

VARIABLE NAMES & EXPLANATIONS FOR MIDUS REFRESHER 1 PROJECT 5

Character 1: MIDUS Sample
R = MIDUS Refresher

Character 2: MIDUS Wave
A = Wave 1

Character 3: Project #
5 = Project #5

Character 4: Measure
S = Self-reports
B = Startle Eyeblink
C = Corrugator EMG
L = Zygomaticus EMG
K = Heart Rate Variability (QRSTool and CMetX – used in MR1 only)
R = Psychophysiology Emotional Response Task - Response Times
A = Psychophysiology Emotional Response Task - Response Accuracy
N = CANTAB Cognitive measures
D = Cube & Paper Test
F = Free Recall
T = Picture Ratings
P = Participant Characteristics
H = Handedness
O = Hearing Test
I = General MRI Information
E = Extracted Structural Brain Measurements
W = Extracted Diffusion Weighted Imaging Measurements

Remaining characters differ to build discrete variables, but all within the given measure type set by character 4.

For Ch4 = S (i.e., Self-reports):

Character(s) 5 (& 6): Scale
DP = Dispositional Positive Affect Scale (DPES)
P = Positive and Negative Affect Schedule (PANAS)
IR = Interpersonal Reactivity Index (IRI)
S = Spielberger State-Trait Anxiety Scale (STA)
E = Emotion Regulation Questionnaire (ERQ)

For Ch5 & 6 = DP (i.e., DPES):

Character 7: Subscale
C = Contentment
J = Joy
H = Hope
L = Love/Attachment
D = Desire
O = Compassion
P = Pride
G = Gratitude
A = Amusement

W = Awe
I = Interest
T = All scales summary score

Characters 8 & 9: Measure

None = Summary Measures
Numbers = Individual Questions

For Ch5 = P (i.e., PANAS):

Character 6: Time Point

- 1 = PANAS-Now, Time 1 (prior to Psychophysiology Emotional Response Task)
- 2 = PANAS-Now, Time 2 (after Psychophysiology Emotional Response Task)
- 3 = PANAS-Now, Time 3 (prior to fMRI Emotional Response Task)
- 4 = PANAS-Now, Time 4 (after fMRI Emotional Response Task)

G = PANAS-General

Character 7: Subscale

P = Positive Affect

N = Negative Affect

Characters 8 & 9: Measure

None = Summary Measures

Numbers = Individual Questions

For Ch5 & 6 = IR (i.e., IRI):

Characters 7 & 8: Subscale

- PT = Perspective-Taking Scale
FS = Fantasy Scale
EC = Empathic Concern Scale
PD = Personal Distress Scale
None = All scales summary score

Characters 9 & 10: Measure

None = Summary Measures

Numbers = Individual Questions

For Ch5 = S (i.e., STAI):

Character 6: Time Point

- 1 = STAI-X1, Time 1 (prior to Psychophysiology Emotional Response Task)
- 2 = STAI-X1, Time 2 (after Psychophysiology Emotional Response Task)
- 3 = STAI-X1, Time 3 (prior to fMRI Emotional Response Task)
- 4 = STAI-X1, Time 4 (after fMRI Emotional Response Task)

T = STAI-X2, Trait anxiety form of STAI

Characters 7 & 8: Measure

None = Summary Measures

Numbers = Individual Questions numbers

For Ch5 = E (i.e., ERQ):

Character 6: Subscale

R = Reappraisal

S = Suppression

Characters 7 & 8: Measure

None = Summary Measures

Numbers = Individual Questions numbers

For Ch4 = B (i.e., Eyeblink Startle):

RA5B = Number of valid eyeblink startle responses measured over entire paradigm

RA5BF = Filter for good eyeblink startle response data

Character 5: Picture Valence

N = Negative

O = Neutral

P = Positive

Character 6: Probe Time

E = Early (2900 ms after picture onset)

M = Mid (4400 ms after picture onset)

L = Late (5900 ms after picture onset)

Character 7: Metric

A = Amplitude (includes only responses, so assesses height of response)

M = Magnitude (includes no responses as a zero, so averaging will be affected by no responses)

For Ch4 = C or L (i.e., Corrugator and Zygomaticus EMG):

RA5C = Filter for good corrugator data (bad corrugator data might exhibit high levels of noise and/or artifact)

RA5L = Filter for good zygomatic data (bad zygomatic data might exhibit high levels of noise and/or artifact)

Character 5: Picture Valence

N = Negative

O = Neutral

P = Positive

Character 6: Time

E = Early (1-4 seconds following picture onset)

