

Applying a Total Error Perspective for Improving Research Quality in the Social, Behavioral, and Marketing Sciences

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Overview

- Background
- Explain the TE Framework
- TE and TQF for Qualitative Research
- Tailoring TE to Any Research Method
- Applying the TE Perspective

Research Quality

- My Premises:
 - A great many research studies are poorly conceptualized, conducted, and/or interpreted
 - The quality of most research studies could be improved with few, if any, cost implications
 - “Getting a Better Bang for the Buck”
 - Using a Total Error approach could help change this

Total Error (TE) Background

- For the past 20+ years, I have used the TE perspective to guide all the research-related activities in which I have engaged
 - As a tenured full professor at Northwestern U. and Ohio State U., and now as a visiting scholar and lecturer 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 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, technical reports, publications, and presentations

Total Error Background

- 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
- By “Total Error,” I refer 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), or at a minimum can UNDERMINE THE CONFIDENCE one can (should) place on them

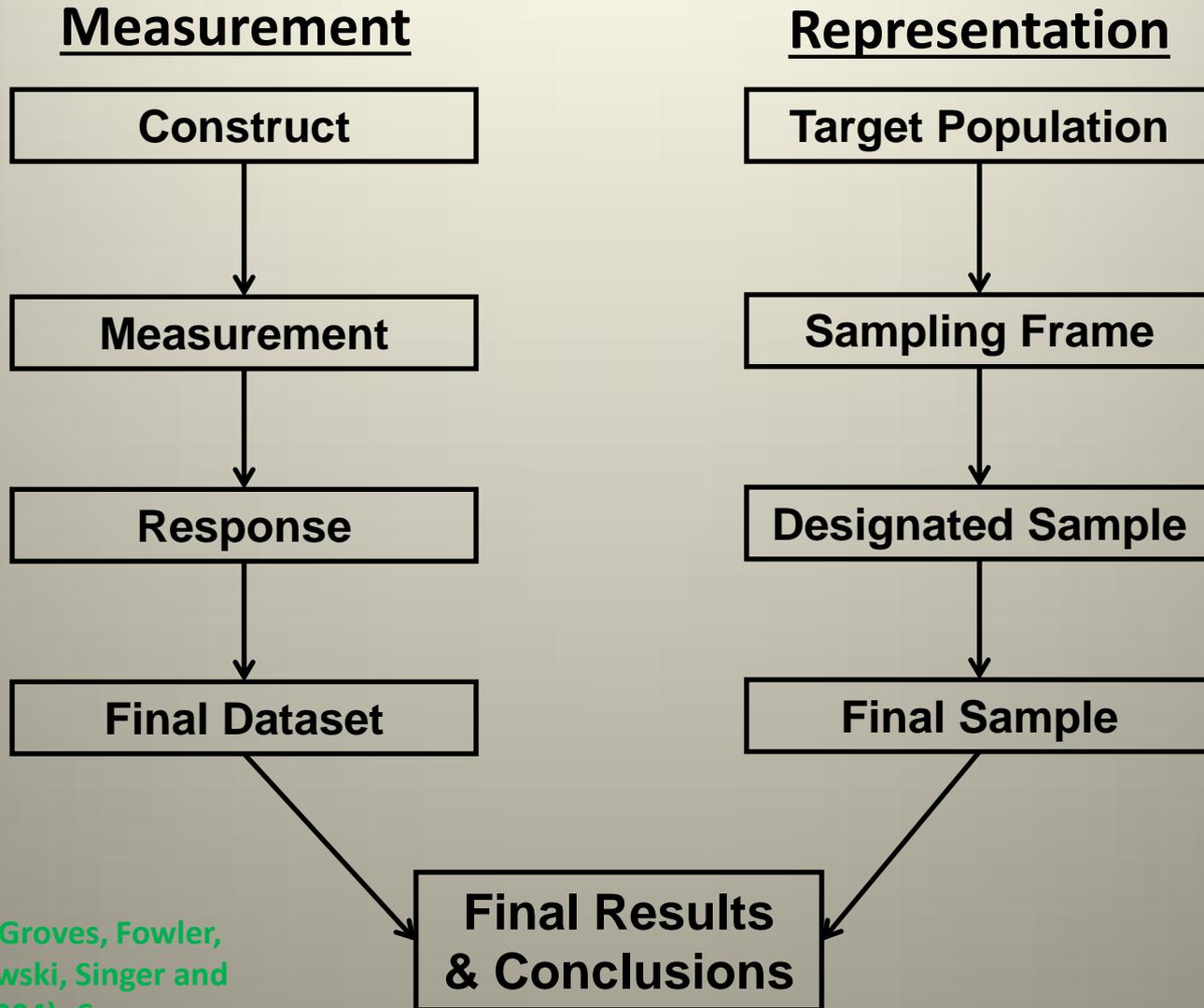
Total Error Background

- TE encompasses 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**, or at least not likely to be so
- TE provides researchers with a comprehensive and systematic framework with which to:
 - Plan research
 - Oversee data collection periods
 - Interpret and disseminate research findings
- It also is a comprehensive and systematic way for a researcher to engage in a rigorous process of self-evaluation and improvement

Total Error Background

- Errors in research may take the form of Bias or Variance
 - **Bias** is a directional source of error
 - As in a “too high” or “too low” sense
 - **Variance** is a nondirectional source of error
 - As in an “imprecision” sense, which lowers confidence
- The TE perspective encompasses these
- Furthermore, I believe Qualitative Researchers, not just Quantitative Researchers, can (and should) benefit from using a variation of the TE perspective
 - Although much of what I say will sound very “quantitative” to those of you who are Qualitative Researchers, I believe it has direct and important implications for Qualitative Research
- And, I believe it is better for researchers to consciously ignore these issues rather than to not be aware of them or not consider them at all

