Applying a Total Error Perspective to Qualitative and Quantitative Social and Marketing Research

PAPOR Short Course

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Today's Short Course

- My 20+ year background with the Total Error perspective
- Detailed overview of the Total Error perspective
- Tailoring the TE perspective for:
  - Survey Research
  - True Experiments
  - Content Analysis
  - In-depth Interviewing
  - Focus Groups
  - Participant/Observational Research
- Applying the TE perspective
  - Critical consumption of all research-based information
  - Structuring one's own writing about research findings
  - Creating RFPs and evaluating proposals
  - Organizing one's expert legal reports and testimony
  - Explaining to a client why a particular research method should be deployed
  - Creating Your Own TE Checklist
- Transparency and Disclosure and the TE perspective

The Total Error Perspective: Background and Overview

Total Error (TE) Background

- I have spent much of my 40 year research career conducting surveys (planning, implementing, and interpreting) for my organizations, my clients, and myself
- I also have spent a good deal of my career carrying out methodological studies to try to improve the quality of the data gathered by surveys
- But I also have done a good deal of qualitative work, including qualitative research as part of program evaluations of public policy social interventions
- Reading Groves' (1989) seminal book, *Survey Costs and Survey Errors*, was the first time I began to think about the value of using a "Total Error" framework/perspective/ mindset as a way to organize the planning, implementation, and analysis of any research study, be it qualitative or quantitative in nature

Total Error (TE) Background

- For the past 20+ years, I have used the TE perspective to guide all the research activities in which I have engaged
  - As a professor at Northwestern U., Ohio State U. and now as a visiting scholar at Northern Arizona U.
  - As founding faculty director of the Northwestern U. Survey Lab and the Ohio State U. Center for Survey Research
  - As VP and chief methodologist for the Nielsen company
  - As an independent consultant for a number of public sector and private sector agencies and organizations
- In all my work, I have tried to impart my belief in the value of using a TE perspective to my students, employees, clients, and even my colleagues
- I also have done this, in part, in the way I have organized the content of most of my courses, publications, and presentations

TE Background

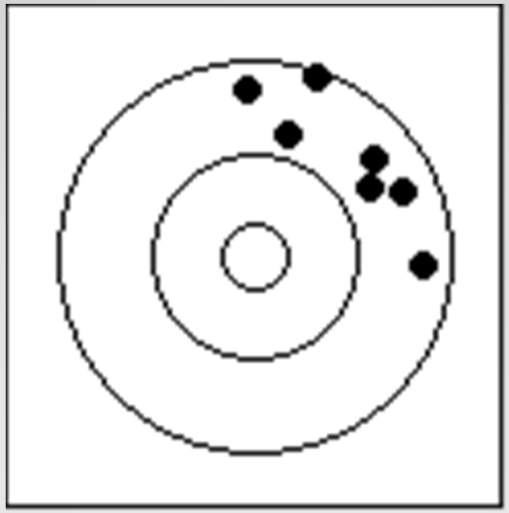
- What is the Total Error Perspective?
- "Total Error" refers to all the problems that can make the information gathered in a research study and the conclusions drawn from that study WRONG (i.e., unreliable and/or invalid)
- Thus, it refers to anything that causes the information gathered in a research study to be of questionable/limited value
  - It helps one determine when research-based information is **Not Fit for Purpose**

TE Background

- Errors in research may take the form of Bias or Variance
  - **Bias** is a directional source of error
  - **Variance** (or **imprecision**) is a nondirectional source of error

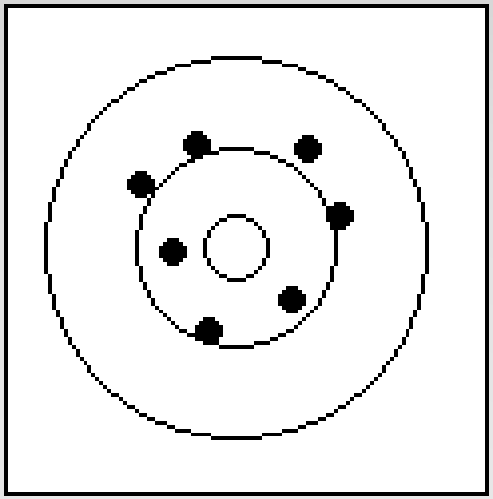
TE Background

- Archery analogy
  - Biased and imprecise (lots of variance)



TE Background

- Archery analogy
  - Unbiased but imprecise (lots of variance)



