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ABSTRACT

The field dependency/independency construct (FDI) was measured using tests of perception of the upright such as the Rod and Frame Test (RFT) and tests of cognitive restructuring such as the Hidden Figures Test (HFT); relationships between cognitive restructing and perception of the upright were investigated. High school seniors received 34 tests including 12 measures of FDI. Analysis of the data using multidimensional scaling, cluster analysis, and factor analysis resulted in five dimensions including two associated with the FDI measures. One of the FDI dimensions measured cognitive restructuring which involved unfamiliar geometric shapes (e.g., Find a Shape Puzzle, Raven Progressive Matrices) and generation of novel representations of the material (e.g., Paper Folding, Paper Form Block, Block Design). The other FDI dimension, related to perception of the upright, was labeled familiar field and was postulated to measure strategy selection in familiar situations. (Author/RL)

The Field Dependence-Independence Construct: Some, One, or None

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Abstract

The field dependency/independency construct (FDI) has been measured using tests of perception of the upright such as the Rod & Frame Test (RFT) and tests of cognitive restructuring such as the Hidden Figures Test (HFT). The relationships between cognitive restructuring and perception of the upright was investigated. High school seniors received 34 tests including 12 measures of FDI. Analysis of the data using multidimensional scaling, cluster analysis, and factor analysis resulted in five dimensions including two associated with the FDI measures. One of the FDI dimensions measured cognitive restructuring; the other, related to perception of the upright, was labeled familiar field and is postulated to measure strategy selection in familiar situations.

The Field Dependence-Independence Construct

Interest in the field dependence/independence (FDI) construct is currently widespread. In the past 10 years there has been a proliferation of research in this area (Witkin, et al, Notes 1, 2, 3). FDI has been associated with logical reasoning ability (Pascual-Leone, et. al., 1978; Linn, 1978; Linn and Pulos, Note 9), teacher success (Witkin, Moore, Goodenough and Cox, 1977), learning and memory (Goodenough, 1976), and cultural differences (Wober, 1966). Researchers use many different tests to measure FDI including the Rod and Frame Test (RFT) (Witkin, 1959), Piaget's water level task often called Bottles, (De Avila & Pascual-Leone, 1976), the Embedded Figures Test (EFT) and the Hidden Figures Test (HFT) Gottschaldt, 1926). These tests are quite diverse and often have only moderate overlap. In spite of widespread interest, the construct represented by the various measures of FDI is not well understood. The purpose of this paper is to clarify the relationship among measures of FDI and to consider implications for a construct of FDI.

Background

Witkin developed measures of FDI to measure a personality dimension. Performance tests designed to measure personality characteristics are often counfounded with general reasoning ability: In a performance situation analytic abilities are likely to aid performance, for example, by facilitating understanding of the instructions, or by contributing to speed of processing information. As early as 1960, Cronbach noted, for measures of FDI: "Nearly all performance tests contain an ability component which is irrelevant to the personality trait supposedly examined. Some control for level of ability is therefore required....General reasoning or spatial ability accounts for as much of Embedded Figures performance as does difficulty in handling perceptual interference. Separation of ability from personality factors in problem-solving tests is not easy, and may not be

reasonable to attempt. Embedded Figures correlates .35 to .60 with ability tests such as Block Design, Number Series, and Thurstone's tests of the spatial factor" (pp. 549-550). In spite of this caution, most researchers have assumed that measures of FDI are largely independent of general reasoning ability. Many researchers have further assumed that the measures of general reasoning or spatial ability (such as Block Design) which correlate with Embedded Figures are also measures of the FDI personality dimension (e.g. Case, 1974).

Recently, Witkin and Goodenough (Note 4) addressed the relationship between general reasoning ability and the FDI personality or style dimenstion. They suggested that FDI as commonly referred to is actually two constructs. The note that FDI tests such as RFT measure the personality construct they originally defined better than tests such as Embedded Figures. They indicate that tests such as Embedded Figures overlap with general and spatial ability but that RFT does not.

The FDI construct is difficult to describe because it has changed over the years and has been interpreted differently by different writers. A historical view is helpful. In 1949 Witkin published the Rod and Frame test and defined FDI as a bipolar personality dimension which assesses the individual's tendency to rely on the visual field or the body itself as a source of cues for locating the upright. The book describing Witkin's theory of psychological differentiation appeared in 1962 (Witkin, et. al., 1962). The book identified FDI using tests such as RFT, the Body Adjustment test (BAT) and the Rotating Room Test (RRT). As early as 1959, however, Witkin noted high correlations of RFT, BAT, and RRT with tests such as the EFT and indicated that EFT was also a measure of FDI.

In 1977, Witkin and Goodenough (Note 4) responded to suggestions that RFT and EFT did not always overlap, and when used interchangeably, often generated contradictory findings. They indicated that some overlap exists between measures of perception of the upright and measures of cognitive restructuring but the overlap is not complete. They summarize this position: "The newer evidence reemphasizes

our earlier view that critical to performance on such tests (RFT) is extent of reliance or body or visual field as primary referents, and suggests that the processes involved may be distinct from, though related to, those involved in the solution of an embedded figures problem, which is an exemplar of a cognitive restructuring task" (p. 5).

