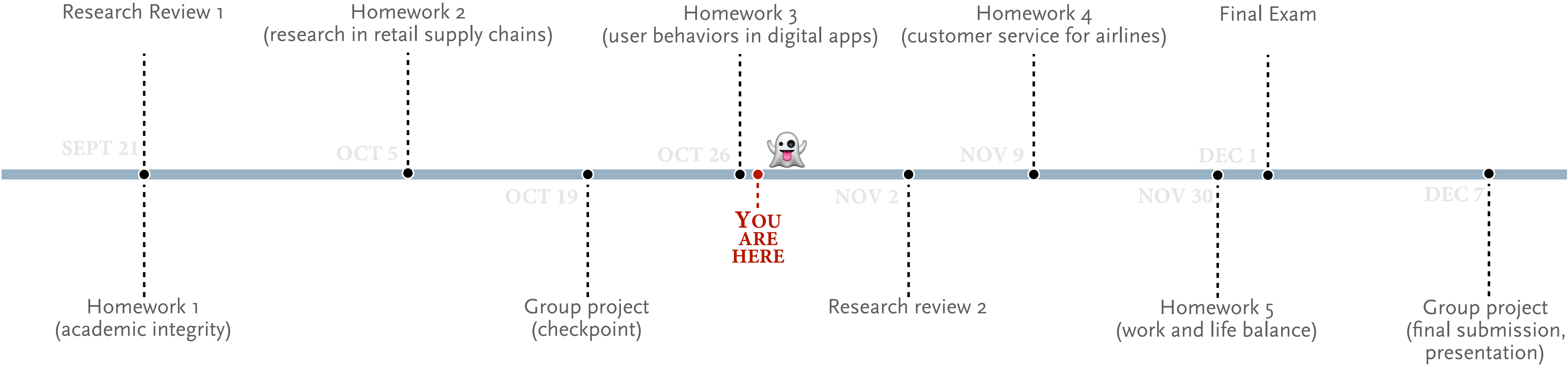


Research Design, Fall 2021

07: survey design and analyses



survey design

A “survey” is a systematic method for gathering information from (a sample of) entities for the purposes of constructing quantitative descriptors of the attributes of the larger population of which the entities are members.

— Groves, *Survey Methodology*, Second Ed.

surveys, survey life cycle
from a *design* perspective

the information we want

questions as a proxy for constructs

answers to the questions

cleaning the data

measurement

Construct
 μ_i

Measurement
 Y_i

Response
 y_i

Edited Response
 y_{ip}

representation

Target Population
 \bar{Y}

Sampling Frame
 \bar{Y}_c

Sample
 \bar{Y}_a

Respondents
 \bar{Y}_r

Postsurvey Adjustments
 \bar{Y}_{rw}

population of interest

portion of population eligible for sampling

sample of the eligible population

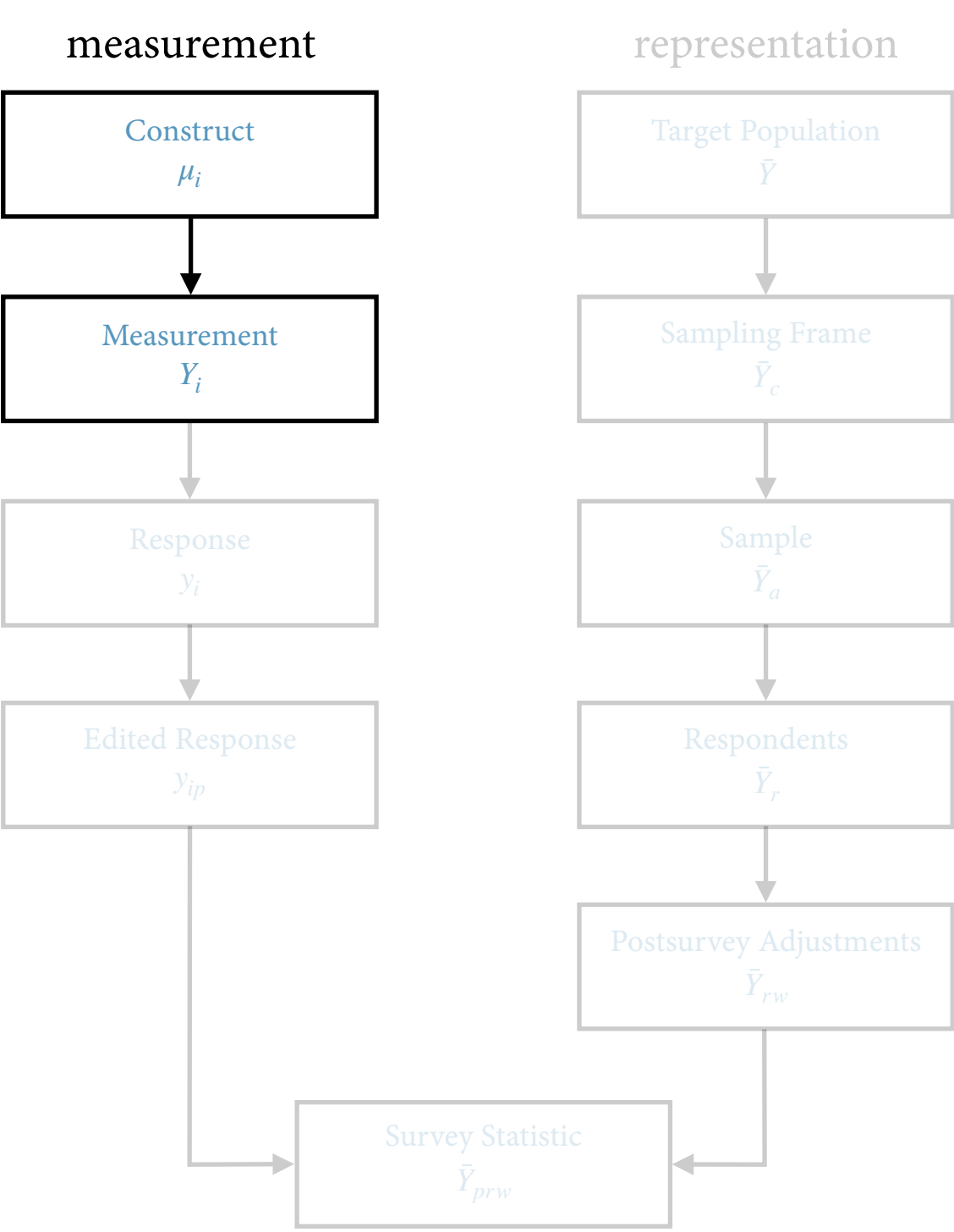
portion of those sampled who respond

*adjust weighting for differences between
makeup of respondents versus population*

