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# MAP ACADEMY

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Methodology, Analytics & Psychometrics



## Developing Better Questionnaires and Measures: Constructing and Testing the Instrument

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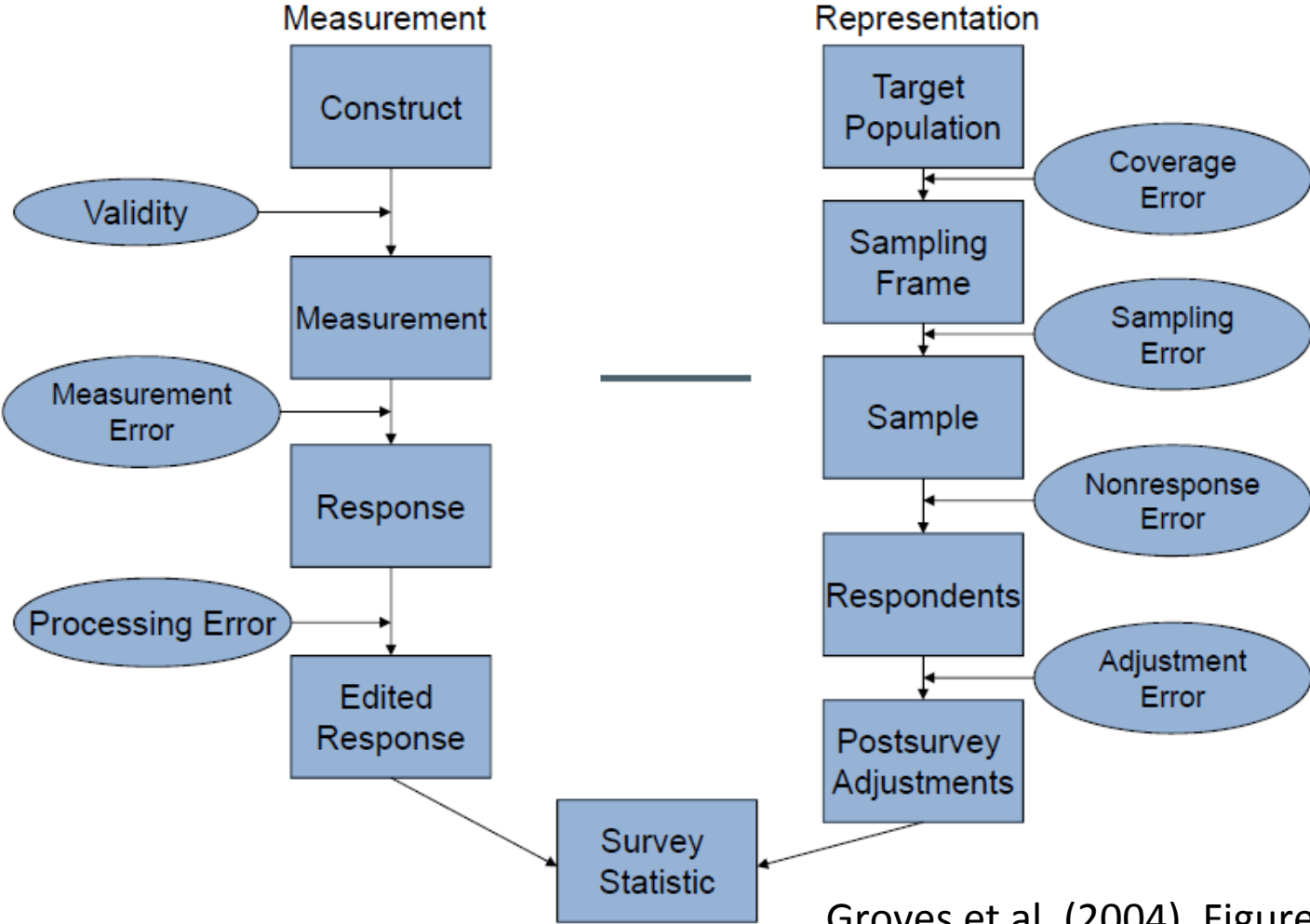
# Outline

- Questionnaire/measurement development process
- Good communication
- Writing Questions
- Visual Design
- From a set of questions to a questionnaire
- Pretesting methods