Perception of the upright, in the formulation, is identified as the bipolar personality or style dimension described in 1949. Witkin and Goodenough (Note 4) say: "In summary, while more experimental research is needed on the specific processes involved in RFT and BAT performance, the available evidence appears to favor the view that individual differences in perception of the upright may be due to a bipolar dimension of reliance or vestibular-vs.-visual cues, and that this dimension is distinguishable from, though related to, the unipolar dimensions of restructuring ability" (p. 20). This bipolar dimension is thought to indicate an individual's style of social interaction. People who rely on visual rather than vestibular cues are hypothesized to make greater use of information gathered by observing individuals in social gatherings than people who rely on vestibular rather than visual cues. This is characterized as a bipolar dimension because in some situations it would be preferable to rely on social or interpersonal information while in other situations autonomy or reliance on internal cues and previously acquired information is preferred. Research evidence for this bipolar dimension is limited. Some research shows that field dependent subjects recall more incidental information than independents (Messick & Damarin, 1964; Goodenough, 1976), suggesting that dependents would gather more information in social situations, where much of the information is incidental.

Pascual-Leone's theory of constructive operators includes a distinction between measures of cognitive restructuring and measures of perception of the upright. Pascual-Leone (Note 5) analyzed the components of RFT and EFT and reported that RFT

involved an integration of postural and visual feedback while EFT involved the integration of figural and visual information. He points out that the processes in RFT differ from EFT because of the figural characteristics of EFT. Pascual-Leone suggests that the geometric nature of EFT stimuli permits some improvement on this test with practice. He suggests that EFT is more confounded with processing capacity than are RFT or Bottles (water level) . Pascual-Leone assumes that what remains when the counfounding of processing capacity with EFT is removed is the same dimension measured in RFT and Bottles. In his own work, Pascual-Leone tends to use a composite of Bottles combined with EFT to measure FDI.

Pascual-Leone, et. al., (1978) believe that subjects who are field dependent are less likely efficiently to select an appropriate strategy for problem solution than field independent subjects who are very good at selecting an appropriate strategy from available strategies. They suggest that field dependent subjects have what they call a weak "interrupt" function. The interrupt function serves to inhibit the activation of irrelevant schemes or strategies for solving a problem. For Pascual-Leone, FDI is not a bipolar dimension: Field dependent subjects are more likely to select an inappropriate strategy, even when they could use the appropriate strategy.

Evidence that cognitive restructuring measures a different construct from perception of the upright is needed. Previous studies have rarely used more than one measure of each potential construct, making investigation difficult. Further problems arise due to the low reliabilities of most measures of perception of the upright. Finally, much of the development of the FDI construct is based on research involving only measures of cognitive restructuring; thus descriptions of FDI generally say more about cognitive restructuring than perception of the upright.

The high correlations of some measures of FDI with general ability or spatial visualization no doubt motivated Witkin and Goodenough to distinguish cognitive

restructuring from perception of the upright. The relation of field dependency to other constructs such as fluid ability and spatial visualization is perplexing. Vernon notes: "The strong positive correlation (of FDI) with such a wide range of spatial tests is almost embarrassing. Is field dependency simply identical with British "k" factor or Thurstone's s?" (Vernon, 1972, p.368). Snow, et. al. (Note 6) report that the cognitive restructuring tests correlate as highly with measures of fluid ability as with each other. Horn and Cattell (1967) identify a spatial visualization construct which includes measures of cognitive restructuring and other spatial ability tests.

Evidence for a construct characterized by perception of the upright is needed. Arbuthnot (1972) reviewed 40 studies using 2 or more measures of FDI. Thirty involved RFT and individually administered EFT's. The average correlation between RFT and EFT was .54. (Shortened versions of EFT were used in some studies, correlations were corrected to the length of the Witkin version.) The average correlation between measures of embedded context was higher, equal to about .80. In the other studies, EFT was generally more highly correlated with WISC Block Design than RFT but this may reflect a greater reliability for EFT.

Witkin and Goodenough (Note 4) say in their recent review of all the literature on FDI, "There has not yet been a study with enough reference tests to determine the precise location of tests of perception of the upright within the cluster (of field dependency)" (p. 18). They indicate that only two factor analytic studies have used more than a single test to assess the role of embedded context questions and perception of the upright in FDI (Goodenough & Karp, 1971; Karp, 1963). In these studies a single FDI factor emerged. According to Goodenough and Witkin (Note 4) no other studies have used enough tests to separate the perception of the upright factor from the other tests commonly used to measure FDI. Vernon (1972) had relevant

data on almost 400 eighth graders. Measures of verbal ability, general ability, spatial ability and RFT were administered. Two factors, one verbal and one spatial accounted for a lot of the variance in RFT but, "visuokinesthetic" factor was suggested by "the relatively low g (general ability) and s (spatial ability) loadings of the RFT scores." (Vernon, 1972, p. 382).

In order to place FDI clearly in the context of the larger domain of ability factors, the present study includes tests of embedded context and perception of the upright, as well as a number of measures of fluid ability, crystallized ability, spatial visualization, memory span, perceptual speed and closure speed. The hypothesis is that measures traditionally associated with FDI will form two factors, one associated with perception of the upright and the other with fluid ability and spatial visualization.

Method

Subjects

In a previous study 241 High School seniors had taken a battery of 31 reference tests (see Snow, et. al., Note 6). Thirty males and 30 females were randomly selected from this pool and paid $2.50 per hour for their participation.

