PRET FILE STRUCTURE DESCRIPTION

**PRET Project Description:**

In order to improve the capability to monitor and evaluate the neurocognitive (NC) status of the International Space Station (ISS) astronauts, the CSA initiated the development of a novel tool called Performance Readiness Evaluation and Training Tool (PRET). PRET is based on a 3D virtual reality Mars mission simulator that offers multi-task activities embedded with NC tests. This would permit the assessment of a user’s neuropsychological performance in areas such as processing speed, memory, attention, and response control.

The initial prototype software (Version 1) was developed in 2010. The PRET prototype went through initial usability testing during the Russian Mars500 isolation study and the software was updated based on this experience, resulting in Version 2). Subsequently, the Carleton University Advanced Cognitive Engineering (ACE) Lab was contracted to perform further testing and evaluation of PRET in a controlled laboratory setting. This was done in four test phases (Phase 1, Phase 2, Phase 3 and Phase 3 Extension). After each phase, the PRET software was further refined and updated. The goal was to verify PRET’s robustness, usability, and ability to detect and predict the neurocognitive readiness of astronauts in performing critical mission tasks. Further testing on the ground is required before space application.

**Brief Description of Carleton University PRET Test Phases**:

* **Phase 1: PRET Usability Testing:** The PRET **version 2.0** was tested with the aim of re-evaluating its usability and software structure.
* **Phase 2: Validation Against Neurocognitive Tests (Part 1):** With PRET **version 3.0** and 50 participants, they compared PRET performance with standardized neurocognitive tests: Delis-Kaplan Executive Function System (DKEFS), Paced Auditory Serial Addition Test (PASAT), Psychomotor Vigilance Task (PVT), Test of Variables of Attention (TOVA), Wechsler Adult Intelligence Scale – Fourth Edition (WAIS-IV), and Wechsler Memory Scale – Fourth Edition (WMS-IV) to performance on neurocognitive tasks in the PRET software.
* **Phase 3: Validation Against Neurocognitive Tests (Part 2):** With PRET **version 4.0** and 160 participants, they analyzed the relationship between standardized neurocognitive tests and the PRET embedded tasks that were adapted from them, determining if the latter was an acceptable proxy for the former.
* **Phase 3 Extension: Test-Retest Reliability and Stabilization:** With PRET **version 5.0** and 40 participants, they assessed the test-retest reliability at one week and four week intervals, comparing PRET to neurocognitive assessment tools Defense Automated Neurobehavioral Assessment (DANA) and Spaceflight Cognitive Assessment Tool for Windows (WinSCAT). PRET was also compared to Patient-Reported Outcomes Measurement Information System (PROMIS-29) and WAIS-IV but weak correlations were found.

**Folders:**

# PRET version 2.0 folder includes:

* **Report** from June 1, 2012 on usability by Carleton University

This is in a folder called *PRET Versions, Data, Analysis, Reports*.

# PRET versions 3.0, 4.0, and 5.0 folders each include:

* **Data files** are SPSS .sav and Excel .xlsx files for each standardized neurocognitive test and PRET task. For some tests, raw files per subject are included but they are also summarized in data files including all variables and outputs used in analyses. Data files containing all subjects and variables are n=50 spreadsheets for PRET version 3.0, n=160 for PRET version 4.0, and n=40 for PRET version 5.0. Any .csv files that cannot be opened in Excel can be opened in WordPad.
  + PRET version 3.0 and 4.0 Neurocognitive test TOVA’s Reaction Times were rounded to the nearest millisecond because of experimental apparatus accuracy. Mean Reaction Times, Commission errors/false alarm, and omission errors/miss were the only variables used in analysis and these are found in the TOVA PDFs; the rest of the variables were not used in analysis so they are not labelled in an understandable way. Original values and variables in PRET version 3.0 & 4.0 raw data can be matched to final sheets:

|  |  |  |
| --- | --- | --- |
| **Column in raw datasheets for NC Test TOVA** | **Raw data sheet** | **n=160 sheet** |
| FD to FF (for subjects in normative sample range)  ER to ET (for subjects in ADHD sample range) | RTMEANH1, RTMEANH2, RTMEANT | TOVA\_RT\_HALF\_1, TOVA\_RT\_HALF\_2, TOVA\_RT\_TOTAL |
| BJ to BL (for subjects in normative sample range)  AX to AZ (for subjects in ADHD sample range) | COMERRH1, COMERRH2, COMERRT | TOVA\_FA\_HALF\_1, TOVA\_FA\_HALF\_2, TOVA\_FA\_TOTAL |
| CE to CG (for subjects in normative sample range)  BS to BU (for subjects in ADHD sample range) | OMERRH1, OMERRH2, OMERRT | TOVA\_MISS\_HALF\_1, TOVA\_MISS\_HALF\_2, TOVA\_MISS\_TOTAL |

* + PVT version 3.0 raw data is included in n=50 spreadsheet. The files in the folders are of the same data divided into one line per file and with no headings.
  + NOTE: PRET version 4.0 Data Files 🡪 NC Tests 🡪 PVT is missing Subject 8115 in the spreadsheets and raw data files due to experimenter error. These are the files for n=160.
* **Analysis files** are SPSS .sav and .spv output files and Excel .xlsx. PRET version 4.0 outliers are included here. PRET version 5.0 outlier files with the endings .OUT (list of outliers), .REJ (summary of outlier analysis results), .RTS (remaining values after outliers removed), and .MEAN (mean of remaining values) can be opened with WordPad or Notepad. The endings don’t indicate their file extensions. These are outliers for DANA, PRET tasks, and WinSCAT.
  + Master tables reflect the result of participant-level outlier analysis (participants removed), not trial-level outlier analysis (individual trials within participant data removed). For version 3.0, there were no outliers. For version 4.0, one master table includes all subjects, n=160, and one with nine outliers removed, n=151. The nature of analysis for version 5.0 did not require a master table.
* **Reports** are from August 30, 2013 on validation against neurocognitive tests (part 1), October 31, 2014 on validation against neurocognitive tests (part 2), and February 29, 2016 on test-retest reliability and stabilization.
* **Software changes** were made to version 3.0, 4.0, and 5.0. This outlines changes between versions.

These are in a folder called *PRET Versions, Data, Analysis, Reports*.

# Documents/folders that cover all PRET versions:

* **Acronyms \_Abbreviations** folder lists any acronyms and abbreviations used within reports or as headings of datasets. *Acronyms\_Abbreviations\_Variables* is a comprehensive list of the acronyms, abbreviations, and PRET variable names used in the user manual, reports, data files, and analysis files over all testing phases. *Analysis File Abbreviations* provides the abbreviations used in all analysis, organized by NC test. *PRET Data File Variable Descriptions* is a list of each PRET variable name with corresponding descriptions. A description of the PRET variables that appear in the output files also appears in the updated PRET user’s manual.
* **History Outline** file describes all PRET version software changes and analyses done. To use links within the document, keep the file *History Outline* in the same folder as subfolders *PRET version 2.0, PRET version 3.0, PRET version 4.0,* and *PRET version 5.0*.
* **User Manual** file describes the technical requirements and instructions for running PRET.
* **PRET Completion Times** folder charts the time taken for each task within PRET for each phase.

# Two additional analyses were done to supplement the analyses and results presented in the final reports.

* **Gamer analysis** compares gamers to non-gamers in their performance using PRET version 5.0.
* **Gender analysis** compares men and women performance in PRET versions 3.0, 4.0, and 5.0

# PRET Software

PRET software has been used non-commercially for governmental purposes and international collaboration with space agencies and/or other CSA partners. For more information, please contact the owner of the dataset.