# THE INSTRUMENT DEVELOPMENT PROCESS

# Total Survey Error



Groves et al. (2004), Figure 2.5

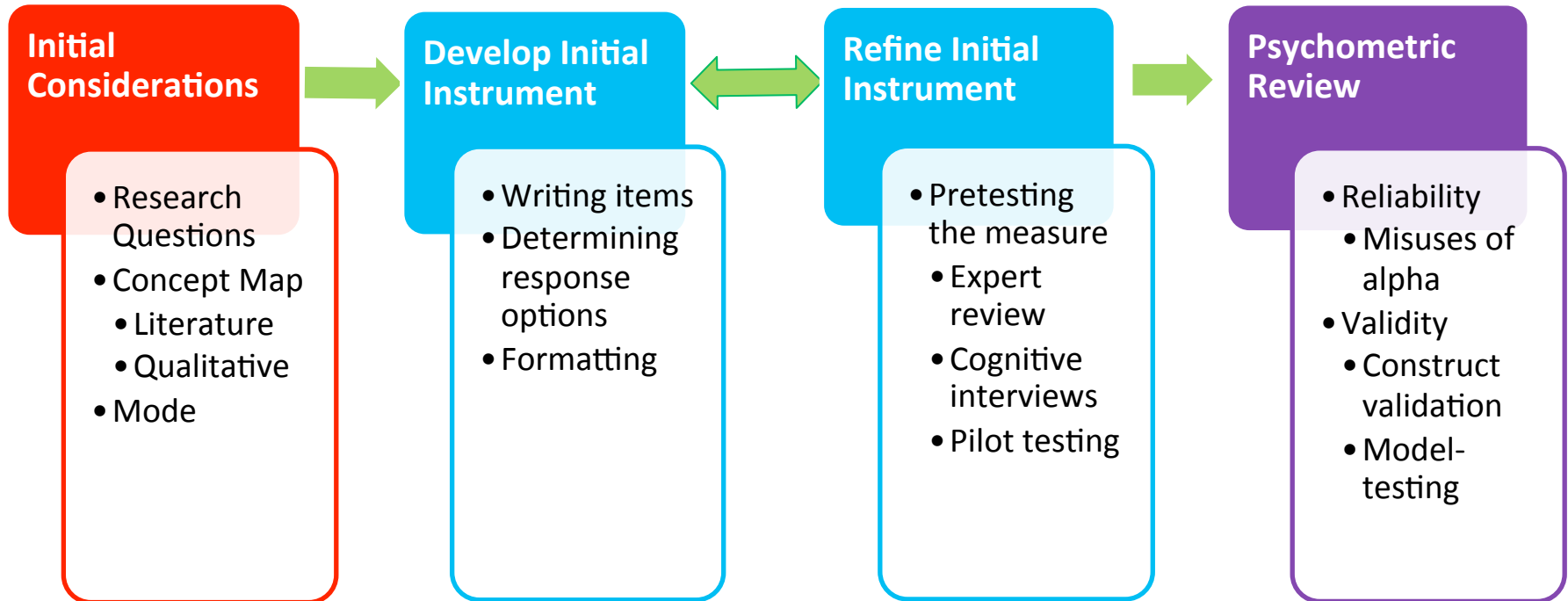


# What does measurement error look like?

- Respondent does not understand the question
- Respondent cannot retrieve the information asked
- Respondent's answer does not map onto available response options
- Shallow processing of question stem or response options
  - Primacy effects (pick first acceptable response)
  - Recency effects (pick most recent acceptable response)
- Over- and under-reporting
- Acquiescence
  - Tendency of respondents to agree to a proposition
- Social desirability
  - Respondents may give answers that are more socially acceptable rather than the true answer



# The instrument development process



# Good instrument development

- Accurately reflects construct(s)
- Optimizes the response process for respondents
- Aligns with the analytical plan
- Minimizes measurement error
- Reduces post-processing costs (e.g., coding, reformatting)



# General Strategies

- Consider the target population
  - Reading level
  - Cultural issues and translation needs
- Enact quality initiatives
  - Establish a questionnaire design team
    - Include substantive experts, measurement and statistical methodologists, survey methodologists, cultural and/or language representatives
  - Review existing literature and studies for question wording
  - Document and justify your instrument modifications and design decisions
  - Pretesting





# COMMUNICATION AND COGNITION

# Elements of good communication

- The logic of conversation
  - What speakers and listeners expect in conversation
- Grice's Four Maxims (Schwarz, 1996)
  1. **Maxim of Manner:** avoid obscurity & ambiguity, be clear & brief, take characteristics of population into account.
  2. **Maxim of Relation:** make relevant contributions.
  3. **Maxim of Quantity:** make contributions as informative as required, but not more informative than required.
  4. **Maxim of Quality:** do not say what you believe to be false, do not say for which you lack evidence.