The comparability of the subsample (n=60) with the original large sample of high school subjects (N=241) was assessed to determine the feasibility of drawing conclusions about the relationships in the 31 test battery using the subsample. Differences in mean scores between the two groups were not significant. (See Appendix A). A principal components analysis of the reference battery for the subsample subjects yielded the same seven factor structure obtained in the analysis on the entire sample (see Snow, et. al, Note 6). Thus, the subsample does not differ from the total sample in important respects, and findings for the whole sample are stable in the subsample.

Procedure and Measures

To investigate cognitive restructuring the Find a Shape Puzzle (FASP) was administered to augment the reference battery. The Bottles test (BOT) and the Portable Rod and Frame Test (RFT) were selected to represent perception of the upright. All 3 tests were individually administered. Five experimenters were employed to administer different tests to different subjects.

Reference Battery. The 31 tests in the reference battery are listed in Table 1. Tests and administration procedures are described in Snow, et.al., (Note 6). Administration was in group and individual sessions.

The Bottles Test (BOT). Modified from Pascual-Leone and DeAvila (1971) BOT is similar to Piaget's water level task. It consisted of 8 drawings of identical bottles, tilted 45 degrees to the left or to the right, opening up or down. Subjects were first shown a drawing of the same bottle upright and half full of water (indicated by a horizontal line). Subjects were then asked to draw the water line on the 8 tilted bottles presented on 8 separate pages. There were no time limits but no erasures were permitted. Items were scored correct if the water line was within 5 degrees of horizontal.

The Portable Rod and Frame Test (RFT). A variation of Oltman's (1968) RFT, was used. Subjects viewed the black rod and frame at one end of an opaque 80 cm. x 80 cm. x 200 cm. box through a viewing slot at the other end. Both the rod and frame could be tilted to each side separately; the rod 32^{o}, the frame 45^{o}. The 8 trials consisted of all 4 combinations of rod and frame tilt repeated twice. The subjects sat in a stable chair, placed their heads such that when the cover of the viewing slot was removed they could only see a tilted frame and the rod (peripheral vision was blocked). The experimenter slowly rotated the rod until the subject indicated it was upright. Subjects were allowed to overshoot once and

then told there would be no backtracking. Scores consisted of the total number of degrees deviation from upright in either direction. Raw scores were normalized using the arc sine transformation and reflected so that high scores indicate closeness to the upright.

The Find a Shape Puzzle (FASP). Adapted from Gottschaldt (1926), on the FASP subjects locate a simple shape in a complex shape. All shapes are line drawings and 5 complex shapes appear on each page, one minute is allowed for locating the simple shape in each of the 5 complex shapes. Four pages are administered, scores consist of the total correct of 20 possible attempts to locate the simple shape.

Results

Table 1 presents the correlations among all tests. The diagonal elements in Table 1 are reliability estimates. Analyses were conducted on both original and disattenuated correlations. Since results were similar, only the former analysis is reported.

Table 1 about here

Hierarchical clustering, multidimensional scaling, and factor analysis were used to analyze the test scores. Results of each method are presented separately.

Hierarchical Clustering.

The average linkage method was used for heirarchical clustering. Violations of the ultrametric assumption were found in the diameter and connectedness methods (Johnson, 1967); the average linkage method yielded a more interpretable solution.

The analysis yielded five clusters:[1]

(1) general fluid/visualization (Gfv), characterized by the Hidden Figures Test and Paper Folding;

(2) general crystallized (Gc), characterized by Terman Concept Mastery and WAIS vocabulary;

(3) perceptual speed (Ps), characterized by Finding A's;

(4) memory span (Ms), characterized by WAIS, Digits Forward and Digits Backward; and

(5) a fifth cluster characterized by RFT, the Bottles test, and WAIS Picture Completion.

The results confirmed the hypothesis that RFT consists of two separate constructs. The cognitive restructuring tests (FASP and the Hidden Figures Test) fell into the Gfv cluster. The perception of the upright tests, RFT and the Bottles test fell in the fifth cluster. Since WAIS Picture Completion also fell in the latter cluster, this cluster was called Familiar Field(Ff) for reasons described below.

Paper Folding as well as Picture Completion was closely related to RFT and the Bottles test (see Table 1). But Paper Folding correlated even more highly with the Gfv tests and thus did not cluster with the Ff tests.

Multidimensional Scaling

A multidimensional scaling of the 34 test correlation matrix was consistent with the cluster analysis and provided a graphic representation of the relationships among clusters and tests. The two dimensional solution (stress=.221) provided an adequate representation.

Figure 1 shows the scaling configuration with the five clusters superimposed.

Figure 1 about here

The two general ability clusters (Gfv and Gc) appear near the center (as tests in these clusters had the highest average correlations with other tests in

the battery, see Marshalek, Note 7, for further discussion). The other three clusters (Ms, Ps, and Ff) fall on the periphery.

Factor Analysis

Results of the factor analysis were consistent with the multidimensional scaling and cluster analyses.

To determine the number of factors to extract, a principal components analysis with unities in the diagonals was performed on the 33 test matrix. An eight component solution accounting for 71% of the total variance was determined to be appropriate.

