Mobile Web Surveys
General Overview and Questionnaire Design Considerations

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Session Overview

- General overview
  - Smartphone coverage rates
  - Device distributions in online surveys
  - Devices differences in nonresponse rates and measurement
- Questionnaire design considerations
  - Mobile optimization
  - Screen design and layout
  - Choosing question formats
- Next steps

General Issues

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Portal Session: Mobile Web Surveys

Why Mobile?

Mobile Web Surveys

- =Web surveys over mobile handheld device with compatible Web browser (e.g., cell phones, smartphones, tablets, e-readers)
  - Basically same technology as "traditional" Web survey but different device on *R* side
- Currently more than 100 different makers of cell phones in U.S. (http://www.gsmarena.com/makers.php3)
  - >3,000 smartphones
  - Wide variety of devices in terms of screen size and resolution, OS, and means of interaction (touchscreen, keyboard, stylus, scroll-wheel, etc.)

https://www.gearbest.com/blog/how-to/4-types-of-phones-phablet-dumb-phone-smartphonewatch-phone-2892

What Makes Mobile Web Different from Regular Web for Surveys?

Technology Features	User Characteristics	Context of Use
• Display dimensions & orientation • Input mode (usually touchscreen) • Bandwidth & connectivity • Software	• Comfort & familiarity • Fine motor skills • Willingness, motivation, & interest • Alternatives available & choice of device • Consumption vs. production • Cost & type of data plan • Shared use of device • Invitation mode	• Location – Safety – Distractions – Presence of others – Environmental cues • User behavior – Multi-tasking – Interstitial activities – Time on task

Source: Couper (2013), Antoun (2015)

Two Forms of Mobile Web Surveys

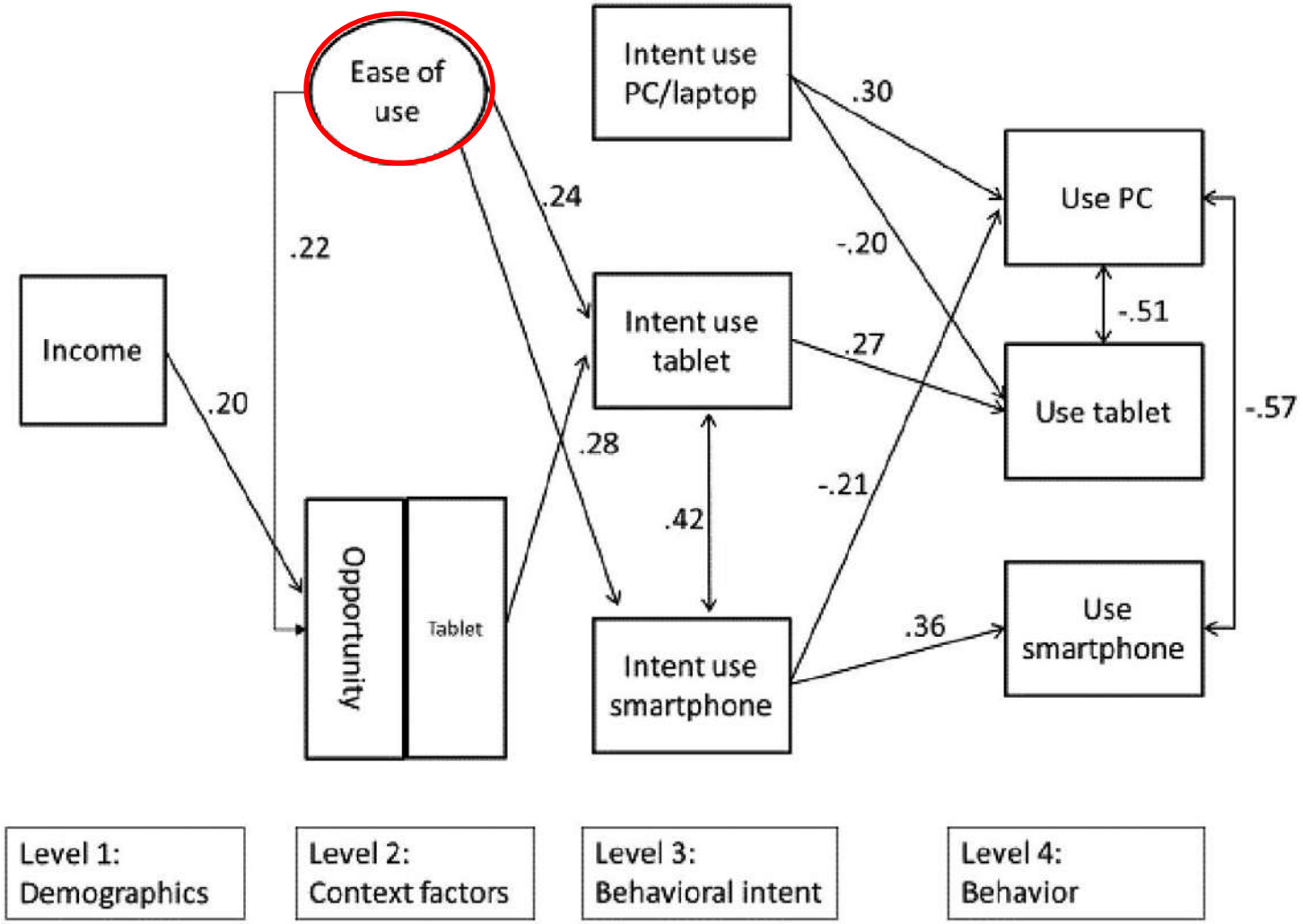
- Completion of Web surveys on mobile Web devices
  - Web surveys completed by some on mobile devices
  - Mix of devices used

- Researcher-driven use of mobile Web
  - Smartphone as primary data collection device
  - Examples: ecological momentary assessment (EMA), diary studies, travel studies, health monitoring, non-reactive measurement
  - Often based on volunteers
  - Sometimes involves downloading and installing research app

Empirical Evidence for Mobile Response

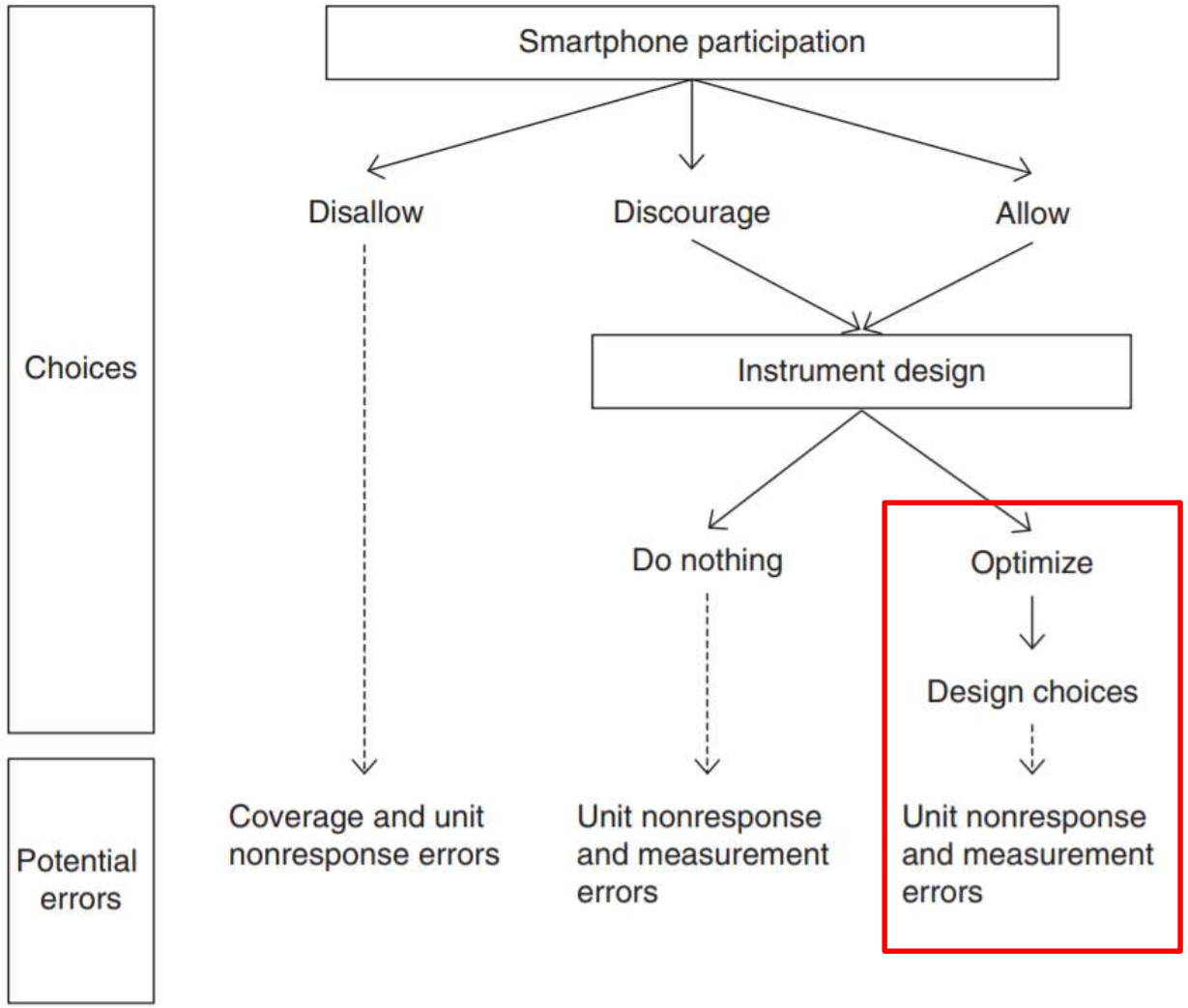
- Cross sectional Web surveys
  - **7-8%** of online *R*s in National Census Test and in American Community Survey used smartphones, **9-10%** used tablets (Horwitz 2016)
- Non-probability online panels
  - **Between 1% and 30%** of U.S. *R*s, dep. on target population (Peterson 2012)
  - **51%** of marketing research surveys in U.S., 10% in Europe (Kinesis 2013)
  - **7.1%** of all Netquest panel members used smartphones; 1.8% tablets; **large increase over time** (Revilla et al. 2014)
- Probability online panels
  - Share in LISS panel increased from 3.1% in Mar. 12 (0.4% smartphones) to **10.9%** in Sep. 13 (1.6% smartphones) (de Bruijne & Wijnant 2014)
  - **Between 16% and 21%** of *R*s used mobile device in first 6 survey waves of GESIS Panel (about half of them smartphone) (Struminskaya et al. 2015)
  - **27%** of *R*s in American Trends Panel completed most recent survey on smartphone, 8% used tablet (Pew Research Center 2015)

Why Do People Use Smartphones for Web Survey Completion? (Haan et al. 2019)



Source: Haan et al. (2019, Fig. 2)

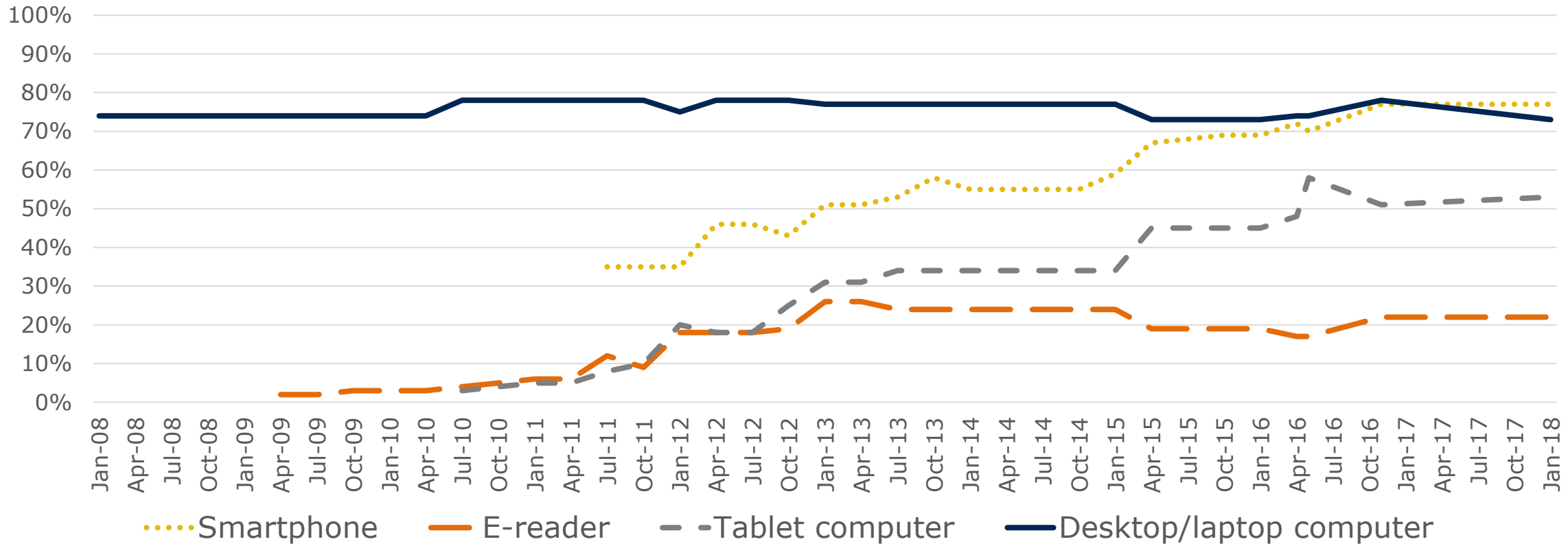
How to Deal with Smartphones in Web Surveys



Source: Peterson et al. (2017, Fig. 10.1)

Device Ownership in the U.S.