M = Middle (5-8 seconds following picture onset)

L = Late (9-12 seconds following picture onset)

For Ch4 = K (i.e., Heart Rate Variability – processed with QRSTool and CMetX)

Character 5: Session Type

1 = Psychophysiology baseline

2 = MRI resting state

Characters 6 & 7: Heart rate variability metric

FV = Filter variable for good HRV data

LF = low frequency band

HF = high frequency band

FF = ratio low frequency over high frequency

HR = heart rate

NI = Number of interbeat intervals

MI = Mean interbeat interval

MH = Mean heart rate

SD = Standard deviation of RR beats (SDNN)

RM = Root means squared successive differences between RR intervals
(RMSSD)

MS = Mean of successive differences between RR intervals
(MSD)

PN = "Percentage of successive normal to normal intervals that differ by more than 50 milliseconds" (PNN50) (Shaffer, McCraty & Zerr, 2014)

CV = Cardiac vagal index (CVI)

CS = Cardiac sympathetic index (CSI)

TL = ToichiL (length of longitudinal axis in Lorenz plot of interbeat intervals (Toichi, Sugiura, Murai, & Sengoku, 1997))

TT = ToichiT (length of transverse axis in Lorenz plot of interbeat intervals
(Toichi, Sugiura, Murai, & Sengoku, 1997))
LH = logHRV (log of time variance in unfiltered interbeat interval series)
LR = logRSA (log of respiratory sinus arrhythmia)
AT = CMetX artifact threshold (in milliseconds) (Allen, Chambers, & Towers, 2007)

For Ch4 = R or A (i.e., Psychophysiology Emotional Response Task reaction time and accuracy):
Character 5: Picture Valence

N = Negative
O = Neutral
P = Positive

For Ch4 = N (i.e., CANTAB cognitive assessments):

Character 5: Test type

M = Motor Screening Task (MOT)
I = Intra-Extra Dimensional Set Shift (IED)
A = Affective Go/No-Go (AGN)
S = Information Sampling Task (IST)
T = Attention Switching Task (AST)
E = Emotion Recognition Task (ERT)
G = Cambridge Gambling Task (CGT)

For Ch5 = M (i.e., MOT):

Character 6: Measure
E = Mean Error
L = Mean Latency

For Ch5 = I (i.e., IED):

Character(s) 6 (& 7): Measure type

Numbers = Summary stage-related measures. See table in
MR1_P5_DOCUMENTATION_OF_CANTAB_20260206 for list of
measures

T = Totals
C = Calculated Measures
S = Stages

For Ch6 = T or C:

Characters 7 & 8: Measure

Numbers = Total measures. See table in
MR1_P5_DOCUMENTATION_OF_CANTAB_20260206 for
list of measures

For Ch6 = S:

Character 7: Type
T = Trials per stage
E = Errors per stage

Character 8: Stage Number
Numbers = Stages #1-9

For Ch5 = A (i.e., AGN):

Character 6: Measure

R = Affective Response Bias (Mean)
L = Mean Correct Latency

T = Total Incorrect (Commissions/Omissions errors)

For Ch6 = L:

Characters 7 & 8: Trial Type

Numbers = Condition (Positive/Negative/Neutral, Shift/Non-shift)

For Ch6 = T:

Character 7: Total Incorrect Responses/Non-responses

M = Total Commissions

O = Total Omissions

Character 8: Trial Type

None = Total

Numbers = Condition (Positive/Negative/Neutral, Shift/Non-shift)

For Ch5 = S (i.e., IST):

Characters 6 & 7: Measure

Numbers = See table in *MR1_P5_DOCUMENTATION_OF_CANTAB_20260206*
for list of measures

For Ch5 = T (i.e., AST):

Character 6: Measure Type

T = Totals

P = Percentages

L = Latency-Related Measures

C = Cost-Related Measures

For Ch6 = T, P, or L:

Characters 7 & 8: Measure

Numbers = See table in

MR1_P5_DOCUMENTATION_OF_CANTAB_20260206 for
list of measures

For Ch6 = C:

Character 7: Measure/Trial Type

C = Mean Congruency Cost

S = Mean Switch Cost

For Ch7 = C or S:

Character 8: Response Type

C = Correct

I = Incorrect

None = All Responses (Correct & Incorrect)

For Ch5 = E (i.e., ERT):

Character 6: Measure Type

P = Percentages

T = Totals

L = Latency-Related Measures

For Ch6 = P or T:

Character 7: Response Type

C = Correct

I = Incorrect

Character 8: Stimulus Type

Numbers = See table in
MR1_P5_DOCUMENTATION_OF_CANTAB_20260206 for
list of measures
None = Total Correct (All Stimulus Types)

