



MIXWILD

User's Guide

Mixed Model Analysis With Intensive Longitudinal Data

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Table of Contents

1. Overview of Mix Suite: The two-stage approach 1
1.1. Instructions for downloading the MixWILD program
1.2. Instructions for formatting your dataset to be MixWILD friendly
1.3. Description of the example dataset
1.4. MixWILD compatibility notes for Windows and macOS users
2. Example 1: Running a standard multilevel model (MLM) using MixWILD 5
2.2. Step-by-step instructions for specifying a standard multilevel model
2.2. Brief interpretation of the multilevel model results 14
3. Example 2: Running MixregIs - Linear Regression model in MixWILD 15
3.1. Step-by-step instructions on running MixregIs - Linear Regression model
4.2. Brief interpretation of the MixregIs - Linear Regression model results
4. Example 3: Running Mixregls- Logistic Regression model in MixWILD 31
4.1. Step-by-step instructions for running Mixregls-Logistic regression model
4.2. Brief interpretation of Mixregls-Logistic regression model results
5. Example 4: Running Mixregmls- Linear regression model in MixWILD 43
5.1. Step-by-step instructions on running Mixregmls - Linear regression model
5.1. Brief interpretation of Mixregmls - Linear Regression model results
6. Example 5: Running Mixregmls - Logistic regression model in MixWILD 57
6.1. Step-by-step instructions for running a Mixregmls- Logistic regression model
6.3. Brief interpretation of Mixregmls-Logistic regression model result
7. Appendix A: Steps to take when the program does not converge to a solution
8. Appendix B: Steps to plot the random subject effects from the ebvar file solution

1. Overview of Mix Suite: The two-stage approach



Stage 1 models

Mixregls (Mixed effects Regression Location Scale modeling): This multilevel model estimates a mixed-effects location scale model, including a *random subject intercept* and *a random subject scale effect.* A random subject intercept effect reflects a subject's mean (or location), and a random scale effect reflects a subject's variability, respectively.

Mixregmls (Mixed effects Regression Multiple Location Scale modeling): This model estimates a mixed-effects location scale model, including a *random subject intercept and slope(s)*, as well *as a random subject scale effect*. The random subject intercept and slope(s) are considered location effects because they reflect a subject's mean response, while the random subject scale effect reflects a subject's variability.

Stage 2 models

Linear Regression model: This single level linear regression model predicts a *continuous subject-level outcome* using the random subject effects from the Stage 1 model as regressors. The random effects can be included in this linear regression model as main effects and as interactions with other subject-level regressors.

Logistic Regression model: This single level logistic regression model predicts a *binary or ordinal subject-level outcome* using the random subject effects from the Stage 1 model as regressors. The random effects can be included in the (binary or ordinal) logistic regression model as main effects and as interactions with other subject-level regressors.

1.1. Instructions for downloading the MixWILD program

- 1. Visit: https://reach-lab.github.io/MIXWILDGUI/
- 2. Submit your email prior to downloading the application in the web page to receive notifications on major software updates.
- 3. Click on macOS (64-bit) or Windows (32-bit) to download the program.
- 4. Select your directory to save the program.
- 5. When finished downloading, double-click on the MixWILD icon follow the instructions to complete installation.



1.2. Instructions for formatting your dataset to be MixWILD friendly

- 1. The dataset should be a .csv file with variable names in the first row.
- 2. Data should be in the long format and sorted ascending or descending by ID number.
- 3. Missing values should **not be blank or periods (.)** in the dataset and should be coded as **numeric values** only (e.g., '-999').

Α	В	С	D	E	F	G	Н	I	J	К
ID	AGE	SEX	WEEKEND	DOW	OBESE	BMI	NEG_AFFECT	POS_AFFECT	MVPA_daily_mins	SED_daily_hours
11	7.47	1	1	6	1	22.13	20	44	31.9	8.33
11	7.47	1	0	0	1	22.13	30	44	31.9	8.33
11	7.47	1	1	6	1	22.13	10	46	31.9	8.33
11	7.47	1	1	6	1	22.13	14	47	31.9	8.33
11	7.47	1	0	4	1	22.13	16	47	31.9	8.33
11	7.47	1	1	5	1	22.13	10	49	31.9	8.33
11	7.47	1	1	5	1	22.13	50	49	31.9	8.33
12	5.47	1	0	1	0	21.26	60	19	24.35	8.6
12	5.47	1	0	1	0	21.26	-999	23	24.35	8.6
12	5.47	1	1	6	0	21.26	-999	32	24.35	8.6
12	5.47	1	1	6	0	21.26	-999	33	24.35	8.6
12	5.47	1	0	0	0	21.26	27	35	24.35	8.6
12	5.47	1	1	5	0	21.26	21	36	24.35	8.6
12	5.47	1	1	5	0	21.26	-999	46	24.35	8.6
12	5.47	1	1	6	0	21.26	-999	58	24.35	8.6
12	5.47	1	1	5	0	21.26	12	-999	24.35	8.6
12	5.47	1	1	5	0	21.26	50	-999	24.35	8.6
13	3.47	1	0	0	1	21.12	-999	47	34.56	8.57
13	3.47	1	0	1	1	21.12	50	50	34.56	8.57
13	3.47	1	0	0	1	21.12	-999	53	34.56	8.57
13	3.47	1	1	6	1	21.12	10	60	34.56	8.57
13	3.47	1	1	6	1	21.12	-999	61	34.56	8.57

Example dataset overview

1.3. Description of the example dataset

Intensive longitudinal data (Number of subjects=1245) from an ecological momentary assessment (EMA) study (range between 4-14 days) will be used as an example dataset to demonstrate different models in the MixWILD program.

Variables in the example dataset

ID: Participant ID number

SEX: 0 (female); 1 (male)

AGE: Number of years (centered around mean age=29.29)

WEEKEND: 0 (weekday); 1 (weekend)

DOW: Day of week; 0: Monday, 1: Tuesday, ..., 6: Sunday

POS_AFFECT: Levels of positive affect reported in each prompt

NEG_AFFECT: Levels of negative affect reported in each prompt

MVPA_daily_mins: Daily averaged moderate-to-vigorous physical activity time

in minutes

SED_daily_hours: Daily averaged sedentary time in hours

OBESE: 0 (not obese); 1 (obese)

BMI: Body Mass Index (centered around mean BMI=24.66)

Descriptive summary of the example variables

	Variable	Туре	Time-varying vs. Time-invariant	N	Mean	SD	Min	Max	Range
1	ID	Nominal	Time-invariant	15167	639.07	393.94	1	1369	1368
2	AGE (centered)	Continuous	Time-invariant	14851	0	16.37	-23.53	47.47	71
3	SEX	Dichotomous	Time-invariant	14899	0.74	0.44	0	1	1
4	DOW	Categorical / Ordinal	Time-varying	15167	3.53	2.25	0	6	6
5	WEEKEND	Dichotomous	Time-varying	15167	0.5	0.5	0	1	1
6	POS_AFFECT	Continuous	Time-varying	13514	43.75	13.7	10	70	60
7	NEG_AFFECT	Continuous	Time-varying	13491	28.91	14.11	10	70	60
8	MVPA_daily_mins	Continuous	Time-invariant	14750	41.96	12.34	15.07	88.46	73.39
9	SED_daily_hours	Continuous	Time-invariant	14094	9.41	1.56	5.35	15.3	9.95
10	OBESE	Dichotomous	Time-invariant	14432	0.47	0.5	0	1	1
11	BMI (centered)	Continuous	Time-invariant	14511	0	6.87	-11.25	23.89	35.14

1.4. MixWILD compatibility notes for Windows and macOS users

The user interface for MixWILD runs in a Java runtime environment that provides feature parity between Windows and Mac versions. Native 64-bit binaries for macOS and Windows written in Fortran are used to execute statistical analyses and generate model output.

- To allow for compatibility with older operating systems and architecture, the Windows version features an option to use 32-bit binaries.
- Users running MixWILD in a virtual machine, such as VMWare or Parallels, should ensure working directories are isolated from hypervisor processes that allow sharing between host and guest. These include common directories such as *Downloads*, *Desktop*, and *Documents*. Instead, create a new folder located at "C:/MixWILD" to improve compatibility.

Suggested references for mixed-effects location-scale model

- Hedeker, D., & Nordgren, R. (2013). MIXREGLS: a program for mixed-effects location scale analysis. *Journal of statistical software*, *52*(12), 1.
- Hedeker, D., Mermelstein, R.J., & Demirtas, H. (2012). Modeling between-subject and within-subject variances in ecological momentary assessment data using mixed-effects location scale models. *Statistics in medicine*, *31*(27), 3328-3336.
- Maher J.P., Dzubur, E., Nordgren, R. Huh, J., Chou, C.P., Hedeker, D., Dunton, G. F. Do fluctuations in positive affective and physical feeling states predict physical activity and sedentary time? *Psychology of Sport and Exercise. In press.*
- Maher, J.P., Huh, J., Intille, S., Hedeker, D., & Dunton, G.F. (2018). Greater variability in daily physical activity is associated with poorer mental health profiles among obese adults. Mental Health and Physical Activity, 14, 74-81.

2. Example 1: Running a standard multilevel model (MLM) using MixWILD



Example question for applying standard multilevel model in MixWILD

• Examine whether participants' momentary negative affect (within-subject, continuous, time-varying variable) can predict their momentary positive affect (within-subject, continuous, time-varying variable), after controlling for sex.

Regressors: Sex (time-invariant); Negative affect (time-varying) **Outcome:** Positive affect (time-varying)

Note:

- A standard multilevel model can be specified in the Stage 1 interface by selecting the "None" option for the Stage 2 Outcome.
- Interaction terms are not generated automatically by the Stage 1 interface. If you would like to test interaction(s), you must manually create interaction variable(s) in your dataset before running the program.

2.2. Step-by-step instructions for specifying a standard multilevel mo del in MixWILD

- 1. Double-click on the MixWILD icon to open the main window.
- 2. Click on "File" and then select "New Model" (or use keyboard shortcut Ctrl + N).



3. Click on "Instructions" to make sure your data are in the correct format.

🙆 – 🗆 🗙	🔮 – 🗆 🗙
Is your dataset Mix{WILD} friendly? Check here	Please follow these instructions
Data File:	1) You should always use a .csv file
Title:	2) You should ensure that missing values are not blanks
Random Location Effects: O Intercept O Intercept + Slope(s)	3) Missing value codes should be numeric only4) Make sure your missing value code is the same as your dataset
	5) Please ensure that the data is sorted by IDs
Stage 2 Outcome: Continuous Dichotomous/Ordinal None	6) The first row in the .csv file should be column names
Contains missing values? Yes No	Got it
Missing value code:	
MIX {WILD} Cancel Reset Submit	

4. Click on **"Browse"** to select the location of your data file (in .csv) and then click **"Open"**.

🕌 Open		×
Look <u>i</u> n:	MixWild	- A C B B
Mixwild_e	xample_data.csv	
File <u>N</u> ame:	Mixwild_example_data.csv	
Thes of Type.		Open _% Cancel

5. Click on "**View Data**" to preview your data file and to verify the data and format are correct.

Help												
no 4 Confi	iguration	Stage 2 Conf	iguration	Store 4 Beaulte	Stago 2 Posults	Migur Model	Mieur Data					
ge i conn	iguration	Stage 2 Com	iyuration	stage 1 Results	staye z Results	View Woder	view Data					
1	Imported	d data file:	Mixwild	example data.csv								
								•				
ľ	ID	AGE	SEX	WEEKEND	DOW OBE	SE BMI	NEG_AFFE	POS_AFFE	MVPA_daily	SED_daily		
	1	10.47	1	0 0	1	-4.79	40	27	38.19	-999		
	1	10.47	1	0 1	1	-4.79	-999	30	38.19	-999		
1	1	10.47	1	0 1	1	-4.79	50	35	38.19	-999		
	1	10.47	1	1 5	1	-4.79	10	38	38.19	-999		
1	1	10.47	1	0 1	1	-4.79	35	43	38.19	-999		
	1	10.47	1	1 5	1	-4.79	40	44	38.19	-999		
	1	10.47	1	0 1	1	-4.79	10	-999	38.19	-999		
	1	10.47	1	0 0	1	-4.79	20	-999	38.19	-999		
	1	10.47	1	0 0	1	-4.79	30	-999	38.19	-999		
	1	10.47	1	0 0	1	-4.79	40	-999	38.19	-999		
	1	10.47	1	1 5	1	-4.79	40	-999	38.19	-999		
	2	20.47	1	0 3	1	-4.79	52	15	22.03	9.46		
	2	20.47	1	0 2	1	-4.79	39	17	22.03	9.46		
	2	20.47	1	0 3	1	-4.79	49	22	22.03	9.46		
	2	20.47	1	1 6	1	-4.79	50	22	22.03	9.46		
	2	20.47	1	1 6	1	-4.79	59	24	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	30	33	22.03	9.46		
	2	20.47	1	1 6	1	-4.79	20	35	22.03	9.46		
	2	20.47	1	0 4	1	-4.79	10	38	22.03	9.46		
	2	20.47	1	1 6	1	-4.79	40	39	22.03	9.46		
	2	20.47	1	1 6	1	-4.79	41	44	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	50	46	22.03	9.46		
	2	20.47	1	0 4	1	-4.79	50	48	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	40	49	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	40	49	22.03	9.46		
	2	20.47	1	0 4	1	-4.79	50	51	22.03	9.46		
	2	20.47	1	0 2	1	-4.79	10	52	22.03	9.46		
	2	20.47	1	0 0	1	-4.79	50	59	22.03	9.46		
	2	20.47	1	0 0	1	-4.79	30	62	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	40	65	22.03	9.46		
	2	20.47	1	1 5	1	-4.79	20	66	22.03	9.46		
	3	17.47	1	0 2	1	-4.79	61	15	22.03	9.46		
	3	17.47	1	0 4	1	-4.79	38	22	22.03	9.46		
	3	17.47	1	1 6	1	-4.79	60	25	22.03	9.46		
	3	17.47	1	0 2	1	-4 79	33	38	22.03	9 46		

- 6. Add a title for your output files. This title name is later displayed in your output files.
- 7. Select "Intercept" from Random Location Effects specification and uncheck "Random Scale".
- 8. Select "None" for Stage 2 Outcome.
- 9. Click on missing values if there are any in your dataset; specify the missing value code in the box (e.g., '-999').

▲ - □ ×
Is your dataset Mix{WILD} friendly? Check here
Data File: C:\MixData\Mixwild_example_data.csv Browse
Title: Example
Random Location Effects: Intercept Intercept + Slope(s)
Random Scale?
Stage 2 Outcome: O Continuous O Dichotomous/Ordinal None
Contains missing values? () Yes () No
Missing value code: -999
Cancel Reset Submit

10. After you submit this first page, you will advance to the page that enables you to configure your Stage 1 model.

dix Suite										_	٥
Help											
age 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data						
Selected mode	el configuration:					Stage 1	l Regressors				
Random locati	ion effects: Intercept		Mean	RS Va	ariance	WS Variance		Mean	BS Variance	WS Variance	
Stage 2 outco	me: None	Level-1	mean	0340	mance	W5 Valuate	Level-2	mean	D3 Variance	VI J Vanance	
ID Variable:											
ID	•										
Stage 1 Outco	me:										
POS_AFFECT	•										
Configure St	age 1 Regressors										
0	Options										
Specify the relat mean and WS va	tionship between the ariance.										
No Associati	ion										
O Linear Assoc	ciation										
○ Ouadratic As	enciation										
MIX {wi	LD}										
Mond Model Analogie With Interaction	Country address Post a							R	eset	Run Stage 1	

- 11. On the Stage 1 Configuration page, select your ID variable and positive affect (a time-varying variable) as your outcome variable.
- 12. By default, **"No Association"** is assumed between the mean and within-subject variance (only relevant for models with random scale). For random scale models, a linear or quadratic association is also possible.

🚳 Mix Suite										-	٥	\times
File Help												
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data							
Selected mode	el configuration:		-			Stage	1 Regressors					
Stage 2 outco	me: None		Mean	BS Va	ariance	WS Variance		Mean	BS Variance	WS Variance		
ID Variable: ID Stage 1 Outcor POS_AFFECT Configure St	The roots The ro	Ster	0 11				Level-2					
Specify the relat mean and WS va	tionship between the ariance. tion ciation	St	ep 12)								
MIX (wi	LD}							F	Reset	Run Stage 1		

13. Click on "Modify Stage 1 regressors" to add other regressors.

14. Select and add time-varying regressor "**NEG_AFFECT**" and time-invariant regressor "**SEX**" into the corresponding boxes.

🌢 Mix Suite									- 0	
File Help										
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data]				_
Selected mod	el configuration:					Stage	1 Regressors			
Random locat	ion effects: Intercept		🛃 Add Stage 1 F	Regressors				- 🗆 🗡	WSVariance	
Stage 2 outco	me: None	Level-1	-							
ID Variable:			Variables					Level-1 (Time Varying)		
ID	•		Age				NEG_AFFECT			
Stage 1 Outco	me:		DOW			Add				
POS_AFFECT	•		BMI MVPA dail	v mins						
Configure St	age 1 Regressors		SED_daily_	hrs						
C	options							Level 2 (Time Investment)		
		K						Level-2 (Time Invariant)		
Specify the relat mean and WS va	tionship between the ariance.					Add	SEX			
No Association	ion									
O Linear Asso	ciation									
○ Quadratic Ac	eenciation									
MIX {wi	LD}		MIX	(WILD)			Cancel	Reset Submit	Run Stage 1	

- 15. Select the box in the mean column to allow regressors to predict the mean level of outcome only.
- 16. Select "**Disaggregate**" for time-varying variable(s) in the mean column if the decomposition of the within-subject and between-subject effects in predicting the outcome is desired.

🍰 Mix Suite										-	٥	×
File Help												
Stage 1 Configuration Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data								
Selected model configuration:					Stage 1	Re	gressors					
Random location effects: Intercept Stage 2 outcome: None	Lough 4	Mean	BS Va	ariance	WS Variance		Louis 2	Mean	BS Variance	WS Variance		
ID Variable:	Level-1						Level-Z					
Stage 1 Outcome: POS_AFFECT												
Configure Stage 1 Regressors Options	l Dis	NEG_AFFECT saggregate?	¥ ¥				SEX	¥				
Specify the relationship between the mean and WS variance. (a) No Association (b) Linear Association												
Ousdratic Association MIX {WILD}									Reset	Run Stage 1		

- 17. Click on "**Options**" to change other default settings if needed.
- 18. For models that do not include a random scale effect, removing subjects with no variance in outcome variable (positive affect in this example) is not necessary. Click on **"Submit'** to continue.