A common factor analysis with eight factors specified was then performed. With unities in the diagonals as original communality estimates, convergence was reached after 16 iterations. The varimax rotated factor structure matrix for this solution is presented in Table 2.

Table 2 about here

Varimax rotation yielded results consistent with the clustering and scaling. The first five factors were labeled as before (Gfv, Gc, Ms, Ps, and Ff). Again the FDI tests split into the Gfv and Ff factors.

Reduced Analysis

A Maximum Likelihood Factor Analysis (MLFA) (Joreskog & Sorbom, 1976) was applied to the 12 Gfv and Ff tests to determine whether two factors were necessary and sufficient. The MLFA method uses a chi square test to determine whether the residual correlation matrix (after the extraction of each factor) suggests the existence of another factor.

Table 3 about here

Clustering and scaling provided additional support for the parsimony of the two factor structure. Figure 2 presents the adequate two dimensional scaling solution (stress=.128) with clustering superimposed and shows the results to be consistent with the MLFA results.

Figure 2 about here

The three Ff tests (the Bottles test, RFT, and WAIS Picture Completion) clustered on one side of the configuration, the remaining nine Gfv tests clustered on the other side.

Summary and Discussion

A correlational analysis of measures of perception of the upright, cognitive restructuring and other abilities demonstrated that perception of the upright partially identified a unique dimension. This dimension was labeled familiar field (Ff.) Measures of cognitive restructuring were closely related to measures identified by Cattell as fluid ability and were part of a factor identified by Snow et al. (Note 6) as general fluid visualization (Gfv). Common measures of spatial ability such as Surface Development were associated with Gfv but not with Ff. Analysis of tests frequently identified as FDI demonstrated that the correlations were best represented by 2 factors (Gfv and Ff).

General fluid/visualization (Gfv).

The Snow et al., (Note 6) analysis of the reference battery yielded seven factors including Gfv. Gfv resembled the ability dimension in EFT described by Cronbach

(1960) including Raven as well as Hidden Figures and Surface Development. Gfv remained stable when the three tests in this study were added. As expected, FASP loaded on Gfv but Bottles and RFT did not. Thus, selection of the subsample did not alter Gfv. Gfv appears stable over time in that FASP, measured somewhat later, behaved like the other Gfv tests.

Witkin identified many of the tests associated with Gfv as measures of cognitive restructuring. Witkin's definition of cognitive restructuring suggests that Gfv measures ability to disembed relevant information in complex situations. Cattell's definition of fluid ability is also consistent with the tests associated with Gfv.

Gfv is identified by tests thought to measure ability rather than personality or style. What do these tests have in common? All tests loading on this factor involve geometric shapes or pictorial material that must be transformed, within strict time limits. All the tests include practice items; the goals are obvious (e.g., find the simple shape). Rapid selection of the appropriate strategy is required for success; feedback on early items can be used to develop an optimum strategy.

Spatial ability. Tests such as surface development and block design have been implicated in discussions of spatial ability. Spatial ability was not separable from Gfv and did not characterize Ff suggesting that Gfv may include whatever is thought to be unique about spatial ability in this battery.

Familiar field (Ff)

Besides the two measures of perception of the upright introduced in this study, Familiar field included Picture Completion. These results confirm Witkin and Goodenough's predictions about the separation of a perception of the upright dimension from cognitive restructuring. What does Ff measure? Several commonalities in the tasks loading on Ff deserve consideration:

(1) Matching familiar templates.

All three Ff tasks involve familiar visual material. In each case the task

representation could be compared with a familiar representation of the same material. In Picture Completion the solver compares the picture presented to a visual template of the situation. WAIS administrators offer anecdotal evidence concerning this approach. For example, clinicians have noted "The California Syndrome," -- Californians are more likely than others to fail the item where the missing information is snow on part of a winter scene. Perhaps Californians have incomplete templates of snow scenes.

In the case of the Bottles test, the half full bottle in the picture is matched with previously experienced half full bottles. In the RFT, the rod is matched to a template of the upright. Thus, all three of these tests involve familiar material and can be solved by comparing the observed representation to a familiar template. In contrast, measures of cognitive restructuring involve unfamiliar geometric shapes (e.g. EFT, FASP, Raven) and generation of novel representations of the material (e.g. Paper Folding, Paper Form Board, Block Design).

(2) Ambiguous instructions suggest multiple strategies.

Part of the task for measures of Ff is to decide what is expected. In our experiments, subjects sometimes ask the experimenter whether they should draw the water in the bottle parallel to the bottom or parallel to the page. Vernon (1972), when discussing the portable rod and frame "...finds considerable difficulty in getting across a uniform understanding of the instructions for this version" (p. 369). Further evidence for ambiguity comes from training studies where some solvers of the Bottles test and RFT realize that they have misinterpreted the instructions.

In Picture Completion, the instructions offer limited criteria to decide whether a missing element is relevant. From the instructions, one could not exclude responses such as " a handkerchief is missing from the jacket pocket" although more pertinent missing items could be mentioned.

Since the instructions are ambiguous, in these tests, problems in selecting a strategy for solution would be expected. Subjects performing the RFT gave these descriptions of strategy selection:

(a) "Well, I squint so that I cannot see the frame at all and I just place the rod as best I can."

