Quality Control Considerations in Naturalistic Driving Data Reduction Efforts

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Data Reduction & Quality Control – What, Why, & How?

- Data Reduction:

  Translating video data into quantifiable data for statistical analysis.

- Quality Control:
  - What: Ensuring the accuracy and precision of that translation
  - Why: People make errors, and no two people are alike.
  - How:
    - Create new data: Know the risks, have a plan
    - Use existing data : Understand the risks and the steps that were taken

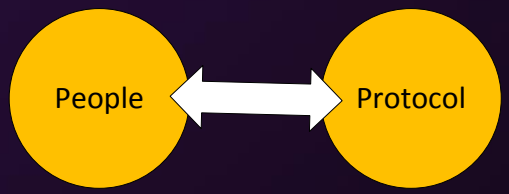
More "Why"s

- Results of data reduction
  - Event identification
  - Environmental conditions
  - Traffic conditions
  - Infrastructure information
  - Secondary tasks
  - Glance locations
  - Driver impairments
  - Vehicle and conflict parameters
  - Event sequence in context
- Results of quality control
  - Allow for multiple people help to code.
  - Confidence that coding is consistent
  - Confirmation that your definitions are clear and complete
  - No (bad) surprises in the end
  - Trust in your overall research results.

Data Reduction Components - People

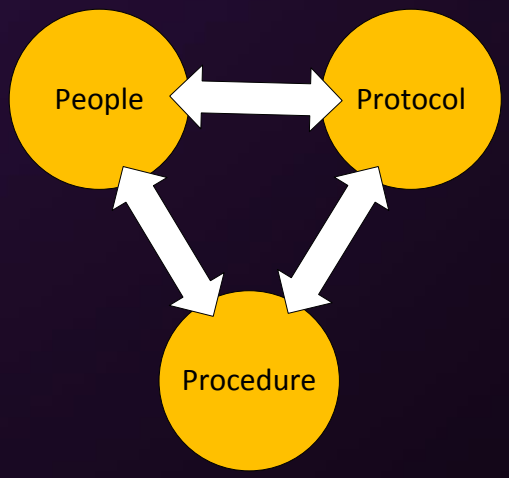
- Researcher(s)
- Project manager(s)
- Staff recruiter(s)
- Staff supervisor(s)
- Staff trainer(s)
- Communications liaison(s)
- Quality control technician(s)
- Data reductionist(s)
- Data analyst(s)

Data Reduction Components: Protocol



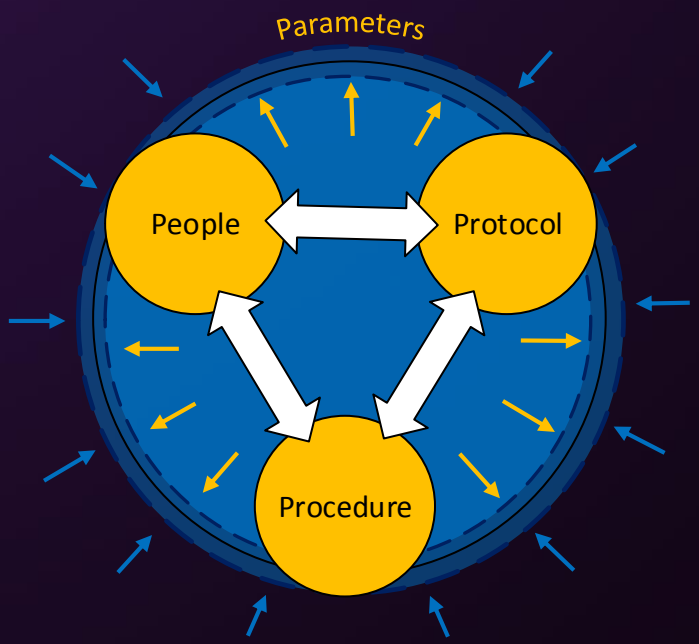
- Operationalizes the research question
- A framework for reduction task
- Relies on people for accurate and consistent interpretation

Data Reduction Components - Procedure



- Instructions for how each member of the team should operate
- Defines communication avenues
- Provides an infrastructure for continuous quality monitoring
- Sets limits to preserve quality, security, etc.