# Cognitive Response Model

- Psychology of Survey Response (Tourangeau et al., 2000)
  - Cognitive steps to complete a question
    1. Perception
    2. Comprehension
    3. Retrieval
    4. Judgment
    5. Reporting



# Psychology of Survey Response

## 1. Perception

- Can the respondent perceive the question?
- Issues
  - Visual/hearing impairments, visual clutter
- Recommendations
  - Use visual design to reduce respondents' level of effort



# Psychology of Survey Response

## 2. Comprehension

- Does the respondent understand what is being asked of them?
- Issues
  - Double-barreled questions, jargon, vague terms (e.g., sometimes), idioms
  - Violations of Maxims of Quantity (be informative as possible) and Manner (be clear)
- Recommendations
  - Ask one question at a time
  - Be very specific
  - Keep language simple and use terminology familiar to the target population



# Psychology of Survey Response

## 3. Retrieval

- Can the respondent recall the appropriate information?
- Issues
  - Long retrieval periods, lack of retrieval cues, fast pace
  - Violations of Maxims of Quantity (be informative as possible) and Manner (be clear)
- Recommendations
  - Use specific reference timeframes
  - Provide retrieval cues
  - Allow respondents sufficient time to engage in recall processes
    - Recall-and-count, rate-based estimation, rate-based impression



# Psychology of Survey Response

## 4. Judgment

- Will the respondent alter their answer in any way?
- Issues
  - Social desirability, acquiescence, inability to retrieve, ordering effects
  - Violate Maxim of Relation (be relevant)
- Recommendations
  - For sensitive topics, use self-administered modes (e.g., web or mail)



# Psychology of Survey Response

## 5. Reporting

- Can the respondent map their response to a given response option?
- Issues
  - Lack of appropriate response options, vague response options, scale label effects, scale range effects
  - Violate Maxim of Manner (take characteristics of population into account), Relation (provide relevant information), Quality (be informative as possible)
- Recommendations
  - Provide relevant response options
  - Use open-ended boxes when unsure of distributions
  - Provide “other (specify)” if response options are not exhaustive
  - Always pretest the instrument!





# Summary: Designing Instruments

- Work with a team
- To reduce avoidable measurement error
  - Understand respondent expectations and how they process questions
  - Foresee problematic areas
  - Consider each question from several respondents' perspectives
- Document and justify every decision



