

Table 1

Measurement invariance results for different substantive collapsing strategies

Collapsing Strategy	Invariance Test	χ^2	df	p	$\Delta\chi^2$	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA
None	Baseline	5076	432	<.01	.	.	.	.99	.98	.05		
	Equal Loadings	28167	620	<.01	19890	188	<.01	.94	.93	.09	-.048	.047
	Equal Loadings & Thresholds	47935	1184	<.01	22897	564	<.01	.90	.94	.09	-.040	-.005
1 = 0	Baseline	3079	432	<.01	.	.	.	.99	.99	.03		
	Equal Loadings	15051	667	<.01	10165	235	<.01	.96	.96	.07	-.033	.031
	Equal Loadings & Thresholds	18158	902	<.01	4542	235	<.01	.95	.96	.06	-.008	-.004
2 = 1	Baseline	4476	432	<.01	.	.	.	.99	.98	.04		
	Equal Loadings	.	.	.	.	.	.	.	.	.
	Equal Loadings & Thresholds	36558	902	<.01	28268	470	<.01	.92	.93	.09	-.074	.045
3 = 2	Baseline	4449	432	<.01	.	.	.	.99	.99	.04		
	Equal Loadings	31953	667	<.01	23954	235	<.01	.93	.93	.10	-.060	.053
	Equal Loadings & Thresholds	39822	902	<.01	10486	235	<.01	.91	.93	.09	-.017	-.003

Table 2

ANOVA results for substantive collapsing scale information measures

		Differences in Information Measures				
		Comparison	diff	se	t	<i>p</i>
Area		4cat - 3is2	3.077	.107	28.82	<.01
		4cat - 2is1	1.337	.107	12.52	<.01
		4cat - 1is0	2.151	.107	20.15	<.01
Maximum		4cat - 3is2	0.310	.092	3.38	<.01
		4cat - 2is1	0.644	.092	7.00	<.01
		4cat - 1is0	-0.673	.092	-7.33	<.01
Trait Level at Maximum		4cat - 3is2	0.391	.025	15.84	<.01
		4cat - 2is1	-0.113	.025	-4.56	<.01
		4cat - 1is0	-0.267	.025	-10.81	<.01

Note. 4cat = no collapsing; 3is2 = categories 3 and 2 combined; 2is1 = categories 2 and 1

combined; 1is0 = categories 1 and 0 combined. Diff indicates the average difference in value

between compared conditions.

Table 3

Measurement invariance results for infrequent collapsing strategies

Collapsing Strategy	Invariance Test	χ^2	df	p	$\Delta\chi^2$	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA
None	Baseline	968	423	<.01	.	.	.	.99	.98	.05	.	.
	Equal Loadings	3722	653	<.01	2488	230	<.01	.94	.93	.09	-.052	.045
	Equal Loadings & Thresholds	No Convergence										
Collapsed	Baseline	865	423	<.01	.	.	.	.99	.98	.05	.	.
	Equal Loadings	.	.	.	.	.	.	.	.	.	.	.
	Equal Loadings & Thresholds	8400	1297	<.01	7046	874	<.01	.84	.92	.10	-.147	.058

Table 4

Simulation results for substantive collapsing (baseline generating model)

Collapsing Strategy	Condition	Invariance Test	χ^2	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA	Converge
None	4	Baseline	435	423	.38	1.00	1.00	.00	-	-	500
		Equal Loadings	29040	653	<.01	.94	.93	.09	-.06	.09	498
		Equal Loadings & Thresholds	42983	1159	<.01	.91	.94	.08	-.03	-.01	360
3 = 2	3a	Baseline	432	423	.41	1.00	1.00	.00	-	-	500
		Equal Loadings	27832	653	<.01	.94	.93	.09	-.06	.09	500
		Equal Loadings & Thresholds	34068	883	<.01	.92	.94	.09	-.01	.00	498
2 = 1	3b	Baseline	433	423	.39	1.00	1.00	.00	-	-	500
		Equal Loadings	31578	653	<.01	.93	.92	.10	-.07	.09	477
		Equal Loadings & Thresholds	33009	883	<.01	.93	.94	.08	.00	-.01	496
1 = 0	3c	Baseline	442	423	.33	1.00	1.00	.00	-	-	500
		Equal Loadings	11594	653	<.01	.96	.96	.06	-.04	.05	459
		Equal Loadings & Thresholds	14866	883	<.01	.95	.96	.06	-.01	.00	500
0 vs. 1-3	2a	Baseline	432	423	.41	1.00	1.00	.00	-	-	500
		Equal Loadings & Thresholds	20891	607	<.01	.94	.93	.08	-.06	.08	500
0 & 1 vs. 2 & 3	2b	Baseline	439	423	.36	1.00	1.00	.00	-	-	500
		Equal Loadings & Thresholds	7709	607	<.01	.97	.97	.05	-.03	.05	428
0-2 vs. 3	2c	Baseline	450	423	.27	1.00	1.00	.00	-	-	500
		Equal Loadings & Thresholds	2538	607	<.01	.99	.99	.02	-.01	.02	117