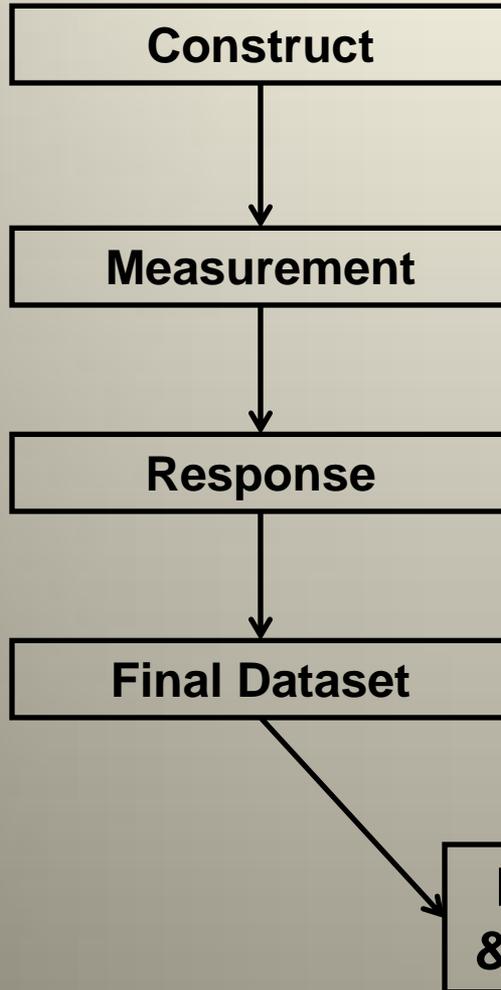
Research Process



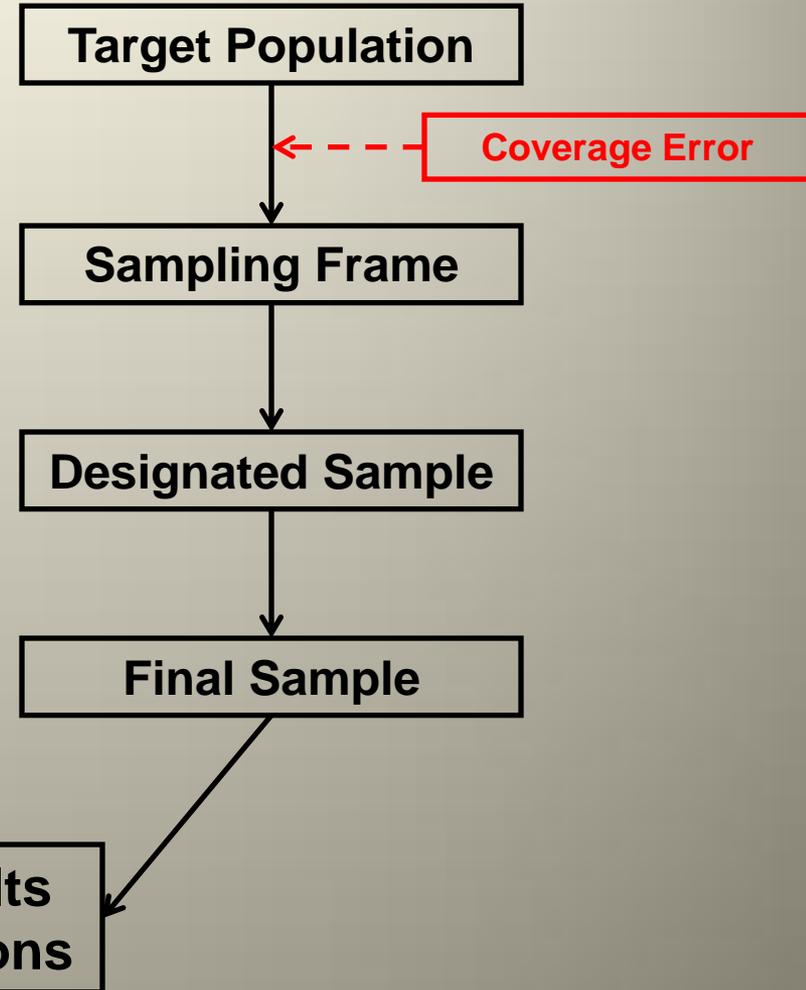
Adapted from Groves, Fowler, Couper, Lepkowski, Singer and Tourangeau (2004), *Survey Methodology*; Wiley.

Total Error Framework

Errors of Measurement



Errors of Representation

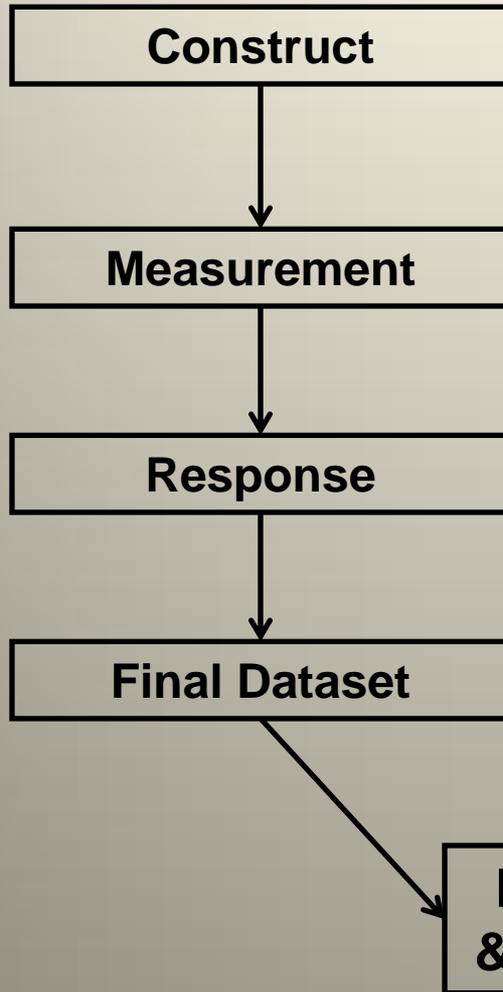


Coverage and Coverage Error

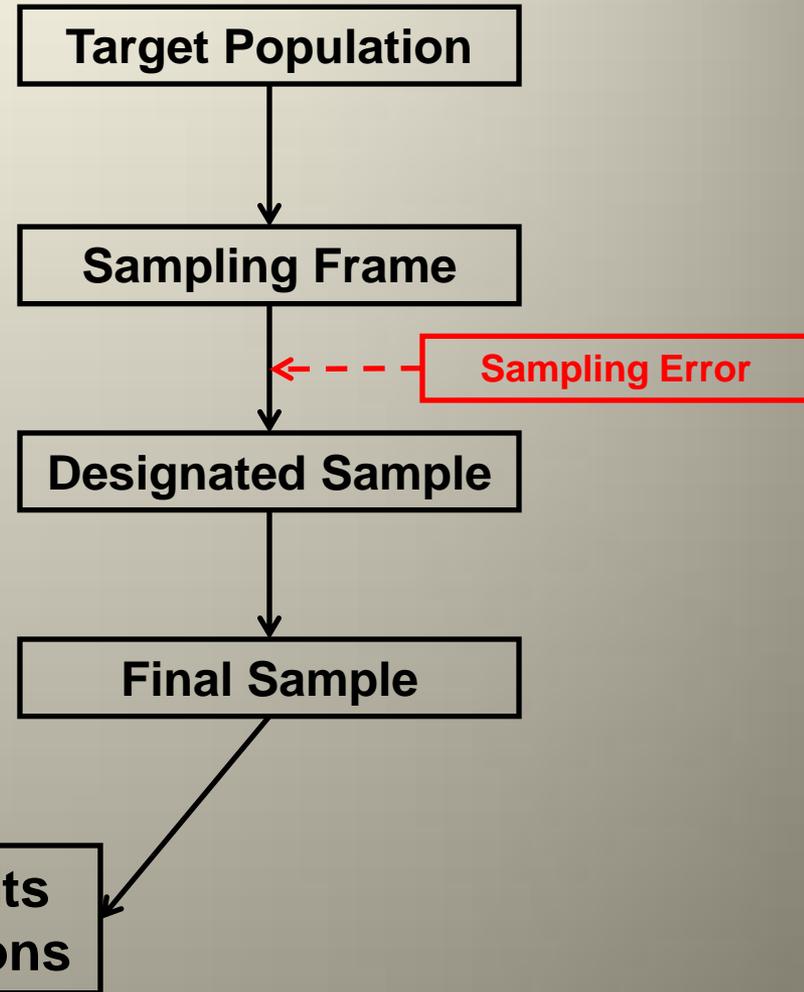
- What is the **Population of Interest** or **Target Population**?
- What list(s) (**sampling frame**) will be used to represent the Target Population?
- How well does the list represent (cover) the Population
 - **Noncoverage** occurs when members (**units/elements**) of the Population are not included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