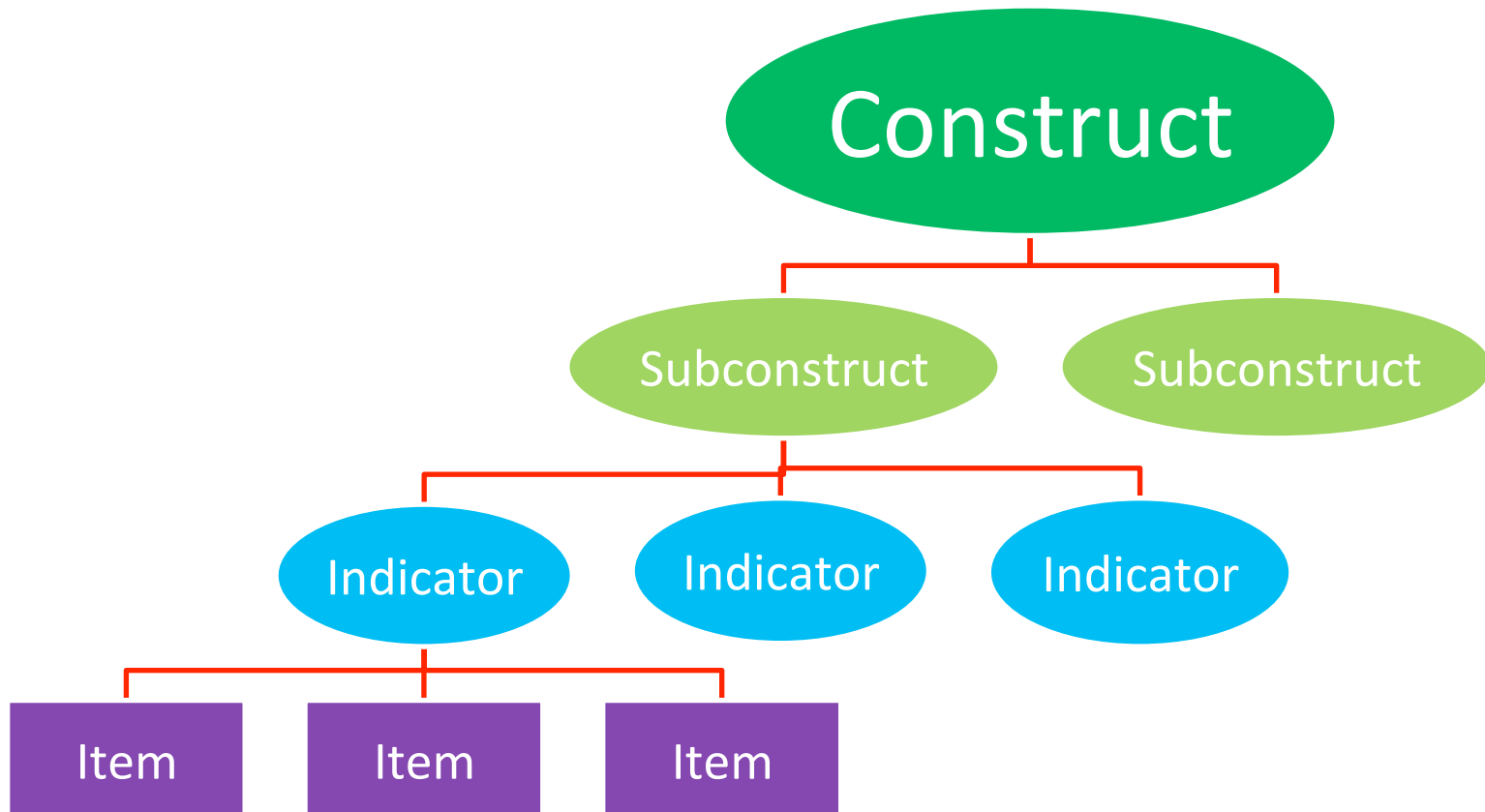
# WRITING QUESTIONS

# Writing Questions

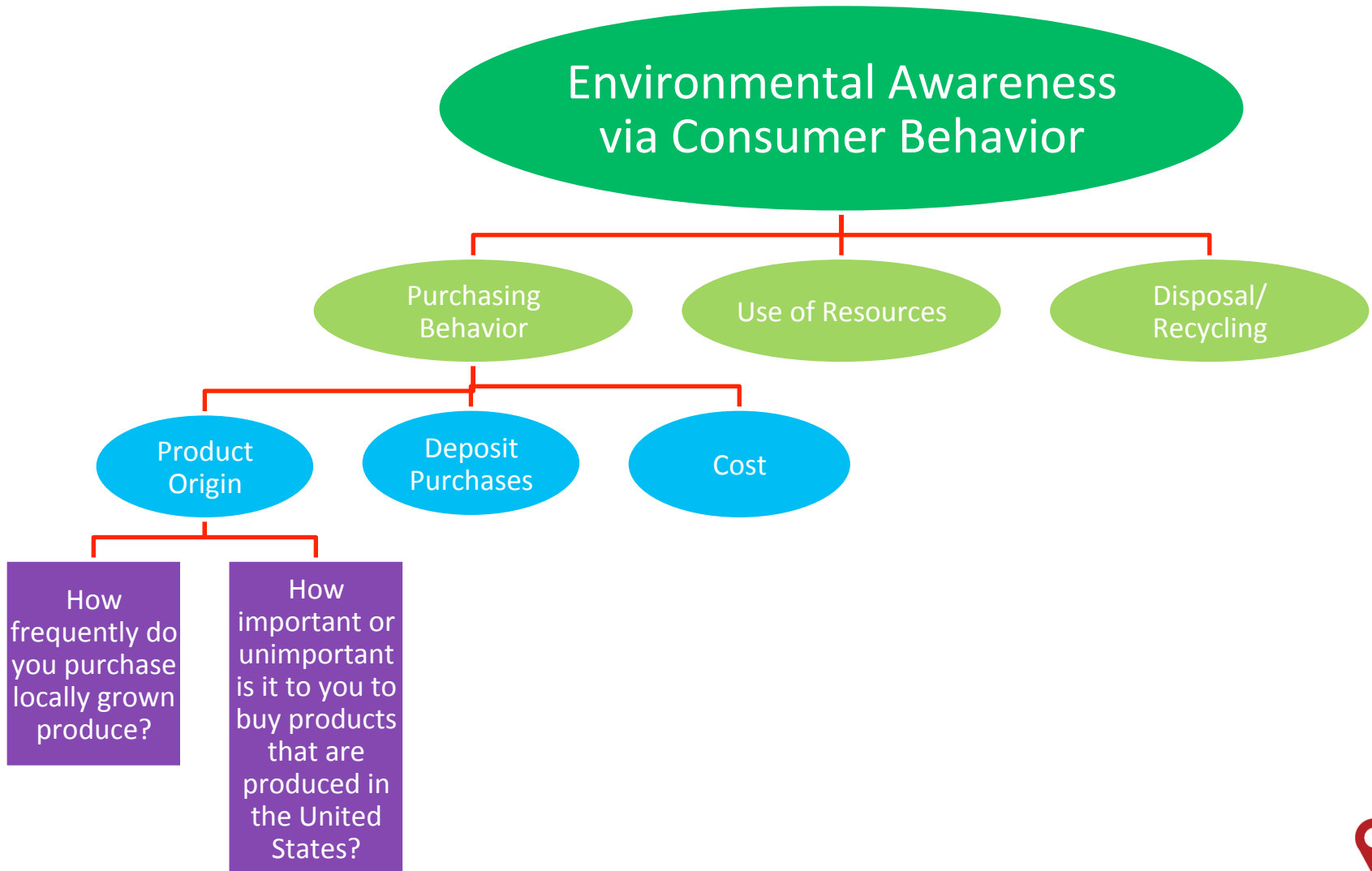
- Concept map
- Level of measurement
- Types of Questions
- Choosing an appropriate response format



# Concept Map



# Example Concept Map



# Writing Questions

- The concept map to create a blueprint
  - Number of items for each construct
- Level of measurement
  - Refine your analytical plan
    - Qualitative (text)
    - Quantitative (nominal, ordinal, interval, ratio)
  - Degree of precision



# Writing Questions

- Degree of precision needed

**What is your age?**

Years

**How old are you?**

Number of years

**In which year were you born?**

Year

**What is your birthdate?**

/  /

MM/DD/YYYY



# Writing Questions

- Types of Questions
  - Knowledge
  - Behavior frequency
  - Attitudinal
  - Socio-demographic





# Knowledge Questions

“Antibiotics kill viruses as well as bacteria. (Is that true or false?)”

“According to the theory of evolution, human beings, as we know them today, developed from earlier species of animals. (Is that true or false?)”

“In your opinion, what are the symptoms of breast cancer?”



# Knowledge Questions

- Uses
  - Determine the public's knowledge or awareness
  - Screen and/or classify respondents
  - Explain behavior
- Considerations
  - Guessing
  - Cheating
- Recommendations
  - Reduce the threat
  - Consider whether the difficulty is appropriate
  - Ask multiple items
  - Avoid in self-administered modes
  - Use open-ended responses to eliminate guessing



# Behavioral Questions

“During the past 12 months, how often have you done each of the following things: allowed a stranger to go ahead of you in line?”

“How many hours of TV do you watch in a typical week?”



# Behavioral Questions

- Uses
  - Measure behavior or events experienced, count events
- Considerations
  - Respondents can be influenced by scale values and/or midpoints
- Recommendations
  - Make the question as specific as possible
  - Use complete sentences or questions
  - Use specific reference periods
    - “In the past 30 days, since February 6, have you visited a doctor?”
  - Ask one question at a time
    - “In the past 30 days, since February 6, have you visited a doctor or dentist?”



