Digital interaction and physical movement of users of an online charity platform

RSS Manchester Local Group Talk

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Outline

- Statisticians for Society
- Working with Freegle and their data
- Spatial analysis
- Reflection & tips

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Statisticians for Society (S4S)

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The scheme

- Matches charity organisations with statisticians
- A *pro bono* / volunteering scheme
- A committee overseeing the whole process

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How it works

- Charity contacts S4S committee, who identifies need & form of support
- Committee emails opportunities to those signed up
- s4s@rss.org.uk
- Fellow of RSS

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My applications

- Unsuccessful the first time
- The advert I applied to the second time

Understanding if current boundaries are the most effective

Estimated time: 12 hours

We are in need of a volunteer for an organisation that operates a platform where people can exchange items for free. It runs in a way where the 'seller' can advertise an item, and a 'buyer' can connect, and then after agreeing, can then collect the item for free.

- ≥ 1 statistician(s)

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First steps

- 3-way meeting:
  - someone from Freegle (Edward)
  - the statistician (me)
  - someone from S4S (Amirah)
- Talk about project proposal
  - Scope
  - Timeline
  - Method
- Put what was discussed in the document
- Sent proposal to *scoper* to approve

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Working with Freegle and their data

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Online platform

- https://www.ilovefreegle.org
- Online dating for stuff
- Like eBay or Gumtree
  - no money involved
- Or donating stuff to charity shop
  - more targeted

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Steps

1. Offerer puts item on Freegle
2. Replier responds to the post
3. Offerer and replier agree time and place
4. Replier goes to offerer's to pick up item
5. Offerer marks item gone on Freegle

What the data look like

```
##    OfferID OfferLat  OfferLng OfferUID ReplyLat  ReplyLng ReplyUID
## 1 66473245 52.04057 -0.702386 10216160 52.02535 -0.801923 37937662
## 2 62004430 51.52760 -0.721791  2364225 51.53138 -0.720402   571023
## 3 59162925 50.80681 -1.876720  3467712 50.72900 -1.840794 36068373
## 4 54667917 54.07795 -2.840993  2060332 53.95756 -2.830094  3855713
## 5 62463673 51.58688 -1.795023 38607572 51.57926 -1.807035 33866461
## 6 58801500 54.55918 -2.496012   869151 54.79905 -2.642533   868189
```

```
##   MessagesExchanged KnownSuccessful PositiveRating NegativeRating
## 1                 6            TRUE          FALSE          FALSE
## 2                 1           FALSE          FALSE          FALSE
## 3                 4           FALSE          FALSE          FALSE
## 4                 6           FALSE          FALSE          FALSE
## 5                 8           FALSE          FALSE          FALSE
## 6                 6            TRUE          FALSE          FALSE
```

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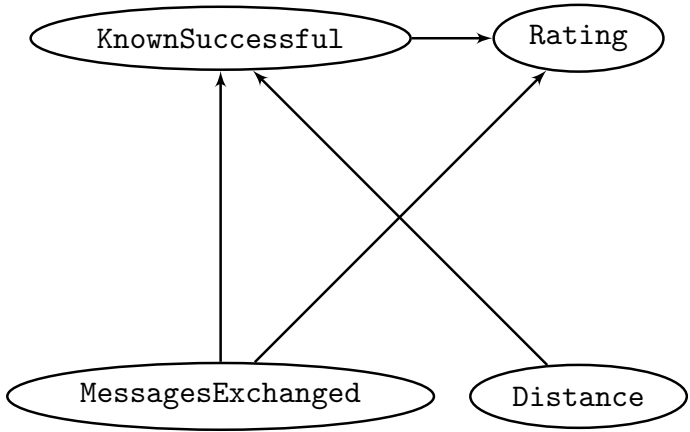
Causal diagram of variables



- What makes an exchange more likely to happen, & by how much?

