## Longitudinal Invariance CFA (using MLR) Example in Mplus v. 8.1 (*N* = 151; 6 items over 3 occasions)

These data measuring a latent trait of social functioning were collected at a Psychiatric Rehabilitation center, in which time 1 was admittance, and times 2 and 3 were collected at six-month intervals. There were six subscales that were completed by the hospital staff for each patient, including positively-oriented measures of Social Competence, Social Interest, and Personal Neatness, and negatively-oriented measures of Psychoticism, Motor Retardation, and Irritability. The negatively-oriented subscales were reflected (\*-1) prior to analysis. Initial models examined the fit of one-factor versus two-factor models given the two valences of the subscales, but the fit of the two-factor model was not a significant improvement, and thus a one-factor model with all six items was used here.

#### Mplus Code to Read in Data:

```
TITLE:
          Longitudinal Invariance
DATA:
          FILE = CAF.dat;
                                                ! Don't need path if in same folder
          FORMAT = free; TYPE = INDIVIDUAL;
                                               ! Defaults
VARIABLE: NAMES = ID v1T1 v1T2 v1T3 v2T1 v2T2 v2T3
                                                           ! Every variable in data set
                     v3T1 v3T2 v3T3 v4T1 v4T2 v4T3
                     v5T1 v5T2 v5T3 v6T1 v6T2 v6T3;
          USEVARIABLES = v1T1 v1T2 v1T3 v2T1 v2T2 v2T3
                                                           ! Every variable in MODEL
                         v3T1 v3T2 v3T3 v4T1 v4T2 v4T3
                         v5T1 v5T2 v5T3 v6T1 v6T2 v6T3;
          MISSING = ALL (9999); ! Make sure to specify all missing values
          IDVARIABLE = ID;
                                  ! ID variable to be included in output files
! Reverse-coding items so that higher = better
DEFINE:
           v4T1 = v4T1*(-1);
           v4T2 = v4T2*(-1);
           v4T3 = v4T3*(-1);
           v5T1 = v5T1*(-1);
           v5T2 = v5T2*(-1);
           v5T3 = v5T3*(-1);
           v6T1 = v6T1*(-1);
           v6T2 = v6T2*(-1);
           v6T3 = v6T3*(-1);
ANALYSIS: ESTIMATOR = MLR; ! For continuous items whose residuals may not be normal
         MODINDICES(3.84); ! For modification indices of p<.05 for df=1
OUTPUT:
         STDYX RESIDUAL;
                            ! Fully standardized solution, local model fit
MODEL:
          ! Model syntax goes here, to be changed for each model
```

# Model 1. Configural Longitudinal Invariance Model (everything separate across time)

	Model 1. Configural Longitudinal Invariance Model (everything	<u>y se</u>
	MODEL: !!!!! Model 1: Configural Longitudinal Invariance	
	Model 1. configural hongiculture invariance	
	! Factor loadings all freely estimated, not labeled	
	Timel BY VITI* V2TI* V3TI* V4TI* V5TI* V6TI*; Time2 BY	
	TIMEZ BI VIIZ^ VZIZ^ VSIZ^ V4IZ^ VSIZ^ V6IZ^; Time3 BV v1T3* v2T3* v2T3* v4T3* v5T3* v6T3* v6T3*;	
	I Item intercepts all freely estimated, not labeled	
	[v1T1* v1T2* v1T3*]; [v2T1* v2T2* v2T3*];	
	[v3T1* v3T2* v3T3*]; [v4T1* v4T2* v4T3*];	
	[v5T1* v5T2* v5T3*]; [v6T1* v6T2* v6T3*];	
	! Residual variances all freely estimated, not labeled	
	v1T1* v1T2* v1T3*; v2T1* v2T2* v2T3*;	
	v3T1* v3T2* v3T3*; v4T1* v4T2* v4T3*;	
	v5T1* v5T2* v5T3*; v6T1* v6T2* v6T3*;	
	Time101 Time201 Time301.	
	! Factor means all fixed=0 for identification	
	[Time1@0 Time2@0 Time3@0];	
	! Factor covariances all freely estimated	
	Time1 Time2 Time3 WITH Time1* Time2* Time3*;	
	! Residual covariances estimated for same item across time	
	v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*;	
	V2T1 V2T2 V2T3 WITH V2T1* V2T2* V2T3*; 2m12m22m2 WITH2m1+2m2+2m2+.	
	V311 V312 V313 WITH V311^ V312^ V313^; v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*·	
	v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*;	
	v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;	
	3.50	
	5.50	
	2.00	
	5.00	
	2.50	
	v. 2.50	
	हू 2.00 + Tir	ne1
	Tir	ne2
	<u><u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u><u></u></u></u>	
	Tir	ne3
ļ		
	0.50 + 20 - 20 - 20 - 20 - 20 - 20 - 20 - 2	

v2

v1

v3

v5

v6

v4

MODEL FIT INFORMATION							
Number of	Free Parameters	75					
Loglikelił	nood						
2	H0 Value	-4430.302					
	H0 Scaling Correction Factor for MLR	1.4617					
	H1 Value	-4284.045					
	H1 Scaling Correction Factor for MLR	1.2029					
Informatio	on Critoria						
IIIOIMacio	Akaike (ATC)	9010 604					
	Bavesian (BIC)	9236 900					
	Sample-Size Adjusted BIC	8999 533					
	$(n^* = (n + 2) / 24)$	0,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
Chi-Square	e Test of Model Fit						
1	Value	283.247*					
	Degrees of Freedom	114					
	P-Value	0.0000					
	Scaling Correction Factor	1.0327					
	for MLR						
RMSEA (RO	ot Mean Square Error Of Approx	imation)					
1010111 (100	Estimate	0 099					
	90 Percent C T	0.095	0 114				
	Probability RMSEA $\leq .05$	0.000	0.114				
	riobability falobil	0.000					
CFI/TLI							
	CFI	0.903					
	TLI	0.870					
Chi-Square	e Test of Model Fit for the Ba	seline Model					
	Value	1896.788					
	Degrees of Freedom	153					
	P-Value	0.0000					
SRMR (Star	ndardized Root Mean Square Res	idual)					
	Value	0.089					
Although the fit is not great, attempts to improve it logically were unsuccessful, so we proceed from here with this as the configural invariance mode. The plot of factor loadings on the left foreshadows what will happen when testing metric invariance next							

UNSTANDARDIZED MODEL RESULTS - NOTE ALL MEASUREMENT PARAMETERS DIFFER ACROSS TIME

					Two-Tailed					Two-Tailed
		Estimate	S.E.	Est./S.E.	P-Value		Estimate	S.E.	Est./S.E.	P-Value
FACTOR 1	LOADINGS	S PER OCCASION								
TIME1	BY					Means (FACTO	OR MEANS FIXED=0 FOR	IDENTIFI	CATION)	
V1T	1	3.222	0.267	12.063	0.000	TIME1	0.000	0.000	999.000	999.000
V2T	1	1.915	0.274	6.997	0.000	TIME2	0.000	0.000	999.000	999.000
V3T:	1	2.080	0.209	9.956	0.000	TIME3	0.000	0.000	999.000	999.000
V4T	1	1.975	0.271	7.298	0.000					
V5T	1	0.931	0.148	6.281	0.000	Intercepts	ARE EXPECTED OUTCOM	E WHEN FA	CTOR IS AT	0)
VGT	1	1.441	0.119	12.101	0.000	V1T1	16.077	0.276	58.220	0.000
						V1T2	17.226	0.245	70.294	0.000
TIME2	BY					V1T3	17.756	0.220	80.620	0.000
V1T2	2	2.863	0.305	9.372	0.000	V2T1	8.672	0.298	29.132	0.000
V2T2	2	2.072	0.197	10.490	0.000	V2T2	9.981	0.263	37.921	0.000
V3T	2	2.133	0.185	11.509	0.000	V2T3	10.442	0.281	37.204	0.000
V4T	2	2.098	0.322	6.514	0.000	V3T1	11.970	0.225	53.108	0.000
V5T	2	1.175	0.239	4.921	0.000	V3T2	12.467	0.218	57.264	0.000
V6T2	2	1.512	0.129	11.749	0.000	V3T3	13.029	0.213	61.157	0.000
						V4T1	-3.037	0.271	-11.216	0.000
TIME3	BY					V4T2	-3.211	0.260	-12.349	0.000
V1T.	3	2.550	0.288	8.865	0.000	V4T3	-2.738	0.249	-11.014	0.000
V2T	3	1.961	0.230	8.539	0.000	V5T1	-1.283	0.138	-9.293	0.000
V3T.	3	1.751	0.210	8.323	0.000	V5T2	-1.664	0.200	-8.338	0.000
V4T	3	1.678	0.260	6.448	0.000	V5T3	-1.247	0.166	-7.511	0.000
V5T	3	1.021	0.170	6.012	0.000	V6T1	-2.871	0.164	-17.508	0.000
V6T.	3	1.523	0.159	9.574	0.000	V6T2	-2.413	0.158	-15.316	0.000
						V6T3	-2.075	0.152	-13.618	0.000
TIME1	WITH	(ESTIMATED FACT	OR COVARIA	NCES)						
TIM	E2	0.786	0.042	18.827	0.000	Residual Va	riances (VARIANCE P	ER ITEM I	HAT IS NOT	THE FACTOR)
TIM	E3	0.707	0.084	8.456	0.000	V1T1	0.241	0.395	0.610	0.542
						V1T2	0.511	0.268	1.907	0.056
TIME2	WITH					V1T3	0.523	0.349	1.497	0.134
TIM	E3	0.671	0.089	7.532	0.000	V2T1	8.672	1.022	8.484	0.000
						V2T2	5.913	0.617	9.581	0.000
*** Res:	idual co	ovariances among	same item	across tim	e ****	V2T3	5.142	0.806	6.379	0.000
V1T1	WITH					V3T1	2.413	0.398	6.067	0.000
V1T:	2	-0.214	0.250	-0.855	0.393	V3T2	2.202	0.369	5.972	0.000
V1T.	3	-0.004	0.247	-0.016	0.987	V3T3	2.381	0.430	5.542	0.000
						V4T1	7.199	1.036	6.950	0.000
V1T2	WITH					V4T2	6.765	0.990	6.834	0.000
V1T.	3	0.113	0.231	0.488	0.626	V4T3	6.456	1.078	5.988	0.000
	• • • •					V5T1	1.824	0.446	4.093	0.000
						V5T2	4.676	1.439	3.251	0.001
Variance	es (FAC]	FOR VARIANCES FI	XED=1 FOR	IDENTIFICAT	ION)	V5T3	2.944	0.752	3.913	0.000
TIM	E1	1.000	0.000	999.000	999.000	V6T1	1.694	0.243	6.974	0.000
TIM	E2	1.000	0.000	999.000	999.000	V6T2	1.103	0.166	6.643	0.000
TIM	E3	1.000	0.000	999.000	999.000	V6T3	0.751	0.162	4.630	0.000

CLDP 948 Example 7b page 4 Model 2a. Metric Invariance Model (ALL loadings held equal across time – identified model using Time1 Factor Variance = 1)

MODEL:		
<pre>!!!!! Model 2a: Metric Longitudinal Invariance</pre>	MODEL FIT INFORMATION	
	Number of Free Parameters 65	
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME		
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1-L6);	Loglikelihood	
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6);	H0 Value -4442.401	
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);	HO Scaling Correction Factor 1.4921	
! Item intercepts all freely estimated, not labeled	for MLR	
[v1T1* v1T2* v1T3*]; [v2T1* v2T2* v2T3*];	H1 Value -4284.045	
[v3T1* v3T2* v3T3*]; [v4T1* v4T2* v4T3*];	H1 Scaling Correction Factor 1.2029	
$[v_{5T1} * v_{5T2} * v_{5T3} * 1]; [v_{6T1} * v_{6T2} * v_{6T3} * 1];$	for MLR	
Pesidual variances all freely estimated, not labeled		
$v_1 = v_1 = v_2 = v_1 = v_2 $	Information Criteria	
v3r1* v3r2* v3r3*: v4r1* v4r2* v4r3*:	Akaike (ATC) 9014 803	
v5r1 v5r2 v5r3 , v1r1 v1r2 v1r3 ,	Bavesian (BIC) 9210 926	
L Factor wariance AT TIME 1 fixed-1 for identification	Sample-Size Adjusted BIC 9005 208	
Time 101 Time 2* Time 3*.	$(n^* - (n + 2))/(24)$	
Ender moons all fixed-0 for identification	$(11^{11} - (11 + 2) / 24)$	
ITimo100 Timo200 Timo3001.	Chi-Square Test of Medal Fit	
[IIMeI@0 IIMe2@0 IIMe3@0],	Value 201 22/*	
minel minel Minel WIMU minelt Minelt Minelt	Degrees of Ereedem	
I Decidual comprises estimated for some item concesting	Degrees of Freedom 124	
1m11m21m2 WIME1m1+1m2+1m2+.	P-Value 0.0000	
VITI VITZ VITS WITH VITI^ VITZ^ VITS^;	Scaling Correction Factor 1.0514	
V2T1 V2T2 V2T3 WITH V2T1* V2T2* V2T3*;	IOT MLR	
V3T1 V3T2 V3T3 WITH V3T1* V3T2* V3T3*;	DNGED (Dect Many Organization)	
V4T1 V4T2 V4T3 WITH V4T1* V4T2* V4T3*;	RMSEA (ROOL Mean Square Error OI Approximation)	
VSTI VST2 VST3 WITH VST1* VST2* VST3*;	Estimate 0.097	A 111
VOTI VOT2 VOT3 WITH VOTI* VOT2* VOT3*;	90 Percent C.1. 0.083 U	J.111
	Probability RMSEA <= .05 0.000	
Does the metric model (2a) fit worse than the configural model (1)?		
Yes, $-2\Delta LL(dt=10) = 19.14$ , $p = .04$		
	CF1 0.898	
	111 0.875	
	(PNP (Otra dan di sad Prat Mara Ormana Pratidual)	
	SRMR (Standardized Root Mean Square Residual)	
	value 0.094	
	MODEL MODIFICATION INDIGES (as least for testing in	
	MODEL MODIFICATION INDICES (relevant for testing inva	arlance)
	BI Statements	
	M.I. E.P.C. SLO E.P.C. S	SLAIX E.P.C.
	DI SLALEMENLS	0 0 5 9
	TIMEL DI VITI IU.3// U.182 U.182	0.033
	TIMEL BY VOTI 0.062 -0.054 -0.054	-0.033
	TIME3 BY VOT3 7.603 0.201 0.175	0.105
	iviodification indices suggest that freeing the loading for V1	at time't would
	help, and that matches our observations, so let's try that.	

