



# Social Influence and Transportation Mode Choice in Ego-Networks of University Students

Frontiers in Transportation

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University of California, Davis


# Project Goals and Questions


- Does social influence play a role in transportation mode choice?
- What types of or when are social networks are relevant to social influence in travel behavior?
- Can social network processes be useful tools for transportation policies and programs?

## Refer a Friend to Win:

... help to **spread the word** ... by **encouraging friends and coworkers** to join the program. If a new goClub member lists your name ... you will be entered to **win a goClub prize basket**...





SACRAMENTO REGION  
**MAY IS BIKE MONTH**  
RIDE YOUR  DURING THE MONTH OF MAY

You've Been Challenged!

**Matt** has challenged you to a cycling competition through [May is Bike Month.com!](http://MayIsBikeMonth.com)

Who can ride the most miles in May?

**I ACCEPT!** **I DECLINE**

You will need to fill out a short registration form in order to log your miles online.

You will not receive any additional emails about this unless you choose to participate.

[If you wish to block all future challenge emails from other friends, click here.](#)

**NEXT STOP: TAKE 5**  
BRING UP TO 5 FRIENDS FOR \$5 ON WEEKENDS



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# Survey and Sample

## Annual Campus Travel Survey at UC Davis (2013-14 Survey)

- Stratified random sample of students, staff, faculty (3,633 respondents)
- Survey collects information about travel patterns, socio-demographics, attitudes, membership in campus transportation programs
- 2,671 student respondents asked if they would like to receive information about a social networks and transportation survey; sent to 1,397

## Social Networks and Transportation Survey

- Mode availability and use, additional attitudinal information, and social network information
- 966 respondents, 544 within Davis, and with geographic and social network information

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# Snowball Strategies

- Three iterations; the good and the bad
- All with name generator: “name up to five contacts...” and snowball contact information questions:
  - 2011-12
    - Asked for email address of contacts in name generator
  - 2012-13
    - Asked for email addresses of contacts at the end of the survey
  - 2013-14
    - Participants given an option to provide email addresses or forward an invitation for the snowball survey

# Snowball Strategies

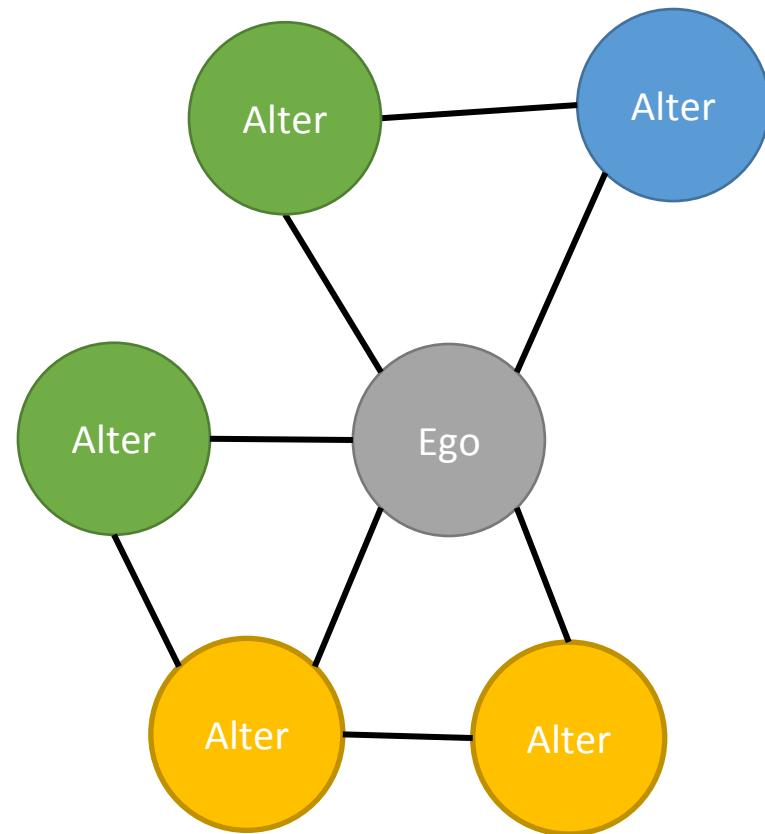
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# Alternative Name Generators (2012)