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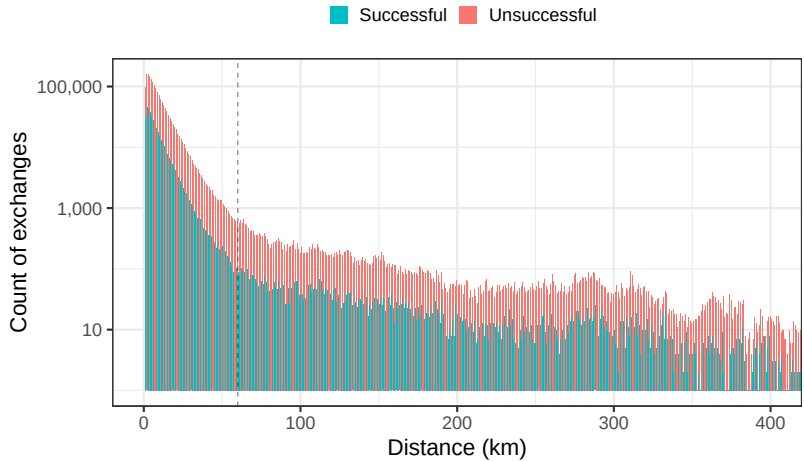
Counts vs distance



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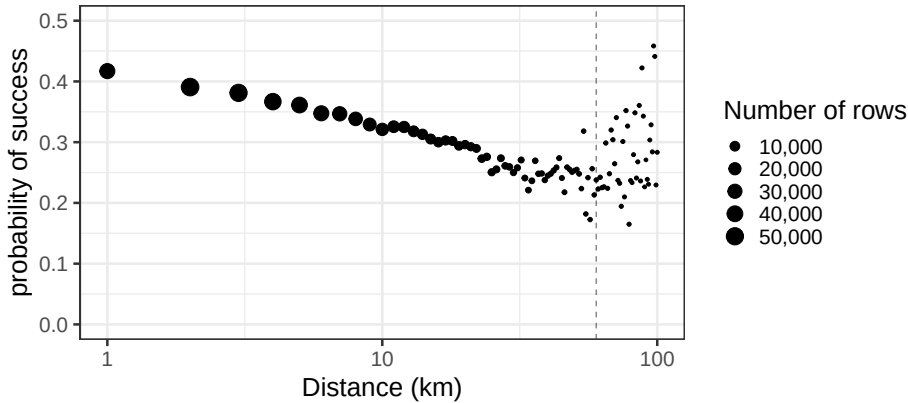
Success probability vs distance



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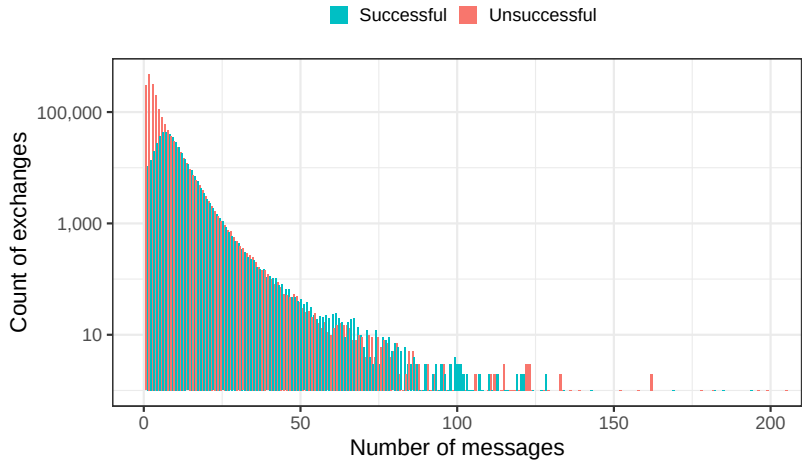
Counts vs # messages



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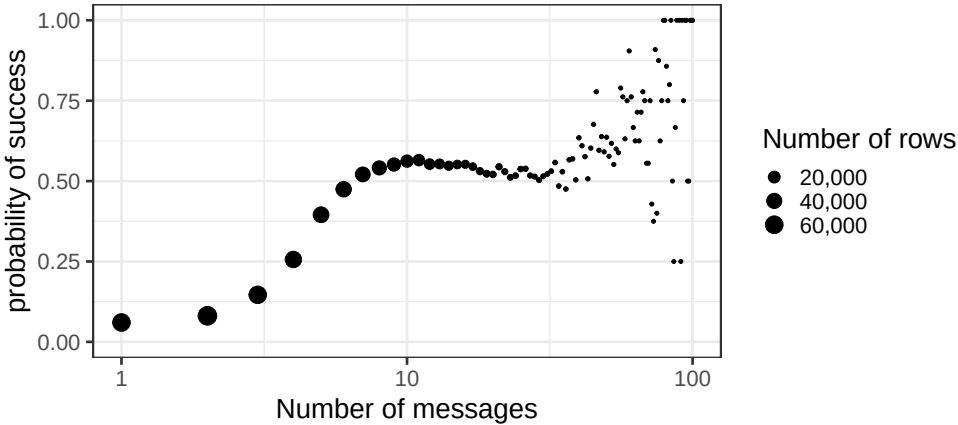
Success probability vs # messages



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Logistic regression?