Total Error Framework

Errors of Measurement



Errors of Representation

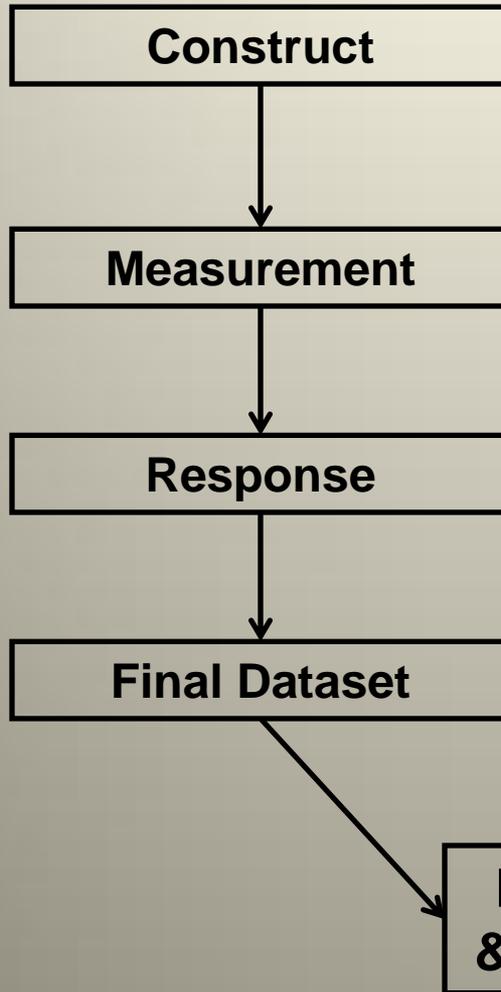


Sampling and Sampling Error

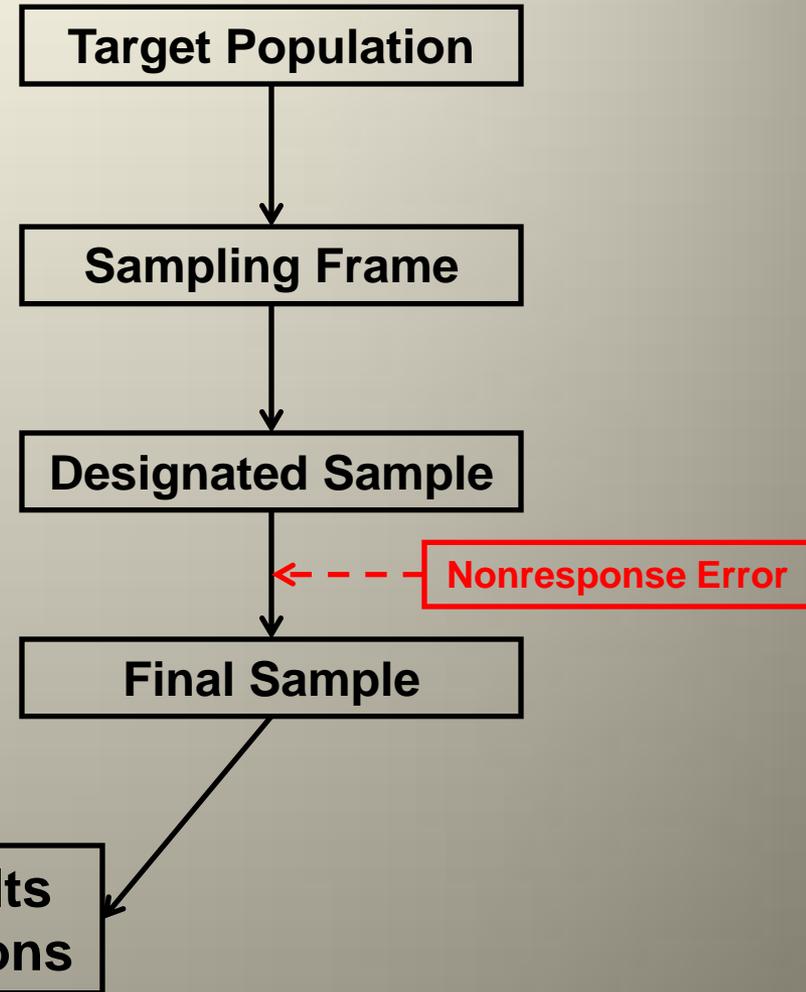
- What type of selection (sampling) will be done from the list(s)
 - How will the units/elements to be studied be chosen, i.e., what is the **sampling design**
 - **Nonprobability selection** includes
 - Unsystematic selection for each unit/element; or
 - Systematic (possibly random) for each unit/element
 - **Probability selection** includes
 - Random selection 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**
 - If using a probability sample, then sampling error can be quantified
 - With sampling error quantified, **confidence intervals** can be calculated

Total Error Framework

Errors of Measurement



Errors of Representation



Unit Nonresponse

- It is extremely 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 (i.e., a 100% AAPOR Response Rate 1 is essentially never achieved)
- 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
 - Language Barriers
 - Other

Unit Nonresponse Error

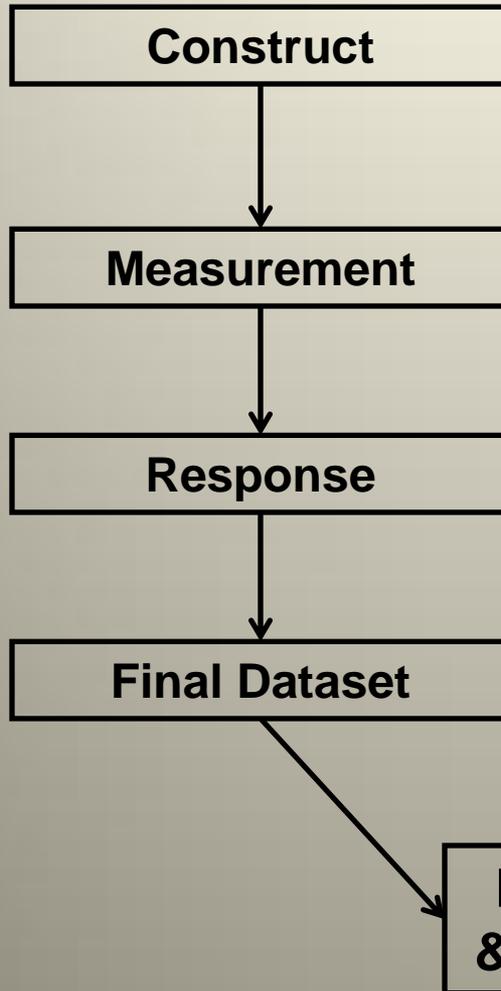
- When (1) part of the Initially Designated sample is not included in the Final sample because no data are gathered from those units/elements, and (2) when these units/elements differ to a non-ignorable degree on key measures from those units/element from whom information was gathered, then **Unit Nonresponse 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 unadjusted data of the study
- However, if the nonresponders (the missing part of the initially designated sample) are not different from the responders on the key measures, d there is no unit nonresponse error

Item Nonresponse

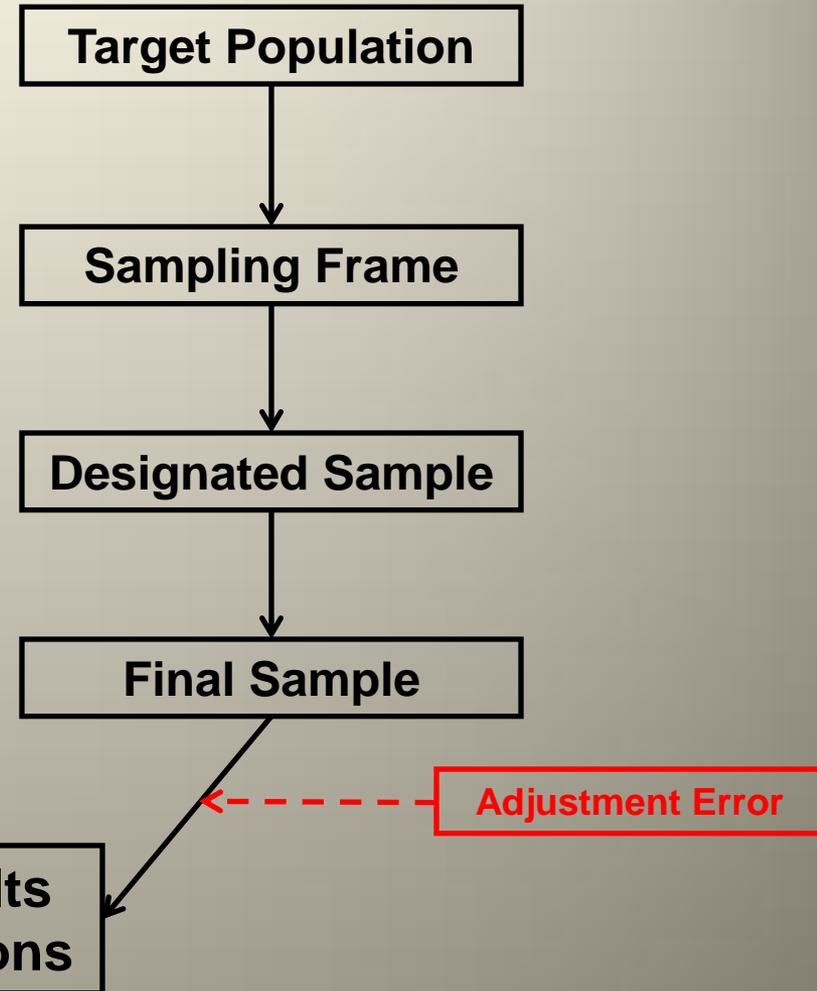
- It is rare for every unit/element in the Final Sample of units/elements from which information is gathered to provide data on every measure sought from them
- The information that is missing from those in the final sample is termed **Item Nonresponse**
- When the part of the final sample that does not provide substantive data on 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 unadjusted data of the study

