Exploring the social consequences of sexual conflict through bedbug (*Cimex lectularius*) social networks

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BIO 708 QMEE 2021

Bedbug sexual conflict and sociality

Multiple matings (via traumatic insemination) are costly to females

Tendency to aggregate

What are the implications of intense sexual conflict on social structure?

(Stutt and Siva-Jothy 2001, Reinhardt and Siva-Jothy 2007)

https://en.wikipedia.org/wiki/Traumatic_insemination#/media/File:Traumatic_insemination_1_edi

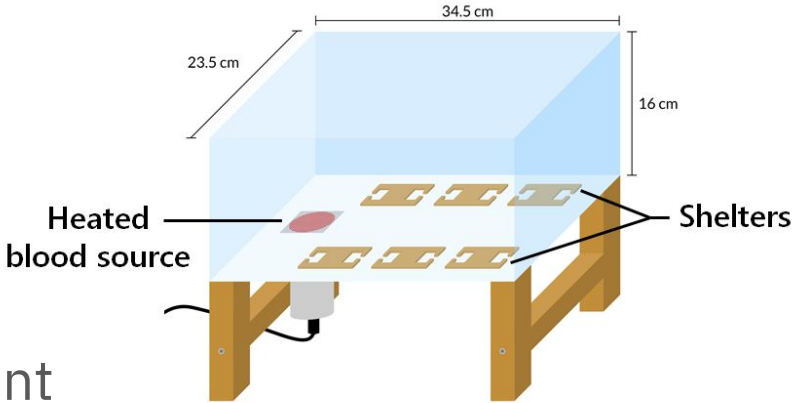
Observations

Observe for 8 hrs x 6 days (under red light)

Treatments:

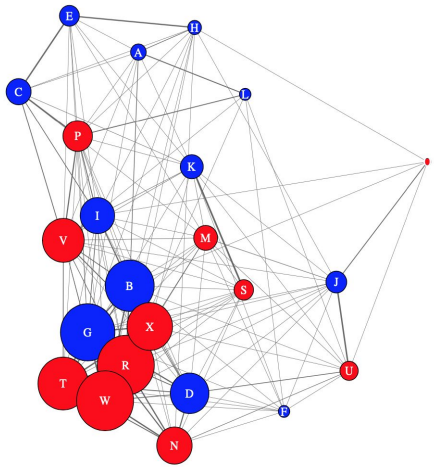
1) High sexual conflict → 2 shelters
2) Low sexual conflict → 12 shelters