For Ch6 = L:

Characters 7 & 8: Stimulus/Response Type

Numbers = See table in
MR1_P5_DOCUMENTATION_OF_CANTAB_20260206 for
list of measures
None = Mean Overall Response Latency

For Ch5 = G (i.e., CGT):

Character 6: Measure Type

A = Delay Aversion
D = Deliberation Time
P = Overall Proportion Bet
Q = Quality of Decision-Making
J = Risk Adjustment
R = Risk Taking

Character 7: Trial Type

A = Ascending Trials
D = Descending Trials
None = All Trials

For Ch4 = D (i.e., Cube & Paper Test):

RA5D = Cube & Paper Total Correct

Character 5: Measure

R = Cube & Paper Total Number of Responses
C = Cube subset
P = Paper subset

For Ch5 = C or P:

Character 6: Subset - Correct vs Number of Responses

A = Number of Correct Response
B = Number of Responses

For Ch4 = F (i.e., Free Recall):

Character 5: Measure

R = Total Recalled
S = Total Recalled (Social)
X = Total Recalled (Non-Social)
P = Total Recalled (Positive)
N = Total Recalled (Negative)
O = Total Recalled (Neutral)

For Ch4 = T (i.e., Picture Ratings):

Character 5: Rating Scale

V = Valence
A = Arousal

Character 6: Picture Valence

P = Positive

N = Negative

O = Neutral

Character 7: Session

1 = Psychophysiology

For Ch4 = P (i.e., Participant Characteristic):

RA5PAGE = Age at P5 visit

RA5PDATE_MO = Month of P5 data collection

RA5PDATE_YR = Year of P5 data collection

Character 5: Participant Characteristic

H = Height

W = Weight

B = BMI

For Ch5 = H:

Character 6: Units of Measurement

M = Metric (Centimeters)

C = Feet/Inches

For Ch4 = H (i.e., Handedness):

RA5HAND = Handedness

For Ch4 = O (i.e., Hearing Test):

Character 5: Side of hearing test

L = Left Ear

R = Right Ear

Character 6: Frequency of tone

1 = 250 Hz

2 = 500 Hz

3 = 1000 Hz

For Ch4 = I (i.e., General MRI Information):

Character 5:

C = Filter for participation in MRI imaging protocol (completed at least T1-weighted structural scan)

F = Radiologist flagged abnormal structural MRI

N = Self-reported neurological condition

T = Time MRI started (military time)

For Ch5 = T:

Character 6: MRI scan

S = Structural scan start time

F = Functional scan start time

For Ch4 = E (i.e., Extracted Structural Brain Measurements):

Character 5: Measurement Type

A = Cortical Area

C = Cortical Curvature

T = Cortical Thickness
V = Cortical Volume
S = Subcortical Volume
B = Brain-Predicted Age

For Ch5 = A, C, T, V, S:

Character 6: Brain Hemisphere

L = Left Hemisphere
R = Right Hemisphere
N = N/A: Measure is bilateral

Character 7: Freesurfer Brain Atlas or Module

D = Destrieux
K = Desikan-Killiany
T = Desikan-Killiany-Tourville (DKT)
A = Aseg Subcortical Atlas or Hippocampal Subfield/Amygdala Nuclei Module

Characters 8 & 9:

Numbers = See table in

MR1_P5_DOCUMENTATION_OF_BRAIN_MEASURES_20260206
for list of measures

For Ch5 = B (i.e., Brain-Based Aging Algorithms):

Character 6: Algorithm

None = RA5EB - Cole brainageR v1.0 - <https://github.com/james-cole/brainageR/tree/1.0>

C = Cole brainageR v2.0 - <https://github.com/james-cole/brainageR/tree/2.0>

T = TSAN brainage - PMID: 34086565 - <https://github.com/Milan-BUAA/TSAN-brain-age-estimation>

P = 3D-CNN brainage - PMID: 36595679 - https://github.com/irimia-laboratory/USC_BA_estimator

D = DunedinPACNI Dunedin Pace of Aging Calculated from NeuroImaging -
PMID: 40595015 - <https://github.com/etw11/DunedinPACNI>

For Ch4 = W (i.e., Extracted Diffusion Weighted Imaging Measurements):

Character 5: Measurement Type

F = Fractional Anisotropy (FA)
M = Mean Diffusivity (MD)
R = Radial Diffusivity (RD)
A = Axial Diffusivity (AD)

