A FACTOR ANALYTIC APPROACH TO IMPULSE
AS MEASURED BY ARROW DOT I, *Q*, AND SORT[1]

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Summary.—The Arrow Dot Impulse, Porteus Maze *Q*, and S-O Rorschach Test were given to 180 Ss. These three measures of impulse were intercorrelated and found to be independent of each other. The above measures were factored along with a measure of intelligence, the MMPI Lie Scale and a direction following test. All impulse tests were independent of intelligence, and only the AD I loaded on a factor resembling direction following ability. It is suggested that the impulse measures not be used interchangeably.

The practice of naming tests for the traits they are purported to measure has frequently resulted in such tests, named for a specific trait, being used interchangeably. The power of common trait names among tests leads to expectations that these tests are measuring a common factor. Unfortunately, the history of measurement indicates little justification for such faith.

One example of this confusion is in the area of impulse measurement. Three such measures are: the IES Impulse score (Dombrose & Slobin, 1958a, 1958b), the Porteus Maze *Q* score (Porteus, 1959), and certain parts of the S-O Rorschach Test (SORT; Stone, 1958). The purposes of this investigation were to relate the IES Arrow Dot to other measures of impulse, to determine the level of communality among these measures and to identify their relationship to outside variables such as age, anxiety, intelligence, and ability to follow direction.

METHOD

Measures

The IES Test was constructed as a projective measure with simplified objective scoring. It has four subparts, each measuring Impulse (I), Ego (E), and Superego (S) functions. The most promising section of the test is the Arrow Dot subtest (AD) which has a reliability of .84 (Rankin & Johnston, 1962) and has been found to discriminate between college students and delinquents (Rankin & Wikoff, 1964). Golias and Roback (1965) report that this measure is capable of differentiating institutionalized female delinquents and female adolescents institutionalized in a mental hospital.

In brief, the AD presents graphic problems in which the subject draws a line from an arrow to a dot goal without breaking barriers, as defined by the instructions. Solid bars must not be crossed, lines may be crossed if there is no

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other access to the dot. Much of the power of the test comes from the subject's response to dashed lines, which are not covered by the instructions. Impulse is scored when subjects go through bar barriers or across solid lines when alternate routes are present. Either following directions or going between the spaces in dashed lines represents ego control, while avoiding these gaps and approaching the dot by an unnecessarily long route represents superego control. These responses are suggested by its authors to be indicative of the subjects' behavior in real life. Although the above interpretations seem logical, the investigator hypothesized that AD might be related to simpler concepts of following direction, degree of intelligence, or anxiety.

The following tests were chosen for comparison with IES in an attempt to define the impulse factor. Because factorial identification is not achieved by the haphazard inclusion of handy variables in a matrix (Guilford, 1959, p. 532), the specific reasons for their inclusion will be mentioned.

The Brown-Carlsen Listening Comprehension Test (Brown & Carlsen, 1955) was constructed "to measure the ability of students to comprehend spoken language" (p. 1). The total Brown-Carlsen (BC) score includes immediate recall; following directions, in which the subject follows verbally administered orders; recognition of transients; recognizing word meaning; and lecture comprehension scores. This test was included because it is a reliable measure of following directions ($r = .90$; Brown & Carlsen, 1955). It was hypothesized that impulse, as defined by breaking forbidden barriers in AD, might be related to an ability to comprehend and obey instructions. This test correlates .72 with verbal ability (Brown & Carlsen, 1955) thus its utility in identifying a factor is reduced unless a separate verbal intelligence test is included in the matrix. Along with the total score, the lecture comprehension test was included because of its published high reliability and its utility in the factorial identification of listening ability.

The Porteus Maze was constructed as an impulse test designed to differentiate between delinquents and normals, thus it could be expected to show some relationship to the AD. The Q score is based on a subject's disobeying instructions and crossing lines. This procedure indicates a direction-following component. Like the AD, the Porteus Q has been reported capable of differentiating between delinquents and normals in the study used to validate the original purpose of the instrument (Grajales, 1948).

The S-O Rorschach Test (Stone, 1958) is a group projective test in which standard Rorschach blots are shown on a screen; the subject responds by marking multiple response categories. Stone (1958) states the SORT includes measures of activity potential (M), structuring (F), rigidity (S), impulsivity ($F - /F$), and anxiety (Fch). If $F - /F$ is an impulse score of the same structure as Porteus Q and AD, it could be hypothesized that it is related to AD and Porteus Q, while S, or rigidity, should be negatively correlated with them. This

follows, if it is considered that a rigid personality should not be impulsive. Activity potential should be positively related to impulse, while SORT anxiety (*Fcb*) may be negatively related to impulse.