# Attitudinal Questions

“Are you in favor of the death penalty for persons convicted of murder?”

“To what extent do you agree or disagree that the use of marijuana should be legalized?”



# Attitudinal Questions

- Attitudinal Questions
  - Uses
    - Measure direction and magnitude of an opinion
  - Considerations
    - Respondents can be influenced by scale values and/or midpoints
  - Recommendations
    - Use neutral and balanced questions
    - Avoid leading words or questions
    - Avoid double negatives
    - Ask one question at a time



# Socio-Demographic Questions

“What is your age?”

“What is the highest degree you have received?”

“What is your marital status?”



# Acquiescence

- Tendency of respondents to agree with a proposition
- Recommendations
  - Provide balanced question stems
    - “Do you favor or oppose...”
    - “How likely or unlikely...”





# Sensitive Questions

- Considerations
  - Privacy
  - Social desirability
  - Item-level refusals
- Recommendations
  - Ensure confidentiality
  - Use a self-administered mode (e.g., mail or web)
  - Emphasize accuracy



# Response Formats

- Considerations
  - Planned analyses
  - Desired level of precision
  - How much you know about the issue
- Which response format fits best?
  - Open-ended
  - Dichotomous
  - Nominal categories
  - Scale
    - Likert scale (e.g., Strongly Agree to Strongly Disagree)
    - Rating scale (e.g., Very likely to Very Unlikely)



# Open-Ended Questions

- Appropriate when
  - Distribution is unknown
  - Numerical answers
  - You want explanatory information (e.g., why, how)
- Considerations
  - More burdensome for respondents
  - Costly to code and analyze
  - Box size influences length of response
  - Label boxes with appropriate units and desired formatting (e.g., MM/DD/YYYY)



# Response Formats

- Nominal
  - Use when
    - Categories are unordered
  - Considerations
    - If options are not exhaustive, allow for additional responses

## What is your marital status?

- Never married
- Married
- Separated
- Divorced
- Widowed

## What is your race? *Mark all that apply.*

- Asian
- American Indian or Alaskan Native
- Black or African American
- White
- Other (specify)



# Response Formats

- Ordinal
  - Use when
    - Categories have inherent ordering
  - Considerations
    - Ensure categories are mutually exclusive

**How often do you find your work stressful?**

- Always
- Sometimes
- Never



# Response Formats

- Likert Scale
  - Uses
    - Measure intensity of an adjective
      - “How satisfied or dissatisfied are you...”
  - Issues
    - Balanced scales
    - Non-labeled options
    - Middle category
  - Recommendations
    - Label each option
    - Separate “Don’t Know” and “Not Applicable” options from scale



# Frequency Scales

How often do you find your work to be stressful?

- Never
- Rarely
- Occasionally
- Regularly

How many times did you find your work to be stressful in the last 30 days?

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10 or more

In the last 12 months, how often did you find your work stressful?

- Not at all
- A few times
- About once a month
- About once a week
- More than once a week

- Avoid vague quantifiers
- Specify a reference period
- Response options combine counts and time



# Question Stem Issues

- Race and ethnicity are not the same
  - Ethnicity is cultural

**What is your race?** *Mark all that apply.*

- Asian
- American Indian or Alaskan Native
- Black or African American
- Hispanic
- White
- Other (specify)

**Are you Hispanic or Latino?**

- Yes
- No

**What is your race?** *Mark all that apply.*

- Asian
- American Indian or Alaskan Native
- Black or African American
- White
- Other (specify)





# Response Format Issues

- Midpoints
  - Odd number of response options provides a neutral, middle category
  - Issues
    - Respondents use all information available to them when responding
      - Assume these represent “normal” or “average”
  - Recommendations
    - When unsure, use an open-ended box



# Response Format Issues

- Number of scale points
  - How many points should a scale have?
  - Issues
    - Few points provide limited information
    - Many points are burdensome for respondents
  - Recommendations
    - 4-7 points
    - Label each point



# Response Format Issues

- Vague quantifiers
  - Non-specific terms used for frequency
  - Issues
    - Terms mean different things to different people
  - Recommendations
    - Avoid using whenever possible

10. How often do you find your work stressful?

- Always
- Often
- Sometimes
- Hardly ever
- Never



# Check-all-that-apply vs. Forced Choice

Which leisure pastimes do you enjoy? *Check all that apply.*

- Reading
- Biking
- Playing video games
- Hiking
- Swimming
- Basketball
- Football
- Other (specify)

Do you enjoy the following leisure pastimes?