One block: 1 replicate of each treatment

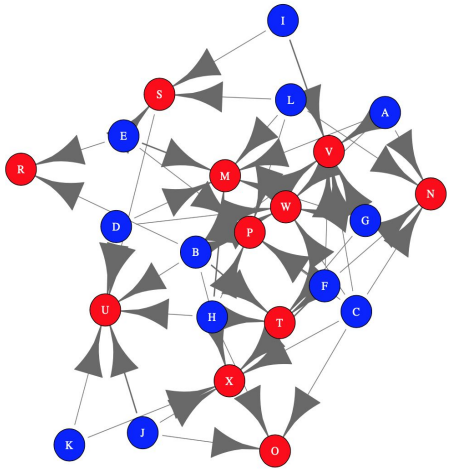


Social Network Analysis

Low Sexual Conflict

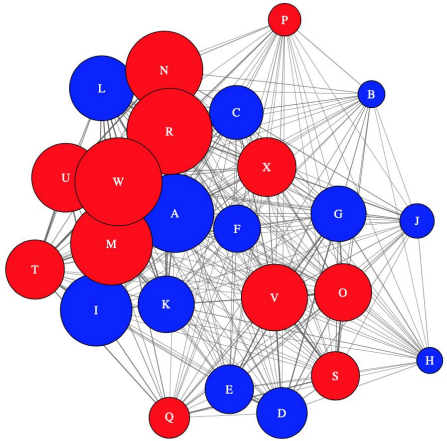


Sociability Network

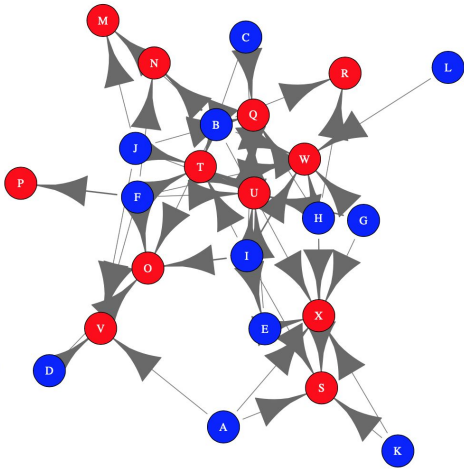


Harassment Network

High Sexual Conflict



Sociability Network



Harassment Network

Predictions

1. Males will be more social than females [SN]

2. Individuals will assort themselves with same-sex conspecifics [SN]

3. Harassment of females will increase as a function of sociability [SN+HN]

4. P1 and P3 will be stronger in the low sexual conflict treatment (12 shelters) compared to the high sexual conflict treatment (2 shelters) [SN+HN]

Prediction 1: Males are more social than females

Measures

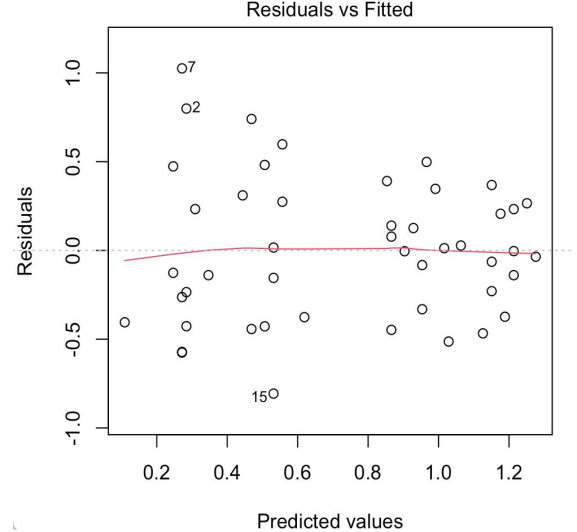
- Calculate sociability strength for each individual
- Compare males vs females for the block