Mean Intercept:		Maximum Iterations:	200
BS Variance Intercept:	×	Ridge:	0.1
WS Variance Intercept:	2	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 +	Resample Stage 2:	b '
Adaptive Quadrature:	×	No. of Samples:	500 -
🗆 Pun in 32 hit m	ode (Experimen	stal: for older Windows based machines)	

19. Verify your model specifications and click on "**Run Stage 1**" to generate the definition (Def) file. The definition file contains the syntax that instructs the program to estimate the specified model. You can save the definition file by clicking "Save Def File".

🛃 Definition File Preview		-		\times
Example Created with MixWILD GUI "Mixwild_example_data_dat" Mixwild_example_data_Output 11 1 0 0 0 0 1 0 0 0.00001 11 1 200 - 0 1 1 0 0 1 9 3	-999 0	0 0.	15 500	0.0000
8				
POS_AFFECT SEX				
NEG_AFFECT				
0 0 0 0				
	Procee	d	Save I	Def File

- 20. In the definition file, click on "**Proceed**" to run your model and generate model output files.
- 21. A window will appear while model estimation is in progress.

Please wait			- 🗆 🗙
MIXWILD:	0.2/52215/638015932	32.612924/2/486032	
MIXWILD:	-2 Log-Likelihood =	90533.78993	
MIXWILD:	Newton-Raphson Iteration	12 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.25670914713273146	27.709763096268119	
MIXWILD:	-2 Log-Likelihood =	90532.71633	
MIXWILD:	Newton-Raphson Iteration	13 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.23600586529592218	24.182840197927160	
MIXWILD:	-2 Log-Likelihood =	90531.84976	
MIXWILD:	Newton-Raphson Iteration	14 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.21539738087375884	21.443158946091941	
MIXWILD:	-2 Log-Likelihood =	90531.14288	
MIXWILD:	Newton-Raphson Iteration	15 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.19583121675913986	19.186896512874963	
MIXWILD:	-2 Log-Likelihood =	90530.56445	
MIXWILD:	Newton-Raphson Iteration	16 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.17767077886790239	17.255165663695497	
MIXWILD:	-2 Log-Likelihood =	90530.09073	
MIXWILD:	Newton-Raphson Iteration	17 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	
MIXWILD:	0.16101013532532055	15.561347077916510	
MIXWILD:	-2 Log-Likelihood =	90529.70267	
MIXWILD:	Newton-Raphson Iteration	18 with ridge 0.1000	
MIXWILD:	maximum correction and	derivative	=
MIXWILD:	0.14581959228264627	14.055274336701141	
MIXWILD:	-2 Log-Likelihood =	90529.38479	
			-
4			•
			Cancel Analysis
			Currect Analysis

22. If the following warning message appears, it indicates that computational difficulties were encountered and prevented the model parameters from being estimated successfully. In this case, confirm the format of your dataset and your model specifications. Troubleshooting suggestions are listed in Appendix A.



23. When the model analyzing is completed, the Stage 1 results can be seen by clicking the "Stage 1 Results" box.

🕌 Mix Suite							– 0 ×
File Help							
Stage 1 Configuration	Stage 2 Configuration Stage 1 Res	sults Stage 2 Results	View Model Vie	w Data			
	Results from stage 1 analy		I				
		•					
	Model without Scale Para	meters					
	Total Iterations = 20						
	Final Ridge value = 0.0						
	Tee Tibeliberd	45422 00	c				
	Log Likelihood	= -40427.00	6				
	Schwarg's Damosian Crit	arion45449.38	6				
	Schwalz 5 Dayesian Cill	errom = -45446.56	0				
	> unltiplied by .?						
	Log Likelihood	= 90854.17	2				
	Akaike's Information Cr	iterion = 90866.17	2				
	Schwarz's Bawesian Crit	erion = 90896.77	2				
	Variable	Estimate	AsymStdError	z-value	p-value		
	BETA (regression coeffic	ients)					
	Intercept	48.59915	1.26909	38.29451	0.00000		
	SEX	-0.64593	0.57666	-1.12013	0.26266	-	
	NEG_AFFECT_BS	-0.15785	0.03967	-3.97891	0.00007		
	NEG_AFFECT_WS	-0.10097	0.00806	-12.52025	0.00000	-	
	ALPHA (BS variance param	eters: log-linear mod	el)				
	Intercept	4.13075	0.05169	79.91641	0.00000		
	TAU (WS variance paramet	ers: log-linear model)				

24. All files generated from the program can be found in a folder with the prefix MixWILD under the same directory of your dataset.

Name Date modified Type Size	• •	MIX	KWILD		~ Ū	Search MIXWILD
MIXWILD1519889795 3/6/2018 5:22 PM File folder	,	^	Name	Date modified	Туре	Size
	s		MIXWILD1519889795	3/6/2018 5:22 PM	File folder	
Mixwild_example_data 2/26/2018 11:54 AM Microsoft Excel C 635 KB	#		Mixwild_example_data	2/26/2018 11:54 AM	Microsoft Excel C	635 KB

25. In the Output_1 txt file, you can find your results that are identical to the results found in the Stage 1 results box

VILD > MIXWILD1519889795			
Name	Date modified	Туре	Size
📙 work	3/6/2018 5:39 PM	File folder	
📧 mix_random	2/26/2018 2:10 PM	Application	665 KB
🔳 mixor	2/26/2018 2:10 PM	Application	914 KB
📧 mixreg	2/26/2018 2:10 PM	Application	967 KB
MIXREGLS_RANDOM_MIXREG	2/26/2018 2:10 PM	DEF File	1 KB
Mixwild_example_data	3/6/2018 5:30 PM	DAT File	635 KB
Mixwild_example_data_Output	2/26/2018 2:10 PM	DEF File	1 KB
Mixwild_example_data_Output_1	2/26/2018 2:10 PM	OUT File	11 KB
Mixwild_example_data_Output_ebvar	2/26/2018 2:10 PM	DAT File	38 KB
repeat_mixor	2/26/2018 2:10 PM	Application	680 KB
📧 repeat_mixreg	2/26/2018 2:10 PM	Application	677 KB

Model without Scale	Parameters			
Total Iterations = Final Ridge value =	= 20 = 0.0			
Log Likelihood Akaike's Informatic Schwarz's Bayesian	= on Criterion = Criterion =	-45427.086 -45433.086 -45448.386		
==> multiplied by - Log Likelihood Akaike's Informatic Schwarz's Bayesian	2 = on Criterion = Criterion =	90854.172 90866.172 90896.772		
Variable	Estimate	AsymStdError	z-value	p-value
BETA (regression coe	efficients)			
Intercept	48.59915	1.26909	38.29451	0.00000
SEX	-0.64593	0.57666	-1.12013	0.26266
NEG_AFFECT_BS	-0.15785	0.03967	-3.97891	0.00007
NEG_AFFECT_WS	-0.10097	0.00806	-12.52025	0.00000
ALPHA (BS variance p	arameters: log	-linear model)		
Intercept	4.13075	0.05169	79.91641	0.00000
TAU (WS variance par	ameters: log-l	inear model)		
Intercept	4.83616	0.01385	349.16421	0.00000

2.2. Brief interpretation of the multilevel model results

```
Model without Scale Parameters
-----
Total Iterations = 20
Final Ridge value = 0.0
 Log Likelihood
                             = -45427.086
Akaike's Information Criterion = -45433.086
 Schwarz's Bayesian Criterion =
                                 -45448.386
 ==> multiplied by -2
Log Likelihood
                                  90854.172
                             =
Akaike's Information Criterion =
                                  90866.172
Schwarz's Bayesian Criterion =
                                  90896.772
Variable
                                 AsymStdError
                      Estimate
                                                    z-value
                                                                   p-value
-----
                                 -----
                                                -----
                                                               _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
BETA (regression coefficients)
Intercept
                      48.59915
                                      1.26909
                                                    38.29451
                                                                   0.00000
SEX
                                      0.57666
                                                    -1.12013
                                                                   0.26266
                      -0.64593
NEG AFFECT BS
                      -0.15785
                                      0.03967
                                                    -3.97891
                                                                   0.00007
NEG AFFECT WS
                      -0.10097
                                      0.00806
                                                   -12.52025
                                                                   0.00000
ALPHA (BS variance parameters: log-linear model)
Intercept
                      4.13075
                                      0.05169
                                                   79.91641
                                                                   0.00000
TAU (WS variance parameters: log-linear model)
                                      0.01385
Intercept
                       4.83616
                                                   349.16421
                                                                   0.00000
```

- Notice that the model results do not include effects on the BS or WS variances; as they were not specified earlier. Alpha and Tau intercepts are default parameters in the output table. These represent the BS and WS variances of positive affect, respectively, on the log scale.
- Results show that after controlling for sex, individuals who have higher mean negative affect have lower mean levels of positive affect (BS estimate = -0.1579, p < .001).
- When individuals have higher momentary negative affect than their own mean, they have lower momentary positive affect (WS estimate = -0.1010, *p* < .001).
- The BS variance in positive affect is reported as the Intercept estimate under Alpha, estimated as exp(4.13) = 62.18. The WS variance in positive affect is reported as the Intercept estimate under Tau, estimated as exp(4.84) = 126.47. Thus, the intraclass correlation (ICC) for positive affect is estimated as 62.18 / (62.18 + 126.47) = 0.33.

3. Example 2: Running MixregIs - Linear Regression model in MixWILD



Example research questions for Mixregls-Linear Regression model

- Examine whether subject-level mean (i.e., random intercept or within-person mean) and subject level variance (i.e., random scale or degree of within-person / intraindividual variability) of momentary positive affect (within-subject, continuous, time-varying variable) predicts subject-level average sedentary hours per day (between-subject, continuous, time-invariant variable), after controlling for sex and day of week (DOW).
- Examine whether participants' age (between-subject, time-invariant variable) *moderates* the associations between participants' mean level (i.e., random intercept) and (i.e., random scale) variance in momentary positive affect in predicting subject-level average hours per day of sedentary behavior (between-subject, continuous, time-invariant variable), after controlling for sex and day of week (DOW).

Stage 1 outcome variable: Positive affect (time-varying)
Stage 1 regressors: Day of week (time-varying); Sex (time-invariant)
Stage 2 outcome variable: Average sedentary hours per day (time-invariant)
Stage 2 regressors: Age (time-invariant); Age x Random Intercept interaction; Age x Random Scale interaction

3.1. Step-by-step instructions on running MixregIs - Linear Regression model in MixWILD

- 1. Double-click on the MixWILD icon to open the main window.
- 2. Click on "File" and then select "New Model" (or use keyboard shortcut Ctrl + N).



3. Click on "Instructions" to make sure your data are in the correct format.

● - □ ×	🙆 – 🗆 X
Is your dataset Mix{WILD} friendly? Check here	Please follow these instructions
Data File: Browse	
Title:	1) You should always use a .csv file
· · · · · · · · · · · · · · · · · · ·	2) You should ensure that missing values are not blanks
Random Location Effects: O Intercept O Intercept + Slope(s)	3) Missing value codes should be numeric only
Random Scale?	4) Make sure your missing value code is the same as your dataset
	5) Please ensure that the data is sorted by IDs
Stage 2 Outcome: O Continuous O Dichotomous/Ordinal O None	6) The first row in the .csv file should be column names
Contains missing values? O Yes O No	Got it
Missing value code:	
MIX {WILD} Cancel Reset Submit	

4. Click on **"Browse"** to select the location of your data file (in .csv) and then click **"Open"**.

🕌 Open		×
Look <u>i</u> n:	MixWild	• 6 6 6 8 5
Mixwild_e	kample_data.csv	
File Nemer		
File <u>N</u> ame:	Mixwiid_example_data.csv	
Files of <u>Type</u> :	Data files	•
		Open Cancel

5. Click on "**View Data**" to preview your data file to verify your data and format are correct.

ge 1 Configuration												
ge i configuration	Stage 2 Cont	figuration	Stage 1 Results	Stage 2 Res	ults View	v Model	View Data					
	otago 2 oon	nguruusn	Stage TheSaits	otago 2 moo		mouch	The Tr Dutty	•			 	
Importe	d data file:	Mixwild	_example_data.csv	,								
ID	AGE	SEX	WEEKEND	DOW	OBESE	BMI	NEG AFFE	POS AFFE	MVPA daily	SED daily		-
1	10.47	1	0 0	1		4.79	40	27	38,19	-999		
1	10.47	1	0 1	1		4.79	-999	30	38.19	-999		į
1	10.47	1	0 1	1	-4	4.79	50	35	38,19	-999		ſ
1	10.47	1	1 5	1		4.79	10	38	38.19	-999		
1	10.47	1	0 1	1	-4	4.79	35	43	38,19	-999		
1	10.47	1	1 5	1		4.79	40	44	38.19	-999		
1	10.47	1	0 1	1		4.79	10	-999	38.19	-999		
1	10.47	1	0 0	1		4.79	20	-999	38.19	-999		
1	10.47	1	0 0	1		4.79	30	-999	38.19	-999		
1	10.47	1	0 0	1		4 79	40	-999	38.19	-999		
1	10.47	1	1 5	1		4.79	40	-999	38.19	-999		
2	20.47	1	0 3	1		4 79	52	15	22.03	9.46		
2	20.47	1	0 2	1		4 79	39	17	22.03	9.46		
2	20.47	1	0 3	1		4 79	49	22	22.03	9.46		
2	20.47	1	1 6	1	-	4 79	50	22	22.03	9.46		
2	20.47	1	1 6	1		4 79	59	24	22.03	9.46		
2	20.47	1	1 5	1	-	4 79	30	33	22.03	9.46		
2	20.47	1	1 6	1		4 79	20	35	22.03	9.46		
2	20.47	1	0 4	1	-	4 79	10	38	22.03	9.46		
2	20.47	1	1 6	1	-	4 79	40	39	22.03	9.46		
2	20.47	1	1 6	1	-	4 79	41	44	22.03	9.46		
2	20.47	1	1 5	1	-	4 79	50	46	22.03	9.46		
2	20.47	1	0 4	1	-	4.79	50	48	22.03	9.46		
2	20.47	1	1 5	1		4 70	40	40	22.00	9.46		
2	20.47	1	1 5	1		4 79	40	49	22.03	9.46		
2	20.47	1	0 4	1		4.75	50	51	22.03	9.46		
2	20.47	1	0 2	1		4 79	10	52	22.03	9.46		
2	20.47	1	0 0	1		4 79	50	59	22.03	9.46		
2	20.47	1	0 0	1		4 70	30	62	22.03	9.46		
2	20.47	1	1 5	4		4.70	40	65	22.03	9.46		
2	20.47	1	1 5	1		4.70	20	66	22.03	0.46		
2	20.47	1	0 0	1		4.70	81	15	22.03	0.40		
2	17.47	1	0 4	4		4.70	20	22	22.03	0.40		
2	17.47	1	4	1		4.79	50	26	22.03	0.46		
3	47.47	4	1 0	1	-1	4.79	00	20	22.03	9.40		

- 6. Add title to your output files. This title name is later displayed in your output files.
- 7. Select "Intercept" from Random Location Effects specification for the subject-level mean and check "Random Scale" for subject-level variability
- 8. Select "Continuous" for the Stage 2 outcome.
- 9. Click on missing values if there are any in your dataset; specify the missing value code in the box (i.e., -999 in the example dataset).

n de caracterista de la construcción	Is your dataset Mix{WILD} friendly? Check here
Data File:	C:\MixData\Mixwild_example_data.csv Browse
Title:	Example
Random Lo Random So Stage 2 Ou Contains m	ocation Effects: Intercept Intercept + Slope(s) cale? Itcome: Continuous Icchotomous/Ordinal None nissing values? Itcome: Yes No
Missing val	lue code: -999

- 10. After you submit, the interface will take you to the page that enables you to configure your Stage 1 model.
- 11.On the Stage 1 configuration page, select your ID variable and positive affect as your Stage 1 outcome variable.
- 12. Specify the association between mean and within- subject (WS) variance of the outcome variable, which is the association of the random location and random scale effects. **"Linear Association"** is selected for the following example. For random scale models, a quadratic association is also possible.

INIX Suite									_	٥	×
File Help											
Stage 1 Configuration Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data	3						
Selected model configuration: Random location effects: Intercept Stage 2 outcome: None ID Variable: ID Stage 1 Outcome: POS_AFFECT	Level-1	Mean Step 1:	BS V	ariance	Stage *	1 Regressors	Mean	BS Variance	WS Variance		
Configure Stage 1 Regressors Options Specify the relationship between the mean and WS variance. O No Association Clumotratic Association O Unadratic Association	Ste	p 12									

- Click on "Modify Stage 1 regressors" to select other regressors.
 Select and add time-varying regressor "DOW" and time-invariant regressor "SEX". (Note that for demonstration, day of the week (DOW) is treated as a linear regressor of positive affect. The user might want to instead treat this as a factor in the model by creating 6 dummy codes for the 7 days.

Mix Suite										- 6
le Help										
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data]				
Selected mode	el configuration:	🔬 Add Stage 1	Regressors				-	- ×		
Random locati Stage 2 outcor	ion effects: Intercept me: None	Variable	5				Level-1 (Tim	e Varying)	BS Variance	WS Variance
ID Variable:	v	SEX WEEKENI DOW)	4	Add Remove					
Stage 1 Outcom	me:	OBE SE BMI NEG_AFFI	ECT							
Configure Sta	age 1 Regressors	MVPA_da SED_daily	illy_mins /_hrs				Level-2 (Time	e Invariant)		
0	ptions				Add					
Specify the relati mean and WS va	ionship between the ariance.			F	temove					
No Association	on									
Linear Assoc	ciation	MIX	{WILD}			Cancel	Reset	Submit		
MIX{wi	LD}	Mixed Model Analys	is With Intensive Longitudinal Data						Reset	Run Stage 1

15. Select to allow Stage 1 regressors to predict mean, between-subject variance, and/or within-subject variance of Stage 1 outcome.

dd Stage 1 Regressors			
Variables			Level-1 (Time Varying)
Age WEEKEND OBESE BMI NEG_AFFECT MVPA_daily_mins SED_daily_hrs	Add Remove	DOW	
	Add Remove	SEX	Level-2 (Time Invariant)
MIX (WILD)		Cancel	Reset Submi

- 15. Select the boxes in the mean column, BS Variance column, and WS Variance column to allow Stage 1 regressors to predict the mean, between-subject variance, and/or within-subject variance of Stage 1 outcome, respectively. Day of week is select to predict the mean.
- 16. Select "**Disaggregate**" for each of the time-varying variable(s) for which decomposition of the within-subject and between-subject effects in predicting Stage 1 outcome is desired. Day of week is not aggregated in this example.