Total Error Framework

Errors of Measurement



Errors of Representation



Data Adjustment

- It is often the case that when all the data have been gathered for the final sample, those elements from whom (or about whom) data will have been gathered will not be representative of the Target Population for reasons related to Noncoverage, Sampling, and Nonresponse
- Thus in many cases quantitative researchers will try to statistically adjust those data to make them more representative of the Target Population before substantive analyses are conducted
- 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

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 to reduce bias (aka **weighting** of the final data), researchers most often will be adding error in the form of variance (imprecision) to the study's findings
 - This happens because with a probability sample, the adjustments contribute to the creation of a "design effect" (*deff*) which most often exceeds the value of 1.00
 - The study's sampling error (were it a simple random sample) must be multiplied by the *deff* (in doing so an **effective sample size** can be determined)
 - The effective sample size is typically a smaller number than the final sample size and thus the confidence intervals for the study are inflated proportional to the \sqrt{deff}
- Although many may disagree, I believe there is a "mental (nonquantitative) equivalent" for these processes in which qualitative researchers can and should engage

Total Error Framework

Errors of Measurement

Construct

Specification Error

Measurement

Response

Final Dataset

Errors of Representation

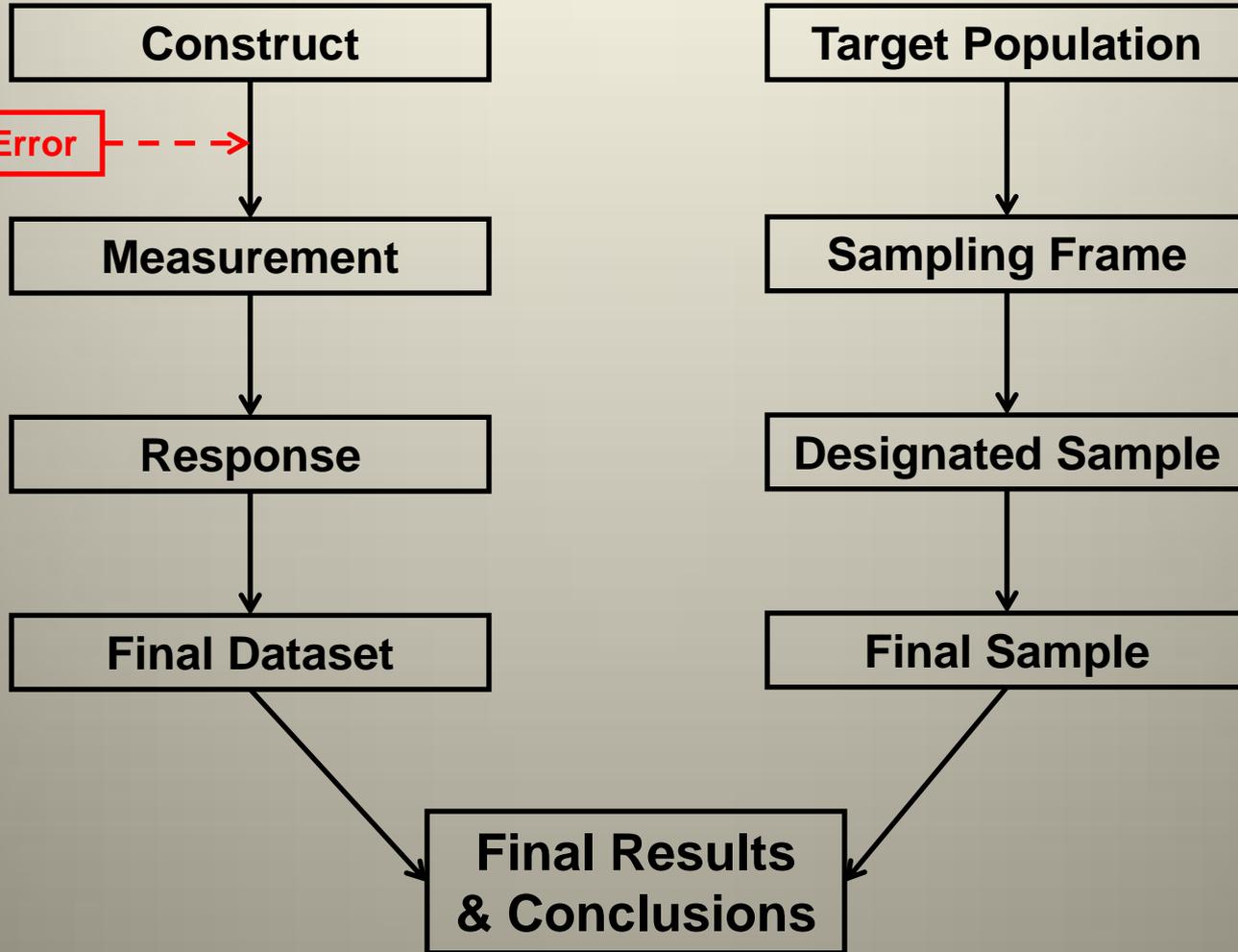
Target Population

Sampling Frame

Designated Sample

Final Sample

Final Results
& Conclusions



Specification of Constructs and Specification Error

- 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 (race relations, alienation, presidential approval, brand awareness, religiosity, etc..) typically are multi-faceted
- Thus, in addition to choosing one's constructs, an early key step in planning one's research is to decide what are the facets of the constructs that will be measured
 - And the reason these decisions are so important is that they guide 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 specify (measure) the constructs of interest
- It also may be a problem with the auxiliary data (including covariates) appended to one’s dataset
- Specification Error is linked to what Campbell and Stanley (1966) termed *Construct Validity*

Total Error Framework

Errors of Measurement

Construct



Measurement



Response



Final Dataset



Measurement Error



Errors of Representation

Target Population



Sampling Frame



Designated Sample



Final Sample



Final Results
& Conclusions

Instrument-related Measurement Error

- Applies to discussion guides, questionnaires, content analysis coding forms, observational forms, etc.; i.e., whatever “tool” is used to gather one’s data
- 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 (and all of their facets) will be **operationalized**
- This happens in the instrument/tool that one creates to help 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

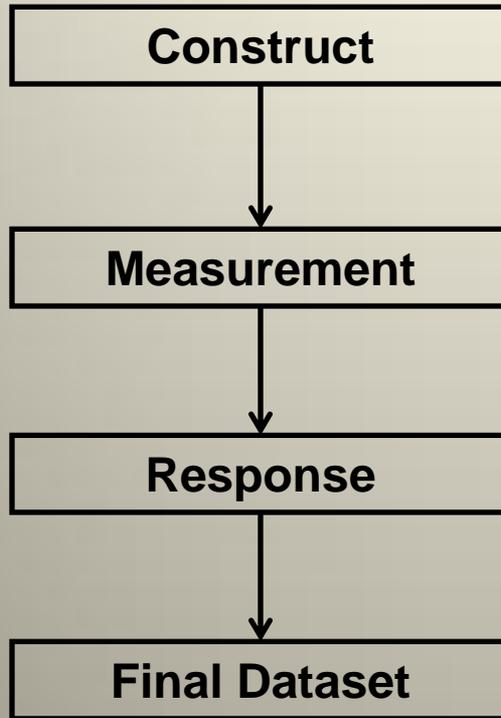
- Respondents can (and often do) contribute variance and bias to the information being gathered
 - They can be **unable** to provide accurate information
 - They can be **unwilling** to provide accurate information
- Thus, the value of measuring such effects