% of U.S. adults who own the following devices



Source: Surveys conducted 2008-2018.

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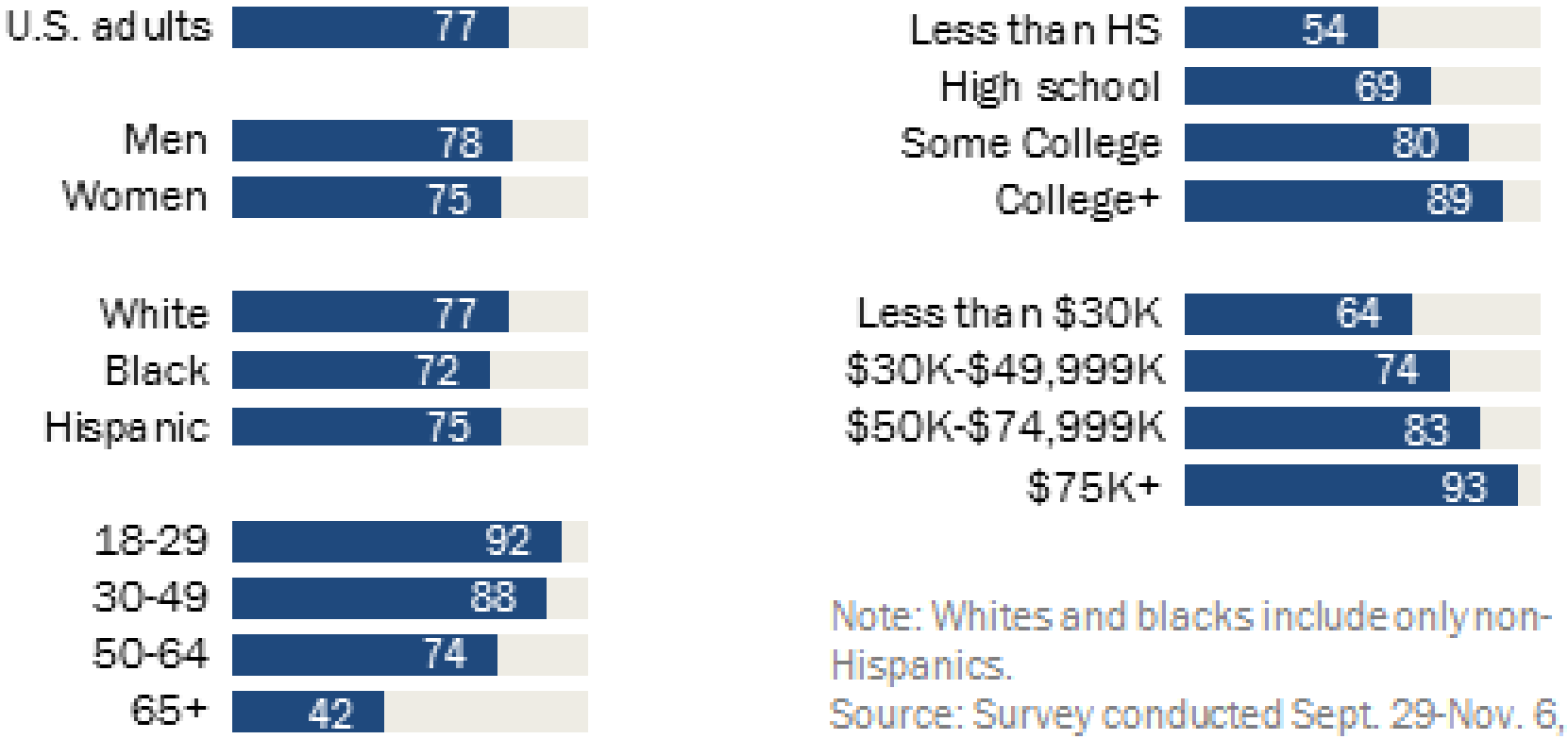
Device Ownership in the U.S.

% of U.S. adults who say they own a smartphone



Note: Whites and blacks include only non-Hispanics.
Source: Survey conducted Sept. 29-Nov. 6, 2016.

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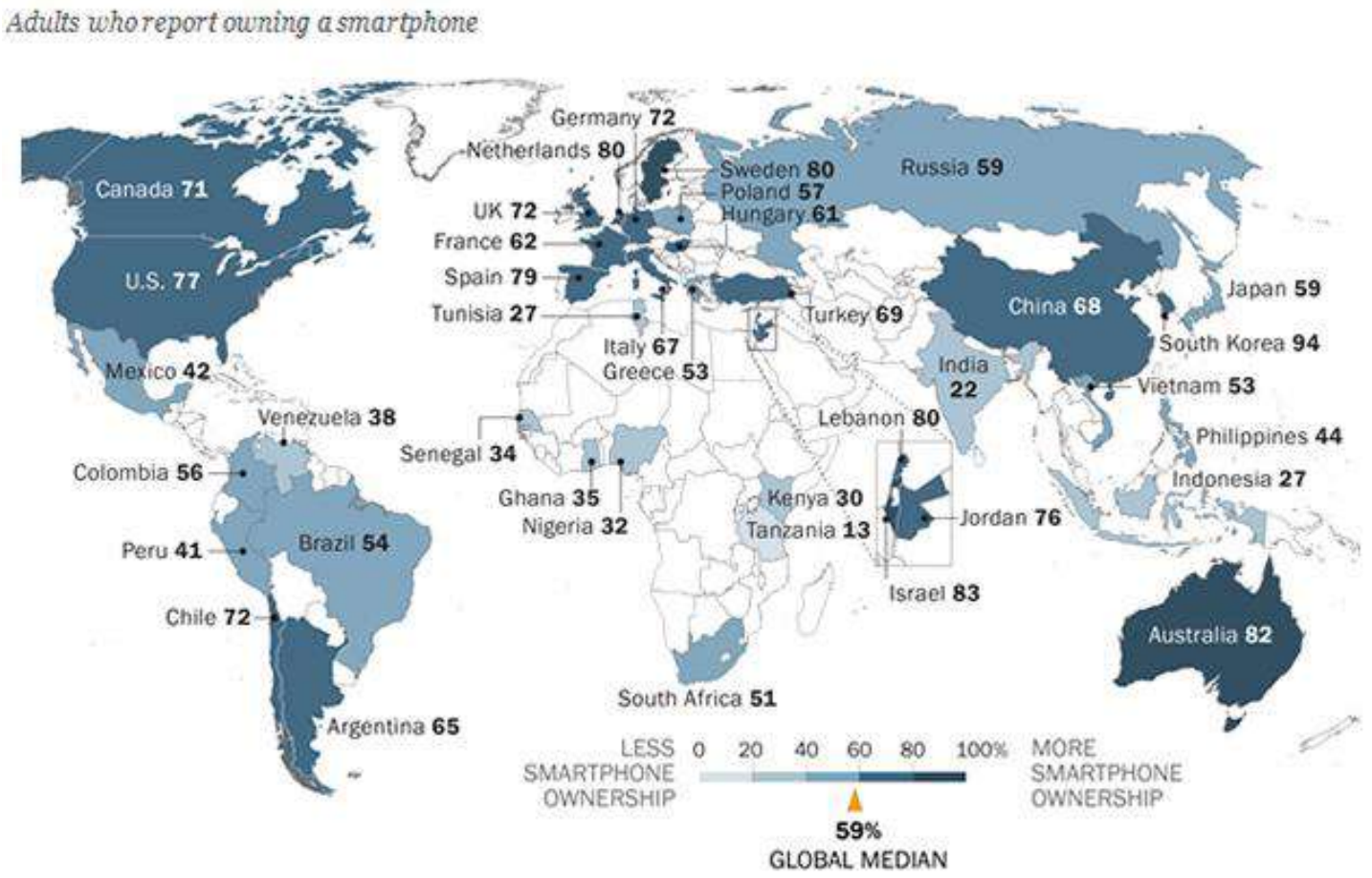
Device Ownership Around the World



Note: Percentages based on total sample.
Source: Spring 2017 Global Attitudes Survey. Q65. U.S. data from a Pew Research Center survey conducted Jan. 3-10, 2018. China data from 2016 Global Attitudes Survey.

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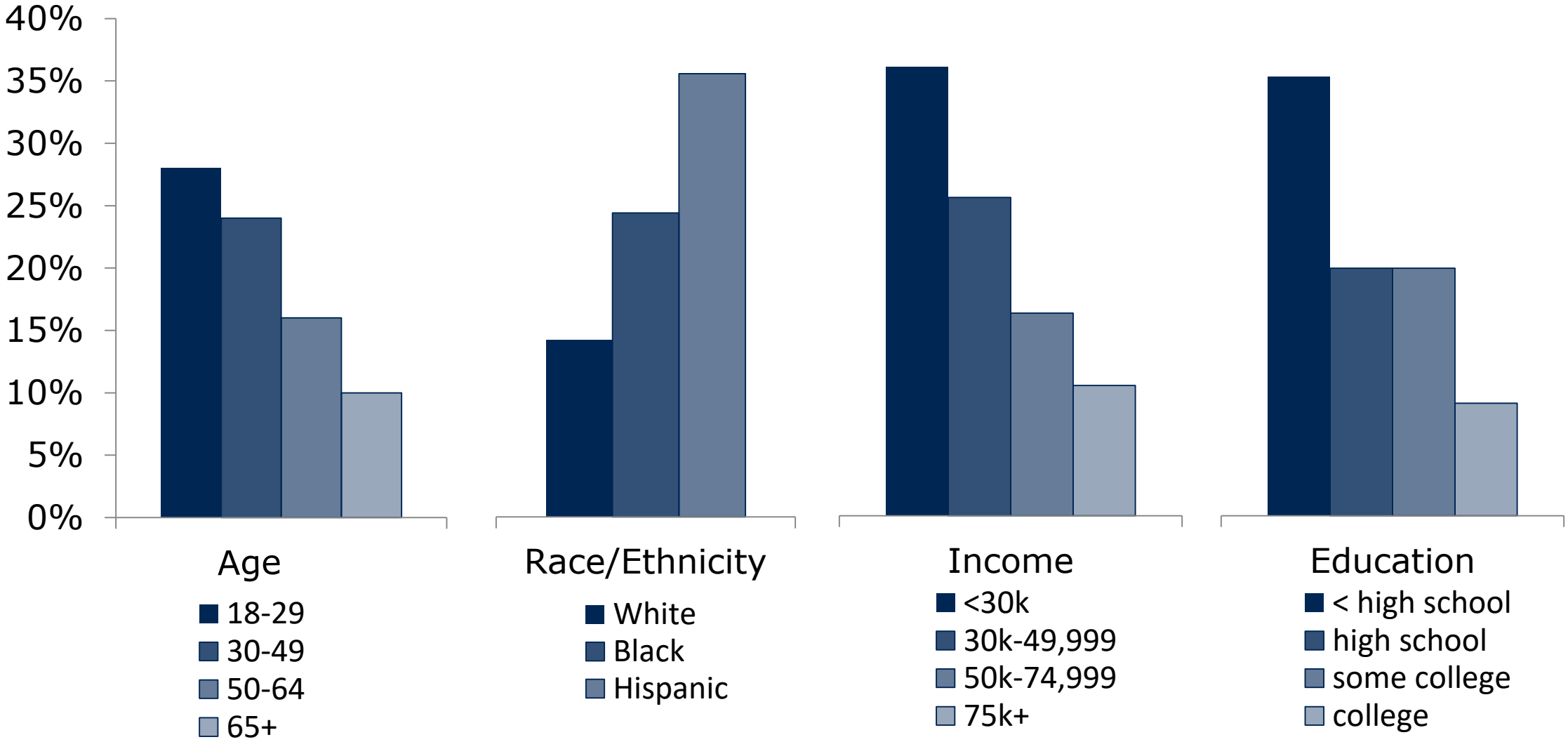
Coverage Bias