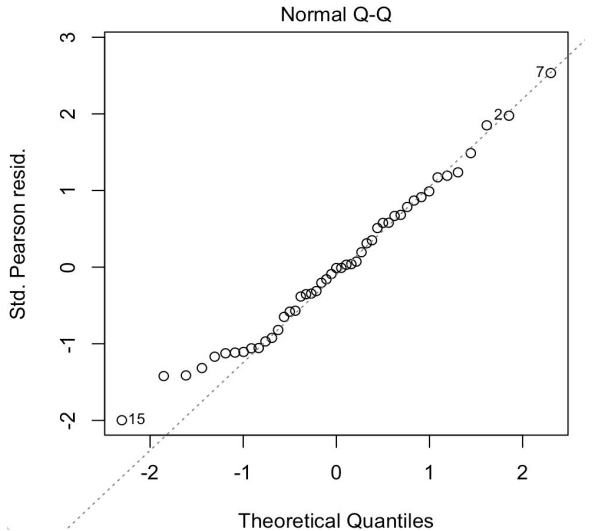
Statistics

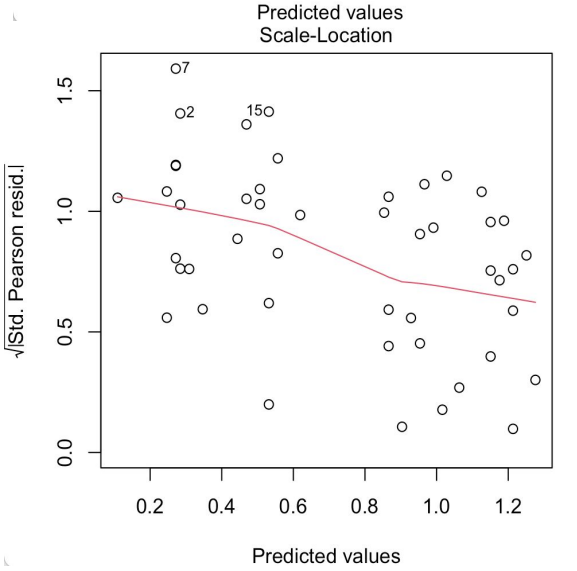
- GLM [next slide]
- Permutations

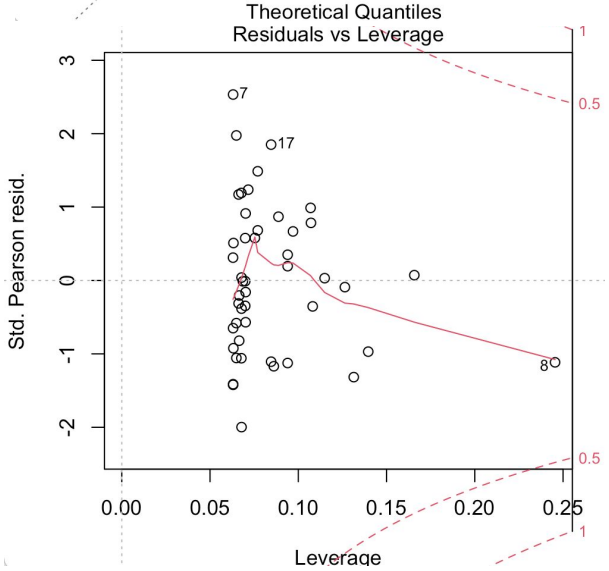
GLM: Males are more social than females

- Response: strength
- Predictors: sex + size + treatment
- Family: Gamma





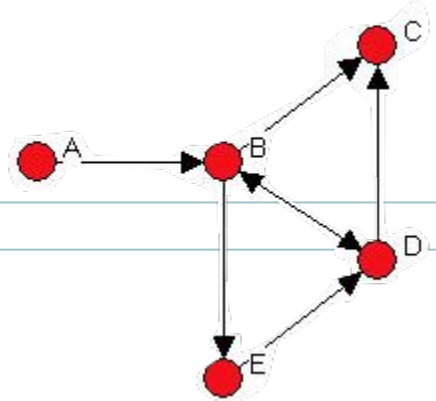




Prediction 1: Males are more social than females

Measures

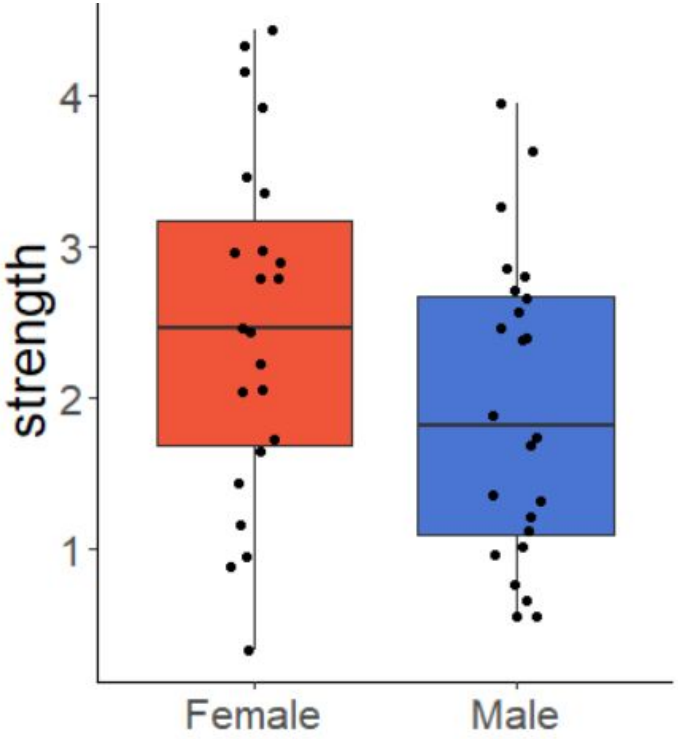
- Calculate sociability strength for each individual
- Compare males vs females for the block