- In this question, think about all the people who have been in **your social circle** over the past six months; this includes **people with whom you live, work or attend class, socialize or participate in activities** etc. or people you speak with over the phone or internet. List the first names of:
  - ...**any five** people who have been in your social circle over the past six months.
  - ...the five contacts you have had the **most frequent regular interaction** with over the past six months.
  - ...five people in your social circle, **with whom you spoke about transportation** in the past six months.



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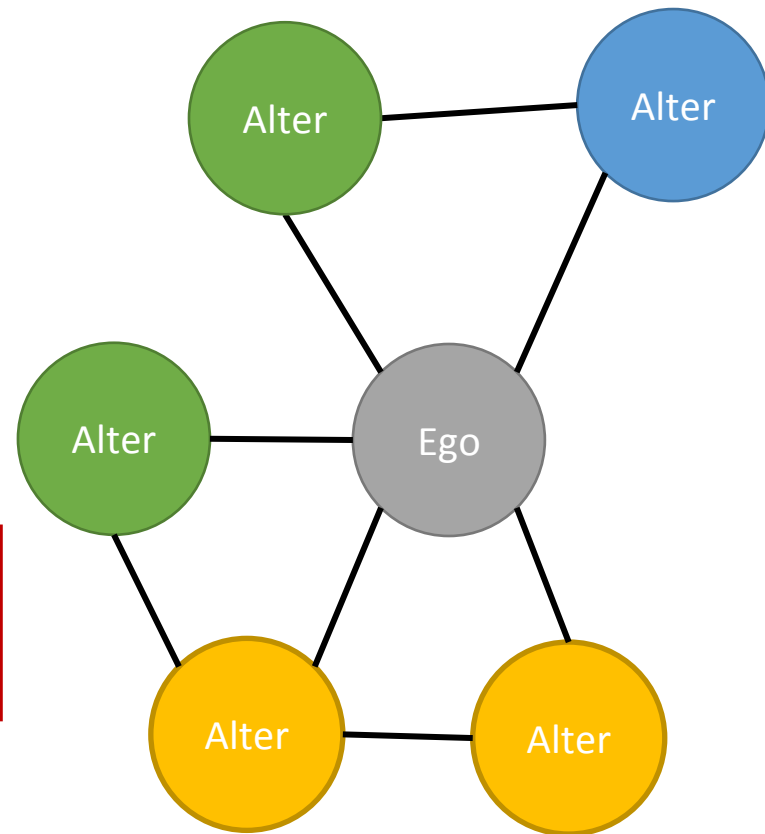
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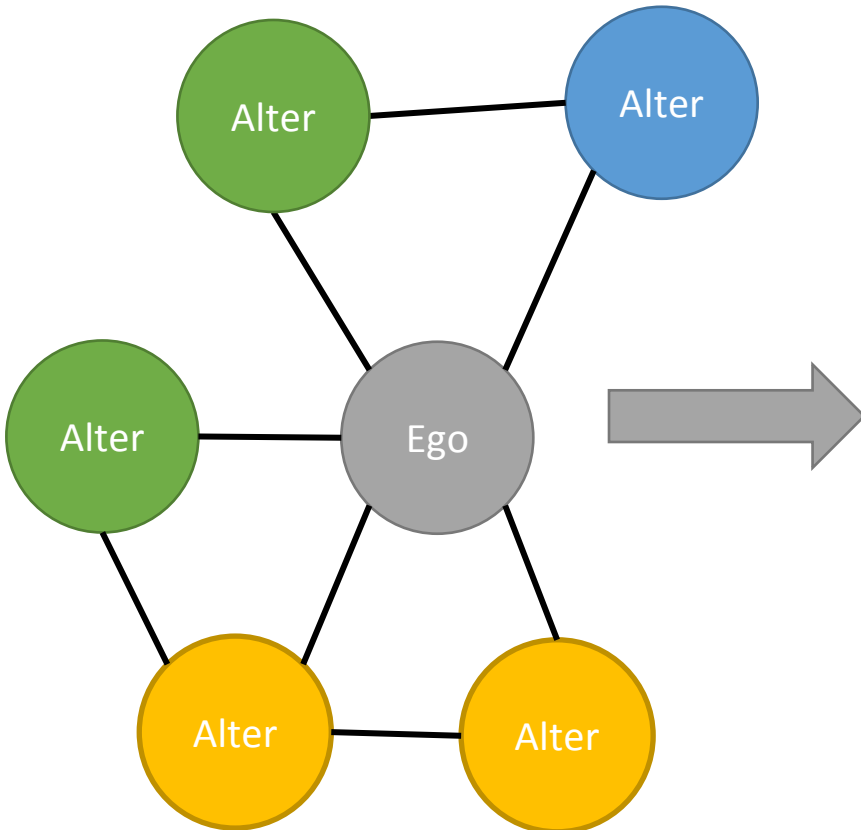