Table 5

Simulation results for substantive collapsing (slope equality generating model)

Collapsing Strategy	Condition	Invariance Test	χ^2	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA	Converge
None	4	Baseline	440	423	.33	1.00	1.00	.00	-	-	500
		Equal Loadings	709	653	.15	1.00	1.00	.00	.00	.00	500
		Equal Loadings & Thresholds	20346	1159	<.01	.96	.97	.06	-.04	.05	500
3 = 2	3a	Baseline	437	423	.36	1.00	1.00	.00	-	-	500
		Equal Loadings	735	653	.07	1.00	1.00	.00	.00	.00	500
		Equal Loadings & Thresholds	10482	883	<.01	.98	.98	.05	-.02	.04	500
2 = 1	3b	Baseline	438	423	.36	1.00	1.00	.00	-	-	500
		Equal Loadings	6215	653	<.01	.99	.99	.04	-.01	.04	500
		Equal Loadings & Thresholds	11264	883	<.01	.98	.98	.05	-.01	.01	500
1 = 0	3c	Baseline	445	423	.30	1.00	1.00	.00	-	-	500
		Equal Loadings	11163	653	<.01	.96	.96	.06	-.04	.05	500
		Equal Loadings & Thresholds	13621	883	<.01	.96	.97	.05	-.01	.00	500
0 vs. 1-3	2a	Baseline	435	423	.39	1.00	1.00	.00	-	-	500
		Equal Loadings & Thresholds	671	607	.11	1.00	1.00	.00	.00	.00	500
0 & 1 vs. 2 & 3	2b	Baseline	441	423	.33	1.00	1.00	.00	-	-	500
		Equal Loadings & Thresholds	6925	607	<.01	.98	.97	.04	-.02	.04	424
0-2 vs. 3	2c	Baseline Equal Loadings & Thresholds	450 2416	423 607	.23 <.01	1.00 .99	1.00 .99	.00 .02	- -.01	- .02	500 112

Note. **Bold** = artifactually poorer fit due to collapsing. **Bold italic** = artifactually better fit due to collapsing.

Table 6

Substantive collapsing simulation scale information ANOVA results

Data Simulation Model													
		<i>Baseline generating model</i>				<i>Slope equality generating model</i>				<i>Slope and threshold equality generating model</i>			
4 Categories compared to:	Condition	diff	se	t	p	diff	se	t	p	diff	se	t	p
Total scale information (area under the curve)*													
3 = 2	3a	0.22	0.01	25.61	<.01	0.22	0.01	26.21	<.01	0.23	0.01	25.95	<.01
2 = 1	3b	0.05	0.01	5.30	<.01	0.05	0.01	5.47	<.01	0.05	0.01	6.01	<.01
1 = 0	3c	0.23	0.01	26.42	<.01	0.23	0.01	26.93	<.01	0.23	0.01	26.83	<.01
0 vs. 1-3	2a	0.55	0.01	63.40	<.01	0.55	0.01	64.92	<.01	0.56	0.01	64.70	<.01
0 & 1 vs. 2 & 3	2b	0.52	0.01	60.58	<.01	0.52	0.01	61.85	<.01	0.54	0.01	61.89	<.01
0-2 vs. 3	2c	0.49	0.01	56.20	<.01	0.49	0.01	57.42	<.01	0.50	0.01	57.28	<.01
Scale information at maximum*													
3 = 2	3a	0.11	0.01	13.50	<.01	0.10	0.01	13.01	<.01	0.10	0.01	11.24	<.01
2 = 1	3b	0.09	0.01	11.13	<.01	0.09	0.01	11.41	<.01	0.10	0.01	11.75	<.01
1 = 0	3c	0.06	0.01	7.10	<.01	0.05	0.01	6.97	<.01	0.05	0.01	5.58	<.01
0 vs. 1-3	2a	0.32	0.01	40.43	<.01	0.30	0.01	38.67	<.01	0.31	0.01	36.78	<.01
0 & 1 vs. 2 & 3	2b	0.26	0.01	33.54	<.01	0.26	0.01	33.80	<.01	0.26	0.01	29.96	<.01
0-2 vs. 3	2c	0.19	0.01	23.65	<.01	0.18	0.01	23.45	<.01	0.18	0.01	20.67	<.01
Latent trait value at maximum													
3 = 2	3a	0.37	0.03	11.88	<.01	0.39	0.03	11.25	<.01	0.34	0.03	11.01	<.01
2 = 1	3b	-0.10	0.03	-3.28	0.04	-0.06	0.03	-1.69	0.62	-0.15	0.03	-4.78	<.01
1 = 0	3c	-0.27	0.03	-8.73	<.01	-0.28	0.03	-8.05	<.01	-0.31	0.03	-10.08	<.01
0 vs. 1-3	2a	0.81	0.03	26.00	<.01	0.83	0.03	24.00	<.01	0.77	0.03	24.86	<.01
0 & 1 vs. 2 & 3	2b	0.06	0.03	1.89	0.49	0.06	0.03	1.82	0.53	0.01	0.03	0.29	1.00
0-2 vs. 3	2c	-0.55	0.03	-17.73	<.01	-0.55	0.03	-15.89	<.01	-0.60	0.03	-19.41	<.01