# Model 2b. Partial Metric Invariance Model with loading for v1 at Time 1 free

<pre>1 Model 2b: Partial Metric Invariance without v1r1 1 Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1r1 Timed BY v1r2* v2r2* v3r2* v4r2* v5r2* (L1-L6); Timed BY v1r2* v2r2* v3r2* v4r2* v5r2* (L1-L6); 1 Total v1r2* v1r3* vrr2* v4r2* v4r3*; 1 v5r1* v5r2* v5r3*; 1 v5r1* v5r2* v5r3*; 1 Pactor means all fixed=0 for identification 1 Imel0 Time20 Time300; 1 Pactor means all fixed=0 for identification 1 Imel0 Time20 Time300; 1 Pactor v5r3* v1rH v2r1* v1r2* v1r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3* v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r3*; v5r1* v5r3* v7r3*; v5r3*; v5r3*; v5r1* v5r3* v7r3* v5r3*; v5r1* v5r2* v5r3*; v5r3*; v5r3*; v5r3* v5r3* v7r3* v5r3*; v5r3* v5r3* v7r3* v5r3*; v5r3* v5r3* v7r3* v5r3*; v5r3* v5r3* v7r3* v5r3*; v5r3* v5r3* v5r3* v5r3*; v5r3* v5r3* v5r3*; v5r3* v5r3* v5r3*; v5r3* v5r3* v5r3* v5r3* v5r3*; v5r3* v5r3* v5r3* v5r3*; v5r3* v5r3* v5r3* v5r3*; v5</pre>	MODEL:		
<pre>! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT vIII Timed EX vIII* v271* v371* v471* v571* v571* (1.1.6.); Time3 EX vIII* v271* v371* v471* v571* v571* (1.1.6.); Time3 EX vIII* v271* v371* v471* v571* v571* (1.1.6.); Item intercepts all freely estimated, not labeled [v111* v172* v173*]; [v271* v272* v273*]; [v371* v372* v373*]; v471* v472* v473*]; [v371* v372* v373*]; v471* v472* v473*]; [v371* v372* v373*]; v471* v472* v473*]; [v371* v372* v373*]; v471* v472* v473*; [v371* v372* v373*]; v471* v472* v473*]; [v371* v372* v373*]; v471* v472* v473*; [race later variances all freely estimated Time1 Time2 Time3V; [race later v11* v122* v173*]; v471* v472* v473*; [v371* v372* v373*]; v471* v372* v573*; [v371* v372* v373*]; v471* v372* v573*; [v371* v372* v373*]; v471* v372* v573*; [v371* v372* v373*]; v471* v472* v473*; [v371* v372* v373*]; v471* v472* v473*; [v371* v372* v373*]; v471* v372* v573*; [v3</pre>	! Model 2b: Partial Metric Invariance without v1T1	MODEL FIT INFORMATION	
<pre>! Pactor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT viII Timed E ViI1* vII* vII* vII* vII* vII* vII* vII* v</pre>		Number of Free Parameters	66
Timel BY vIT1 + VIT2 + VIT3 +	! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1		
Time2 BY VIT2* V2T2* V3T2* V4T2* V5T2* V6T2* (L1-L6); Time3 BY VIT3* V2T3* V3T3* V3T* V5T2* V5T3* (L1-L6); I tem intercepts all freely estimated, not labeled (VIT1* VIT2* VIT3*) (V4T1* V4T2* V4T3*); (V5T1* V5T2* V5T3*); (V4T1* V4T2* V4T3*); (V5T1* V5T2* V5T3*); (V4T1* V4T2* V4T3*); V5T1* V5T2* V5T3*; V4T1* V4T2* V4T3*); I residual variances all freely estimated, not labeled VIT1* VIT2* V1T3*) V5T1* V5T3* V5T3*; V5T3*; V5T1* V5T2* V5T3*; V4T1* V4T2* V4T3*; V5T1* V5T2* V5T3*; V4T1* V4T2* V4T3*; V5T1* V5T2* V5T3*; V5T3*; V5T3*; V5T3*; I residual covariances all fixed=0 for identification Time2 Time2 Time3*() I residual covariances all fixed=0 for identification Time2 Time2 Time3*() I residual covariances all fixed=0 for same item across time V5T1 V5T2* V5T3*; V4T1* V4T2* V4T3*; V5T1 V5T2* V5T3*; V4T1* V4T2* V4T3*; V5T1 V5T2* V5T3*; V4T1* V4T2* V4T3*; V5T1 V5T2* V5T3*; V4T3* V1T1* V5T2* V5T3*; V5T1 V5T2* V5T3* V5T3*; V5T3*; V5T1 V5T2* V5T3* V5T3*; V5T3*; V5T1 V5T2* V5T3* VT1* V5T2* V5T3*; V5T1 V5T2* V5T3* VT1* V5T2* V5T3*; V5T1 V5T2* V5T3* VT1* V5T2* V5T3*; V5T1 V5T2* V5T3* V5T3*; V5T1 V5T2* V5T3*; V5T1 V5T	Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	Loglikelihood	
Time 3 BY VIT3* VI	Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6);	HO Value	-4435,669
<pre>! Item intercepts all freely estimated, not labeled [viTi* viTi* vi</pre>	Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);	HO Scaling Correction Factor	1 4980
$\begin{bmatrix} viTi* vi$	! Item intercepts all freely estimated, not labeled	for MLR	1.1900
<pre>ivit: viz: viz: viz: viz: viz: viz: viz: viz</pre>	[v1r1* v1r2* v1r3*]: [v2r1* v2r2* v2r3*]:		-1291 015
<pre>I Searing Correction Factor 1.2039 I Searing Correction Factor 1.2039 I Searing Correction Factor 1.2039 I Restinal variances all fixed=0 for identification ITime12 Time3 Time2* Time3*; I Restinal covariances all fixed=0 for identification ITime12 Time3 Time2* Time3*; I Restinal covariances estimated for same item across time VTI vir2 vir3 WTH vir1* vir2* vir3*; vir1 vir2 vir3 WTH vir1* vir3* vir3*; vir1 vir2 vir3 WTH vir1* vir3* vir3*; vir1 vir2 vir3 WTH vir1* vir3* vir3*; vir1 vir2 vir3 WTH vir1* vir3*; vir3* vir1</pre>	$[v_3 m_1 + v_3 m_2 + v_3 m_3 + 1] \cdot [v_4 m_1 + v_4 m_2 + v_4 m_3 + 1] \cdot$	III Value	1 2020
<pre>IDE PLAC IDE PLA</pre>	[v5r1* v5r2* v5r3*] · [v6r1* v6r2* v6r3*] ·	for MID	1.2029
<pre>virit vir2* vir2*, vir2* vir2* vir3*; virit vir2* vir2*, vir2* vir2* vir3*; virit vir2* vir2*, vir3*, virit vir2* vir3*; if actor warkance AT TIME I fixed=1 for identification Time10 Time2 Virit virit* vir2* vir3*; if actor covariances all fixed=0 for identification Time10 Time2 Virit* viri</pre>	I Posidual variances all freely estimated not labeled	LOT MLR	
$ \begin{array}{c} \text{Virt}  \text{Virt} $	- restant variances all freety estimated, not fabered		
<pre>Akaike (AIC)</pre>	$-2m^{+} + -2m^{-} + -2m^$	Information Criteria	
$ \begin{array}{c} \text{Voll}  \text{Voll} $		Akaike (AIC)	9003.337
<pre>Sample-Size Adjusted BIC 8933.595 (n* = (n + 2) / 24) Sample-Size Adjusted BIC 8933.595 (n* = (n + 2) / 24) Sample-Size Adjusted BIC 8933.595 (n* = (n + 2) / 24) Chi-Square Test of Model Fit Value 280.301* Value 280.301* Value 280.301* Degrees of Freedom 123 P-Value 0.0000 Scaling Correction Factor 1.0446 for MLR RMSEA (Root Mean Square Error Of Approximation) Estimate 0.095 90 Percent C.I. 0.081 0.109 Probability RMSEA &lt;= .05 0.000 CFI/TLI CFI 0.904 TLI 0.881 SRMR (Standardized Root Mean Square Residual) Value 0.091 Does the partial metric model (2b) fit better than the full metric model (2a)? Yes, -2ALL(df=1) = 7.16, p &lt; .01 Does the partial metric model (2b) fit worse than the configural model (1)? No, -2ALL(df=9) = 8.98, p = .44 No large invariance-related modification indices were found, so we'll call it good! Onto the next model! The plot of intercepts on the left</pre>	VSTI VSTZ VSTS VOTI VOTZ VOTS ;	Bayesian (BIC)	9202.478
Timel@I Timel@I Timel%I Timel%I timed. Factor means all fixed=0 for identification [Timel@I Timel%I timed%I timed%Timel%I timed%Timel%I timel%I tim	! Factor variance AT TIME I fixed=1 for identification	Sample-Size Adjusted BIC	8993.595
<ul> <li>Pattor means all fixed-0 for identification [Timel2 Time3 Time3 WTH time1 time2 Time3 WTH time1 time3 time3 time3 times time viT1 v1T2 v1T3 WTH v1T1 * v1T2* v1T3*; v2T1 v2T2 v2T3 WTH v2T1* v1T2* v1T3*; v3T1 v3T2 v3T3 WTH v3T1* v3T2* v3T3*; v4T1 v4T2 v4T3 WTH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WTH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WTH v4T1* v5T2* v5T3*; v6T1 v5T2 v5T3 WTH v5T1* v5T2* v5T3*; v5T1 v5T2 v5T3 V5T2* v5T3*; v5T1 v5T2 v5T3 V5T2* v5T3*; v5T1 v5T2 v5T3 v5T2 v5T3*; v5T1</li></ul>	Timel@1 Time2* Time3*;	$(n^* = (n + 2) / 24)$	
$ \begin{bmatrix} Time 20 \ Time 200 \ Time 1 \ Time 2 \ Time 1 \ Time 1 \ Time 2 \ Time $	! Factor means all fixed=0 for identification		
<pre>! Factor covariances all freely estimated Time1 Time2 Time3 WTH Time1 Time2 Time3*; ! Residual covariances estimated for same item across time v1r1 v1r2 v1r3 WTH v1r1* v2r2* v2r3*; v3r1 v3r2 v3r3 WTH v2r1* v4r2* v4r3*; v5r1 v5r2 v5r3 WTH v5r1* v5r2* v5r3*; v6r1 v6r2 v6r3 WTH tort * v6r2* v6r3*;</pre> <pre>Value 290.301*</pre> Degrees of Freedom 123 P-Value 0.0000 Scaling Correction Factor 1.0446 v0.000 Scaling Correction Factor 0.000 Scaling Co	[Time100 Time200 Time300];	Chi-Square Test of Model Fit	
Time1 Time2 Time3 WITH Time1* Time2* Time3*; Persidual covariances estimated for same item across time v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*; v1T1 v1T2 v1T3 WITH v2T1* v2T2* v2T3*; v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v4T1 v4T2 v4T3 WITH v5T1* v5T2* v5T3*; v4T1 v6T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*; 20.00 15.00 5.00 5.00 10.00	! Factor covariances all freely estimated	Value	290.301*
<pre>! Residual covariances estimated for same item across time v1T1 v1T2 v1T3 wiTH v1T1* v1T3*; v2T1 v2T2 v2T3 WITH v2T1* v1T2* v1T3*; v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*; v5T1 v5T2 v5T3 WITH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v6T2* v6T3*;</pre>	Time1 Time2 Time3 WITH Time1* Time2* Time3*;	Degrees of Freedom	123
v1rl v1r2 v1r3 WTH v1r1* v1r2* v1r3*; v2r1 v2r2 v2r3 WTH v2r1* v2r2* v2r3*; v3r1 v3r2 v3r3 WTH v3r1* v3r2* v3r3*; v4r1 v4r2 v4r3 WTH v4r1* v4r2* v4r3*; v6r1 v6r2 v6r3 WTH v6r1* v6r2* v6r3*; v6r1 v6r2 v6r3 WTH v6r1* v6r2* v6r3*; v6r3 WTH v6r1* v6r2* v6r3*; v6r4 (Standardized Root Mean Square Residual) value 0.091 Dees the partial metric model (2b) fit better than the full metric model (2a)? Yes, -2ΔLL(df=1) = 7.16, $\rho < .01$ Does the partial metric model (2b) fit worse than the configural model (1)? No, -2ΔLL(df=9) = 8.98, $\rho = .44$ No large invariance-related modification indices were found, so we'll call it good! Onto the next mode!! The plot of intercepts on the left	! Residual covariances estimated for same item across time	P-Value	0.0000
v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*; v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*; v4T1 v4T2 v4T3 WITH v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3 v5T2* v5T3*; v6T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3 v5T3*; v6T1 v5	v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*;	Scaling Correction Factor	1.0446
v3T1 v3T2 v3T3 WTTH v3T1* v3T2* v3T3*; v4T1 v4T2 v4T3 WTTH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WTTH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WTTH v6T1* v6T2* v6T3*; v6T1 v6T3 v6T3 wTTH v6T3* v6T3*; v6T1 v6T3 v6T3*; v6T1 v6T3*; v6T1 v6T3*; v6T1 v6T3*; v6T1 v6T3*; v6	v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*;	for MLR	
v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*; 20.00 15.00 15.00 10.00 15.00 10.00	v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*;		
v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*; 20.00 15.00 10.00 5.00 10.	v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*;	RMSEA (Root Mean Square Error Of Approxin	mation)
v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*; 20.00 15.00 10.00 5.00 -5.00 v1 v2 v3 v3 v4 v5	v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*;	Estimate	0.095
$\begin{array}{c} 20.00 \\ 15.00 \\ 10.00 \\ -5.00 \\ -5.00 \\ -5.00 \\ -1 \\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \\ v_5 \\ v_6 \\ \end{array}$	v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;	90 Percent C.I.	0.081 0.109
$\frac{20.00}{15.00} + \frac{1000}{1000} + \frac{1000}{10$	22.22	Probability RMSEA <= .05	0.000
$ \begin{array}{c} 15.00 \\ 10.00 \\ 5.00 \\ -5.00 \\ -5.00 \\ -1 \\ v1 \\ v2 \\ v3 \\ v4 \\ v5 \\ v5 \\ v5 \\ v5 \\ v6 \\ \end{array} \begin{array}{c} CFI/TLI \\ CFI \\ TLI \\ 0.904 \\ TLI \\ 0.00 \\ Value \\ 0.091 \\ \end{array} \\ \begin{array}{c} CFI/TLI \\ CFI \\ TLI \\ 0.881 \\ \\ SRMR (Standardized Root Mean Square Residual) \\ Value \\ 0.091 \\ \end{array} \\ \begin{array}{c} Does the partial metric model (2b) fit better than the full metric model \\ (2a)? Yes, -2\Delta LL(df=1) = 7.16, p < .01 \\ \end{array} \\ \begin{array}{c} Does the partial metric model (2b) fit worse than the configural model \\ (1)? No, -2\Delta LL(df=9) = 8.98, p = .44 \\ \end{array} \\ \begin{array}{c} No large invariance-related modification indices were found, so we'll \\ call it good! Onto the next model! The plot of intercepts on the left \end{array}$	20.00		
$ \begin{array}{c} 15.00 \\ \textbf{m} \\ $		CFT/TIT	
$\frac{15.00}{10.00} + \frac{10.00}{10} + \frac$		CFI	0 904
$ \begin{array}{c} \text{Im} \\ \text{Im} $	15.00		0 881
<ul> <li>SRMR (Standardized Root Mean Square Residual) Value</li> <li>Does the partial metric model (2b) fit better than the full metric model (2a)? Yes, -2ΔLL(df=1) = 7.16, p &lt; .01</li> <li>Does the partial metric model (2b) fit worse than the configural model (1)? No, -2ΔLL(df=9) = 8.98, p = .44</li> <li>No large invariance-related modification indices were found, so we'll call it good! Onto the next model! The plot of intercepts on the left</li> </ul>			0.001
$\int_{V_{1}}^{T_{1}} \int_{V_{2}}^{T_{2}} \int_{V_{3}}^{T_{1}} \int_{V_{4}}^{T_{1}} \int_{V_{5}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{1}}^{T_{1}} \int_{V_{2}}^{T_{1}} \int_{V_{3}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{1}}^{T_{1}} \int_{V_{2}}^{T_{1}} \int_{V_{3}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{6}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{1}} \int_{V_{6}}^{T_{6}} \int_{V_{6}}^$		SRMR (Standardized Root Mean Square Resi	1 ( [ 4 1 ]
Time 1 5.00 0.00 -5.00 v1 v2 v2 v3 v4 v5 v6 v6 v6 v6 v6 v1 v2 v3 v4 v5 v6 v	19	Value	0.001
$\int_{-5.00}^{9} \int_{-1.00}^{9} \int_{-5.00}^{9} \int_{-1.00}^{9} $	E 10.00	Value	0.091
$\begin{array}{c} \mathbf{I} \\ \mathbf{F} \\ $			
$ \frac{1}{5.00} + \frac{1}{\sqrt{1}} + \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{3}} + \frac{1}{\sqrt{4}} + \frac{1}{\sqrt{5}} + \frac{1}{\sqrt{6}} + $	Time2		
Time3 Time3 (2a)? Yes, $-2\Delta LL(dt=1) = 7.16, p < .01$ Does the partial metric model (2b) fit worse than the configural model (1)? No, $-2\Delta LL(dt=9) = 8.98, p = .44$ No large invariance-related modification indices were found, so we'll call it good! Onto the next model! The plot of intercepts on the left		Does the partial metric model (2b) fit better the	an the full metric model
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	Time3	(2a)? Yes, $-2\Delta LL(dt=1) = 7.16$ , $p < .01$	
0.00 + 0.00 +	<u>2</u>		
0.00 -5.00 v1 v2 v3 v4 v5 v6 (1)? No, $-2\Delta LL(df=9) = 8.98, p = .44$ No large invariance-related modification indices were found, so we'll call it good! Onto the next model! The plot of intercepts on the left		Does the partial metric model (2b) fit worse th	an the configural model
-5.00 -5.00	0.00 +	(1)? No $-2\Lambda I I (df=9) = 8.98 \ p = 44$	<b>3</b>
-5.00 -5.00		(1)1 110; <u>LEE</u> ((1 0) 0.000; p 111	
-5.00 + v1 v2 v3 v4 v5 v6 No large invariance-related modification indices were found, so we'll call it good! Onto the next model! The plot of intercepts on the left			
v1 $v2$ $v3$ $v4$ $v5$ $v6$ call it good! Onto the next model! The plot of intercepts on the left	-5.00	No lorge inverience related modification indi	an wore found an we'll
v1 v2 v3 v4 v5 v6    call it good! Onto the next model! The plot of intercepts on the left		no large invariance-related modification indic	es were iouria, so we li
	V1 V2 V3 V4 V5 V6	call it good! Onto the next model! The plot of	intercepts on the left
foreshadow what we will find with testing scalar invariance		foreshadow what we will find with testing sca	lar invariance