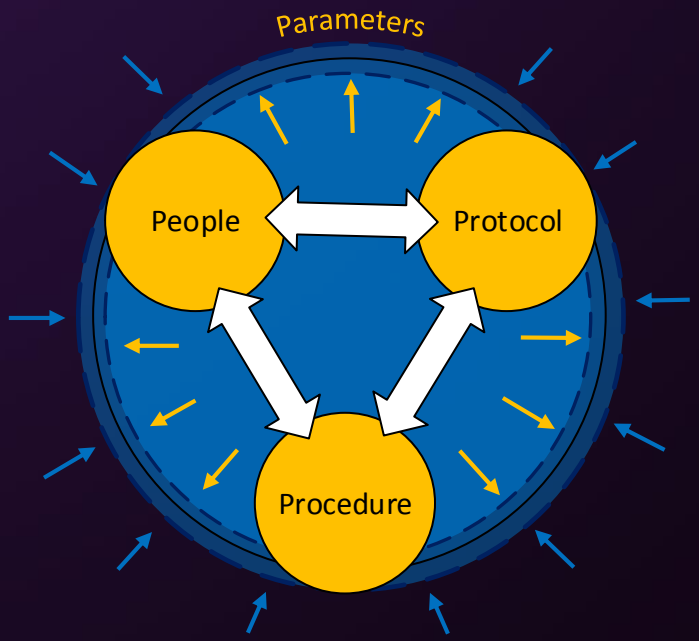
Data Reduction Components – Parameters



Time
Budget
Space
Video Specs
Equipment
Software
Network/Database
Training Tools

- Defines the workspace within which other components must operate (while maintaining quality)
- Often dynamic, either further constraining other components or allowing them to expand