Note. *Outcome is transformed to natural log to better approximate a normal distribution.

Table 7

Simulation results for infrequent collapsing (baseline generating model)

Collapsing Strategy	Condition	Invariance Test	χ^2	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA	Converge
None	4	Baseline	431	423	.42	1.00	1.00	0.01	-	-	497
		Equal Loadings	3531	653	<.01	0.94	0.94	0.09	-0.06	0.09	447
		Equal Loadings & Thresholds	5624	1159	.00	0.91	0.94	0.09	-0.03	-0.01	166
3 = 2	3a	Baseline	429	423	.44	1.00	1.00	0.01	-	-	499
		Equal Loadings	3411	653	<.01	0.94	0.93	0.09	-0.06	0.08	331
		Equal Loadings & Thresholds	4389	883	<.01	0.92	0.94	0.09	-0.02	0.00	388
2 = 1	3b	Baseline	429	423	.44	1.00	1.00	0.01	-	-	499
		Equal Loadings	3727	653	<.01	0.93	0.93	0.10	-0.07	0.09	390
		Equal Loadings & Thresholds	4295	883	<.01	0.93	0.94	0.09	-0.01	-0.01	329
1 = 0	3c	Baseline	475	423	.32	1.00	1.00	0.01	-	-	498
		Equal Loadings	1954	653	<.01	0.96	0.96	0.06	-0.04	0.05	78
		Equal Loadings & Thresholds	2611	883	<.01	0.94	0.96	0.06	-0.01	0.00	390
0 vs. 1-3	2a	Baseline	430	423	.43	1.00	1.00	0.01	-	-	500
		Equal Loadings & Thresholds	2656	607	<.01	0.94	0.93	0.08	-0.06	0.07	353
0 & 1 vs. 2 & 3	2b	Baseline	433	423	.41	1.00	1.00	0.01	-	-	500
		Equal Loadings & Thresholds	1444	607	<.01	0.97	0.96	0.05	-0.03	0.05	81
0-2 vs. 3	2c	Baseline	446	423	.30	1.00	1.00	0.01	-	-	499
		Equal Loadings & Thresholds	957	607	<.01	0.98	0.98	0.03	-0.02	0.02	43

Table 8

Simulation results for infrequent collapsing (slope equality generating model)