2b UNSTANDARDIZED PARTIAL METRIC MODEL RESULTS - ALL FACTOR LOADINGS ARE HELD EQUAL EXCEPT v1T1

Two-Tailed									Two-Tailed		
	Estimate	S.E.	Est./S.E.	P-Value		Estimate	S.E.	Est./S.E.	P-Value		
TIME1 BY	IME1 BY					Means (FACTOR MEANS FIXED=0 FOR IDENTIFICATION)					
V1T1	3.233	0.261	12.362	0.000	TIME1	0.000	0.000	999.000	999.000		
V2T1	1,950	0.201	9,706	0.000	TIME2	0.000	0.000	999.000	999.000		
V3T1	1.967	0.198	9,910	0.000	TIME3	0.000	0.000	999.000	999.000		
V4T1	1.899	0.224	8.481	0.000							
V.5m1	0.968	0.137	7.055	0.000	Intercepts	- SCALED SO SHOULD BE	EOUAL	ACROSS TIME			
V6T1	1 476	0 1 3 1	11 247	0 000	V1T1	16 078	0 276	58 267	0 000		
	1.1/0	0.101		0.000	V1T2	17 225	0 245	70 282	0 000		
TTME2 BY	7				V1T2 V1T3	17 756	0.222	80 036	0 000		
V1T2	2 644	0 234	11 315	0 000	V113 V2m1	8 672	0.222	29 071	0.000		
V112 V2T2	1 950	0 201	9 706		V211 V2T2	9 980	0.250	37 872	0.000		
V212 V3T2	1 967	0.201	9.700	0.000	V212 V2T3	10 434	0.201	37 245	0.000		
VJ12 VJ12	1 907	0.190	9.910	0.000	V2IJ 172m1	11 070	0.200	57.24J 52 102	0.000		
V412 V75m2	1.099	0.224	0.401	0.000	VSII	12.970	0.225	53.192	0.000		
V 512	0.968	0.137	1.055	0.000	V312	12.408	0.217	57.325	0.000		
V 612	1.4/6	0.131	11.24/	0.000	V3T3	13.041	0.212	61.441	0.000		
					V4T1	-3.034	0.267	-11.343	0.000		
TIME3 BY					V4T2	-3.210	0.260	-12.365	0.000		
V1T3	2.644	0.234	11.315	0.000	V4T3	-2.720	0.254	-10.720	0.000		
V2T3	1.950	0.201	9.706	0.000	V5T1	-1.288	0.137	-9.377	0.000		
V3T3	1.967	0.198	9.910	0.000	V5T2	-1.663	0.199	-8.340	0.000		
V4T3	1.899	0.224	8.481	0.000	V5T3	-1.246	0.169	-7.373	0.000		
V5T3	0.968	0.137	7.055	0.000	V6T1	-2.871	0.164	-17.506	0.000		
V6T3	1.476	0.131	11.247	0.000	V6T2	-2.414	0.158	-15.319	0.000		
					V6T3	-2.087	0.154	-13.571	0.000		
TIME1 WI	TH										
TIME2	0.847	0.078	10.837	0.000	Residual V	ariances – ITEM VARIAN	ICE THAT	IS NOT THE	FACTOR		
TIME3	0.682	0.124	5.508	0.000	V1T1	0.170	0.374	0.454	0.650		
					V1T2	0.548	0.265	2.070	0.038		
TIME2 WI	TH				V1T3	0.509	0.314	1.618	0.106		
TIME3	0.699	0.128	5.473	0.000	V2T1	8.702	1.026	8.483	0.000		
					V2T2	5.895	0.605	9.746	0.000		
*** Residual	L covariances among	same item	across time	e ****	V2T3	5.177	0.795	6.514	0.000		
					V3T1	2.502	0.386	6.484	0.000		
V1T1 WIT	ГН				V3T2	2.178	0.352	6.183	0.000		
V1T2	-0.225	0.249	-0.904	0.366	V3T3	2.309	0.416	5.548	0.000		
V1T3	-0.012	0.236	-0.049	0.961	V4T1	7.172	1.021	7.021	0.000		
					V4T2	6.759	0.967	6.990	0.000		
V1T2 WI	тн				V4T3	6.613	1.128	5.860	0.000		
V1T3	0.132	0.230	0.573	0.566	V5T1	1.829	0.443	4.131	0.000		
	0.102			2.000	V5T2	4.678	1.430	3.272	0.001		
					V5T2	2 944	0 760	3 872	0 000		
Variances (	ACTOR VARIANCE AT	TTME1=1 FO	B TDENTIFIC	ATTON)	V6T1	1 707	0 242	7 050			
ттм <u>г</u> 1	1 000	0 000		999 000	V011 V6T2	1 090	0.242	6 599			
	1 162	0.000	6 270	000.000	V012 V6T2	0 784	0.170	1 610	0.000		
	1.102	0.157	5 000	0.000	VUIJ	0.704	0.1/0	4.010	0.000		
TIMES	0.941	0.137	5.999	0.000							
1					1						

E.P.C. Std E.P.C. StdYX E.P.C.