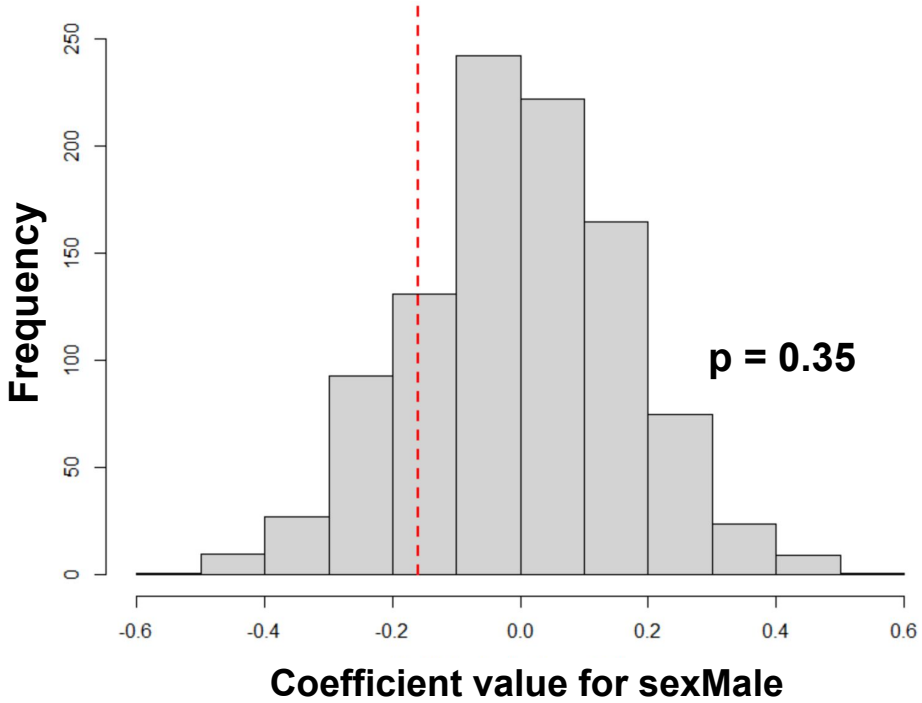


Statistics

- GLM
- Node-label permutation (1000 for each network), compute new strength for each node after each permutation and run the same GLM on new data

Prediction 1: Males are more social than females





Prediction 2: Individuals prefer same-sex interactions

Measures

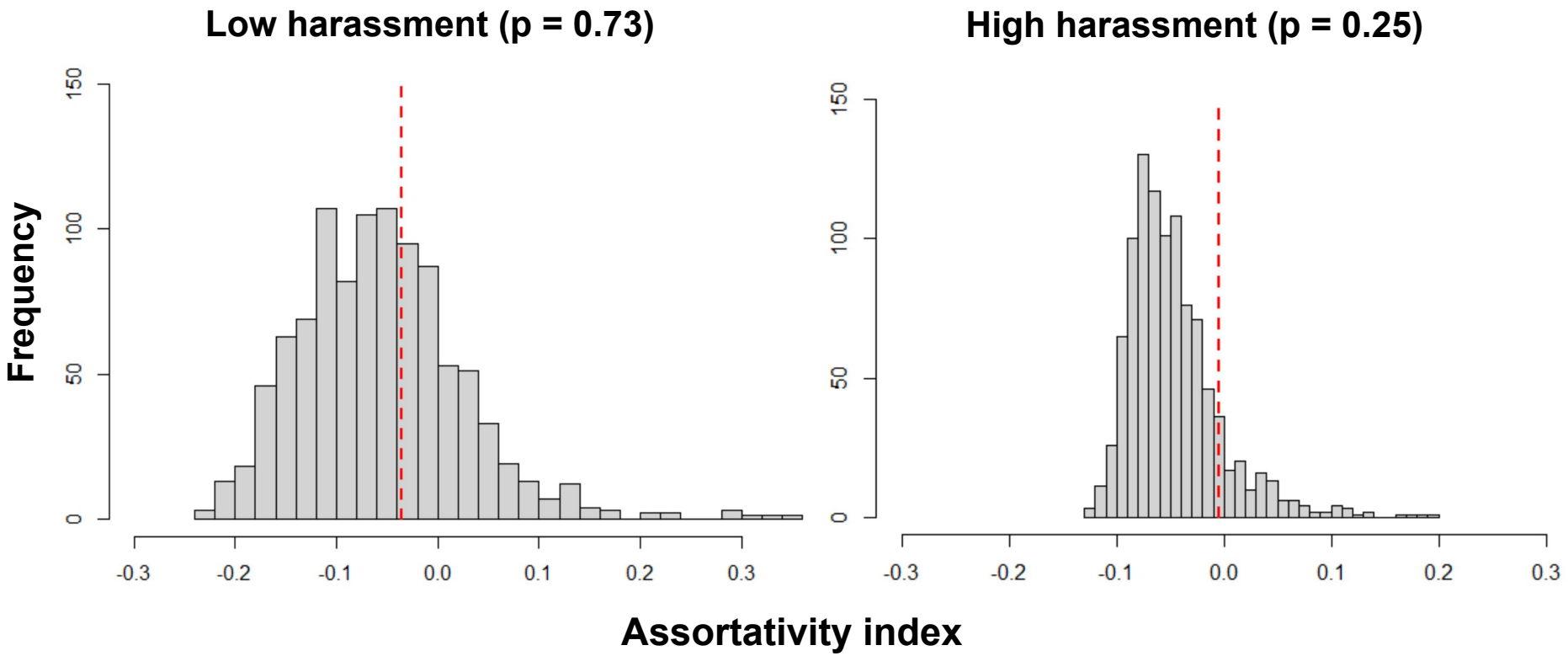
- Calculate assortment by sex:
  - A single value between -1 to 1 for each network
  - 0 = equal interaction with sexes