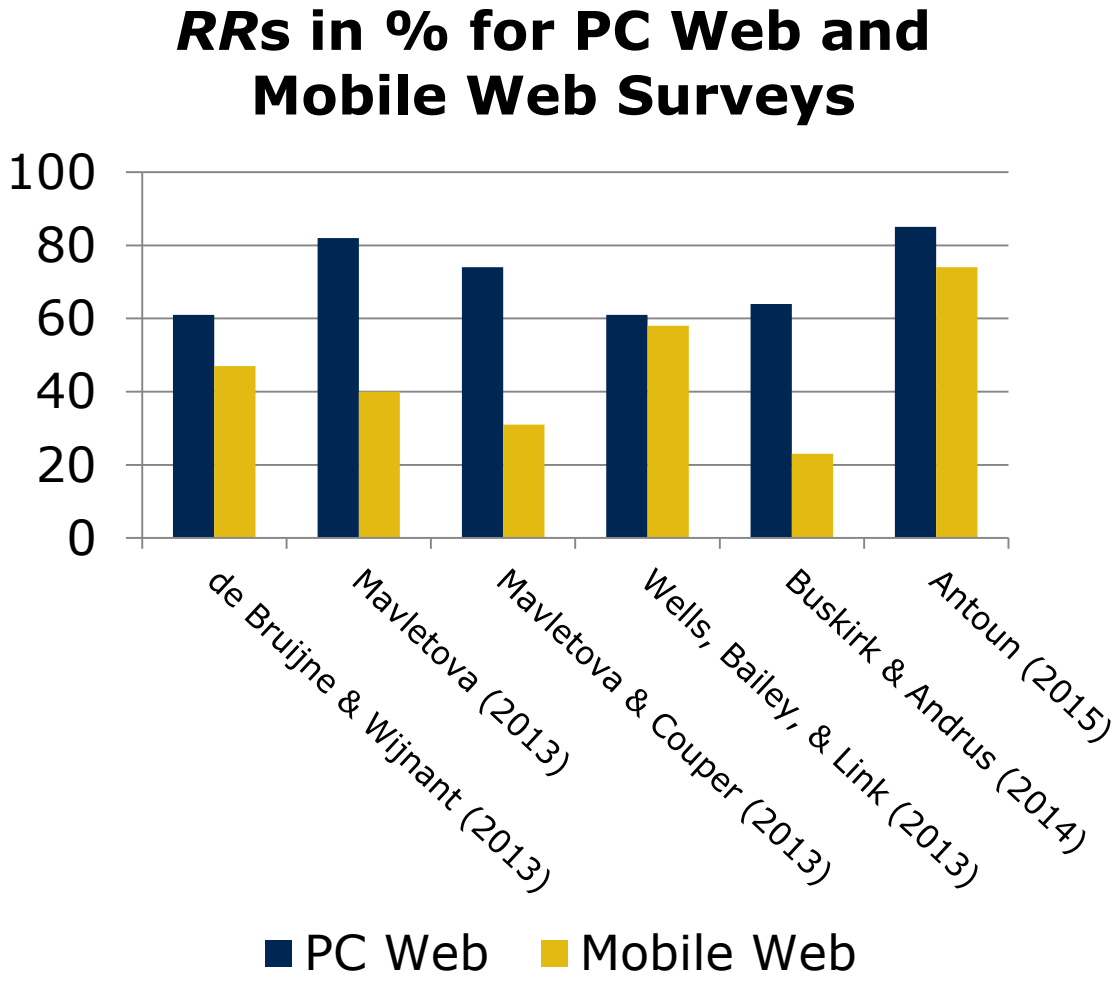
- In mobile-only surveys, undercoverage of specific socio-demographic groups can lead to coverage bias
- Bias seems to decrease over time and with increasing smartphone penetration (Baier et al. 2018; Fuchs & Busse 2009; Metzler & Fuchs 2014)
- Standard weighting procedures can account for differences in observed socio-demographics between users and non-users of smartphones (Baier et al. 2018; Fuchs & Busse 2009; Metzler & Fuchs 2014) and for some substantive measures (Couper et al. 2018; Antoun et al. 2019)
- Size of bias might also depend on OS (Keusch et al. under review)

Who Is Smartphone-dependent?



Source: Pew Research Center (2018)

Nonresponse in Mobile Web Surveys



- Smartphone *R*s compared to non-smartphone *R*s…
  - …younger (Mavletova 2013; Wells, et al. 2013; de Bruijne & Wijnant 2013; Toepoel & Lugtig 2014; Antoun 2015; Haan et al. 2019)
  - …more likely to be female (Wells, et al. 2013; de Bruijne & Wijnant 2013; Keusch & Yan 2017; Haan et al. 2019)
  - …heavier mobile Web users (Mavletova 2013)
  - …primarily rely on smartphones to access Internet (Wells, et al. 2013)

Source: Couper, Antoun, & Mavletova (2017)

Nonresponse in Mobile Web Surveys

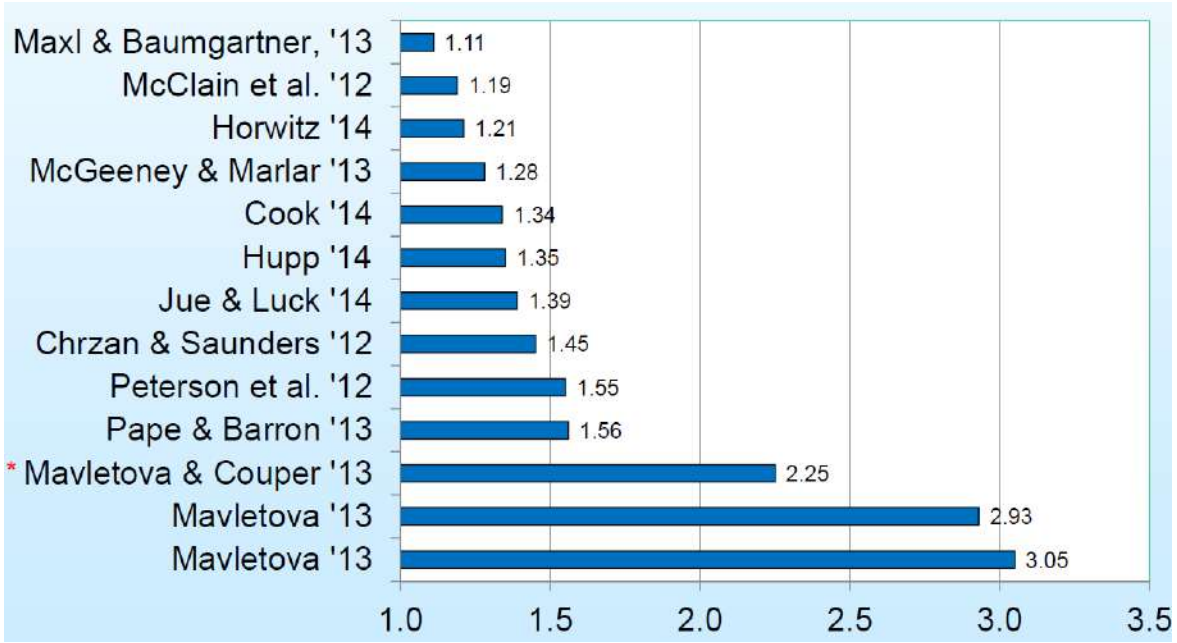
- Evidence that *RR*s lower and break-off rates higher for mobile Web than PC Web, even when surveys optimized for mobile devices
  - Average **break-off rates** from 18 comparisons for **Web 5.5%** and **mobile Web 13.4%** (Couper et al. 2017)

- Explanation for lower response rate and higher break-off rates
  - Time (=burden)
  - Survey experience less satisfying

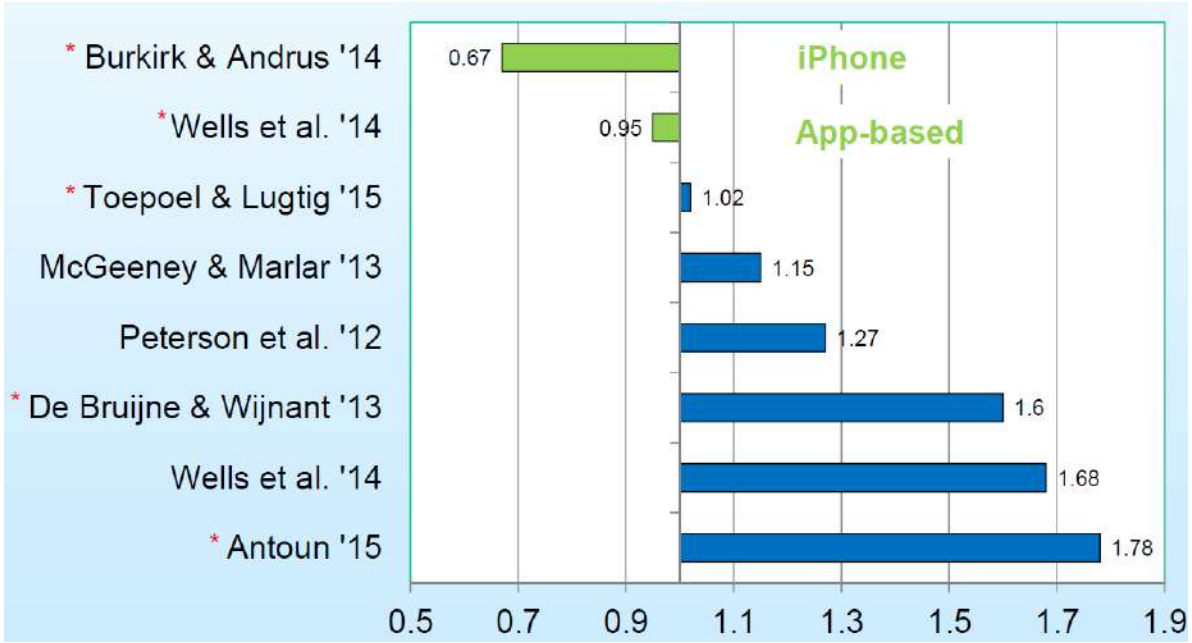
Completion Time in Mobile Web Surveys

- Several studies show that responding on mobile device takes sign. longer than on PC
  - Requires more effort from *R*
  - Lower page loading speed, slower Internet connection, or more difficult task

Non-optimized Surveys



Optimized Surveys



Source: Couper & Peterson (2015)

Measurement Error in Mobile Web Surveys

- Generally, four sources of measurement error
  - Interviewer: not relevant in mobile Web surveys
  - Respondent:
    - General, cognitive processing seems to be same as in other modes (Peytchev & Hill 2010)
    - Context and environmental influence cannot be ruled out (mobility, bystanders)
  - Questionnaire
  - Mode of data collection

  } Design restrictions in mobile Web surveys
- Two distinct features of mobile devices (in particular smartphones) make them different from desktop/laptop computers
  - Relatively small (narrow) screen
  - Method of data entry (predominantly touchscreen)

Measurement Error in Mobile Web Surveys

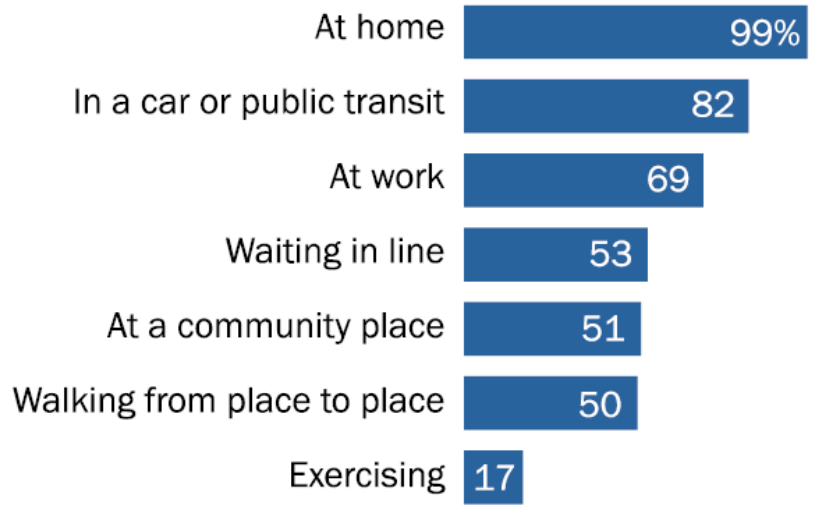
- Survey completion on mobile device (especially smartphone) different than survey completion on desktop/laptop
  - Tablet seems to be more similar to desktop/laptop than smartphone

- As long as care taken of design, very few (reliable) differences after controlling for self-selection and nonresponse (Peterson 2012; de Bruijne & Wijnant 2013; Toepoel & Lugtig 2014; Keusch & Yan 2017)
  - Exceptions: sometimes more item missing data (de Bruijne & Wijnant 2013; Mavletova & Couper 2014, 2016; Lugtig & Toepoel 2015; Keusch & Yan 2017) and shorter responses to open-ended questions (Mavletova 2013; Peterson et al. 2013; Wells et al. 2014; Lambert & Miller 2015; Struminskaya et al. 2015; Revilla & Ochoa 2016)

Measurement Error in Mobile Web Surveys

- Several studies report that mobile *R*s more likely to take survey out of home
  - Bystanders, strangers might be present
  - Answers could suffer from social desirability bias
- Only weak empirical evidence for more social desirable responding
  - No significant effect of survey mode on socially undesirable responses (Mavletova 2013; Antoun et al. 2017)
  - Only small differences in response to sensitive questions (alcohol consumption, income) (Mavletova & Couper 2013)

% of smartphone owners who used their phone from the following locations at least once over the course of 14 surveys spanning a one-week period



Source: Pew Research Center (2015)

Questionnaire Design Considerations

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Presentation adapted from these sources:

Couper, M.P., Antoun, C., Mavletova, A. (2017). Mobile Web Surveys: A Total Survey Error Perspective. In Biemer, P. et al. Total Survey Error in Practice. New York: Wiley, pp 133–54.