Interviewer-related Measurement Error

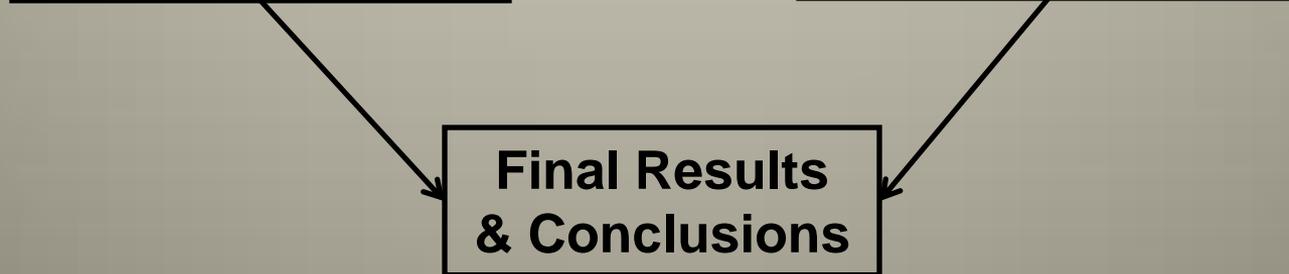
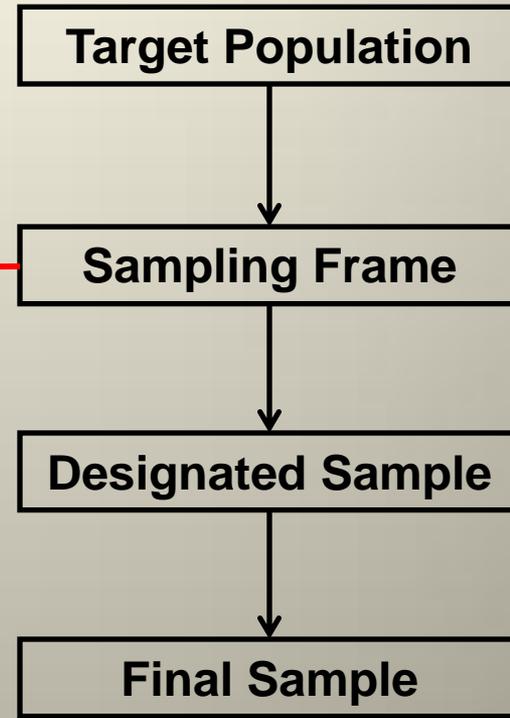
- Human beings who gather data – and in doing so “create” data – in a research study can (and often do) contribute error in the form of variance or bias as they are gathering that information
 - They may do so because of their own behaviors, beliefs, and attitudes, be those conscious or unconscious
 - They may do so because of their own personal characteristics, including their voice and other physical characteristics
- Training and monitoring on-going data collection can help a great deal, but are unlikely to eliminate all such problems
 - Thus the value of measuring such effects

Total Error Framework

Errors of Measurement



Errors of Representation



Interrelationship Between Sampling Frame and Measurement

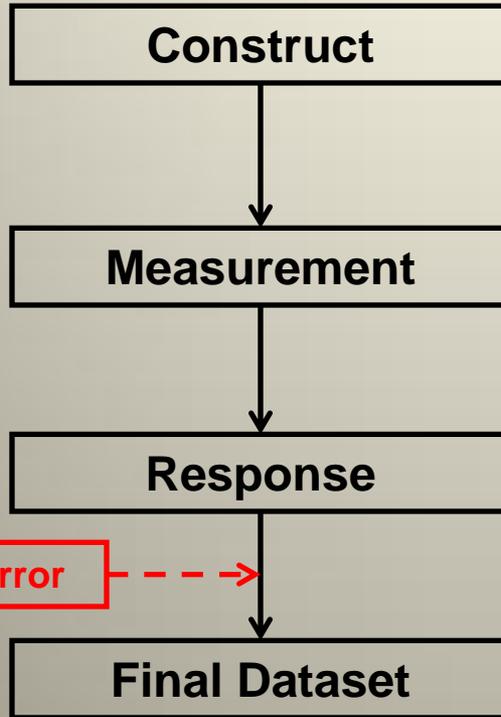
- Generally, a researcher decides early on about the list (frame) that will be used to sampling the target population
- This decision will determine the mode(s) of data collection that can be used to measure the constructs of interest, for example:
 - An RDD frame will allow data collection to be done via telephone, and/or via mail or in-person for those numbers that can be matched to addresses, or via Internet if respondents have Internet access and are given a URL
 - An ABS frame will allow data collection to be done via mail and in-person and/or via telephone for those persons whose addresses can be matched to a phone number, or via Internet if respondents have internet access and are given a URL
- Furthermore, the frame chosen may restrict the constructs that can be measured in the study

Mode-related Measurement Error

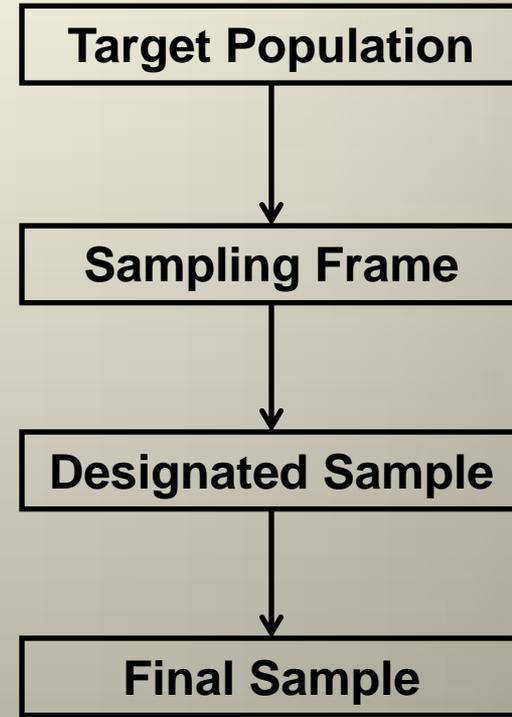
- Different modes can contribute error in the form of Variance or Bias
 - In-person
 - Landline telephone
 - Mobile device
 - Postal Mail
 - Online

Total Error Framework

Errors of Measurement



Errors of Representation



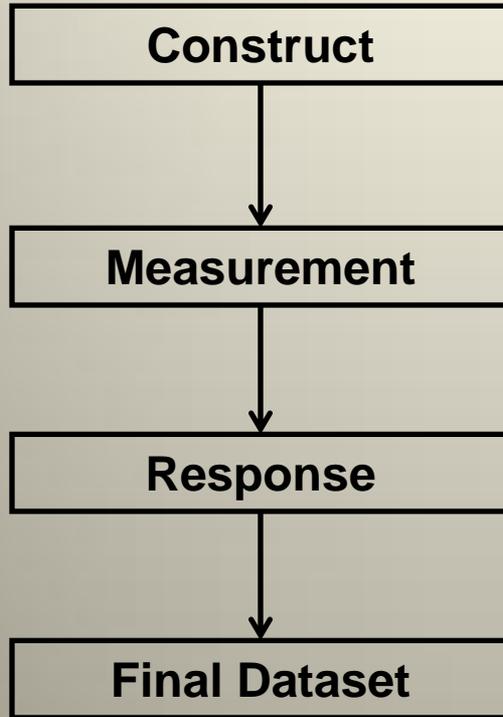
**Final Results
& Conclusions**

Processing Error

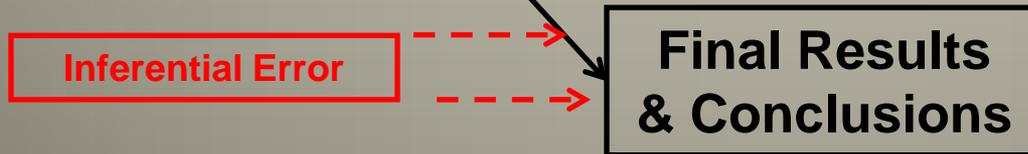
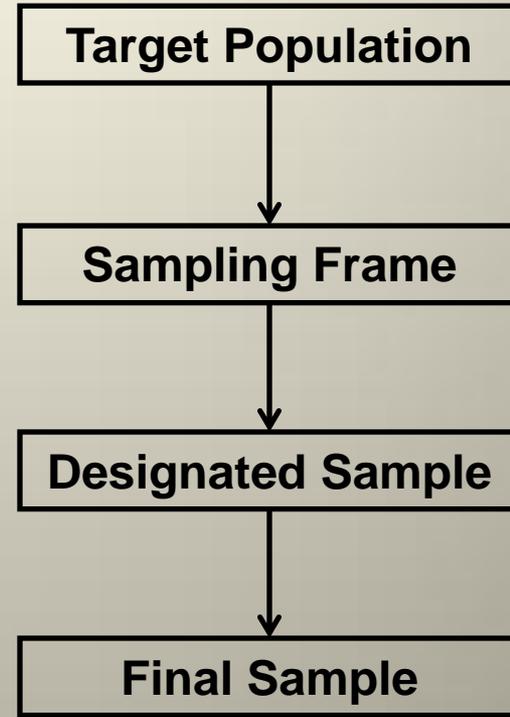
- The “raw data” that are gathered in a research study almost always need to be processed before they can be analyzed
- This may include:
 - Transcribing audio recordings
 - Fixing or dropping “bad” data
 - Coding raw data (e.g., open-ended verbatims) into other forms
 - Imputing missing data
 - Deriving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