Statistics

- Permutations: Node-label permutation (1000) then compute a new assortativity score for each shuffled network

(Hoppitt and Farine, 2018)

Prediction 2: Individuals prefer same-sex interactions



Prediction 3: Harassment increases as a function of female sociability

Measures

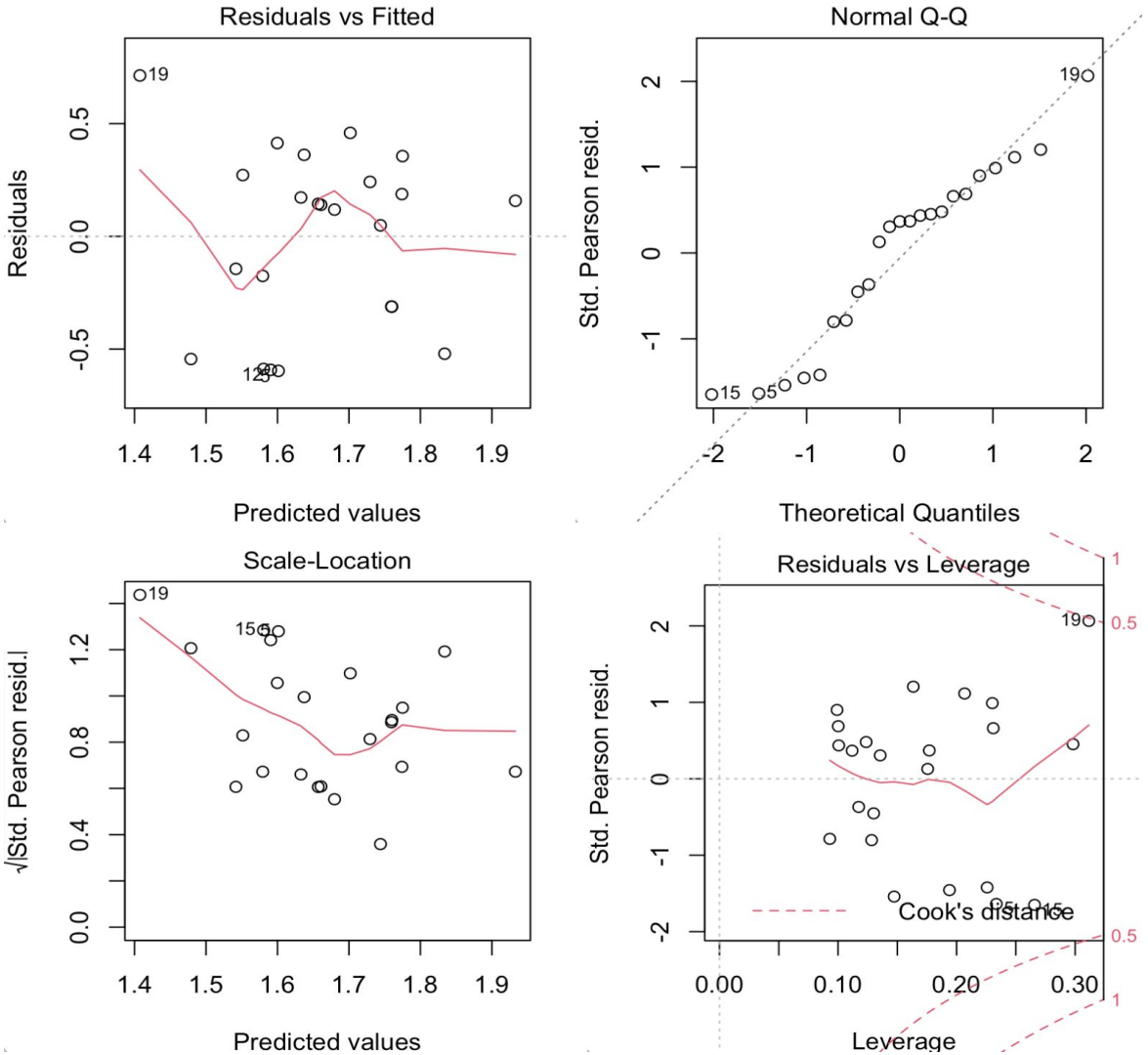
- Harassment: number of matings
- Test within females for the block