-0.189

0.094

0.113

-0.084

-0.017

-0.241

### Model 3a. Scalar Invariance Model (all intercepts held equal across over time except v1T1); identified by Time1 mean=0

MODEL:		
! Model 3a: Full Scalar Invariance without v1T1	MODEL FIT INFORMATION	
	Number of Free Parameters	57
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1		
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	Loglikelihood	
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6):	HO Value	-4461.842
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (11-16):	HO Scaling Correction Factor	1 5846
I them intercepts NOW CONSTRAINED FOULI ACROSS TIME EXCEPT 1171	for MLR	1.0010
[+1m1*1. [+1m2* +1m2*1 /T1.		-1281 015
$[v_{11}, v_{12}, v_{12}, v_{13}, (11), .$	Ul Capling Correction Easter	1 2020
$[v211^{\circ} v212^{\circ} v213^{\circ}] (12),$	for MID	1.2029
$[V_{311}^{*}, V_{312}^{*}, V_{313}^{*}]$ (13);	IOL MLK	
$[\nabla 4T1^*  \nabla 4T2^*  \nabla 4T3^*]$ (14);		
[v511* v512* v513*] (15);	Information Criteria	
[v6T1* v6T2* v6T3*] (16);	Akaike (AIC)	9037.685
! Residual variances all freely estimated, not labeled	Bayesian (BIC)	9209.670
v1T1* v1T2* v1T3*; v2T1* v2T2* v2T3*;	Sample-Size Adjusted BIC	9029.271
v3T1* v3T2* v3T3*; v4T1* v4T2* v4T3*;	$(n^* = (n + 2) / 24)$	
v5T1* v5T2* v5T3*; v6T1* v6T2* v6T3*;		
! Factor variance AT TIME 1 fixed=1 for identification	Chi-Square Test of Model Fit	
Time1@1 Time2* Time3*;	Value	342.530*
! Factor mean AT TIME 1 fixed=0 for identification	Degrees of Freedom	132
[Time1@0 Time2* Time3*];	P-Value	0.0000
! Factor covariances all freely estimated	Scaling Correction Factor	1.0381
Time1 Time2 Time3 WITH Time1* Time2* Time3*;	for MLR	
! Residual covariances estimated for same item across time		
v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*:	RMSEA (Root Mean Square Error Of Approx	(imation)
v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*;	Estimate	0.103
v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*:	90 Percent C I	0 089 0 116
v $dr1$ $v$ $dr2$ $v$ $dr3$ $w$ $TrH$ $v$ $dr1$ $*$ $v$ $dr2$ $*$ $v$ $dr3$ $*$	Probability RMSEA <= 05	0 000
	itobability idibility .05	0.000
word word word with words words .		
		0 870
		0.8/9
Does the full scalar model (3a) fit worse than the partial metric model		0.860
(2b)? Yes, −2∆LL(df=9) = 55.13, <i>p</i> <.01		
	SRMR (Standardized Root Mean Square Res	(idual)
	Value	0.093
Mandifficientiana indiana accordante for since the second structure and second structure and second structure a	MODEL MODIELCARION INDICES (no lowersh fo	
Modification indices suggest that freeing these intercepts would help, so	MODEL MODIFICATION INDICES (relevant to	or invariance testing)
let's try v5T1 first (biggest $\chi^2$ change suggested).	Means/Intercepts/Inresnolds	
	M.I. E.P.C. S	TA E.P.C. STAYX E.P.
	$\begin{bmatrix} 1 & \sqrt{2} & 1 \\ 1 & \sqrt{2} & 1 \end{bmatrix}$ 14.761 -0.696	-0.18
	[ V2T2 ] 5.578 0.307	0.307 0.09
	[ V4T1 ] 10.400 0.366	0.366 0.11
	[ V4T2 ] 5.167 -0.271	-0.271 -0.08
	[ V5T1 ] 20.890 -0.027	-0.027 -0.01
	[ V5T2 ] 14.191 -0.596	-0.596 -0.24

## Model 3b. Partial Scalar Invariance Model (all intercepts held equal across over time except v1T1 and v5T1)

<pre>Model FIT INFORMATION Model FIT INFORMA</pre>	MODEL: ! Model 3b: Partial Scalar Invariance, no v1T1 v5T1	
<pre>i Pactor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT vIT: Time B Y vIT: * v2T: * v3T: * v4T: * v5T: * v5T: * (CL: La L2-L5); Time3 BY vIT: * v3T: * v4T: * v5T: * v5T: * (CL: L6); Time3 BY vIT: * v3T: * v3T: * v5T: * v5T: * (CL: L6); I tem intercepts NOW CONSTRAINED EQUAL ACROSS TIME, no vIT v5T: [v1T:*] (v1T:* v1T3* v2T3* v4T3* v4T3* (L1:L6); [v4T1:* v4T2* v4T3*] (L1); [v4T1:* v4T3* v4T3* v4T3* v4T3* v4T3*; [v4T1:* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3*; [v4T1:* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3*; [v4T1:* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3*; [v4T1:* v4T1:* v4T3* v4T3* v4T3* v4T3* v4T3* v4T3*; [v4T1:* v4T1* v4T2* v4T3*; [v4</pre>		MODEL FIT INFORMATION
Time BY VITI* V2T* V3T* V4T* V5T* V5T* V5T* (L1-L6);Time BY VIT3* V2T* V3T* V4T* V5T* V5T* V5T* (L1-L6);I tem intercepts NOV CONSTRAINED EQUAL ACROSS TIME, no vITI V5TI[V2T1* V2T* V3T*] (L1);[V2T1* V2T* V3T*] (L1);[V3T1* V3T* V3T* V3T* V4T* V4T*] (L1);[V4T1* V4T* V4T* V4T*] (L1);[V4T1* V4T* V4T* V4T* V4T*[V4T1* V4T* V4T* V4T* V4T*[V4T1* V4T* V4T* V4T* V4T*[V4T1* V4T* V4T* V4T* V4T*[V51* V51* V51* V51* V51* V51*[V51* V51* V51* V51* V51* V51* V51*[V51* V51* V51* V51* V51* V51* V51* V51*	! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1	Number of Free Parameters 58
Time3 BY V12* V27* V37* V47* V47* V57* V57* (12-16); Time3 BY V17* V27* V37* V37* V47* V57* V57* (12-16); Time3 BY V17* V17* V37* V37* V37* V57* V57* (12-16); I vtrii; V17* V17* V17* V17* V17* V17* V17* V17*	Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	
Time if the interverts of CONSTRAINED EQUAL ACROSS TIME, no vIT1 v5T1 [vTT1+'); [v12+'v173+' (11); [vT1+' v22+'v173+' (11); [vT1+' v22+'v173+' (12); [vT1+' v22+'v173+' (13); [vT1+' v22+'v173+' (13); [vT1+' v22+'v173+' (13); [vT1+' v12+'v173+' v11+'v12+'v13+; v11+'v12+'v173+' v11+'v12+'v13+; v11+'v12+'v133+' v11+'v12+'v13+; 'Factor variances AT TIME 1 fixed=1 for identification Time181' time2' time3' time2' time3'; ! Factor variances AT TIME 1 fixed=1 for identification Time181' time2' time3' time2' time3'; ! Factor variances at I freely estimated Time18' time3' time3' time3' time3' time3'; ! Factor variances at I freely estimated Time1' time2' time3' time3' time3' time3'; ! Factor variances at I freely estimated Time1' time2' time3' time3' time3' time3'; ! Factor variances at I freely estimated Time1' time3' time3' time3' time3' time3'; ! Factor variances estimated for same item across time v11' v12' v13' w1TH v11' v12'' v13''; v4TI v4T2' v4T3' w1TH v4T1' v4T2'' v4T3'; v4TI v4T2' v4T3' w1TH v4T1'' v4T2'' v4T3'; v4T1 1 11.529' -0.599' -0.599' -0.164 [v4T2] 1 6.398' -0.306' -0.30	Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6):	Loglikelihood
I Tem intercept NOP CONSTRAINED EQUAL ACROSS TIME, no vIT1 v5T1 [VIT1+] (v12+v134] (11); [V2T1+ v22+v2T34] (12); [V4T1+ v42+v4T34] (13); [V4T1+ v42+v4T34] (14); [V5T1+] (v52+v5734] (15); [V5T1+ v522+v5734] (15); [V5T1+ v572+v5734] (16);H Scaling Correction Factor 1.5626 H VALUE4284.045 HI Scaling Correction Factor 1.2029 I actor v471+v472+v4734] (14); [V5T1+ v122+v4734] (14); [V5T1+ v122+v4734] (14); [V5T1+ v122+v4734] (15); [V5T1+ v122+v4734] (16);I residue variances at I freely estimated, not labeled v171+v172+v1734; v271+v472+v4734; v571+v572+v5734; v571+v472+v4734; v571+v472+v4734; v473+; v571+v472+v4734; v473+; v571+v472+v4734; v473+; v571+v472+v4734; v473+; v571+v472+v4734; v473+; v471 v122 v173 WITH v171+v172+v1734; v471 v172 v173 WITH v471+v472+v1734; v471 next (biggest x² change suggested).H H Scaling Correction Factor 1.5626 H H K H H H H H H H H H H H H H H H H H	Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);	H0 Value -4450.001
$\begin{bmatrix} vTII+1; [vII2+vII3+] (II); [vII2+vII3+] (II); [vII2+vII3+] (II); [vII1+1], [vII2+vII3+] (II); [vII1+vII2+vII3+] (II); [vII1+vII1+vII1+vII1+vII1+vII1+vII1+vII1$	! Item intercepts NOW CONSTRAINED EQUAL ACROSS TIME, no v1T1 v5T1	HO Scaling Correction Factor 1 5626
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	[v1T1*]: [v1T2* v1T3*] (I1):	for MLR
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	$[v_2T1* v_2T2* v_2T3*]$ (12):	H1 Value -4284 045
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	[ U 3 m 1 * U 3 m 2 * U 3 m 3 * 1 ( T 3 ) ·	H1 Scaling Correction Factor 1 2029
InternationIveSite1(vESite1)(vES	[v312 v312 ] (13), $[v2\pi1* v2\pi2* v2\pi3*1 (T4) \cdot$	for MLR
Iver: 		
Notification indices still suggest that freeing these intercepts would help. so let's try v4T1 next (biggest $\chi^2$ change suggested).Interface help would help. content of the start of the	$[v_{011}], [v_{012}], v_{013}], (13), [v_{011}], v_{012}], v_{013}], (13), ($	Information Critoria
Instances <th>L Posidual variances all freely estimated not labeled</th> <th></th>	L Posidual variances all freely estimated not labeled	
$ \begin{array}{c} \text{Virt}  \text{Virt} $	$\frac{1}{100} + \frac{1}{100} + \frac{1}$	Paucoian (PIC) 9010.001
Volst volst, vo	$v_{111}^{-} v_{112}^{-} v_{113}^{-}, v_{211}^{-} v_{212}^{-} v_{213}^{-},$	Sample-Size Adjusted PIC 9007 440
$ \begin{array}{c} Vol1* Vol2* Vol3*; Vol2* Vol3*; Vol2* Vol3*; Vol2* Vol3*; Vol3*; Vol2* Vol3*; Vol3*$	V311* V312* V313*, V411* V412* V413*,	$\int \frac{d^2}{dt^2} = \int \frac{dt^2}{dt^2} = \int \frac{dt^2}{d$
<pre>Pactor variance at like 1 like 1</pre>	VSII VSIZ VSIS; VOII VOIZ VOIS;	$(n^{*} = (n + 2) / 24)$
$ \begin{array}{c} \mbox{Interley Times} \mbox{Interley} \m$	Factor variance AT TIME I TIXed=1 for Identification	Chi Omunua Mast of Madel Rit
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Timel@l Time2* Time3*;	Chi-Square Test of Model Fit
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	Factor mean AT TIME I FIXed=U for identification	Value 318.018^
1Product covariances all freely estimated Timel Timel	[Time160 Time2* Time3*];	Degrees of Freedom 131
Timel	! Factor covariances all freely estimated	P-Value 0.0000
Introduct covariances estimated for same item across time vill vill? vill? will? will? will? will? will? will? will?for MLRIntroduct will? vill? will? will? will? will?Vill vill? vill? will? will? will? will?Vill vill? vill? will? will? will? will?Vill vill? will? will? will?Vill vill? will? will? will?Vill vill? will? will? will?Vill vill? will? will?Vill vill? will?Vill vill? will?Vill vill?Operation indices still scalar model (3b) fit better than the full scalar model (3a)?Yes, -2ALL(df=1) = 15.16, p <.01Does the partial scalar model (3b) fit worse than the partial metric model(2b)? Yes, -2ALL(df=8) = 27.84, p <.01M.I. E.P.C. Std E.P.C. Std YXE.P.C.So let's try v4T1 next (biggest $\chi^2$ change suggested).M.I. E.P.C. Std E.P.C. Std YXE.P.C.[V2T1] ] 11.529-0.599[V2T2] ] 4.3900.278[V4T1] ] 13.7950.4250.425[V4T2] ] 6.398-0.306-0.096	Time1 Time2 Time3 WITH Time1* Time2* Time3*;	Scaling Correction Factor 1.043/
viti viti viti viti viti viti viti viti	! Residual covariances estimated for same item across time	for MLR
v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*; v2T1 v4T2 v4T3 WITH v2T1* v3T3*; v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;RMSEA (Root Mean Square Error Of Approximation) EstimateDoes the partial scalar model (3b) fit better than the full scalar model (3a)? Yes, -2 $\Delta$ LL(df=1) = 15.16, p < .01CFI/TLIObes the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, -2 $\Delta$ LL(df=8) = 27.84, p < .01Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C.C.P.C.Vert 111.529 Vert 20.278 VAT1 next (biggest $\chi^2$ change suggested).	v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*;	
v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*; v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;Estimate $0.097$ 90 Percent C.I. Probability RMSEA <= .05	v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*;	RMSEA (Root Mean Square Error Of Approximation)
v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*; v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2 v6T3 WITH v5T1* v5T2* v5T3*; v6T1 v6T2* v6T3*;90 Percent C.I. $0.084$ $0.111$ Probability RMSEA <= .05	v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*;	Estimate 0.097
v5T1 $v5T2$ $v5T3$ $wITH$ $v5T2*$ $v5T3*$ $v5T3*$ $v5T3*$ $v5T2*$ $v5T3*$ $v5T3*$ $v5T3*$ $v5T2*$ $v5T3*$	v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*;	90 Percent C.I. 0.084 0.111
v6Tl v6T2 v6T3 WITH v6T1* v6T2* v6T3*;CFI/TLIDoes the partial scalar model (3b) fit better than the full scalar model (3a)? Yes, $-2\Delta LL(df=1) = 15.16, p < .01$ CFI0.893 TLIDoes the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84, p < .01$ 0.086Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C.E.P.C. [ V2T1 ]11.529 (2T1 ]0.599 (2T1 )0.599 (2T1 )CFI/TLI0.893 (2D2 )	v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*;	Probability RMSEA <= .05 0.000
Does the partial scalar model (3b) fit better than the full scalar model (3a)? Yes, $-2\Delta LL(df=1) = 15.16, p < .01$ CFI TLI0.893 TLIDoes the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84, p < .01$ 0.893 0.8750.875Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C.Std E.P.C.Image: Start of the start of	v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;	
Does the partial scalar model (3b) fit better than the full scalar model (3a)? Yes, $-2\Delta LL(df=1) = 15.16, p < .01$ CFI 0.893 TLIDoes the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84, p < .01$ CSISRMR (Standardized Root Mean Square Residual) ValueModification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C. I 11.529E.P.C. 0.278Std YXE.P.C. [V2T1]11.529 4.3900.599 0.278-0.164 0.278O.085 0.2780.425 0.4250.132 0.132		CFI/TLI
Yes, $-2\Delta LL(df=1) = 15.16, p < .01$ TLI $0.875$ Does the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84, p < .01$ SRMR (Standardized Root Mean Square Residual) Value $0.086$ Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C. (V2T1 )E.P.C. Std E.P.C. StdYXE.P.C. [ V2T2 ]4.3900.2780.2780.085[ V4T2 ]6.398-0.306-0.306-0.096	Does the partial scalar model (3b) fit <i>better</i> than the full scalar model (3a)?	CFI 0.893
Does the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84$ , $p < .01$ SRMR (Standardized Root Mean Square Residual) ValueModification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C.Std E.P.C. Std E.P.C. StdYXE.P.C. [ V2T2 ]11.529-0.599-0.599-0.164[ V4T1 ]13.7950.4250.4250.132[ V4T2 ]6.398-0.306-0.096	Yes. $-2\Delta LL(df=1) = 15.16$ . $p < .01$	TLI 0.875
Does the partial scalar model (3b) fit worse than the partial metric model (2b)? Yes, $-2\Delta LL(df=8) = 27.84$ , $p < .01$ SRMR (Standardized Root Mean Square Residual) ValueValue0.086Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).M.I.E.P.C.Std E.P.C. Std E.P.C. StdYXE.P.C.[ V2T1 ]11.529-0.599-0.599-0.164[ V2T2 ]4.3900.2780.2780.085[ V4T1 ]13.7950.4250.4250.132[ V4T2 ]6.398-0.306-0.096		
Value $0.086$ Value $0.086$ (2b)? Yes, $-2\Delta LL(df=8) = 27.84, p < .01$ $0.086$ Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested). $M.I.$ $E.P.C.$ $[V2T1]$ $11.529$ $11.529$ $-0.599$ $-0.599$ $-0.164$ $[V2T2]$ $Value0.086Modification indices still suggest that freeing these intercepts would help,so let's try v4T1 next (biggest \chi^2 change suggested).M.I.E.P.C.[V2T1]11.529-0.599-0.599-0.164[V4T1]13.7950.4250.4250.306-0.1640.085$	Does the partial scalar model (3b) fit worse than the partial metric model	SRMR (Standardized Root Mean Square Residual)
Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested). MODEL MODIFICATION INDICES (relevant for invariance testing)Means/Intercepts/Thresholds M.I. E.P.C. Std E.P.C. StdYXE.P.C.[V2T1] 11.529 -0.599 -0.599 -0.164[V2T2] 4.390 0.278 0.278 0.278 0.085[V4T1] 13.795 0.425 0.425 0.132[V4T2] 6.398 -0.306 -0.306 -0.096	$(2b)^2$ $($	Value 0.086
Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).MODEL MODIFICATION INDICES (relevant for invariance testing) Means/Intercepts/ThresholdsMODEL MODIFICATION INDICES (relevant for invariance testing) Means/Intercepts/ThresholdsM.I.E.P.C.E.P.C.[V2T1]11.529-0.599-0.599[V2T2]4.3900.2780.2780.085[V4T1]13.7950.4250.4250.132[V4T2]6.398-0.306-0.306-0.096	$(20)$ fres, $-2\Delta LL(u) = 0 = 27.04, p < .01$	
Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).       M.I.       E.P.C.       E.P.C.       Std E.P.C.       Std YX         [ V2T1 ]       11.529       -0.599       -0.599       -0.164         [ V2T2 ]       4.390       0.278       0.278       0.085         [ V4T1 ]       13.795       0.425       0.425       0.132         [ V4T2 ]       6.398       -0.306       -0.306       -0.096		MODEL MODIFICATION INDICES (relevant for invariance testing)
Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).       M.I.       E.P.C.       E.P.C.       Std E.P.C.       Std YX         [V2T1]       11.529       -0.599       -0.599       -0.164         [V2T2]       4.390       0.278       0.278       0.085         [V4T2]       6.398       -0.306       -0.306       -0.096		Means/Intercepts/Thresholds
Modification indices still suggest that freeing these intercepts would help, so let's try v4T1 next (biggest $\chi^2$ change suggested).       M.I.       E.P.C.       E.P.C.       Std E.P.C.       Std YX         E.P.C.       [V2T1]       11.529       -0.599       -0.599       -0.164         [V2T2]       4.390       0.278       0.278       0.085         [V4T2]       13.795       0.425       0.425       0.132         [V4T2]       6.398       -0.306       -0.306       -0.096		
so let's try v4T1 next (biggest $\chi^2$ change suggested). [ V2T1 ] 11.529 -0.599 -0.599 -0.164 [ V2T2 ] 4.390 0.278 0.278 0.278 0.085 [ V4T1 ] 13.795 0.425 0.425 0.132 [ V4T2 ] 6.398 -0.306 -0.306 -0.096	Modification indices still suggest that freeing these intercepts would help.	M.I. E.P.C. Std E.P.C. StdYX
[ V2T1 ]       11.529       -0.599       -0.599       -0.164         [ V2T2 ]       4.390       0.278       0.278       0.085         [ V4T1 ]       13.795       0.425       0.425       0.132         [ V4T2 ]       6.398       -0.306       -0.096	so let's try v4T1 next (biggest $v^2$ change suggested)	E.P.C.
[ V2T2 ]       4.390       0.278       0.278       0.085         [ V4T1 ]       13.795       0.425       0.425       0.132         [ V4T2 ]       6.398       -0.306       -0.306       -0.096		[ V2T1 ] 11.529 -0.599 -0.599 -0.164
[ V4T1 ]         13.795         0.425         0.425         0.132           [ V4T2 ]         6.398         -0.306         -0.306         -0.096		[ V2T2 ] 4.390 0.278 0.278 0.085
[V4T2] 6.398 -0.306 -0.306 -0.096		[V4T1] 13.795 0.425 0.425 0.132
		[ V4T2 ] 6.398 -0.306 -0.306 -0.096