Total Error Framework

Errors of Measurement



Errors of Representation



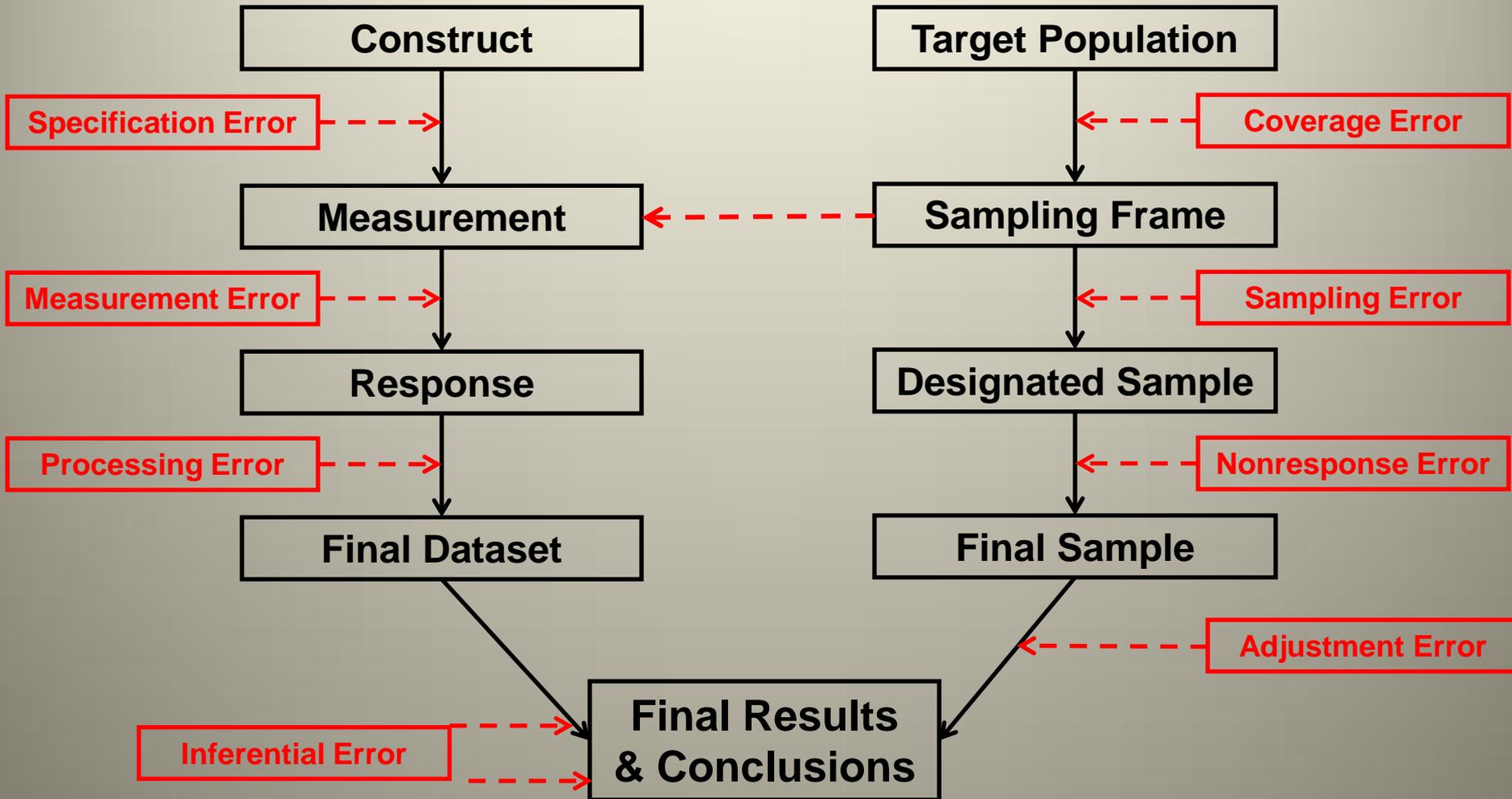
Errors of Inference

- 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 concern is what Campbell and Stanley (1966) termed ***Statistical Conclusion Validity***
- Furthermore, the researcher(s) may (and often do) draw inferences that are not supported (warranted) 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 concern is what Campbell and Stanley (1966) termed ***Internal Validity***