The Educational Testing Service's Verbal Factor Test V3 (ETS V3) is a pure-factor, timed, multiple-choice test similar in appearance to most standardized verbal scales. It was included to identify any contamination contributed by verbal ability or intelligence as defined by verbal ability.

The Taylor Manifest Anxiety Scale (TMAS; Taylor, 1953) was included because of its frequent empirical relation to measures of neuroticism.

The MMPI Lie Scale is normally given as a check on the validity of the TMAS, and it was further postulated that a tendency to lie would be positively correlated with impulse score.

Age was included as a variable because previous research (Rankin & Johnston, 1962) indicated that age was related to impulse, with older female subjects being more impulsive than males and younger females. It was thus speculated that the other impulse factors might be related to age.

Subjects

Two-hundred and fifty students in five introductory psychology classes were given three sets of tests at approximately 1-wk. intervals. Test set 1 was composed of the TMAS, MMPI *L*, and ETS V3. Set 2 included the BC, AD, and the Porteus Maze *Q*. Set 3 was a presentation of the SORT. In all, 190 subjects were present for all three sessions. For ease of data handling, 10 male subjects were discarded randomly to balance the *N*s at 90 males and 90 females.

Test Administration

The procedures outlined in the respective publications were followed exactly for the TMAS, MMPI Lie, ETS V3, and BC. The group version of the AD was employed, following the suggestions of Johnston (1963). A special modified form of the Porteus Maze *Q* was utilized in which the eight standard Vineland Revision mazes from years 7 to adult were stapled into packets. This provides only one Maze per year, even if errors are made in execution and the subjects can re-trace after error. Thus, the *Q* score in this study does not follow prescribed administration, however, while few execution errors occur, many qualitative errors do. This procedure reduces the information available for evaluation; however, Porteus states that first and second maze performances can be matched and that "the individual pattern of behavior is established in 80% of individuals on the first and last three-quarters of an inch they draw in tracing each maze" (Porteus, 1959, p. 161). The scoring system as described by Porteus was applied to the available information. With an *N* of 177, odd-even reliability for the over-all *Q* was determined to be .82 corrected. There is no easily available comparison for individually administered test reliability, but this figure is in line with the other impulse measures.

RESULTS AND DISCUSSION

Table 1 presents the correlations, mean and standard deviations for all variables. The most surprising finding in this table is the low intercorrelation among the impulse variables. Certain hazards of interpretation lie in this table since there are auto-correlations among the IES variables, the Brown-Carlsen subtests, and among the SORT subscores.

Table 2 represents the pertinent product-moment correlations between the AD I test and the other variables. For the total group, it is interesting to note that the other two impulse tests do not significantly correlate with I.

The lack of an I × age correlation is unexpected in light of the *r* found by Rankin and Johnston (1962). This is perhaps a result of the smaller age variance in the present sample [*SD* = 1.78 vs 11.98 in the Rankin and Johnston work (1962)]. The low but significant negative correlation between following direction and I supports the hypothesis that the AD I test may be saturated with a lack of ability to follow directions. In an attempt to better understand these interrelationships, a factor analysis following the U.C.L.A. Biomedical BMD03M 7040 conversion, utilizing varimax rotation with unity in the diagonal, was employed. In an attempt to reduce false factors generated by the experimental dependence among I, E, and S on the AD, only AD I and those SORT components not included in the *F* — /*F* score were included. Only following directions and lecture comprehension were included from the Brown-Carlsen to eliminate auto-correlations that would occur if the total score was included. The variables included for factor analysis were: Porteus Maze *Q*, Arrow Dot Impulse, Brown-Carlsen E (lecture comprehension) and D (directions), MMPI Lie, TMAS, ETS V3, SORT *W*, *S*, *M*, *Fch*, and *F* — /*F*. Each of these fulfills the requirement of experimental independence. Age was dropped because of its almost complete lack of correlation with other variables.

The resultant rotated factors and their communalities are presented in Table 3. The seven factors are clear in their structure, if not in their interpretation.

Factor I is a verbal fluency factor identified by ETS V3 and the two Brown-Carlsen scores. The fact that the ETS V3 and the BC scores load on the same factor is further confirmation of the high verbal IQ × BC correlation reported by Brown and Carlsen (1955). This verbal saturation would lead to the speculation that the BC would not be appropriate in situations in which one compares low IQ delinquents with normals.

Factor II is a strong SORT *W* and *Fch* factor. These tests tap theoretical and anxiety dimensions. It is of minor interest to note that if this is a theoretical factor, it is a non-verbal theoretical one, as seen from the low ETS V3 saturation. Further, SORT anxiety has no TMAS saturation.