🔬 Mix Suite											-	٥	\times
File Help													
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View	Model View Data	1							
Selected mode	el configuration:					Stage 1	Re	gressors					
Ranuomiocau	on enects: intercept		Mea	n	BS Variance	WS Variance			Mean	BS Variance	WS Variance		
Stage 2 outcor	me: None	Level-1						Level-2					
ID Variable:	•												
Stage 1 Outcor	me:												
POS_AFFECT	•	_											
Configure St	age 1 Regressors		DOW	2									
0	ptions	Dis	saggregate?					SEX		×	×		
Specify the relat mean and WS va No Associati International Constraints Association	ionship between the iriance. on clation												
MIX (MI	LD}												
	counter-official Pratic									Reset	Run Stage 1		

- 17. Click on "Options" to change other default settings if needed.
- 18. In most cases, Mean, BS and WS intercept should remain checked. Also, uncheck the "**Discard Subjects**" option to use all data for analysis.
- 19. By default, the estimated random effects of the Stage 1 analysis (i.e., random location and scale effects) are resampled 500 times in the Stage 2 analysis. Resampling is necessary because the random effects are estimated quantities that are entered as regressors in the Stage 2 model. (refer to the supplemental documents for further description of Options settings)

Mean Intercept:	~	Maximum Iterations:	200-
BS Variance Intercept:	2	Ridge:	0.1
WS Variance Intercept:	Ľ	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 -	Resample Stage 2:	V
Adaptive Quadrature:	M	No. of Samples:	500
🗌 Run in 32-bit mo	ode (Experimer	ntal: for older Windows-based machines)	

20. Click on "Submit" and then go to "Configure Stage 2".

🕌 Mix Suite									— i) ×
File Help										
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data	1				
							Stage 2 Interactions			
		Stage-2	Regressors	Main Effects	R	andom Location	Random Scale	Location X Scale		
Stage 2	outcome: aily_hrs	-								
Cor	ifigure Stage 2 Regressor	rs 💥								
										4
		Stag	e 2 ou	tcom	e sh	ould be	e a time-	invariant	variable	
		in yo	ur data	a set.	If it	is a tin	ne-varyir	ng variab	le, the	
		prog	ram w	II cale	cula	te each	n subject	's averag	ge and	
		treat	this av	verag	e as	s the St	tage 2 oi	utcome		
MIX	{WILD}		Sup	press Scale X R	andom Inter	raction	Reset	Run Stage 1 and 2		1
									_	

- 21. Select "SED_daily_hours" as Stage 2 outcome variable.
- 22.Add Stage 2 regressor(s) into the model. Stage 2 regressor(s) are also generally time-invariant variable(s), however if they are time-varying then the program will calculate subject averages of those variables. Click on "**Submit**" when finished.

🛃 Add Stage 2 regressors		=		×
Variables WEEKEND DOW OBE SE BMI NEG_AFFECT MVPA_daily_mins SED_daily_hrs	Add Remove ?	Level 2 (TT	me Invariant)
MIX {WILD}	Cancel	Reset	Submit	t

23. Select to add Stage 2 main effect(s) and interaction effect(s) with Stage 1 random effects as regressors. For example, by clicking the "Location x Scale" box, a 3-way interaction (AGE x Random location x Random scale) will be included to predict the Stage 2 outcome. This Location x Scale interaction option is enabled only if main effects are selected.

🖆 Mix Suite										- 0	×
File Help											
Stage 1 Configurat	ion Stage 2 Configuration	Stage 1 F	Results	Stage 2 Results	View Model	View Data]				
											1
								Stage 2 Interact	tions		
					Main Effects	Ra	ndom Location	n Random Sca	ale Location X Scale		
Et.	ano 2 Outcomo:	6	Stage-2 F	legressors						1	
30	ige z Outcome.										
SI	D_daily_hrs	-									
	Configure Stage 2 Regresso	rs									
_											
			Age		¥		r	×			
M	X {WILD}			Sup	press Scale X R	andom Inter	action	Reset	Run Stage 1 and 2		
Marcal M											

24. Click on Stage 1 and Stage 2 configurations to verify your model. Click on "**Run Stage 1 and 2**" to generate the definition file. The definition file contains the syntax that instructs the program to estimate the specified model.

x Suite									-	- 0	
Help											
ge 1 Configuration S	tage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data						
											1
											I
							Stage 2 Interactions	5			I
											l
				Main Effects	Rand	m Location	Random Scale	Location X Scale			1
Stage 2 Out	tcome:	Stage-2	Regressors								I
Stage 2 Ou	come.										I
SED_daily_	_hrs	-									I
											I
Config	ure Stage 2 Regressor	'S									I
											I
											I
		4.00				-		_			I
		Age				V	V				I
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									1		I
MIX {	WILD}		Sup	press Scale X R	andom Interact	on	Reset	Run Stage 1 and 2			I
								75			_

25. In the definition file, click on "**Proceed**" to run your model and generate model output files. If you see a field with the text "**null**", it means that there is a mistake in your model specifications that should be fixed.

Sefinition File Preview	_	
Example Created with MixWILD GUI "Mixwild_example_data_dat" Mixwild_example_data_Output 11 2 1 1 0 0 0 0 0 0 0 0.00001 11 1 200 - 0 0 0 0 45401 1 9 5 3 3 3	-999 0 1 0	.15 500 0.0000
POS_AFFECT DOW SEX SEX SEX		
1 1 1 0 11 2 2 2		
SED_daily_hrs Age Age Age		
	Proceed	Save Def File

26.A window will appear while model estimation is in progress. The time for generating the final output depends on the dataset size and complication of your specified model. If your Stage 1 model has many regressors or if you select a large number for resampling, the run time could range up to 5 to 10 minutes.

🛃 Mix Suite		0 ×
File Help	🕌 Please wait	- 🗆 X
dig Mr. Suite File Help Stage 1 Configuration Stage 2 Configuration Stag Results from stage 1	Please wait WIXWILD: Mover VIVIOUV Scale Taismeters MIXWILD: Newton-Rapheon Iteration 1 with ridge 0.2000 MIXWILD: Maximum correction and derivative MIXWILD: 6.7982076554194326E-002 45.815331409699148 MIXWILD: 6.2 Log-Likelihood = 96153.70976 MIXWILD: Maximum correction and derivative MIXWILD: Maximum correction and derivative MIXWILD: -2 Log-Likelihood = 96149.73822 MIXWILD: -2 Log-Likelihood = 96149.73822 MIXWILD: Newton-Rapheon Iteration 3 with ridge 0.2000	
	<pre>HIXPHID: maximum correction and derivative MIXPHID: 1.6067093114422535-002 4.9253532295113054 MIXPHID: 1.20g-Likelihood = 96144.80929 MIXPHID: Newton-Raphoon Iteration 4 with ridge 0.2000 MIXPHID: maximum correction and derivative MIXPHID: Naminum correction and derivative MIXPHID: 1.3101372215932090E.002 2.995271807665894 MIXPHID: Newton-Raphoon Iteration 5 with ridge 0.2000 MIXPHID: Maximum correction and derivative MIXPHID: Newton-Raphoon Iteration 5 with ridge 0.2000 MIXPHID: Newton-Raphoon Iteration 6 with ridge 0.2000 MIXPHID: Newton-Raphoon Iteration 6 with ridge 0.2000 MIXPHID: Newton-Raphoon Iteration 6 with ridge 0.2000 MIXPHID: 2.20095352331-003 1.508191505938220 MIXPHID: 7.168199972855331F-003 1.508191505938220 MIXPHID: 8.1004 = 961440 - 90400</pre>	-
	MINUTLE: Vs Log-Likelihood = 30:40.3-000 MINUTLE: Meximum correction and derivative MINUTLE: Scr24600370145522-003 1.1030135389550950 MINUTLE: -2 Log-Likelihood = 96149.47170	Cancel Analysis

27. If the following warning message appears, it indicates that computational difficulties were encountered that prevented the model parameters from being estimated successfully. In this case, double-check the format of your dataset and your model specifications. Some suggestions for steps to take are listed in Appendix A.

MIXWILD: VOLUME IN	arive t is wi	Indows			
MIXWILD: Volume Ser	rial Number is	s CSD3-6C7B			
MIXWILD:					
MIXWILD:					
MIXWILD:					
MIXWILD:02/20/2018	12:57 PM	<dir></dir>			
MIXWILD:02/20/2018	12:57 PM	<dir></dir>			
MIXWILD:02/20/2018	12:57 PM	<dir></dir>	lib		
MIXWILD:02/14/2018	08:10 PM	9,619,194	mixreg.jar		
MIXWILD:02/14/2018	08:10 PM	472	MixWILD.cfg		
MIXWILD:	2 File(s)	9,619,66	6 bytes		
MIXWILD:	3 Dir(s)	56,732,880,89	6 bytes free		
MIXWILD: Volume in	drive C is W:	indows			
MIXWILD: Volume Ser	rial Number is	s C8D3-6C7B			
Failed to build model. Ple	ase revisit your	regressors and tr	y again. For more info	rmation, ch	neckout h
Failed to build model. Ple	ase revisit your	regressors and tr	y again. For more info	rmation, ch	neckout h
Failed to build model. Ple	ase revisit your	regressors and tr	y again. For more info	mation, ch	neckout h
Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018	ase revisit your 11:35 AM 11:35 AM	regressors and tr	y again. For more infor MIXREGMLS_RANDOM mixregmls_random	MIXOR.de	neckout h
Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	11:35 AM 11:35 AM 11:33 AM	regressors and tr	y again. For more infor MIXREGMLS_RANDOM_ mixregmls_random_ Mixwild_example_c	MIXOR.de _mixor.ex data.dat	neckout h
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Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	11:35 AM 11:35 AM 11:35 AM 11:33 AM 11:35 AM 11:35 AM	regressors and tr OK 312 894,938 653,611 636,414 650,681	y again. For more infor MIXREGMLS_RANDOM mixregmls_random Mixwild_example_c mix_random.exe repeat_mixor.exe	MIXOR.de _mixor.ex data.dat	neckout h
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28. When estimation is completed, the Stage 1 and Stage 2 results can be seen by clicking the Stage 1 and Stage 2 Results boxes, respectively.

Mix Suite											-	
File Help	Stan	e 2 Configuratio	n Stage 1 Results	Stane 2 Results	View Model	View D	ata					
stage i configuration	Stay	e z conngurauo	stage i Results	stage z Results	VIEW MODEI	View D	ata					
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									=			
		mixREGLS.DE	EF specifications									
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		data and o	output files:									
		Mixwild_ex	ample_data_Output									
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🚮 Mix Suite											-	5 ×
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			SLD_dd119_1110			5500	19.9000	1.5505				
				11								
			Independent varia	ibles	iean	mîn	жах	std dev				
			Age	-2.15	-23.	5300	47.4700	16.4941				
			Random Location a	und Scale EB mean	estimates	win		etd do				
								stu ue♥				
			Locat_1	0.00	-2.	4318	2.4368	0.9075				
			Scale	-0.00	.100 -1	7895	2.0324	0.6370				

29. All files generated from the program can be found in a folder with the prefix MixWILD under the same directory of your dataset.

MD	WILD		
	Name	Date modified	Туре
	MIXWILD151988987	3/6/2018 5:39 PM	File folder
*	🔊 Mixwild_example_data	2/26/2018 11:54 AM	Microsoft Excel Comma Separated Values File

30. The OUT files with suffix_1 and _2 are the results that are identical in the Stage 1 and Stage 2 boxes in the MixWILD program.

Name	Date modified	Туре	Size
mix_random	11/9/2017 4:45 PM	DEF File	1 KB
💷 mix_random	11/9/2017 4:43 PM	Application	802 KB
📧 mixreg	11/9/2017 4:43 PM	Application	1,142 KB
MIXREGLS_RANDOM_MIXREG	11/9/2017 4:43 PM	DEF File	1 KB
Mixwild_example_data	11/9/2017 3:48 PM	Microsoft Excel C	1,148 KB
Mixwild_example_data_Output	11/9/2017 4:43 PM	DEF File	1 KB
Mixwild_example_data_Output_1	11/9/2017 4:45 PM	OUT File	15 KB
Mixwild_example_data_Output_2	11/9/2017 4:54 PM	OUT File	3 KB
Mixwild_example_data_Output_ebrando	11/9/2017 4:45 PM	DAT File	11,029 KB
Mixwild_example_data_Output_ebvar.dat	11/9/2017 4:45 PM	DAT File	85 KB
Mixwild_example_data_Output_level2.dat	11/9/2017 4:45 PM	DAT File	86 KB
Mixwild_example_data_Output_random	11/9/2017 4:45 PM	DEF File	1 KB
Mixwild_example_data_Output_random	11/9/2017 4:54 PM	OUT File	2 KB
Mixwild_example_data_Output_repeat_m	11/9/2017 4:45 PM	DEF File	1 KB
repeat_mixreg	11/9/2017 4:45 PM	DEF File	1 KB
📧 repeat_mixreg	11/9/2017 4:43 PM	Application	763 KB

- 31. The OUT files with suffix_1 contains the results from Stage 1 model.
- 32. There are three sets of submodel results in output_1: the first submodel does not include scale parameters, the second submodel includes scale parameters but not random scale parameters, and the third submodel includes both the scale and the random scale parameters.
- 33.A brief description of the results from the third submodel will be provided in the following section.

Model without Scale Parameters			
Total Iterations = 15			
Final Ridge value = 0.0			
Log Likelihood =	-48074.154		
Schwarz's Bayesian Criterion =	-48095.238		
==> multiplied by -2			
Log Likelihood =	96148.308		
Akaike's Information Criterion = Schwarz's Bayesian Criterion =	96160.308 96190.477		
Variable Estimate	AsymStdError	z-value	p-value
BELA (regression coefficients) Intercept 42.57495	0.55102	77.26612	0.00000
DOW 0.39721	0.04749	8.36346	0.00000
SEX -0./2502 ALPHA (BS variance parameters: log	0.60446 Jinear model)	-1.19945	0.23035
Intercept 4.29050	0.09491	45.20633	0.00000
SEX -0.20952	0.11272	-1.85881	0.06305
Intercept 4.83228	0.01339	360.98308	0.00000
Nedel MITH Coole D			
model WIIH Scale Parameters			
Total Iterations = 19 Final Ridge value = 0.0			
That High value - 0.0			
Log Likelihood = Akaike's Information Criterion =	-480/1.771 -48078 771		
Schwarz's Bayesian Criterion =	-48096.369		
==> multiplied by -2			
Log Likelihood =	96143.542		
Akaike's Information Criterion =	96157.542		
Schwarz s bayesian criterion =	90192.739		
Variable Estimate	AsymStdError	z-value	p-value
BETA (regression coefficients)			
Intercept 42.57119	0.55126	77.22558	0.00000
SEX -0.73211	0.60471	-1.21067	0.22602
ALPHA (BS variance parameters: log	g-linear model)		
Intercept 4.28008 SEX -0.19562	0.09600 0.11361	44.58391 -1.72189	0.00000
TAU (WS variance parameters: log-	linear model)		
Intercept 4.88403 SFX -0.06836	0.02752	177.50260	0.00000
			0102333
Model WITH RANDOM Scale			
Total Iterations = 17			
⊦ınal Kidge value = 0.0			
Log Likelihood =	-47914.216		
Akaike's Information Criterion =	-47923.216 -47945 843		
	475451045		
==> multiplied by -2	95828 /132		
Akaike's Information Criterion =	95846.432		
Schwarz's Bayesian Criterion =	95891.686		
Variable Estimate	AsymStdError	z-value	p-value
BETA (regression coefficients)			
Intercept 42.57868	0.55031	77.37179	0.00000
DUW 0.39158 SEX _0 73865	0.04563	8.58138	0.00000
ALPHA (BS variance parameters: log	g-linear model)	1.21201	5.22520
Intercept 4.28473	0.09386	45.65031	0.00000
-0.14654 TAU (WS variance parameters: log-1	0.11109 linear model)	-1.31913	0.18/13
Intercept 4.78679	0.03843	124.56564	0.00000
SEX -0.04782	0.04447	-1.07528	0.28225
Std Dev 0.40712	0.02080	19.57251	0.00000
Random location (mean) effect on W	IS variance	6 47055	0.0000
LOC Eff -0.14581	0.02253	-6.47252	0.00000

Mixwild_example_data_C)utput_2 - Notep	ad		
File Edit Format View	Help			
Mixwild Example2				
Created with MixWIL	D GUI			
Level 2 obervation	5 =	1128		
Descriptives				
Dependent variable				
	mean	min	max	std dev
	0 2044	F 3500	45 2000	4 5000
SED_daily_nrs	9.3941	5.3500	15.3000	1.5909
Independent variab	les			
	mean	min	max	std dev
Age	-2.1523	-23.5300	47.4700	16.4941
Denden Leestien en	4 6 1 - 50			
Kandom Location an	d Scale EB	mean estimate	25	std dov
	mean	штп	max	sta dev
Locat 1	0.0000	-2.4318	2.4368	0.9075
Scale	-0.0000	-1.7895	2.0324	0.6370
Locat_1*Scale	-0.0242	-3.3730	3.6866	0.6370

34. The OUT file with suffix_2 contains the results from Stage 2 model.

35.Location_1 (random intercept) and Scale (random scale) main effects and their interaction (Location_1*Scale) are default regressors in Stage 2 model results.