	<u>Yes</u>	<u>No</u>
Reading	<input type="checkbox"/>	<input type="checkbox"/>
Biking	<input type="checkbox"/>	<input type="checkbox"/>
Video games	<input type="checkbox"/>	<input type="checkbox"/>
Hiking	<input type="checkbox"/>	<input type="checkbox"/>
Swimming	<input type="checkbox"/>	<input type="checkbox"/>
Basketball	<input type="checkbox"/>	<input type="checkbox"/>
Football	<input type="checkbox"/>	<input type="checkbox"/>

- Forced choice formats encourages deeper processing Smyth et al. (2008)
- Results cannot be compared across these two questions



# Question Stems

- Recommendations
  - Use clear, familiar terminology with unambiguous meanings
  - Ask one question at a time
  - Questions should be neutral and balanced
  - Adopt or adapt demographic questions from well-established surveys



# Response Formats

- Recommendations
  - Response options should match question stem
  - Scales
    - Use specific labels and label each option
    - Use realistic and relevant ranges
  - Avoid reverse-coded items (flipped scale)
  - Provide balanced scales
  - When in doubt, ask as an open-ended question



# Summary: Question Writing

- Develop all components together
  - Question stem
  - Response formats
  - Add instructions where necessary (e.g., skip instructions, mark all that apply)
  - Visual design elements
- Reevaluate each question
  - Consider different respondent profiles



# VISUAL DESIGN



# Visual Design

- Influences how respondents perceive and recognize patterns (Jenkins & Dillman, 1997)
  - Help respondents cognitively process the survey
- Make the respondent's task easier (Dillman et al., 2005)
  - Establish a clear navigational path
  - Create patterns to reduce respondent burden
    - Distinct usage of stylistic property, such as boldface
    - Use styling elements consistently to reinforce instructions



# Visual Design

- Recommendations for question stems (Dillman et al., 2005)
  - Create natural groupings of questions on each page
  - Establish a connection between question stems to response options by locating all question elements with 8-10 character range
  - Establish simple, consistent, and regular purpose for each styling property (e.g., boldface, italics and underlining)
    - Ex. Italics are used only for instructions and not for any other purpose
  - Place instructions where they are needed



# Visual Design

- Recommendations for response formatting
  - Boxes
    - Use boxes appropriately sized for the format of information requested (Couper et al., 2008)
    - Rounded boxes promote positive visceral processing, which appeals on an emotional level (Dillman et al., 2005)
    - Label the response boxes to reinforce the format of response desired (e.g., MM/YYYY)
  - Spacing
    - Equal spacing gives equal importance to all response options (Tourangeau et al., 2004)
    - Visually separate nonsubstantive response options such as “Not Applicable” from substantive response options to avoid influencing the perceived midpoint (Tourangeau et al., 2004)
    - Align all options vertically



# Visual Design

- Recommendations for response formatting
  - Instructions (Redline et al., 2003)
    - Use symbols such as arrows and bold typeface to direct respondents to the correct sequence