TE Background

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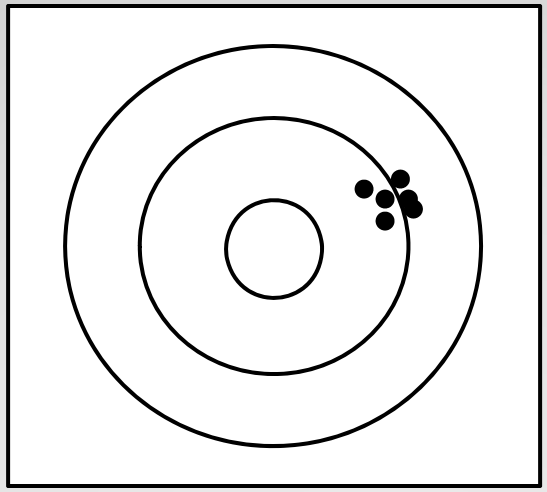
  - Biased but precise (little variance)



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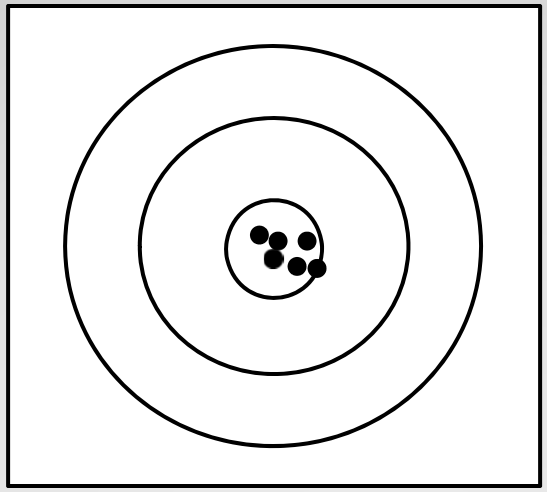
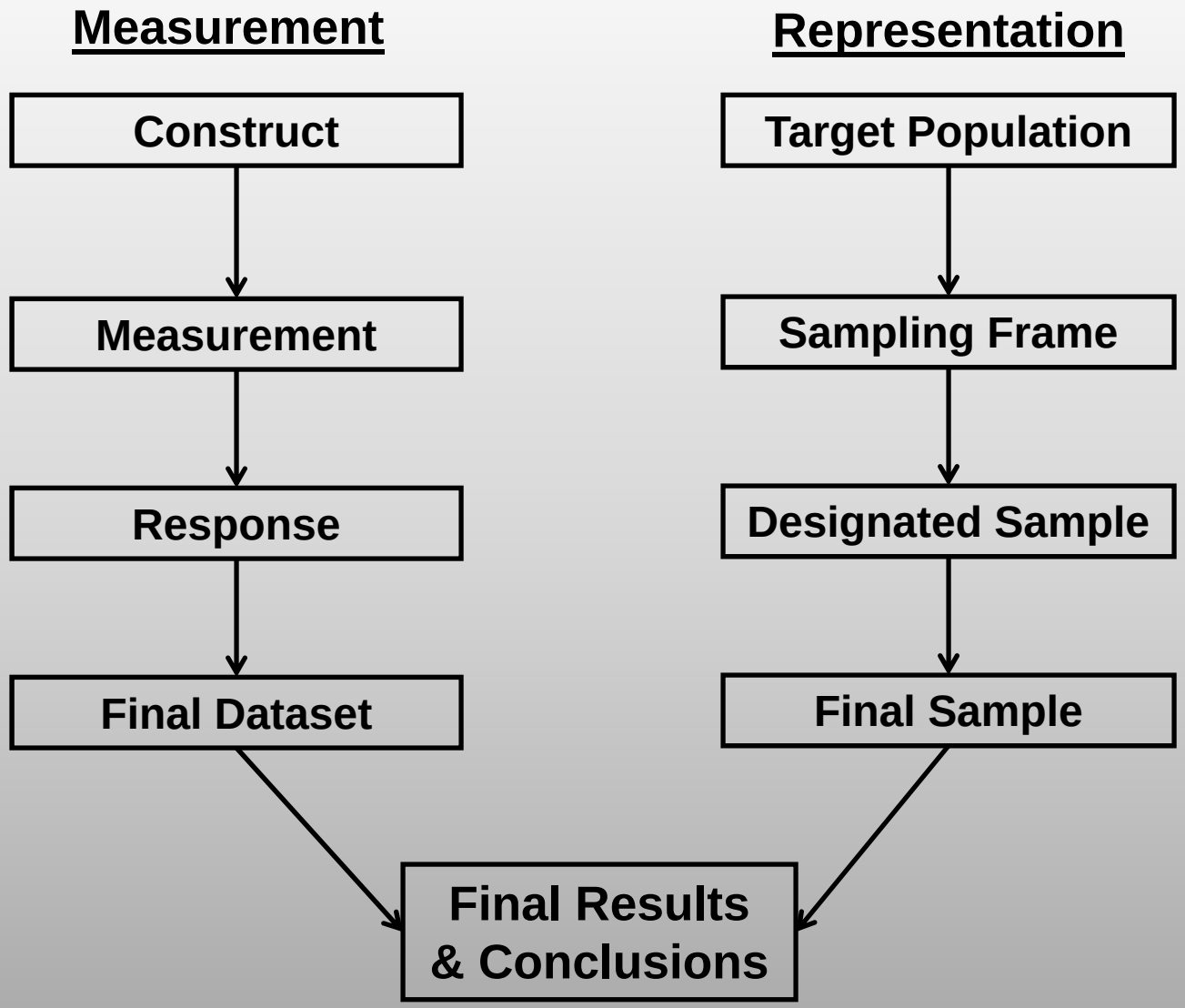
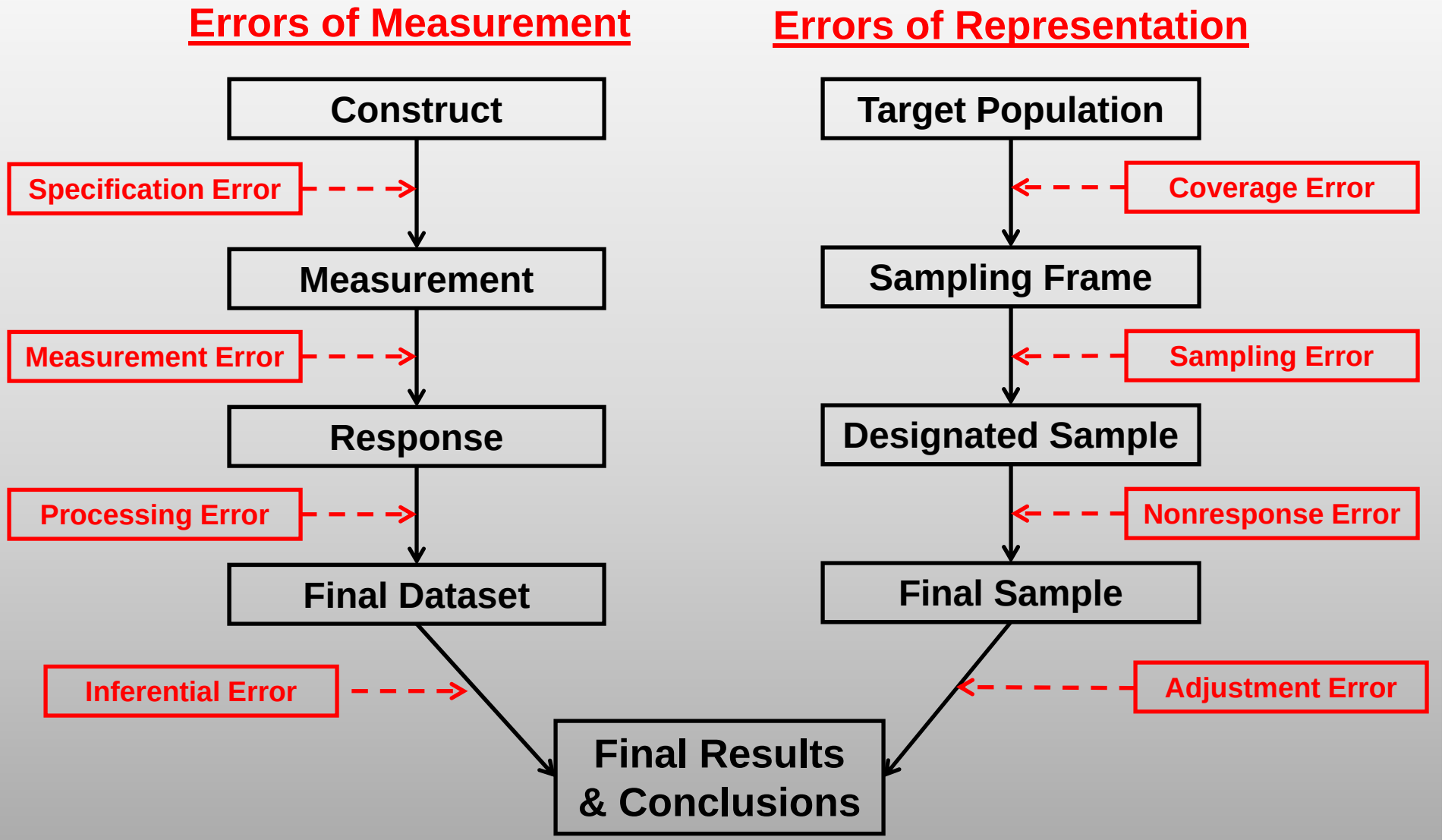