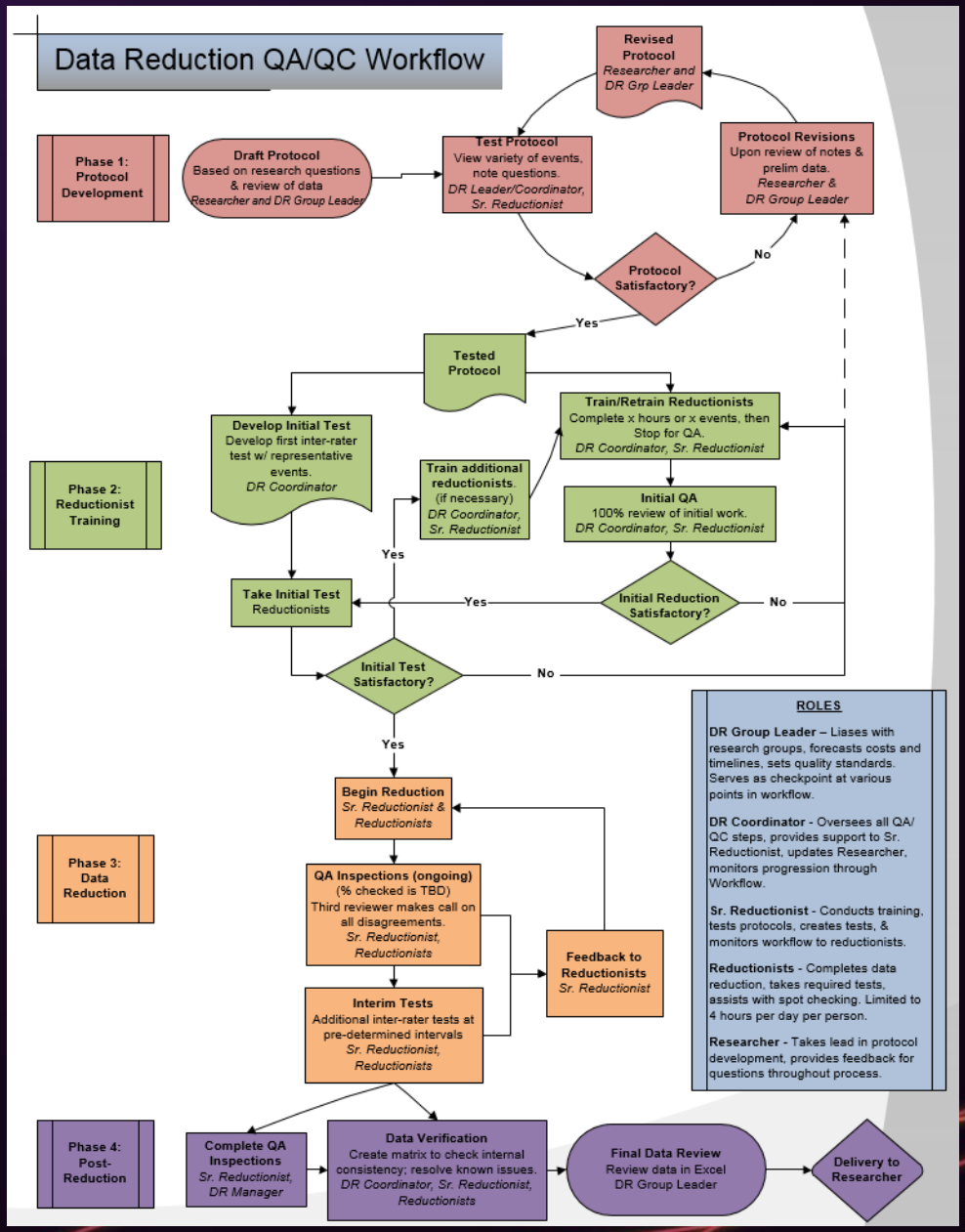
Data Reduction Components - Workspace



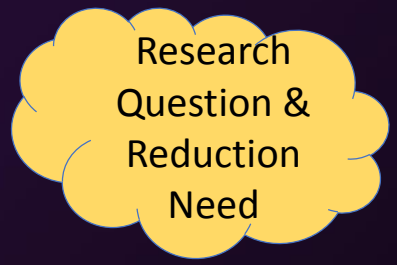
Components interact within a 3-dimensional, dynamic space.

The secret is making them work together!

Quality Control Workflow


Data Reduction QA/QC Workflow
Revised Protocol
Researcher and DR Grp Leader
Phase 1: Protocol Development
Draft Protocol
Based on research questions & review of data
Researcher and DR Group Leader
Test Protocol
View variety of events, note questions.
DR Leader/Coordinator, Sr. Reductionist
Protocol Revisions
Upon review of notes & prelim data.
Researcher & DR Group Leader
Protocol Satisfactory?
No
Yes
Tested Protocol
Train/Retrain Reductionists
Complete x hours or x events, then Stop for QA.
DR Coordinator, Sr. Reductionist
Develop Initial Test
Develop first inter-rater test w/ representative events.
DR Coordinator
Phase 2: Reductionist Training
Train additional reductionists (if necessary)
DR Coordinator, Sr. Reductionist
Initial QA
100% review of initial work.
DR Coordinator, Sr. Reductionist
Yes
Take Initial Test
Reductionists
Yes
Initial Reduction Satisfactory?
No
Initial Test Satisfactory?
No
Yes
ROLES
DR Group Leader – Liases with research groups, forecasts costs and timelines, sets quality standards. Serves as checkpoint at various points in workflow.
DR Coordinator - Oversees all QA/QC steps, provides support to Sr. Reductionist, updates Researcher, monitors progression through Workflow.
Sr. Reductionist - Conducts training, tests protocols, creates tests, & monitors workflow to reductionists.
Reductionists - Completes data reduction, takes required tests, assists with spot checking. Limited to 4 hours per day per person.
Researcher - Takes lead in protocol development, provides feedback for questions throughout process.
Begin Reduction
Sr. Reductionist & Reductionists
Phase 3: Data Reduction
QA Inspections (ongoing)
(% checked is TBD)
Third reviewer makes call on all disagreements.
Sr. Reductionist, Reductionists
Feedback to Reductionists
Sr. Reductionist
Interim Tests
Additional inter-rater tests at pre-determined intervals
Sr. Reductionist, Reductionists
Phase 4: Post-Reduction
Complete QA Inspections
Sr. Reductionist, DR Manager
Data Verification
Create matrix to check internal consistency; resolve known issues.
DR Coordinator, Sr. Reductionist, Reductionists
Final Data Review
Review data in Excel
DR Group Leader
Delivery to Researcher