Survey Statistic
 \bar{Y}_{prw}

Our analysis

surveys, designing questions — relate them directly to your research questions

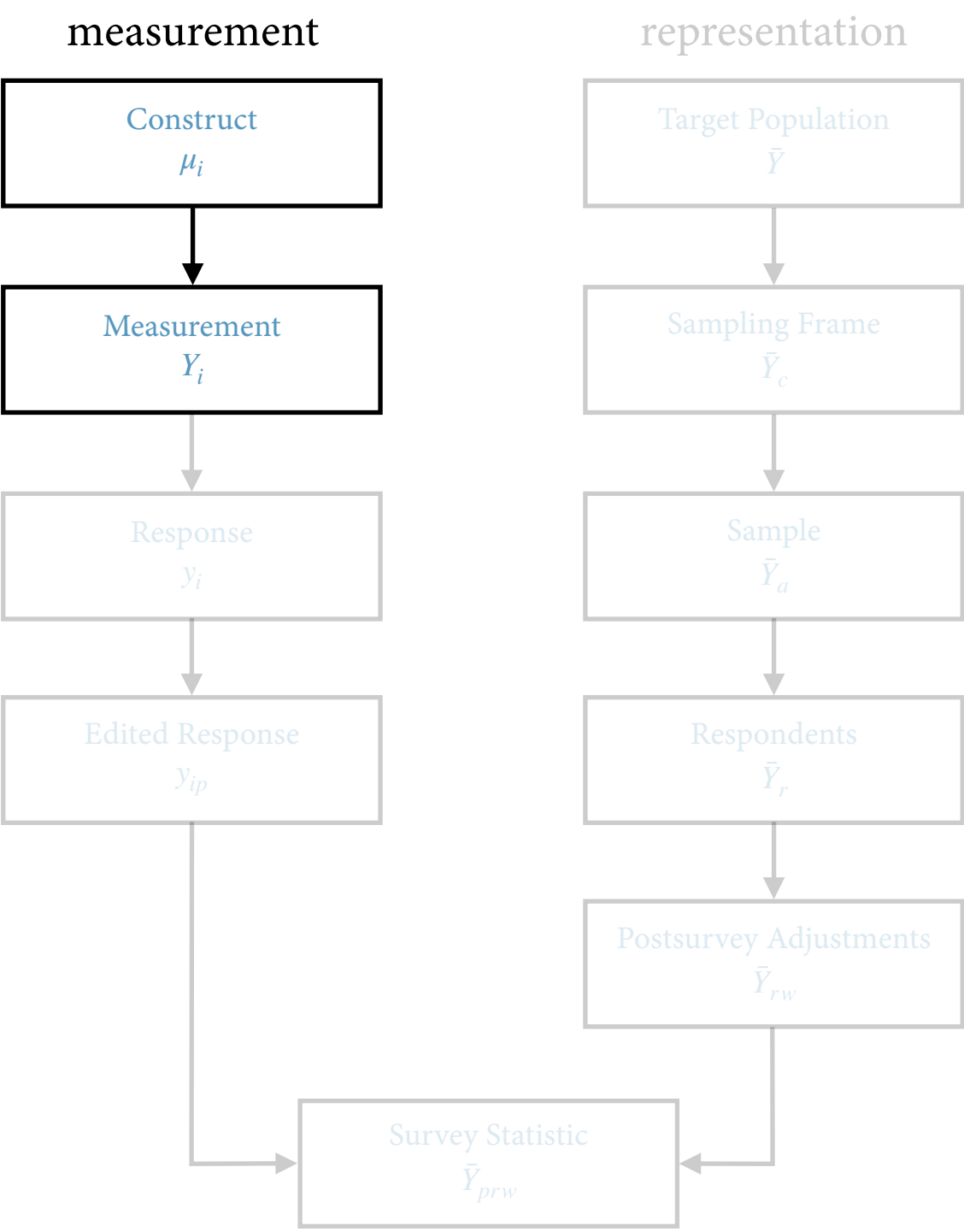


Decide your research questions *before* writing any survey questions.

Keep your research questions *directly visible* while you are working on your questionnaire.

Test for relevance: every time you write a question, *ask yourself* “Why do I want to know this?” Answer it in terms of the way it will help you to answer your research question. “It would be interesting to know” is not an acceptable answer.

surveys, designing questions — be specific, *and nuanced to reduce bias and variance*



“Ask what you want to know, not something else.”
— Bradburn, *Asking Questions*

... while considering form

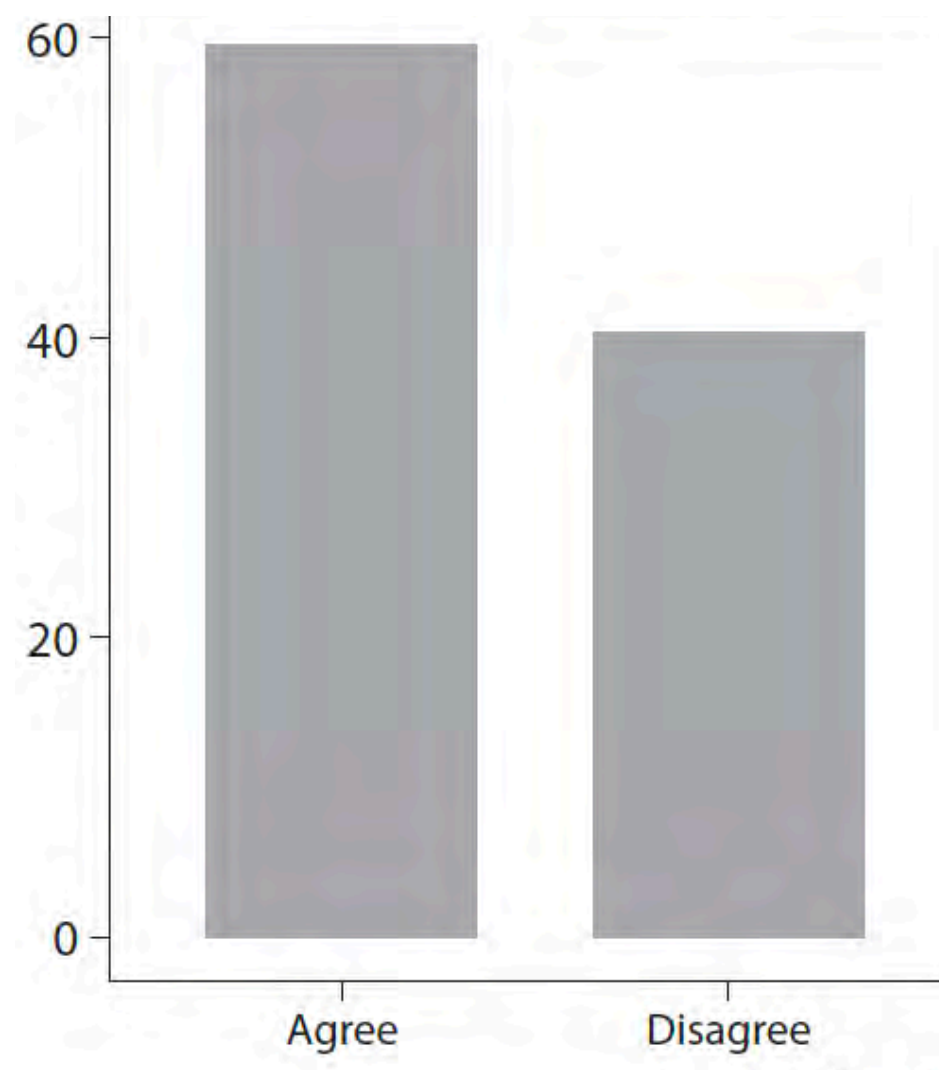
- clarity*
- length*
- complexity*
- bias*