Research Process



Total Error Framework



Errors of Representation

- Coverage Error
- Sampling Error
- Nonresponse Error
- Adjustment Error
- These errors are linked to what Campbell and Stanley (1963) termed External Validity

Coverage

- What is the **Population of Interest** or **Target Population**?
- What list(s) (**sampling frame**) will be used to represent the Target Population?
- How well does the list represent (cover) the Population
- **Noncoverage** occurs when members (**units/elements**) of the Population are not included (covered) in the list(s)
- If applicable, how will **within-unit coverage** be deployed to select the elements from which or about which information will be gathered

Coverage Error

- If the part of the Population not included (covered) by the list(s), or omitted from the with-unit selection, is different on key measures of interest in non-ignorable ways from the part that is included, then it is said that a **Coverage Error** has resulted
- When this happens it typically biases the findings of the study

Sampling

- What type of selection (sampling) will be done from the list(s)
  - How will the **units/elements** to be studied be chosen, i.e., what is the **sampling design**
    - **Nonprobability selection**
      - Unsystematic selection for each unit/element
      - Systematic (possibly random) for each unit/element
    - **Probability selection**
      - Random for each unit/element
      - Non-zero probability of selection for each unit/element
      - Known probability of selection for each unit/element
  - What degree of statistical precision, if any, is required
  - How many units/elements will be chosen to create an **Initially Designated Sample**

Sampling Error

- For quantitative studies:
  - If using a probability sample, then sampling error can be quantified
    - With sampling error quantified, **confidence intervals** can be calculated
  - If using a nonprobability sample, then sampling error cannot be quantified
    - If it were to be quantified, it would be meaningless
    - But under certain assumptions, **credibility intervals** can be calculated
- For qualitative studies, this is a "mental" exercise

Unit Nonresponse

- It is very rare for the **Final Sample** of units/elements from which information (data) is gathered to be the same size as the initially designated sample one starts with
- The difference between the initially designated sample and the final sample is termed Unit Nonresponse
  - Unit nonresponse is common in all types of research
- Reasons for Unit Nonresponse
  - Noncontact
  - Refusals
  - Other

Unit Nonresponse Error

- When part of the Initially Designated sample is not included in the Final sample because no information is gathered from those units/elements, and when these units/elements differ to a non-ignorable degree on key measures from those units/element from whom information was gathered, then **Unit Nonresponse Error** is said to have occurred
- When this happens those selected units/elements not in the final sample are said to be "not missing at random"
- When this happens it typically biases the findings of the study
- However, if the missing part of the initially designated sample (the nonresponders) are not different from the responders on the key measures, then they are said to be "missing at random" and there is no unit nonresponse error

Item Nonresponse

- It is very rare for every unit/element in the **Final Sample** of units/elements from which information is gathered to provide data on every measure sought from them
- The information that is missing from those in the final sample is termed **Item Nonresponse**
- Reasons for Item Nonresponse
  - Not being able to provide the data being sought, e.g., being uncertain
  - Not being willing to provide the data being sought, e.g., refusing to do so

Item Nonresponse Error

- When part of the final sample that does not provide substantive data of a given measure differs in non-ignorable ways on this measure from those in the final sample that do provide data, then **Item Nonresponse Error** is said to have occurred
- When this happens the data not gathered from the final sample are said to be "not missing at random"
- When this happens it typically biases the findings of the study
- However, if the missing data from the item-nonresponders on key measures are not different from the data from responders on these key measures, then the data are said to be "missing at random"

