MIDUS 3
PROJECT 3
(Main MIDUS participants Wave 3, Milwaukee Wave 2, and ReFielding Sample)

Data File Notes
Cognitive Test Battery

Brief Test of Adult Cognition by Telephone (BTACT)

Margie E. Lachman, Project Leader

MIDUS

Midlife in the United States

Brief Test of Adult Cognition by Telephone (BTACT)

- The BTACT includes 7 subtests that provide an index of cognitive function in domains of key importance in cognitive aging.
- Six of the BTACT subtests provide accuracy data.
- The Stop and Go Switch Task (SGST), which is a dual executive-function reaction time test, yields both accuracy and latency data.
- The cognitive battery was developed, processed, cleaned, and scored by Project 3. The battery was administered in a telephone interview. The data are labeled with "C3" which corresponds to MIDUS 3/ Project 3.

For more information about the BTACT instrument see:

- Lifespan Lab Website*:*

http://www.brandeis.edu/departments/psych/lachman/instruments/index.html

- Monitoring cognitive functioning: Psychometric properties of the Brief Test of Adult Cognition by Telephone (published article; doi: 10.1177/1073191113508807)

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4050038/

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- **BTACT Subtests:**

1. Immediate word list recall *(tests episodic verbal memory)*

Although participants hear only 15 words, the data fields for the immediate and delayed word recall tests each include 26 variables to allow for 15 list words and up to 11 possible repetitions (reporting a list item more than once) and intrusions (reporting non-list items). We use '90' as a code for intrusions (a measure of interest) to distinguish these from inapplicable responses. We measure total number of unique responses up to 15 (C3TWLITU), as well as total number of repetitions (C3TWLITR) and intrusions (C3TWLITI).

2. Digits backward span *(tests working memory)*

The measure is the highest number of digits recalled up to 8 (C3TDBS).

3. Category fluency *(tests verbal ability and speed and executive functioning)*

The primary measure of interest is total number of unique responses (C3TCTFLU).

4. The Stop and Go Switch Task *(tests reaction time, attention, taskswitching, inhibitory control)*

The primary measure of interest is the mean latency of switch and nonswitch trials (C3TSMXBB).

C3TSMXBB = mean (C3TSMXBO, C3TSMXBS) *where*
C3TSMXBO = median RT of all mixed-task nonswitch
C3TSMXBS = median RT of all mixed-task switch

5. Number series *(tests fluid intelligence/ reasoning)*

We give the actual number of the answer given for each of the 5 items (C3TNS1, C3TNS2, C3TNS3, C3TNS4, C3TNS5), the accuracy of each response (C3TNS1C, C3TNS2C, C3TNS3C, C3TNS4C, C3TNS5C), as well as total correct (C3TNSTOT).

6. Backward counting *(tests speed of processing)*

The primary measure of interest is the number of items correctly reported (C3TBKTOT). This is derived from the last number reached (C3BKCT), taking off points for errors (numbers omitted or reported erroneously, out of the correct sequence; C3BKERR). The total correct is calculated as C3TBKTOT = (100 – (C3BKCT + C3BKERR)).

7. Delayed word list recall *(tests episodic verbal memory/forgetting)*

This is given as the last subtest. As with immediate recall there are 26 fields to allow for repetitions and intrusions. Measures of interest are total number of unique items

recalled up to 15 (C3TWLDTU), as well as repetitions (C3TWLDTR) and intrusions (C3TWLDTI).

- **Composites:**

1. Forgetting

We provide a measure of forgetting (C3TWLF) calculated as the proportion forgotten between immediate and delayed word list recall [(Word List Immediate: Tot Unique Items - Word List Delayed: Tot Unique Item)/ Word List Immediate: Tot Unique Items] = [(C3TWLITU – C3TWLDTU)/C3TWLITU].

2. BTACT Composite

We provide a composite measure (C3TCOMP) that is calculated as the mean of z-scores for all tests except SGST: word list recall (sum of immediate and delayed tests), digits backward, category fluency, number series, and backward counting. First we computed the z-scores for all tests (i.e., word list recall, digits backward, category fluency, number series, and backward counting) and then we averaged them. The z-scores were computed using the means and standard deviations obtained on the main national MIDUS 2 sample (*N* = 4206). Therefore, the variable C3TCOMP can be used for longitudinal analyses. If interested in one global cognitive measure, the composite summary score can be used instead of the two factors (Episodic Memory and Executive Functioning).

Notes:

1. For some participants, one or more cognitive tests were defined as problematic using the variables (C3TWLIFP = 1; C3TDBFP = 1; C3TCTFFP = 1; C3TNSFP = 1; C3TBKFP = 1; C3TWLDFP = 1). Please note that to compute the BTACT composite we included the problematic cognitive tests. However, the composite was calculated only for the complete cases with scores on all tests.
2. The composite has shown good internal consistency (MIDUS 3 longitudinal Cronbach's Alpha = .73)

3. Factor Scores: Episodic Memory & Executive Functioning

We conducted exploratory and confirmatory factor analysis of the BTACT including latencies from the Stop & Go Tasks' switch and nonswitch trials (Lachman, Agrigoroaei, Tun, & Weaver, 2014). We included the measures from the above-mentioned "BTACT Composite" (Word List Immediate, Digits Backward, Category Fluency, Number Series, Backward Counting, and Word List Delayed) as well as the mean of switch and non-switch trial latencies (multiplied by -1 to ensure higher scores indicated faster response times).