surveys, sources of error — form of questions matter

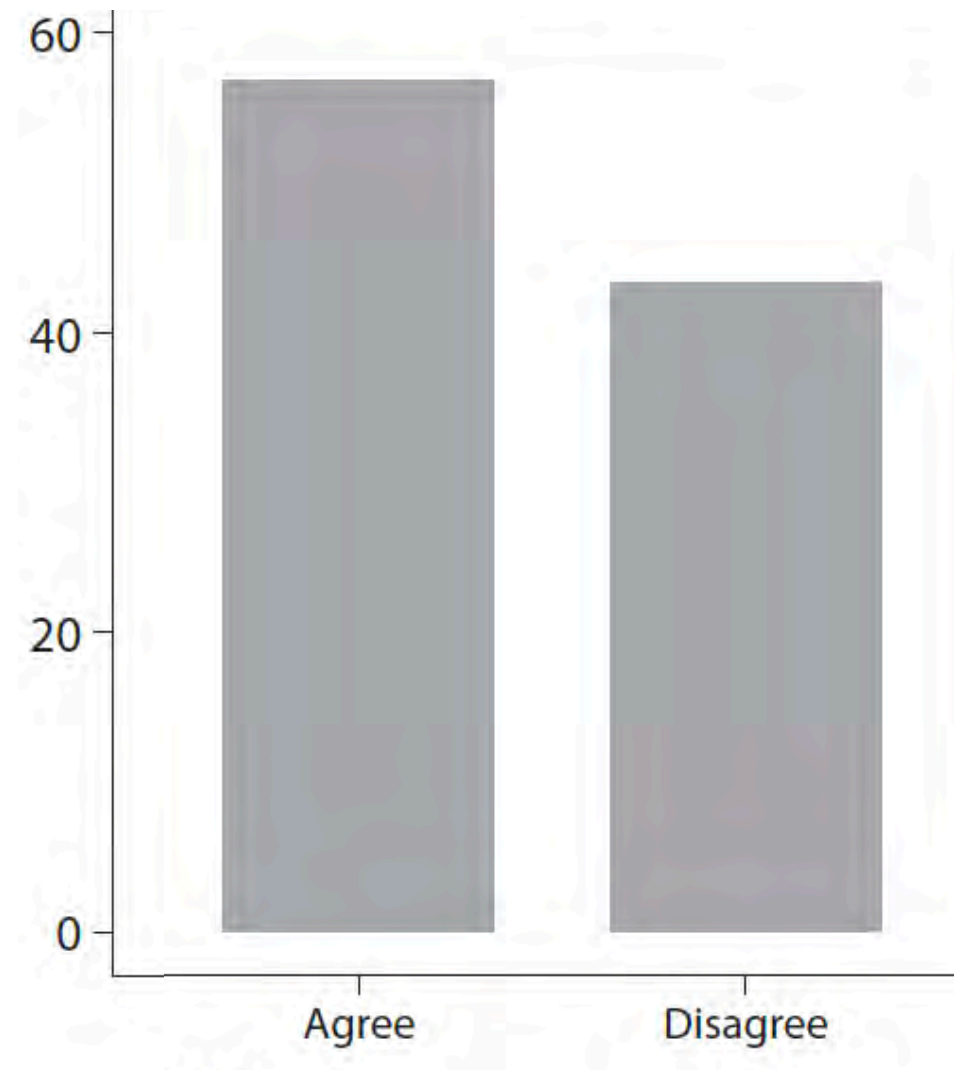
“How much do you agree with the following statement:
Individuals are more to blame than *social conditions* for
crime and lawlessness in this country.”

“How much do you agree with the following statement:
Social conditions are more to blame than *individuals* for
crime and lawlessness in this country.”

“How much do you agree with the following statement:
Individuals are more to blame than *social conditions* for
crime and lawlessness in this country.”



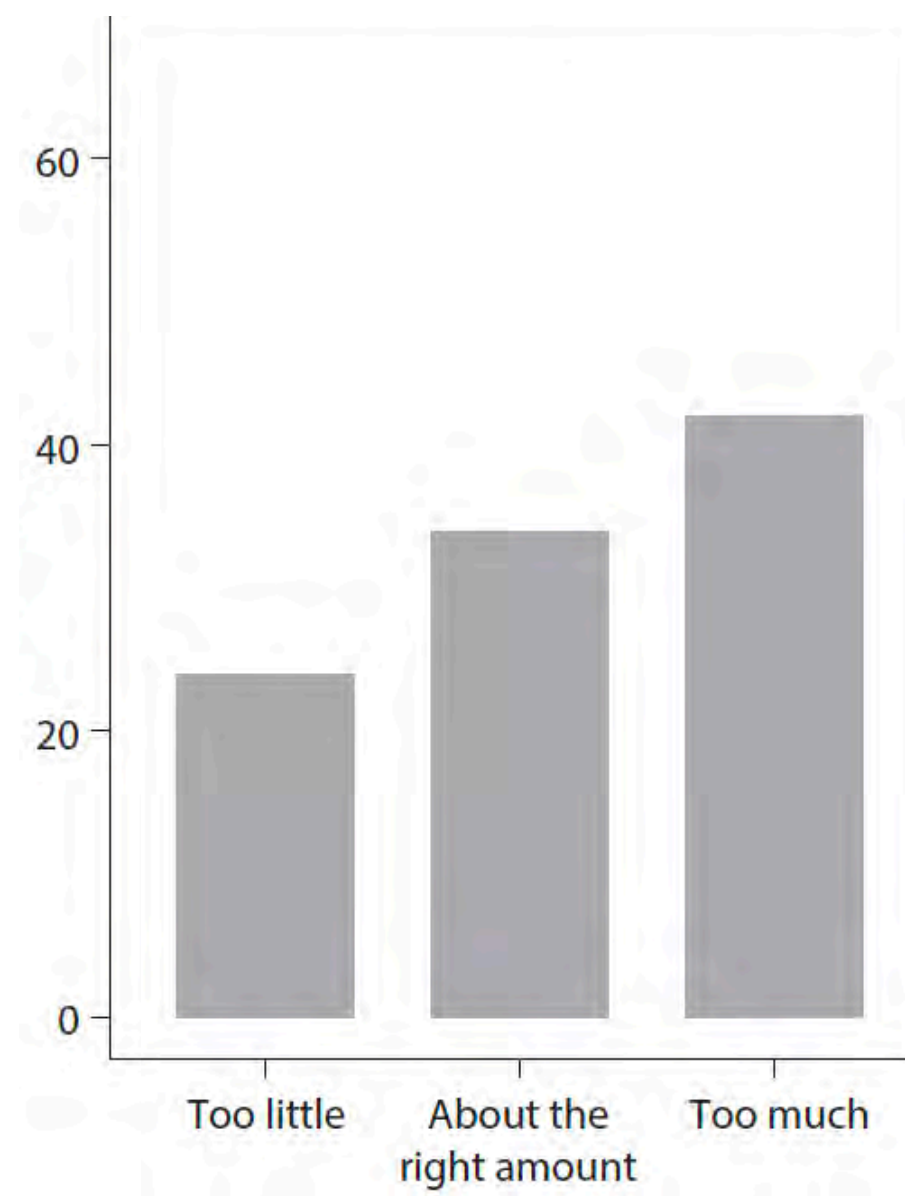
“How much do you agree with the following statement:
Social conditions are more to blame than *individuals* for
crime and lawlessness in this country.”



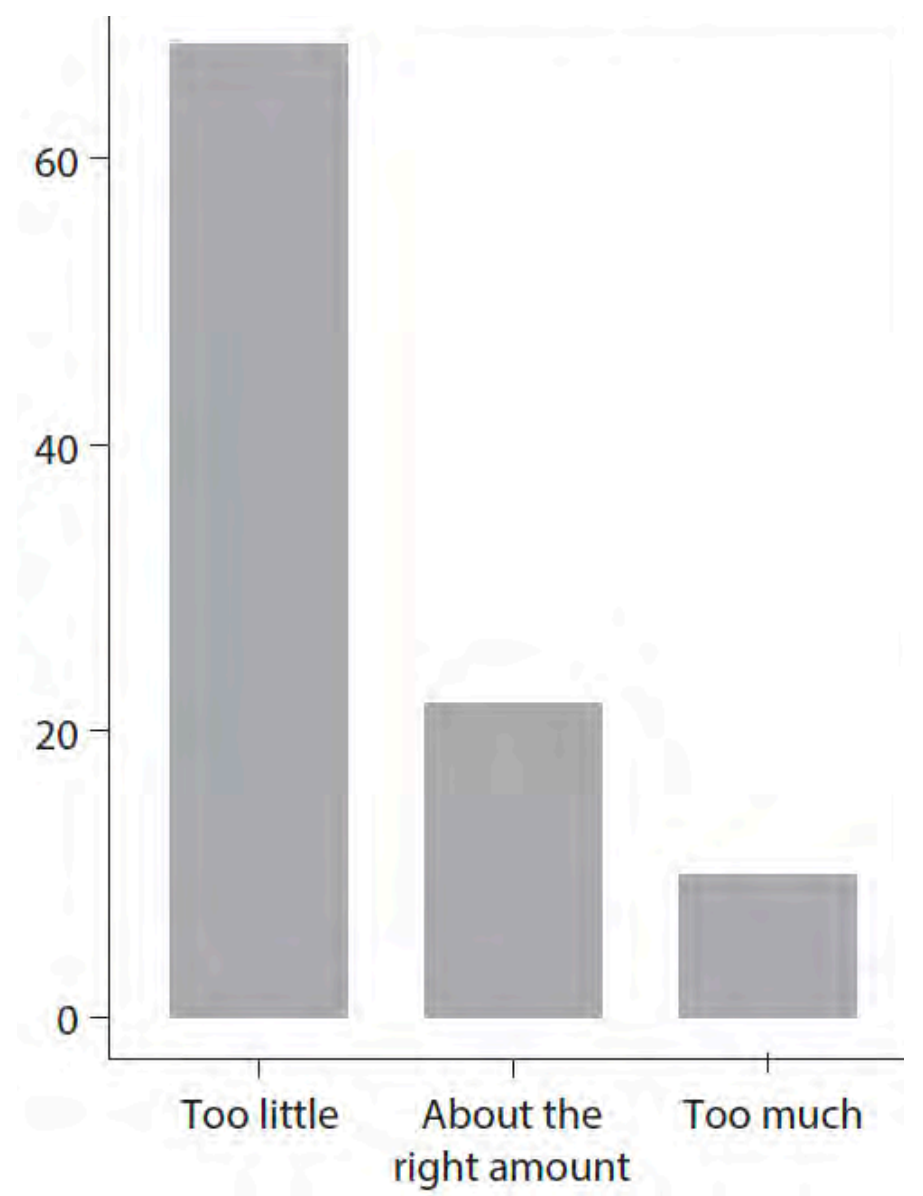
“We are faced with many problems in this country, none of which can be solved easily or inexpensively. Please tell us whether you think we are spending too much, too little, or about the right amount on *welfare*.”