Character 6: Brain Hemisphere

G = Global Measure
L = Left Hemisphere
R = Right Hemisphere
N = N/A: Measure is bilateral

Character 7: Method Used

I = IIT Atlas v4.1
J = JHU Atlas
T = Manual Tractography

Characters 8 & 9:

Numbers = See table in

MR1_P5_DOCUMENTATION_OF_BRAIN_MEASURES_20260206 for list
of measures

References:

Facial electromyography (corrugator, zygomatic, and eyeblink startle)

- Blumenthal, T.D., Cuthbert, B.N., Filion, D.L., Hackley, S., Lipp, O.V., & Van Boxtel, A. (2005). Committee report: Guidelines for human startle eyeblink electromyographic studies. *Psychophysiology*, 42, 1-15.
- Bradley, M. M., Codispoti, M., & Lang, P. J. (2006). A multi-process account of startle modulation during affective perception. *Psychophysiology*, 43(5), 486–497. doi: 10.1111/j.1469-8986.2006.00412.x
- Cacioppo, J. T., Petty, R. E., Losch, M. E., & Kim, H. S. (1986). Electromyographic activity over facial muscle regions can differentiate the valence and intensity of affective reactions. *Journal of Personality and Social Psychology*, 50(2), 260–268. <http://doi.org/10.1037/0022-3514.50.2.260>
- Larsen, J. T., Norris, C. J., & Cacioppo, J. T. (2003). Effects of positive and negative affect on electromyographic activity over zygomaticus major and corrugator supercilii. *Psychophysiology*, 40(5), 776–785. <http://doi.org/10.1111/1469-8986.00078>
- Tassinary, L. G., & Cacioppo, J. T. (2000). The Skeletomotor System: Surface Electromyography. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of Psychophysiology* (2nd ed., pp. 163–199). Cambridge University Press.
- Tassinary, L. G., Cacioppo, J. T., & Vanman, E. J. (2007). The Skeletomotor System: Surface Electromyography. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of Psychophysiology* (3rd ed., pp. 267–299). Cambridge University Press.

HRV

- Allen, J.J.B., Chambers, A.S., & Towers, D.N. (2007). The many metrics of cardiac chronotropy: A pragmatic primer and a brief comparison of metrics. *Biological Psychology*, 74, 243-262.
- Shaffer, F., McCraty, R., & Zerr, C. L. (2014). A healthy heart is not a metronome: an integrative review of the heart's anatomy and heart rate variability. *Frontiers in psychology*, 5, 1040. doi:10.3389/fpsyg.2014.01040
- Toichi, Sugiura, Murai, & Sengoku. (1997). A new method of assessing cardiac autonomic function and its comparison with spectral analysis and coefficient of variation of R–R interval. *Journal of the Autonomic Nervous System*, 62(1), 79-84.

Cube & Paper

- Gilbertson, M.W., Williston S.K., Paulus, L.A., Lasko, N.B., Gurvits, T.V., Shenton, M.E., Pitman, R.K., Orr, S.P. (2007). Configural cue performance in identical twins discordant for posttraumatic stress disorder: Theoretical implications for the role of hippocampal function. *Biol Psychiatry*, 62(5), 513-520.

Diffusion Weighted Imaging atlases

- Mori S, Oishi K, Jiang H, et al. (2008) Stereotaxic white matter atlas based on diffusion tensor imaging in an ICBM template. *Neuroimage*, 40(2), 570–582. doi:10.1016/j.neuroimage.2007.12.035
- Zhang S, Arfanakis K. (2018) Evaluation of standardized and study-specific diffusion tensor imaging templates of the adult human brain: Template characteristics, spatial normalization accuracy, and detection of small inter-group FA differences. *Neuroimage*, 172, 40-50.

Freesurfer-Based Structural MRI atlases and Modules

Desikan-Killiany-Tourville (DKT) Brain Atlas

- Klein, A., & Tourville, J. (2012). 101 labeled brain images and a consistent human cortical labeling protocol. *Frontiers in neuroscience*, 6, 171. <https://doi.org/10.3389/fnins.2012.00171>

Desikan-Killiany Brain Atlas

Desikan R.S., Ségonne F., Fischl B., Quinn B.T., Dickerson B.C., Blacker D., Buckner R.L., Dale A.M., Maguire R.P., Hyman B.T., Albert M.S., & Killiany R.J. (2006). An automated labeling system for subdividing the human cerebral cortex on MRI scans into gyral based regions of interest. *Neuroimage*, 31(3), 968-980.

