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Field-dependence, Judgment of Weights by Females and an Appeal for a More Complex Approach to the Study of Individual Differences

s) Bernard J. Fine

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Field-Dependence, Judgment of Weights by Females and an Appeal for a More Complex Approach to the Study of Individual Differences

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Fine (1972a) has presented evidence of a strong, non-linear relationship between field-dependence-independence (~~hereinafter~~ referred to as "field-dependence;" Witkin, 1964, 1965; Witkin, Dyk, Faterson, Goodenough and Karp, 1962), introversion-extraversion (hereinafter referred to as "extraversion;" Eysenck, 1967) and neuroticism (Eysenck, 1967). In the context of that relationship, he suggested that differences between individuals in field-dependence might be conceptualized profitably as at least partially genetically-based differences in "sensitivity," as contrasted with "strength" (Eysenck, 1967), of the nervous system.

Differences in "sensitivity" were assumed to depend upon the extent to which the nervous system becomes "differentiated" as an individual develops. "Differentiation" differed from the use of the term by Witkin et al. (1962) in that it was considered in its biological sense as being referable to <u>physical</u> characteristics of components of the nervous system or of the nervous system as a whole, e.g., size, number and/or distribution of specific types of receptors, elaborateness or complexity of neural networks, quality or quantity of neural transmitter substances, with these ultimately reducible to differences in the molecular structure of enzymes and proteins (Fine, 1972a, 1973). (Witkin's concern with "differentiation" primarily was with reference to the socio-psychological rather than the physical aspects of development, and focussed on broad areas such as ego development and independence of self and the influence of environment.)

From this conceptual base, it was reasoned that "sensitivity" of the nervous system should be related to ability to discriminate among stimuli, the more differentiated and, hence, the more "sensitive" the system, the better the ability to discriminate. Because of his specific interest in field-dependence at the time, Fine postulated that individuals with highly "sensitive" nervous systems should be those who are most proficient on spatial perception tests such as the Hidden Figures Test (HFT; Witkin, et al. 1962) or the Gottschaldt Hidden Shapes Test (HST; Cattell, et al., 1955) from which the HFT was derived, i.e., individuals who, in Witkin's schema, had come to be called "field-independent." Conversely, individuals with the least "sensitive" nervous systems were postulated as being those who are least proficient on tests of spatial perception, and who had come to be referred to as "field-dependent." Thus, Witkin's concept, field-dependence, became a construct which was thought to be both a behavioral manifestation of and an indirect approximation of the level of development of aspects of the nervous system.

To test the generality of the "sensitivity" hypothesis, a number of studies of the relationship between field-dependence and other types of complex sensory discrimination have been carried out. To date, the hypothesis has been tested and very strongly supported with respect to both the discrimination of colors (Fine, 1973) and contrast sensitivity (Fine & Kobrick, 1987), and, to a lesser extent, with discrimination of weights (Fine, 1973). The color discrimination results now have been replicated many times with male subjects [Fine & Kobrick, 1980, 1983 (color test given, but results not reported), 1987 (p.781)] and also in a study specifically focussed on females (Fine, 1983a). In all of the studies of the discrimination of colors and in the contrast sensitivity study, the performance of field-independent groups was markedly superior to that of field-dependent groups.

A major shortcoming of the weight discrimination study (Fine, 1973) was that the test used to measure weight discrimination ability was not very sensitive. There also was evidence in that study that weight discrimination was related to extraversion as well as to field-dependence. No relationship with extraversion had been found in any of the color discrimination studies or the contrast sensitivity study.

Accordingly, the study presented here was designed specifically to re-examine the relationship between field-dependence and the ability to judge weights, using a more sensitive test, and to inquire further into a possible relationship between extraversion and discrimination of weight.

To further verify the relationship between field-dependence and the discrimination of colors, a color discrimination test also was given.

Consistent with the "sensitivity" hypothesis, it was predicted that field-independent persons would be significantly better than field-dependent persons at both weight and color discrimination. No predictions were made regarding a possible relationship between extraversion and weight discrimination.

Method

Subjects

Subjects (Ss) were 17 female soldier volunteers, ages 20-34 (median=22) who had been screened by a physician to insure that they were in good health for participation in a larger study of which this one was a part (Fine, 1987). Informed consent was obtained from each S. The research conformed to US Army Medical Research & Development Command Regulation 70-25 on Use of Volunteers in Research.