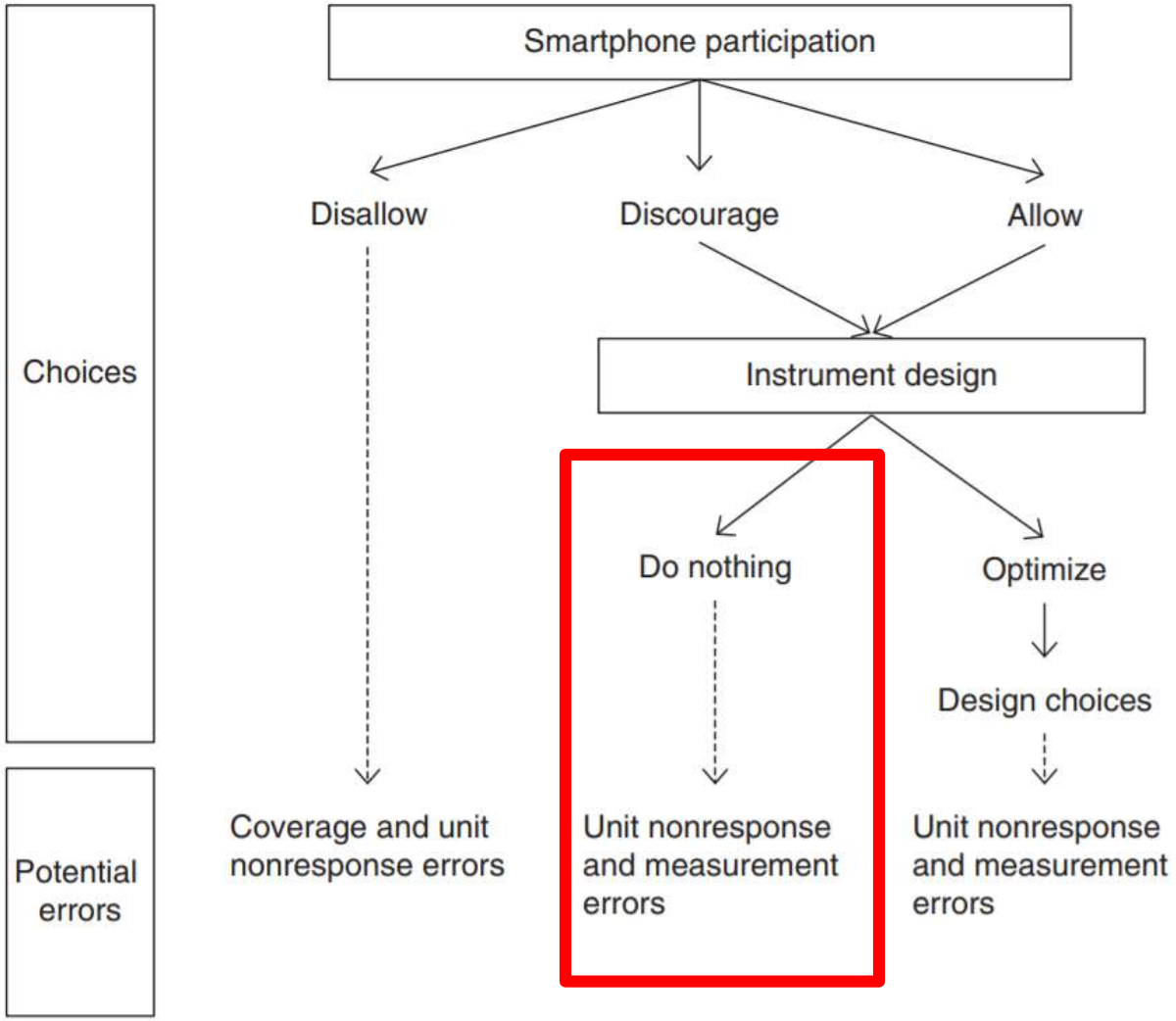
Antoun, C., Katz, J., Argueta, J., & Wang, L. (2017). Design Heuristics for Effective Smartphone Surveys. *Social Science Computer Review.*

Wang, L., Antoun, C., Sanders, R., Nichols, E., Olmsted Hawala, E.L., Falcone, B., Figueroa, I., & Katz, J. (2017). Experimentation for Developing Evidence-Based UI Standards of Mobile Survey Questionnaires. *In ACM SIGCHI proceedings, CHI'17*, Denver, CO.

Caveats: Research on Mobile Web Design is…

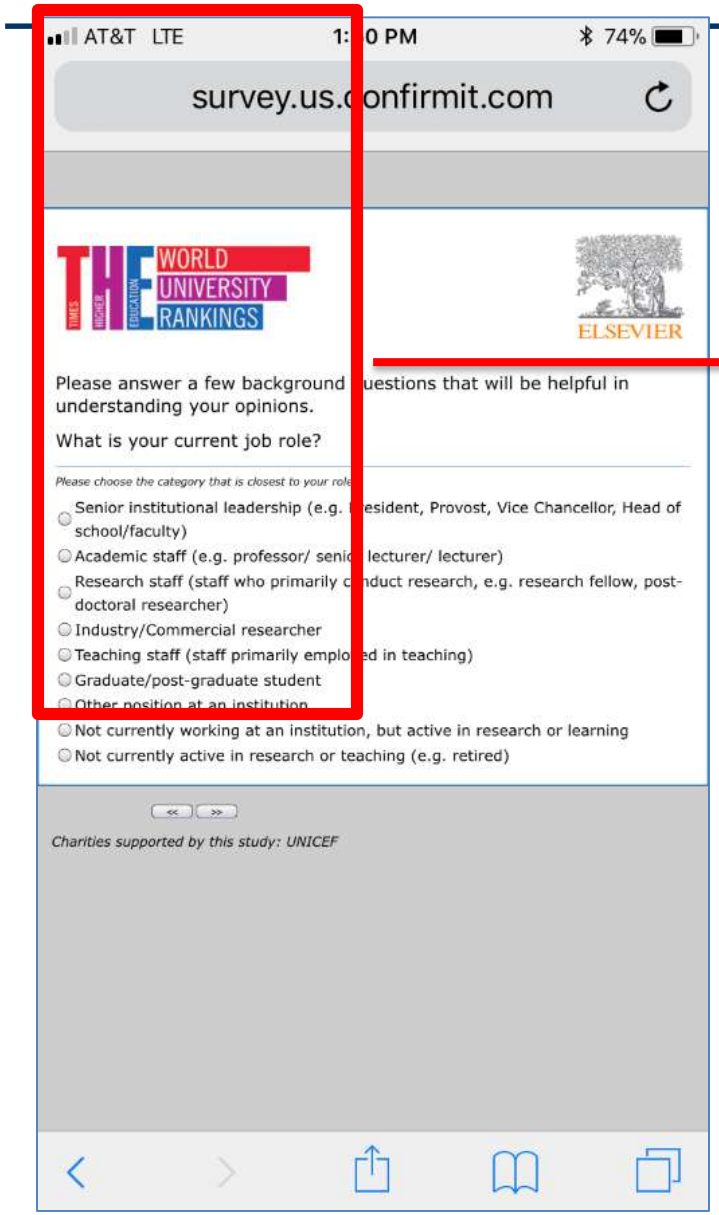
- Relatively new
  - first studies were published about 9 years ago
- Fast-moving
  - in part because phones are constantly changing
- Doesn’t always replicate across studies
  - in part because best design depends on your target population

Non-Optimized Mobile Surveys

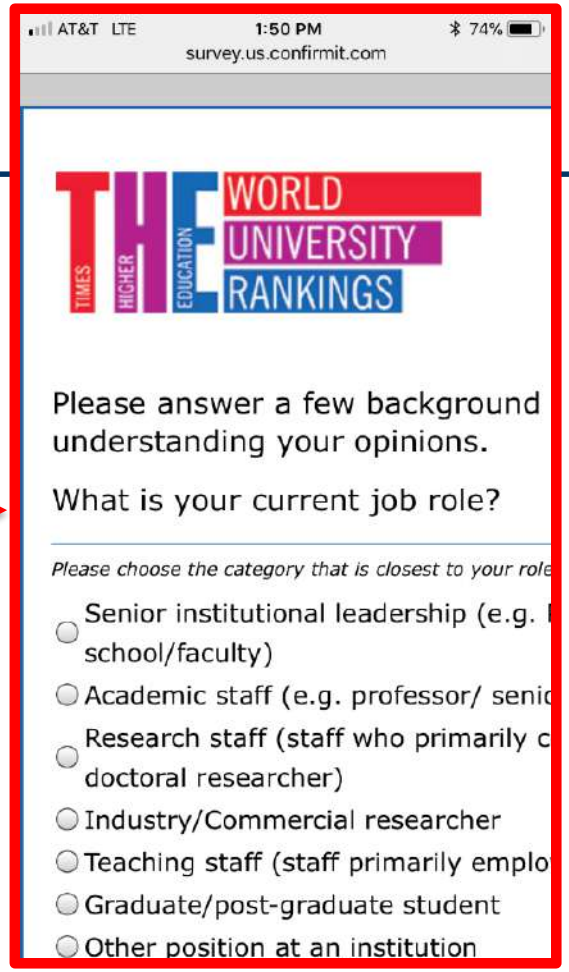


- One approach is to deliver the PC version of the questionnaire to mobile devices without any changes

For Example:

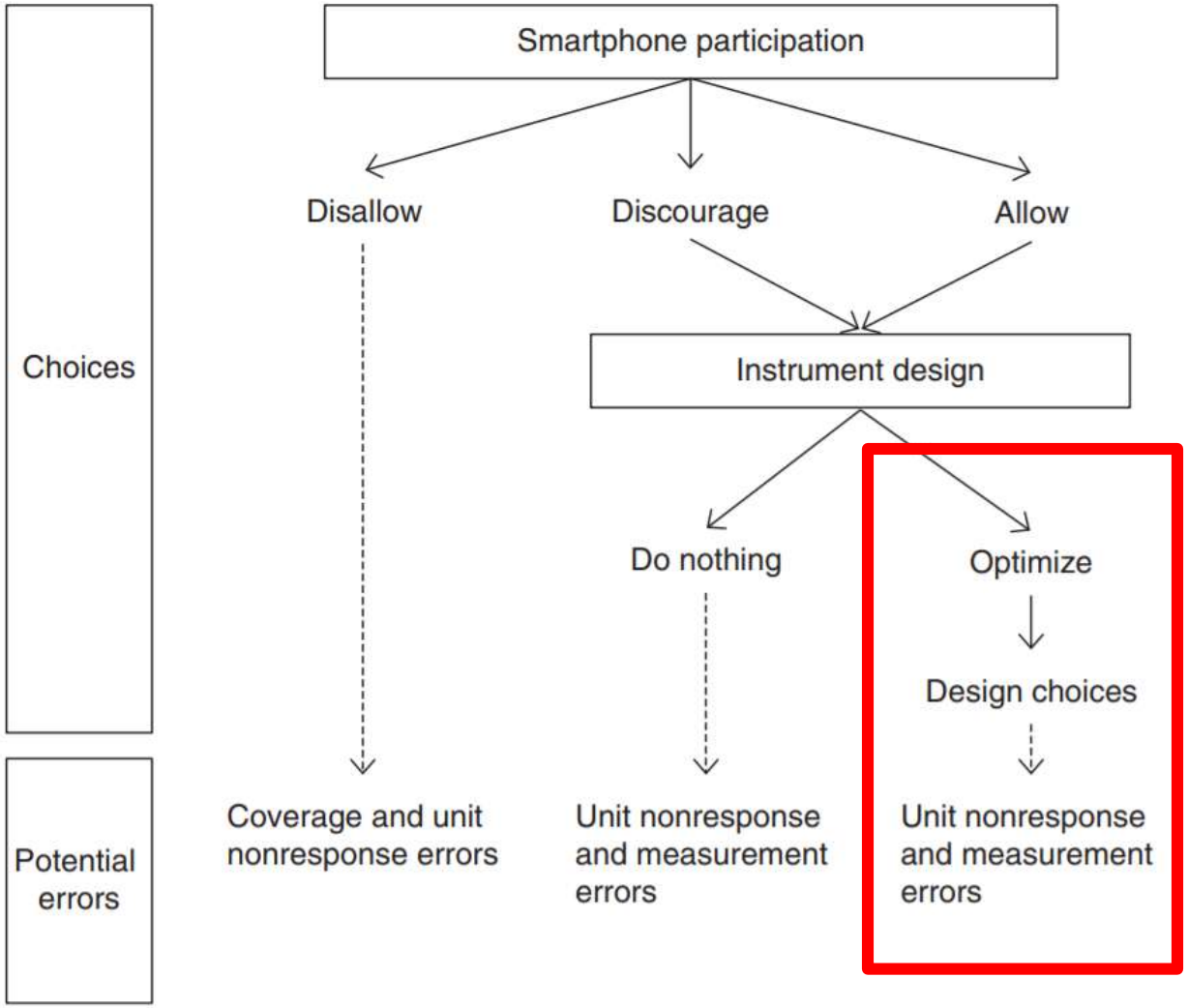


Zoomed view



- What's the problem?
  - Small font size
  - Small touch target size
  - When zoomed in, question spills off the screen and respondent is forced to scroll
  - …

Optimized Mobile Surveys



- Another approach is to deliver an adapted version of the questionnaire to mobile devices
- Different people use different terms to refer to similar things
  - "optimization"
  - "mobile-friendly design
  - "fluid design"
  - "responsive design"
  - …