Final Results				
Average Log Likel:	ihood =	-2106.858 (sd	= 0.712)	
Akaike's Informat	ion Criterion =	-2113.858	,	
Schwarz's Bayesian	n Criterion =	-2131 //57		
Schwar 2 S Dayesia	in criticrion	2101.407		
==> multiplied by	-2			
Log Likelihood	-2 =	4213 717		
Akaika's Informati	ion Critorion -	4213.717		
Akaike's informat.	ion criterion =	4227.717		
Schwarz's Bayesian	n Criterion =	4262.914		
Variable	Estimate	AsymStdError	z-value	p-value
Intercept	9.37372	0.06947	134.92350	0.00000
Age	0.01798	0.00439	4.09480	0.00004
Locat_1	0.07699	0.06590	1.16843	0.24263
Locat_1*Age	-0.00310	0.00360	-0.85909	0.39029
Scale	0.03241	0.08328	0.38913	0.69718
Scale*Age	-0.00030	0.00455	-0.06596	0.94741
Locat_1*Scale	-0.00638	0.08802	-0.07246	0.94224
Resid.Variance	2.45392	0.10338	23.73801	0.00000

4.2. Brief interpretation of the MixregIs - Linear Regression model results

Stage i model with random scale parameters										
cale										
Estimate	AsymStdError	z-value	p-value							
BETA (regression coefficients)										
42.56827	0.55150	77.18565	0.00000							
0.39107	0.04564	8.56896	0.00000							
-0.75529	0.61028	-1.23761	0.21586							
parameters: log	(-linear model)									
4.28374	0.09391	45.61507	0.00000							
-0.14547	0.11116	-1.30873	0.19063							
arameters: log-l	inear model).									
4.78671	0.03845	124.50564	0.00000							
-0.04727	0.04449	-1.06250	0.28801							
ard deviation										
0.40728	0.02081	19.57622	0.00000							
an) effect on W	S variance									
-0.14551	0.02253	-6.45824	0.0000							
	Estimate Estimate Defficients) 42.56827 0.39107 -0.75529 parameters: log 4.28374 -0.14547 arameters: log-1 4.78671 -0.04727 ard deviation 0.40728 ean) effect on M -0.14551	Estimate AsymStdError Defficients) 42.56827 0.55150 0.39107 0.04564 -0.75529 0.61028 parameters: log-linear model) 4.28374 0.09391 -0.14547 0.11116 arameters: log-linear model) 4.78671 0.03845 -0.04727 0.04449 ard deviation 0.40728 0.02081 ean) effect on WS variance -0.14551 0.02253	Estimate AsymStdError z-value befficients) 42.56827 0.55150 77.18565 0.39107 0.04564 8.56896 -0.75529 0.61028 -1.23761 parameters: log-linear model) 45.61507 -0.14547 0.11116 -1.30873 arameters: log-linear model) 4.78671 4.78671 0.03845 124.50564 -0.04727 0.04449 -1.06250 ard deviation 0.40728 0.02081 19.57622 ean) effect on WS variance -0.14551 0.02253 -6.45824							

Stage 1 model with random scale parameters

- The Stage 1 model (with random scale) shows that "Day of week (DOW)" is positively related to positive affect (mean estimate=0.3911, *p*<.01). People report higher positive affect when it is closer to weekend (0=Monday, 1=Tuesday,..., 6=Sunday. (As mentioned earlier, DOW is used as a linear regressor of positive affect for this example. Users might want to instead treat this as a factor in the regression model by creating 6 dummy codes for the 7 days).
- The Stage 1 model also shows that there is significant variability in scale across subjects, as the Std Dev for the Random scale (on the log scale) is estimated as 0.4073 (*p*<.001). Therefore, individuals differ from each other in their degree of within-subject/intraindividual variability in positive affect.
- The Stage 1 model also shows that the random scale (i.e., withinsubject/intraindividual variance) is negatively associated with the random intercept (i.e., within-subject mean), as indicated by the estimate for the Loc Eff for Random location (mean) effect on WS variance (estimate = -0.14551, *p*<.001). Individuals with overall higher mean positive affect are *less erratic/more stable* in their positive affect responses. (Note that this result may be also due to a ceiling effect in the affect response scale).

Final Results				
Variable	Estimate	AsymStdError	z-value	p-value
Intercept	9.37388	0.06878	136.29122	0.00000
Age	0.01783	0.00467	3.81784	0.00013
Locat_1	0.08217	0.06927	1.18612	0.23557
Locat_1*Age	-0.00307	0.00364	-0.84282	0.39933
Scale	0.04340	0.08158	0.53200	0.59473
Scale*Age	-0.00018	0.00502	-0.03537	0.97178
Locat_1*Scale	-0.01308	0.09619	-0.13600	0.89182
Resid.Variance	2.47808	0.10483	23.63836	0.00000

Stage 2 model with continuous subject-level outcome

- In the Stage 2 final results table, Locat_1 refers to the effect of the random intercept (i.e., within-subject mean) on average hours per day of sedentary behavior; Scale refers to the effect of random scale (i.e., within-subject variance) on average hours per day of sedentary behavior; and Locat_1* Scale is the interaction between random intercept and random scale predicting average hours per day of sedentary behavior.
- After controlling for other variables in the model, this linear regression model shows that "Age" is positively related to average hours per day of sedentary behavior (estimate=0.0178, *p*<.001), indicating that older subjects spend more time being sedentary.
- The interaction between Age and the Random Intercept and the interaction between Age and Random Scale do not predict individuals' average hours per day of sedentary behavior.
- Also, the random intercept (i.e., within-subject mean), random scale (i.e., withinsubject variance), and their interaction do not predict individuals' average hour per day of sedentary behavior.

Note:

- 1. In these output files, the numbers of level 1 and level 2 observations correspond to the available non-missing observations of level 1 and level 2 variables included in the model(s).
- 2. For a given run, the program includes observations that have non-missing data for the outcomes (both Stage 1 and Stage 2), and all regressors (both Stage 1 and Stage 2) included in that particular run. Thus, the program uses all available data for a given run.
- 3. Refer to the supplemental documents for more detailed explanation of the Stage 1 and Stage 2 model results.

4. Example 3: Running Mixregls- Logistic Regression model in MixWILD



Example research question for Mixregls-Logistic Regression model

• Examine whether subject-level mean (i.e., random intercept or within-person mean) and subject level variance (i.e., random scale or degree of within-subject/intraindividual variability) of momentary positive affect (within-subject, continuous, time-varying variable) predict subject-level obesity risk (between-subject, dichotomous, time invariant variable).

Stage 1 outcome variable: Positive affect (time varying)
Stage 1 regressors: None (an empty model)
Stage 2 outcome variable: Obese vs Non-obese (time invariant)
Stage 2 regressors: Random intercept; Random scale; Random intercept x Random scale interaction (these are all default regressors in Stage 2 model results)

4.1. Step-by-step instructions on running Mixregls-Logistic regression model in MixWILD

- 1. Double-click on the MixWILD icon to open the main window.
- 2. Click on "File" and then select "New Model" (or use keyboard shortcut Ctrl + N).



3. Click on "Instructions" to make sure your data are in the correct format.

🖌 – 🗆 X	🛎 – 🗆 🗙
Is your dataset Mix{WILD} friendly?	Please follow these instructions
Data File: Browse	1) You should always use a cau file
Title:	2) You should ensure that missing values are not blanks
Random Location Effects: O Intercept O Intercept + Slope(s)	3) Missing value codes should be numeric only
Random Scale?	4) Make sure your missing value code is the same as your dataset
Stage 2 Outcome: O Continuous O Dichotomous/Ordinal O None	5) Please ensure that the data is sorted by IDs6) The first row in the .csv file should be column names
Contains missing values? O Yes O No	Got it
Missing value code:	
MIX {WILD} Cancel Reset Submit	

4. Click on **"Browse"** to select the location of your data file (in .csv) and then click **"Open"**.

🕌 Open		×
Look <u>i</u> n:	MixWild	
Mixwild_e	xample_data.csv	
File <u>N</u> ame:	Mixwild_example_data.csv	
Files of <u>Type</u> :	Data files	•
		Open Cancel

5. Click on "**View Data**" to preview your data file to verify your data and format are correct.

🅌 Mix Suite													-		Х
File Help															
Stage 1 Config	guration	Stage 2 Conf	iguration	Stage 1 Results	Stage 2 Res	ults	View Model	View Data							
I	Imported	data file:	Mixwild	_example_data.cs	/										
_	ID	AGE	SEX	WEEKEND	DOW	OBESE	BMI	NEG_AFFE	POS_AFFE	MVPA_daily	SED_daily				
	1	10.47	1	0 0	1		-4.79	40	27	38.19	-999			-	^
	1	10.47	1	0 1	1		-4.79	-999	30	38.19	-999				1
	1	10.47	1	0 1	1		-4.79	50	35	38.19	-999				
	1	10.47	1	1 5	1		-4.79	10	38	38.19	-999				
	1	10.47	1	0 1	1		-4.79	35	43	38.19	-999				
	1	10.47	1	1 5	1		-4.79	40	44	38.19	-999				
	1	10.47	1	0 1	1		-4.79	10	-999	38.19	-999				
	1	10.47	1	0 0	1		-4.79	20	-999	38.19	-999				
	1	10.47	1	0 0	1		-4.79	30	-999	38.19	-999				
	1	10.47	1	0 0	1		-4.79	40	-999	38.19	-999				
	1	10.47	1	1 5	1		-4.79	40	-999	38.19	-999				
	2	20.47	1	0 3	1		-4.79	52	15	22.03	9.46				
	2	20.47	1	0 2	1		-4.79	39	17	22.03	9.46				
	2	20.47	1	0 3	1		-4.79	49	22	22.03	9.46				
	2	20.47	1	1 6	1		-4.79	50	22	22.03	9.46				
	2	20.47	1	1 6	1		-4.79	59	24	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	30	33	22.03	9.46				
	2	20.47	1	1 6	1		-4.79	20	35	22.03	9.46				
	2	20.47	1	0 4	1		-4.79	10	38	22.03	9.46				
	2	20.47	1	1 6	1		-4.79	40	39	22.03	9.46				
	2	20.47	1	1 6	1		-4.79	41	44	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	50	46	22.03	9.46				
	2	20.47	1	0 4	1		-4.79	50	48	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	40	49	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	40	49	22.03	9.46				
	2	20.47	1	0 4	1		-4.79	50	51	22.03	9.46				
	2	20.47	1	0 2	1		-4.79	10	52	22.03	9.46				
	2	20.47	1	0 0	1		-4.79	50	59	22.03	9.46				
	2	20.47	1	0 0	1		-4.79	30	62	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	40	65	22.03	9.46				
	2	20.47	1	1 5	1		-4.79	20	66	22.03	9.46				
	3	17.47	1	0 2	1		-4.79	61	15	22.03	9.46				
	3	17.47	1	0 4	1		-4.79	38	22	22.03	9.46				
	3	17.47	1	1 6	1		-4.79	60	25	22.03	9.46				
	3	17.47	1	0 2	1		-4.79	33	38	22.03	9.46				•

- 6. Add title to your output files.
- 7. Select "Intercept" from Random Location Effects specification for subject-level mean. Select "Random Scale" for subject-level variability.
- 8. Select "Dichotomous/Ordinal" for Stage 2 outcome.
- 9. Click on missing values if there are any in your dataset; specify the missing value code in the box (i.e., -999 in the example dataset).

Data File:	C:\Users\donts\Documents\Mixwild_example_data.csv Browse
Title:	Example
Random Lo	cation Effects: Intercept Intercept + Slope(s)
Random So	ale? 🖌
Stage 2 Ou	tcome: O Continuous Dichotomous/Ordinal None
Contains m	issing values? () Yes () No
Missing va	ue code: -999
Se	9606 9606

10. After you submit, the interface will take you to the page that enables you to configure your Stage 1 model.

🅌 Mix Suite										_	ð	×
File Help												
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data]						
Selected mode	el configuration:					Stage 1	Regressors					
Random locati	on effects: Intercept											
Stage 2 outcor	ne: Dichotomous	Level-1	Mean	B\$ Va	ariance	WS Variance	Level-2	Mean	BS Variance	WS Variance		
ID Variable:												
ID	•											
Stage 1 Outcor	ne:											
POS_AFFECT	-											
Configure Sta	age 1 Regressors											
0	ptions	_										
Specify the relation	ionship between the											
mean and WS va	nance.											
No Association	on											
Linear Assoc	iation											
Ouadratic As	enciation											
MIX {wi	LD}							F	Reset	Configure Stage 2		
- 11.On the Stage 1 configuration page, select your ID variable and positive affect (a timevarying variable) as your Stage 1 outcome variable.
- 12. Specify the association between the mean and within- subject (WS) variance, which is the association of the random location and random scale effects. **"Linear Association"** is selected for this example. For random scale models, a quadratic association is also possible.

🕌 Mix Suite	-	o ×
File Help		
Stage 1 Configuration Stage 2 Configuration Stage	1 Results Stage 2 Results View Model View Data	
Selected model configuration:	Stage 1 Regressors	
Random location effects: Intercept		
Stage 2 outcome: Dichotomous	Stage 1 is an <i>empty model</i> which has no	
ID Variable:	rogrossors but it will include a random	
ID 👻		
Stage 1 Outcome:	Intercept and a random scale effect. Both	
POS_AFFECT	effects will be used in Stage 2 as	J
Configure Stage 1 Regressors Options Specify the relationship between the mean and WS variance. No Association () Linear Association () Guadratic Association () Churdratic Association () Churdratic Association () Churdratic Association	ep 12 Reset Configure Stage 2	

- 13. Click on "**Options**" to change other default settings if needed.
- 14. By default, the estimated random effects of the Stage 1 analysis (i.e., random location and scale effects) are resampled 500 times in the Stage 2 analysis. Resampling is necessary because the random effects are estimated quantities that are entered as regressors in the Stage 2 model.
- 15. Leave "**Discard Subjects**" unchecked, so we do not drop participants who have 0 variation in their Stage 1 outcome variable. Click on "**Submit**"

Mean Intercept:	~	Maximum Iterations:	200
BS Variance Intercept:	×	Ridge:	0.1
WS Variance Intercept:	2	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 <u>*</u>	Resample Stage 2:	2
Adaptive Quadrature:		No. of Samples:	500

(Refer to the supplemental documents for further description of Options settings)

16. In "**Configure Stage 2**", select Stage 2 outcome variable. It should be a dichotomous or ordinal time-invariant variable from your data set.

🕌 Mix Suite									-	- 0	×
File Help											
Stage 1 Configuration Stage 2 Configurat	ion Stage 1 Results	Stage 2 Results	View Model	View Data							
						Stage 2 Intera	actions				
			Main Efforte	Da	ndom Location	Deadar	C l -	Leasting X Coole			
	Stage-2	Regressors	Main Enects	Ka	IIIUUIII LOCAUUII	Kandom	scale	Location X Scale			
Stage 2 Outcome:											
OBESE											
obloc -											
Configure Stage 2 Regr	essors										
Check outcome categ	ories										
]		
MIX {WILD}		Sup	press Scale X R	andom Intera	action	Reset	R	un Stage 1 and 2			
Mount Model Available With Interesting Lower And Party											
									_		

17. Select "**Obese**" as the Stage 2 outcome variable and check if the outcome categories are correct.

Stage 2 Outcome:	
OBESE	•
Configure Stage 2 Regressors	
Check outcome categories	
2 Categories: 1) 0 2) 1	

18. Stage 2 also has no regressors, so you don't need to click on the "Configure Stage 2 Regressors" button. The random intercept, random scale, and the random intercept x random scale interaction will be included as default regressors in Stage 2.

- 🕌 Mix Suite ٥ Х File Help
 Stage 1 Configuration
 Stage 1 Results
 Stage 2 Results
 View Model
 View Data
 Stage 2 Interactions Main Effects Random Location Random Scale Location X Scale Stage-2 Regressors Stage 2 Outcome: OBE SE -Configure Stage 2 Regressors ... Check outcome categories 2 Categories 1) 0 2) 1 MIX {WILD} Reset Run Stage 1 and 2 Suppress Scale X Random Interaction
- 19. Click on Stage 1 and Stage 2 configurations to double-check your model. Click on "Run Stage 1 and 2" to generate the definition file.

20. The definition file contains the syntax that instructs the program to estimate the specified model. In the definition file, click on "**Proceed**" to run your model and generate model output files.

Definition File Preview	-	
example3 Created with MixWILD GUI "C:\Users\Desktop\Mixwild_example_data.dat" Mixwild_example_data_Output 11 0 0 0 0 0 0 0 0 0 0 0.000001 11 1 200 500 0.00000 0 0 1 1 9) —999 C	1 0.10
POS_AFFECT		
0 0 0 0 2 6 1 0		
OBESE		
Proc	eed S	Save Def File

21. A window will appear while model estimation is in progress.

MIXWILD: 2.39/510216201/533E-002 10/.653/9534366694		
MIXWILD: -2 Log-Likelihood = 103697.91955		
MIXWILD: Newton-Raphson Iteration 3 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 2.0330861695070410E-002 75.282248805403427		
MIXWILD: -2 Log-Likelihood = 103693.05841		
MIXWILD: Newton-Raphson Iteration 4 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 1.7061945537560328E-002 51.967185277877817		
MIXWILD: -2 Log-Likelihood = 103690.23417		
MIXWILD: Newton-Raphson Iteration 5 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 1.3671101042575516E-002 35.105849699625281		
MIXWILD: -2 Log-Likelihood = 103688.62898		
MIXWILD: Newton-Raphson Iteration 6 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 2.0277091325247382E-002 23.049333968927098		
MIXWILD: -2 Log-Likelihood = 103687.77382		
MIXWILD: Newton-Raphson Iteration 7 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 6.5627262123434844E-003 7.0160429102150887		
MIXWILD: -2 Log-Likelihood = 103687.12457		
MIXWILD: Newton-Raphson Iteration 8 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 1.5565980656081001E-003 2.7676265543152434		
MIXWILD: -2 Log-Likelihood = 103687.06306		
MIXWILD: Newton-Raphson Iteration 9 with ridge 0.3000		
MIXWILD: maximum correction and derivative		
MIXWILD: 3.5812968218833880E-004 1.0903124122934118		
MIXWILD: -2 Log-Likelihood = 103687.05919		
4		

22. If the following warning message appears, it indicates that computational difficulties were encountered and prevented the model parameters from being estimated successfully. In this case, double-check the format of your dataset and your model specifications. Some suggestions for steps to take are listed in Appendix A.