(b) "Well, I actually move my head back a bit so I can kind of see the side of the mask, and then I have some additional information to line the rod up with."

(c) "I think of my nose as being in the middle of the grid with my forehead being at the top and my chin at the bottom, and I try to place the rod right on that same grid."

(d) "Well, I sure don't line the rod up with the corners of the picture frame. I make sure that it's in the middle and not in the corners."

(e) "I estimate the angle between the edge of the picture frame and a vertical position and I adjust the rod so that the angle is accurate."

The grid strategy (c above) was most frequently associated with successful performance; many of not most of these strategies are available to subjects. Reminiscent of Flavell's (1977) conception of production deficiency, it appears that strategies are available and the task is to choose which are relevant. The problem is to select the optimal strategy from those that are available.

(3) Limited feedback.

Once the instructions are presented for these tasks, subjects receive little feedback concerning erroneous responses. Subjects who consistently line the rod up with the picture frame will not be told that they have done something wrong. Subjects who draw the water line parallel to the bottom of the bottle routinely complete Bottles without receiving negative feedback. In Picture Completion, feedback is given if the subject fails the first easy trials and subjects are cautioned to select the most essential missing item. Subjects can say, for example, that a chimney lacks smoke and not perceive that the answer is wrong. Some feedback is available for Picture Completion since WAIS administrators note that subjects are sometimes frustrated by items in Picture Completion which they cannot

solve. In contrast, tests of cognitive restructuring, such as Embedded Figures, are preceeded by practice items and incorrect answers are obvious.

If feedback is helpful, then we would expect some effect from training. Training on bottles has had somewhat contradictory effects (e.g., Harris, Hanley, & Best, 1978). Subjects who seem not to comprehend the directions often profit from instruction. For example, some subjects say, "Oh, I didn't realize you wanted me to draw the line parallel to the ground. I thought it should be like the first picture." RFT also is recalcitrant to training although clarification of instructions is helpful. Thus, some subjects respond: "Oh, I thought I was supposed to line the rod up with the picture frame." But others, even after numberous feedback trials, persevere in making inaccurate responses (Morell, 1976). Feedback, is but one issue in performance.

(4) The tests are untimed.

There is no advantage for achieving fast solutions to Ff tasks unlike cognitive restructuring tasks. The Bottles test is untimed, and RFT will be slowed if the subject so requests. Fifteen seconds per item is allowed for Picture Completion, but most subjects respond in the first few seconds.

The emergence of a dimension of FDI related to perception of the upright was anticipated by Witkin and Goodenough (Note 4). The Ff dimension that emerged in this analysis differs somewhat from their predictions but is compatible with several empirical studies.

Witkin anticipated that a perception of the upright dimension would define a bipolar personality characteristic, representing selective attention to non-social information at one end, and attention to social or interpersonal information at the opposite end. The characteristics of Ff are not particularly consistent with this description. It may be that applying familiar templates guides information selection but there is no reason to presume that familiar templates focus attention on non-social information. Ability to solve problems with ambiguous instructions, limited feedback, and unlimited time may be associated with attention to non-social information

in this investigation since the tasks did not involve social information but generalization to interpersonal tasks cannot be predicted.

Witkin's report that dependents have a better recall of incidental information might explain the relationship of Picture Completion to Ff: People who recall incidental information may fail to separate adequately the incidental from the relevant and thus fail to select the most relevant missing item in Picture Completion. On the other hand, Witkin postulated that field dependent people should have better memory for faces; they might thus be better at noting elements missing from a face (as one of the Picture Completion items) but high scores on Picture Completion are associated with field independence.

Clarification of the relationship between Ff and the Witkin bipolar dimension awaits further investigation. A major problem with the Witkin dimension is the lack of a task capitalizaing on field dependence: dependence is defined as the absence of field independence in common measures of FDI. To further complicate matters, Witkin and Goodenough (Note 4) suggested that the bipolar dimension is actually tripolar with the third pole being a synthesis of the "good" elements of the other poles.

We hypothesize that Ff measures ability to select a relevant strategy from salient but irrelevant strategies in a familiar situation. Ambiguous instructions and limited feedback encourage selection of irrelevant strategies, especially if they are salient. Individuals may select irrelevant strategies, even when given unlimited time. Several studies (e.g., Tversky & Kahneman, 1974) have demonstrated that selection of salient but irrelevant information occurs without time constraints. Failure to apply adequately a familiar template may indicate inability to select a relevant strategy for comparing the template to the situation. The Tversky and Kahneman study is also illustrative of this point: Subjects compared only a few elements of their presumed templates to descriptions of people who could be either lawyers or engineers and drew conclusions from these few elements.

Our hypothesis that Ff measures strategy selection when there are salient irrelevant competing strategies is consistent with Pascual-Leone's (Pascual-Leone, et al., 1978) suggestion that dependents have a weak "interrupt" function. In RFT performance, Pascual-Leone emphasizes the competition between visual and postural information in determining whether a strategy is adequate. A person with a weak interrupt function overemphasizes visual information which is salient but irrelevant.