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# Ego-network Travel Behaviors



Proportion of alters that bike  
 $= \frac{\textit{count of alters that bike}}{\textit{total alters names (5)}}$

# Egos Behave Like Their Alters

| Ego Mode Choice                                      | Bike | Bus | Drive |
|--|------|-----|-------|
| Sample Size  | 388  | 162 | 96    |
| Average proportion of alters that bike; $p < 0.000$  | 49%  | 26% | 27%   |
| Average proportion of alters that bus; $p < 0.000$   | 13%  | 41% | 10%   |
| Average proportion of alters that drive; $p < 0.041$ | 20%  | 20% | 45%   |

<sup>1</sup> Percentages do not add up to 100% because alters can use other modes, and because these are averages across mode choice

<sup>2</sup> p-values for analysis of variance of mean percentage across mode choices (across each row)

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# Why? Egos Behave Like Their Alters



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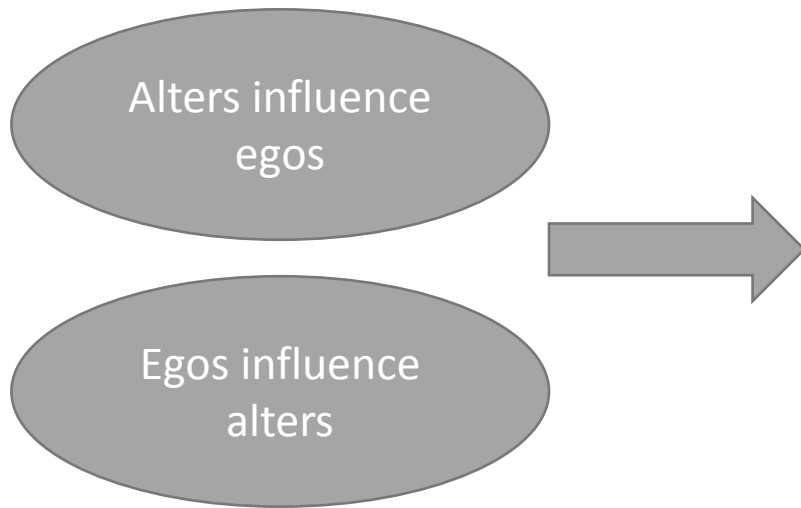
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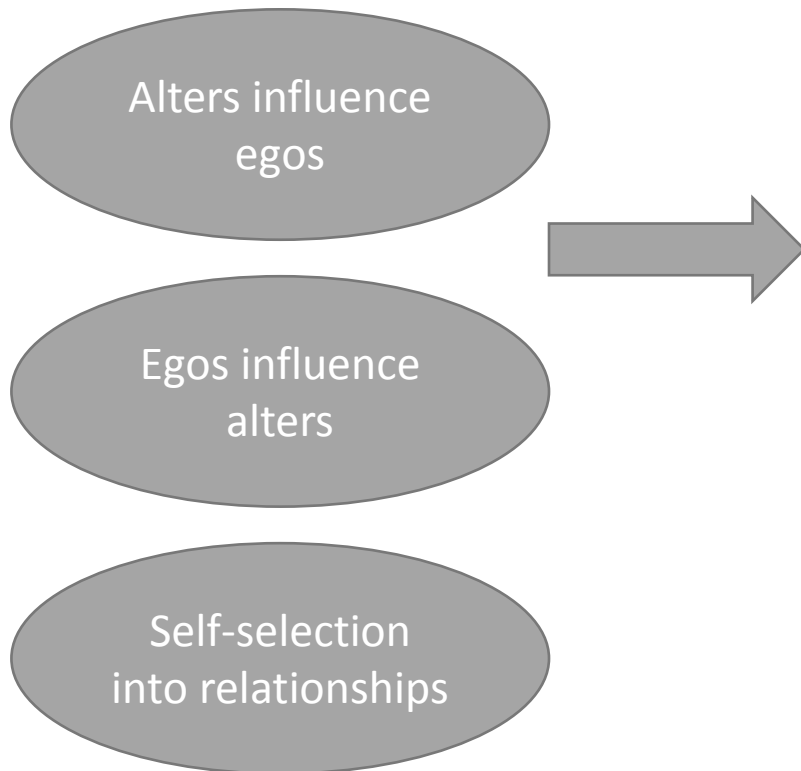
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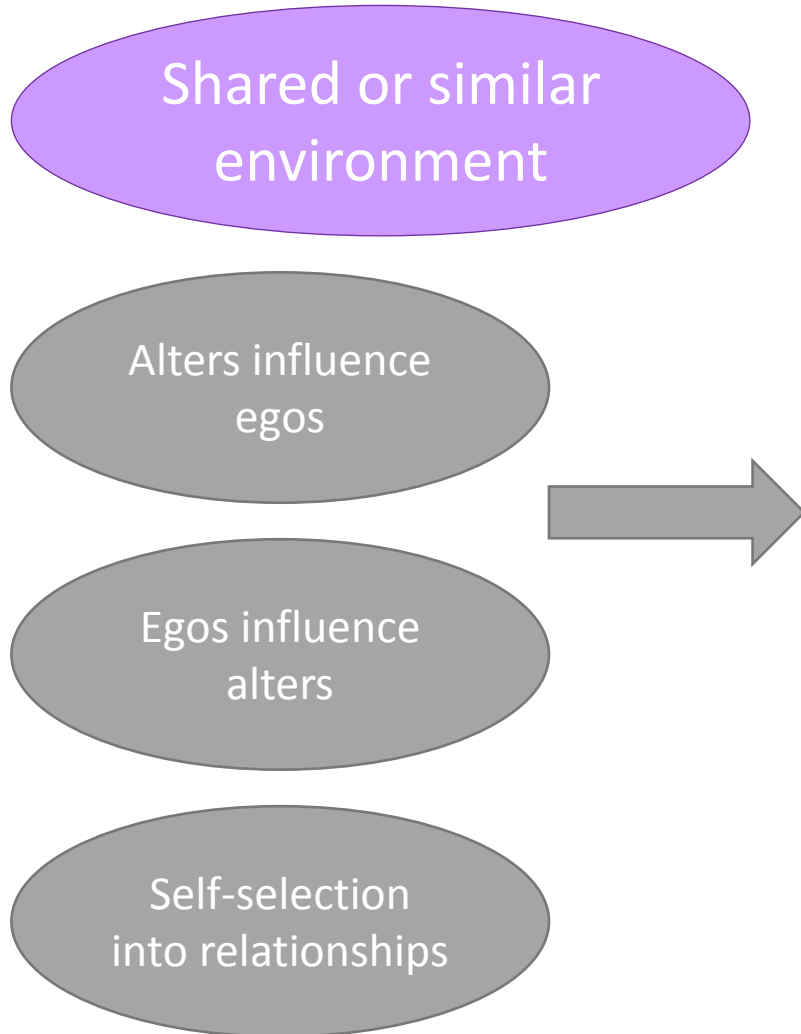
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# Alter Choice Environment