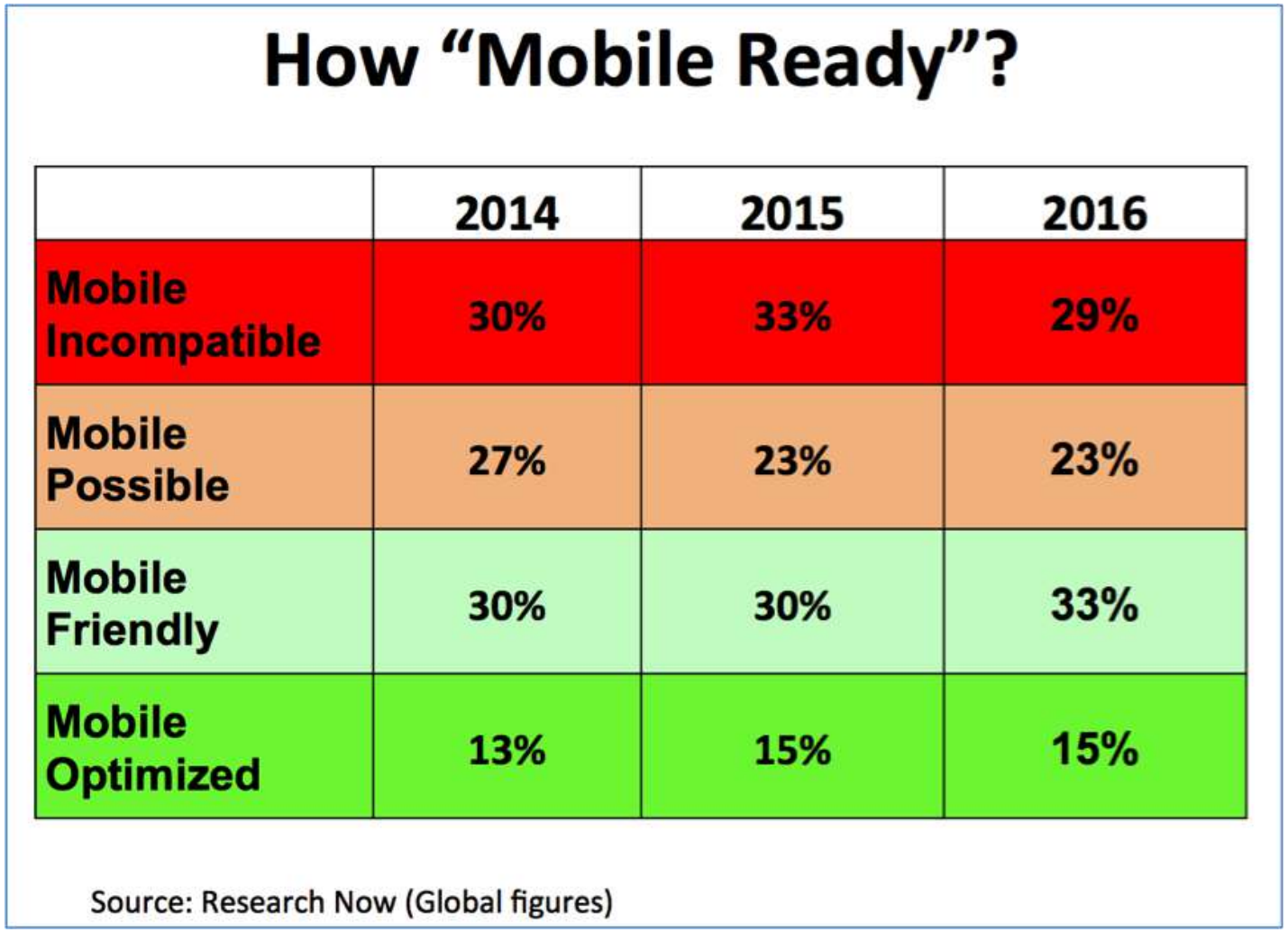
For Example:

- Lots of variation across designs
- Typical features:
  - Larger fonts
  - Larger touch targets
  - Content fit to **width** of screen

Impact of Optimization

- Several papers have made comparisons between the two designs:
  - McGeeney & Marlar (2013)
  - Sarraf, Brooks, Cole, & Wang (2015)
  - Revilla, Toninelli, & Ochoa (2017)
- Optimization…
  - Consistently reduces completion times
  - Can reduce breakoffs
  - Consistently improves respondent satisfaction
- Thus, mobile optimization is a valuable way to improve survey quality and respondent satisfaction among those completing the survey on a smartphone

Surprisingly, Not Everyone is Doing It

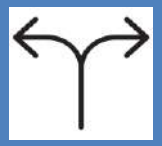


Source: https://newmr.org/blog/major-update-on-mobile-market-research/

Optimization Process

- Three main steps

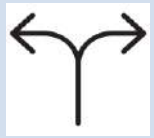
Detect features of the device being used by the respondent



Deliver the appropriate design for their device in real-time

Design the mobile version to be effective on their device

Detect features of the device being used by the respondent



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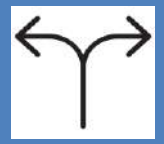
Two Ways of Gathering Device Information

- Browser specs extracted from User Agent String (Callegaro, 2010)
  - Example: `Mozilla/5.0 (iPhone; CPU iPhone OS 12_2 like Mac OS X) AppleWebKit/605.1.15 (KHTML, like Gecko) FxiOS/16.2b14898 Mobile/15E148 Safari/605.1.15`
  - https://www.whatsmyua.info/
  - Real-time processing required for mobile optimization
- Maximum screen dimensions extracted using JavaScript
  - Example: Width=375 px; Height=667 px
  - Design ("CSS") pixels are more useful than hardware pixels
    - Design pixels are unit of measurement (375px = 3.9 inches)
    - Hardware pixels are individual dots of light in the display
  - http://whatismyscreenresolution.net/

Detect features of the device being used by the respondent



Deliver the appropriate design for their device in real-time

Design the mobile version to be effective on their device

Key Delivery Decisions

- Number of questionnaire templates ("style sheets")
  - Older: one mobile version, one PC version
  - Newer: at least one version for each type of device (phone, tablet, PC)
- Exact "breakpoint" between designs
  - Generally determined by width rather than height
  - You can figure out the breakpoints of your survey
    - From the Firefox menu: Select "Responsive Design Mode" from the Web Developer submenu in the Firefox Menu

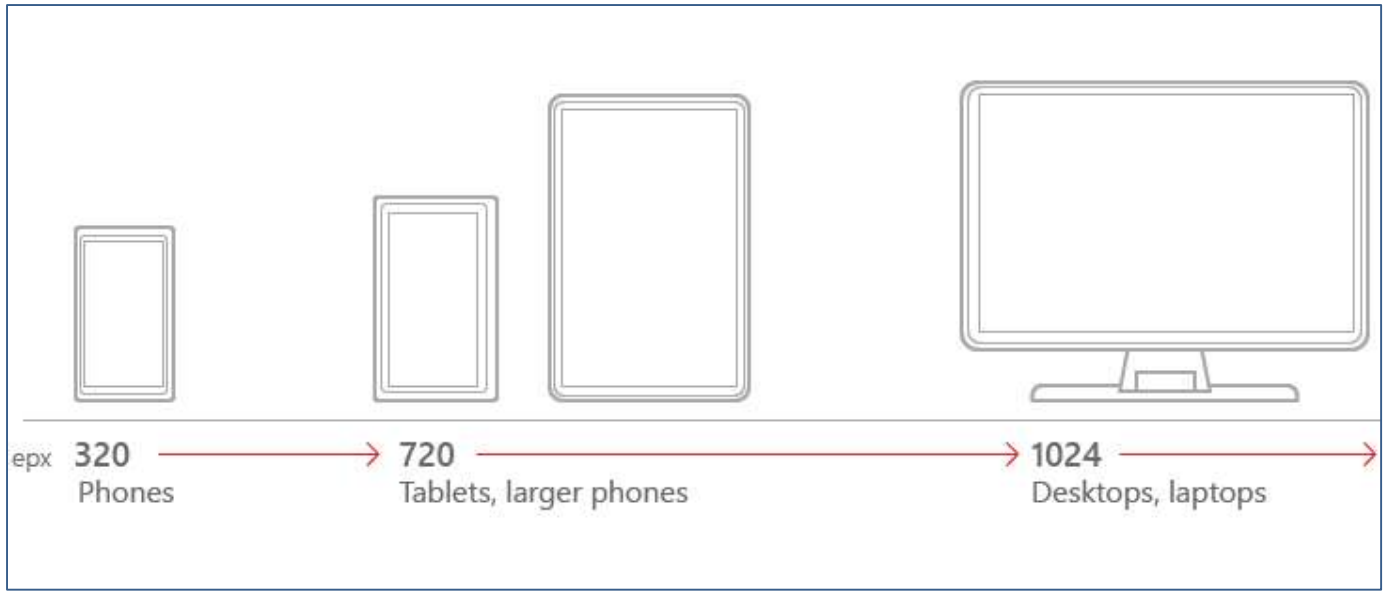
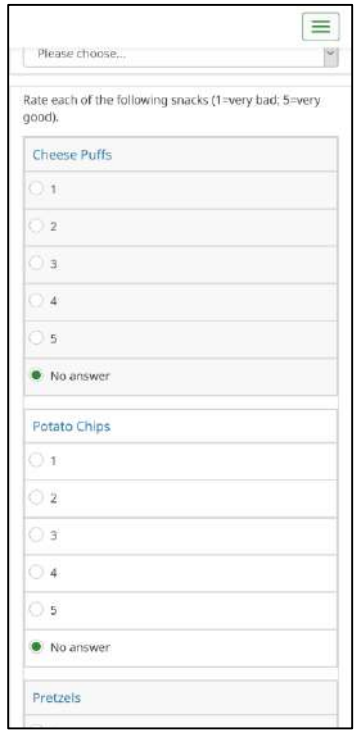


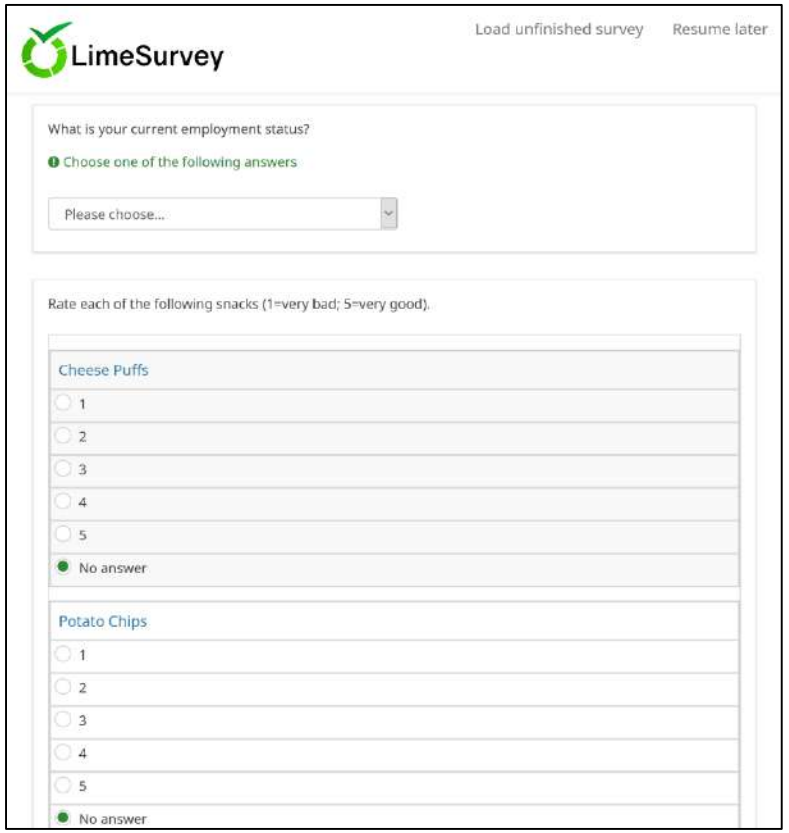
Image source: https://bit.ly/2znHj29

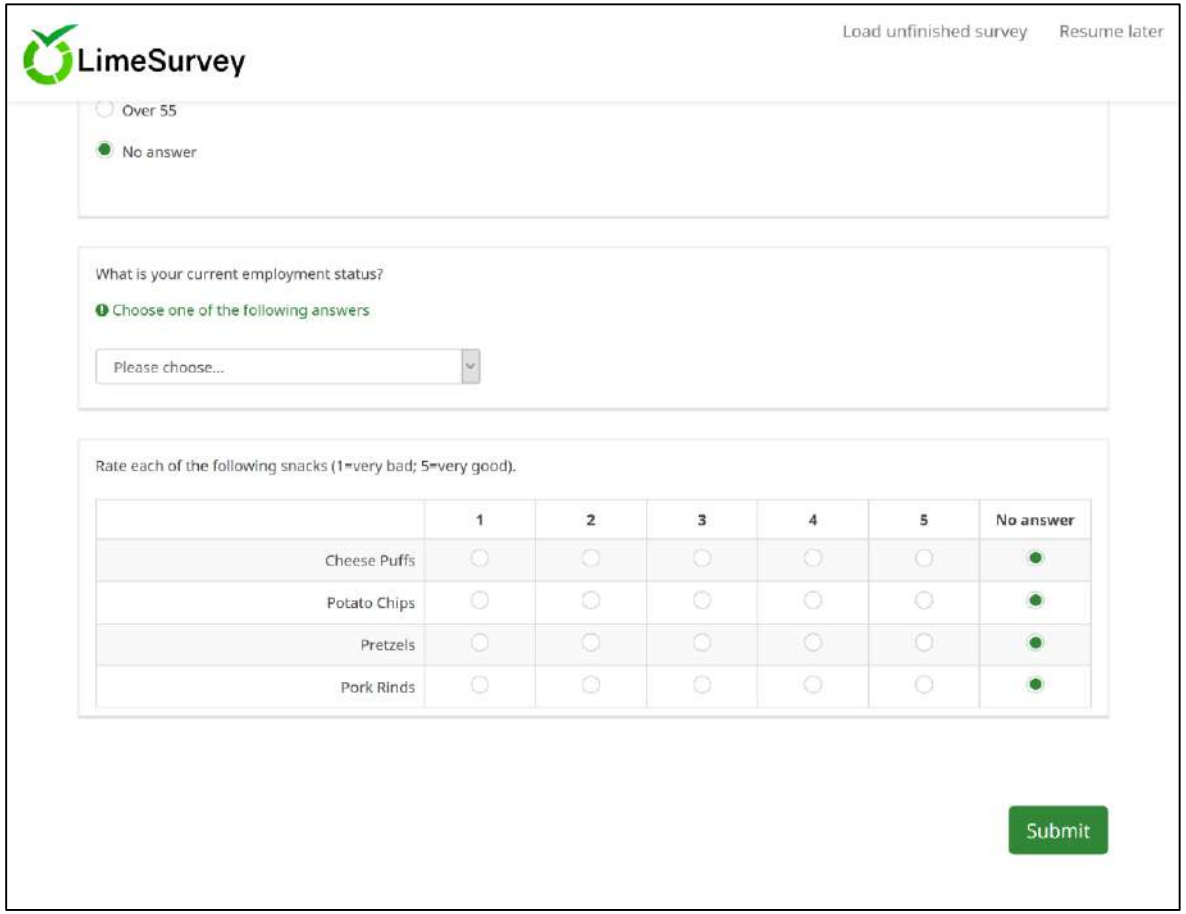
Example

Screen width

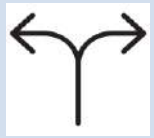
<768 px Phones → 768-1024 px Tablets → >1024 px PCs







