A Practical Visualization Approach for Paradata Monitoring in Adaptive Total Design

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Overview

- Using adaptive total design (ATD) in a web/mail experiment

- Real time monitoring of costs and quality
  - Visualizing the survey process as it unfolds
  - Identifying metrics critical to quality (CTQ)
  - Displaying data for effective decision making

- Case study: Residential Energy Consumption Survey (RECS) National Pilot

- Lessons learned and recommendations
What is Adaptive Total Design? (ATD)

- Process to identify and monitor key features of a survey design that are critical to data quality (CTQ)

- Similar to *responsive design* and *adaptive design*
  - real-time monitoring of data
  - ATD goal to minimize total survey error and costs

- CTQ monitoring vital
  - to determine if/when interventions will be applied
  - aids in projecting outcomes of experiments
Range of decisions that can be made is dependent on the data available and options for intervention

Some features that can be manipulated or carry importance depending on mode/mix of modes:

<table>
<thead>
<tr>
<th>Example Features</th>
<th>Field</th>
<th>Phone</th>
<th>Mail</th>
<th>Web</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interviewer effects</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time of day</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasons for refusal</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical characteristics of HH</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Advance materials</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Survey appearance</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Incentives / other costs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Key steps to CTQs and ATD

- Begin with a flow diagram of the process

- Identify the CTQs
  - need to be monitored and the metrics or indicators that work best for addressing
  - highly correlated with costs or errors or some other component

- Organize the data and visualize the variation in CTQs in “real-time” (e.g. daily)

- 3 Ds: Distribute, Discuss, Decide whether/how to react
Illustration using RECS

- Periodic survey of households collecting energy characteristics, usage patterns, and demographics.

- Traditionally an in-person survey using computer-assisted personal interviewing (CAPI) for data collection.

- 3 pilots to determine feasibility, cost-effectiveness, time efficiency, and response validity of RECS using mixture of web and paper questionnaires delivered by mail.

  - Pilot 2: Cities Pilots (May to July 2015)
    - ATD monitoring across experimental conditions

  - Pilot 3: National Pilot (October 2015 to February 2016)
    - designed while Cities Pilot still in progress
8 treatment combinations of equal sample size
- 4 contact strategies; 2 incentives levels (all get $5 prepaid)

<table>
<thead>
<tr>
<th>Contact Strategy</th>
<th>Promised Incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web (CAWI) Only</td>
<td>$10  $20</td>
</tr>
<tr>
<td>Web (CAWI), then Paper (PAPI)</td>
<td>$10  $20</td>
</tr>
<tr>
<td>Choice</td>
<td>$10  $20</td>
</tr>
<tr>
<td>Choice Plus</td>
<td>$10 for paper, $20 for paper, $20 for web, $30 for web</td>
</tr>
</tbody>
</table>

Extended nonresponse followup (xNRFU)
- single UPS high-priority mailing
- abbreviated, one-page questionnaire
- random half offered additional $10
## Phase: 1. Main Study Data Collection

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Contact Materials/Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAWI Only</strong></td>
<td>Prenotice postcard  Letter + URL + $10/20 promised* Reminder postcard  Letter + URL + $10/20 promised Reminder postcard  UPS letter + URL + $10/20 promised</td>
</tr>
<tr>
<td><strong>CAWI/PAPI</strong></td>
<td>&quot;</td>
</tr>
<tr>
<td><strong>Choice</strong></td>
<td>&quot; + PAPI</td>
</tr>
<tr>
<td><strong>Choice+</strong></td>
<td>&quot; + PAPI + $10 bonus offer for web response</td>
</tr>
</tbody>
</table>

### Notes:
- * 50% randomly assigned for $10 or $20 at sample draw
- ** 50% randomly assigned to be offered additional $10 upon nonresponse followup sample draw
- " Same as CAWI Only

**Days Between:**
- 3
- 5
- 15
- 5
- 20
- 35
- 42

**Stop data collection**
RECS National Pilot CTQs

- **Submission rate**: cases submitted via web or paper form divided by the total number of sampled cases

- **Ineligible, Incompletion, breakoff, undeliverable rates**

- **Web survey timing** overall and by section

- **Comparison of estimates to benchmarks**
  - American Community Survey (ACS) benchmarks
  - comparisons to sampling frame
Submission rates by mode protocol

Cumulative Submission (%)

Day in Data Collection

- CAWI Only
- Web/mail mailing 1
- Reminder 1
- Mailing 2
- Postcard 2
- Mailing 3 (UPS)
- Nonresponse followup
- End of data collection
Submission rates by mode protocol

- **CAWI/PAPI**
- **CAWI Only**

- Web/mail mailing 1
- Reminder 1
- Mailing 2
- Postcard 2
- Mailing 3 (UPS)
- Nonresponse followup
- End of data collection
Submission rates by mode protocol
Submission rates by mode protocol
- Limit number of lines
- Patterns for b/w printing
Submission rates by mode protocol

- Simple, readable axes and legends
Submission rates by mode protocol

- Maximize the data-ink ratio (proportion of ink used to show data)
Proportion of submissions by web

Cumulative Submission by Web (%)

Day in Data Collection

- CAWI Only
- CAWI/PAPI
- Choice+
- Choice

Legend:
- Web/mail mailing 1
- Reminder 1
- Mailing 2
- Postcard 2
- Mailing 3 (UPS)
- Nonresponse followup
- End of data collection
Respondent age vs. ACS benchmark
Submission by domain

Cumulative Submission (%)

RECS Domain (0=overall)

1 (CT, MA, ME, NH, RI, VT); 2 (NY); 3 (NJ, PA); 4 (IL, IN, OH); 5 (MI, WI); 6 (IA, MN, ND, SD); 7 (KS, MO, NE); 8 (DE, MD, VA, WV); 9 (GA, NC, SC); 10 (FL); 11 (AL, KY, MS, TN); 12 (AR, LA, OK); 13 (TX); 14 (CO, ID, MT, UT, WY); 15 (AZ, NM, NV), 16 (CA); 17 (OR, WA); 18 (HI); 19 (AK)

Cumulative Submission Rate (%)
0-5
5-10
10-15
15-20
20-25
25-30
30-40
40-50
50-60
60-100
- Simple maps possible in most modern software packages (e.g. Excel)

- Tradeoffs in number/types of colors, visualizing relative differences
3 Ds: Distribute, Discuss, Decide

- Reports run nightly, automated SAS/Excel process published on project web portal for full team access

- Reports reviewed daily by data collection team, discussed in depth on weekly project calls

- Reports allowed for review and decision making during data collection
  - Cities Pilot ATDs led to design decisions for National Pilot
  - National Pilot ATDs led to decisions for 2015 RECS
ATD offers flexible approach to
- managing data collection
- monitoring data quality
- predicting survey and experimental outcomes

Interactive dashboards
- great for public dissemination
- But well-designed static graphs can help project team stay “on the same page.”
Lessons learned and recommendations (2)

- Good visualization of the process and highly predictive metrics are key attributes

- Graphics should incorporate “gestalt principles of visual perception”

- A hallmark of the approach is the 3 Ds:
  - Distribute
  - Discuss
  - Decide
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