Data Adjustment

- It is often the case that when all the data have been gathered for the final sample, the final sample will not be representative of the population for reasons related to Coverage, Sampling, and Nonresponse
- Thus in many cases the quantitative researchers will try to adjust those data to make them more representative of the Target Population before substantive analyses are conducted
- In contrast, qualitative researchers can engage in mental "adjustments" to the information gathered in their studies to try to account such errors of representation

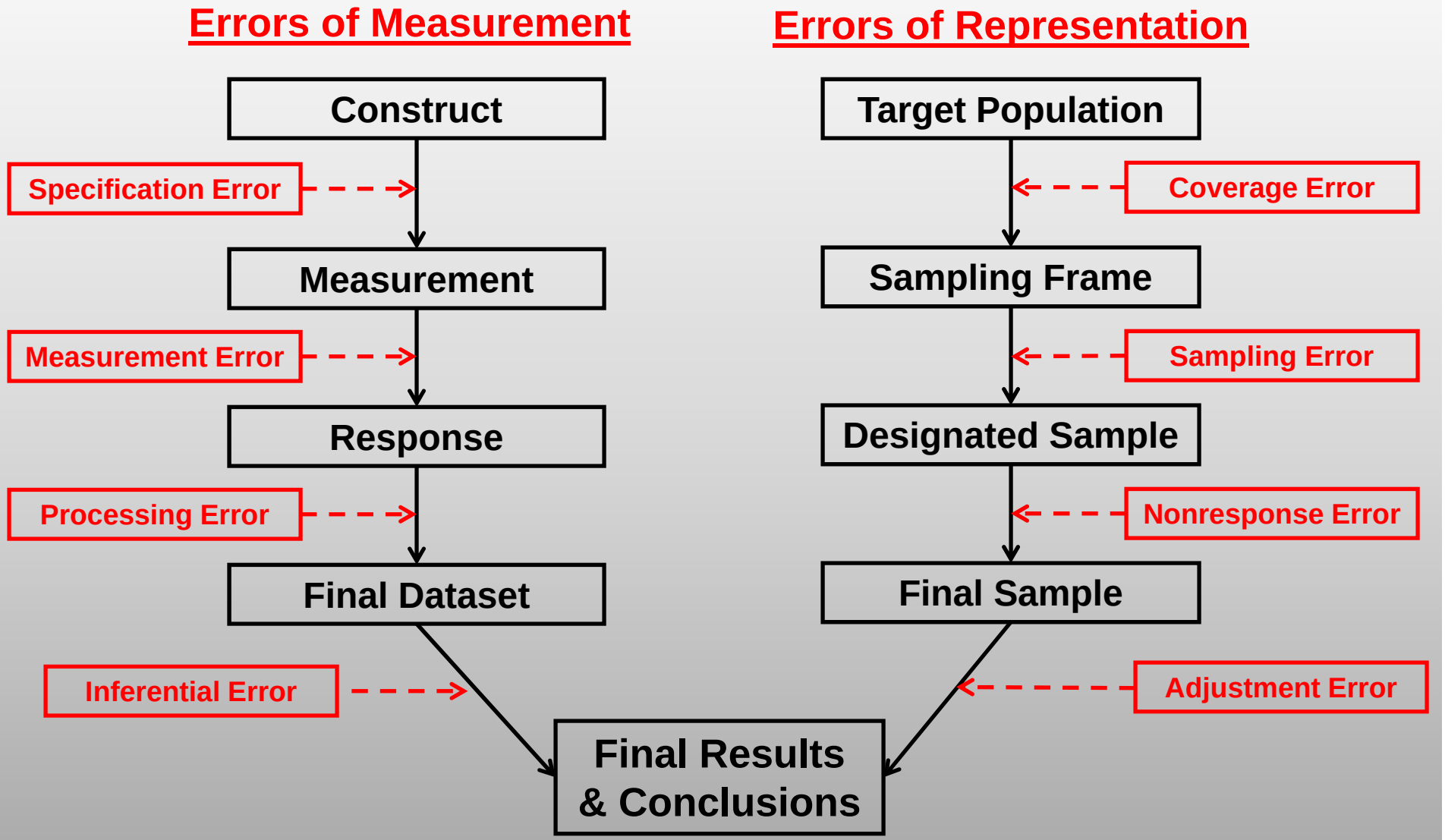
Data Adjustment

- To do this effectively quantitative researchers must know how the final sample of units/elements differs in key ways from the population and for this to be possible **population parameters** (aka **universe estimates**) must be known
  - Coverage-related reasons of unrepresentativeness may be correctable if the researchers know what key characteristics associated with noncoverage make the non-covered different from the covered
  - Sampling-related reasons of unrepresentativeness often can be adjusted based on the particular sampling design used
  - Nonresponse-related reasons of unrepresentativeness may be correctable if the researchers know what key characteristics associated with nonresponse make the responders different from the nonresponders
- Qualitative researchers can do mental equivalents