Measures

(a) The weight discrimination task consisted of 15 white plastic cylinders, each 3.4 cm. in diameter and topped with a black plastic cap, 4 cm. in diameter. Cylinders with caps were 5.3 cm. tall. They were filled with tiny metal bearings to specific weights. Empty space in each cylinder was filled with cotton. The weight of the cylinders ranged from 75 to 145 grams in 5 gram increments +/- .1 gram. Each cylinder was numbered on the bottom with its appropriate rank, in increasing order of heaviness, from 1 to 15.

(b) Field-dependence was assessed by the HST (Cattell, et al., 1955). Participants were categorized on the basis of norms established from test scores of 154 female soldiers previously tested with the HST. Persons with scores in the lower third of that distribution (18 or below; N=6) were classified as field-dependent, those scoring in the upper third (26 or higher; N=5) as field-independent and the remainder (N=6) as "field-central."

(c) Extraversion was measured with the Maudsley Personality Inventory (MPI; Eysenck, 1959) rather than with later inventories by the Eysencks, since norms from a large soldier population (N=600+) were available for the MPI from our past research. Ss were divided into three groups based on these norms (male and female norms were identical). Persons scoring in the lower third of the distribution (26 or below; N=3) were classified as introverts, those in the upper third (34 and higher; N=9) as extraverts, and the remainder of the group (N=5) constituted a "middle" category.

(d) Color discrimination ability was measured by the Farnsworth-Munsell 100-Hue Test (Farnsworth, 1957), which was designed to separate persons with normal color vision into classes of superior, average and low color discrimination ability and to measure zones of color confusion of color defective persons. A detailed description of the test and its scoring can be found in Fine (1973).

Design and procedure

Each S was tested with the weight test at the same time on two successive days, three trials per day. A five-minute time limit was allowed for each trial. Inter-trial intervals also were of five minutes duration to allow for recovery from fatigue induced by the demanding task.

S was instructed to use her preferred hand to arrange the cylinders from lightest to heaviest using any method of comparison she desired. Ss were monitored carefully to insure that they did not invert the cylinders. After each trial, the ordered cylinders were turned over and the order of arrangement was recorded. Ss were allowed to see how well they had done. During the ensuing rest period, cylinders were returned to the starting position and thoroughly shuffled for the next trial.

The color discrimination test was taken the day prior to the weight discrimination test. Two trials were given, separated by a five-minute interval. Persons administering the weight test had no idea of Ss' levels of performance on the color test.

Results

The score for a given cylinder in the weight discrimination test was the sum of the difference between the number of that cylinder, i.e., its rank, and the numbers of the cylinders immediately above and below it in the ordering that had been established by the S. Thus, correct placement of all cylinders in the series resulted in each cylinder receiving a score of 2. Incorrect placement of cylinders resulted in individual cylinder scores in excess of 2, herein termed "error scores." For example, a two-cylinder transposition (...4,5,7,6,8,9...) resulted in an error score of 4; a three-cylinder transposition (...4,5,7,8,6,9,10...) resulted in an error score of 8, etc.

Essentially, this is the same system that is used for scoring the color discrimination test (Farnsworth, 1957).

Analyses of variance (ANOVAS) of the weight discrimination error scores were performed for the field-dependence and the extraversion dimensions over the six trials.

For field-dependence, between groups (trichotomized) differences were significant ($F=10.6$, df2,14, $p<.0001$); differences between trials were not. The mean error scores for each field-dependence sub-group by trials, day and combined days are shown in Table 1, along with the respective t-tests (one-tail) and p-values for the field-dependence/field-independence sub-group comparisons.

Insert Table 1 About Here

No significant effects were found for extraversion. The correlation between field-dependence and extraversion was not significant ($r=.06$).