### Model 3c. Partial Scalar Invariance Model (all intercepts held equal across over time except v1T1, v5T1, v4T1)

MODEL: ! Model 3c: Partial Scalar Invariance, no v1T1 v5T1 v4T1	
	MODEL FIT INFORMATION
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1	Number of Free Parameters 59
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6);	Loglikelihood
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);	HO Value -4442.214
! Item intercepts NOW CONSTRAINED EQUAL ACROSS TIME,	HO Scaling Correction Factor 1.5647
! no v1T1 v5T1 v4T1	for MLR
[v1T1*]; [v1T2* v1T3*] (I1);	H1 Value -4284.045
[v2T1* v2T2* v2T3*] (I2);	H1 Scaling Correction Factor 1.2029
[v3T1* v3T2* v3T3*] (I3);	for MLR
[v4T1*]; [v4T2* v4T3*] (I4);	
[v5T1*]; [v5T2* v5T3*] (I5);	Information Criteria
[v6T1* v6T2* v6T3*] (I6);	Akaike (AIC) 9002.427
! Residual variances all freely estimated, not labeled	Bavesian (BIC) 9180.447
v1T1* v1T2* v1T3*; v2T1* v2T2* v2T3*;	Sample-Size Adjusted BIC 8993.718
v3T1* v3T2* v3T3*; v4T1* v4T2* v4T3*;	$(n^* = (n + 2) / 24)$
v5T1* v5T2* v5T3*; v6T1* v6T2* v6T3*;	
! Factor variance AT TIME 1 fixed=1 for identification	Chi-Square Test of Model Fit
Time1@1 Time2* Time3*;	Value 304.537*
! Factor mean AT TIME 1 fixed=0 for identification	Degrees of Freedom 130
[Time1@0 Time2* Time3*];	P-Value 0.0000
! Factor covariances all freely estimated	Scaling Correction Factor 1.0387
Time1 Time2 Time3 WITH Time1* Time2* Time3*;	for MLR
! Residual covariances estimated for same item across time	
v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*;	RMSEA (Root Mean Square Error Of Approximation)
v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*;	Estimate 0.094
v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*;	90 Percent C.I. 0.081 0.108
v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*;	Probability RMSEA <= .05 0.000
v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*;	-
v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*;	CFI/TLI
	CFI 0.900
Does the partial scalar model (3c) fit <i>better</i> than the partial scalar model	TLI 0.882
(3b)2 $V_{00} = 2\Lambda [1/(df-1)] = 0.24$ $p < 01$	
(3D): 165, $-2\Delta LL(01-1) = 9.24$ , $p < .01$	SRMR (Standardized Root Mean Square Residual)
	Value 0.092
Does the partial scalar model (3c) fit worse than the partial metric model	
<b>(2b)?</b> Eh, −2ΔLL(df=7) = 13.99, <i>p</i> =.05	MODEL MODIFICATION INDICES (relevant for invariance testing)
	Means/Intercepts/Thresholds
	-
	M.I. E.P.C. Std E.P.C. StdYX E.P.C.
Although fit is close to not worse than the partial metric model, there is	a [V2T1] 8.560 -0.497 -0.497 -0.137
algorithms and the store index for yOT4, suggesting leadined strain Os	
significant mounication index for vz i i, suggesting localized strain. So	
let's see what happens if we free that one, too.	