Adjustment Error

- The effort of quantitative researchers to adjust the final sample's data before performing substantive analyses with them is an effort to try to reduce (or possibly) eliminate known and suspected biases in the that data
- However, in doing such adjustments (aka **weighting** of the final data) researchers will be adding error in the form of variance (imprecision) to the study's findings
- This happens because with a probability sample, the adjustments create a "design effect" (**deff**) which most often exceeds the value of 1.00
- The study's sampling error must be multiplied by the deff (in doing so an **effective sample size** is created)
- The effective sample size is typically some smaller number than the final sample size and thus the confidence intervals for the study are inflated proportional to the √deff

Total Error Framework



Errors of Measurement

- Specification Error
- Measurement Error
  - Questionnaire-related
  - Respondent-related
  - Interviewer-related
  - Mode-related
- Processing Error
- Inferential Error

Specification of Constructs

- Research studies are conducted to shed light on problems/issues/topics that are judged to be important
- The topics of interest are represented by the constructs the researchers choose to study
- Constructs typically are multi-faceted
- Thus, an early key step in planning one's research is to decide what are the facets of the constructs that will be measured
  - One of the reasons this is so important is that it guides the choices made about exactly what information needs to be gathered for/about the selected units/elements

Specification Error

- To the extent that no information is gathered about important facets that help define a construct of interest, a Specification Error has resulted
- Of note, this is a special problem when secondary analysis is used with an existing dataset that was gathered for some purpose other than the new purpose(s) towards which the researcher now wants to put the information
  - In these cases, the information being used for the secondary analysis may simply not be "fit for purpose" because it does not sufficiently measure the constructs of interest
- Specification Error is linked to what Campbell and Stanley termed Construct Validity

Questionnaire-related Measurement Error

- After one's constructs of interests and their facets have been fully specified, a key next step for any research study is deciding how the constructs of interest (and all of their facets) will be **operationalized**
- This happens in the instrument one creates to gather information (data) from the subjects of the study
- Error in the form of variance or bias can be caused by the ordering, wording, and formatting of the data collection instrument used in a research study

Respondent-related Measurement Error

- In most research the respondent or subject is a human being
- But in some studies the subjects of the research – the units/elements that data are gathered from or about – are not human (e.g., dogs) and may not even be animate (e.g., newspaper articles)
- Respondents/subjects can contribute variance and bias to the information being gathered
  - They can be unable to provide accurate information
  - They can be unwilling to provide accurate information

Interviewer-related Measurement Error

- Human beings who gather information in a research study can contribute error in the form of variance or bias as they are gathering that information
  - They may do so because of their own behaviors, beliefs, and attitudes, be those conscious or unconscious
  - They may do so because of their own personal characteristics, including their voice and other physical characteristics

Mode-related Measurement Error

- Data can be gathered from human beings either through a self-administered mode or an interviewer-administered mode
- It can be gathered via a mechanized mode or non-mechanized mode
- A research study can be multi-mode
- Different modes can contribute error in the form of variance or bias

Processing Error

- The "raw data" that are gathered in a research study typically need to be processed before they can be analyzed
- This includes:
  - Fixing or dropping "bad" data
  - Coding raw data (e.g., open-ended verbatims) into other forms
  - Imputing missing data
  - Deriving new variables
  - Appending auxiliary variables
- In each case, variance or bias may be created by the processes that are applied to the information that was gathered

Errors of Inference

- When the information gathered in a research study is analyzed – i.e., when "sense" is made of the data – the researcher(s) may not use the best or even correct analytic "tools"
  - This is related to what Campbell and Stanley termed Statistical Conclusion Validity
- Furthermore the researcher(s) may draw inferences that are not supported by the nature of the research design that was used
  - In particular, cause-and-effect conclusions may be drawn when the research design was something other than an unconfounded experiment to test what was studied
    - This is related to what Campbell and Stanley termed Internal Validity