“We are faced with many problems in this country, none of which can be solved easily or inexpensively. Please tell us whether you think we are spending too much, too little, or about the right amount on *assistance to the poor*.”

“We are faced with many problems in this country, none of which can be solved easily or inexpensively. Please tell us whether you think we are spending too much, too little, or about the right amount on *welfare*.”



“We are faced with many problems in this country, none of which can be solved easily or inexpensively. Please tell us whether you think we are spending too much, too little, or about the right amount on *assistance to the poor*.”



Huber, Gregory A., and Celia Paris. “Assessing the Programmatic Equivalence Assumption in Question Wording Experiments.” *Public Opinion Quarterly* 77, no. 1 (2013): 385–97. <https://doi.org/10.1093/poq/nfs054>.

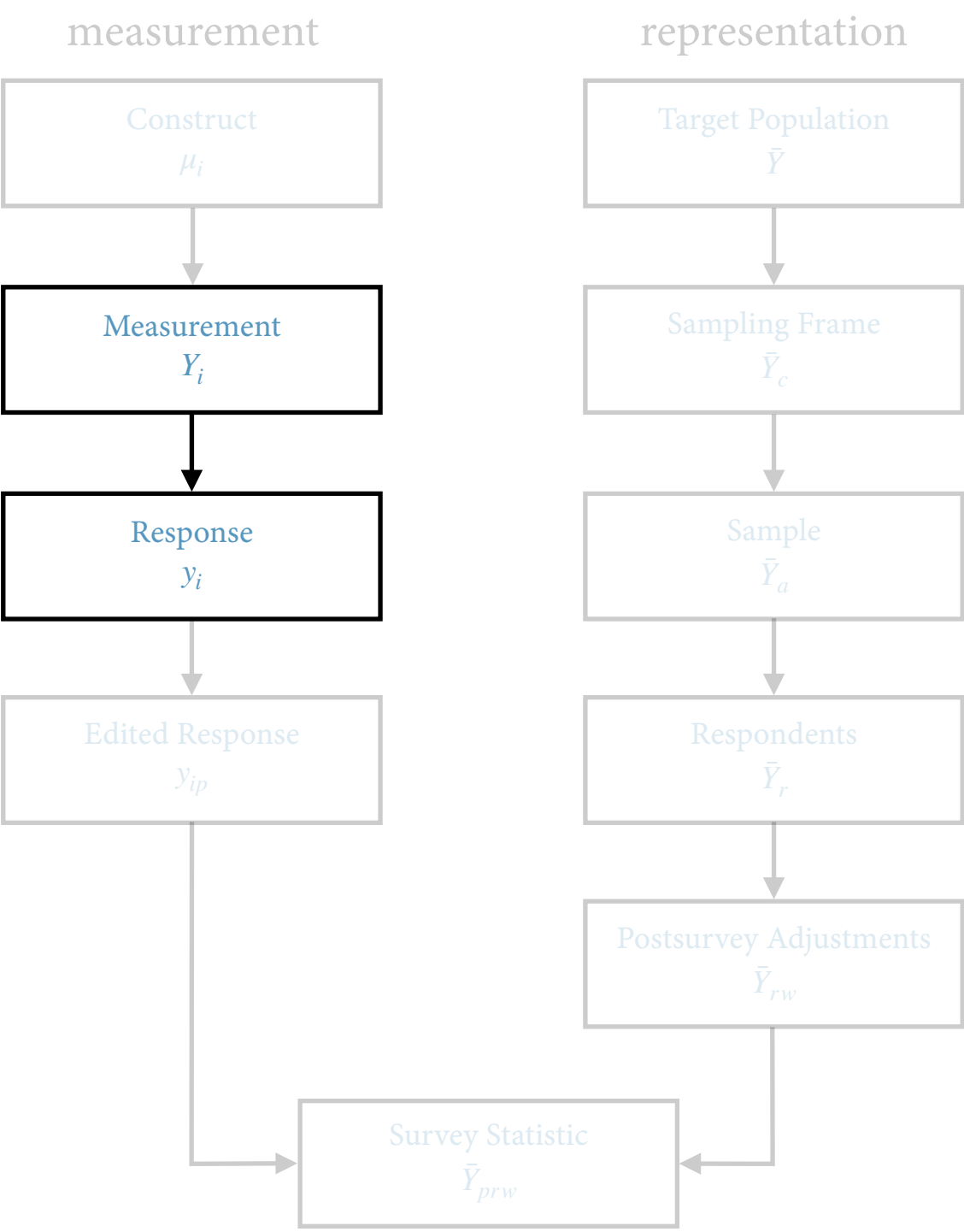
welfare, n. | ...

4a. *Originally U.S.* Organized provision for the basic physical and material well-being of *people in need*, esp. financial support as provided for by legislation. Also: provision of initiatives, funding, or facilities within a business or other institution to maintain or improve the well-being of workers, students, etc.

...