Eysenck (1983) has indicated that correlating field-dependence scores with the entire extraversion scale, rather than separately with its impulsivity and sociability components, may understate what he perceives to be a rather strong similarity between field-dependence and extraversion. He has suggested that it is the impulsivity component of the extraversion scale which mediates correlations with field-dependence. Accordingly, separate correlations were run between field-dependence and impulsivity ($r=.00$) and field-dependence and sociability ($r=-.25$). Neither correlation was significant ($N=17$). Impulsivity and sociability were related at the $p<.10$ level ($r=.45$). To validate this result, a similar set of correlations on another set of data (Fine and Kobrick, 1980) were computed. This analysis yielded an $r=.05$ between impulsivity and field-dependence and an $r=.09$ between sociability and field-dependence; both non-significant ($N=35$). Here, impulsivity and sociability were significantly related ($r=.53$, $p<.01$). We did no further analyses in this vein.

The small N and somewhat skewed extraversion distribution (only 3 introverts) did not allow for examination for non-linear associations between the field-dependence and extraversion dimensions, e.g., grouping Ss into sub-groups representing combinations of the two dimensions such as field-dependent introverts, field-dependent extraverts, etc. (see Fine, 1972a) and comparing performance scores of these sub-groups.

Finally, as predicted, the field-independent group was found to be significantly superior to the field-dependent group in color discrimination on both trials (t-test; $p<.05$, 1-tail), providing yet another corroboration of that relationship.

Discussion

The results clearly support the prediction that the field-independent group would be superior to the field-dependent group in weight discrimination ability. Taking the average for the six trials, which, perhaps, is the best indicator of the differences between groups, the $t=3.38$ yields a W (Hays, 1963) of .49, indicating that field-dependence accounted for nearly 50% of the variance in weight discrimination performance.

The lack of a significant relationship between field-dependence and extraversion (or between field-dependence and impulsivity or sociability) supports the position (Fine, 1983b) that the two dimensions are independent. [While Eysenck (1983) contends that his perceived association between extraversion and field-dependence may hold primarily when field-dependence is measured by the rod-and-frame test, Fine and Danforth (1975) have discredited the rod-and-frame test as a measure of field-dependence, and question its meaning.]

For some reason, perhaps because it is less complicated, many, if not most, investigators pursue a one-dimensional approach to the study of individual differences. The "science," collectively, appears to operate at times as if there is a single "magic" variable waiting to be discovered which will unravel the mystery of individual variations in behavior.

In fact, however, the substance of recent research implies quite the opposite, i.e., that the study of individual differences in behavior must be attuned to an ever-increasing complexity, as knowledge about the human nervous system increases. Much of the recent knowledge substantiates what was said 15 years ago (Fine, 1972a, 1973) when field-dependence was first conceptualized as "sensitivity" of the nervous system.

For example, Curcio, Sloan, Packer, Hendrickson and Kalina (1987) have found a 2.9- fold range in maximum cone density in the foveas of young adult human eyes (four retinas from eye bank donors) which they state "may contribute to individual differences in acuity." This is "sensitivity" as differences in "size, number and/or distribution of... cells...." (Fine, 1973, p. 287). Furthermore, the magnitude of the differences may be much greater than 2.9-fold, because Curcio et al. (1987) worked with an extremely small N and, in all probability, did not work with foveas which were representative of the maximum cell density differences possible between individuals.

Haier (cited in Hostetler, 1988), used positron emission tomography (PET) and found a negative relationship between the rate of glucose metabolism in cortical areas of the brain and performance on Raven's Advanced Progressive Matrices, a type of cognitive performance somewhat similar to that subsumed by the field-dependence concept. Haier is quoted as suggesting that individuals with higher cognitive ability may have more efficient or denser neural circuits (underlining mine), which allow their brains to perform well at lower metabolic rates. This is "sensitivity" as "elaborateness" of neural circuits; precisely consistent with Fine (1972a, 1973).

Livingstone and Hubel (1988) recently have summarized visual processes in both primates and humans, indicating that components of the visual system are much more subdivided and specialized than heretofore believed. Thus, to paraphrase, cells in the higher visual areas and cortical areas 1 and 2 are "segregated" (their term) into three interacting components that select differentially for such parameters as movement, orientation and color, with the pathways that are selective for one component deriving from different locations than the pathways selective for other components. At lower levels, in the retina and geniculate, cells differ in color selectivity, contrast sensitivity, spatial resolution, etc. These sub-systems all work together in complex interaction. This is "sensitivity" as complexity of neural networks, previously noted in Fine (1972a,1973). It also is highly consistent with observations about complexity in Fine and Kobrick (1987, p. 781).