🛃 P	lease wait						
-	MIXWILD: VOLUME IN	arive C is Wi	Indows				-
	MIXWILD: Volume Ser	ial Number is	s C8D3-6C7B				
	MIXWILD:						
	MIXWILD:						
	MIXWILD:						
	MIXWILD:02/20/2018	12:57 PM	<dir></dir>	•			
	MIXWILD:02/20/2018	12:57 PM	<dir></dir>				
	MIXWILD:02/20/2018	12:57 PM	<dir></dir>	lib			
	MIXWILD:02/14/2018	08:10 PM	9,619,194	1 mixreg.jar			
	MIXWILD:02/14/2018	08:10 PM	472	2 MixWILD.cig			
	MIXWILD:	2 File(s)	9,619,66	66 bytes			
	MIXWILD:	3 Dir(s)	56,732,880,89	96 bytes free			
	MIXWILD: Volume in	drive C is Wi	Indows				
	MIXWILD: Volume Ser	1al Number 1s	s C8D3-6C7B				
	Failed to build model. Ple	ase revisit your	regressors and tr	ry again. For more infor	mation, ch	eckout	help d
	Failed to build model. Ple	ase revisit your	regressors and tr	ry again. For more infor	mation, ch	eckout	help d
	Failed to build model. Ple MIXWILD:02/26/2018	ase revisit your	Interpression of the second se	ry again. For more infor	MIXOR.de	eckout f	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018	ase revisit your 11:35 AM 11:35 AM	112 312 894,938	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_	MIXOR.de:	eckout f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	ase revisit your 11:35 AM 11:35 AM 11:33 AM	312 894,938 653,611	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d	MIXOR.de: mixor.exe ata.dat	eckout f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	11:35 AM 11:35 AM 11:33 AM 11:33 AM 11:35 AM	CK 312 894,938 653,611 636,414	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe	MIXOR.de: mixor.ex ata.dat	eckout f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	11:35 AM 11:35 AM 11:33 AM 11:33 AM 11:35 AM 11:35 AM	312 312 894,933 653,611 636,414 650,681	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe	MIXOR.de: mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018	11:35 AM 11:35 AM 11:33 AM 11:33 AM 11:35 AM 11:35 AM 11:35 AM	312 894,936 653,611 636,414 650,681 647,097	y again. For more infor MIXREGMLS_RANDOM_ mixregmls_random_ Mixwild_example_d mix_random.exe repeat_mixor.exe repeat_mixreg.exe	MIXOR.de MIXOR.de mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s)	regressors and tr OK 312 894,933 653,611 636,41 650,681 647,097 5,319,14	y again. For more infor MIXREGMLS_RANDOM_ 1 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixreg.exe 47 bytes	MIXOR.de: mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: MIXWILD:	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s)	312 894,933 653,611 636,414 650,681 647,097 5,319,14 56,732,880,89	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe 37 bytes 36 bytes free	MIXOR.de: mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD: MIXWILD: MIXWILD: MIXWILD: MIXWILD:	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) : -1073741515	312 312 894,933 653,611 636,414 650,683 647,097 5,319,14 56,732,880,89	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe 7 repeat_mixreg.exe 36 bytes free	MIXOR.de: mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD: MIXWILD: MIXWILD: MIXWILD: MIXWILD: MIXWILD: MIXWILD:	ase revisit your 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) 2 Dir(s) 11:35 AM	312 312 894,938 653,611 636,414 650,681 647,097 5,319,14 56,732,880,89	y again. For more infor MIXREGMLS_RANDOM_ mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe 7 repeat_mixreg.exe 17 bytes 96 bytes free	MIXOR.de: mixor.ex: ata.dat	f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:MIXWILD: MIXWILD: Exit Value	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) : -1073741515	312 312 894,936 653,611 636,414 650,681 647,097 5,319,14 56,732,880,895	y again. For more infor MIXREGMLS_RANDOM_ 8 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe 7 repeat_mixreg.exe 86 bytes free	MIXOR.de: mixor.ex ata.dat	f e	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD: MIXWILD: MIXWILD: MIXWILD: MIXWILD: 4	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) : -1073741515	312 312 894,938 653,611 636,414 650,681 647,097 5,319,14 56,732,880,855	y again. For more infor MIXREGMLS_RANDOM_ mixregmls_random_ Mixwild_example_d i mix_random.exe I repeat_mixor.exe 7 repeat_mixreg.exe 17 bytes 16 bytes free	MIXOR.de mixor.ex ata.dat	f e el Analy	help d
	Failed to build model. Ple MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: 02/26/2018 MIXWILD: MIXWILD: MIXWILD: Exit Value	11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) 1: -1073741515	regressors and tr 0K 312 894,933 653,611 636,414 650,681 647,097 5,319,14 56,732,880,895	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 1 Mixwild_example_d 4 mix_random.exe 1 repeat_mixor.exe 7 repeat_mixreg.exe 47 bytes 96 bytes free	MIXOR.de: mixor.ex: ata.dat	f e e el Analy	help d
	Failed to build model. Ple MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:02/26/2018 MIXWILD:Exit Value	ase revisit your 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 11:35 AM 8 File(s) 2 Dir(s) 2 Dir(s)	312 312 894,938 653,611 636,414 650,681 647,097 5,319,14 56,732,880,885	ry again. For more infor 2 MIXREGMLS_RANDOM_ 3 mixregmls_random_ 4 mix_random.exe 1 repeat_mixor.exe 7 repeat_mixor.exe 47 bytes 96 bytes free	MIXOR.de: mixor.ex ata.dat	f e el Analy	help d

23. When estimation is completed, the Stage 1 and Stage 2 results can be seen by clicking the Stage 1 and Stage 2 Results boxes, respectively.

🕌 Mix Suite			- 0 ×
File Help			
Stage 1 Configuration	Stage 2 Configurati	on Stage 1 Results Stage 2 Results View Model View Data	
	Results fro	m stage 1 analysis	
		······································	
	MIXREGLS:	Mixed-effects Location Scale Model with BS and WS variance models	
	mixREGLS.I	DEF specifications	
	Example		
	Created 1	with MixWILD GUI	
	data and	output files:	
	Mixwild_0	example_data.dat	
		Mixwild_example_data_Output_1.out	
	CONVERGEN	NCE CRITERION = 0.00001000	
	RIDGEIN	= 0.1000	
	NQ	= 11 DE _ 1 (Denne odorking lodorking)	
	MAXIT	<pre>sts = 1 (U=non-adaptive, l=adaptive) = 200</pre>	
	Descriptiv	ves	
	N 1		
	Number of	f level-1 observations = 12/99	
Mix Suite			- 0 ×
File Help			
Stage 1 Configuration	Stage 2 Configurati	ion Stage 1 Results Stage 2 Results View Model View Data	
	Posults fro	stane 2 analysis	
	Results inc	un seeße z anonisus	
		Example	
		Created with MixWILD GUI	
		Level 2 operations = 1170	
		Descriptives	
		Dependent variable	
		mean min max std dev	
		OBESE 0.4213 0.0000 1.0000 0.4938	
		Independent variables	
		mean min max std.dev	
		Random Location and Scale EB mean estimates	
		Weatt Witt Max 210 G&A	
		Locat_1 0.0000 -2.5147 2.4395 0.9083	
		Scale -0.0000 -1.9624 2.0125 0.6356	
		nora(_1.5rate -0.0220 -5.4042 5.4040 0.0550	

24. All files generated from the program can be found in a folder with the prefix MixWILD under the same directory of your dataset.

Name	Date modified	Туре
MIXWILD151988989	3/6/2018 5:39 PM	File folder
🚯 Mixwild_example_data	2/26/2018 11:54 AM	Microsoft Excel Comma Separated Values File

25. The output files with suffix_1 and _2 are the results that are identical in the Stage 1 and Stage 2 boxes in the MixWILD program.

Name ^	Date modified	Туре	Size
work	2/1/2018 10:48 AM	File folder	
mix_random	2/1/2018 10:48 AM	DEF File	1 KB
📧 mix_random	2/1/2018 10:47 AM	Application	665 KB
📧 mixor	2/1/2018 10:47 AM	Application	914 KB
📧 mixreg	2/1/2018 10:47 AM	Application	967 KB
MIXREGLS_RANDOM_MIXOR	2/1/2018 10:46 AM	DEF File	1 KB
🚯 Mixwild_example_data	1/31/2018 5:10 PM	Microsoft Excel C	720 KB
Mixwild_example_data	2/1/2018 10:41 AM	DAT File	719 KB
Mixwild_example_data_Output	2/1/2018 10:47 AM	DEF File	1 KB
Mixwild_example_data_Output.mwa	2/1/2018 10:46 AM	MWA File	101 KB
Mixwild_example_data_Output.mwd	2/1/2018 10:46 AM	MWD File	20 KB
Mixwild_example_data_Output_1	2/1/2018 10:48 AM	OUT File	12 KB
Mixwild_example_data_Output_2	2/1/2018 10:48 AM	OUT File	2 KB
Mixwild_example_data_Output_ebrandom	2/1/2018 10:48 AM	DAT File	1,142 KB
Mixwild_example_data_Output_ebvar	2/1/2018 10:48 AM	DAT File	88 KB
Mixwild_example_data_Output_level2	2/1/2018 10:48 AM	DAT File	38 KB
Mixwild_example_data_Output_random	2/1/2018 10:48 AM	DEF File	1 KB
Mixwild_example_data_Output_random_500	2/1/2018 10:48 AM	OUT File	1 KB
Mixwild_example_data_Output_repeat_mixor	2/1/2018 10:48 AM	DEF File	1 KB
I repeat_mixor	2/1/2018 10:48 AM	DEF File	1 KB
📧 repeat_mixor	2/1/2018 10:47 AM	Application	680 KB
📧 repeat_mixreg	2/1/2018 10:47 AM	Application	677 KB

- 26. There are two submodel results in Output_1. The first submodel does not include scale parameters; the second submodel includes the random scale estimates.
- 27. A brief description of the results from the second submodel will be provided in the following section.

4.2. Brief interpretation of Mixregls-Logistic regression model results Stage 1: model with random scale parameters

Model WITH RANDOM Scale				
Total Iterations = 15 Final Ridge value = 0.0				
Log Likelihood Akaike's Information Criterio Schwarz's Bayesian Criterion	= -499 n = -499 = -500	992.010 997.010 009.685		
==> multiplied by -2 Log Likelihood Akaike's Information Criterio Schwarz's Bayesian Criterion	= 999 n = 999 = 1000	984.021 994.021 019.370		
Variable Estima	te Asyr	nStdError	z-value	p-value
BETA (regression coefficients)				
Intercept 43.319	17	0.26098	165.98699	0.00000
ALPHA (BS variance parameters:	log-linea	ar model)	05 34004	0.00000
Intercept 4.185	5/ 14maam	0.04906	85.31084	0.00000
TAU (WS variance parameters: 1	og-iinear	MOGEL)	248 26182	0 00000
Rendom scale standard deviatio	74 n	0.01914	240.20102	0.00000
Std Dev 0.404	59	0.02046	19.77955	0.00000
Random location (mean) effect	on WS vari	iance		

- Since there are no regressors in the Stage 1 model, only the intercept estimates are presented in the mean (Beta), between-subject (Alpha), and the within-subject (Tau) sections in the Stage 1 results.
- The Stage 1 model shows that there is significant variability in scale across subjects, as the Std Dev for the Random scale (on the log scale) is estimated as 0.4046 (*p*<.001). Therefore, individuals differ from each other in their degree of within-subject/intraindividual variability in positive affect.
- The Stage 1 model also shows that the random scale (i.e., withinsubject/intraindividual variance) is negatively associated with the random intercept (i.e., within-subject mean), as indicated by the estimate for the Loc Eff for Random location (mean) effect on WS variance (estimate = -0.1358, *p*<.001). Individuals with overall higher mean positive affect are less erratic/more stable in their positive affect responses. (Note that this result may be also due to a ceiling effect in the affect response scale).

Stage 2: model with a dichotomous subject-level outcome

Mixwild_example_data_Output_2 - Notepad								
File Edit Format View I	Help							
Mixwild example3 Created with MixWILD	GUI							
Level 2 obervations	= 1176							
Final Results								
Variable	Estimate	AsymStdError	z-value	p-value				
Intercept	0.11711	0.08991	1.30248	0.19275				
Locat_1	0.41851	0.08533	4.90443	0.00000				
Scale	0.12689	0.10840	1.17059	0.24176				
Locat_1*Scale	-0.09245	0.11596	-0.79726	0.42530				

- In the Stage 2 final results table, Locat_1 refers to the effect of the random intercept (i.e., within-subject mean) on obesity risk; Scale refers to the effect of random scale (i.e., within-subject variance) on obesity risk; and Locat_1* Scale is the interaction between random intercept and random scale of positive affect in predicting obesity risk (a subject-level binary variable).
- The Stage 2 model does not include regressors, however, the random intercept (*Locat_1*), the random scale (*Scale*), and the interaction effect (*Locat_1*Scale*) are default regressors in the Stage 2 final results table.
- This logistic regression model shows that the random intercept (*Locat_1*) is
 positively associated with obesity risk (estimate OR = -0.4185, p<.001). Subjects
 who have higher means levels of positive affect than others are less likely to be
 obese.
- The interaction between the random intercept and random slope of positive affect does not predict individual's obesity risk.

Note:

- The numbers of level 1 and level 2 observations correspond to the available nonmissing observations of level 1 and level 2 variables included in both Stage 1 and Stage 2 models. Thus, since there are no regressors, observations with missing positive affect (level-1) or missing obesity (level-2) are not included in either Stage 1 or Stage 2 analyses.
- 2. Please refer to the supplemental documents for more detailed explanation of the Stage 1 and Stage 2 model results.

5. Example 4: Running Mixregmls- Linear regression model in MixWILD



Example research question for MixregmIs-Linear Regression model

- Examine whether subject-level mean (i.e., random intercept or within-person mean) and subject-level variance (i.e., random scale or degree of within-person / intraindividual variability) of momentary positive affect (within-subject, continuous, time-varying variable) predicts subject-level average minutes per day of moderate to vigorous physical activity (MVPA; between-subject, continuous, time-invariant variable), in addition to their positive affect change between weekdays and weekends (within-subject, dichotomous, time-varying variable), and BMI (betweensubject, continuous, time-invariant variable).
- Examine whether there is significant variability between individuals in the *association* (i.e., random slope) between weekday/weekend and momentary positive affect (i.e., whether individuals differ from each other in the extent to which positive affect increases towards the end of the week), after controlling for subject-level mean and subject-level variance.
- Examining whether the variability between individuals in the *association* (i.e., random slope) between weekday/weekend and momentary positive affect predicts average minutes per day of MVPA, after controlling for BMI.

Stage 1 outcome variable: Positive affect (time-varying) Stage 1 regressor (with random slope): Weekday/Weekend (time-varying) Stage 2 outcome variable: Average minutes per day of MVPA (time-invariant) Stage 2 regressor: BMI (time-invariant)

5.1. Step-by-step instructions on running Mixregmls - Linear regression model in MixWILD

- 1. Double-click on the the MixWILD icon to open the main window.
- 2. Click on "File" and then select "New Model" (or use keyboard shortcut Ctrl + N).



3. Click on "Instructions" to make sure your data are in the correct format.

-		×	-
Is your dataset Mix{WILD} friendly? Check here		_	Please follow these instructions
Data File:	Browse		1) You should always use a .csv file
Title:			2) You should ensure that missing values are not blanks
Random Location Effects: O Intercept O Intercept + Slope(s)			3) Missing value codes should be numeric only
Random Scale?			4) Make sure your missing value code is the same as your dataset
			5) Please ensure that the data is sorted by IDs
Stage 2 Outcome: O Continuous O Dichotomous/Ordinal	None		6) The first row in the .csv file should be column names
Contains missing values? O Yes O No			Got it
Missing value code:			
		-	
MIX {WILD} Cancel Reset S	Submit		
Maart Model Analysis With Intensive Lowoth detail Data			

4. Click on **"Browse"** to select the location of your data file (in .csv) and then click **"Open"**.

🕌 Open		×
Look <u>i</u> n:	MixWild	• G C B E
Mixwild_e	xample_data.csv	
File <u>N</u> ame:	Mixwild_example_data.csv	
Files of <u>Type</u> :	Data files	•
		Open Cancel

5. Click on "**View Data**" to preview your data file to verify your data and format are correct.

🅌 Mix Suite													-		×
File Help															
Stage 1 Configur	ration	Stage 2 Config	juration	Stage 1 Results	Stage 2 Re	sults	/iew Model	View Data							
Imj	ported	data file:	Mixwild_	example_data.cs	1				•						
	ID	AGE	SEX	WEEKEND	DOW	OBESE	BMI	NEG_AFFE	POS_AFFE	MVPA_daily	SED_daily				
1		10.47	1	0 0	1		-4.79	40	27	38.19	-999				
1		10.47	1	0 1	1		-4.79	-999	30	38.19	-999				
1		10.47	1	0 1	1		-4.79	50	35	38.19	-999				
1		10.47	1	1 5	1		-4.79	10	38	38.19	-999				
1		10.47	1	0 1	1		-4.79	35	43	38.19	-999				
1		10.47	1	1 5	1		-4.79	40	44	38.19	-999				
1		10.47	1	0 1	1		-4.79	10	-999	38.19	-999				
1		10.47	1	0 0	1		-4.79	20	-999	38.19	-999				
1		10.47	1	0 0	1		-4.79	30	-999	38.19	-999				
1		10.47	1	0 0	1		-4.79	40	-999	38.19	-999				
1		10.47	1	1 5	1		-4.79	40	-999	38.19	-999				
2		20.47	1	0 3	1		-4.79	52	15	22.03	9.46				
2		20.47	1	0 2	1		-4.79	39	17	22.03	9.46				
2		20.47	1	0 3	1		-4.79	49	22	22.03	9.46				
2		20.47	1	1 6	1		-4.79	50	22	22.03	9.46				
2		20.47	1	1 6	1		-4.79	59	24	22.03	9.46				
2		20.47	1	1 5	1		-4.79	30	33	22.03	9.46				
2		20.47	1	1 6	1		-4.79	20	35	22.03	9.46				
2		20.47	1	0 4	1		-4.79	10	38	22.03	9.46				
2		20.47	1	1 6	1		-4.79	40	39	22.03	9.46				
2		20.47	1	1 6	1		-4.79	41	44	22.03	9.46				
2		20.47	1	1 5	1		-4.79	50	46	22.03	9.46				
2		20.47	1	0 4	1		-4.79	50	48	22.03	9.46				
2		20.47	1	1 5	1		-4.79	40	49	22.03	9.46				
2		20.47	1	1 5	1		-4.79	40	49	22.03	9.46				
2		20.47	1	0 4	1		-4.79	50	51	22.03	9.46				
2		20.47	1	0 2	1		-4.79	10	52	22.03	9.46				
2		20.47	1	0 0	1		-4.79	50	59	22.03	9.46				
2		20.47	1	0 0	1		-4.79	30	62	22.03	9.46				
2		20.47	1	1 5	1		-4.79	40	65	22.03	9.46				
2		20.47	1	1 5	1		-4.79	20	66	22.03	9.46				
3		17.47	1	0 2	1		-4.79	61	15	22.03	9.46				
3		17.47	1	0 4	1		-4.79	38	22	22.03	9.46				
3		17.47	1	1 6	1		-4.79	60	25	22.03	9.46				
3		17.47	1	0 2	1		-4.79	33	38	22.03	9.46			•]