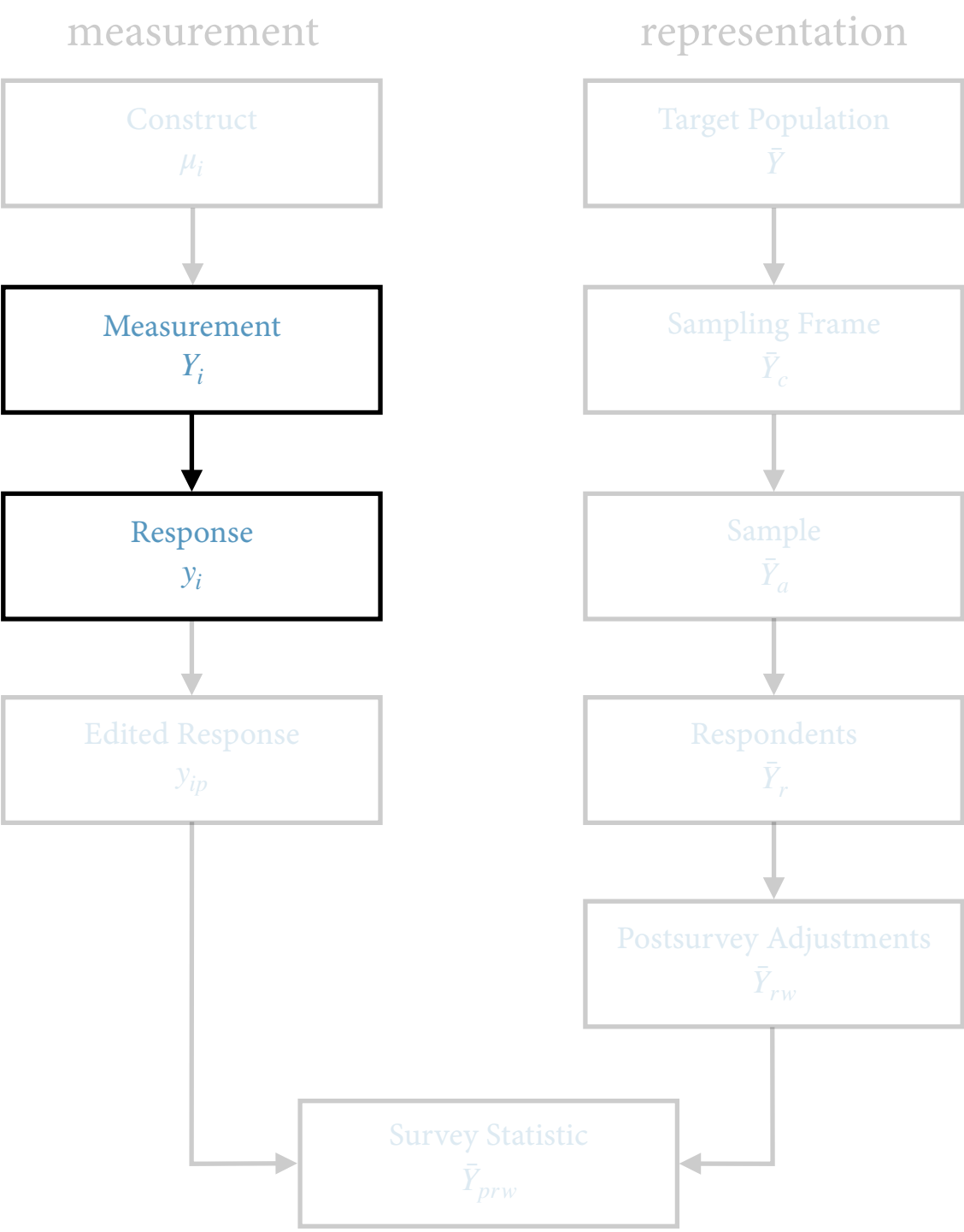
4c. *Originally and chiefly North American.* Financial support given by the state to *those who are unemployed or otherwise in need*; frequently in on welfare.

surveys, measuring people — a test for possible bias



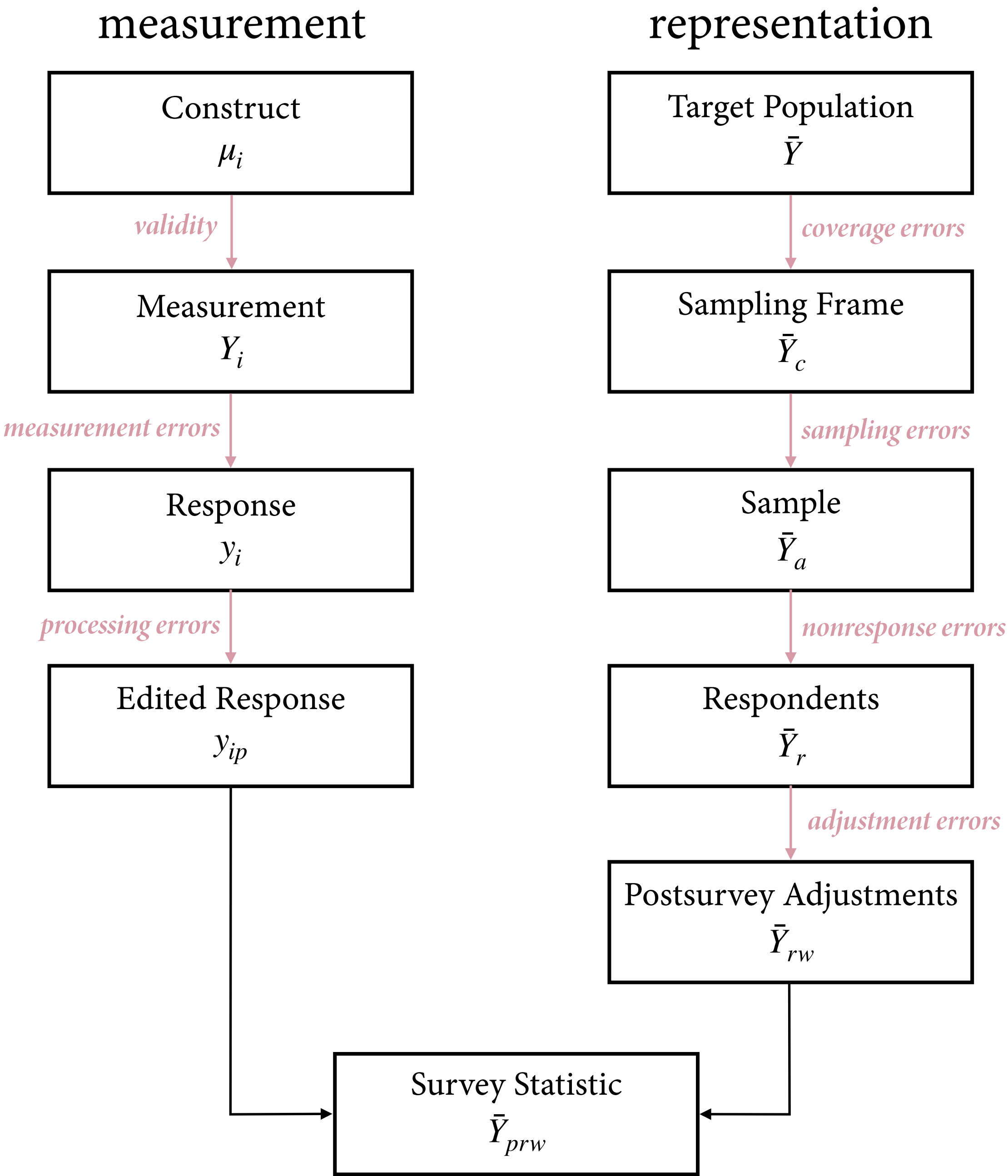
Could respondents feel there is a socially or morally right or wrong answer to your question?

surveys, designing response types, *different types provide different information and require different analyses*