Quality Control Workflow



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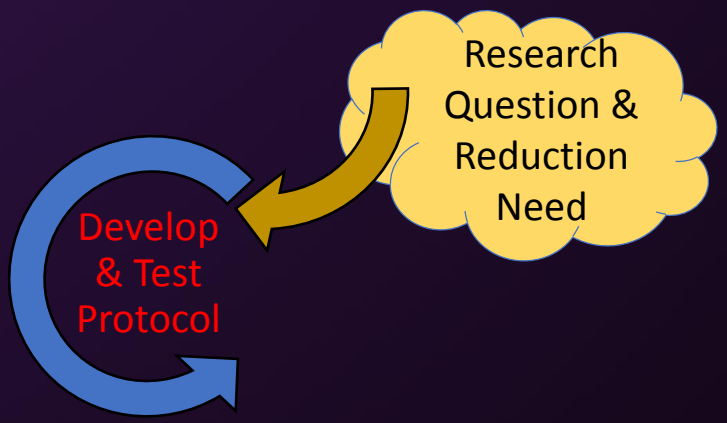
Reduced Data for Analysis

Two endpoints to define:

1. Research question & data needed
2. Data analysis plan

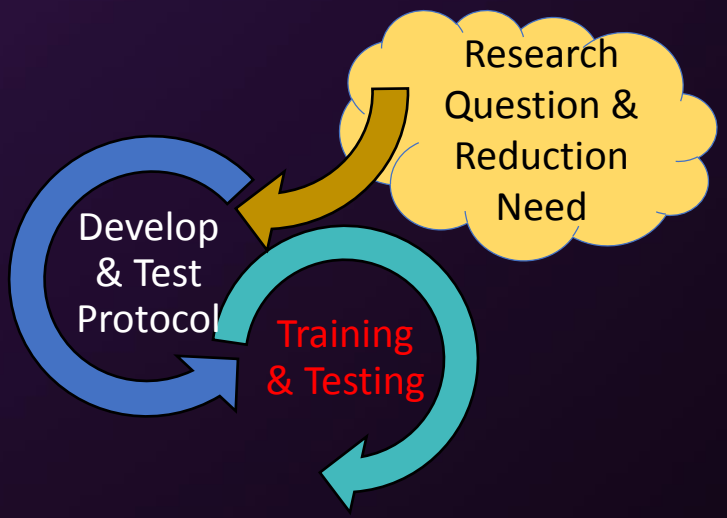
QC Workflow – Protocol



- Write, test, rewrite, retest
- Review ample video
- 3 Goals:
  1. Adequate information
  2. Accurate information
  3. Efficient retrieval
- Expect questions and revisions

Reduced Data for Analysis

QC Workflow – Training/Testing



- Develop a training dataset and a proficiency test
- Train small cohorts
- Train QC staff first
- Sample loop:
  - Review protocol on own
  - In-person training
  - Review training data
  - Complete proficiency test
  - Start over with next cohort

Reduced Data for Analysis

QC Workflow – Feedback

- Ongoing reduction phase
- Two key QC steps:
  1. Continuous checks and feedback
  2. Repeated testing, evaluation, & retraining
- Communication critical

QC Workflow - Verification

- Wrapping up all previous loops
- Check for "sanity" of reduced data
  1. Completeness
  2. Unexpected or unusual responses
  3. Internal consistency
- Prepare final dataset

QC Workflow – In Practice

←Research question + Video data in

←Four overlapping, bidirectional loops

←Reduced data out

Questions to Ask

- Research question + Existing/needed data?
- Analysis plan?
- Roles filled by which people?
- Resources and limitations?
- Protocol existing or needed?
- Key quality concerns?
- How will your team operate and communicate with each other and you?