## Model 3d. Partial Scalar Invariance Model (all intercepts held equal across over time except v1T1, v5T1, v4T1, v2T1)

MODEL: ! Model 3d: Partial Scalar Invariance,	MODEL FIT INFORMATION
! no v1T1 v5T1 v4T1 v2T1	Number of Free Parameters 60
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1	Loglikelihood
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	H0 Value -4437.665
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6):	HO Scaling Correction Factor 1.5560
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16):	for MLR
I them intercents NOW CONSTRAINED FOLIAL ACROSS TIME	H1 Value -4284 045
I DO WITH WETH WATH WOTH	H1 Scaling Correction Factor 1 2020
	for MID
$[v211^{+}]; [v212^{+}v213^{+}] (12);$	To Secure this of California
$[V3T1^{+} V3T2^{+} V3T3^{+}]$ (13);	Information Criteria
$[v4T1^*]; [v4T2^* v4T3^*] (14);$	Akalke (ALC) 8995.330
[v5T1*]; [v5T2* v5T3*] (I5);	Bayesian (BIC) 9176.366
[v6T1* v6T2* v6T3*] (I6);	Sample-Size Adjusted BIC 8986.473
! Residual variances all freely estimated, not labeled	$(n^* = (n + 2) / 24)$
v1T1* v1T2* v1T3*; v2T1* v2T2* v2T3*;	
v3T1* v3T2* v3T3*; v4T1* v4T2* v4T3*;	Chi-Square Test of Model Fit
v5T1* v5T2* v5T3*; v6T1* v6T2* v6T3*;	Value 295.789*
! Factor variance AT TIME 1 fixed=1 for identification	Degrees of Freedom 129
Time1@1 Time2* Time3*;	P-Value 0.0000
! Factor mean AT TIME 1 fixed=0 for identification	Scaling Correction Factor 1.0387
[Time1@0 Time2* Time3*];	for MLR
! Factor covariances all freely estimated	
Time1 Time2 Time3 WITH Time1* Time2* Time3*;	RMSEA (Root Mean Square Error Of Approximation)
! Residual covariances estimated for same item across time	Estimate 0.093
v1T1 v1T2 v1T3 WITH v1T1* v1T2* v1T3*;	90 Percent C.I. 0.079 0.106
<b>v2T1 v2T2 v2T3 WITH v2T1* v2T2* v2T3*;</b>	Probability RMSEA <= .05 0.000
<b>v3T1 v3T2 v3T3 WITH v3T1* v3T2* v3T3*</b> ;	CFI/TLI
<b>v4T1 v4T2 v4T3 WITH v4T1* v4T2* v4T3*:</b>	CFI 0.904
v5T1 v5T2 v5T3 WITH v5T1* v5T2* v5T3*:	TLT 0.887
v6T1 v6T2 v6T3 WITH v6T1* v6T2* v6T3*:	
	Chi-Square Test of Model Fit for the Baseline Model
20	
	Degrees of Freedom 153
15	SPMP (Standardized Poot Mean Square Posidual)
	SMAR (Standardized Root Mean Square Residuar)
	Value 0.091
t 10 - Time1	
	Does the partial scalar model (3d) fit <i>better</i> than the partial scalar model
Time 2	(3c)? Yes, -2ΔLL(df=1) = 8.73, <i>p</i> <.01
a innes	Does the partial scalar model (3d) fit worse than the partial metric model
-	(2b) 2 No 2 Al ( $df=0$ ) = 4.25 p = 6.2
	(20): NO, $-2\Delta LL(UI-0) = 4.00, p = .00$
	No invariance-related modification indices remain, so we are done!
	The intercepts at the end of Model 3d are shown on the left
v1 v2 v3 v4 v5 v6	

3d UNSTANDARDIZED PARTIAL SCALAR MODEL RESULTS

				r -	Fwo-Tailed				]	Two-Tailed
		Estimate	S.E.	Est./S.E.	P-Value		Estimate	S.E.	Est./S.E.	P-Value
TIME1	BY					Means (FACTOR M	1EAN AT TIME1 FIXE	D=0 FOR	IDENTIFICATI	ION)
V1T1		3.231	0.262	12.330	0.000	TIME1	0.000	0.000	999.000	999.000
V2T1		1.953	0.201	9.739	0.000	TIME2	0.293	0.081	3.625	0.000
V3т1		1.974	0.198	9,989	0.000	TIME3	0.521	0.093	5,612	0.000
V4T1		1,904	0.220	8,656	0.000					
V5T1		0.983	0.138	7.097	0.000	Intercepts				
V6T1		1.477	0.130	11.353	0.000	V1T1	16.090	0.274	58.684	0.000
						V1T2	16.425	0.281	58.364	0.000
TIME2	BY					V1T3	16.425	0.281	58.364	0.000
V1T2		2.629	0.232	11.317	0.000	V2T1	8.674	0.294	29.540	0.000
V2T2		1,953	0.201	9.739	0.000	V2T2	9.413	0.261	36.036	0.000
V3T2		1.974	0.198	9,989	0.000	V2T3	9.413	0.261	36.036	0.000
V4T2		1.904	0.220	8,656	0.000	V3T1	11.950	0.225	53.099	0.000
V5T2		0.983	0.138	7.097	0.000	V3T2	11.950	0.225	53.099	0.000
V6T2		1.477	0.130	11.353	0.000	V3T3	11.950	0.225	53.099	0.000
			0.100	11.000	0.000	V4T1	-3.024	0.267	-11.334	0.000
TTME3	BY					V4T2	-3.744	0.299	-12.535	0.000
V1T3	21	2.629	0.232	11.317	0.000	V4T3	-3.744	0.299	-12.535	0.000
V2T3		1,953	0.201	9.739	0.000	V5T1	-1.215	0.131	-9.277	0.000
V3T3		1.974	0.198	9,989	0.000	V5T2	-1.802	0.207	-8.706	0.000
V4T3		1.904	0.220	8.656	0.000	V5T3	-1.802	0.207	-8.706	0.000
V5T3		0.983	0.138	7.097	0.000	V6T1	-2 854	0 161	-17 688	0 000
V6T3		1 477	0 1 3 0	11 353	0 000	V6T2	-2 854	0 161	-17 688	0 000
1010		±•1//	0.100	11.000	0.000	V6T2 V6T3	-2 854	0 161	-17 688	0 000
TTME1	WTTH						2.001	0.101	27.0000	0.000
TIME2	2	0.850	0.079	10.809	0.000	Residual Varia	ances (ITEM VARIAN	CE THAT	IS NOT THE F	FACTOR)
TIME	3	0.686	0.124	5.543	0.000	V1T1	0.170	0.374	0.454	0.650
						V1T2	0.548	0.265	2.070	0.038
TIME2	WITH					V1T3	0.509	0.314	1.618	0.106
TIME	3	0.706	0.128	5.519	0.000	V2T1	8.702	1.026	8.483	0.000
						V2T2	5.895	0.605	9.746	0.000
*** Resid	dual covar	iances among s	same item	across time	2 ****	V2T3	5.177	0.795	6.514	0.000
		,				V3T1	2.502	0.386	6.484	0.000
V1T1	WITH					V3T2	2.178	0.352	6.183	0.000
V1T2		-0.206	0.246	-0.838	0.402	V3T3	2.309	0.416	5.548	0.000
V1T3		-0.010	0.233	-0.043	0.966	V4T1	7.172	1.021	7.021	0.000
						V4T2	6.759	0.967	6,990	0.000
V1T2	WITH					V4T3	6.613	1.128	5,860	0.000
V1T3		0.130	0.231	0.561	0.575	V5T1	1.829	0.443	4.131	0.000
		0.200	0.201	0.001	0.070	V5T2	4.678	1.430	3.272	0.001
						V5T3	2.944	0.760	3.872	0.000
Variances	S (FACTOR	VARIANCE AT T	IME1=1 FO	R IDENTIFICA	ATION)	V6T1	1.707	0.242	7.059	0.000
TTME1	1	1,000	0.000	999.000	999.000	V6T2	1.090	0.165	6.599	0.000
TIME	- 2	1,167	0.187	6.252	0.000	V6T3	0.784	0.170	4.618	0.000
TIME	- 3	0.947	0.156	6.054	0.000		0.701	0.1/0	1.010	0.000
	-	0.01/	0.100	0.001						

# Model 4a. Residual Variance Invariance Model (error variances held equal for all except non-invariant items)

MODEL: ! Model 4a: Residual Variances					
! except for non-invariant items	MODEL FIT	INFORMATION			
	Number of	Free Paramete:	rs	5	52
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1					
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	Loqlikelih	lood			
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6);	2	H0 Value		-4454.59	92
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);		HO Scaling Co	rrection Facto	r 1.548	37
! Item intercepts NOW CONSTRAINED EOUAL ACROSS TIME,		for MLR			
! no v1T1 v5T1 v4T1 v2T1		H1 Value		-4284.04	15
[v1T1*]; [v1T2* v1T3*] (I1);		H1 Scaling Co	rrection Facto	r 1.202	29
[v2T1*1]; $[v2T2*v2T3*1]$ (I2);		for MLR			
[v3T1* v3T2* v3T3*] (I3);					
[v4T1*1: [v4T2* v4T3*1 (I4):	Informatio	n Criteria			
[v5T1*]; [v5T2* v5T3*] (I5);	1111011110010	Akaike (ATC)		9013.18	3.5
[v6T1*, v6T2*, v6T3*] (16):		Bavesian (BIC	)	9170.08	33
' Residual variances NOW CONSTRAINED EQUAL ACROSS TIME		Sample-Size A	, diusted BIC	9005.50	)9
(WHEN POSSIBLE)		$(n^* = (n + 1))$	2) / 24)	5000.00	
v1r1*: v1r2* v1r3* (E1):		(11 (11 ) )	2) / 21/		
$\psi_{2} = 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1$	Chi-Square	Test of Mode	l Fit		
$v_{2} = 1$ , $v_{2} = 0$ , $v_{$	Chir Dquare	Value	1 1 1 0	318 28	?∩*
$\psi d\tau 1 \star \cdot \psi d\tau 2 \star \psi d\tau 3 \star (E4) \cdot$		Degrees of Fr	eedom	13	27
UST1* UST2* UST3* (E5) ·		P-Value	ccaoin	0 000	)0
v6r1* v6r2* v6r3* (E6) ·		Scaling Corre	ction Factor	1 071	7
I Factor variance AT TIME 1 fixed=1 for identification		for MLR		1.071	_ /
Time101 Time2* Time3**					
I Factor mean AT TIME 1 fixed=0 for identification	RMSEA (ROO	t Mean Square	Error Of Appr	oximation)	
[Time100 Time2* Time3*1:	1010111 (1000	Estimate	DITOT OF MPPT	0 00	2
' Factor covariances all freely estimated		90 Percent C	т	0.02	x0 0 107
Time1 Time2 Time3 WITH Time1* Time2* Time3*:		Probability R	±• MSEA <= 05	0.00	0.10
I Residual covariances estimated for same item across time		1100d01110y Id	.00	0.00	
wiri wiro wiro Wirth wirit wirot wirot.	CFT/TT.T				
271 v12 v12 v12 v11 v11 v21 v21 v21 v21 v2	011/111	CFI		0.80	6
		TT.T		0.02	24
				0.00	L L L L L L L L L L L L L L L L L L L
	SRMR (Stan	dardized Root	Mean Square B	(Leuchael	
	SIMI (Scall	Value	Mean Square I		35
		Varue		0.01	
	MODEL MODI	FICATION INDI	CES (relevant	for invariar	nce testing)
	Moans/Into	rconte/Throch	olde	ior invaria	ice cesering,
Does the full residual model (4a) fit worse than the partial scalar model	Means/ Ince	icepts/intesh	0105		
<b>(3d)?</b> Yes, −2ΔLL(df=8) = 24.72, <i>p</i> <.01		мт	FPC	+d F P C	SHAVX F P C
	Variances/	Residual Vari	. 1.1.0 ances		JULIA D.I.C.
	variances/	Nesiuuai vali	111000		
	V5T2	12 7	39 0 755	0 755	0 153
Modification indices suggest freeing v5 across Time2 and Time3, so let's	V5T3	12.7	40 -1 125	-1 125	-0 238
mounication multes suggest neering vo actoss fillez and filles, so lets	V6T1	13 7		0 421	0 12/
try that next.	VGT3	±J./* 7 Q	15 -0 393	-0 303	-0 124
	v010	7.0		0.375	0.121

# Model 4b. Partial Residual Variance Invariance Model (error variances held equal for all except non-invariant items and v5T2/T3)

MODEL: ! Model 4b: Residual Variances							
! except for non-invariant items, v5T2-v5T3	MODEL FIT INFORMATION						
	Number of Free Parameters 53						
! Factor loadings NOW CONSTRAINED EQUAL ACROSS TIME EXCEPT v1T1							
Time1 BY v1T1* v2T1* v3T1* v4T1* v5T1* v6T1* (L1a L2-L6);	Loglikelihood						
Time2 BY v1T2* v2T2* v3T2* v4T2* v5T2* v6T2* (L1-L6);	H0 Value -4447.259						
Time3 BY v1T3* v2T3* v3T3* v4T3* v5T3* v6T3* (L1-16);	HO Scaling Correction Factor 1.5823						
! Item intercepts NOW CONSTRAINED EQUAL ACROSS TIME.	for MLR						
! no v1T1 v5T1 v4T1 v2T1	H1 Value -4284.045						
[v1m1+1: [v1m2+ v1m3+1 (T1):	H1 Scaling Correction Factor 1 2029						
$[v_2 m_1 + 1] \cdot [v_2 m_2 + v_2 m_3 + 1] (T_2)$	for MLR						
$[v_{4}\pi_{1} \star_{1} \cdot [v_{4}\pi_{2} \star_{2} \star_{3}\pi_{3} \star_{1}]$ (14)	Information Criteria						
[v== ], [v== ]	$\frac{1}{2} \frac{1}{2} \frac{1}$						
	Bayogian (BIC) 9160 434						
L DOSIDURI VOIZ VOIZ VOIZ (10),	Samplo-Size Adjusted BIC 8992 604						
(MUEN DOSSIDE) except (EET2)-(EET2)	(nt - (n + 2)) (24)						
$\pi^{(mmk} = 0.0010 \text{ m}) \in \mathbb{R}^{-0.012} = 0.012$	$(11^{+} - (11^{+} 2)^{+} / 24)$						
	Chi-Square Test of Model Fit						
$v_{211}, v_{212}, v_{213}, (z_2),$	Value Value 200 201*						
	Degrees of Freedom						
V411", V412" V413" (E4), "EEM1+, "EEM2+, "EEM2+.	B-Value 0.0000						
$v_{511}^{*}, v_{512}^{*}, v_{513}^{*}, v_{$	Scaling Correction Eactor 1 0551						
Voll <sup>*</sup> Voll <sup>*</sup> Voll <sup>*</sup> (EO);	for MTD						
minute minute an time i lixed-i for identification	LOT MLK						
Timel@I Time2* Time3*;	DMCER (Deat Mass Course Engen of Researching)						
Fractor mean AT TIME I TIXed=0 for Identification	KMSEA (ROOL Mean Square Error OI Approximation)						
[Time100 Time2* Time3*];	Do Douroopt C T 0.032						
: Factor covariances all freely estimated	90 Percent C.1. 0.078 0.105						
Time: Times Times with Time: Times Times;	Probability RMSEA <= .05 0.000						
: Residual covariances estimated for same item across time							
VIII VIIZ VIIS WITH VIII* VIIZ* VIIS*;	U.901						
V3T1 V3T2 V3T3 WITH V3T1* V3T2* V3T3*;	TL1 0.888						
V411 V412 V413 WITH V411* V412* V412*;							
V5T1 V5T2 V5T3 WITH V5T1* V5T2* V5T3*;	SRMR (Standardized Root Mean Square Residual)						
V6T1 V6T2 V6T3 WITH V6T1* V6T2* V6T3*;	Value 0.093						
Does the partial residual model (4b) fit <i>better</i> than the full residual model	MODEL MODIFICATION INDICES (relevant for invariance testing)						
(4a)? Yes, −2∆LL(df=1) = 10.06, <i>p</i> <.01	Means/Intercepts/Thresholds						
Does the partial residual model (4b) fit worse than the partial scalar model (3d)? Eh, $-2\Delta LL(df=7) = 14.14$ , $p = .05$	M.I. E.P.C. Std E.P.C. StdYX E.P.C. Variances/Residual Variances						
	V6T1 13.772 0.419 0.419 0.125						
	V6T3 7.149 -0.373 -0.373 -0.118						
Modification indices suggest freeing v6 from Time1, so lot's try that payt							