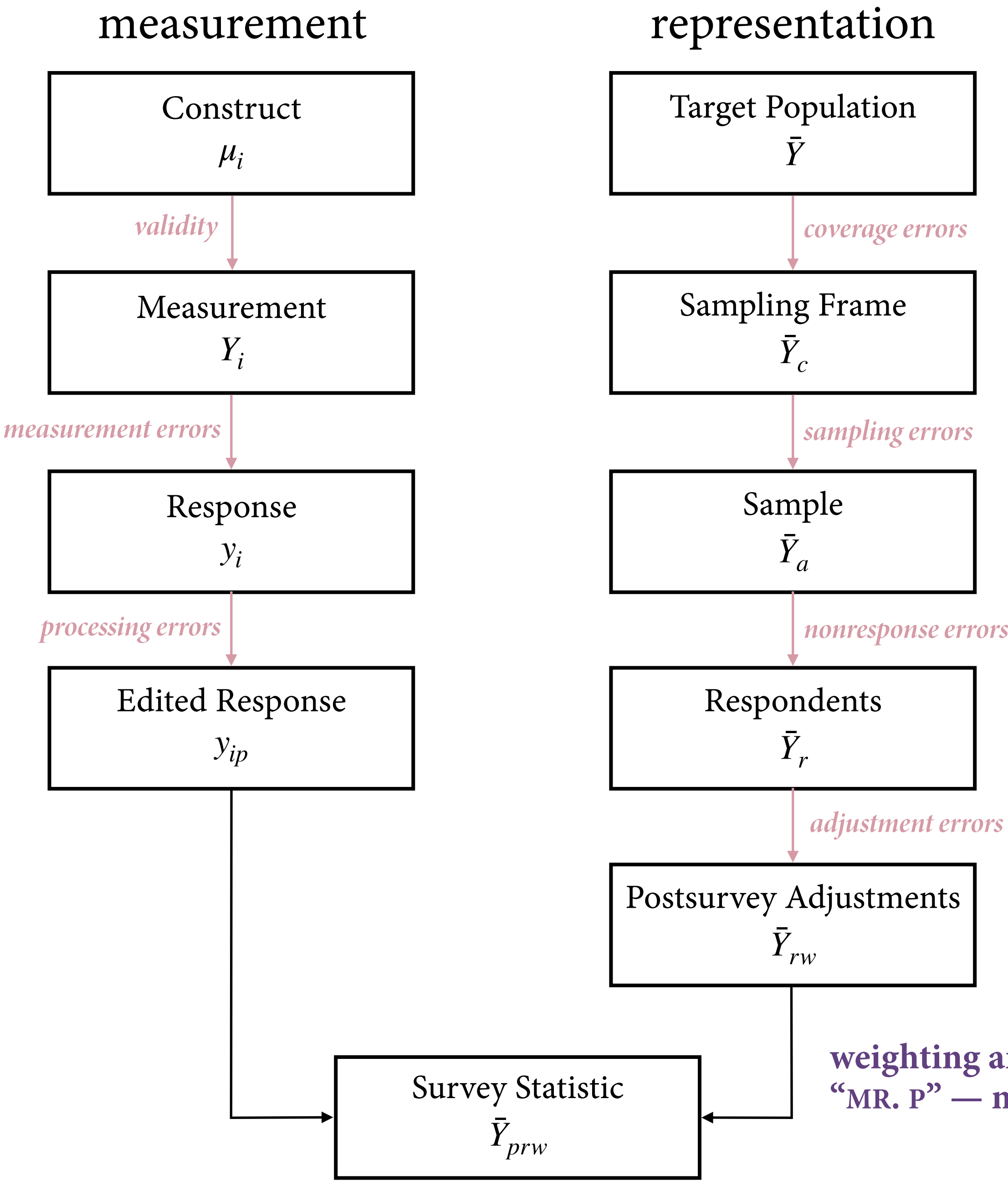


data types		examples	
binary		Yes, No	
nominal		Sweet, Sour, Savory, Salty, Bitter	
ordinal		Strongly disagree, Disagree, Neutral, Agree, Strongly agree	
<i>Likert scale</i>		-2	-1 0 +1 +2
interval and ratio scales		Temperature (deg C), Length (m)	

surveys, survey life cycle
from a *quality* perspective



Bradburn, 2004
high-quality surveys
survey experiments
pre-testing



(multiple) imputation

weighting and adjustment
“MR. P” — multi-level regression and post-stratification

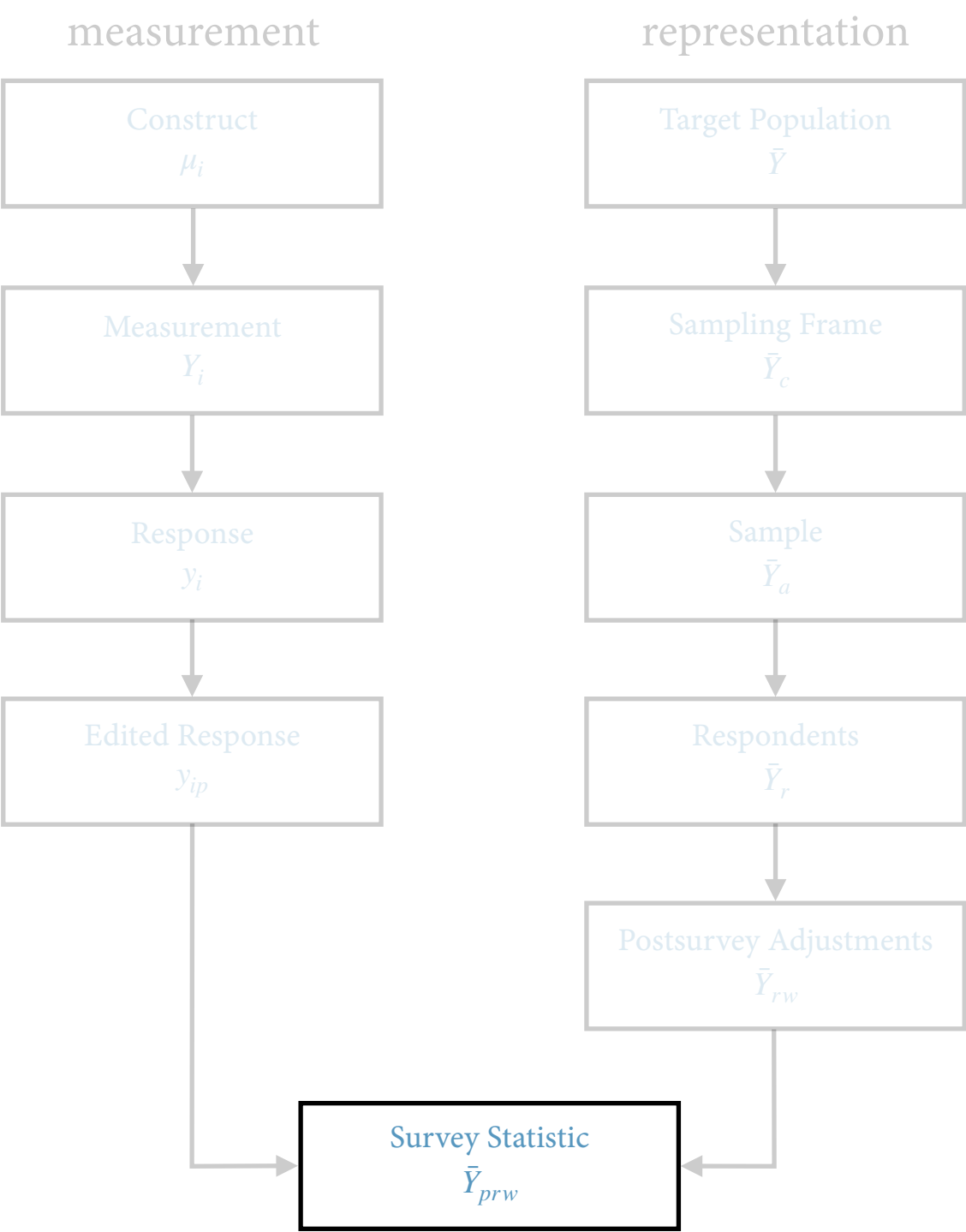
$$\hat{y}^{\text{PS}} = \frac{\sum_{j=1}^J N_j \hat{y}_j}{\sum_{j=1}^J N_j}$$

(additional methods of) analyses for categorical responses (from surveys)

Consider an ordered categorical outcome y that can take on the values $1, 2, \dots, K$.

Simple linear regression — $y \sim N(X\beta)$ — may be a useful approach if the *number of categories is large* and if *they can be considered equally spaced*.

Of note, this assumes that measures (e.g., from respondents’ answers) are actually *spread across a reasonable range of the categories*. For example, if on a scale of 1 to 10, responses are always a 9 or 10, then a linear model probably will not work well.