Detect features of the device being used by the respondent



Deliver the appropriate design for their device in real-time

Design the mobile version to be effective on their device

Designing Effective Mobile Web Questionnaires

- **What does a questionnaire that is truly "optimized" for smartphones look like?**
- Several key design decisions related to:

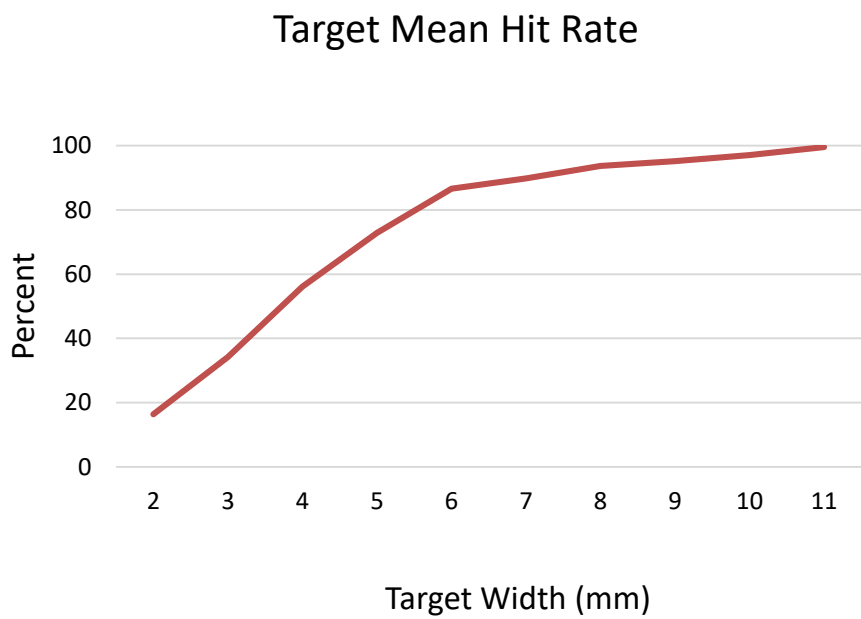
  Screen design and layout
  - Touch target sizes
  - Fitting content to the width of the screen
  - Method of displaying questions: scrolling vs. paging…

  Question types
  - Single-choice
  - Text-entry
  - Drop boxes
  - Grids…

  Length of questions/questionnaire

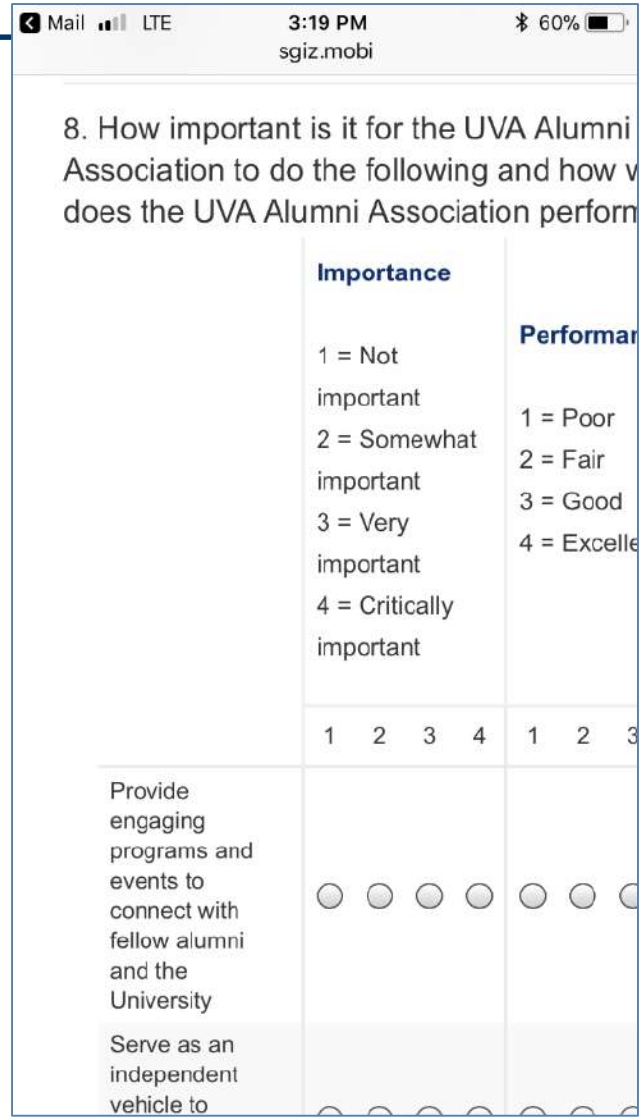
Touch Target Sizes

- Size of 10mm x 10mm considered standard for web design
  - www.nngroup.com/articles/touch-target-size
- Wang et al. (2018)
  - Measured touch errors as older adults tapped circle on iPhone screen
  - Varied size and location of target
  - 200+ trials per participant
- Larger targets reduce touch errors
- Gains level off at 6mm in diameter/width
- Large sizes may be appropriate for targets are frequently touched (*NEXT* button)



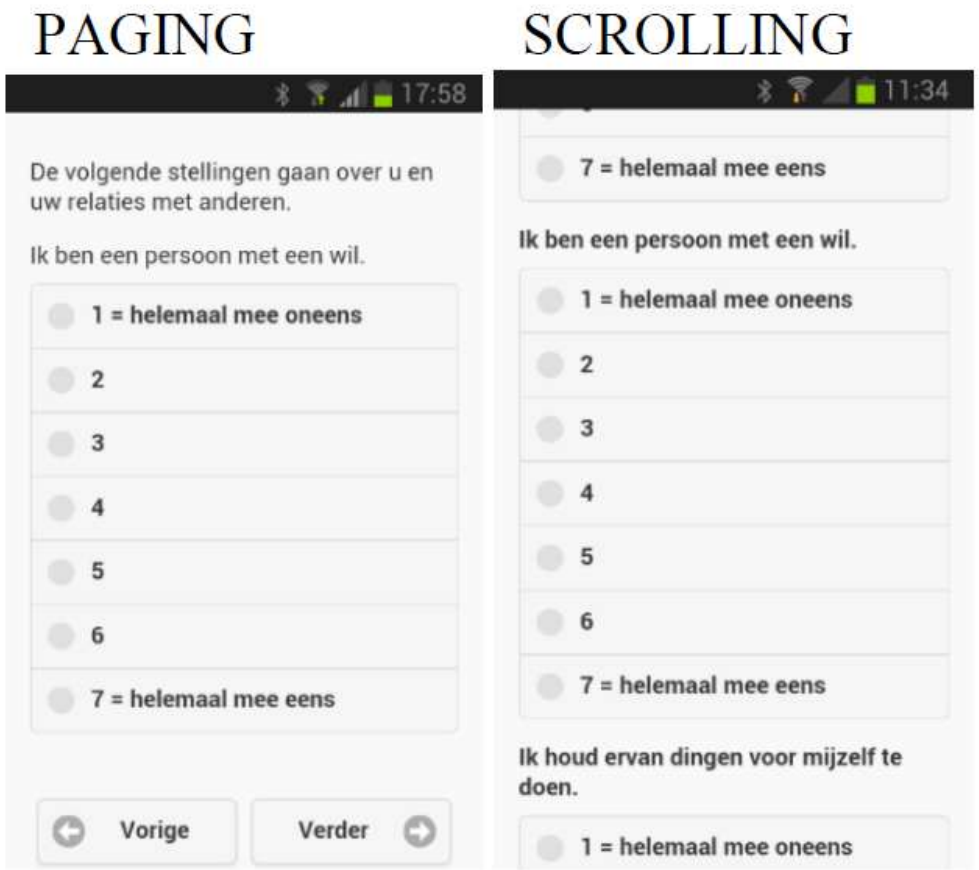
Fitting Content to Width* of Screen

*"Width" when phone is held upright, not sideways
  - Few people hold phone in landscape mode (naturally, or when asked)
- Why important?
  - Respondents show less willingness to scroll horizontally than vertically if portion of question spills off the screen (e.g., Stapleton 2013; de Bruijne & Wijnant 2014).
- Hard to do for questions with large numbers of response options and/or long labels that are displayed horizontally
- Design solution:
  - "Wrap" text in question stem
  - "Stack" response options



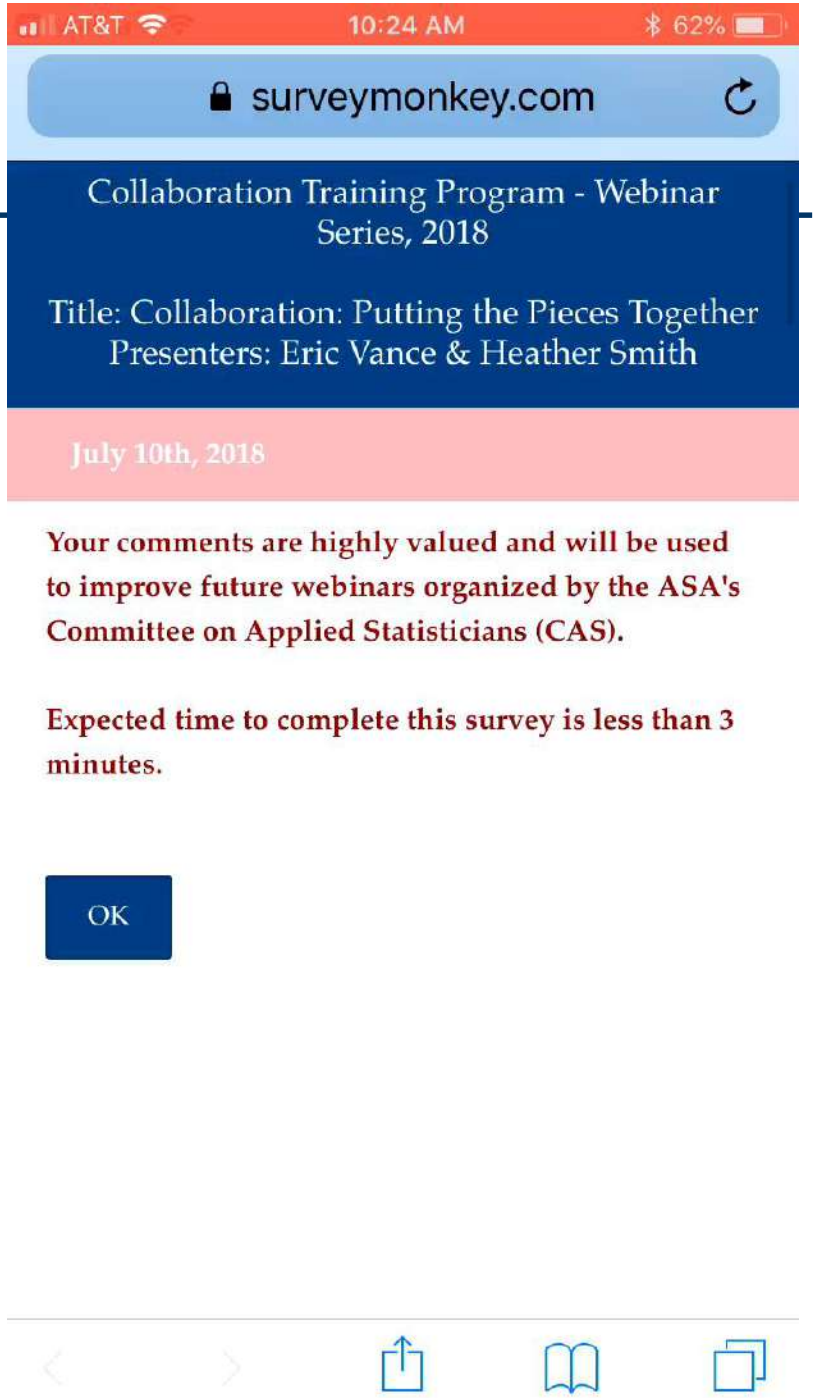
Paging vs. Scrolling Design

- Scrolling design seems to be efficient
  (Mavletova & Couper 2014; de Bruijne & Wijnant 2014)
  - scrolling time < time involved in tapping *NEXT* button and loading each new page
  - Making page size manageable
    - Periodic page breaks
    - Visual separators between questions?
    - Bolding question stems?
  - Scrolling design is less practical with skips



Automated Navigations

- Next question is automatically displayed after answer is selected
- Automatic paging
  - de Bruijne (2015) finds substantially more missing data: "some respondents seemed not to understand that the survey had automatically moved on to the next item"
- Auto-scrolling is more effective?
  - see video