Model 4c. Partial Residual Variance Invariance Model (error variances held equal for all except non-invariant items, v5T2/T3, v6T1)



MODEL F Number	IT INFORMATION of Free Parameters	54	
Loglike	lihood HO Value HO Scaling Correction Factor for MLR H1 Value H1 Scaling Correction Factor for MLR	-4439.971 1.5771 -4284.045 1.2029	
Informa	tion Criteria Akaike (AIC) Bayesian (BIC) Sample-Size Adjusted BIC (n* = (n + 2) / 24)	8987.942 9150.876 8979.971	
Chi-Squ	are Test of Model Fit Value Degrees of Freedom P-Value Scaling Correction Factor for MLR	296.084* 135 0.0000 1.0533	
RMSEA (	Root Mean Square Error Of Approx Estimate 90 Percent C.I. Probability RMSEA <= .05	imation) 0.089 0.075 0.000	0.103
CFI/TLI	CFI TLI	0.908 0.895	
SRMR (S	tandardized Root Mean Square Res Value	idual) 0.092	
Does the model (4	e partial residual model (4c) fit better <b>4b)?</b> Yes. $-2\Delta LL(df=1) = 11.20$ , $p < 01$	r than the part	ial residual
Does the model (\$	e partial residual model (4c) fit worse 3d)? No, −2ΔLL(df=6) = 3.38, p =.76	e than the part	ial scalar
No inva The res	riance-related modification indices r idual variances at the end of Model	emain, so we 4c are shown	are done! on the left.

Next is structural invariance.

4c UNSTANDARDIZED FINAL MEASUREMENT INVARIANCE SOLUTION

				r	Two-Tailed					Two-Tailed
		Fetimato	с F	Fet /S F	P-Valuo		Estimato	C F	Fet /S F	P-Valuo
		Locimate	0.0.	LSC./J.L.	rvalue		Estimate	0.1.	LSC./S.L.	rvalue
TIME1 B	Y					Means (FACT	OR MEAN AT TIME1 F	'IXED=0 FOR	IDENTIFICAT	ION)
V1T1		3.214	0.259	12.409	0.000	TIME1	0.000	0.000	999.000	999.000
V2T1		1.945	0.200	9.735	0.000	TIME2	0.295	0.081	3.654	0.000
V3T1		1,983	0.196	10.094	0.000	TIME3	0.520	0.092	5,668	0.000
V4T1		1.913	0.219	8.741	0.000					
V5T1		0.987	0.138	7.154	0.000	Intercepts	- V3 AND V6 ARE H	OLDING THIS	TOGETHER W	ITTH TIME1
V6T1		1,470	0.123	11.975	0.000	V1T1	16.089	0.275	58.597	0.000
		1.1.0	0.120	11.070	0.000	V1T2	16 418	0 283	58 056	0 000
TTME2	BY					V1T3	16 418	0 283	58 056	0 000
V1T2		2 644	0 230	11 473	0 000	v2r1	8 675	0.200	29 523	0.000
V112 V2T2		1 9/5	0.200	9 735	0.000	V2T1 V2T2	9 416	0.254	35 991	
VZIZ V2T2		1 002	0.200	10 004	0.000	V212 V2T2	9.410	0.202	35 001	0.000
VJIZ V/m2		1 012	0.190	0 7/1	0.000	VZIJ 12001	9.410 11 050	0.202	53.991 52.170	0.000
V412 V502		1.913	0.219	0./41	0.000	VJII	11.950	0.225	53.170	0.000
V D'TZ		0.90/	0.100	1.1.075	0.000	V JTZ	11.950	0.225	53.170 E2 170	0.000
V 612		1.4/0	0.123	11.9/5	0.000	V3T3	11.950	0.225	53.170	0.000
						V4T1	-3.024	0.266	-11.352	0.000
TIME3	BY					V4112	-3.750	0.298	-12.565	0.000
V1T3		2.644	0.230	11.473	0.000	V4T3	-3.750	0.298	-12.565	0.000
V2T3		1.945	0.200	9.735	0.000	V5T1	-1.213	0.131	-9.275	0.000
V3T3		1.983	0.196	10.094	0.000	V5T2	-1.803	0.207	-8.720	0.000
V4T3		1.913	0.219	8.741	0.000	V5T3	-1.803	0.207	-8.720	0.000
V5T3		0.987	0.138	7.154	0.000	V6T1	-2.851	0.160	-17.815	0.000
V6T3		1.470	0.123	11.975	0.000	V6T2	-2.851	0.160	-17.815	0.000
						V6T3	-2.851	0.160	-17.815	0.000
TIME1	WITH									
TIME2		0.843	0.078	10.745	0.000	Residual Va	ariances - ITEM VA	RIANCE THAT	IS NOT THE	FACTOR
TIME3		0.683	0.124	5.505	0.000	V1T1	0.285	0.342	0.831	0.406
						V1T2	0.539	0.233	2.316	0.021
TIME2	WITH					V1T3	0.539	0.233	2.316	0.021
TIME3		0.692	0.126	5.489	0.000	V2T1	8.562	1.004	8.526	0.000
						V2T2	5.592	0.502	11.132	0.000
*** Residu	al covaria	nces amono	r same item	across time	2 ****	V2T3	5.592	0.502	11.132	0.000
		-				V3T1	2.312	0.271	8.534	0.000
V1T1 W	ТТН					V3T2	2.312	0.271	8.534	0.000
V1T2		-0 165	0 230	-0 716	0 474	V3T3	2 312	0 271	8 534	0 000
V1T2 V1T3		0 014	0 212	0 066	0 948	V010 V4T1	7 139	1 043	6 842	0.000
VIIJ		0.011	0.212	0.000	0.910	V4T2	6 686	0 870	7 684	
V1T2	លកកម					V1T2	6 606	0.070	7.004	0.000
× ۲۲۱ س۲	VV T T T T	0 153	0 230	0 667	0 505	V413 V5m1	0.000 1 970	0.070	/.004 / 070	0.000
VIIJ		0.100	0.230	0.00/	0.303	V511 V502	1.029	U.440 1 /FF	*.0/0	0.000
•••••	•					VOTZ VEMO	4.705	1.400	2.233	0.001
Manal company		DIANCE NE	mTMD1 1 DO			VOT3	2.908	0.749	3.881 7 120	0.000
variances	(FACTOR VA	KIANCE AT	TIMEI=I FO	K IDENTIFICA	ATION)	VOTI	1.064	0.233	7.138	0.000
TIMEI		1.000	0.000	999.000	999.000	V 6'T'2	0.957	0.136	/.039	0.000
'TIME2		1.159	0.186	6.231	0.000	V6T3	0.957	0.136	/.039	0.000
TIME3		0.934	0.151	6.171	0.000					
1						1				

## STRUCTURAL INVARIANCE TESTS

Model 5a. l	Factor Varia	<u>nce Invar</u> ia	nce Model		Model 6a. Factor Covariance Invariance N					e Model
MODEL: ! Model 5a: 1	MODEL: ! Model 5a: Factor Variance Invariance					MODEL: ! Model 6a: Factor Covariance Invariance				
(rest of code before	e and after	is same as	4c)		(rest of	code before and after is same as 5a)				
<pre>Model 5a: Factor Variance Invariance (all fixed to 1 now) Time101 Time201 Time301;</pre>					<pre>! Model 6a: Factor Covariance Invariance (all fixed equal) Time1 Time2 Time3 WITH Time1* Time2* Time3* (Fcov);</pre>					
MODEL FIT INFORMATIO	ON				MODEL FI	T INFORMATI	ON			
Number of Free Para	meters		52		Number of	f Free Para	ameters		50	
Loglikelihood					Loglikel	ihood				
H0 Value			-4441.238			H0 Value			-4443.654	
H0 Scaling	g Correction	Factor	1.5848			H0 Scalin	ng Correcti	lon Factor	1.5649	
for MLR						for MLR	ξ			
H1 Value			-4284.045			H1 Value			-4284.045	
H1 Scaling	g Correction	Factor	1.2029			H1 Scalin	ng Correcti	lon Factor	1.2029	
IOI MLR	-				Trafarmat	IOI MLR	-			
Information criteria	a TC)		0006 175		informat.	Nicciler (A	a toto		0007 200	
AKAIKE (A.	IC) (DIC)		0142 274			Akaike (A	(DIC)		0120 172	
Bayesian Comple Civ	(DIC)	DIC	9143.374			Bayesian Comple Ci	(BIC)	d DTC	9130.172	
sample-size	2e Adjusted n + 2) / 24)	BIC	0910.199			sampre-sr	(n + 2) / 2		09/9.92/	
Chi-Square Test of N	Model Fit				Chi-Squa	re Test of	Model Fit			
Value	noder ite		297 152*		CIII DQuu	Value	nouce ric		297 568	*
Degrees of	f Freedom		137			Degrees c	f Freedom		139	
P-Value	I IICCUOM		0 0000			P-Value			0 0000	
Scaling Co	orrection Fa	ctor	1.0580			Scaling C	Correction	Factor	1.0728	
for MLR						for MLR	ξ			
RMSEA (Root Mean Squ	uare Error O	f Approxima	ation)		RMSEA (R	oot Mean Sc	quare Erroi	Of Appro	ximation)	
Estimate			0.088			Estimate	-		0.087	
90 Percent	t C.I.		0.074	0.102		90 Percen	nt C.I.		0.073	0.101
Probabilit	ty RMSEA <=	.05	0.000			Probabili	ty RMSEA <	<= .05	0.000	
CFI/TLI	-				CFI/TLI		-			
CFI			0.908			CFI			0.909	
TLI			0.897			TLI			0.900	
SRMR (Standardized H	Root Mean Sq	uare Residu	ual)		SRMR (Standardized Root Mean Square Residual)					
Value	-		0.100			Value		-	0.100	
Does the factor varian model (4c)? No, −2∆LL	<b>ice model (5</b> a) _(df=2) = 1.84,	) fit worse th p =.40	an the partia	al residual	Does the model (5a	factor covar a)? No, −2∆L	riance mode L(df=2) = 2.3	<b>el (6a) fit w</b> o 32, <i>p</i> =.31	orse than the f	actor variance
Factor Covariances.					FACTOR CO	OVARIANCES	FROM MODEI	6a (REPR	ESENT CORREL	ATIONS):
TIME1 WITH					TIME1 WI	TH TIME2	0.724	0.053	13.748	0.000
TIME2	0.778	0.042	18.375	0.000	TIME1 WI	TH TIME3	0.724	0.053	13.748	0.000
TIME3	0.713	0.087	8.214	0.000	TIME2 WI	TH TIME3	0.724	0.053	13.748	0.000
TIME2 WITH					FACTOR M	EANS FROM M	MODEL 6a (F	REPRESENT	MEAN DIFFERE	NCES):
TIME3	0.662	0.095	6.929	0.000	TIME	1	0.000	0.000	999.000	999.000
					TIME	2	0.284	0.079	3.605	0.000
					TIME	3	0.520	0.091	5.700	0.000

