# Willingness of the public to share geolocation information in a U.S. Census Bureau survey

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# Accessing location information on mobile

- Cell phone location can be determined from: •
  - Global positioning system (GPS) data
  - Cell site location information (CSLI)
- Location information includes: Latitude and lacksquareLongitude and elevation
- A smartphone owner turns on the location in ۲ settings.
- Sites ask permission to use this information if it is turned on





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100%

High accuracy

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# Motivation for studying location data sharing

- Household surveys and censuses are location based
- Using technology to provide location information could reduce the burden of answering address questions and possibly increase the accuracy of such location data
- Limited research on either topic
  - Crawford, S. (2017); Gruteser & Liu, 2004; Huang, Matsuura, Yamane & Sezaki, 2005:



### **Research Questions**

- What percent of respondents will share location information in a survey sponsored by the U.S. Census Bureau?
- Does the design or presentation of the location request make a difference in whether respondents will share?
  - How the request is asked replicating Crawford's research to an extent
  - Where the request is presented at the beginning of the survey or at the end of the survey
- How accurate is the location information?



# **General Method**

- Census Bureau nonprobability research panel frame
- 2,000 emails selected
  - 1,285 of them had never been selected for a Census Bureau research study, and 715 had completed an earlier study
- Split panel experiment: 2x2 (2 factors each with 2 conditions)
- Two week data collection May 16- May 28, 2016
- Email notification (up to 3) with a link to the survey
  - Email stated to use a smartphone or other mobile device with GPS enabled not a desktop or laptop computer
  - Best if you answer at your home address
  - 5-minute survey



# **Split-panel Factors**

- "How" Factor: How the geolocation request was asked
  - Control: Phone pop-up only
  - Experimental: Survey question asking for permission and then, if granted, the phone pop-up
- "Where" Factor: Where the geolocation request was presented
  - Control: Beginning of the survey
  - Experimental: At the end of the survey



# Data collected in the survey

- General demographics of participant
- Some opinion data
- Home address
- Whether respondent was at home when answering survey
- Geolocation data
- Device used (this was from paradata)



### Control: "How" Factor

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| Rural Route  |
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| (The reason we ask is because we are testing<br>whether your geolocation maps to the address<br>you provided. This will help us plan for the<br>2020 Census.) | home  |
| Bight now, I'm at that address  |       |
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| Bight now, I'm at that address  |  |  |  |  |
| Bight now I'm someplace else  |  |  |  |  |
| https://mobile.respond.qa.census.gov/<br>wants to know your location  |  |  |  |  |
| Remember preference   |  |  |  |  |
| Decline Share location  |  |  |  |  |
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# Experimental: "How" Factor

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|--|---|--------------------|---|-------------|---|
| Where do you live? (Help)<br>Please select the type of address associated with<br>your residence.<br>Address type:<br>Street Address   | Are you answering this survey from the<br>address you entered earlier or are you<br>answering it from someplace else?<br>(The reason we ask is because we are testing<br>whether your geolocation maps to the address<br>you provided. This will help us plan for the<br>2020 Census.)  | lf at<br>home<br>→ | May we collect your mobile device's<br>location/position? This will help us make sure<br>you are counted in the right place.<br>Yes<br>No   | If yes<br>→ | May we collect your mobile device's<br>location/position? This will help us make sure<br>you are counted in the right place.<br>Yes<br>No   |
| P.O. Box   | Bight now, I'm at that address     Dicktorese line and a second sec |                    | 0 0   |             | 0 0   |
| Rural Route  | <ul> <li>Right now, I'm someplace else</li> </ul>   |                    |   |             | https://mobile.respond.qa.census.gov/<br>wants to know your location  |
| Address Number (For example: 5007)   | 00  |                    |   |             | Remember preference   |
| Street Name (For example: N Maple Ave)   |   |                    | ~   |             | Decline Share location  |
|  |   |                    |   |             |   |



### Control: "Where" Factor

#### Login



#### Please Log In

The email address you enter must match the email address where you received the survey invitation.

| E-mail Address |
|----------------|
|----------------|

Note: You may only complete the survey one time per invitation. Once you enter the survey you will not be able to reenter later and the survey will time-out after 15 minutes of inactivity.

