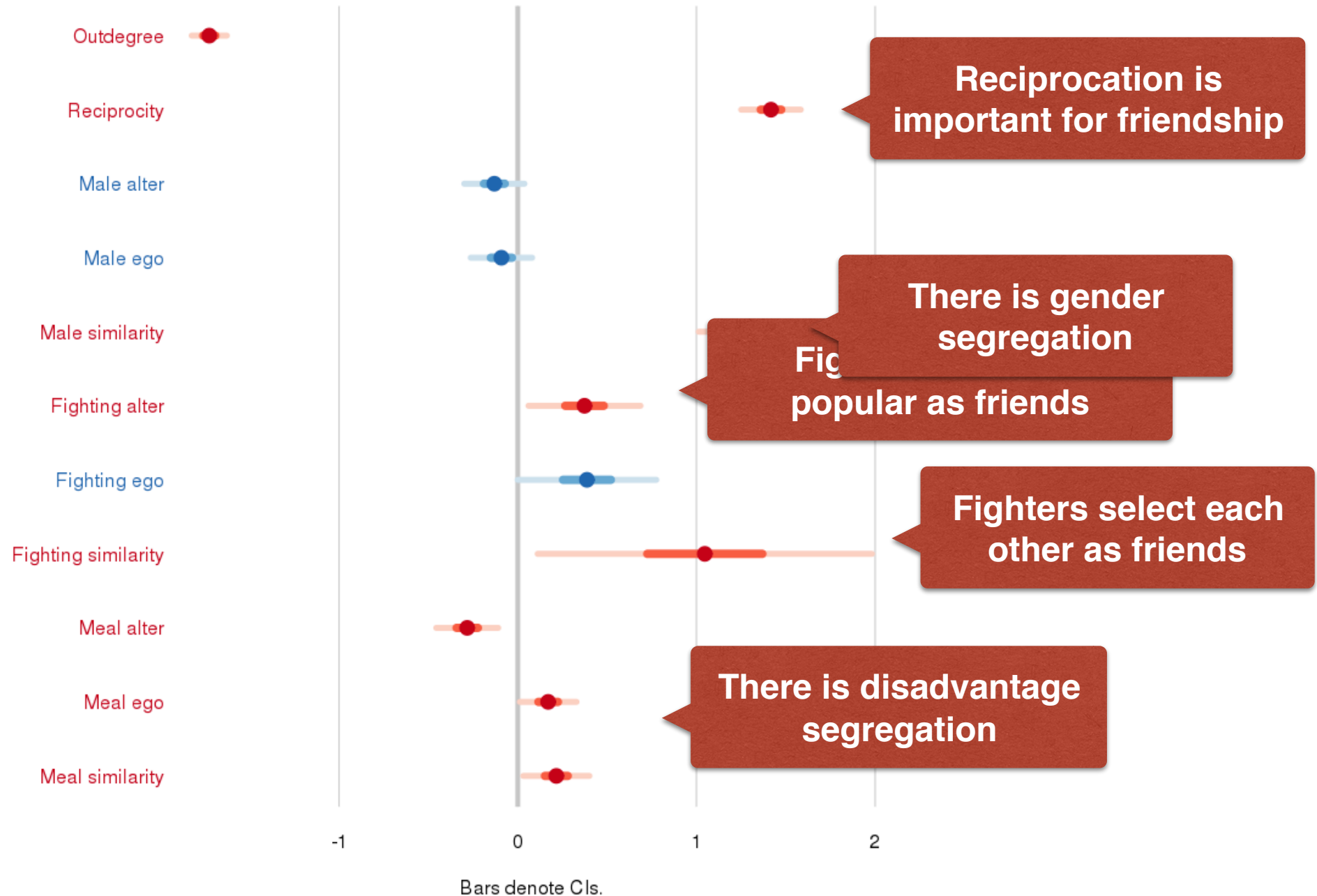


Model Specification: Behavior

- 1. Shape (linear and quadratic):** Shape of the objective function → basic shape of the observed distribution of the behavioral variable.
- 2. Average Similarity**