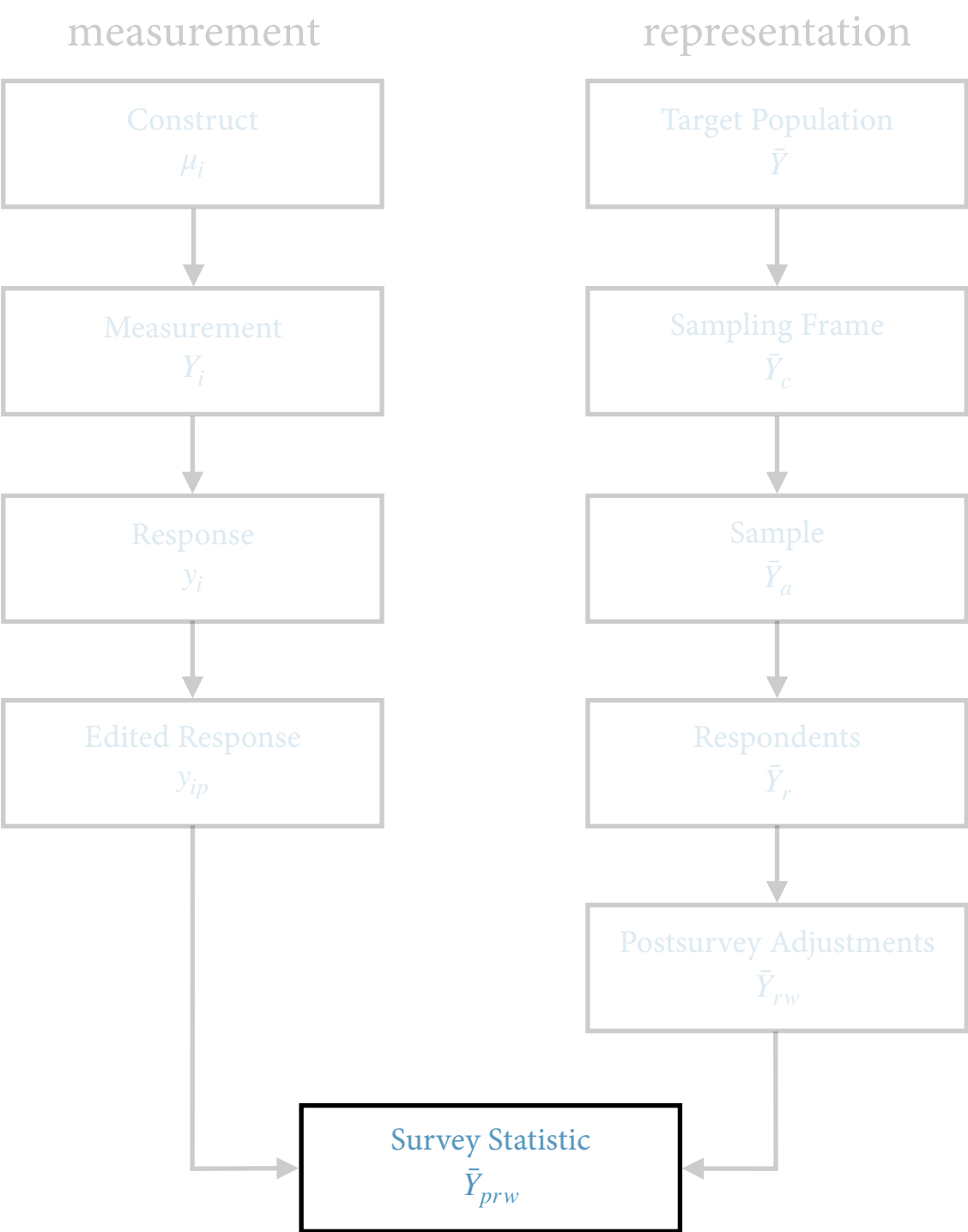
Consider an ordered categorical outcome y that can take on the values $1, 2, \dots, K$.

An ordered logistic model can be written in two equivalent ways. First we express it as a series of logistic regressions:

$$\begin{aligned} \Pr(y > 1) &= \text{logit}^{-1}(X\beta) \\ \Pr(y > 2) &= \text{logit}^{-1}(X\beta - c_2) \\ \Pr(y > 3) &= \text{logit}^{-1}(X\beta - c_3) \\ &\dots \\ \Pr(y > K - 1) &= \text{logit}^{-1}(X\beta - c_{K-1}) \end{aligned}$$

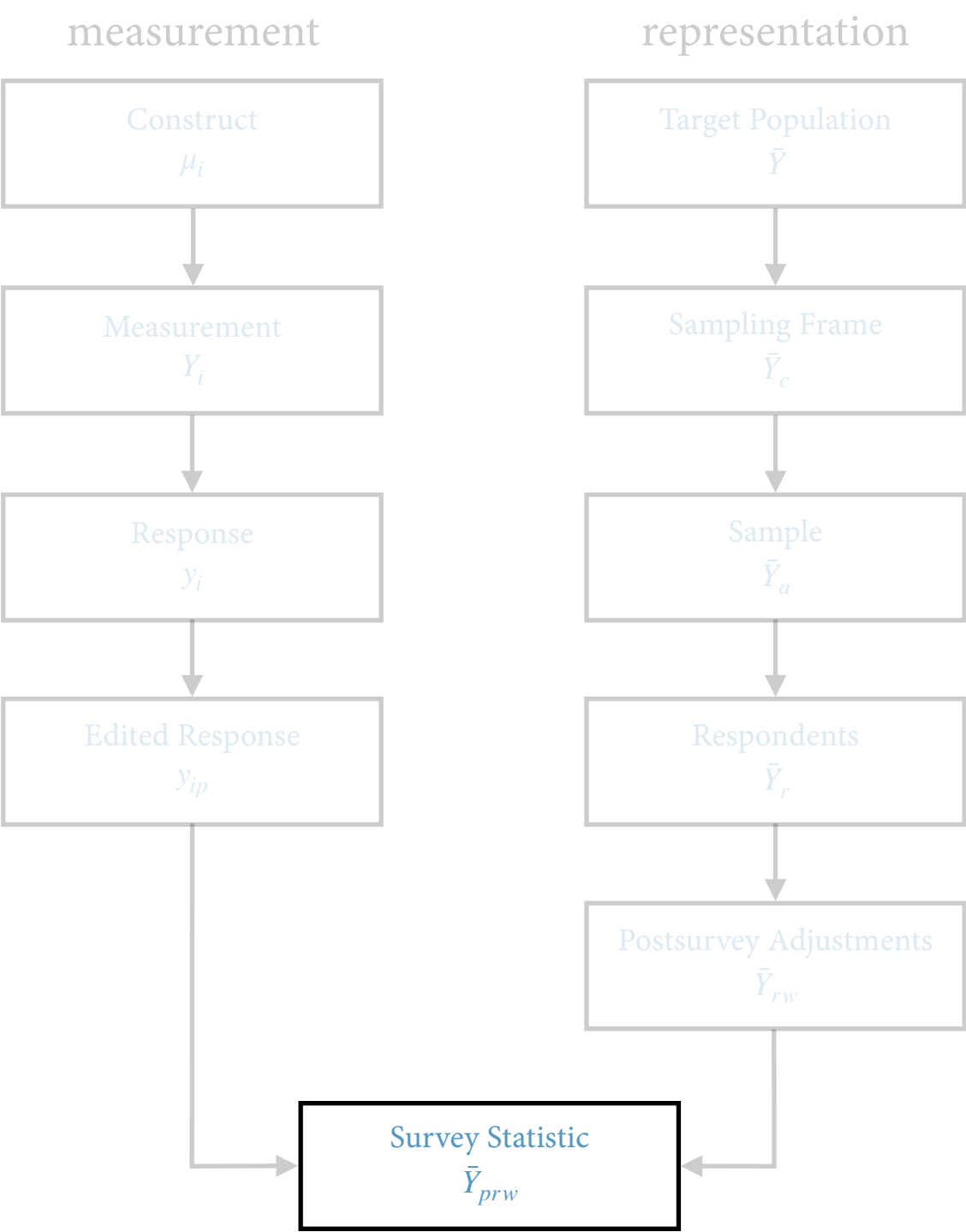
Then, we can subtract the expressions to get the probabilities of individual outcomes:

$$\begin{aligned} \Pr(y = k) &= \Pr(y > k - 1) - \Pr(y > k) \\ &= \text{logit}^{-1}(X\beta - c_{k-1}) - \text{logit}^{-1}(X\beta - c_k) \end{aligned}$$



survey analyses, ordered categorical responses, different approaches: latent variable (z_i) with cutpoints c_k

Consider an ordered categorical outcome y that can take on the values $1,2,\dots,K$.