## Center for Environmental Policy and Behavior

**In order to better understand the transportation options available to each of your contacts, we would like a general idea of where they live now.**

**For each of your contacts, provide as much information as you can about where they live now. If you do not know, leave blank.**

| Street they live on  | Nearby cross street  | Area of town or neighborhood name | City or Town, State  |
|----------------------|----------------------|-----------------------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/>              | <input type="text"/> |
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- Instrumental variable based on alter choice environment:
  - Correlated with endogenous variable – proportion of alters that bike
  - Uncorrelated with dependent variable – ego’s choice to bike

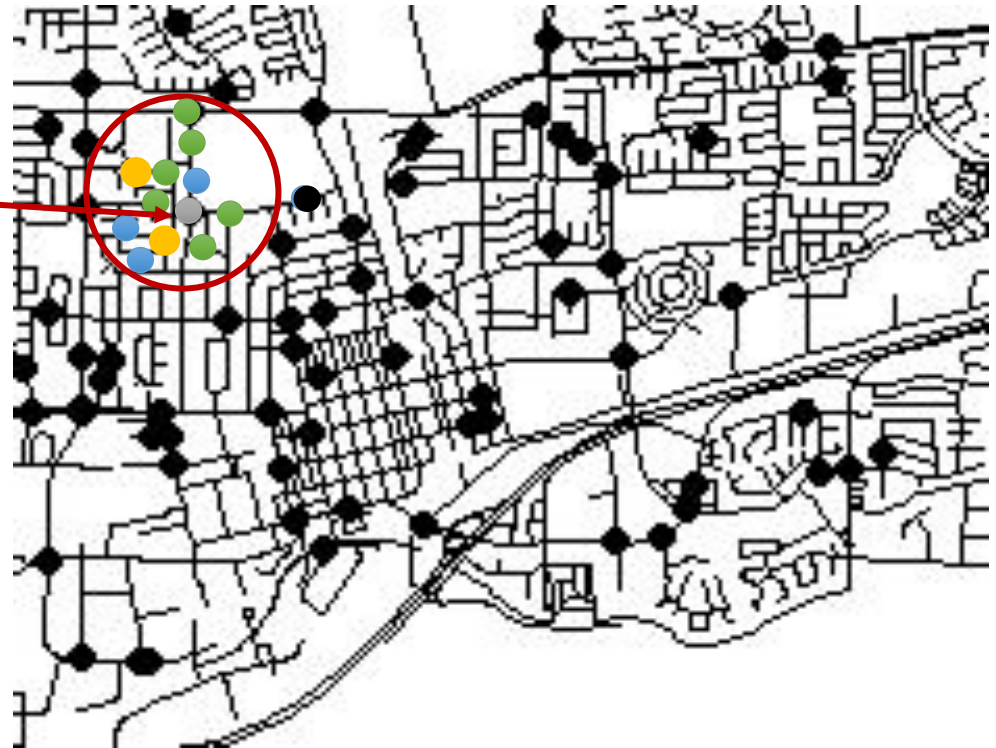
# Neighborhood Biking Density

Alter residential location

0.3 mile radius neighborhood

Neighborhood bike density =  
percentage of neighbors that bike

(as reported in Campus Travel Survey, Social  
Networks Survey or reported for alters by egos)