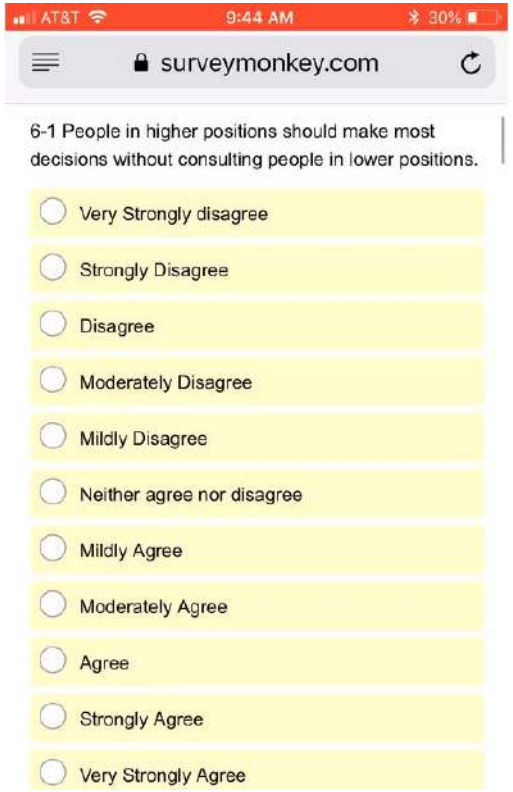


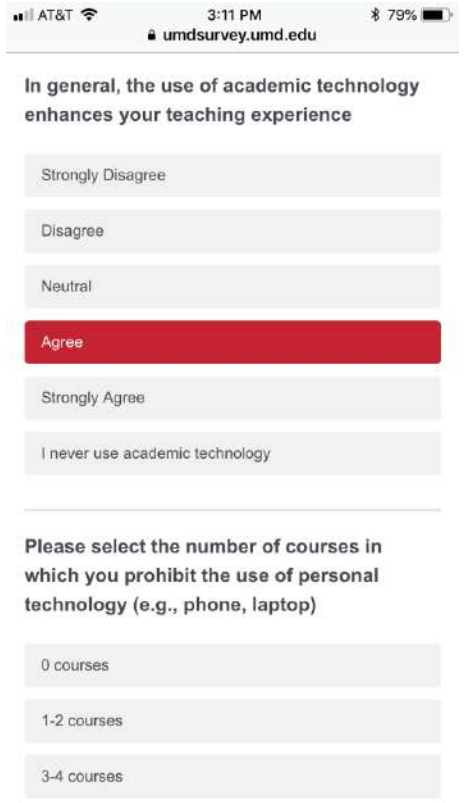
Other Layout Considerations

- Font sizes
  - Using larger fonts to promote easy reading of questions
- Maximizing available screen space
  - Avoiding large logos/images, headers, and progress bars leaves more open screen space
- Design and placement of *NEXT* and *PREVIOUS* button
  - Making it only visible at the end of the page rather than always visible

Question Types - Radio buttons/check-boxes

- No apparent UX problems if sufficiently large
- Response behavior same as in PC Web (across 8 studies)
- Several different design options:





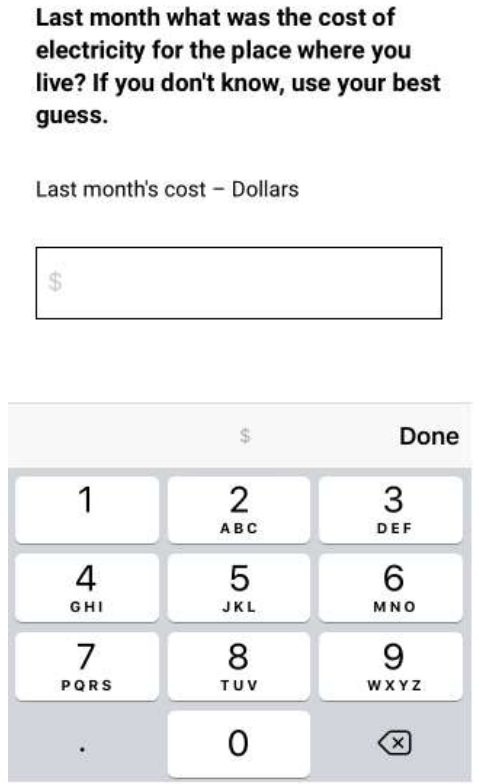
Source: Nichols (2017)

Design of Response Options

- Antoun et al. (2017) compared four designs
  - Larger icons produced shorter completion times and improved tapping accuracy
  - Wide button yielded no addition benefit but also not harm
  - Participants preferred two designs with larger icons

Text Boxes

- Mixed evidence: respondents type fewer characters in mobile (6 studies); type at least as much as in PC Web (6 studies)
  - Should be limited according to survey software companies
    - https://bit.ly/2PQnuag
    - https://bit.ly/2LxtC97
  - Depends on type of open question?
- Recommendation: keypad that appears should allow the respondents to enter the information that's requested
  - Numeric entry boxes: respondents prefer if numeric keypad opens rather than full (alphanumerical) keypad (Wang et al. 2018)



Source: Wang et al. (2018)

Drop Boxes

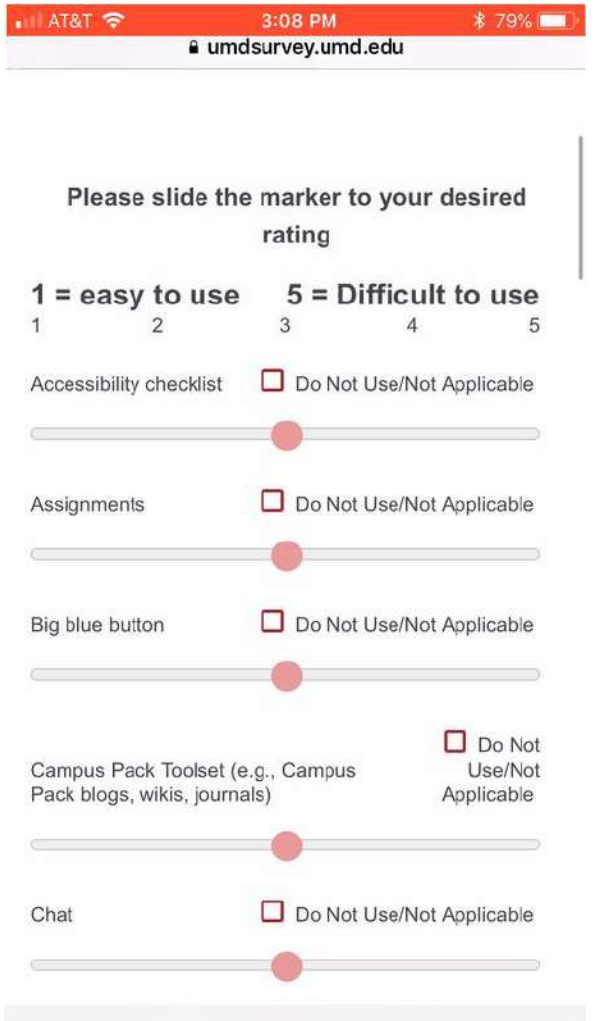
- Rendered as “picker” wheels OR “spinner” lists
- Pickers have lots of issues…
- Nichols et al. (2017)
  - compared pickers, spinners, and radio button/keyboard entry
  - Completion time per questions: 21, 15, 13
  - Screen touches per questions: 6.5, 3.5, 2.6
- More effective in certain situations?
  - Entire list can be anticipated by respondents before selecting the drop box
  - List follows a natural order
  - Response categories have short labels

iPhone picker

Android spinner

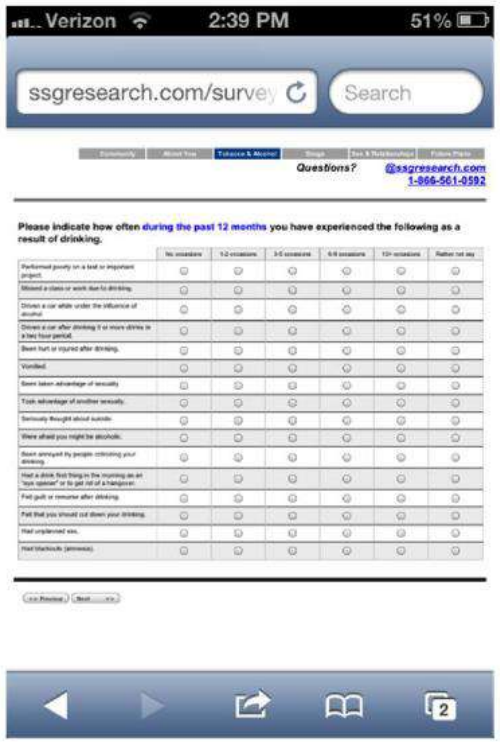
Sliders

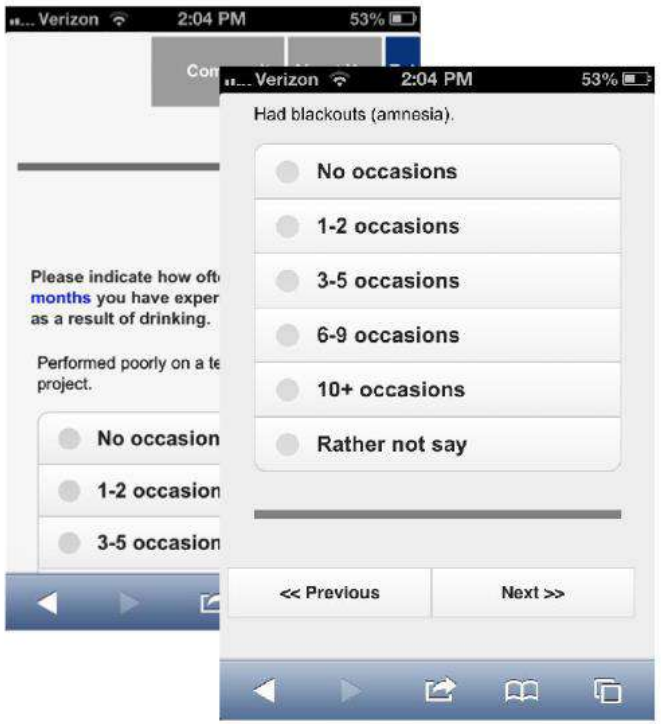
- Another widget used to conserve screen space
- Slider bar is short when displayed horizontally
- Some papers have compared sliders on smartphone and PCs (Buskirk et al 2015; Funke 2016)
- Generally harder to use on smartphones
  - Increased breakoffs
  - Less precise answers
- More effective when respondents are moving it to a general region rather than a precise location?



Grids

- As effective as on PCs when scale is short (i.e. small number of scale points and short scale labels) (e.g., Mavletova et al. 2017)
- Not as effective is scale is long
- A way of dealing with long grids is to present the rows as individual items

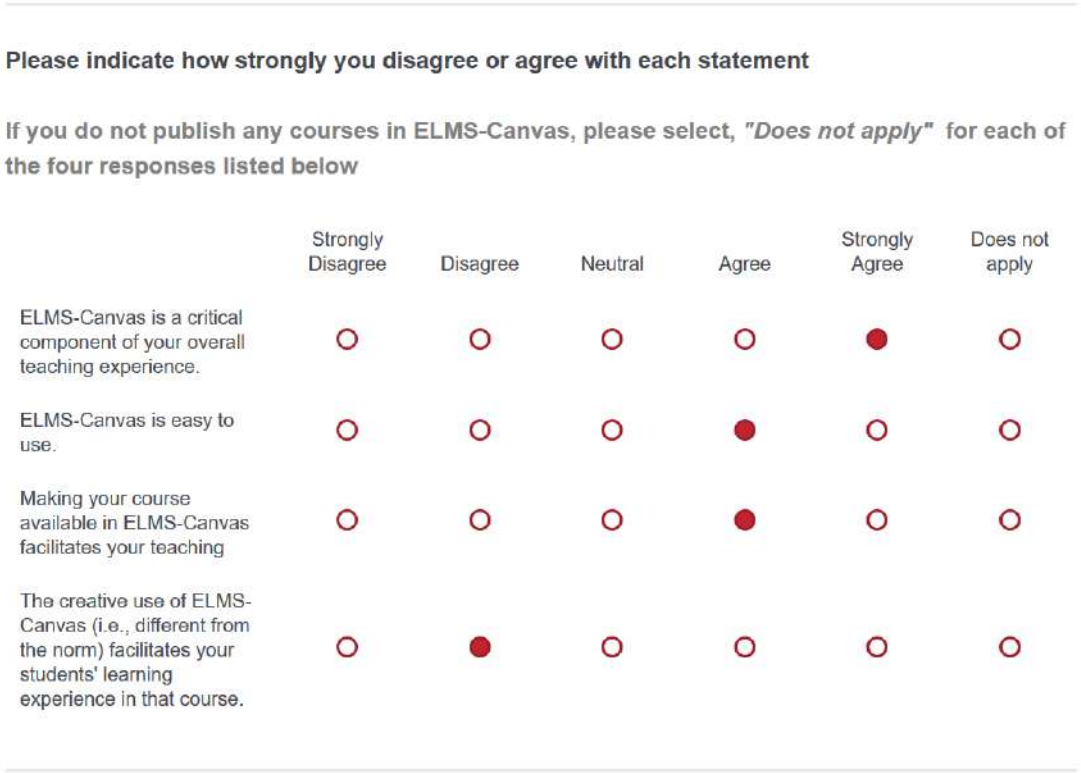




(McClain and Crawford 2013)