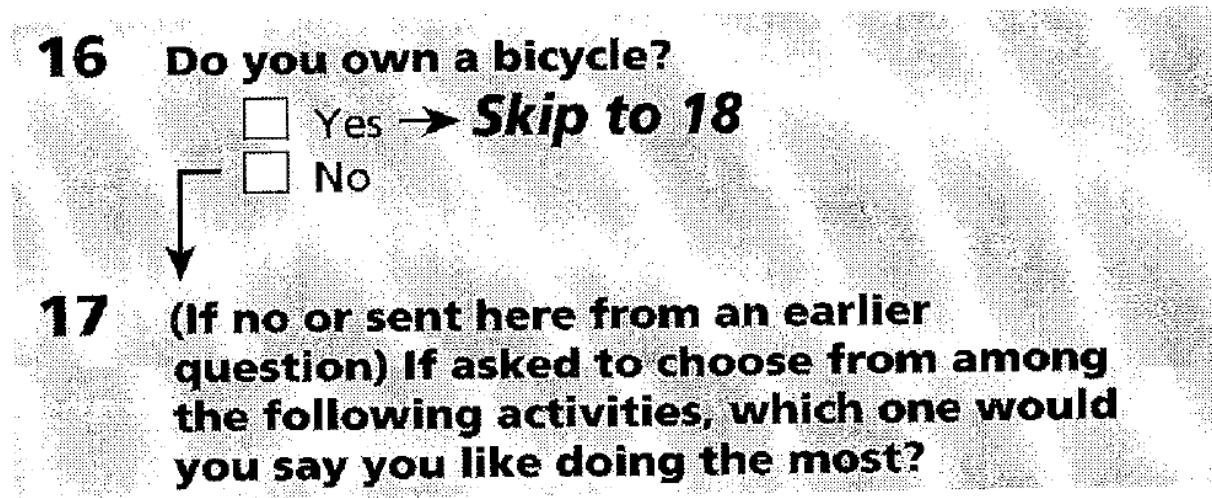


Fig. 1c. The Detection instruction from the classroom experiment



# FROM QUESTIONS TO A QUESTIONNAIRE

# From Questions to a Questionnaire

- Form sections
  - Reconcile the number of questions with the blueprint
    - Eliminate the “nice to know” questions
  - Consider possible contextual effects



# From Questions to a Questionnaire

- Contextual effects (Schuman & Presser, 1996)
  - Order effects
    - Respondents feel the need to make their answers to one question consistent with answers to a second question
  - Part-Whole contrast effects
    - Specific-general ordering creates differences compared to general-specific ordering
    - Contrast, rather than consistency
  - Part-Whole consistency
    - Marital and general happiness ordering leads to increased general happiness
    - Defines general happiness in terms of marital happiness (consistency)



# From Questions to a Questionnaire

- Ordering
  - Organize information
  - Create groupings and logical layout
  - Work on individual pieces sequentially
- Recommendations
  - Start with an easy, interesting question that applies to everyone
  - Ask factual questions before attitudinal questions on the same topic
  - Place sensitive and demographic questions near the end of the survey  
(Dillman, 2008)





# PRETESTING AND EVALUATING THE INSTRUMENT

# Methods for Pretesting

- Methods to evaluate questions and procedures
  - Qualitative techniques
    - Expert review
    - Cognitive interviews
    - Interviewer debriefing
  - Quantitative
    - Pilot testing
    - Behavior coding



# Methods for Pretesting

- Expert review
  - Review of draft materials to identify a wide variety of potential problems
    - Substantive experts
    - Methodologists
    - Analysts
    - Translators
- Cognitive interviews
  - Respondents asked to “think aloud” while completing questionnaire or measure
    - Concurrent or retrospective
    - With or without scheduled probes



# Methods for Pretesting

- Pilot test
  - Field test of instrument and procedures on a small scale
    - Examine responses for problems
    - Psychometric review
      - Reliability
      - Validity
      - Measurement invariance across subpopulations, modes or languages





## Study of Early Career Researchers

Educational  
Background

First Employment  
Position

Current  
Employment

Work Expectations

Mentoring

Funding

Future Career Plans

About You

Questions? [nsf-researchers@ssgresearch.com](mailto:nsf-researchers@ssgresearch.com)

How many months does this salary cover?

Months:

<< Previous

Next

>>

Powered by DatStat

- **Response Options**
  - The frequencies indicate a large number of 9 month salaries. Since a wide range was reported, this question is useful in its current form.



# Methods for Pretesting

- Interviewer debriefing
  - Interviewers report experiences after pilot test
- Behavior coding
  - Code interviewer-respondent interactions during pilot test to identify frequency of issues



# Summary: Pretesting

- Always pretest the instrument
- Combine multiple methods to enhance instrument quality
- Document all findings and modifications



# Next Steps

## Developing Better Questionnaires and Measures: Psychometric Review

Leslie Hawley, Ph.D.

Friday, April 3

11:30 a.m. to 1:00 p.m.

Georgian Suite, Nebraska Union

- Reliability
- Validity
- Validation procedures and approaches





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# QUESTIONS? COMMENTS?

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