# Household Members

|   | Ego-Network Size: | 1 alter | 2 alters | 3 alters | 4 alters | 5 alters |
|---|-------------------|---------|----------|----------|----------|----------|
| Household members excluded from ego-networks (N = 273; average ego-network has 2.14 alters) | Count of Egos     | 108     | 77       | 44       | 30       | 14       |
|   | Percent of Egos   | 40%     | 28%      | 16%      | 11%      | 5%       |
| Household members included in ego-networks (N = 428; average ego-network has 3.14 alters)   | Count of Egos     | 82      | 68       | 87       | 90       | 101      |
|   | Percent of Egos   | 19%     | 16%      | 20%      | 21%      | 24%      |
| Household members included in ego-networks (N = 273; average ego-networks has 3.36 alters)  | Count of Egos     | 34      | 47       | 50       | 70       | 72       |
|   | Percent of Egos   | 12%     | 17%      | 18%      | 26%      | 26%      |

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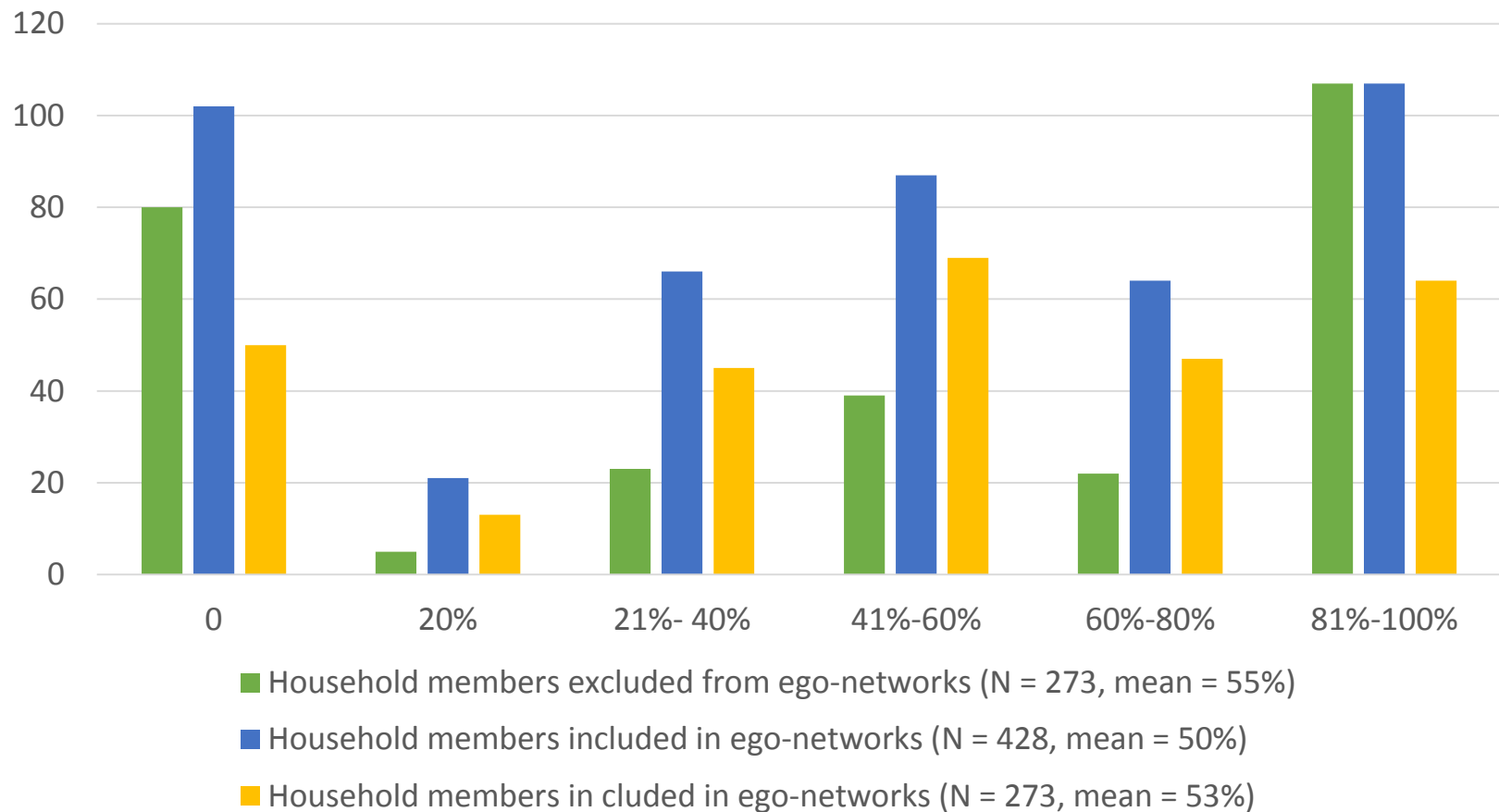
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# Proportion of Alters Biking