Linn (1978) demonstrated, in a series of experiments, that RFT measured ability to select a relevant strategy when salient irrelevant strategies were suggested by the problem. She found that RFT only predicted performance with salient irrelevant information. Subjects low in RFT failed problems that required controlling variables when salient but irrelevant results of an uncontrolled experiment were presented. Subjects low in RFT were indistinguishable from those high on RFT for controlling variables problems with only relevant information. Furthermore, training on application of the controlling variables strategy did not improve performance on problems with salient irrelevant information, suggesting that strategy selection not strategy application was impeding performance. Training was successful for problems with only relevant information.

Both theoretical and empirical evidence point towards the existence of an Ff dimension. Currently, Ff is best characterized as a measure of strategy selection which is important for familiar situations involving salient irrelevant information.

Frequently researchers obtain a composite FDI score by summing scores on cognitive restructuring and perception of the upright. However, since Ff differs from cognitive restructuring, the most informative analysis would assess the separate contribution of each test. Ff emerged in a high ability homogeneous population used in this study but might be masked by other factors in a more diverse population.

Footnotes

1. The anticipated Closure Speed (Cs) cluster did not emerge since the two Cs tests were combined for this analysis.
2. Two tests, Uses and Film Memory fell outside the five major clusters and were therefore eliminated from the factor analyses.

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Table 1

Test Intercorrelations

		1	2	3	4	5	6	7	8	9	10	11	12
1.	Bottles	-											
2.	Rod & Frames Test	32	-										
3.	Picture Completion	25	34	-									
4.	Block Design	39	10	24	-								
5.	Object Assembly	17	00	40	51	-							
6.	Identical Pictures	-02	06	25	46	44	-						
7.	Hidden Figures	23	15	31	46	35	43	-					
8.	Form Board	28	16	34	42	43	40	65	-				
9.	Paper Folding	35	27	21	-10	43	33	56	49	-			
10.	Surface Development	32	08	36	61	51	58	58	54	66	-		
11.	Raven Progressive Matrices	07	-09	25	50	41	39	60	44	49	66	-	
12.	Find a Shape Puzzle	27	21	42	46	50	29	45	53	55	61	51	-
13.	Gestalt	29	09	33	46	47	25	27	28	40	45	35	45
14.	Film Memory	12	-04	-03	-01	-08	27	14	21	04	08	13	-01
15.	Auditory Letter Span	10	-07	15	29	20	25	29	09	22	32	30	16
16.	Visual Numbers Span	03	06	16	19	28	27	28	05	38	33	15	22
17.	Finding A's	-19	-24	04	19	23	51	35	21	11	33	41	22
18.	Number Comparison	-03	-13	-07	-10	12	36	17	17	14	09	03	04
19.	Word Transformation	23	-02	25	51	45	56	50	38	30	56	58	52
20.	Camouflaged Words	-06	-15	29	27	24	27	32	15	13	23	36	23
21.	Word Beginnings & Endings	12	-01	24	48	27	26	32	18	24	34	39	28
22.	Uses	08	-22	13	15	22	21	04	06	16	23	09	09
23.	Necessary Arithmetic Operations	18	-01	27	24	32	22	47	32	57	53	50	33
24.	Letter Series	26	-11	16	46	25	29	49	23	42	58	66	34
25.	Terman Concept Mastery	20	-08	23	37	44	12	36	17	49	49	52	32
*26.	Information	25	-05	22	39	24	10	32	15	44	45	37	28
*27.	Comprehension	08	-04	05	12	25	05	31	12	35	24	42	19
*28.	Arithmetic	30	07	12	37	32	13	27	29	37	45	40	42
*29.	Similarities	25	10	22	33	27	12	22	15	38	27	35	25
*30.	Digit Span - Forward	13	07	-06	36	08	06	42	24	34	21	29	17
*31.	Digit Span - Backward	-24	-11	-04	-06	-05	02	-01	-21	-12	09	00	-13
*32.	Vocabulary	22	04	33	29	33	13	24	12	42	42	49	27
*33.	Digit Symbol	-02	-03	11	12	19	49	20	15	17	21	21	20
*34.	Picture Arrangements	10	-04	07	23	34	17	17	25	40	41	43	24

* Wechsler Adult Intelligence Scale

Table 2

Sorted Rotated Factor Loadings

Test	Gfv	Gc	PS	MS	FI	6	7	8
1. Surface Development	78	-	-	-	-	-	-	-
2. Block Design	68	-	-	-	-	-	27	-
3. Raven	67	41	-	-	-28	-	-	-
4. FASP	65	-	-	-	-	-	-	-
5. Form Board	62	-	-	-	-	-	-	-
6. Hidden Figures	60	-	-	-	-	39	-	-
7. Object Assembly	60	-	-	-	-	-	-	-
8. Gestalt	60	-	-	-	-	-	-	-
9. Identical Pictures	58	-	45	-	-	-	-	-
10. Paper Folding	53	34	-	-	32	-	-	48
11. Picture Arrangements	32	29	-	-	-	-	-	45
12. Letter Series	46	43	-	-	-	29	-	-
13. Arithmetic	27	33	-	-	-	-	58	-
14. Word Transformation	52	29	48	-	-	-	36	-26
15. Nec. Arith. Oper.	33	53	26	-	-	-	-	27
16. Word Beg. & End.	32	48	26	-	-	-	-	-28
17. Vocabulary	-	90	-	-	-	-	-	-
18. Terman	-	78	-	-	-	-	36	-
19. Information	-	74	-	-	-	-	-	-
20. Comprehension	-	70	-	-	-	-	-	-
21. Similarities	-	68	-	-	-	-	-	-
22. Camouflaged Words	-	41	-	37	-	-	-	-32
23. Digit Span-Forward	-	32	-	-	-	75	-	-
24. Number Completion	-	-	94	-	-	-	-	-
25. Digit Symbol	-	-	67	-	-	-	-	-
26. Finding A's	35	-	62	-	-40	-	-	-
27. Visual Numbers Span	-	-	-	72	-	-	-	-
28. Digit Span-Backward	-	-	-	66	-	-	-	-
29. Auditory Letter Span	-	38	-	52	-	27	-	-
30. Rod & Frame Test	-	-	-	-	62	-	-	-
31. Bottles	-	-	-	-	46	-	29	-
32. Picture Completion	45	-	-	-	42	-30	-	-

