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Higher Order Invariance and Age Comparisons in Depression, Neuroticism, and Anxiety

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Nesselroade and colleagues (Nesselroade, 2007; Nesselroade, Gerstorf, Hardy, & Ram, 2007; Nesselroade & Estabrook, 2008) proposed an alternative conception of factor invariance that retains key elements of the traditional metric invariance view but also is designed to accommodate idiosyncrasy. This proposal involves using factor loadings as a filter for idiosyncratic features of the manifest variables while constraining the intercorrelations among the latent variables to be invariant across individuals, subgroups, or other units. This moves the locus of invariance to a higher level of analysis (e.g., second-order factors). In this approach, the second-order factors may take the meaning and interpretation usually reserved for first-order factors in more traditional invariance models.

The purpose of the present study is to apply the higher-order invariance conception to prominent measures of depression, neuroticism, and anxiety across age-defined subgroups rather than across repeatedly-measured individuals. 2,490 participants from eight studies carried out from 2005 to 2007 by the Salthouse laboratory, measured on the Center for Epidemiological Studies - Depression scale (CES-D), the State-Trait Anxiety Inventory (STAI-Trait), and the Neuroticism dimension of the NEO Personality Inventory. This data was split by age into two (N=1272, 1218), three (N=830, 817, 843) or four groups (N=633, 639, 601, 617) for the purposes of testing different types of invariance models. A six-factor confirmatory solution (1 Neuroticism Factor, 2 Anxiety Factors and 3 Depression Factors) is fit to the data, with constraints made to establish and compare higher order invariance through idiographic filtering (factor intercorrelation matrices equal across groups) to configural, weak, strong and strict factorial invariance models, defined by constraints described by Meredith (1993).

Model comparison shows the idiographic filter model to provide superior fit to the data than either the traditional or null models in both absolute and parsimony-adjusted metrics, most notably in the four-group model. These results have both substantive and methodological implications. There are apparent but small differences in factors across these groups, indicating that age differences in depression, anxiety and neuroticism cannot be expressed simply as functions of changes in the constructs. Future work will expand the data analysis to include additional affective measures, provide information on the higher-order structures and show where and how these groups differ over the lifespan.

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Table 1

Fit Statistics for Invariance Models

Two-Group	χ^2	df	$\Delta\chi^2$	Δ df	p	CFI	AIC	RMSEA
Configural	9273.55	2216				0.873	240235.82	0.051
Weak	9604.75	2312	331.20	96	<.001	0.869	240375.02	0.051
Strong	10001.24	2356	727.69	140	<.001	0.863	240683.51	0.052
Strict	10897.16	2406	1623.61	190	<.001	0.847	241479.43	0.054
Idiographic	9305.96	2231	32.41	15	0.006	0.873	240238.23	0.051
Three-Group	χ^2	df	$\Delta\chi^2$	Δ df	p	CFI	AIC	RMSEA
Configural	10387.85	3324				0.872	239354.78	0.051
Weak	11094.11	3516	706.26	192	<.001	0.862	239677.04	0.052
Strong	11770.94	3604	1383.10	280	<.001	0.852	240177.87	0.053
Strict	13084.86	3704	2697.01	380	<.001	0.830	241291.79	0.056
Idiographic	10433.13	3354	45.29	30	0.036	0.871	239340.06	0.051
Four-Group	χ^2	df	$\Delta\chi^2$	Δ df	p	CFI	AIC	RMSEA
Configural	11981.33	4432				0.866	239489.06	0.053
Weak	12784.51	4720	803.18	288	<.001	0.857	239716.24	0.053
Strong	13611.10	4852	1629.77	420	<.001	0.845	240278.83	0.055
Strict	15006.19	5002	3024.87	570	<.001	0.822	241373.93	0.058
Idiographic	12034.05	4477	52.73	45	0.200	0.866	239451.79	0.053

Note. Model fit statistics for a confirmatory factor analysis of measures of neuroticism, anxiety and depression. Likelihood ratio tests ($\Delta\chi^2$) compare all models to the configural invariance model, in which all other models are nested.