Your responses to these questions are protected by law under Title 13 of the United States Code. This is the same law that protects your privacy. No one outside the Census Bureau will see your answers.



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#### Demo and opinion

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| 1. Are you male or female?                                  | h                    |
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| 2. What is your age?  | one or               |
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| O 65 or older   |                      |
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| High School Diploma or GED     Approval Expires: 04/30/2017 | ssibility<br>Privacy |
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# Experimental: "Where" Factor

#### Login



#### Please Log In

The email address you enter must match the email address where you received the survey invitation.

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|--|--|------------------------------|---|--|
| Log  | jin  |                              |   |  |
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Your responses to these questions are protected by law under Title 13 of the United States Code. This is the same law that protects your privacy. No one outside the Census Bureau will see your answers.

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inactivity.

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# Split Panel

|                    | "Where" Control | "Where" Experimental |
|--------------------|-----------------|----------------------|
| "How" Control      | 500             | 500                  |
| "How" Experimental | 500             | 500                  |



# Analysis Methods

- Will respondents share location information in a survey sponsored by the U.S. Census Bureau? *Percent overall and by factor*
- Does the design or presentation of the location request make a difference in whether respondents will share? *Chi-square and logistic regression*
- How accurate is the location information? Independent geolocation conducted by Census Bureau Geography Division staff with comparison to latitude and longitude collected



#### Response rate and sharing rate





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### Will respondents share geolocation data



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#### Does how the geolocation request is made matter?

- Answer: Perhaps
- Adding an explicit questions asking for permission (in addition to the default phone pop-up question)
  - Trend is for increased the sharing of geolocation coordinates however, significance levels are borderline
    - Overall chi-square test:  $\chi^2 = 2.0$ , p = .15
    - Model results:
      - Asking an explicit question to collect coordinates versus not asking an explicit question
      - Odds ratio = 2.0, *p* = .08
  - Survey breakoffs were not impacted by whether there was an explicit geolocation question
    - χ<sup>2</sup>=0.18, p=0.67



# Does where the geolocation request is made matter?

- Answer: Yes
- Requesting address data and geolocation data at the end of the survey
  - Significantly increased the sharing of geolocation coordinates
    - Overall chi-square test:  $\chi^2 = 4.4$ , p = .04
    - Model results:
      - Placing the address and geolocation question at the end of the survey versus early in the survey
      - Odds ratio = 2.1, *p* = .05
  - Significantly decreased survey break-offs
    - Overall chi-square test:  $\chi^2$ =5.2, *p*=0.02



#### Covariates in model

- Respondents without a college degree were less willing to share their location data than respondents with a college degree (p=0.05);
- White non-Hispanic respondents were marginally more willing to share their location data than non-white respondents (p=0.10); and
- There was no detectable difference at the 95 percent confidence level in the willingness to share location data by sex, age, type of device used, or by whether they had previously participated in a Census Bureau research study.



#### How accurate is the information





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# Summary of Results

- 1/3 of respondents were willing to share geolocation data within the survey.
- Placing the address question and the geolocation request at the end of the survey increases both survey completes and the sharing of geolocation data.
- We found no downside to adding an explicit question about the geolocation request, and some marginal increase in the sharing of geolocation coordinates
- We found some differences in sharing the data by race and education, but we did not find any difference by age, sex, type of device, or whether the respondent had participated in a survey with us previously.
- Half of the geolocation data gathered identified the address in the correct block.
- About 1/3 of geolocation gathered from a PC was very far from the actual location.



# Future Work

- Repeat experiment with different population
- Determine sample size needed to confirm differences in main effects and covariates
- Determine if there are any covariates that can help determine the accuracy of the geolocation coordinates to the block level.



#### Questions

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#### Addendum:

#### Education and race were significant in model



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### Addendum: Sex & age were not significant at 95% CI



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#### Addendum:

#### Whether they participated earlier & device were not significant at 95% Cl



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