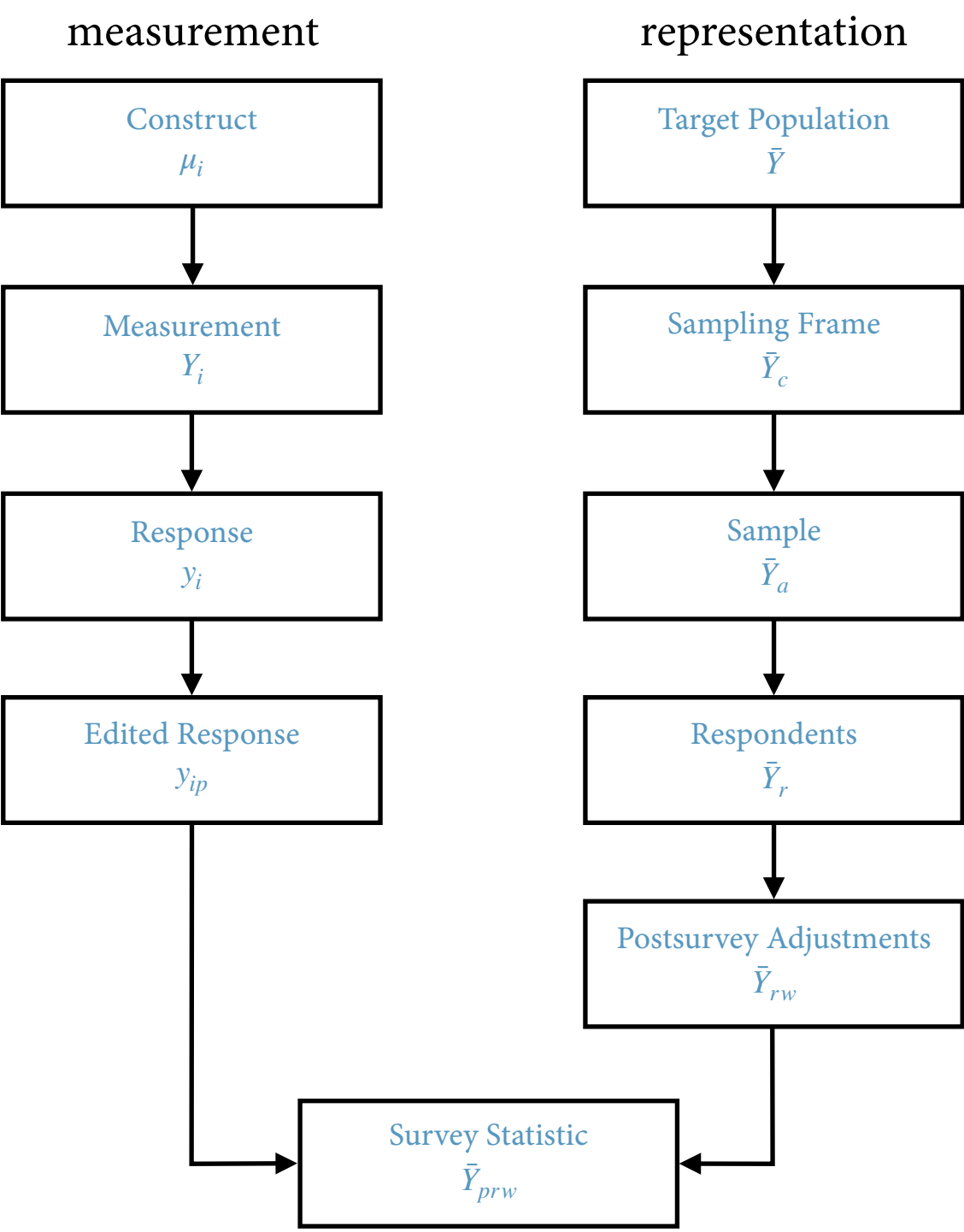


Here's yet another way we can parameterize a model for outcome y_i :

$$y_i = \begin{cases} 1, & \text{if } z_i < 0 \\ 2, & \text{if } z_i \in (0, c_2) \\ 3, & \text{if } z_i \in (c_2, c_3) \\ \dots & \\ K-1, & \text{if } z_i \in (c_{K-2}, c_{K-1}) \\ K, & \text{if } z_i > c_{K-1}, \end{cases} \quad z_i = \text{logit}^{-1}(X_i\beta)$$

group practice — design a survey

group practice designing and analyzing surveys, the scenario



Microsoft’s Xbox includes the ability for researchers to survey users (once or repeatedly over time) of the gaming platform. Gamers must opt-in to any surveys. The demographics of Xbox users are highly skewed by sex — who predominantly tend to identify as male (over 90 percent) — and age (around 65 percent, aged 18-29), among other attributes.

In this scenario, you are given then opportunity to conduct survey research on the Xbox platform to learn more about global *behaviors* of fitness. You decide what aspect of fitness your research will focus on.

Design a few research questions for the survey, explain what responses you would collect for those questions, and how you might analyze those responses to make an inference about the overall human condition in relation to your focus on fitness.

Consider what limitations may constrain your inferences and how you might address those limitations.

Of note, for an in-depth review of an analysis of research questions in other contexts using the Xbox delivery platform, review Gelman, *High-Frequency Polling with Non-Representative Data*.

resources

References

Biemer, Paul P., and Lars Lyberg. *Introduction to Survey Quality*. Wiley Series in Survey Methodology. Hoboken, NJ: Wiley, 2003.

Bradburn, Norman M., Seymour Sudman, and Brian Wansink. *Asking Questions: The Definitive Guide to Questionnaire Design-- for Market Research, Political Polls, and Social and Health Questionnaires*. Revised edition. San Francisco, CA: Jossey-Bass, 2004.

Downes, Marnie, Lyle C Gurrin, Dallas R English, Jane Pirkis, Dianne Currier, Matthew J Spittal, and John B Carlin. *Multilevel Regression and Poststratification: A Modeling Approach to Estimating Population Quantities From Highly Selected Survey Samples*. American Journal of Epidemiology 187, no. 8 (August 1, 2018): 1780–90.

Gelman, Andrew. *Struggles with Survey Weighting and Regression Modeling*. Statistical Science 22, no. 2 (May 2007): 153–64.

Gelman, Andrew, Jennifer Hill, and Aki Ventari. “15.5 Ordered and Unordered Categorical Regression”. In *Regression and Other Stories*. S.l.: Cambridge University Press, 2020.

Gelman, Andrew, Sharad Goel, David Rothschild, and Wei Wang. “High-Frequency Polling with Non-Representative Data.” In *Political Communication in Real Time*, edited by Dan Schill, Kirk Rita, and Amy E. Jasperson, 1st ed. New York: Routledge, 2016.

Groves, Robert M., ed. *Survey Methodology*. 2nd ed. Wiley Series in Survey Methodology. Hoboken, N.J: Wiley, 2009.

Lax, Jeffrey R., and Justin H. Phillips. *How Should We Estimate Public Opinion in The States?* American Journal of Political Science 53, no. 1 (January 2009): 107–21.

Salganik, Matthew J. *Asking Questions, Chp. 3*. In *Bit by Bit. Social Research in the Digital Age*. Princeton University Press, 2018.

Schwarz, Norbert. *Questionnaire Design: The Rocky Road from Concepts to Answers*. In *Survey Measurement and Process Quality*, edited by Lars Lyberg. Wiley Series in Probability and Statistics. New York: Wiley, 1997.

Si, Yajuan, Rob Trangucci, Jonah Sol Gabry, and Andrew Gelman. *Bayesian Hierarchical Weighting Adjustment and Survey Inference*. ArXiv:1707.08220 [Stat], June 23, 2020.

Valliant, Richard, Jill A. Dever, and Frauke Kreuter. *Practical Tools for Designing and Weighting Survey Samples. Statistics for Social and Behavioral Sciences*. Cham: Springer International Publishing, 2018.