Destrieux Brain Atlas

Fischl B., van der Kouwe A., Destrieux C., Halgren E., Ségonne F., Salat D.H., Busa E., Seidman L.J., Goldstein J., Kennedy D., Caviness V., Makris N., Rosen B., & Dale A.M. (2004). Automatically parcellating the human cerebral cortex. *Cereb Cortex*, 14(1), 11-22.

Aseg Subcortical Brain Atlas

Fischl B., Salat D.H., Busa E., Albert M., Dieterich M., Haselgrove C., van der Kouwe A., Killiany R., Kennedy D., Klaveness S., Montillo A., Makris N., Rosen B., & Anders M. Dale A.M. (2002). Whole brain segmentation: automated labeling of neuroanatomical structures in the human brain. *Neuron*, 33, 341-355.

Hippocampal Subfields

Iglesias, J.E., Augustinack, J.C., Nguyen, K., Player, C.M., Player, A., Wright, M., Roy, N., Frosch, M.P., Mc Kee, A.C., Wald, L.L., Fischl, B., and Van Leemput, K.(2015). A computational atlas of the hippocampal formation using ex vivo, ultra-high resolution MRI: Application to adaptive segmentation of in vivo MRI. *Neuroimage*, 115, 117-137

Amygdala Nuclei

Saygin ZM & Kliemann D (joint 1st authors), Iglesias JE, van der Kouwe AJW, Boyd E, Reuter M, Stevens A, Van Leemput K, Mc Kee A, Frosch MP, Fischl B, Augustinack JC. (2017). High-resolution magnetic resonance imaging reveals nuclei of the human amygdala: manual segmentation to automatic atlas. *Neuroimage*, 155, 370-382.

Brain-Based Aging Algorithm

Cheng J, Liu Z, Guan H, Wu Z, Zhu H, Jiang J, Wen W, Tao D, Liu T. Brain Age Estimation From MRI Using Cascade Networks With Ranking Loss. *IEEE Trans Med Imaging*. 2021 Dec;40(12):3400-3412. doi: 10.1109/TMI.2021.3085948. Epub 2021 Nov 30. PMID: 34086565.

Cole JH, Leech R, Sharp DJ, for the Alzheimer's Disease Neuroimaging Initiative (2015). Prediction of brain age suggests accelerated atrophy after traumatic brain injury. *Ann Neurol* 77(4): 571-581.

Cole, J. H., & Franke, K. (2017). Predicting Age Using Neuroimaging: Innovative Brain Ageing Biomarkers. *Trends in Neurosciences*, 40(12), 681–690.

<http://doi.org/10.1016/j.tins.2017.10.001>

Cole JH, Poudel RPK, Tsagkrasoulis D, Caan MWA, Steves C, Spector TD, Montana G. Predicting brain age with deep learning from raw imaging data results in a reliable and heritable biomarker. *Neuroimage*. 2017 Dec;163:115-124. doi: 10.1016/j.neuroimage.2017.07.059. Epub 2017 Jul 29. PMID: 28765056.

Cole JH, Ritchie SJ, Bastin ME, Valdes Hernandez MC, Munoz Maniega S, Royle N et al. (2018). Brain age predicts mortality. *Molecular psychiatry*, 23: 1385-1392.

Whitman, E. T., Elliott, M. L., Knott, A. R., Abraham, W. C., Anderson, T. J., Cutfield, N. J., Hogan, S., Ireland, D., Melzer, T. R., Ramrakha, S., Sugden, K., Theodore, R., Williams, B. S., Caspi, A., Moffitt, T. E., & Hariri, A. R. (2025). DunedinPACNI estimates the longitudinal Pace of Aging from a single brain image to track health and disease. *Nature aging*, 5(8), 1619–1636.

<https://doi.org/10.1038/s43587-025-00897-z>

Yin, C., Imms, P., Cheng, M., Amgalan, A., Chowdhury, N. F., Massett, R. J., Chaudhari, N. N., Chen, X., Thompson, P. M., Bogdan, P., Irimia, A., & Alzheimer's Disease Neuroimaging Initiative (2023). Anatomically interpretable deep learning of brain age captures domain-specific cognitive impairment. *Proceedings of the National Academy of Sciences of the United States of America*, 120(2), e2214634120. <https://doi.org/10.1073/pnas.2214634120>

DPES

Shiota, M. N., Keltner, D., & John O. P. (2006). Positive emotion dispositions differentially associated with Big Five personality and attachment style. *Journal of Positive Psychology*, 1, 61-71.

ERQ

Gross, J.J., & John, O.P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, 85, 348-362.

IRI

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology*, 10, 85.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 44, 113-126.

PANAS

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.

STAI-X

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.