Tailoring the TE Perspective to Different Research Methods

TE and Survey Research

Errors of Representation	
Error Type	**Key Considerations**
Coverage	What is the target population and what sampling frame(s) will be used to cover this population; how will elements be covered within sampled units, i.e., which within-unit selection procedure will be used
Sampling	What sampling design will be used to draw the initially designated sample
Nonresponse	What strategies will be used to minimize nonresponse; will a nonresponse bias study be conducted
Adjustment	What variables will be used to adjust for unequal probabilities of selection and for noncoverage and nonresponse; what will be the *deff* and the effective sample size

TE and Survey Research

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key facets of the constructs that must have data gathered about them
Questionnaire	What previously existing questionnaire items will be used and what new items must be created; what will be the order of the items; what format will be most user-friendly; what pilot testing will be done
Respondent	How will respondents be motivated to provide fully accurate data; how will data quality be studied
Interviewer	How will interviewers be trained and monitored; how will interviewer error be assessed
Mode	Which mode(s) will be used; if more than one mode, how will mode effects be studied
Processing	How will data be cleaned, missing data imputed, and new variables derived
Inferential	Is any experimentation built into the questionnaire

TE and Experimental Design

Errors of Representation	
Error Type	**Key Considerations**
Coverage	To what population is the experiment meant to generalize; what subject pool will be used to represent this population; what will be the nature of noncoverage
Sampling	How will subjects be recruited from the subject pool and how will they be randomly assigned to the different experimental conditions
Nonresponse	What strategies will be used to minimize noncooperation; will any consideration be given to whether noncooperators differed from cooperators and thus does this limit external validity
Adjustment	Should any such adjustments be made

TE and Experimental Design

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key dependent variables, independent (treatment) variables, and covariates
Questionnaire	How will the dependent variables, independent variables and covariates be operationalized; what pilot testing will be done
Respondent	How will respondents be equally motivated to provide fully accurate data across experimental conditions
Interviewer	Usually not relevant unless experiment is embedded within a survey questionnaire
Mode	May be relevant as experimental treatments may be administered via any mode
Processing	How will data be cleaned and new variables derived (e.g., creating a scaled variable)
Inferential	Are there confounds undermining the integrity of the experiment

TE and Content Analysis

Errors of Representation	
Error Type	**Key Considerations**
Coverage	What population of content will be studied; what will be the source/archive for this content; how will that source be accessed; what will be the size and nature of noncoverage
Sampling	How will the individual units/elements of that content be selected for study
Nonresponse	What are the chances that sampled content will not be available for study from the content archive; what will happen when this occurs
Adjustment	Unlikely to be an issue unless a complex sampling design is used

TE and Content Analysis

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key constructs that will be measured/coded
Questionnaire	How will the constructs be operationalized on the coding form; what pilot testing will be done
Respondent (Content)	Not Applicable, unless the condition of the content is such that it is hard to decipher (e.g., illegible)
Interviewer (aka Coder)	Who will do the coding, how will they be trained, how will their coding reliability be determined
Mode	Computerized or paper and pencil coding
Processing	How will data be cleaned and new variables derived (e.g., creating a scaled variable)
Inferential	Not likely to be applicable, as the method is predominately descriptive

TE and In-Depth Interviewing

Errors of Representation	
Error Type	**Key Considerations**
Coverage	What population of persons will be interviewed; what will be the list(s) for this population; how will that list(s) be accessed; what will be the nature of noncoverage on the list
Sampling	How will the individual persons on the list(s) be selected for interviewing; if all are selected, is this actually a "census," and if so sampling error is not applicable
Nonresponse	What strategies will be used to minimize noncooperation; how will possible nonresponse bias be assessed
Adjustment	Only relevant if researchers will mentally "weight" the information gained from some interviewees differently than that from other interviewees

TE and In-Depth Interviewing

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key constructs that will be asked about in the interviews
Questionnaire	How structured and scheduled will the questions be within the interview; what pilot testing will be done
Respondent	How will interviewees be motivated to provide fully accurate information
Interviewer (aka Coder)	How will interviewers develop rapport with interviewees; how will bias be avoided
Mode	Which mode(s) will be used for interviewing; how will interviews be captured/recorded
Processing	How will interviews be transcribed and sense made of them
Inferential	How will objectivity be maintained in drawing conclusions