Total Error Framework

Errors of Measurement

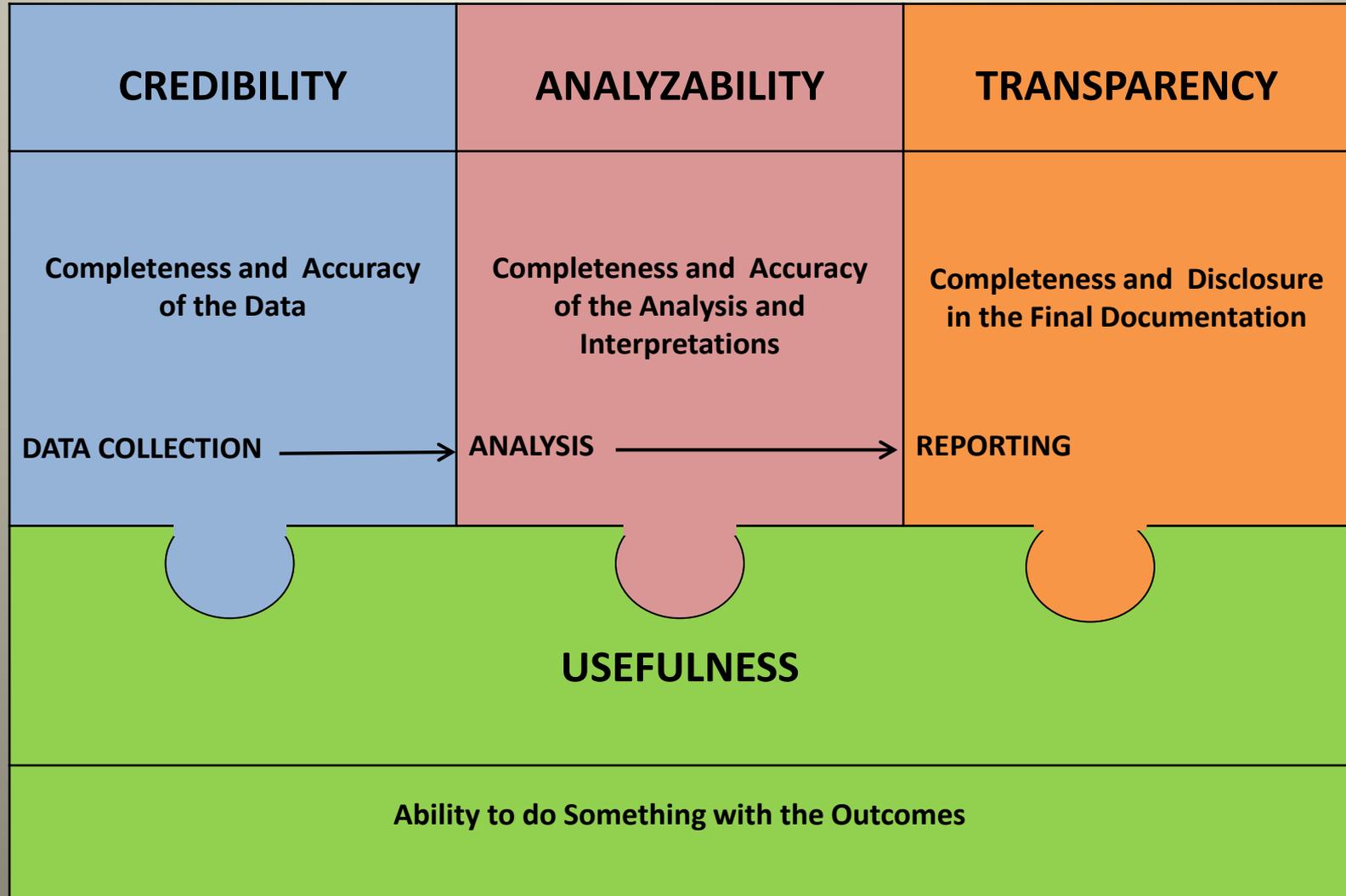
Errors of Representation



From the Quantitative to the Qualitative

- I am primarily a quantitative researcher, but have often used a variety of qualitative methods and value them
- Although the language I have been using is primarily associated with quantitative research, I believe the concepts apply as well to qualitative research
- To that end, for more than a year, I have been engaged in a rewarding adventure working with a long-experienced qualitative researcher, Margaret Roller, writing a qualitative methods book due to be published in 2014 by Guilford
- Our book uses terminology about Research Quality that is more familiar to qualitative researchers

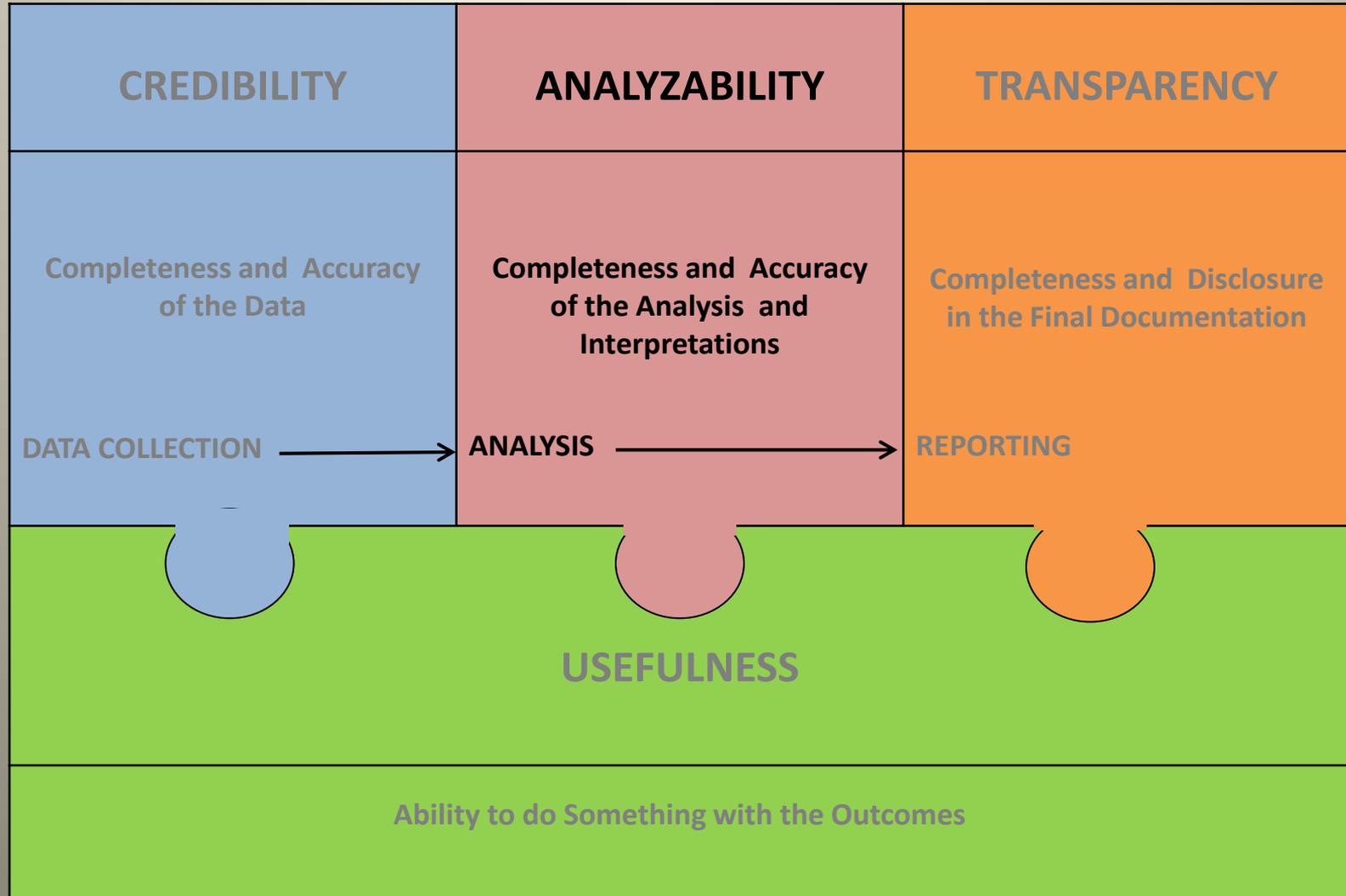
Total Quality Framework (TQF) for Qualitative Research (Roller & Lavrakas, Forthcoming)



TQF: Credibility

- Completeness and Accuracy of Data
 - Scope (representation; external validity)
 - Coverage Error
 - Sampling Error
 - Unit Nonresponse Error
 - Measurement (construct validity)
 - Specification Error
 - Instrument-related Measurement Error
 - Respondent-related Measurement Error
 - Item Nonresponse Error
 - Interviewer-related Measurement Error
 - Mode-related Measurement Error

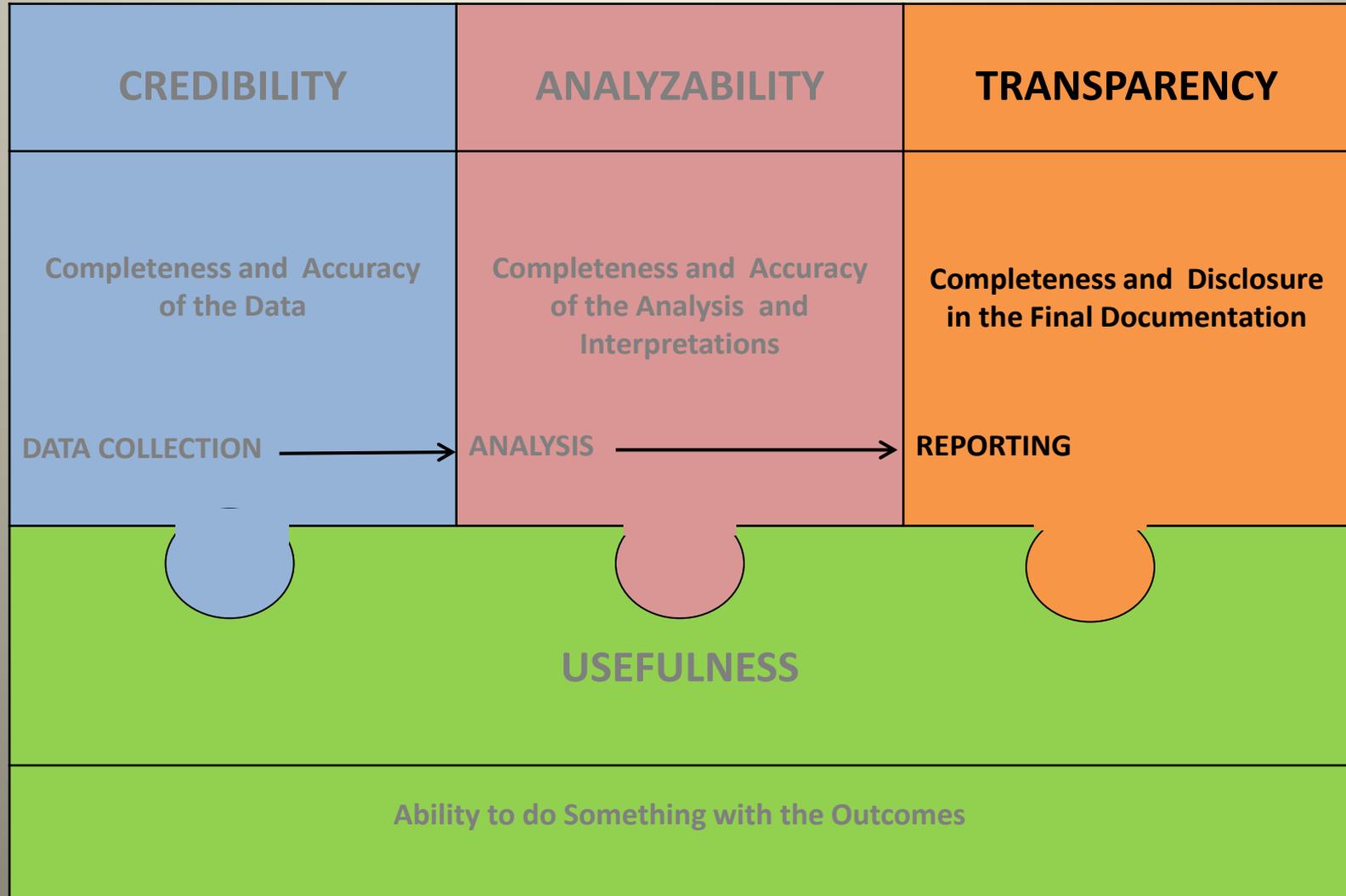
Total Quality Framework (TQF) for Qualitative Research (Roller & Lavrakas, Forthcoming)



