



## Study 9

### Factorial Structures of Bipolar Dimensions.

#### Source:

Watson, D. (1988). The vicissitudes of mood measurement: Effects of varying descriptions, time frames, and response formats on measures of positive and negative affect. *Journal of Personality and Social Psychology*, 55(1), 128-121.

#### Aim of Watson's study:

Watson investigates the effects of various methodical conditions on the factorial representation of scales assessing positive and negative affect: Effects of response format on measures of Positive Affect (PA) and Negative Affect, NA, and this is a point of departure for the present reanalysis. PA and NA measures from six different questionnaires were used (see sources below) that were administered either using the 'extent' format or the 'frequency' format.

In the 'extent' format, subjects were asked to indicate 'to what extent have you felt this way (happy, depressed, proud, restless, bored, upset...)' using the following five options:

- 1 very slightly or not at all
- 2 a little
- 3 moderately
- 4 quite a bit
- 5 very much

In the 'frequency' format, four options were provided:

- 1 little or none of the time
- 2 some of the time
- 3 a good part of the time
- 4 most of the time

The results in summary were, as expected, that "the two-factor structure is robust across the two different rating formats, and highly convergent NA and PA factors emerge regardless of whether an extent or frequency format is used. Nevertheless, the data also suggest that frequency-format ratings will produce a slightly stronger 'Pleasantness-Unpleasantness' factor.

## Aim of the present reanalysis by Varimin:

Watson's finding stirs up a fundamental problem of studies using rating data. The problem is due, in my view, to methodological (response format) conditions: The problem may be condensed by asking, "Why do all or nearly all factorial studies on dimensions of attitudes, feelings, evaluative and other qualitative judgments end up with two-dimensional solutions even though ordinary conceptual treatment of such phenomena leads us to expect uni-dimensional, however bipolar, results with polarities such as 'short' vs. 'long,' which are polar opposites of the dimension 'length' and 'warm' vs. 'cold' as polar opposites of 'temperature' etc-, etc?"

Conventional factorial analyses of data, all simple-structure oriented, that 'should have' revealed single bipolar dimensions actually did deliver, as a rule, two orthogonal (independent) dimensions, as the following examples show:

Affects (moods): F1 positive, F2 negative affect (assessed with the PANAS scale, Watson & Tellegen, 1988).

Sex role perception (androgyny): F1 masculinity, F2 Femininity (with BSRI, Bem, 1974).

Future orientation: F1 optimism, F2 pessimism ( assessed by LOT, the Life Orientation Test, Scheier & Carver, 1985)

Political behaviour: F1 left-wing-revolutionary, F2 right-wing-conservative (Weisberg, 1980).

In view of such results, the psychological and social research community tends to believe that these F1 vs. F2 opposites are actually independent. Von Schur & Kies (1994) objected to such conclusions, vehemently pointing at methodological reasons: In the authors' view, the culprit is factor analysis. "*The identification of two factors, when one factor is expected, is an artifact caused by using factor analysis on data...*" (p. 97). Data with reasonably bipolar structure, the authors contend, are apt to be analysed by the 'unfolding' technique introduced by Coombs (1964). They also refer to criticisms of Bentler (1969) and Hamilton (1968), who "suggested independently that the factorial result, deviating from ordinary expectancy, might be due to response style..." and to 'acquiescence' in particular.

Instead of switching the modeling of data from factor analysis to the unfolding technique, which is von Schuur's suggestion, I take the chance to reanalyze Watson's two data sets, one based on extent rating data and the other on frequency rating data, in order to compare the results and expecting to uncover indications of the presumed response style effect.

## Method:

The subjects (N = 338) used 54 descriptors of positive and negative mood as listed and composed in Tables 2 and 3. They rated their mood as experienced in the 'past few weeks.' Tables 1A (extent format data) and 1B (frequency format data) show intercorrelations of the variables used.

Table 1A .  
Data obtained by four-point frequency format

Correlations: Input for PCA 1  
 .47 1  
 .39 .74 1  
 .50 .86 .77 1  
 .52 .82 .77 .91 1  
 .48 .73 .67 .76 .77 1  
 -.13 -.17 -.12 -.26 -.25 -.28 1  
 -.25 -.16 .06 -.25 -.25 -.23 .46 1  
 -.13 -.10 -.02 -.22 -.22 -.18 .41 .75 1  
 -.28 -.26 -.17 -.37 -.38 -.34 .53 .75 .76 1  
 -.27 -.27 -.14 -.37 -.37 -.32 .53 .79 .77 .93 1  
 -.28 -.25 -.13 -.33 -.34 -.33 .47 .78 .81 .84 .86 1

For the names of the 12 variables, see Tables 2 and 3.