#### Model 7a. Factor Mean Invariance Model





#### 6a UNSTANDARDIZED FINAL STRUCTURAL INVARIANCE SOLUTION

Two-Tailed				Two-Tailed					
	Estimate	S.E.	Est./S.E.	P-Value		Estimate	S.E.	Est./S.E.	P-Value
TIME1 BY					Means (FACTOR	MEAN AT TIME1 FIXE	ED=0 FOR	IDENTIFICATI	ON)
V1T1	3.229	0.243	13.272	0.000	TIME1	0.000	0.000	999.000	999.000
V2T1	1.993	0.170	11.754	0.000	TIME2	0.284	0.079	3.605	0.000
V3T1	2.029	0.169	12.022	0.000	TIME3	0.520	0.091	5.700	0.000
V4T1	1.939	0.214	9.077	0.000					
V5T1	0.986	0.147	6.701	0.000	Intercepts -	V3 AND V6 ARE HOLI	DING THIS	TOGETHER WI	TH TIME1
V6T1	1.508	0.109	13.821	0.000	<b>V1T1</b>	16.099	0.271	59.420	0.000
-					V1T2	16.428	0.281	58.488	0.000
TIME2 BY					V1T3	16.428	0.281	58,488	0.000
V1T2	2.704	0.232	11.677	0.000	V2T1	8,681	0.292	29.694	0.000
V2T2	1 993	0 170	11 754	0 000	V2T2	9 423	0 259	36 368	0 000
V3T2	2 029	0 169	12 022	0 000	V2T2 V2T3	9 423	0.259	36 368	0.000
V312 V4T2	1 939	0.105	9 077	0.000	V213 V3m1	11 956	0.200	53 706	0.000
V H I Z V 5 T 2	1.555	0.214	6 701	0.000	V3T1 V3T2	11 956	0.223	53 706	0.000
V J I Z V G T 2	1 500	0.147	12 021	0.000	V J I Z	11 056	0.223	53.700	0.000
V012	1.300	0.109	13.021	0.000	VJIJ V/m1	-2 019	0.223	-11 462	0.000
					V4II V4II	-3.018	0.203	10 704	0.000
TIMES BY	0 704	0 0 0 0 0	11 (77	0 000	V412	-3.737	0.292	-12.784	0.000
V1T3	2.704	0.232	11.6//	0.000	V4T3	-3.737	0.292	-12.784	0.000
V2T3	1.993	0.170	11./54	0.000	V5T1	-1.210	0.131	-9.269	0.000
V3T3	2.029	0.169	12.022	0.000	V5T2	-1.791	0.203	-8.807	0.000
V4T3	1.939	0.214	9.077	0.000	V5T3	-1.791	0.203	-8.807	0.000
V5T3	0.986	0.147	6.701	0.000	V6T1	-2.847	0.159	-17.889	0.000
V6T3	1.508	0.109	13.821	0.000	V6T2	-2.847	0.159	-17.889	0.000
					V6T3	-2.847	0.159	-17.889	0.000
TIME1 WITH									
TIME2	0.724	0.053	13.748	0.000	Residual Var	iances - ITEM VARIA	ANCE THAT	IS NOT THE	FACTOR
TIME3	0.724	0.053	13.748	0.000	V1T1	0.351	0.331	1.060	0.289
					V1T2	0.562	0.231	2.432	0.015
TIME2 WITH					V1T3	0.562	0.231	2.432	0.015
TIME3	0.724	0.053	13.748	0.000	V2T1	8.506	0.999	8.511	0.000
					V2T2	5.563	0.494	11.261	0.000
*** Residual cov	variances among s	same item	across time	3 ****	V2T3	5.563	0.494	11.261	0.000
	-				V3T1	2.288	0.269	8.507	0.000
V1T1 WITH					V3T2	2.288	0.269	8.507	0.000
V1T2	-0.106	0.225	-0.471	0.638	V3T3	2,288	0.269	8.507	0.000
V1T3	0.038	0.215	0.175	0.861	V4T1	7.134	1.041	6.853	0.000
	0.000	0.210	0.170	0.001	V4T2	6.694	0.873	7.666	0.000
V1T2 WTTH					V4T3	6 694	0 873	7 666	0.000
V1T2	0 130	0 243	0 534		V5T1	1 825	0.446	4 092	0.000
0 593	0.130	0.245	0.004		V5T2	4 705	1 454	3 235	0.000
0.000					V5T3	2 921	0 752	3 887	0 000
Variances (FACTO	NR VARIANCES CONS		FOUAL)		V6T1	1 656	0 235	7 054	0.000
TTME1				999 000	VOII VGT2	0.942	0 131	7 1 9 9	0.000
	1 000	0.000	000.000	999.000	VUIZ VGDO	0.942	0.101	7 100	0.000
TIMEZ TIMEZ	1.000	0.000	999.000	999.000	V 0.T.2	0.942	0.131	/.108	0.000
TIME3	T.000	0.000	999.000	999.000					

#### Example write-up for these analyses:

The extent to which a confirmatory factor model measuring social functioning (with six observed indicators) exhibited measurement invariance and structural invariance over time (i.e., across three occasions taken at six-month intervals) was examined using Mplus v. 8.1 (Muthén & Muthén, 1998–2017). Robust maximum likelihood (MLR) estimation was used for all analyses; accordingly, nested model comparisons were conducted using the rescaled difference in the model –2LL values as a function of the difference in model degrees of freedom. A configural invariance model was initially specified in which three correlated factors (i.e., the factor at the three occasions) were estimated simultaneously; all factor means were fixed to 0 and all factor variances were fixed to 1 for identification. Residual covariances between the same indicators across occasions were estimated as well. As shown in Table 1, although the configural invariance model had marginal fit, reasonable attempts to improve the fit were unsuccessful. Thus, the analysis proceeded by applying parameter constraints in successive models to examine potential decreases in fit resulting from measurement or structural non-invariance over the three occasions.

Equality of the unstandardized indicator factor loadings across occasions was then examined in a metric invariance model. The factor variance was fixed to 1 at time 1 but was freely estimated at times 2 and 3. All factor loadings were constrained equal across time; all intercepts and residual variances were still permitted to vary across time. Factor covariances and residual covariances were estimated as described previously. The metric invariance model fit significantly worse than the configural invariance model  $-2\Delta LL(10) = 19.14$ , p = .04. The modification indices suggested that the loading of indicator 1 at time 1 was a source of misfit and should be freed. After doing so, the partial metric invariance model fit significantly better than the full metric invariance model,  $-2\Delta LL(1) = 7.16$ , p < .001, and the partial metric invariance model did not fit worse than the configural invariance model $-2\Delta LL(9) = 8.98$ , p = .44. The fact that partial metric invariance (i.e., "weak invariance") held indicates that the indicators were related to the latent factor equivalently across time, or more simply, that the same latent factor was being measured at each of occasion (with the exception of indicator 1, which was more related to the factor at time 1 than at times 2 or 3).

Equality of the unstandardized indicator intercepts across time was then examined in a scalar invariance model. The factor mean and variance were fixed to 0 and 1, respectively, at time 1 for identification, but the factor mean and variance were then estimated at times 2 and 3. All factor loadings and indicator intercepts were constrained equal across time (except for indicator 1 at time 1); all residual variances were still permitted to differ across time. Factor covariances and residual covariances were estimated as described previously. The scalar invariance model fit significantly worse than the partial metric invariance model,  $-2\Delta LL(9) = 55.13$ , p < .01. The modification indices suggested that the intercept of indicator 5 at time 1 was the largest source of the misfit and should be freed. After doing so, although the partial scalar invariance model had significantly better fit than the full scalar invariance model,  $-2\Delta LL(1) = 15.16$ , p < .01, it still fit worse than the partial metric invariance model,  $-2\Delta LL(8) = 27.84$ , p < 001. The modification indices suggested that the intercept of indicator 4 at time 1 was the largest remaining source of the misfit and should be freed. After doing so, although the new partial scalar invariance model (with the intercepts for indicators 1, 4, and 5 freed at time 1) fit significantly better than the previous partial scalar invariance model (without the intercept for indicator 4 freed at time 1),  $-2\Delta LL(1) =$ 9.24, p < .01, it still fit marginally worse than the partial metric invariance model,  $-2\Delta LL(7) = 13.99$ , p = 05. The modification indices suggested that the intercept of indicator 2 at time 1 was the largest remaining source of the misfit and should be freed. After doing so, the new partial scalar invariance model (with the intercepts for indicators 1, 2, 4 and 5 freed at time 1) fit significantly better than the previous partial scalar invariance model (without the intercept for indicator 2 freed at time 1),  $-2\Delta LL(1) = 8.73$ , p < .01, and it did not fit significantly worse than the partial metric invariance model,  $-2\Delta LL(6) = 4.35$ , p = .63. The fact that partial scalar invariance (i.e., "strong invariance") held indicates that times 2 and 3 have the same expected response for each indicator at the same absolute level of the trait, or more simply, that the observed differences in the indicator means between times 2 and 3 is due to factor mean differences only. However, indicators 1 and 2 had a lower expected indicator response at the same absolute level of social functioning at time 1 than at time 2 or 3, while indicators 4 and 5 had a higher expected response.

Equality of the unstandardized residual variances across time was then examined in a residual variance invariance model. As in the partial scalar invariance model, the factor mean and variance were fixed to 0 and 1, respectively, for identification at time 1, but the factor mean and variance were still estimated at times 2 and 3. All factor loadings (except for indicator 1 at time 1), item intercepts (except for indicators 1, 2, 4, and 5 at time 1), and all residual variances (except for indicators 1, 2, 4, and 5 at time 1) were constrained to be equal across groups. Factor covariances and residual covariances were estimated as described previously. The residual variance invariance model fit significantly worse than the last partial scalar invariance model,  $-2\Delta LL(8) = 24.72$ , p < .01. The modification indices suggested that the residual variance of indicator 5 at time 2 versus time 3 was the largest remaining source of the misfit and should be freed. After doing so, the partial residual variance invariance model fit significantly better than the residual invariance model,  $-2\Delta LL(1) = 10.06$ , p < .01, but still fit marginally worse than the last partial scalar invariance model,  $-2\Delta LL(7) = 14.14$ , p = .05. The modification indices suggested that the residual variance of indicator 6 at time 1 was the largest remaining source of the misfit and should be freed. After doing so, the new partial residual variance invariance model (with residual variances for indicators 1, 2, 4, 5, and 6 free at time 1; indicator 5 free at times 2 and 3 also) fit significantly better than the partial residual invariance model (without the residual variance for indicator 6 at time 1 freed),  $-2\Delta LL(1) = 11.20$ , p < .01, and did not fit worse than the last partial scalar invariance model,  $-2\Delta LL(6) = 3.38$ , p = .76. The fact that partial residual variance invariance (i.e., "strict invariance") held indicates that the amount of indicator variance not accounted for by the factor was the same across times 2 and 3 (except for indicator 5, for which there was more residual variance at time 2). However, 5 out of 6 indicators did not have residual variance invariance at time 1 (although this was required because of a lack of metric or scalar invariance for indicators 1, 2, 4, and 5).

After achieving partial measurement invariance as was just described, structural invariance was then tested with three additional models. First, the factor variance at times 2 and 3 (which had been estimated freely) was constrained to 1 (i.e., to be equal to the factor variance at time 1), resulting in a nonsignificant decrease in fit relative to the last partial residual invariance model,  $-2\Delta LL(2) = 1.84$ , p = .40. Thus, equivalent amounts of individual differences in social functioning were found across time. Second, the factor covariances across time were constrained to be equal (which become factor correlations given a variance of 1 for each factor across time), resulting in a nonsignificant decrease in fit relative to the factor variance model,  $-2\Delta LL(2) = 2.32$ , p = .31. Third, the factor means at times 2 and 3 (which had been estimated freely) was constrained to be equal to each other, resulting in a significant decrease in fit relative to the factor covariance invariance model  $-2\Delta LL(2) = 2.32$ , p = .31. Third, the factor means at times 2 and 3 (which had been estimated freely) was constrained to be equal to each other, resulting in a significant decrease in fit relative to the factor covariance invariance model  $-2\Delta LL(1) = 11.15$ , p < .01, indicating that the factor mean at time 3 was significantly higher than at time 2. The factor mean at time 2 was already significantly different from 0 (the factor mean at time 1), and thus, the three factor means were significantly different, increasing over time.

In conclusion, these analyses showed that partial measurement invariance was obtained over time—that is, the relationships of the indicators to the latent factor of social functioning were equivalent at times 2 and 3, although primarily not equivalent at time 1, as previous described. These analyses also showed that partial structural invariance was obtained over time, such that the same amount of individual differences variance in social functioning was observed with equal covariance over time across occasions (i.e., compound symmetry of the latent factor), although the amount of social functioning on average increased significantly over time. Model parameters from the final model are given in Table 2.

Muthén, L. K., & Muthén, B.O. (1998–2017). Mplus User's Guide. Eighth Edition. Los Angeles, CA: Muthén & Muthén.

(see excel worksheet for Table 1; Table 2 would have unstandardized and standardized estimates and their SEs)

You might also replace all the nested model comparisons tests in the text with a table that provides them instead.