Factor III is a SORT impulse factor defined by a negative *S* (rigidity) loading and a positive *F* — /*F* (impulse) loading. This factor is unique and the other impulse tests do not load on it.

TABLE 1

PEARSONIAN CORRELATIONS AMONG VARIABLES AND ASSOCIATED MEANS AND STANDARD DEVIATIONS ($n = 180$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	M	SD
1*		-03	-06	12	-12	-21	-08	-13	-04	-13	-02	17	03	-08	00	00	19	10	05	17	04	-06	-06	-02	00	07	19.37	1.78
2			-03	-08	14	-03	02	-13	-06	-08	-08	-06	04	-14	07	07	-02	13	29	19	61	69	71	50	27	61	26.26	16.89
3				-74	21	-24	-11	-27	02	04	-12	-04	-11	-03	-08	-08	13	-08	02	12	-08	-11	06	-04	-01	-04	1.79	2.28
4					-81	17	05	26	00	05	12	00	-15	10	04	07	-10	-05	-06	-18	-03	02	-17	08	-05	-04	19.73	3.78
5						-05	03	-14	-02	04	-08	-03	-11	-12	01	-04	04	09	06	16	11	07	19	-08	-08	09	1.48	2.60
6							73	77	-09	-12	60	10	05	02	-03	06	-11	-03	-07	-16	-03	02	03	-09	-05	00	53.31	7.27
7								36	-07	-11	51	08	01	-01	-01	06	-07	03	-11	-04	-07	04	10	-05	-02	02	14.02	2.83
8									-07	-10	41	21	05	00	-13	03	06	-09	-13	-29	-05	-05	-09	-04	-09	-08	14.93	2.92
9										-16	-04	-03	-02	-02	11	-07	04	06	02	-10	-14	-07	-02	04	10	-13	3.30	1.90
10											-07	01	-01	05	03	-01	-09	-02	-01	00	-07	-16	01	-05	-06	-02	17.78	8.13
11												18	08	-04	-11	13	-10	-03	-05	-18	-13	-02	04	-19	-06	-02	37.84	9.46
12													-02	-39	-36	02	45	07	-02	-06	-02	-06	-01	-06	04	-15	30.56	5.74
13														33	04	-10	05	-24	-02	-10	06	11	-06	09	-04	00	13.13	2.85
14															-07	-32	-27	-78	-06	04	-13	-04	-17	06	-11	-09	28.77	4.45
15																-03	-20	61	04	-02	08	04	03	-01	13	04	11.74	4.02
16																	-39	22	08	-03	-01	10	05	05	-05	16	9.91	3.34
17																		09	-06	01	02	01	-01	05	08	-16	17.67	3.87
18																			10	-03	14	06	15	-10	17	10	90.23	22.74
19																				21	21	11	09	02	41	21	1.14	1.75
20																					16	08	16	-13	21	08	.29	0.58
21																						52	14	21	04	41	3.68	4.37
22																							20	23	14	31	4.64	5.34
23																								07	13	39	8.88	9.36
24																									08	40	6.27	4.97
25																										03	.98	1.20
26																											.43	0.81

Note.—$r = .18$ at $p_{.05}$; $r = .21$ at $p_{.01}$; decimals omitted in correlations.

*1, *S*'s age; 2, Porteus *Q*; 3, Arrow Dot I; 4, Arrow Dot E; 5, Arrow Dot S; 6, Brown-Carlsen Total; 7, Lecture Comprehension; 8, Follow Directions; 9, MMPI Lie; 10, Taylor MAS; 11, ETS Vocabulary 3; 12, SORT *W*; 13, SORT *S*; 14, SORT *F*; 15, SORT *F*—; 16, SORT *M*; 17, SORT *Fcb;* 18, SORT *F—/F*; 19, Porteus *Q* First Third; 20, Porteus *Q* Last Third; 21, Cut Corners; 22, Crossed Lines; 23, Pencil Lifts; 24, Wavy Lines; 25, Wrong Direction; 26, Error in No. 7.

TABLE 2

AD CORRELATIONS WITH VARIABLES IN MATRIX

Test	r with AD I	Test	r with AD I
Porteus Q	−.03	SORT W	.04
Brown-Carlsen E	−.11	SORT S	−.11
Brown-Carlsen D	−.27*	SORT M	−.08
MMPI L	−.02	Fcb	.13
TMAS	.04	F — /F	−.08
ETS V3	−.12		

*$p = .01$ $(n = 180)$.

Factor IV is an almost pure TMAS factor with the predictable negative lie score loading. The almost complete lack of impulse saturation on this dimension indicates that these impulse tests are free from dependence upon a neuroticism-anxiety dimension.