Eigenvalues:

5.93 3.15 0.75 0.64 0.35 ...

Table 1B.  
Data obtained by five-point rating scales of the extent format

Correlations, Input for PCA:

1  
 .77 1  
 .64 .68 1  
 .81 .82 .78 1  
 .79 .77 .74 .92 1  
 .72 .72 .63 .78 .81 1  
 -.48 -.38 -.33 -.51 -.57 -.54 1  
 -.37 -.28 -.14 -.40 -.45 -.48 .77 1  
 -.40 -.32 -.25 -.44 -.46 -.43 .72 .72 1  
 -.54 -.44 -.39 -.61 -.62 -.61 .82 .78 .77 1  
 -.55 -.44 -.40 -.61 -.62 -.59 .80 .75 .74 .93 1  
 -.50 -.41 -.37 -.55 -.57 -.56 .77 .77 .77 .85 .87 1

For names of variables, see Tables 2 and 3.

Eigenvalues:

7.69	2.17	0.41	0.33	0.28	...
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Procedure of data analysis and results:

Watson subjected the correlations to PCA and rotated the initial solution to simple structure (Varimax). His summary of results stated this: *“In summary, the two-factor structure is robust across the two different rating formats and highly convergent NA and PA factors emerge regardless of whether an extent or frequency format is used. Nevertheless the data also suggest that frequency-format ratings will produce a slightly stronger Pleasantness-Unpleasantness factor which in turn may lead to more inversely related PA and NA scores [of the frequency factor]”* (pg. 137).

Varimax results

Watson did not tabulate the results of his Varimax analysis. He merely described them partially after visual inspection.

Table 2

Varimax-rotated loadings of factors:

	Extent format		Frequency format		Variables
	F1 Positive Affect	F2 Negative Affect	F1 Positive Affect	F2 Negative Affect	
01	-.19	<b>.59</b>	-.30	<b>.83</b>	Negative Affect Scales Bradburn (1969) (5 items) 1) PANAS (10 items) Stone et al. (1985) (5 items) Diener & Emmons 1 (1984) (5 items) Diener & Emmons 2 (1984) (6 items) Mc Adams & Constantian (1981) (?items)
02	-.09	<b>.91</b>	-.17	<b>.88</b>	
03	.05	<b>.88</b>	-.09	<b>.86</b>	
04	-.21	<b>.92</b>	-.33	<b>.90</b>	
05	-.21	<b>.92</b>	-.38	<b>.86</b>	
06	-.20	<b>.84</b>	-.39	<b>.78</b>	
07	<b>.60</b>	.16	<b>.85</b>	-.28	Positive Affect Scales Bradburn (1969) (5 items) PANAS (10 items) Stone et al. (1985) (8 items) Diener & Emmons 1 (1984) (4 items) Diener & Emmons 2 (1984) (6 items) Mc Adams & Constantian (1981) (? items)
08	<b>.89</b>	.06	<b>.89</b>	-.12	
09	<b>.88</b>	.02	<b>.85</b>	-.17	
10	<b>.91</b>	.21	<b>.88</b>	-.35	
11	<b>.93</b>	.19	<b>.87</b>	-.36	
12	<b>.91</b>	.18	<b>.87</b>	-.30	
%	38.4	37.2	42.1	40.1	1) Variables for the frequency format taken from Warr et al. (1983) based on Bradburn.
	Sum = 75.7		Sum = 82,1		

Varimax factor interpretation:

F1 reveals large positive loadings of **positive** affect variables for extent as well as frequency format data.

F2 reveals large positive loadings of **negative** affect variables for extent as well as frequency format data.

The loadings of variables of frequency format data are not systematically different from corresponding loadings of extent format data.

Criticism:

As expected, Varimax gives rise to two orthogonal factors. Thus, affect with positive and negative content are ostensibly independent. Watson's result that *"the frequency-format ratings will produce a slightly stronger Pleasantness-Unpleasantness factor"* does not become convincingly manifested. His evidence for this conclusion is based on arbitrarily selected singular correlations.