- Probability plateaus around 0.57
- In real-life data, probability approaches 1 as the variable (# messages) increases
- Replace $\log \frac{p}{1-p}$ by $\log \frac{p}{0.57-p}$ as linear combination of variables
- Call this the modified log odds

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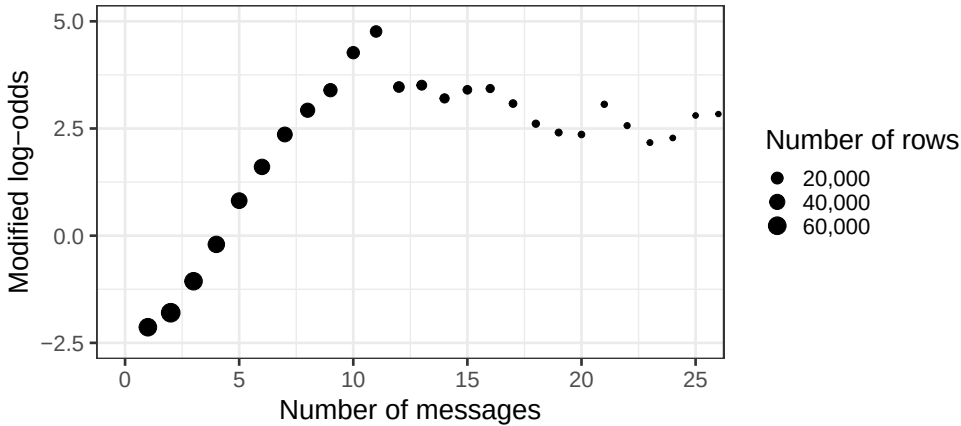
Modified log-odds vs # messages



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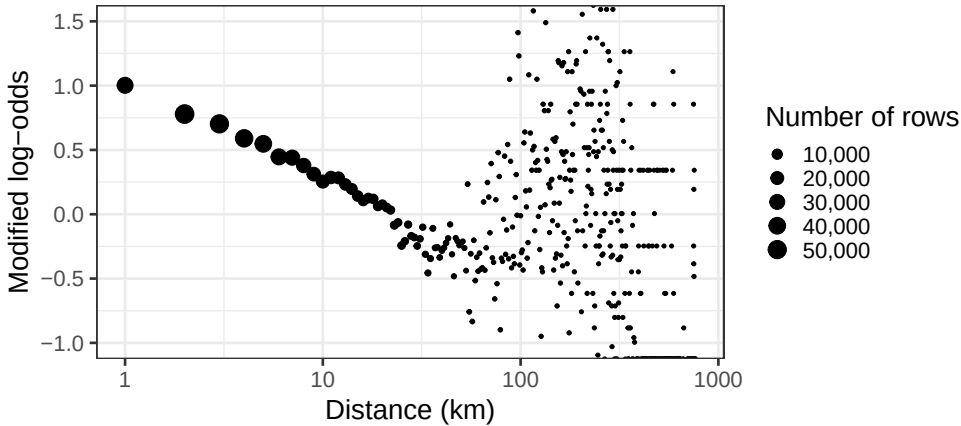
Modified log-odds vs distance



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Modified logistic regression

$$\log \frac{p_i}{0.565 - p_i} = -2.79 + 0.783 \times \text{Number of messages}_i - 0.261 \times \log(\text{Distance}_i)$$

better than

$$\log \frac{p_i}{1 - p_i} = -0.618 + 0.0339 \times \text{Number of messages}_i - 0.148 \times \log(\text{Distance}_i)$$

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The mid-point call

- Me and S4S reviewers (and Amirah)
- I presented, they made comments
- An extension to the project deadline

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Final model

From

$$\log \frac{p_i}{0.565 - p_i} = -2.79 + 0.783 \times \text{Number of messages}_i - 0.261 \times \log(\text{Distance}_i)$$

to

$$\log \frac{p_i}{0.566 - p_i} = -3.14 + 0.885 \times \text{Number of messages}_i - 0.0653 \times \log(\text{Distance}_i) - 0.0562 \times \text{Number of messages}_i \times \log(\text{Distance}_i)$$