Statistics

- GLM [next slide]
- Permutations

GLM: Harassment increases as a function of sociability

- Response: matings
- Predictors: strength + size + treatment
- Family: Gamma



Prediction 3: Harassment increases as a function of female sociability

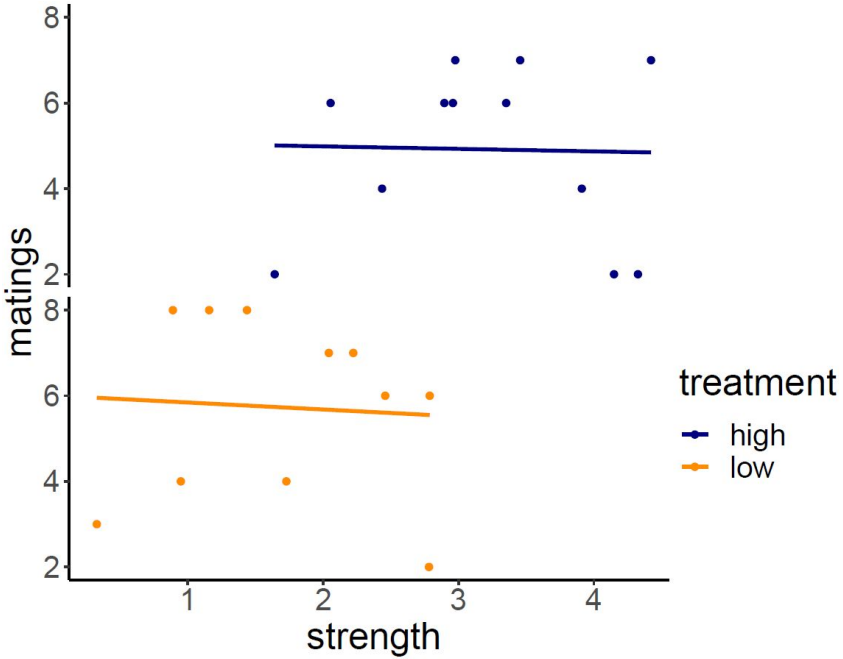
Measures

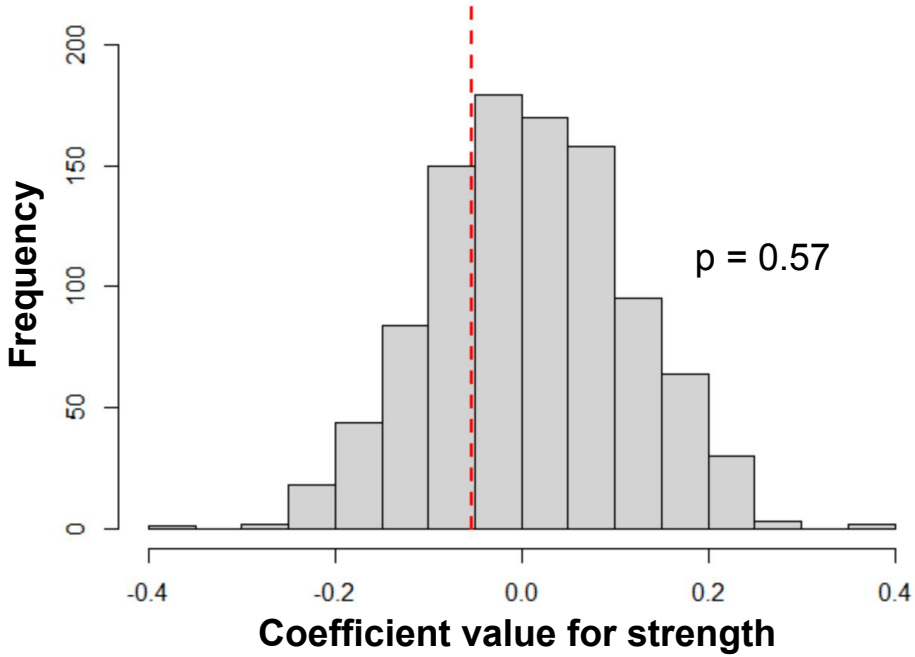
- Harassment: number of matings
- Test within females for the block