Table 3

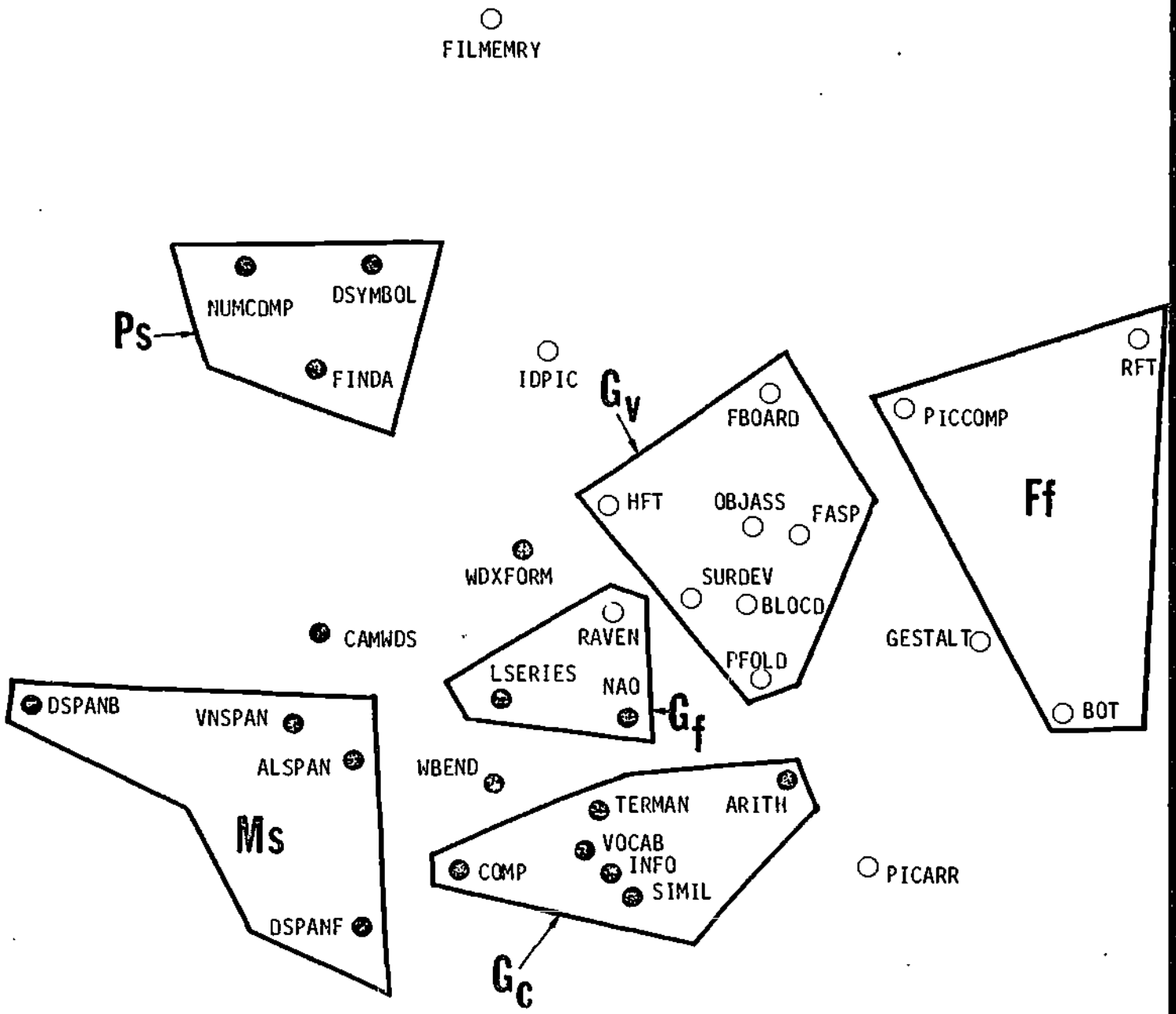
Maximum Likelihood Solution

	One Factor Solution		Two Factor Solution			Three Factor Solution			
	χ^2 (54) = 74.9 $\rho <$ .05 Tucker's reliability = .897		χ^2 (43) = 53.0 $\rho >$ .10 Tucker's reliability = .938			χ^2 (33) = 39.8 $\rho >$ .10 Tucker's reliability = .945			
	Unrotated		Rotated			Vari-max Rotated			
Test	I	Unique variances	I'	II'	Unique variances	I'	II'	III'	Unique variances
1. Bottles	-.35	.88	.21	.48	.73	.07	.21	.49	.71
2. Rod & Frame Test	-.17	.97	-.07	.76	.42	.06	-.03	.74	.45
3. Picture Completion	-.44	.81	.33	.42	.72	.13	.31	.42	.71
4. Block Design	-.69	.53	.65	.20	.53	.21	.63	.19	.52
5. Object Assembly	-.62	.62	.60	.14	.62	.10	.62	.14	.58