- 6. Add title to your output files.
- 7. Select "Intercept + Slope" from Random Location Effects specification for subjectlevel mean and subject-level slope. Check "Random Scale" for subject-level variability.
- 8. Select "Continuous" for Stage 2 outcome.
- 9. Click on missing values if there are any in your dataset; specify your missing value code in the box (i.e., -999 in the example dataset).

a File: C.1	Jsers\donts mple	Documents	\Mixwild_examp	ple_data.csv	Browse
e: Exa	mple				
ndom Locati					
	n Effects:	Interce	pt 💿 Inte	rcept + Slope(s)
ndom Scale?	2				
ge 2 Outcon	e: 💿 Co	ntinuous	O Dichotom	ous/Ordinal	○ None
ntains missir	g values?	• Yes	O No		
sing value c	ode: -9	99			
Set se	d: 53	564			

10. After you submit, the interface will take you to the page that enables you to configure your Stage 1 model.

e 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data				
Selected mod	el configuration:					Stage 1	Regressors		
Random locat Stage 2 outco	ion effects: Intercept + Slo me: Continuous	ope _ Level-1 —	Mean	Rand	om Slo	Scale	Level-2	Mean	Scale
ID Variable:									
ID	-								
Stage 1 Outco	me:								
POS_AFFECT	-								
Configure St	age 1 Regressors								
C)ptions								
Association of r	andom location & scale?								
Association of t	andoni locadoli di scale.								
Yes									
⊖ No									

- 11. On the Stage 1 configuration page, select your ID variable and positive affect as your Stage 1 outcome variable.
- 12. Specify the association between mean and within- subject (WS) variance, which is the association between the random location and random scale effects. The default is no association, but "**Yes**" is selected for the following example.

🕌 Mix Suite									
File Help									
Stage 1 Configuration Stage 2 Configuration	Stage 1 Results St	age 2 Results	View Model	/iew Data]				
Selected model configuration: Random location effects: Intercept + Slop Stane 2 outcome: Continuous	pe	Mean	Random	Slo	Stage 1 Scale	Regressors	Mean	Scale	
ID Variable: ID Variable: ID Stage 1 Outcome: POS_AFFECT Configure Stage 1 Regressors Options Association of random location & scale?	-Level-1					-Level-2			
 Yes No 									
MIX (WILD)							Reset	Configure Stage 2	

13. Click on **"Modify Stage 1 regressors"** and select time-varying regressor **"WEEKEND"** as the regressor in the Stage 1 model.

variables		Level-1 (Time Varying)
Age SEX DOW OBESE BMI NEG_AFFECT MVPA_daily_mins SED_daily_hrs	Add	D
	Add Remove	Level-2 (Time Invariant

- 14. Select the boxes in the mean column, BS Variance column, and WS Variance column to allow Stage 1 regressors to predict mean, between-subject variance, and/or within-subject variance of Stage 1 outcome, respectively.
- 15. In this example, weekend is selected to predict the mean and is allowed to have a random slope on positive affect (i.e., the weekend effect on positive affect will vary across subjects).
- 16. Select "**Disaggregate**" for each of the time-varying variable(s) for which decomposition of the within-subject and between-subject effects in predicting Stage 1 outcome is desired. Weekend is not disaggregated in this example.

Vix Suite									-
Help	V		V	V	Vien	1			
age 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data				
Selected mod	el configuration:					Stage	1 Regressors		
Stage 2 outco	me: Continuous	Level-1 —	Mea	n Rano	iom Sio	Scale	Level-2	Mean	Scale
ID Variable:	•								
Stage 1 Outco	me:	_							
Configure St	age 1 Regressors		WEEKEND	V	×				
C	options	Di	saggregate?				r l		
Association of r	andom location & scale?								
Yes									
🔾 No									
MIX{wi	LD}								

17. Click on "Options" to change other default settings if needed.

Mean Intercept:	~	Maximum Iterations:	200
38 Variance Intercept:	×	Ridge:	0.1
WS Variance Intercept:	r	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 ×	Resample Stage 2:	*
Adaptive Quadrature:	×	No. of Samples:	500 -
Run in 32-bit mo	de (Experimer	tal: for older Windows-based machines)	

- 18. In most cases, we will keep Mean, BS and WS intercept checked.
- 19. By default, the estimated random effects of the Stage 1 analysis (i.e., random location and scale effects) are resampled 500 times in the Stage 2 analysis. Resampling is necessary because the random effects are estimated quantities that are entered as regressors in the Stage 2 model.
- 20. Leave "Discard Subjects" unchecked, to retain all participants in the Stage 1 analysis. Click on "Submit". (refer to the supplemental documents for further description of Options settings)

		Maximum Iterations:	200
BS Variance Intercept:	2	Ridge:	0.1
WS Variance Intercept:	2	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 ×	Resample Stage 2:	¥
Adaptive Quadrature:		No. of Samples:	500

21. Select "MVPA_daily_minutes" as Stage 2 outcome variable.

🕌 Mix Suite						-	đ	×
File Help								
Stage 1 Configuration Stage 2 Configuration Stage	e 1 Results Stage 2 Results	View Model View	Data					
			S	Stage 2 Interactions				
		Main Effects	Random Location	Random Scale	Location X Scale			
Stage 2 Outcome	Stage-2 Regressors		1					
stage z outcome.	_							
MVPA_daily_mins								
Configure Stage 2 Regressors								
	-							
MIX (MULD)				Posot	Pup Stage 1 and 2			
IVITA (VVILD)	Sup	press scale X Random	Interaction	Nebel	Run Stage 7 dilu 2			

22. Add Stage 2 regressor "**BMI**" into the model. Stage 2 regressor(s) are generally time-invariant variable(s). However, if they are time-varying variables, the program will calculate subject averages of the variable. Click on "**Submit**" when finished.

🛃 Add Stage 2 regressors		_		\times
Variables Age SEX WEEKEND DOW OBESE NEG_AFFECT SED_daily_hrs	Add Remove ?	Level 2 (Tii	me Invarian	t)
MIX (WILD) Meet Model Analysis With Interdieve Longitudinal Data	Cancel	Reset	Submi	t

23. Select to add main effect of BMI in predicting daily MVPA minutes. In this example, the interactions between BMI and random location or random slope were not tested, so the remaining boxes are unchecked.

🕌 Mix Suite											- 0	\times
File Help												
Stage 1 Configuration	Stage 2 Configuration	Stage 1	Results	Stage 2 Results	View Model	View Da	ita					
												1
								Stage 2 Int	eractions	5		
					Main Effects		Dandam Lagar	tion Devide		Leasting V Cools		
			Stage-2	Regressors	Main Ellects	•	Kandom Loca	uon Kando	m scale	Location X Scale		
Stage 2	2 Outcome:											
10/04	deite mine											
MVPA_	_daliy_mins	•										
Co	nfigure Stage 2 Regressor	S										
			BMI		*							
IVIIX	({WILD}			Sup	press Scale X R	tandom Int	teraction	Reset		Kun Stage 1 and 2		
		_										

- 24. Click on Stage 1 and Stage 2 configurations to double-check your model Click on "Run Stage 1 and 2" to generate the definition file. The definition file contains the syntax that instructs the program to estimate the specified model.
- 25. In the definition file, click on "**Proceed**" to run your model and generate model output files. If you see a field with the text "**null**", it means that there is a mistake in your model that should be fixed.



26. A window will appear while model estimation is in progress. The time for generating the final output depends on the data size and complication of your specified model, the run time to estimate a model including random slope could range up to 20 minutes or longer.

		00,	
MIXWILD:	6.1815835095153818E-004 26.911/84325163946		
MIXWILD:	-2 Log-Likelihood = 88099.24115		
MIXWILD:	Newton-Raphson Iteration 60 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	5.9207227136535317E-004 25.520190814888352		
MIXWILD:	-2 Log-Likelihood = 88099.23903		
MIXWILD:	Newton-Raphson Iteration 61 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	5.6676266186373846E-004 24.200616865463360		
MIXWILD:	-2 Log-Likelihood = 88099.23712		
MIXWILD:	Newton-Raphson Iteration 62 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	5.4224518977100079E-004 22.949329239307637		
MIXWILD:	-2 Log-Likelihood = 88099.23541		
MIXWILD:	Newton-Raphson Iteration 63 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	5.1852926467836071E-004 21.762788801105589		
MIXWILD:	-2 Log-Likelihood = 88099.23387		
MIXWILD:	Newton-Raphson Iteration 64 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	4.9561889406376613E-004 20.637640369387878		
MIXWILD:	-2 Log-Likelihood = 88099.23248		
MIXWILD:	Newton-Raphson Iteration 65 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	4.7351344260768326E-004 19.570703104020058		
MIXWILD:	-2 Log-Likelihood = 88099.23123		
MIXWILD:	Newton-Raphson Iteration 66 with ridge 0.1000		
MIXWILD:	maximum correction and derivative		
MIXWILD:	4.5220830541771120E-004 18.558961400703936		
MIXWILD:	-2 Log-Likelihood = 88099.23011		
4	1		

27. If the following warning message appears, it indicates that computational difficulties were encountered that prevented the model parameters from being estimated successfully. In this case, double-check the format of your dataset and your model specifications. Some suggestions for steps to take are listed in Appendix A.



28. When estimation is completed, the Stage 1 and Stage 2 results can be seen by clicking the Stage 1 and Stage 2 Results boxes, respectively.

Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Re	sults View Model	View Data			
	Results from st	age 1 analysis						
	Model WITH	RANDOM Scale a	nd Locati	on-Scale Associ	ation			
	Total Ite	rations = 15						
	Final Ridge	e value = 0.00						
	Log Likeli	nood	=	-49663.899				
	Akaike's I	nformation Cri	terion =	-49672.899				
	Schwarz's 1	Bayesian Crite	rion =	-49695.671				
	==> multip.	lied by -2						
	Log Likeli	nood	=	99327.797				
	Akaike's In	nformation Cri	terion =	99345.797				
	Schwarz's i	Bayesian Crite	rion =	99391.342				
						-	-	
	Variable	E	stimate	Asymstatrior	z-va	iue p-va	alue	
	DETA (Norma	anion accéfici						
	DEIA (regre	ssion coeffici	2 54022	0 20252	145 45	0.00	0000	
	Intercept	3	2.54922	0.29252	145.45	823 0.00	000	
	WEEKEND		1.04091	0.23799	0.92	0.00	1000	
	Random (loca	ation) Effect	Variances	and Covariance	5			
	Intercept	7	1.87876	3.91368	18.36	605 0.00	0000	
	Covariancel	2 -1	0.40457	2.37375	-4.38	318 0.00	0001	
	WEEKEND	1	4.78058	2.60495	5.67	404 0.00	0000	=
	TAU (WS var	iance paramete	rs: log-l	inear model)				_
	Intercept		4.71390	0.01958	240.81	170 0.00	0000	
	Random loca	tion effects o	n WS vari	ance (log-linea	r model)			-

Stage 1 Configuration | Stage 2 Configuration | Stage 1 Results | Stage 2 Results | View Model | View Data |

	Results	from	stage	2	anal	vsis
--	---------	------	-------	---	------	------

Locat_2	-0.0000	-1.5834	1.8591	0.5152		
Scale	-0.0000	-1.9131	1.7382	0.6266		
Locat_1*Scale	-0.0175	-2.9460	3.5733	0.6266		
Number of replica	tions =	500				
Final Results						
Average Log Likel	ihood =	-4458.884	(sd= 2.993)			
Akaike's Informat	ion Criterion =	-4464.884				
Schwarz's Bayesia	n Criterion =	-4480.065				
==> multiplied by	-2					
Log Likelihood	=	8917.768				
Akaike's Informat	ion Criterion =	8929.768				
Schwarz's Bayesia	n Criterion =	8960.130				
Variable	Estimate	AsymStdErro	r z-	value	p-value	
					-	
Intercept	60.58810	1.4079	4 43.	03307	0.00000	
BMI	-0.76587	0.0504	9 -15.	16847	0.00000	
Locat 1	1.46400	0.4542	4 3.	22297	0.00127	
Locat 2	-0.27521	0.6467	0 -0.	42556	0.67043	
Scale	1.34265	0.5710	3 2.	35128	0.01871	
	-0.66794	0.5939	4 -1.	12459	0.26076	
Locat_1*Scale						

29. All files generated from the program can be found in a folder with the prefix MixWILD under the same directory of your dataset.

1 📙 י	↑ 📙 > MIXWILD									
ACCESS		Name	Date modified	Туре						
		MIXWILD151988992	3/6/2018 5:39 PM	File folder						
iloads	*	Mixwild_example_data	2/26/2018 11:54 AM	Microsoft Excel Comma Separated Values File						

30. The OUT files with suffix_1 and _2 are the results that are identical to those in the Stage 1 and Stage 2 boxes.

WILD > MIXWILD151988992			
Name	Date modified	Туре	Size
work	4/1/2018 5:06 PM	File folder	
🧾 mix_random	2/26/2018 1:12 PM	DEF File	1 KB
📧 mix_random	2/26/2018 12:49 PM	Application	665 KB
📧 mixor	2/26/2018 12:49 PM	Application	914 KB
📧 mixreg	2/26/2018 12:49 PM	Application	967 KB
MIXREGMLS_RANDOM_MIXREG	2/26/2018 12:48 PM	DEF File	1 KB
🔊 Mixwild_example_data	3/8/2018 11:42 AM	Microsoft Excel C	635 KB
Mixwild_example_data	2/26/2018 12:47 PM	DAT File	635 KB
Mixwild_example_data_Output	2/26/2018 12:49 PM	DEF File	1 KB
Mixwild_example_data_Output.mwa	2/26/2018 12:48 PM	MWA File	94 KB
Mixwild_example_data_Output.mwd	2/26/2018 12:48 PM	MWD File	20 KB
Mixwild_example_data_Output_1	2/26/2018 1:12 PM	OUT File	14 KB
Mixwild_example_data_Output_2	2/26/2018 1:13 PM	OUT File	3 KB
Mixwild_example_data_Output_ebrandom	2/26/2018 1:12 PM	DAT File	1,707 KB
Mixwild_example_data_Output_ebvar	2/26/2018 1:12 PM	DAT File	156 KB
Mixwild_example_data_Output_level2	2/26/2018 1:12 PM	DAT File	55 KB
Mixwild_example_data_Output_random	2/26/2018 1:12 PM	DEF File	1 KB
Mixwild_example_data_Output_random_500	2/26/2018 1:13 PM	OUT File	2 KB
Mixwild_example_data_Output_repeat_mixreg	2/26/2018 1:12 PM	DEF File	1 KB
📧 repeat_mixor	2/26/2018 12:49 PM	Application	680 KB
🧾 repeat_mixreg	2/26/2018 1:12 PM	DEF File	1 KB
📧 repeat_mixreg	2/26/2018 12:49 PM	Application	677 KB

31. There are 3 submodel results in Output_1. The first submodel does not include scale parameters; the second submodel includes the random scale estimates, and the third submodel includes the random scale estimates and the random location-scale association as follows. (A brief description of results from the following third submodel will be provided)

Total Iterations = 15 Final Ridge value = 0.00 Log Likelihood = -49663.899 Akaike's Information Criterion = -49672.899 Schwarz's Bayesian Criterion = -49695.671	Model WITH RANDOM Scale and Loc	atio	n-Scale Association
Log Likelihood = -49663.899 Akaike's Information Criterion = -49672.899 Schwarz's Bayesian Criterion = -49695.671	Total Iterations = 15 Final Ridge value = 0.00		
	Log Likelihood Akaike's Information Criterion Schwarz's Bayesian Criterion	= = =	-49663.899 -49672.899 -49695.671

5.1. Brief interpretation of Mixregmls - Linear Regression model results

Stage 1 model with random scale and location-scale association

Model WITH RANDOM Scale and Location-Scale Association								
Total Iterations Final Ridge value	; = 15 ; = 0.00							
Variable	Estimate	AsymStdError	z-value	p-value				
BETA (regression o	coefficients)							
Intercept	42,54922	0.29252	145,45823	0.00000				
WEEKEND	1.64891	0.23799	6.92840	0.00000				
Random (location) Effect Variances and Covariances								
Intercept	71.87876	3.91368	18.36605	0.00000				
Covariance12	-10.40457	2.37375	-4.38318	0.00001				
WEEKEND	14.78058	2.60495	5.67404	0.00000				
TAU (WS variance p	arameters: log-l	inear model)						
Intercept	4.71390	0.01958	240.81170	0.00000				
Random location effects on WS variance (log-linear model)								
Intercept	-0.12200	0.02285	-5.33863	0.00000				
WEEKEND	-0.03975	0.03458	-1.14954	0.25033				
Random scale stand	lard deviation							
Std Dev	0.40098	0.02108	19.01857	0.00000				

- The Stage 1 model shows that weekend is positively associated with positive affect (estimate=1.6489, *p*<.001). Individuals overall have higher mean positive affect on weekend days relative to weekdays.
- There is significant variability in both intercept (i.e., random intercept) and slope (i.e., random slope) across subjects. The random intercept is estimated as 71.8788 on the log scale (p<.001) and the random slope is estimated as 14.7808 on the log scale (p<.001). Therefore, individuals differ from each other in their mean levels of positive affect and in their associations between weekday/weekend and momentary positive affect.
- The random intercept and random slope are negatively associated with each other (estimate= -10.4045, *p*<.001). This negative covariance indicates that subjects with higher weekday mean levels of positive affect (i.e., higher levels of the intercept) do not increase in positive affect as much on weekends, relative to subjects with lower weekday positive affect.
- For the relationships between the random location and scale effects, the random intercept (i.e., weekday positive affect) is negatively associated with the WS variance (estimated as -0.1220 on the log scale (*p*<.001). This indicates that subjects with higher weekday positive affect are more consistent/less erratic in their mood reports. A subject's random slope (positive affect change on weekend days relative to weekdays) is not significantly related to a subject's WS variance.
- There is significant variability in scale across subjects, as the Std Dev for the Random scale is estimated as 0.4010 on the log scale (*p*<.001). Thus, individuals differ from each other in their degree of within-subject/intraindividual variability in positive affect.