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Potential changes

- Nudging those who messaged too few times
- Minimal difference for those messaged more than 10 times
- Current effectiveness of the platform
- Concrete numbers help

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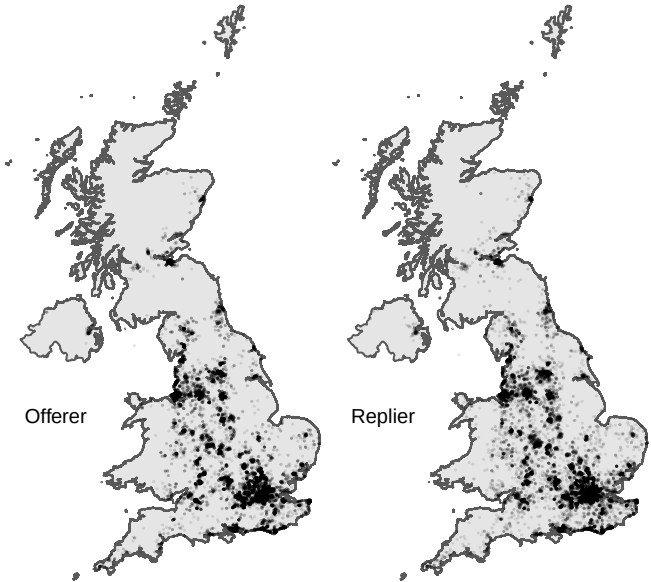
Spatial analysis

Location of users



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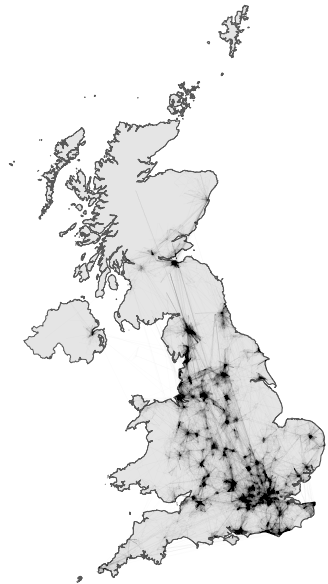
Interaction network



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Questions

- Are the communities learned from the data similar to those created by the board / volunteers?
- How far is a user willing to travel for an item?
  - physical distance
  - adjustment by urban scaling factors, and/or
  - level of social deprivation

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Some thoughts & tips

Great match

- The charity knows what needs to be answered
- They know their data well
- Knowledge of statisticians complement what they have

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Hone in your skills

- Presentation
  - Verbal
  - Written
- Give concrete models and numbers
  - ~~high-level advice~~
- Coding
  - Data cleaning & visualisation via tidyverse in R

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Reproducibility

Rmarkdown

- Text + code chunks
- One script file to rule them all
- Generates pdf document, pdf slides, html, etc.
- Ensures it still works when the data changes

Notebook approach

- Jupyter notebook for Python

Interactive visualisation

Meet in person

- The human interaction

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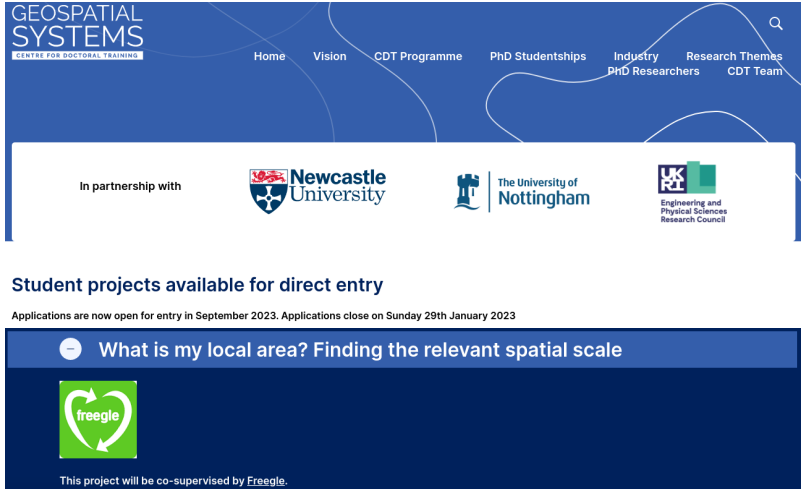
Shameless plug



https://geospatialcdt.ac.uk/studentship-projects/

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Thank you

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