Statistics

- GLM
- Shuffle just the females in the mating networks and re-run the GLM

Prediction 3: Harassment increases as a function of female sociability





Prediction 4: Effects of P1 and P3 will be stronger in the low sexual conflict treatment

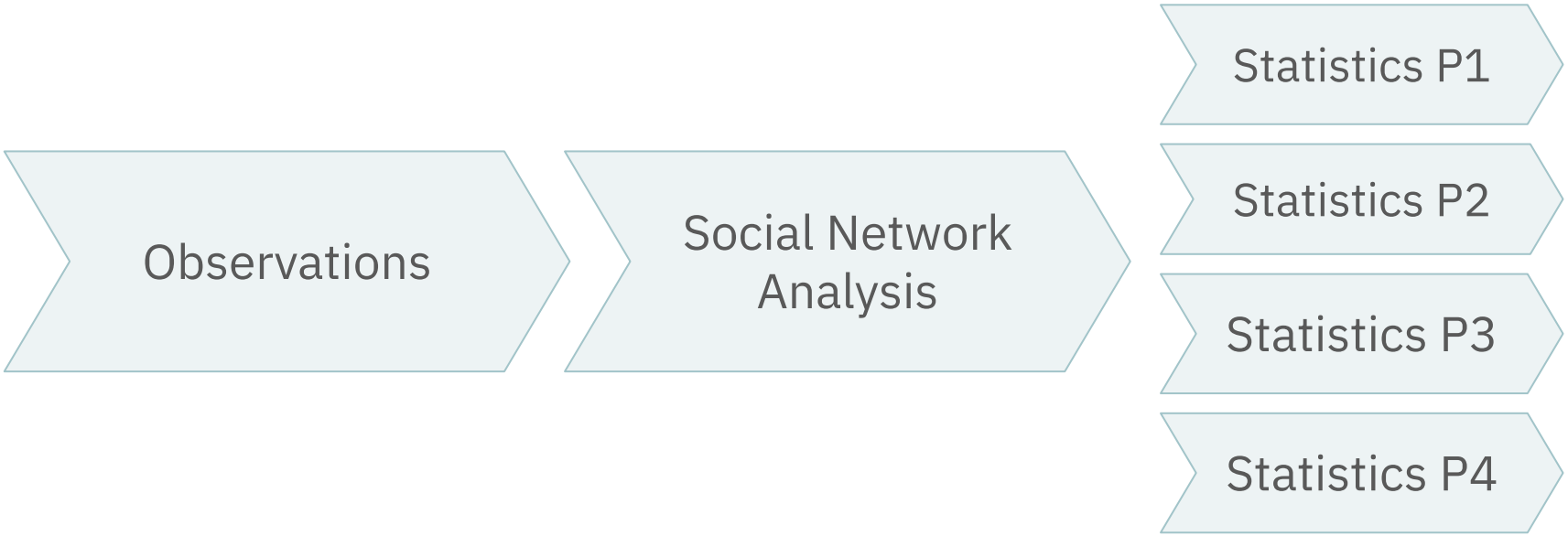
Measures

- Compare treatments for sociability between sexes (P1) and harassment as a function of sociability in females (P3)

Statistics

- GLM: Interaction between sex and treatment
- Permutations: ...?

Conclusion


Observations
Social Network Analysis
Statistics P1
Statistics P2
Statistics P3
Statistics P4

References

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Stutt, A. D., & Siva-Jothy, M. T. (2001). Traumatic insemination and sexual conflict in the bed bug Cimex lectularius. *Proceedings of the National Academy of Sciences of the United States of America*, *98*(10), 5683–5687. https://doi.org/10.1073/pnas.101440698