Final Results				
Average Log Likeli	hood =	-4458.884 (sd	= 2.993)	
Akaike's Informati	on Criterion =	-4464.884		
Schwarz's Bayesian	Criterion =	-4480.065		
==> multiplied by	-2			
Log Likelihood	=	8917.768		
Akaike's Informati	on Criterion =	8929.768		
Schwarz's Bayesian	Criterion =	8960.130		
Variable	Estimate	AsymStdError	z-value	p-value
Intercept	60.58810	1.40794	43.03307	0.00000
BMI	-0.76587	0.05049	-15.16847	0.00000
Locat_1	1.46400	0.45424	3.22297	0.00127
Locat_2	-0.27521	0.64670	-0.42556	0.67043
Scale	1.34265	0.57103	2.35128	0.01871
Locat_1*Scale	-0.66794	0.59394	-1.12459	0.26076
Resid.Variance	123.57794	5.15942	23.95190	0.00000

Stage 2 model with continuous subject-level outcome

- In the Stage 2 final results table, Locat_1 refers to the effect of the random intercept (i.e., within-subject mean) on MVPA minutes; Locat_2 refers to the effect of the random slope (i.e., within-subject association between weekday/weekend and positive affect) on MVPA minutes; Scale refers to the effect of random scale (i.e., within-subject variance) on MVPA minutes; and Locat_1* Scale is the interaction between random intercept and random scale predicting MVPA minutes.
- Results show that after controlling for other variables, subjects' BMI is negatively associated with mean MVPA minutes (estimate= -0.7659, *p*<.001).
- The random intercept (*Locat_1*) positively predicts MVPA minutes when the random scale is zero (estimate= 1.1460, *p*<.001). Since the random effects are centered around zero, a random scale of zero represents the average scale. For subjects with average scale of positive affect, higher levels of weekday positive affect are associated with higher daily MVPA minutes.
- The random scale (Scale) is significant in predicting MVPA minutes when the random intercept (Locat_1) is zero (estimate=1.3427, p<.05). Since the random effects are centered around zero, a random intercept of zero represents the average positive affect level on weekdays. For subjects with average weekday levels of positive affect, higher levels of mood variability are associated with higher averaged daily MVPA minutes.

Note:

1. The numbers of level 1 and level 2 observations correspond to the available nonmissing observations of level 1 and level 2 variables included in both Stage 1 and Stage 2 models. Thus, these analyses are carried out using observations that are non-missing in terms of both outcomes (positive affect and averaged daily MVPA) and regressors (weekend and BMI). Refer to the supplemental documents for more detailed explanation of the Stage 1 and Stage 2 model results.

6. Example 5: Running Mixregmls - Logistic regression model in MixWILD



Example research questions for Mixregmls-Logistic Regression model

- Examine whether subject-level mean (i.e., random intercept or within-person mean) and subject-level variance (i.e., random scale or degree of within-person / intraindividual variability) of momentary positive affect (within-subject, continuous, time-varying variable) predicts subject-level obesity risk (between-subject, dichotomous, time-invariant variable), in addition to their positive affect change between weekdays and weekends (within-subject, dichotomous, time-varying variable).
- Examine whether there is significant variability between individuals in the association (i.e., random slope) between weekday/weekend and momentary positive affect (i.e., whether individuals differ from each other in the extent to which positive affect increases towards the end of the week), after controlling for subject-level mean and subject-level variance.
- Examining whether the variability between individuals in the association (i.e., random slope) between weekday/weekend and momentary positive affect predicts subject-level obesity risk, after controlling for Age.
- Examining whether participants' Age could moderate the associations between mean levels (i.e., random intercept) and variances (i.e., random scale) in positive affect in predicting obesity risk, and whether participants' Age could moderate weekend-positive affect association (i.e., random slope) in predicting obesity risk.

Stage 1 outcome variable: Positive affect (time varying)

Stage 1 regressor (with random slope): Weekend vs. Weekday (time varying); Sex (time invariant)

Stage 2 outcome variable: Obese or Non-obese (time invariant)

Stage 2 regressors: Age (time invariant); Age x random intercept interaction; Age x random scale interaction; Age x random intercept x random scale interaction

6.1. Step-by-step instructions for running a Mixregmls- Logistic regression model in MixWILD

1. Double-click on the MixWILD icon to open the main window.

2. Click on "File" and then select "New Model" (or use keyboard shortcut Ctrl + N).



3. Click on "Instructions" to make sure your data are in the correct format.

-		×	4	- 0	×
Is your dataset Mix{WILD} friendly? Check here	Browse			Please follow these instructions	
				1) You should always use a .csv file	
Title:				2) You should ensure that missing values are not blanks	
Random Location Effects: O Intercept O Intercept + Slope(s)				3) Missing value codes should be numeric only	
Random Scale?				4) Make sure your missing value code is the same as your dataset	
				5) Please ensure that the data is sorted by IDs	
Stage 2 Outcome: O Continuous O Dichotomous/Ordinal) None			6) The first row in the .csv file should be column names	
Contains missing values? O Yes O No				Got it	
Missing value code:					
		-			
VIX (WILD) Cancel Reset	Submit	1			

4. Click on **"Browse"** to select the location of your data file (in .csv) and then click **"Open"**.

🕌 Open		×
Look <u>i</u> n:	MixWild	- A A - B =
Mixwild_e	xample_data.csv	
File <u>N</u> ame:	Mixwild_example_data.csv	
Files of <u>Type</u> :	Data files	•
		Open Cancel

5. Click on "**View Data**" to preview your data file to verify your data and format are correct.

á Mix Suite												
File Help												
Stage 1 Conf	iguration	Stage 2 Conf	iguration	Stage 1 Results	Stage 21	Results	View Model	View Data				
otago i oom	garation		0	otago i noounto				- non bata	*			 _
	Imported	data file:	Mixwild	_example_data.cs	SV							
	ID	AGE	SEX	WEEKEND	DOW	OBES	E BMI	NEG_AFFE	POS_AFFE.	MVPA_daily	SED_daily	
	1	10.47	1	0	0	1	-4.79	40	27	38.19	-999	
	1	10.47	1	0	1	1	-4.79	-999	30	38.19	-999	
	1	10.47	1	0	1	1	-4.79	50	35	38.19	-999	
	1	10.47	1	1	5	1	-4.79	10	38	38.19	-999	
	1	10.47	1	0	1	1	-4.79	35	43	38.19	-999	
	1	10.47	1	1	5	1	-4.79	40	44	38.19	-999	
	1	10.47	1	0	1	1	-4.79	10	-999	38.19	-999	
	1	10.47	1	0	0	1	-4.79	20	-999	38.19	-999	
	1	10.47	1	0	0	1	-4.79	30	-999	38.19	-999	
	1	10.47	1	0	0	1	-4.79	40	-999	38.19	-999	
	1	10.47	1	1	5	1	-4.79	40	-999	38.19	-999	
	2	20.47	1	0	3	1	-4.79	52	15	22.03	9.46	
	2	20.47	1	0	2	1	-4.79	39	17	22.03	9.46	
	2	20.47	1	0	3	1	-4.79	49	22	22.03	9.46	
	2	20.47	1	1	6	1	-4.79	50	22	22.03	9.46	
	2	20.47	1	1	6	1	-4.79	59	24	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	30	33	22.03	9.46	
	2	20.47	1	1	6	1	-4.79	20	35	22.03	9.46	
	2	20.47	1	0	4	1	-4.79	10	38	22.03	9.46	
	2	20.47	1	1	6	1	-4.79	40	39	22.03	9.46	
	2	20.47	1	1	6	1	-4.79	41	44	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	50	46	22.03	9.46	
	2	20.47	1	0	4	1	-4.79	50	48	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	40	49	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	40	49	22.03	9.46	
	2	20.47	1	0	4	1	-4.79	50	51	22.03	9.46	
	2	20.47	1	0	2	1	-4.79	10	52	22.03	9.46	
	2	20.47	1	0	0	1	-4.79	50	59	22.03	9.46	
	2	20.47	1	0	0	1	-4.79	30	62	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	40	65	22.03	9.46	
	2	20.47	1	1	5	1	-4.79	20	66	22.03	9.46	
	3	17.47	1	0	2	1	-4.79	61	15	22.03	9.46	
	3	17.47	1	0	4	1	-4.79	38	22	22.03	9.46	
	3	17.47	1	1	6	1	-4.79	60	25	22.03	9.46	
	3	17 47	1	0	2	1	-4 79	33	38	22.03	9.46	

- 6. Add title to your output files. Select "Intercept + Slope" from Random Location Effects specification for subject-level mean and subject-level slope. Check "Random Scale" for subject-level variability.
- 7. Select "Dichotomous/Ordinal" for the Stage 2 outcome.
- 8. Click on missing values if there are any in your dataset; specify your missing value code in the box (i.e., -999 in the example dataset).

📓 – 🗆 🗙
Is your dataset Mix{WILD} friendly? Check here
Data File: C:\Users\donts\Documents\Mixwild_example_data.csv Browse
Title: Example
Random Location Effects: O Intercept
Random Scale?
Stage 2 Outcome: Continuous Dichotomous/Ordinal None
Contains missing values?
Missing value code: -999
Set seed: 42022
MIX {WILD} Cancel Reset Submit

- 9. After you submit, the interface will take you to the page that enables you to configure your Stage 1 model.
- 10. Select ID variable and positive affect as your Stage 1 outcome variable.

Mix Suite				- 0
e Help				
tage 1 Configuration Stage 2 Configuration Stage 1 Res	ults Stage 2 Results View Mode	I View Data		
Selected model configuration: Random location effects: Intercept + Slope	 Mean Rar	Stage 1 Re	gressors Mean	Scale
Stage 2 outcome: Dichotomous ID Variable: ID Stage 1 Outcome: POS_AFFECT Configure Stage 1 Regressors	.1		Level-2	
Association of random location & scale?				
⊖ No				
MIX (WILD)			Reset	Configure Stage 2

- 11. Specify the association between the mean and within- subject (WS) variance, which is the association of the random location and random scale effects. The default is no association, but "**Yes**" is selected for the following example.
- 12. Click on "Modify Stage 1 regressors". Select "Weekend" for time-varying regressor and select "Sex" as a time-invariant regressor and click on "Submit".

🕌 Mix Suite			– 0 ×
File Help			
Stage 1 Configuration Stage 2 Configuration	Stage 1 Results Stage 2 Results View Model View Data]	
Selected model configuration:	Add Stage 1 Regressors	- 🗆 X	
Random location effects: Intercent + Slo	ne		-
Stage 2 outcome: Dichotomous	Variables	Level-1 (Time Varving)	Scale
stage z outcome. Dichotomous	Ane		
ID Variable:	SEX Add		
ID 👻	WEEKEND		
	DOW Remove		
Stage 1 Outcome:	OBESE		
	BMI NEG AFEECT		
POS_AFFECT	MVPA daily mins Stop 12		
	SED_daily_hrs		
Configure Stage 1 Regressors			
Ontions		Level-2 (Time Invariant)	
Options			
	Add		
	Remove		
Association of random location & scale?			
Yes			
Step 11			
○ No			
	IVIIA (VVILD) Meet Model Analysis With Interesting Longitudinal Data	Cancel Reset Submit	
MIX (WILD)			
		Reset	Configure Stage 2

13. Select the boxes in the mean column, random slope, and scale column to allow Stage 1 regressors to predict the mean, estimate random slope, and/or random scale of Stage 1 outcome, respectively. In this example, weekend will be included in the mean model and allow for it to have a random slope (i.e., the positive affect change between weekdays and weekends will be allowed to vary across subjects).

🔬 Mix Suite										_	٥	×
File Help												
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data							
Selected mod Random locat Stage 2 outco ID Variable: ID Stage 1 Outco	el configuration: ion effects: Intercept + Sio me: Dichotomous	pe	Mean	Rand	om Slo	Stage 1 Scale	Re	gressors Level-2	Mean	Scale		
Configure St	age 1 Regressors	Di	WEEKEND saggregate?	¥	×			SEX	×			
Association of ra Yes No	andom location & scale?											
MIX{wi	LD}								Reset	Configure Stage 2]	

14. Select "**Disaggregate**" for each of the time-varying variable(s) for which decomposition of the within-subject and between-subject effects in predicting Stage 1 outcome is desired. In this case, we will not disaggregate the Weekend variable.

🕌 Mix Suite											_	٥	×
File Help													
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data								
Selected mode	el configuration:					Stage 1	1 Reg	jressors					
Random locati	ion effects: Intercept + Slo	pe	Maan	Dand	om Elo	Foolo			Mag	-	Faala		
Stage 2 outcor	me: Dichotomous	Level-1	Medii	Kanu	0111 510	Scale	76	Level-2	Mea		Scale	_	
ID Variable:													
ID	-												
Stage 1 Outcor	me:												
POS_AFFECT	-												
Configure St													
Configure St	age 1 Regressors		WEEKEND	2	1								
0	ptions	Di	saggregate?					SE	X	V		_	
Association of ra	andom location & scale?												
Non													
U Tes													
⊖ No													
MIV	LD)												
										Reset	Configure Stage 2	2	

15. Click on "**Options**" to change other default settings if needed. In most cases, we will keep Mean, BS and WS intercept checked.

Mean Intercept:	×	Maximum Iterations:	200
BS Variance Intercept:	~	Ridge:	0.1
WS Variance Intercept:	V	Standardize All Regressors?	
Convergence Criteria:	0.00001	Discard Subjects with no Variance?	
Quadrature Points:	11 +	Resample Stage 2:	
Adaptive Quadrature:	~	No. of Samples:	500

- 16. By default, the estimated random effects of the Stage 1 analysis (i.e., random location and scale effects) are resampled 500 times in the Stage 2 analysis. Resampling is necessary because the random effects are estimated quantities that are entered as regressors in the Stage 2 model.
- 17. Leave "**Discard Subjects**" unchecked, so we do not drop participants who have 0 variation in their Stage 1 outcome variable. Click on "**Submit**" (Refer to the supplemental documents for further description of Options settings)

- 18. Select **"Obese"** as Stage 2 dichotomous outcome variable in Stage 2 configuration page. Check if the outcome categories are correct.
- 19. Click on "Configure Stage 2 Regressors" to add regressor(s).

🛃 Mix Suite									- 0	×
File Help										
Stage 1 Configuration	Stage 2 Configuration	Stage 1 Results	Stage 2 Results	View Model	View Data					
										1
						Stad	e 2 Interactions			
						0				
				Main Effects	Random Lo	ocation	Random Scale	Location X Scale		
Stage	2 Outcome:	Stage-2	Regressors		1					
Stage	ez outcome.									
SEX		-								
c	onfigure Stage 2 Regresso	rs								
	Check outcome categories									
	tegorios:									
1) 0	stegories.									
2) 1										
MI	X {WILD}		Sup	oress Scale X Ra	indom Interaction		Reset	Run Stage 1 and 2		
Musel Model A	Instantin Wilds, Internation I newstanding Party									

20. Select **"Age"** as a regressor in the Stage 2 model. Stage 2 regressor(s) are generally time-invariant variable(s). However, if they are time-varying variables, the program will calculate subject averages of the variable. Click on **"Submit"** when finished.

Add Stage 2 regressors		_		×
Variables WEEKEND DOW OBE SE BMI NEG_AFFECT MVPA_daily_mins SED_daily_hrs	Add Remove ?	Level 2 (Ti	me Invariant)	
MIX {WILD} Maked Model Analysis Web Intensive Longitudinal Data	Cancel	Reset	Submit	

21. Select to add Stage 2 main effect(s) and interaction effect(s) with Stage 1 random effects as regressors.

🕌 Mix Suite									-	ð	×
File Help											
Stage 1 Configuration	Stage 2 Configuration	Stage 1	Results Stage 2 Results	View Model	View Da	ta					
						s	stage 2 Interactions				
				Main Effects		Random Location	Random Scale	Location X Scale			
Stage 2	Outcome:		Stage-2 Regressors								
		_									
SEX		-									
Con	figure Stage 2 Regressor	s									
Ct	heck outcome categories										
2 Cate	gories:		Age	*		×	×	v			
1) 0 2) 1									1		5
			In this exar	nple, w	ve se	elected "Le	ocation x S	cale" box,	which m	ean	s
			that a 3-v	vav int	terad	tion will	be includ	led to pre	edict sta	ge	2
			outcomo	, Alco +	h. +		randam la	, aation y	randam		~
			outcome.	AISO, L	ne t	wo-way		cation x	ranuom	SCal	e
	(interaction	s will	be i	ncluded.	This locat	ion x sca	le intera	ctio	n 📗
MIX	{WILD}		ontion is pr	halder	only	if main e	fforts are s	plactad			J
				labicu	Unity	ii iiiaiii c					

22. Click on Stage 1 and Stage 2 configurations to double-check your model. Click on "Run Stage 1 and 2" to generate the definition file.



23. The definition file contains the syntax that instructs the program to estimate the specified model. In the definition file, click on "**Proceed**" to run your model and generate model output files.