6. Identical Pictures	-.58	.66	.59	.06	.64	.24	.55	.03	.64
7. Hidden Figures	-.72	.48	.68	.24	.48	.91	.37	.18	.00
8. Form Board	-.68	.53	.62	.29	.53	.47	.46	.26	.49
9. Paper Folding	-.73	.48	.64	.38	.45	.31	.57	.36	.45
10. Surface Development	-.86	.25	.85	.20	.24	.26	.83	.19	.21
11. Raven	-.71	.49	.78	.05	.38	.40	.67	-.08	.38
12. Find a Shape Puzzle	-.71	.50	.63	.35	.48	.17	.62	.35	.46

FIGURE CAPTIONS

Figure 1. Two dimensional scaling solution for reference battery tests. Stress (formula 1) = .221.

Figure 2. Two dimensional scaling solution for subset of reference battery tests. Stress (formula 1) - .128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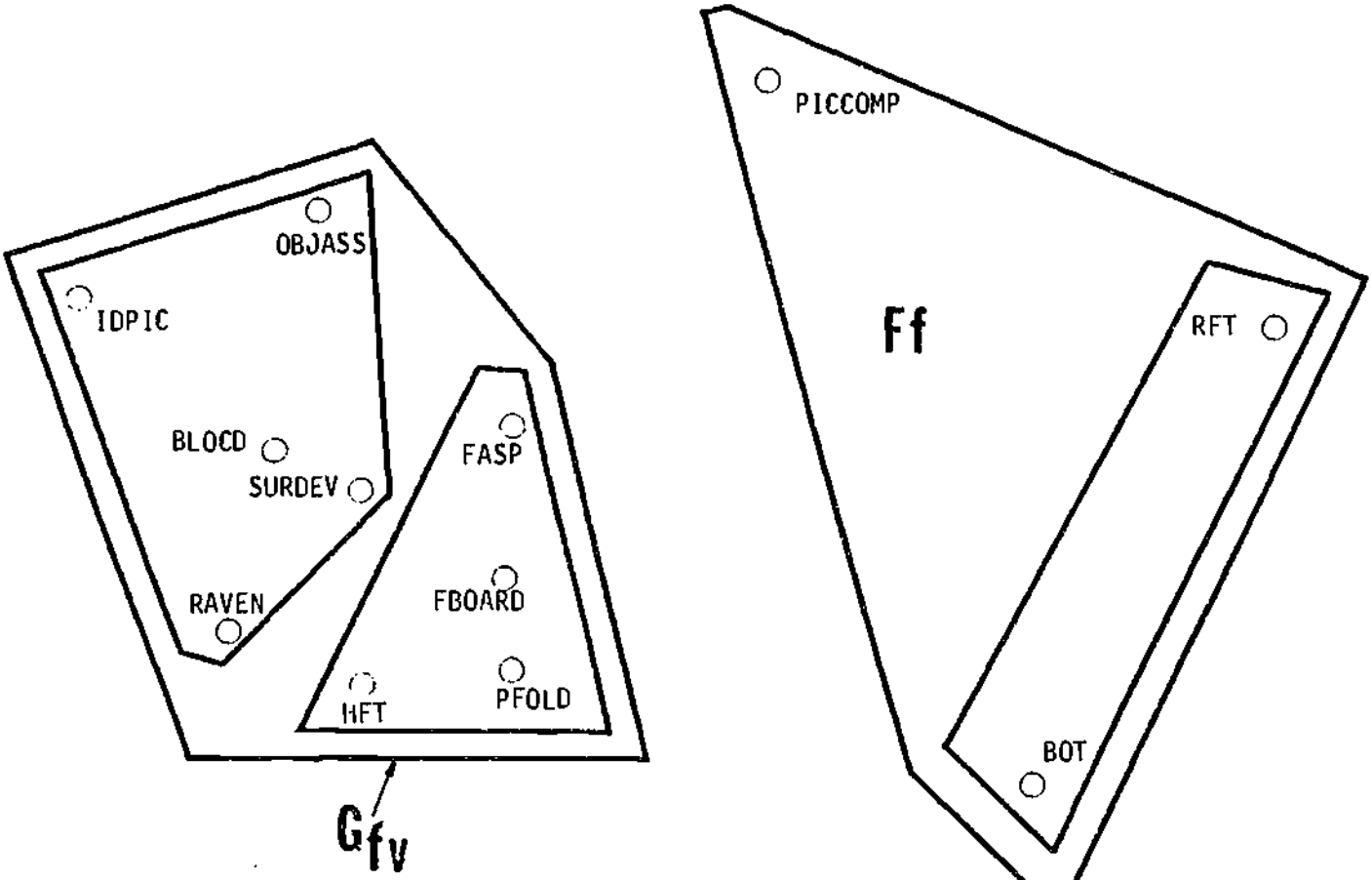
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