Study 2

Reflection-Impulsivity: Does Varimin Reveal MTMM Components?

Source:

Smith, I. L. & Singer, S. (1977). Multitrait-multimethod analysis of reflection-impulsivity. *Educational and Psychological Measurement, 37*, 929-937

Aim of Smith & Singer's study:

Smith & Singer (SS) aim at validating the theory of Reflection-Impulsivity (RI) advanced by Kagan et al. (1964). R-I is a proposed trait responsible for exerting a person's intellectual resources by either more speed of activity (spending less time for finding solutions, "impulsivity") or more accuracy (less errors among solutions, "reflection").

Method:

SS applied two measures: M1 that was either the Matching Familiar Figures Test (MFFT) or the Kansas Reflection-Impulsivity Scale (KRIP); M2 that was the Test of Reflection-Impulsivity in Social Content (TRISC). In addition, a Classroom Reflection-Impulsivity Scale (CRIRS) was administered. M1 and M2 were tasks of moderate difficulty for participants; they were tasks at which they could spend more or less time to find a solution. The variables scored were response time to the first selection and the total number of errors. The scale TRISC were presented to teachers of participants for rating their inclination for reflection and impulsivity by statements such as "typically works quickly, makes few mistakes, etc.". Scores for Impulsivity were 1= quick decision time, 2=slow decision time; scores for Reflection were 1 = few errors, 2 = many errors.

Procedure:

115 children of educable mentally retarded classes (6.5-12 years) were used as participants. The teachers' assessments for Reflection-Impulsivity assessment showed variance . The data were analyzed by applying Campbell & Fiske's (1959) MTMM, i.e., differential visual comparisons of intercorrelations. Factor analysis was not applied.

Table 1

Input for applying factor analysis (Table 1 of source):

```
 1
-.21  1
 .60 -.35   1
-.40 .56 -.36   1
 .11 -.17 .21 .00  1
-.04 .33 -.25 .29  -.20  1
```

Eigenvalues:

```
2.45 1.11 1.02 0.67 9.45  …
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Varimax results (see Table 2)

The following Varimax results have been obtained by recalculation.

Varimax F1 loadings are large for the Time variables of the R-I test; all other variables have inconspicuous F1 loadings.

Varimax F2 loadings are large for the Error variables of the R-I test; all other variables have inconspicuous F2 loadings.

Varimax F3 has one large loading only for the teachers' Time ratings.

Varimax F4 has one large loading only for the teachers' Error ratings.

Table 2

Varimax loadings:

	F1 Time R-I Test1		F2 Error R-I Test2		F3 Time Teacher		F4 Error Teacher	
1	**.905**		-.162		.019		.085	Time R-I-Test 1
2	-.084		**.882**		-.182		.171	Error R-I-Test 1
3	**.829**		-.174		.160		-.234	Time R-I-Test 2
4	-.324		**.806**		.147		.148	Error R-I-Test 2
5	.084		-.038		**.977**		-.092	Time Teacher rating
6	-.046		.171		-.093		**.970**	Error Teacher rating
%	27.1		25.2		17.4		17.7	

Criticism:

The designers of R-I-tests considered the relative proportion of time and error variables as measures for Reflection-Impulsivity. The Varimax result engenders high loadings for two individual variables measuring test time (F1, Test 1 and Test 2) and two for errors (F2, Test 1 and Test 2). The teachers' time and error ratings are also associated with separate factors (F3 and F4). The actual interaction of sources of variance is not revealed.

Varimin results
Table 3

Varimin loadings:

	F1 R-I		F2 Effort		F3 Balanced components		F4 Test vs. teacher	
1	.511		.539		.431		-.341	Time R-I-Test 1
2	.679		-.299		.421		-.346	Error R-I-Test 1
3	.698		.266		.304		-.385	Time R-I-Test 2
4	.583		-.543		.402		-.025	Error R-I-Test 2
5	.596		-.464		.445		.451	Time: Teacher ratings
6	.612		.471		.477		.398	Error: Teacher ratings
	37.9		19.7		17.4		12.4	

Table 4

Minimal pairs :

	Bold numbers represent loadings of pairs of variables for one focal factor. Non-bold numbers represent loadings of the paired variables for non-focal factors				
Var. No.	F1 R-I	F2 Effort	F3 g	F4 Test vs. Teacher (Error)	
1	.511	.539	.431	-.341	Time R-I-Test 1
2	-.679	-.299	.421	-.346	Error R-I-Test 1
1	.511	.539	.431	-.341	Time R-I-Test 1
5	.596	-.464	.445	.451	Time: Teacher ratings
2	-.679	-.299	.421	-.346	Error R-I-Test 1
6	-.612	.471	.477	.451	Error Teacher ratings

Comments on minimal pair comparisons:

F1: The bipolar outcome for Time vs. Error with Test 1 (and Test 2) is conspicuous.

F2: The polarity of Objective Time vs. Time ratings by teachers is noticeable.

F3: This factor (a g-factor) seems to represent the children's variance of general intelligence which should be apparent in their objective test results as well as in their teachers' ratings.

F4: The polarity of objective errors vs. teacher ratings of errors is noticeable.

In sum:

The Varimax result from this study is at variance with various expectations, while Varimin results generally meet them. Varimin thus masters multitrait-multimethod (MTMM) data; Varimax fails with such data. Particular procedures that have been proposed for analyzing MTMM data seem to be unnecessary and less efficient.