TE and Focus Groups

Errors of Representation	
Error Type	**Key Considerations**
Coverage	What population of persons will be represented; what will be the list (s) for this population; how will the list(s) be accessed; what will be the nature of noncoverage on the list(s)
Sampling	How will the individual persons on the list(s) be selected to participate
Nonresponse	What strategies will be used to minimize noncooperation; how will possible nonresponse bias be assessed
Adjustment	Not applicable

TE and Focus Groups

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key constructs that will be discussed
Questionnaire	How structured and scheduled will the discussion guide be; what pilot testing will be done
Respondent	How will participants be motivated to provide fully accurate information and not to feel inhibited in expressing themselves
Interviewer (aka Moderator)	How will the moderator develop rapport with group and within the group; how will bias be avoided
Mode	Which mode(s) will be used for the group "discussion;" how will the discussion be captured/recorded
Processing	How will the discussion be transcribed and analyzed
Inferential	How will objectivity be maintained in drawing conclusions

TE and Observational Research

Errors of Representation	
Error Type	**Key Considerations**
Coverage	What population of persons will be represented; what will be the list of locations to observe this population; how will that list be accessed; what will be the nature of noncoverage on the list
Sampling	How will the individual places and/or times of observation from the list(s) be selected
Nonresponse	Not applicable
Adjustment	Not applicable, unless a complex sampling design is deployed

TE and Observational Research

Errors of Measurment	
Error Type	**Key Considerations**
Specification	What are the key behavioral constructs that will be observed and what are the facets of each
Questionnaire	How will the observational information be collected
Respondent	Will people know they are being observed
Interviewer (aka Observer and/or Coder)	Will the observer also be a participant in the behavior(s) being observed; how will bias be avoided; if coders are used, who will do the coding, how will they be trained, how will their coding reliability of determined
Mode	Which mode(s) will be used for gathering the observations
Processing	How will observational data be transcribed and analyzed
Inferential	How will objectivity be maintained in drawing conclusions

Applying the TE Perspective

When Consuming Research Findings and Other Information

- TE is a way of thinking about research and many other types of information in one's life
- It offers a crucial set of questions to ask yourself about the likely accuracy (reliability and validity) of any research study you come across
- TE issues can be used to evaluate the likely accuracy of any information upon which you are thinking about basing a decision
  - How much confidence can I place on this information being correct "enough" for the decision I need to make?

When Writing Your Own Research Reports

- TE can be used as an organizational framework for an Appendix detailing the methodology of your study
- TE can be used as a roadmap for a self-critique of the strengths and weakness of your research
- Any research literature review can be enhanced by using TE to structure your critique of that body of knowledge
  - Far too often, literature reviews do not include an evaluation of the reliability and validity of the literature being reviewed
- Any review of a research study proposal or a manuscript can be enhanced using the TE approach

Creating RFPs and Evaluating/Scoring Submitted Proposals

- RFPs for research to be conducted are a perfect venue for explicitly applying the TE framework
  - This forces the funding agency to think carefully about what they are requesting
  - It forces those submitting a proposal to think explicitly about how to improve the quality of the information that will be gathered in the study and articulate what they think should be done to address the important sources of error that could threaten the entire value of the research
  - The system used by reviewers scoring proposals can be structured to coincide with TE, so that an objective, logical, and comprehensive evaluation is carried out in identifying the best vendor

Expert Legal Reports and Testimony

- Attorneys and Judges are, for the most part, unfamiliar with the TE perspective
- But once it is explained to them, they find it very appealing because it is logical and comprehensive
- TE is appropriate whether an expert is planning a research study to gather evidence for her/his client or if the expert is critiquing a research study the opposing party is using as evidence

Explaining Why a Particular Research Method Should be Deployed

- TE helps one structure any meeting with a potential client to explain why a particular research method is the most cost-effective one
  - Helps showcase the study's strengths
  - Allows one to be up front (Transparent) about the study's limitations/weaknesses

Creating Your Own TE Checklist

- Take the time to use the TE framework to think back through your research plans, proposals, oversight of the field period, and reports
- Why not create an explicit TE checklist for yourself and use it until the TE way of thinking becomes second nature to you…

Transparency and Disclosure

- TE provides you with an explicit, logical, and comprehensive way to:
  - Think critically about any research you are planning
  - Structure how you monitor your research while it's being fielded
  - Think critically about what implications and recommendations can be made with confidence from your findings
- Even if you do not disclose this detailed level of thinking to anyone else, you will benefit by holding yourself to a higher standard
  - And those you work with/for also will benefit from you doing this

Thank You