Created "C:\User	with s\chi	MixW ihhsi	ILD (v\De:	GUI sktop\	New	folder	(3)\M	ixwi	lld e	xample	data	a.dat
Mixwild_	exam	ple_d	ata_(Dutput	;				_		-	
11 2 1 50 0.00 1 9 4 3 4	000	0 0	0	0 0	0	0.00001	11	1	200	-999	0 :	1 0.3
POS_AFFE WEEKEND WEEKEND	CT SEX											
1 1 1	1 2	2										
6												
6 1 0												
6 1 0 2												
6 1 0 2 2 2												
6 1 0 2 2 2 2												
6 1 0 2 2 2 2 0BESE												
6 1 0 2 2 2 2 2 0BESE Age												
6 1 0 2 2 2 0BESE Age Age Age												
6 1 0 2 2 2 0BESE Age Age Age Age												

24. A window will appear while model estimation is in progress. The time for generating the final output depends on the size of your dataset and the complication of your specified model, especially in the Stage 1 model. The run time to estimate a model including random slope could range up to 20 minutes or longer.

MIXWILL	6 18158350951538188-004 /6 911784375163946	
MTYWTID.	-2 Log-Likelihood - 88000 24115	
MIXWILD	Newton-Banhson Iteration 60 with ridge 0 1000	
MIXWILD.	maximum correction and derivative	
MIXWILD	5 9207227136535317F-004 25 520190814888352	
MIXWILD:	-2 Log-Likelihood = 88099.23903	
MIXWILD:	Newton-Raphson Iteration 61 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	5.6676266186373846E-004 24.200616865463360	
MIXWILD:	-2 Log-Likelihood = 88099,23712	
MIXWILD:	Newton-Raphson Iteration 62 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	5.4224518977100079E-004 22.949329239307637	
MIXWILD:	-2 Log-Likelihood = 88099.23541	
MIXWILD:	Newton-Raphson Iteration 63 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	5.1852926467836071E-004 21.762788801105589	
MIXWILD:	-2 Log-Likelihood = 88099.23387	
MIXWILD:	Newton-Raphson Iteration 64 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	4.9561889406376613E-004 20.637640369387878	
MIXWILD:	-2 Log-Likelihood = 88099.23248	
MIXWILD:	Newton-Raphson Iteration 65 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	4.7351344260768326E-004 19.570703104020058	
MIXWILD:	-2 Log-Likelihood = 88099.23123	
MIXWILD:	Newton-Raphson Iteration 66 with ridge 0.1000	
MIXWILD:	maximum correction and derivative	
MIXWILD:	4.5220830541771120E-004 18.558961400703936	
MIXWILD:	-2 Log-Likelihood = 88099.23011	
4	II.	

25. If the following warning message appears, it indicates that computational difficulties were encountered and prevented the model parameters from being estimated successfully. In this case, double-check the format of your dataset and your model specifications. Some suggestions for steps to take are listed in Appendix A.



26. When estimation is completed, the Stage 1 and Stage 2 results can be seen by clicking the Stage 1 and Stage 2 Results boxes, respectively.

	and a second sec	Model WITH RANDOM Scale and Location-Scale Association					
	> multiplied by	-2					
	Log Likelihood		99495.733				
	Akaike's Informat	ion Criterion =	99515.733				
	Schwarz s bayesia	n Criterion =	33366.300				
	Variable	Estimate	AsymStdError	z-value	p-value		
	BETA (regression c	oefficients)					
	Intercept	42.96071	0.50136	85.68797	0.00000		
	WEEKEND	1.67701	0.23744	7.06279	0.00000		
	SEX	-0.65533	0.56931	-1.15108	0.24970		
	Random (location)	Random (location) Effect Variances and Covariances					
	Intercept	71.74435	3.91378	18.33122	0.00000		
	Covariance12	-9.81681	2.35683	-4.16493	0.00003		
	WEEKEND	14.26338	2.57335	5.54273	8.00008		
	TAU (WS variance p	arameters: log-l	inear model)				
	Intercept	4.71828	0.01968	239.78505	0.00000		
	Random location ef	Random location effects on WS variance (log-linear model)					
	Intercept	-0.12884	0.02304	-5.59199	0.00000		
	WEEKEND	-0.03716	0.03530	-1.05270	0.29248		
	Random scale stand	ard deviation					
	Std Dev	0.40514	0.02103	19.26143	0.00000		
Configuration	Stage 2 Configuration Stage 1	Results Stage 2 R	esults View Model	View Data			

Number of success	ful replications	- 500		
Final Results				
Average Log Likel	ihood =	-633.691 (so	= 4.049)	
Akaike's Informat	ion Criterion =	-643.691		
Schwarz's Bayesia	n Criterion =	-669.015		
==> multiplied by	-2			
Log Likelihood	-	1267.382		
Akaike's Informat	ion Criterion =	1287.382		
Schwarz's Bayesia	n Criterion =	1338.030		
Vaniable	Ectimate	AcumStdEnnon	z valua	e value
variable	cstimate	Asymotocreor	z-value	p-value
Intercent	0 23204	0 13907	1 70008	0 07301
Ago	0.05103	0.12057	5 90725	0.07201
Age Locat 1	-0.26222	0.00003	-2 60300	0.00000
Locat_1*Age	0.20222	0.00611	0 80068	0 42332
Locat 2	0.03530	0 13734	0.00000	0.79716
Locat 2*Age	0.00000	0.01000	0.49871	0 68275
Scale	0 15985	0.12141	1 31670	0 18794
Scale*Age	0.02447	0.00788	3,10482	0.00190
Locat 1*Scale	0.16109	0.14936	1.07849	0.28082
1*S*Age	.0.00005	0.00943	-0.00608	0.99515
r 2 MBC	-0.00000	0.00343	-0.00000	0.00010

27. All files generated from the program can be found in a folder with the prefix MixWILD under the same directory of your dataset.

↑ 📙 > MIXWILD							
access		Name	Date modified	Туре			
ion i		MIXWILD151988993	3/6/2018 5:39 PM	File folder			
nloads	7 	Kixwild_example_data	2/26/2018 11:54 AM	Microsoft Excel Comma Separated Values File			

28. The OUT files with suffix_1 and _2 are the results that are identical to those in the Stage 1 and Stage 2 boxes.

WILD > MIXWILD151988993						
Name	Date modified	Туре	Size			
work	4/2/2018 12:25 PM	File folder				
/// mix_random	2/26/2018 12:18 PM	DEF File	1 KB			
📧 mix_random	2/26/2018 11:55 AM	Application	665 KB			
🔲 mixor	2/26/2018 11:55 AM	Application	914 KB			
🔲 mixreg	2/26/2018 11:55 AM	Application	967 KB			
MIXREGMLS_RANDOM_MIXOR	2/26/2018 11:55 AM	DEF File	1 KB			
Mixwild_example_data	2/26/2018 11:55 AM	DAT File	635 KB			
Mixwild_example_data_Output	2/26/2018 11:55 AM	DEF File	1 KB			
Mixwild_example_data_Output.mwa	2/26/2018 11:55 AM	MWA File	94 KB			
Mixwild_example_data_Output.mwd	2/26/2018 11:55 AM	MWD File	20 KB			
Mixwild_example_data_Output_1	2/26/2018 12:18 PM	OUT File	14 KB			
Mixwild_example_data_Output_2	2/26/2018 12:18 PM	OUT File	3 KB			
Mixwild_example_data_Output_ebrandom	2/26/2018 12:18 PM	DAT File	1,715 KB			
Mixwild_example_data_Output_ebvar	2/26/2018 12:18 PM	DAT File	157 KB			
Mixwild_example_data_Output_level2	2/26/2018 12:18 PM	DAT File	107 KB			
Mixwild_example_data_Output_random	2/26/2018 12:18 PM	DEF File	1 KB			
Mixwild_example_data_Output_random_500	2/26/2018 12:18 PM	OUT File	2 KB			
Mixwild_example_data_Output_repeat_mixor	2/26/2018 12:18 PM	DEF File	1 KB			
//////////////////////////////////////	2/26/2018 12:18 PM	DEF File	1 KB			
📧 repeat_mixor	2/26/2018 11:55 AM	Application	680 KB			
📧 repeat_mixreg	2/26/2018 11:55 AM	Application	677 KB			

29. There are 3 submodel results in Output_1. The first two submodels present the results with and without random scale estimates, and the third submodel include the estimation of random location effects as well as the random location-slope associations as follows. (A brief description of the results from the following third submodel will be provided)

```
Model WITH RANDOM Scale and Location-Scale Association

Total Iterations = 16

Final Ridge value = 0.00

Log Likelihood = -49747.866

Akaike's Information Criterion = -49757.866

Schwarz's Bayesian Criterion = -49783.190
```

6.3. Brief interpretation of MixregmIs-Logistic regression model result

Stage 1 model with random scale and location-scale association

Model WITH RANDOM Scale and Location-Scale Association								
Variable	Estimate	AsymStdError	z-value	p-value				
BETA (regression coefficients)								
Intercept	42.96071	0.50136	85.68797	0.00000				
WEEKEND	1.67701	0.23744	7.06279	0.00000				
SEX	-0.65533	0.56931	-1.15108	0.24970				
Random (location) Effect Variances and Covariances								
Intercept	71.74435	3.91378	18.33122	0.00000				
Covariance12	-9.81601	2.35683	-4.16493	0.00003				
WEEKEND	14.26338	2.57335	5.54273	0.00000				
TAU (WS variance parameters: log-linear model)								
Intercept	4.71828	0.01968	239.78505	0.00000				
Kandom location effects on WS variance (log-linear model)								
Intercept	-0.12884	0.02304	-5.59199	0.00000				
WEEKEND	-0.03716	0.03530	-1.05270	0.29248				
Random scale standard deviation								
Std Dev	0.40514	0.02103	19.26143	0.00000				

• The Stage 1 model shows that weekend is positively associated with positive affect (estimate=1.6489, *p*<.001). Individuals overall have higher mean positive affect on weekend days relative to weekdays.

- There is significant variability in both intercept (i.e., random intercept) and slope (i.e., random slope) across subjects. The random intercept is estimated as 71.7444 on the log scale (*p*<.001) and the random slope is estimated as 14.2634 on the log scale (*p*<.001). Therefore, individuals differ from each other in their mean levels of positive affect and in their associations between weekday/weekend and momentary positive affect.
- The random intercept and random slope are negatively associated with each other (estimate= -9.8160, *p*<.001). This negative covariance indicates that subjects with higher weekday mean levels of positive affect (i.e., higher levels of the intercept) do not increase in positive affect as much on weekends, relative to subjects with lower weekday positive affect.
- For the relationships between the random location and scale effects, the random intercept (i.e., weekday positive affect) is negatively associated with the WS variance

(estimated as -0.1288 on the log scale (p<.001). This indicates that subjects with higher weekday positive affect are more consistent/less erratic in their mood reports. A subject's random slope (positive affect change on weekend days relative to weekdays) is not significantly related to a subject's WS variance.

• There is significant variability in scale across subjects, as the Std Dev for the Random scale is estimated as 0.4051 on the log scale (*p*<.001). Thus, individuals differ from each other in their degree of within-subject/intraindividual variability in positive affect.
Final Results				
Average Log Likel	lihood =	-633.691 (sd=	4.049)	
Akaike's Informat	ion Criterion =	-643.691		
Schwarz's Bayesia	an Criterion =	-669.015		
==> multiplied by	/ -2			
Log Likelihood	=	1267.382		
Akaike's Informat	ion Criterion =	1287.382		
Schwarz's Bavesian Criterion =		1338,030		
Variable	Estimate	AsymStdError	z-value	p-value
Intercept	-0.23204	0.12897	-1.79908	0.07201
Age	0.05102	0.00865	5.89725	0.00000
Locat_1	-0.26222	0.10074	-2.60300	0.00924
Locat_1*Age	0.00489	0.00611	0.80068	0.42332
Locat_2	-0.03530	0.13734	-0.25703	0.79716
Locat_2*Age	0.00409	0.01000	0.40871	0.68275
Scale	0.15985	0.12141	1.31670	0.18794
Scale*Age	0.02447	0.00788	3.10482	0.00190
Locat_1*Scale	0.16109	0.14936	1.07849	0.28082
L*S*Age	-0.00006	0.00943	-0.00608	0.99515

Stage 2 model with dichotomous subject-level outcome

- In the Stage 2 final results table, Locat_1 refers to the effect of the random intercept (i.e., within-subject mean) on obesity risk; Locat_2 refers to the effect of the random slope (i.e., within-subject association between weekday/weekend and positive affect) on obesity risk; Scale refers to the effect of random scale (i.e., within-subject variance) on obesity risk; and Locat_1* Scale is the interaction between random intercept and random scale predicting obesity risk.
- Results show that after controlling for other variables, subjects' Age is positively associated with increased obesity risk (estimate OR= 0.0510, *p*<.001). Older subjects are more likely to be obese than younger subjects.
- The random intercept (*Locat_1*) positively predicts obesity risk when the random slope and random slope are zero (estimate OR= -0.2622, *p*<.001). Since the random effects are centered around zero, a random scale of zero represents the average scale. For subjects with average scale of positive affect, higher levels of weekday positive affect are associated with higher daily MVPA minutes.
- The interaction between Age and random scale is significant in predicting obesity risk in this model (estimate OR= -0.0245, *p*<.001). The positive association of Age on obesity risk is more pronounced for subjects that are more erratic/less stable in

their positive affect scores. Subjects who are older and who have higher variability in positive affect are more likely to be obese.

• The random slope and other 2-way and 3-way interactions do not predict people's obesity risk in this model.

Note:

- 1. The numbers of level 1 and level 2 observations correspond to the available nonmissing observations of level 1 and level 2 variables included in both Stage 1 and Stage 2 models. Thus, these analyses are carried out using observations that are non-missing in terms of both outcomes (Positive affect and Obesity) and all regressors (Weekend, Sex, and Age).
- 2. In terms of level-1 variables (Positive affect and Weekend), only the level-1 missing observations are removed. In terms of the level-2 variables (Obesity, Sex, and Age), if a given subject is missing any of these, then they are not included in the analyses.
- 3. Please refer to the supplemental documents for more detailed explanation of the Stage 1 and Stage 2 model results.

7. Appendix A: Steps to take when the program does not converge to a solution

MixWILD can be used to estimate some rather advanced and complicated statistical models. In some cases, the program does not converge to a solution. This can be because the data does not contain enough information to estimate all of the parameters of the specified model. In this case, trying to estimate a simpler model is warranted. In general, it is good practice to start simply and build model complexity incrementally. In this way, users can get a feel for which variables and/or options may be causing trouble in estimation.

In addition to simplifying the model that one is attempting to estimate, the MixWILD program does include some options that can sometimes be modified to help in estimation of the model parameters. These are included on the Options page and will be described below.

1. This first comment pertains to models that include random scale parameters. Random scale parameters allow subjects to have individual estimates of the withinsubject variance, and this is the distinguishing feature of a **mixed-effects location scale model**. The possibility of random scale parameters is specified on the first page that is encountered in the MixWILD program under the "**Random Scale?**" selection. In the graphic below, this is not specified, but clicking on the box to the right of "**Random Scale?**" adds random scale parameters to the Stage 1 model.

Data File:					Browse
Title:					
Random Loca	tion Effects:	O Interce	pt 🔿 Inte	ercept + Slop	e(s)
Random Scal	e?				
Stage 2 Outc	ome: 🔿 Con	tinuous	O Dichotor	nous/Ordinal	○ None
Contains mis	sing values?	⊖ Yes	() No		
Missing value	code:				

In some cases, there may be subjects in the dataset that exhibit no variation on the Stage 1 outcome variable. In other words, their values on the outcome variable are exactly the same for all of their observations. This can be particularly true if there are subjects with few observations (say 2 or 3) in the dataset and/or the Stage 1 outcome variable is not really continuous but an ordinal outcome with say 5 categories. For such subjects with no variation on the outcome, the estimate of their random scale goes to negative infinity and can cause the program to fail to converge. In this case, selection of the **"Discard Subjects with no Variance?"** option (clicking on the box to the right of this question) on the Options page can facilitate model convergence. Selection of this option will remove these subjects from the Stage 1 analysis (and also the Stage 2 analysis if that is specified).

		1_	
BS Variance Intercept:	Ridge:		0.1
WS Variance Intercept:	Standardize All Reg	gressors?	
Convergence Criteria: 0.0	Discard Subjects v	vith no Variance?	
Quadrature Points:	11 - Resample Stage 2:		V
Adaptive Quadrature:	No. of Samples:		500 -

2. In some cases, the scale of the regressors included in an analysis can be very large. For example, consider a scenario in which one has a variable for days in the study, which ranges from 1 to 365 for a year-long study. In this case, because of the large scale of the variable, any parameter associated with this variable will be quite small and can be difficult to estimate. In such cases, standardizing the regressors by selecting "Standardize All Regressors" might be considered. Selection of this option will transform all regressors to be variables with 0 mean and variance of 1.

3. Estimation of the Stage 1 model involves a numerical integration (i.e., quadrature) over the random effect distribution. By default, MixWILD performs adaptive quadrature with 11 points to do this integration. The more points one uses, typically the more accurate is the solution, but also the more time it takes to estimate the model parameters. Usually, 11 points is sufficient, but if model convergence is not achieved, then increasing the points can sometimes help. So, for example, one might try 15, 21, or 25 points rather than the default of 11. Switching from adaptive to non-adaptive quadrature can sometimes work, though typically adaptive quadrature is preferred.

4. The value of the "Ridge" is usually set to a small fractional value. The ridge increases the values of the diagonal elements of the 2nd derivative matrix by a factor of 1 multiplied by the ridge value (i.e., if the ridge is set to .1, then the diagonal elements of the 2nd derivative matrix are all multiplied by 1.1). The reason that this is helpful is that this matrix must be inverted at each iteration of the solution, and inversion of this matrix becomes computationally difficult to the extent that the off-diagonal elements of this matrix get large, relative to the diagonal elements. Thus, in cases of non-convergence, one might try increasing the ridge value to 0.15, 0.2, or even 0.25. This will slow down the estimation, but in some cases can aid in model convergence.

Ultimately, if one tries these options and still experiences convergence problems, it is probably the case that the data does not contain enough information to estimate the specified model. Again, it is a good idea to start simply and to build model complexity in an incremental manner. For example, one might start with a model that does not include any regressors (i.e., a null model) and then to add in regressors one by one or in sets of variables. This will help to isolate where problems develop and to indicate what is and what is not possible with a given dataset.