- Instrumental variable or control function approach
  - Stage 1; endogenous variables are modeled as a linear function of instruments and the residuals are saved
  - Stage 2; residuals and endogenous variables are included as predictors in binary probit model
    - Rivers and Vuong (1988)
    - Terza et al. (2008)
  - Stage 2 estimates are consistent, but scaled by the parameter:  $(1 - \rho^2)^{-1/2}$

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# 2SRI Model Results

|   | Excluding Household Members |              | Including Household Members |              | Including Household – Reduced Sample |              |
|---|-----------------------------|--------------|-----------------------------|--------------|--------------------------------------|--------------|
| <b>Variables in Model (Coefficients reflect effect on likelihood of biking)</b> | N = 249; 156 Bike (63%)     |              | N = 388; 241 Bike (62%)     |              | N = 249; 156 Bike (63%)              |              |
|   | Estimate                    | (Std. Error) | Estimate                    | (Std. Error) | Estimate                             | (Std. Error) |
| <b>Intercept</b>  | -3.326***                   | (0.972)      | -1.794*                     | (0.733)      | -3.308***                            | (0.989)      |
| <b>Proportion of Alters Biking</b>  | 1.313*                      | (0.65)       | 2.148***                    | (0.57)       | 2.517***                             | (0.709)      |
| <b>Stage 1 Residual</b>   | -0.857                      | (0.685)      | -1.328*                     | (0.595)      | -1.673*                              | (0.746)      |
| <b>Ego's Age (years)</b>  | 0.085**                     | (0.029)      | 0.042.                      | (0.023)      | 0.074*                               | (0.03)       |
| <b>Ego is female</b>  | -0.39.                      | (0.209)      | -0.501**                    | (0.171)      | -0.432*                              | (0.214)      |
| <b>Ego's Distance to Campus</b>   | -0.197**                    | (0.071)      | -0.156**                    | (0.052)      | -0.18*                               | (0.07)       |
| <b>Ego Member of GoClub</b>   | 0.244                       | (0.254)      | 0.431*                      | (0.212)      | 0.229                                | (0.258)      |
| <b>Ego has Annual Parking Permit</b>  | -1.983**                    | (0.667)      | -1.266**                    | (0.472)      | -1.934**                             | (0.662)      |
| <b>Ego's Commute Days Per Week</b>  | 0.356**                     | (0.113)      | 0.156.                      | (0.087)      | 0.281*                               | (0.117)      |
| <b>Model Diagnostics</b>  |                             |              |                             |              |                                      |              |
| <b>First Stage R-squared</b>  | R <sup>2</sup> = .145       |              | R <sup>2</sup> = .177       |              | R <sup>2</sup> = .169                |              |
| <b>First Stage F Statistic (Instrument)</b>                                     | F = 37.65                   |              | F = 68.45                   |              | F = 50.65                            |              |
| <b>Log Likelihood</b>   | -124.879                    |              | -197.29                     |              | -118.61                              |              |
| <b>Rho-Squared – Market Share Base</b>  | 0.24                        |              | 0.24                        |              | 0.28                                 |              |
| <b>Likelihood Ratio Test (Stage1 Residual)</b>                                  | 1.53; Pr(>Chisq): 0.216     |              | 30.53; Pr(>Chisq): < .001   |              | 20.68; Pr(>Chisq): < .001            |              |