A principal axis factor analysis with oblique rotation yielded two factors with eigenvalues greater than one. We also found a good fit for the two-factor model using confirmatory factor analysis. The first factor represented Episodic Memory (C3TEM) and was comprised of Word List Immediate and Word List Delayed. The second factor, Executive Functioning (C3TEF), was made up of the remaining variables. Each factor was computed as a mean of the z-scores for the respective tests. The z-scores were computed using the means and standard deviations obtained on the main national MIDUS 2 sample (*N* = 4206). Therefore, the variables C3TEM and C3TEF can be used for longitudinal analyses. The Executive Functioning factor (C3TEF) was computed using the Stop and Go Switch Task variable C3TSMXBBC which is the mean latency of switch and nonswitch trials (C3TSMXBB) corrected based on the metronome values (see section 4. below "Filters and Cell Phone Adjustments for Stop & Go Switch Task").
Because the Executive Functioning factor includes a variable from the Stop & Go Switch Task, see the note concerning filter use at the end of this document.

▪ Stop & Go Switch Task (SGST)

The Stop & Go Switch Task (SGST) is a dual executive-function test that was administered as part of the MIDUS telephone cognitive battery to assess important control functions including task-switching and inhibitory control. It provides both accuracy and latency measures.

The test includes 2 single-task blocks and a mixed-task block that required alternating between 2 tasks. In the single-task blocks participants give a vocal response as quickly as possible to the stimulus words "RED" and "GREEN"; the first block follows a "NORMAL" (congruent) response rule (say "STOP" to "RED", and "GO" to "GREEN"), then the second block follows a "REVERSE" (incongruent) response rule (say "GO" to RED", and "STOP" to "GREEN"). In the mixed-task block the cues "NORMAL" and "REVERSE" are given at unpredictable intervals, requiring the participant to switch between the congruent and incongruent response rules. Task-switching ability is reflected by the difference between performance on nonswitch trials and switch trials. Inhibitory control function is reflected by poorer performance on incongruent trials as compared to congruent trials.

1. Trial Types

This speeded task produces accuracy and latencies (in seconds) for 3 blocks of trials:

A. A *congruent* ("NORMAL") *single-task* measure (20 trials) in which the participant is expected to respond "STOP" to stimulus "RED", and "GO" to stimulus "GREEN".
B. An *incongruent* ("REVERSE") *single-task* measure (20 trials) in which the participant is expected to respond "GO" to stimulus "RED", and "STOP" to stimulus "GREEN".

C. A *mixed-task* that alternates between normal and reverse responses rules, depending on cue "NORMAL" or "REVERSE". Cue changes occur at random intervals after runs of 2, 3, 4, 5, or 6 trials of the same type. The first trial after a cue change is designated as a SWITCH trial. Subsequent trials in the run that do not involve a cue change are designated as NONSWITCH trials. There are 32 trials; however, trials 1-3 are considered a warm-up prior to the first switch and are not included in summary statistics.

2. Individual Trials

Raw scores for individual trials encode both accuracy and latency in seconds (to 3 decimal places). An incorrect trial (a "wrong answer") is coded as '95', and is not included in latency composites. An invalid trial is coded as '99' (e.g. participant is distracted, or makes responses other than "STOP" or "GO").

3. Composite Scores

Summary statistics include the following:

A. **Accuracy**: percent correct aggregated over conditions.
B. **Latency**: median reaction time, in seconds, for correct trials aggregated over conditions. We have chosen to use medians to avoid right-skewing of means with long response times.
C. **Costs**: we provide two measures of switch cost that give an estimate of the difference in performance on trials that require switching response rule and trials that do not require a switch. (1) General switch costs compare latencies on mixed-task trials to single-task trials. (2) Local switch costs compare mixed-task switch trials to mixed-task nonswitch trials. For both general and local switch costs, *absolute* costs represent a simple difference score between the easier and more difficult condition (e.g., A – B). *Relative* costs give the proportional decline in performance from the easier to the harder condition, and thus control for differences in baseline performance (e.g., (A-B)/A).

4. Filters and Cell Phone Adjustments for Stop & Go Switch Task

We provide two levels of filters. Researchers who wish to use all valid files can choose to select the Valid filter (i.e., cases in which there were no technical malfunctions, the participant understood the task and was not distracted by external events). The descriptive data for the SGST in the codebook were calculated using this 'Valid' filter. In our analyses, in addition to using only valid cases we have used a criterion of 75% accuracy in each condition to ensure that participants were performing the task correctly; researchers who wish to use this approach can select cases based on the 'Clean' filter. Note that the BTACT Executive Functioning Factor is computed using a variable from the SGST, and therefore the 'Clean' filter should be applied when using this factor.

The SGST latency values vary as a function of phone type (see variable C3PHONTYPE= landline (1) vs. cell phone (2)), with longer lag times usually obtained for cell phones. In order to adjust for the cell phone delays, we administered a metronome task at the beginning and at the end of the SGST. Please see the file M3_P3_BTACT_README_20190114.

The metronome task generated 20 time lags between the metronome clicks and the numbers (10 measured at the beginning and 10 at the end of the SGST). Given the large variability and time to get the gist of the task, the first two lags in each block (i.e., lag 1, lag 2 and lag 11, lag 12) were not taken into account in the scoring. The 16 remaining lags were used to compute two scores for each participant measuring the cell phone delays at the beginning and at the end of the SGST, respectively. The first score (C3TSMMB) was the median of the first 8 lags (from 3 to 10); the second score (C3TSMME) was the median of the last 8 lags (from 13 to 20). In order to adjust for the cell phone delays, we recommend (1) subtracting the mean of these two scores from the SGST latency composite scores (see file M3_P3_BTACT_Variable-Naming_20181119). These adjustment scores are only provided for the cell phones in which there was a lag between the counting and the metronome clicks.