Factor V is of the most interest to this investigation. It is best defined as the IES AD I factor. Its independence of the other impulse measures follows the general trend, while the negative saturation contributed by the BC Direction Test coupled with its independence of ETS V3 indicates that AD I is perhaps related to a non-intellectual following of directions.

Factor VI is the Porteus Maze Q factor which also has a light SORT saturation. The relative independence of this factor from ETS V3 saturation is further support for Porteus's contention that Maze Q is not related to an intellectual function.

Factor VII is a SORT Fcb factor, free from W as found in Factor II.

Factor VIII is a residual.

TABLE 3

ROTATED FACTOR MATRIX

Test	Factor								b^a
	I	II	III	IV	V	VI	VII	VIII	
Porteus Maze Q	−.04	−.03	.02	−.01	−.01	.42	−.04	−.01	.18
Arrow Dot I	−.11	.06	.07	.01	.51	−.05	.07	−.01	.29
Brown-Carlsen E	.72	−.02	.05	−.01	−.08	.08	.02	−.02	.53
Brown-Carlsen D	.47	.19	−.07	.00	−.37	−.20	.00	−.13	.45
MMPI Lie	−.07	−.01	.01	−.41	.03	−.07	.03	.09	.20
TMAS	−.12	−.03	.00	.38	.06	−.12	−.03	.12	.20
ETS V3	.69	.08	−.09	−.01	−.09	−.11	−.17	.03	.54
SORT W	.14	.69	.05	.05	.01	−.06	−.03	.00	.51
SORT S	.03	.02	−.50	−.02	−.10	.06	.05	.05	.27
SORT M	.09	−.09	.19	.06	−.08	.10	−.61	.00	.44
Fcb	−.07	.61	.01	−.11	.07	.03	.40	.00	.56
F — /F	−.02	.12	.43	−.08	−.03	.23	−.14	.11	.30

There are three major results from this analysis. First, three measures (the AD I, Porteus Maze Q, and SORT $F - /F$) have been called "impulse" tests. In spite of the common name given to these three measures, low correlations are found among them and they do not saturate on a common "impulse" factor. In fact, they are so remarkably independent of each other it is suggested that the term "impulse" be used with great care.

In identifying what these "impulse" tests measure, it is noted that they are free from verbal and anxiety dimensions. The AD I has a significant relationship to following directions. The three measures are quite specific, which will make their eventual identification easier. This independence of the three "impulse" measures, while leading to a problem in definition, does give rise to interesting assessment possibilities because Porteus Maze Q and the AD I have been found capable of differentiating between delinquents and non-delinquents. With two different measures capable of assessing delinquency, the prospects are good that a combined measure will be more predictive. The addition of the $F - /F$ score might increase the power of such a predictor if this measure is shown to be predictive in such situations. Research is proceeding in this direction.

REFERENCES

BROWN, J. I., & CARLSEN, G. R. *Brown-Carlsen Listening Comprehension Test.* New York: Harcourt, Brace, & World, 1955.

DOMBROSE, L. A., & SLOBIN, M. S. The IES Test. *Percept. mot. Skills,* 1958, 8, 347-389. (a)

DOMBROSE, L. A., & SLOBIN, M. S. *The IES Test.* Missoula, Mont.: Psychological Test Specialists, 1958. (b)

FRENCH, J. W., EKSTROM, R. B., & PRICE, L. A. *Manual for Kit of Reference Tests for Cognitive Factors.* Princeton: Educational Testing Service, 1963.

GOLIAS, G. A., & ROBACK, H. B. IES Arrow-Dot performance of institutionalized delinquents and adolescent patients in a mental hospital. *Percept. mot. Skills,* 1965, 21, 561-562.

GRAJALES, M. L. Porteus Qualitative Maze Test as a measure of delinquency. Unpublished doctoral dissertation, Fordham Univer., 1948.

GUILFORD, J. P. *Psychometric methods.* New York: McGraw-Hill, 1959.

JOHNSTON, J. O. A group version of the IES Test. Unpublished master's thesis, Oklahoma State Univer., 1963.

PORTEUS, S. D. *The maze test and clinical psychology.* Palo Alto, Calif.: Pacific Books, 1959.

RANKIN, R. J., & JOHNSTON, J. O. Influences of age and sex on the IES Test. *Percept. mot. Skills,* 1962, 15, 775-778.

RANKIN, R. J., & WIKOFF, R. L. The IES Arrow-Dot performance of delinquents and nondelinquents. *Percept. mot. Skills,* 1964, 18, 207-210.

STONE, J. B. *S-O Rorschach Test.* Los Angeles: California Test Bureau, 1958.

TAYLOR, J. A. A personality scale of manifest anxiety. *J. abnorm. soc. Psychol.,* 1953, 48, 285-290.