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| <b>Ego's Distance to Campus</b>   | -0.197**                    | (0.071)      | -0.156**                    | (0.052)      | -0.18*                               | (0.07)       |
| <b>Ego Member of GoClub</b>   | 0.244                       | (0.254)      | 0.431*                      | (0.212)      | 0.229                                | (0.258)      |
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| <b>Log Likelihood</b>   | -124.879                    |              | -197.29                     |              | -118.61                              |              |
| <b>Rho-Squared – Market Share Base</b>  | 0.24                        |              | 0.24                        |              | 0.28                                 |              |
| <b>Likelihood Ratio Test (Stage1 Residual)</b>                                  | 1.53; Pr(>Chisq): 0.216     |              | 30.53; Pr(>Chisq): < .001   |              | 20.68; Pr(>Chisq): < .001            |              |

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# 2SRI Model Results

|   | Excluding Household Members |              | Including Household Members |              | Including Household – Reduced Sample |              |
|---|-----------------------------|--------------|-----------------------------|--------------|--------------------------------------|--------------|
| <b>Variables in Model (Coefficients reflect effect on likelihood of biking)</b> | N = 249; 156 Bike (63%)     |              | N = 388; 241 Bike (62%)     |              | N = 249; 156 Bike (63%)              |              |
|   | Estimate                    | (Std. Error) | Estimate                    | (Std. Error) | Estimate                             | (Std. Error) |
| Intercept   | -3.326***                   | (0.972)      | -1.794*                     | (0.733)      | -3.308***                            | (0.989)      |
| Proportion of Alters Biking   | 1.313*                      | (0.65)       | 2.148***                    | (0.57)       | 2.517***                             | (0.709)      |
| Stage 1 Residual  | -0.857                      | (0.685)      | -1.328*                     | (0.595)      | -1.673*                              | (0.746)      |
| Ego's Age (years)   | 0.085**                     | (0.029)      | 0.042.                      | (0.023)      | 0.074*                               | (0.03)       |
| Ego is female   | -0.39.                      | (0.209)      | -0.501**                    | (0.171)      | -0.432*                              | (0.214)      |
| Ego's Distance to Campus  | -0.197**                    | (0.071)      | -0.156**                    | (0.052)      | -0.18*                               | (0.07)       |
| Ego Member of GoClub  | 0.244                       | (0.254)      | 0.431*                      | (0.212)      | 0.229                                | (0.258)      |
| Ego has Annual Parking Permit   | -1.983**                    | (0.667)      | -1.266**                    | (0.472)      | -1.934**                             | (0.662)      |
| Ego's Commute Days Per Week   | 0.356**                     | (0.113)      | 0.156.                      | (0.087)      | 0.281*                               | (0.117)      |
| <b>Model Diagnostics</b>  |                             |              |                             |              |                                      |              |
| First Stage R-squared   | R <sup>2</sup> = .145       |              | R <sup>2</sup> = .177       |              | R <sup>2</sup> = .169                |              |
| First Stage F Statistic (Instrument)  | F = 37.65                   |              | F = 68.45                   |              | F = 50.65                            |              |
| Log Likelihood  | -124.879                    |              | -197.29                     |              | -118.61                              |              |
| Rho-Squared – Market Share Base   | 0.24                        |              | 0.24                        |              | 0.28                                 |              |
| Likelihood Ratio Test (Stage1 Residual)   | 1.53; Pr(>Chisq): 0.216     |              | 30.53; Pr(>Chisq): < .001   |              | 20.68; Pr(>Chisq): < .001            |              |

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# Conclusions and Next Steps

Socially connected individuals make similar transportation choices

2SRI model suggests social influence affects mode choice, even when controlling for similarities in the characteristics of ego and alter choice environments

Inter-household processes may further explain similarities in mode choice (or differences in other populations)

Next: Experiments with socially transportation programs

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