TQF: Analyzability

- Assumes Credible Data are being used
- Completeness and Accuracy of Analysis and Interpretations (aka Sense-Making)
 - Processing Error
 - Adjustment Error
 - Inferential Error
 - Verification
 - Peer Debriefings, Reflexive Journals, Deviant Cases, Triangulation, Member Checks
 - Cause-and-Effect Reasoning

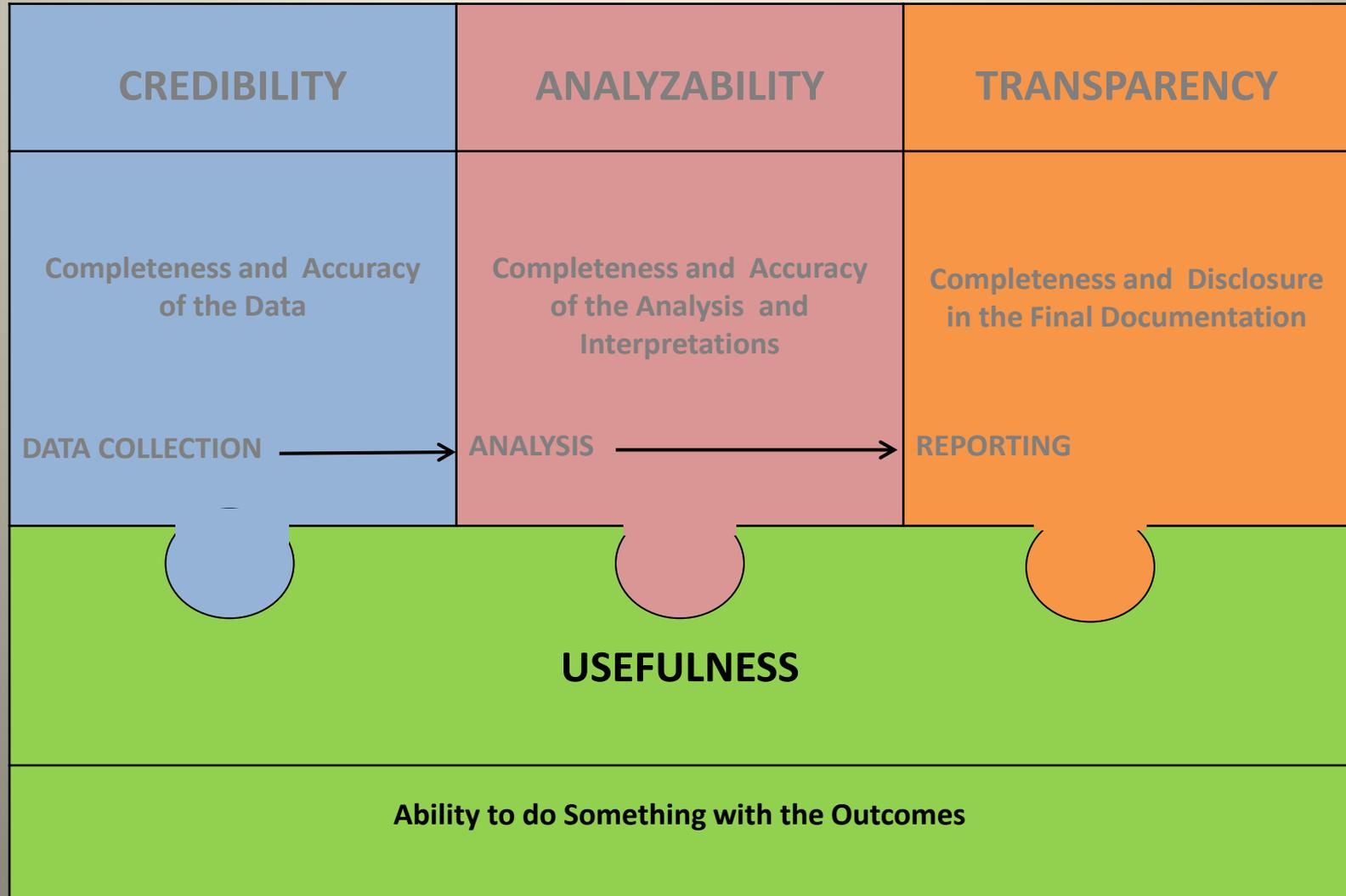
Total Quality Framework (TQF) for Qualitative Research (Roller & Lavrakas, Forthcoming)



TQF: Transparency

- Completeness and Disclosure in Final Documents
 - Thick Descriptions
 - Rich Details
 - Applicability/Transferability to Other Contexts

Total Quality Framework (TQF) for Qualitative Research (Roller & Lavrakas, Forthcoming)



TQF: Usefulness

- Ability to “Do Something” with the Outcomes
 - Support/Refute, Refine, Generate Hypotheses
 - Make Actionable Recommendations

Tailoring the TE Perspective to Different Research Methods

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 Measurement	
Error Type	Key Considerations
Specification	What are the key constructs that will be measured/coded
Instrument (Coding Form)	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	Relevant whenever researchers mentally “weight” the information gained from some interviewees differently than that from other interviewees

TE and In-Depth Interviewing

Errors of Measurement	
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	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 Measurement	
Error Type	Key Considerations
Specification	What are the key constructs that will be discussed
Instrument (Discussion Guide)	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 the 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(s) will be represented; what will be the list of locations and times 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	Are any sampled times and/or locations “missed”; are these materially different from those observed?
Adjustment	Not applicable, unless a complex sampling design is deployed

TE and Observational Research

Errors of Measurement	
Error Type	Key Considerations
Specification	What are the key behavioral constructs that will be observed and what are the facets of each
Instrument	How will the observational information be collected
Respondent	Will people know they are being observed; if Yes, how might this affect their behavior?
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 and TQF Perspectives

- Teaching Research Methods
- Planning New Research using a Cost-Benefit Perspective
- Conducting Literature Reviews
- Developing RFPs and Scoring Proposals
- Reviewing any Research-related Manuscript
- Legal Evidence and Testimony
- Transparency and Disclosure

- In Life...
 - How to judge the reliability and validity of any information on which we base our decisions

Total Error Article in POQ

- Today's presentation is based on an article that will appear in the journal, *Public Opinion Quarterly*, in the fall 2013 issue:
 - Lavrakas, Paul J. 2013. "Presidential Address: Applying a Total Error Perspective for Improving Research Quality in the Social, Behavioral, and Marketing Sciences." *Public Opinion Quarterly* 77:831–50.

Thank You!