Varimin results

Table 3

Varimin-rotated loadings of factors:

	Extent Format		Frequency Format		Variables
	F1 Affect	F2 Resp. Set	F1 Affect	F2 Resp. Set	
01	<b>-0.55</b>	.28	<b>-0.80</b>	.37	Negative Affect Scales
02	<b>-0.71</b>	.57	<b>-0.74</b>	.51	
03	<b>-0.59</b>	.66	<b>-0.67</b>	.54	
04	<b>-0.80</b>	.51	<b>-0.87</b>	.40	
05	<b>-0.80</b>	.50	<b>-0.88</b>	.34	
06	<b>-0.73</b>	.45	<b>-0.83</b>	.27	
07	.53	.31	.80	.41	Positive Affect Scales
08	.67	.69	.71	.55	
09	.64	.61	.72	.48	
10	.79	.50	.87	.37	
11	.79	.52	.87	.36	
12	.77	.52	.83	.40	
					Variables for the frequency format taken from Warr et al. (1983) based on Bradburn.
%	<b>49.4</b>	<b>26.2</b>	<b>64.1</b>	<b>18.1</b>	
	Sum = 75.7		Sum = 82.1		

#### Interpretation of Varimin factors:

A predominant F1 factor with bipolar loadings for affect variables is present for the extent as well as frequency format data. Two particular observations deserve attention:

(1) Loadings of the affect dimension F1 are considerably larger for frequency format data than for extent format data.

(2) Loadings of factor F2 are considerably smaller for frequency format data than for extent format data.

This makes sense by assuming that F2 variance is an effect of response set variance that is diminished under the frequency format condition so that more F1 variance can be manifested under the frequency condition

#### Conclusion:

For both samples, those with extent and frequency format questions, F2 is a general factor (g), i. e., a factor with only positive loadings and little variance across variables. The contribution of g-factors to explained variance is, thus, not necessarily larger than that of non-g factors.

Second, the fact, now observed, that the percentage of explained variance of g-factors may be affected by manipulating response format (by an 'assigned' response bias as it were) allows the conclusion that g-factors of rating data might generally be interpreted, partly or perhaps even fully under certain conditions, as manifestations of response bias that are unrelated to the objectives that participants are asked to rate for whatever attributes.

Watson's comparison of results from content and frequency data was not guided by hypotheses or expectancies. His contention that "*stronger NA-PA correlations were observed when a frequency ... rating format was used*" (p. 139) might fit with looking at selected correlations. However, the main difference between 'extent' and 'frequency' formats seems to be that an application of frequency categories for ratings forces the participants, more or less, to use quantitative, i. e., somewhat more precise concepts ("some of the time," "most of the time," etc.) even though still without numerical precision.

In other words, an attitude of increased precision and accurateness is probably induced by the frequency format, and this attitude of increased precision apparently suffices to diminish, or even to preclude an attitude of unaccountable negligence, which is probably prevalent with an ascribed extent format ("slightly," "moderately," "very much," etc.). An extent format allows response sets, such as acquiescence, to become effective and to raise contributions to g-factors, particularly in cases when g factors cannot easily be also interpreted as due to psychological or other behavior-relevant variables.

References:

Bem, S. L. (1974) The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*, 115-162.

Bentler, P. M. (1969) Semantic space is (approximately) bipolar. *The Journal of Psychology, 71*, 33-40.

Coombs, C. H. (1964) *A Theory of Data*. New York: Wiley.

Hamilton, D. (1968). Personality attributes associated with extreme response style. *Psychological Bulletin, 69*, 192-203.

Scheier, M. F. & Carver, C. S. (1985). Optimism, coping, and health. Assessment and implications for generalized outcome expectancies. *Health Psychology, 4*, 219-247.

van Schuur, W. H. & Kiers, H. A. L. (1994) Why factor analysis often is the incorrect model for analyzing bipolar concepts, and what model to use instead. *Applied Psychological Measurement, 18*(1), 97-110

Watson, D. & Tellegen, L. A. (1985). Toward a consensual structure of mood. *Psychological Bulletin, 98*, 219-235.

Weisberg, H. F. (1980). A multidimensional conceptualization of party identification. *Political Behavior, 2*, 33-60.