



Study 3

Self- versus Peer-report Data: Is a Three-mode Factor Analysis Required?

Source:

Bentler, P. M. & Lee, S-Y. (1978). Statistical aspects of a three-mode factor analysis model. *Psychometrika*, 43,(3), 343-333.

Aim of Bentler & Lee's study:

Testing a derivative of Tucker's (1966) three-mode model for decomposing three-way data observations. "The model represents more than a mathematical exercise since it can be shown to be applicable to real data in the three-mode context as well as being, conceptually, a generalization of two-mode factor analysis" (p. 344).

Method:

First, the study deals with the test statistics and with developing a computer program to implement the basic mathematical theory. For illustration, rating data were used from self- and peer-reporting.

Procedure:

Four variables were used: ambition, attractiveness, leadership, and extraversion. Seventy-two subjects were asked to describe themselves using bipolar adjectives and short phrases.

Each variable represents a composite score computed across 20 items. Friends of the subjects were asked to describe each subject using the same items (peer report).

Table 1

Input for factor analysis:

1
.223 1
.337 .418 1
.223 .290 .693 1
.402 .070 .226 .210 1
.035 .442 .251 .219 .233 1
.160 .196 .603 .639 .379 .314 1
.093 .180 .451 .645 .269 .283 .582 1

For names of variables, see Tables 2 and 3

Eigenvalues:

3.42	1.16	1.13	0.09	0.47	...
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Varimax results

Table 2

Varimax loadings:

	F1	F2	F3	F4	Informant	Objective
1	.091	.889	.029	.285	Self-report	ambition
2	.181	.347	.811	.211	Self-report	attractiveness
3	.755	.397	.251	.062	Self-report	leadership
4	.891	.159	.111	.002	Self-report	extraversion
5	.153	.277	.069	.885	Peer-report	ambition
6	.142	-.198	.843	.330	Peer-report	attractiveness
7	.793	-.007	.134	.328	Peer-report	leadership
8	.792	-.150	.107	.245	Peer-report	extraversion
%	33.8	15.3	18.5	14.9		

Varimax F1 is interpreted as leadership and extraversion, which makes sense since dominance attributes are generally considered as components of extraversion.

Varimax F2 is interpreted as ambition if self-reported. This restrictive condition is questionable. What about pee-reported ambition?

Varimax F3 is attractiveness, either self- or peer-reported, matching the Varimin result (see below).

Varimax F4 is ambition if peer-reported. This again is a questionable restriction.

Criticism:

Only two of four Varimax factors make sense, two factors are questionable. A general factor (brought out by Varimin, see below) is not manifested statistically. The variance due to mode of report (self vs. peer) is not manifested statistically.

Varimin results

Table 3

Varimin loadings:

	F1 g	F2 Ambition (+) vs Other Features (-)	F3 Attrac- tiveness (-) vs Personality (+)	F4 Self-report (-) vs Peer-report	Informant	Objective
1	.608	.502	.237	-.445	Self-report	ambition
2	.628	-.319	-.455	-.391	Self-report	attractiveness
3	.644	-.401	.353	-.306	Self-report	leadership
4	.538	-.523	.511	-.087	Self-report	extraversion
5	.658	.481	.233	.411	Peer-report	ambition
6	.630	-.275	-.515	.375	Peer-report	attractiveness
7	.587	-.371	.454	.257	Peer-report	leadership
8	.463	-.474	.435	.304	Peer-report	extraversion
%	35.7	18.2	17.0	11.5		

Varimin F1 is a general factor with large positive loadings across all variables, for self- as well as peer-report. F1 is presumably due to 'acquiescence' and/or 'social desirability', i.e., response sets attributable to the subjects' as well as their friends' (peers) rating behavior.

Varimin F2 is a bipolar factor for self- and peer-report, interpretable as ambition vs. "other features." The other features are extraversion, leadership, and attractiveness. Ambition seems to differ from the other three variables in some way (not necessarily in a contrastive way).

Varimin F3 is a bipolar factor interpretable as 'attractiveness' vs. other features. The other features are personality traits; attractiveness cannot be conceived as a personality trait. The authors noticed, for different reasons, though, that attractiveness has different functions: "Attractiveness is not a particularly good indicator of either dimension."

Varimin F4 is a bipolar factor distinguished by sign are self-and peer-report. Apparently, the peer-report introduced some extra variance. Without comparing in detail the self- and peer-ratings, one cannot know in which way the two samples of raters differed (perhaps by leniency or familiarity with judgmental objects).

Table 4

Minimal pairs :

Bold numbers are loadings of pairs of variables for one focal factor. Non-bold numbers are loadings of paired variables for non-focal factors						
Var. no.	F1 g	F2 Ambition (+) vs Other Features (-)	F3 Attrac- tiveness (-) vs Personality (+)	F4 Self-report (-) vs Peer-report (+)	Self- or Peer-report	Trait Variables
1	.608	.502	.237	-.445	Self-repo	ambition
4	.538	-.523	.511	-.087	Self-repo	extraver
5	.658	.481	.233	.411	Peer-repo	ambition
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Comments on minimal pair comparison:

- F1: No minimal pairs are useful
- F2: Ambition is considerably different from extraversion.
- F3: Attractiveness is not an attribute of personality as is extraversion and leadership.
- F4: Peer-report differs from self-report to a notable degree.

In sum:

Varimin factors are sufficiently interpretable, while Varimax-factors are not; they remain obscure. Varimin reveals an expected general factor (F1) and an easily conceivable mode of judgment factor (F4). Varimax rotation does not reveal these factors.

The model of the three-mode factor analysis by Bentler & Lee, an extravagant factorial model, avoids the insufficiencies of simple structure modeling without improving its result considerably, if at all.