- 3. In-degree effect**

- 4. Out-degree effect**

- 5. Additional controls:** gender and meal eligibility

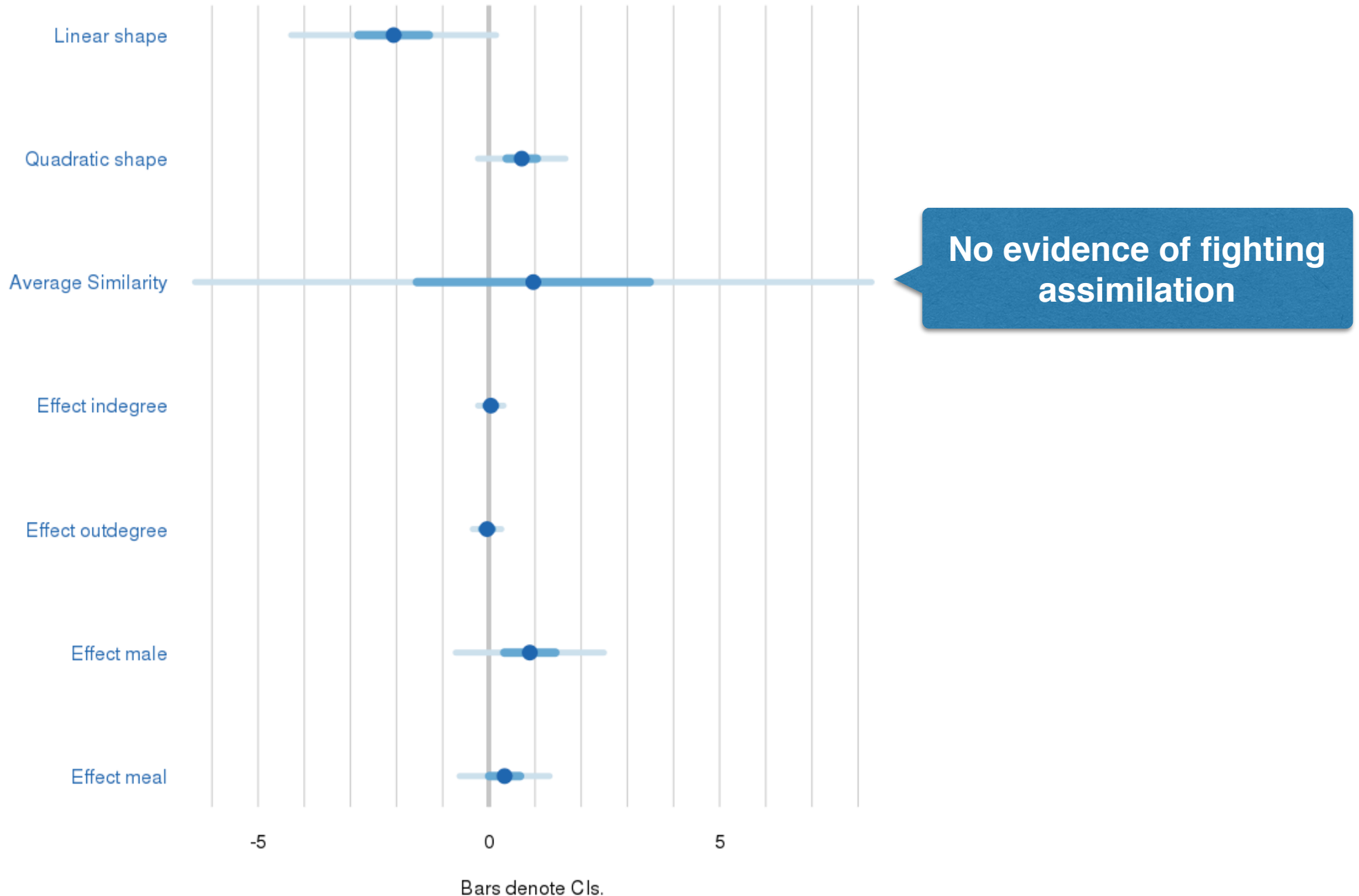
Results Dyadic Effects: Friendship

Objective Function Friendship



Results Dyadic Effects: Behavior

Objective Function Fighting

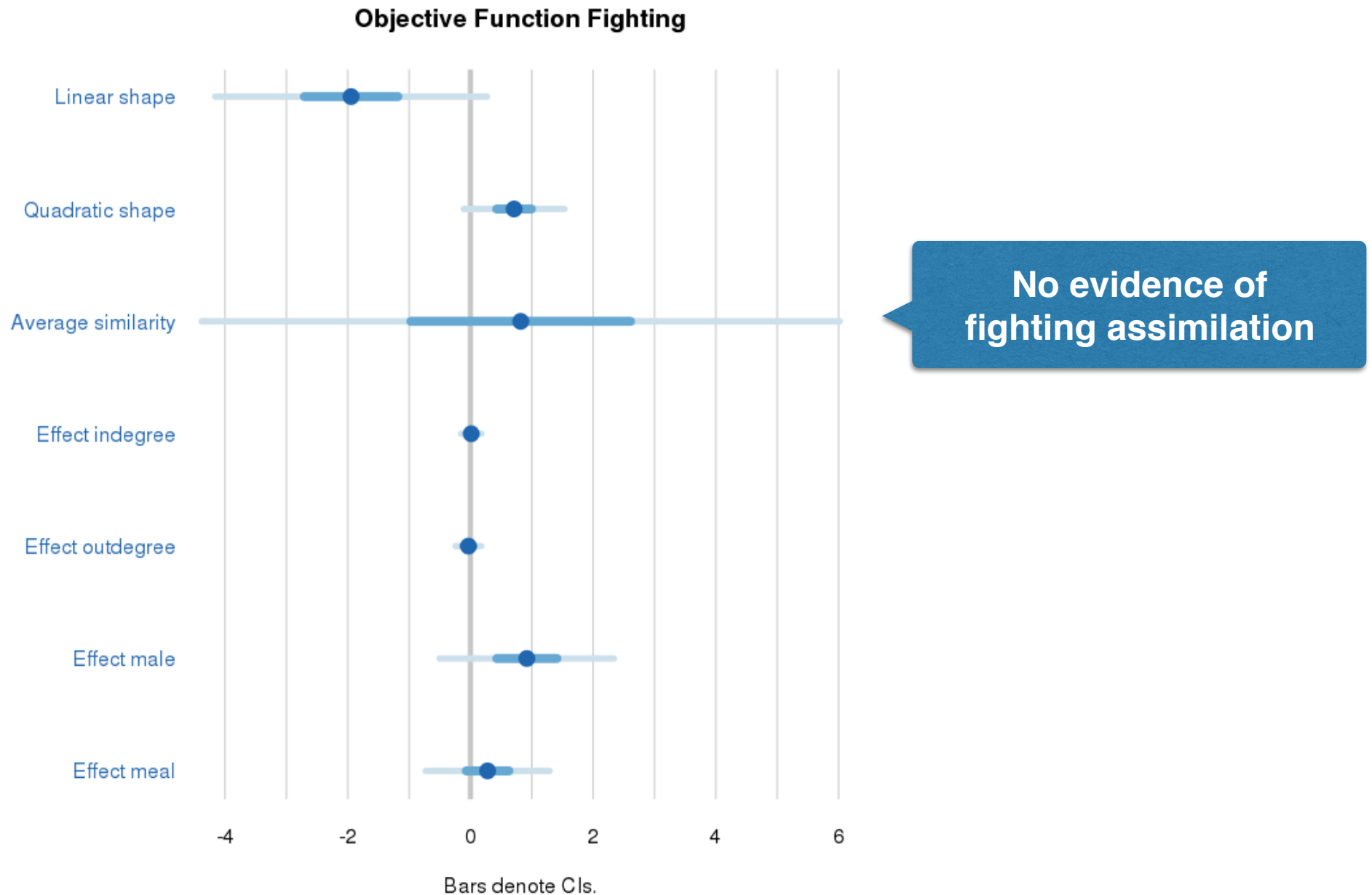


Results Triadic Effects: Friendship

Objective Function Friendship



Results Triadic Effects: Behavior



Summary

- Selection ✗
- Assimilation ✗
- Aggressive adolescents more attractive as friends ✗
- Gender differences (models not shown)
 - Assimilation coefficient too imprecise to estimate interactions
 - Girls may be more likely to select aggressive boys as friends ✗
- My results are more in line with [Dijkstra et al. \(2011\)](#), **but I am using only one school**
 - Measurement differences

Next Steps

- **To examine time heterogeneity**

- There are indications of time heterogeneity
- Process may change over adolescence (from 11 to 16 years old)
- Problems of measurement

- **Goodness of fit**

- Convergence is not enough
- Can the micro-mechanisms used reproduce properties that have not been explicitly modeled?
 - *Degree distribution*
 - *Geodesic distances*
 - *Triad Census*

- **More schools:** explore differences between them and use different measures of violence (not only fighting at school)

Thank you!