Accordion Grids

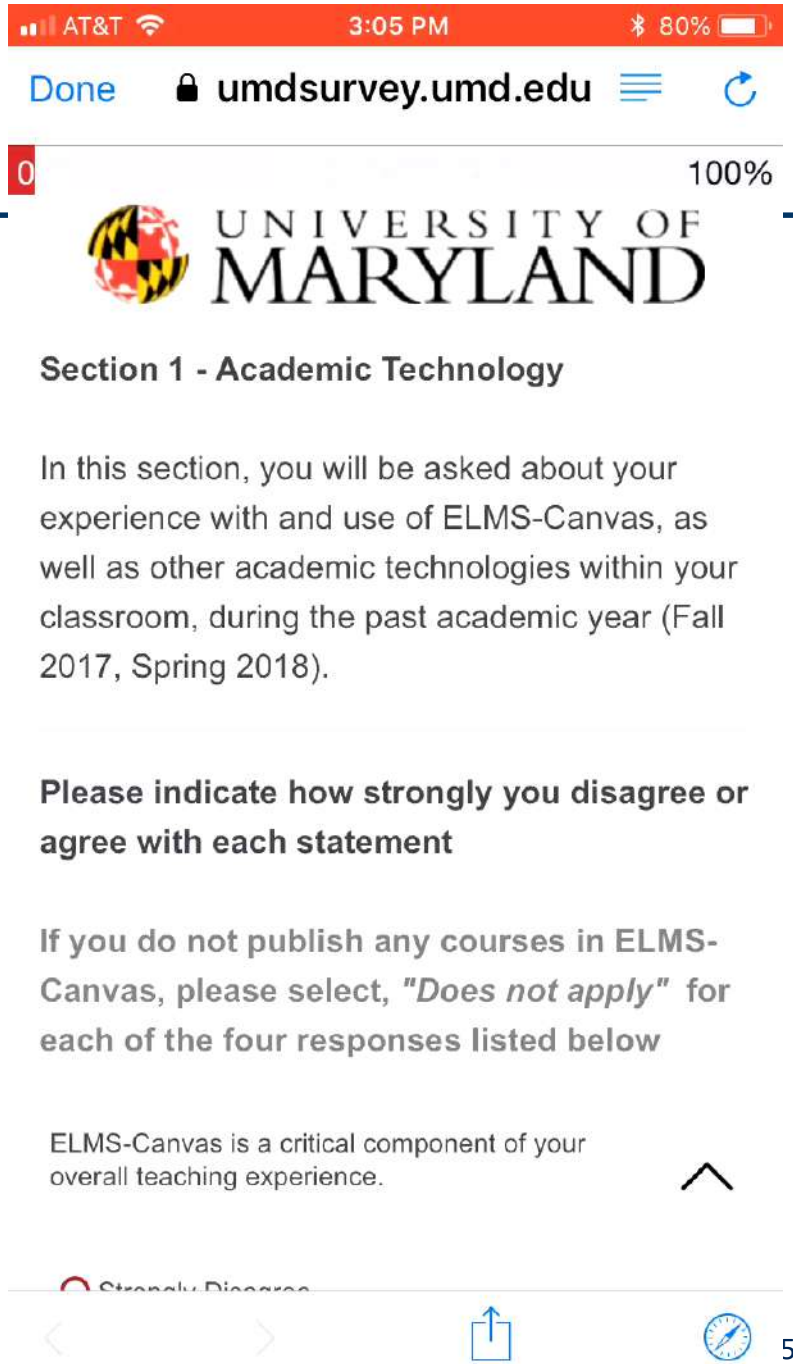
- Expands in place to reveal hidden information
  - see video
  - www.nngroup.com/articles/mobile-accordions/



Please indicate how strongly you disagree or agree with each statement

If you do not publish any courses in ELMS-Canvas, please select, *"Does not apply"* for each of the four responses listed below

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Does not apply
ELMS-Canvas is a critical component of your overall teaching experience.	○	○	○	○	●	○
ELMS-Canvas is easy to use.	○	○	○	●	○	○
Making your course available in ELMS-Canvas facilitates your teaching	○	○	○	●	○	○
The creative use of ELMS-Canvas (i.e., different from the norm) facilitates your students' learning experience in that course.	○	●	○	○	○	○

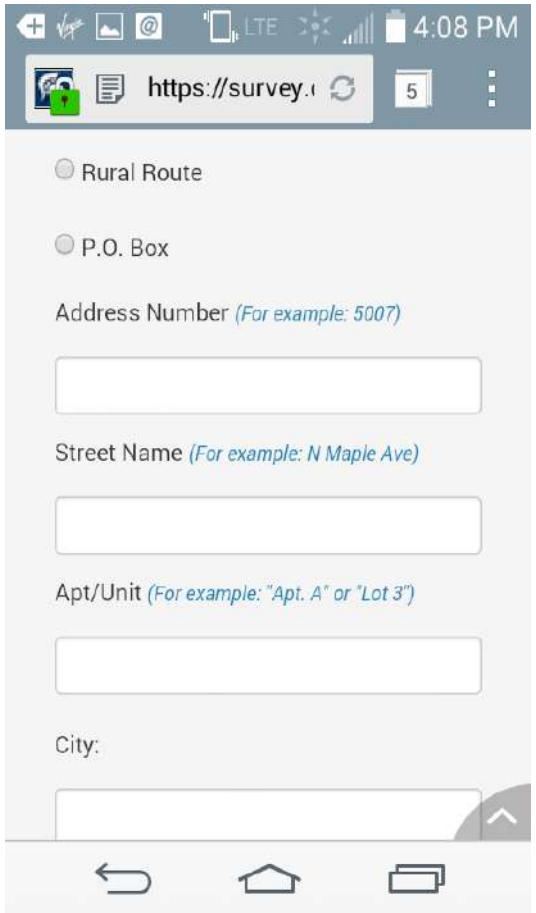


"Mobile First" Design

- Traditionally, PC version of questionnaire is designed first and then adapted for mobile users – What if this is reversed (e.g., Tharp 2015)
- Potential advantages:
  - Delivers best experience to mobile users?
  - Write shorter questions with fewer response options and shorter labels
  - Eliminates problematic question types from the start
- Potential disadvantages:
  - Delivers worse experience for PC users?
- Either way comparability across designs is priority, as is usability within each design

Recommendation: Optimize and Test!

- Test on different smartphones with real users, redesign, & repeat.
- Example issues from initial designs for Census test (Nichols 2017)



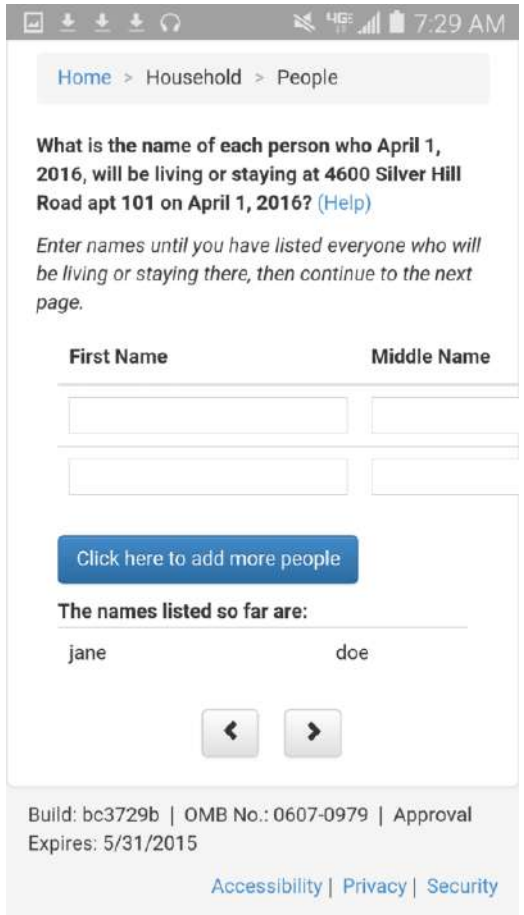


Table for Expert Review

Heuristics	Description	Evaluation
1. Readability	Text is large enough to promote easy reading	[degree to which heuristic has been satisfied]
2. Ease of selection	Touch targets are large enough to tap accurately	
3. Visibility across the page	All content is visible without horizontal scrolling	
4. Simplicity of design features	Design features are simple for respondents to use	
5. Predictability across devices	Questionnaire functions in a predictable way across different devices	

Adapted from Antoun et al. (2018)

Next Steps

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AAPOR 74th Annual Conference
Portal Session: Mobile Web Surveys

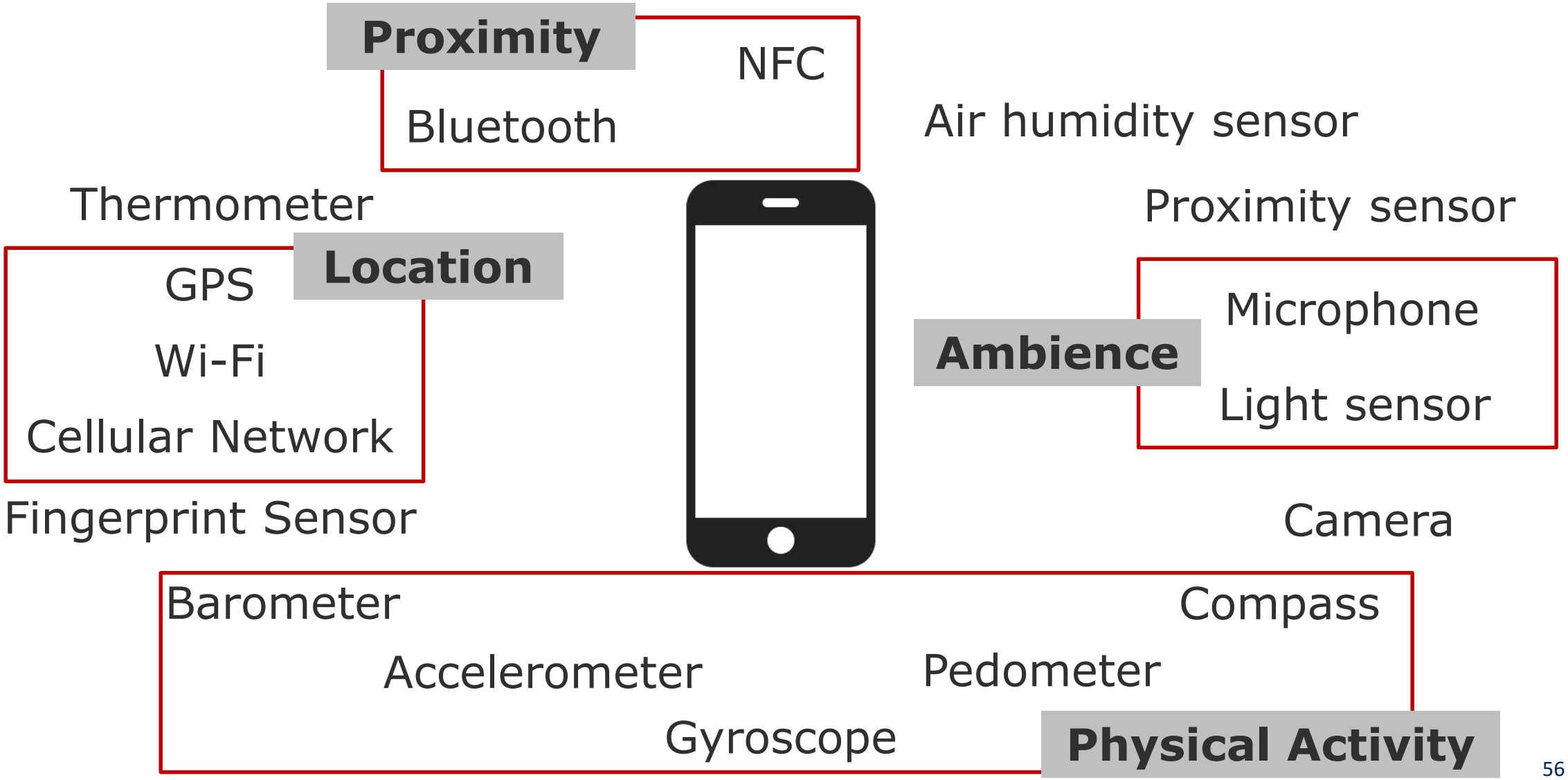
Modularizing Web Surveys

- With rise of smartphones comes need for shorter questionnaires
- One option is to modularize questionnaires into smaller "chunks"

	Between-Respondent Modularization			Within-Respondent Modularization		
Respondents	Module 1	Module 2	Module 3	Module 1	Module 2	Module 3
	Q1–Q10	Q11–Q20	Q21–Q30	Q1–Q10	Q11–Q20	Q21–Q30
Respondent A	T1	T1	—	T1	T2	T3
Respondent B	—	T1	T1	T2	T2	T3
Respondent C	T1	—	T1	T3	T3	T3

- Experiment in Dutch LISS panel (Toepoel & Lugtig 2018): normal length survey vs. survey split into 3 parts vs. survey split into 10 parts
  - Modularization produces…
    - Higher start rates but also higher dropout rates
    - Less missing information
    - More use of smartphone to complete survey
    - Fewer item missings and satisficing

Native Smartphone Sensors



Benefits of Passive Smartphone Data Collection

- Compared to surveys, passive mobile data collection has potential to…
  - …provide richer data
  - …decrease respondent burden
  - …reduce measurement error (e.g., Boase and Ling 2013, Scherpenzeel 2017)

- Smartphone sensor data have many characteristics of Big Data
  - Large volume, high velocity, variety of data formats

- Combining passive smartphone data collection with self-reports introduces "design" to Big Data

Challenges of Passive Mobile Data Collection

- Undercoverage
  - See discussion above
- Nonparticipation
  - Lower hypothetical willingness for passive tracking than actively completing tasks (Keusch et al. in press; Revilla et al. 2016, 2018; Wenz et al. 2019)
  - Actual download rates around 16% in panel surveys (Kreuter et al. 2018; Jäckle et al. 2019)
- Measurement
  - Sensor-based errors, missing data, erroneous data, problem of inference
- Ethics & data protection
  - Providing GDPR-compliant consent
  - Sometimes users do not understand what/how data are collected

Thank You!

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