Collapsing Strategy	Condition	Invariance Test	χ^2	df	p	CFI	TLI	RMSEA	Δ CFI	Δ RMSEA	Converge
None	4	Baseline	433	423	0.40	1.00	1.00	0.01	-	-	497
		Equal Loadings	669	653	0.37	1.00	1.00	0.01	0.00	0.00	497
		Equal Loadings & Thresholds	3345	1159	<.01	0.96	0.97	0.06	-0.04	0.05	489
3 = 2	3a	Baseline	430	423	0.43	1.00	1.00	0.01	-	-	500
		Equal Loadings	669	653	0.38	1.00	1.00	0.01	0.00	0.00	500
		Equal Loadings & Thresholds	1994	883	<.01	0.98	0.98	0.05	-0.02	0.04	495
2 = 1	3b	Baseline	432	423	0.41	1.00	1.00	0.01	-	-	499
		Equal Loadings	1201	653	<.01	0.99	0.99	0.04	-0.01	0.03	496
		Equal Loadings & Thresholds	2133	883	<.01	0.97	0.98	0.05	-0.01	0.01	496
1 = 0	3c	Baseline	470	423	0.33	1.00	1.00	0.01	-	-	497
		Equal Loadings	1854	653	<.01	0.96	0.96	0.06	-0.04	0.05	402
		Equal Loadings & Thresholds	2399	883	<.01	0.95	0.96	0.06	-0.01	0.00	489
0 vs. 1-3	2a	Baseline	431	423	0.42	1.00	1.00	0.01	-	-	500
		Equal Loadings & Thresholds	621	607	0.38	1.00	1.00	0.01	0.00	0.00	496
0 & 1 vs. 2 & 3	2b	Baseline	433	423	0.40	1.00	1.00	0.01	-	-	500
		Equal Loadings & Thresholds	1322	607	<.01	0.97	0.97	0.05	-0.03	0.04	247
0-2 vs. 3	2c	Baseline	445	423	0.30	1.00	1.00	0.01	-	-	499
		Equal Loadings & Thresholds	927	607	<.01	0.98	0.98	0.03	-0.02	0.02	67

Note. **Bold** = artifactually poorer fit due to collapsing. **Bold italic** = artifactually better fit due to collapsing.

Table 9

ANOVA results for infrequent collapsing scale information measures

		Data Simulation Model											
		Baseline generating model				Slope equality generating model				Slope and threshold equality generating model			
4 Categories compared to:	Condition	diff	se	t	p	diff	se	t	p	diff	se	t	p
Total scale information (area under the curve)*													
3 = 2	3a	0.22	0.01	17.89	<.01	0.22	0.01	17.71	<.01	0.23	0.01	17.21	<.01
2 = 1	3b	0.05	0.01	3.84	.01	0.05	0.01	3.86	<.01	0.05	0.01	4.14	<.01
1 = 0	3c	0.22	0.01	17.87	<.01	0.22	0.01	17.63	<.01	0.23	0.01	17.21	<.01
0 vs. 1-3	2a	0.55	0.01	43.97	<.01	0.55	0.01	43.67	<.01	0.56	0.01	42.58	<.01
0 & 1 vs. 2 & 3	2b	0.52	0.01	41.80	<.01	0.52	0.01	41.30	<.01	0.54	0.01	40.55	<.01
0-2 vs. 3	2c	0.47	0.01	37.93	<.01	0.47	0.01	37.49	<.01	0.48	0.01	36.40	<.01
Scale information at maximum*													
3 = 2	3a	0.10	0.02	4.44	.01	0.10	0.03	3.91	.02	0.09	0.03	3.29	.06
2 = 1	3b	0.08	0.02	3.65	.03	0.09	0.03	3.52	.03	0.10	0.03	3.65	.03
1 = 0	3c	0.04	0.02	1.60	.63	0.03	0.03	1.35	.73	0.02	0.03	0.92	.87
0 vs. 1-3	2a	0.30	0.02	13.08	<.01	0.28	0.03	11.43	<.01	0.29	0.03	10.51	<.01
0 & 1 vs. 2 & 3	2b	0.23	0.02	10.09	<.01	0.23	0.03	9.18	<.01	0.22	0.03	7.90	<.01
0-2 vs. 3	2c	0.12	0.02	5.23	.04	0.11	0.03	4.65	.07	0.09	0.03	3.34	.23
Latent trait value at maximum													
3 = 2	3a	0.34	0.04	8.60	<.01	0.35	0.04	8.65	<.01	0.32	0.04	8.39	<.01
2 = 1	3b	-0.08	0.04	-2.16	0.37	-0.05	0.04	-1.27	.74	-0.11	0.04	-2.96	.15
1 = 0	3c	-0.26	0.04	-6.73	<.01	-0.27	0.04	-6.57	<.01	-0.29	0.04	-7.60	<.01
0 vs. 1-3	2a	0.75	0.04	19.23	<.01	0.77	0.04	18.80	<.01	0.74	0.04	19.02	<.01
0 & 1 vs. 2 & 3	2b	0.05	0.04	1.21	0.80	0.05	0.04	1.24	.80	0.02	0.04	0.42	.98
0-2 vs. 3	2c	-0.50	0.04	-12.72	<.01	-0.50	0.04	-12.27	<.01	-0.54	0.04	-14.05	<.01

Note. *Outcome is transformed to natural log to better approximate a normal distribution.