Both extraversion and field-dependence, each conceptualized as being of biological origin, tap into this complexity as behavioral "markers" for "strength" and "sensitivity," respectively, of the nervous system. "Sensitivity" seems to be related to the range and specificity of possible responses of the system, its ability to sense, interpret and process stimuli and with the fineness of its "tuning"; in short, to the kinds of things noted above by Curcio et al.(1987), Haier (in Hostetler, 1988) and Livingston and Hubel (1988). "Strength" seems to be related to the control or management of the system. It is manifested by such parameters as ease of conditioning and extinguishing responses, and, possibly, is involved in the "appropriateness" of responses. There undoubtedly are other dimensions, either already known or awaiting discovery or formulation. For example, "arousal" or "activation" may represent a "mobilization" dimension intermediate to "sensitivity" and "strength."

Since most investigators in the areas in question have worked only with field-dependence or only with extraversion, the "power" of what appears to be a very strong and frequently occurring non-linear association between the two virtually has gone unnoticed.

The potential of this "power" may be appreciated by considering the following empirical examples taken from some of my previously published and unpublished research (the data from some of which were re-analyzed for this paper).

(1) In a study which retrospectively examined the relationship between field-dependence, extraversion and neuroticism (see Fine, 1972a for background), it was predicted that the combination of field-dependence and extraversion, as manifested specifically in field-dependent introverts would yield a higher incidence of neuroticism than would any other combination of the two dimensions. This prediction was substantiated in each of four independent studies, all using the MPI (Eysenck, 1959) and the HST (Cattell et al., 1955) and in several other studies using other measures. In the studies in which the MPI and the HST were used, trichotomization was based on norms derived from a data base of over 600 military Ss.

Table 6 from Fine (1972a), shown below as Table 2, summarizes the combined results of the field-dependence, extraversion, neuroticism inter-relationship for the four studies in which the MPI and HST were used.

Insert Table 2 about here

Clearly, the combination of the two dimensions in this predicted non-linear relationship contributed something greater than either dimension separately. Moreover, the correlations between extraversion and field-dependence in each of the four studies were .00 (N=54), -.02 (N=53), .18 (N=54) and .01 (N=17; this r was not stated in the published article), all non-significant.

(2) Another example can be found in Fine (1972b). (The Ss in this study were the same as in one of the four groups combined in Table 2.) This research related intrinsic motivation, intelligence and personality to cognitive and motor performance. Results from two tasks are of interest here. One was a purely cognitive task, solving anagram puzzles, and the other was a motor performance task with a cognitive component, sorting five different kinds of screws (differing in shape and color) into five appropriately labelled containers. Both tasks were performed under "self-paced" conditions, i.e. the task was assigned for a specific period of time, to be done without anyone but S present. Each task was performed once in the morning and once in the afternoon of the same day.

Since the N (54) was too small to divide the group into 3rds on the basis of field-dependence and extraversion combinations, medians, were used. These were based on norms from a larger military population. No predictions were made in this retrospective analysis.

For the anagram task, considering morning performance only (see means in Table 3), it was found that the field-independent Ss, as a group, were significantly superior (% correct) to the field-dependent Ss ($p < .01$). No differences were found between introverts and extraverts. However, further analysis (ANOVA and t-tests) of the interaction between field-dependence and extraversion revealed that the field-dependent extravert sub-group had a mean performance score that was significantly poorer than each of the other three sub-groups representing combinations of field-dependence and extraversion (vs. independent extraverts, $p=.01$; vs. independent introverts, $p=.06$; vs.

dependent introverts, p=.09). Also, despite there being no overall differences between extraverts and introverts, field-independent extraverts were found to be superior to field-dependent introverts (p=.04). Clearly, the combination of field-dependence and extraversion elucidated more specific sources of poor performance than either dimension separately.

Insert Table 3 About Here

Similar results were found with the morning performance of the screw-sorting task (see Table 3). Over-all, the field-independent group performed significantly better than the field-dependent group (p< .01), whereas no significant differences were found between extraverts and introverts. However, ANOVA and t-tests indicated that poorest performance was centered in the field-dependent extravert sub-group which had significantly poorer performance than the other three sub-groups (vs. independent extraverts, p=.01; vs. independent introverts, p=.02; vs. dependent introverts, p=.09).

Thus, while extraversion ordinarily would not have been considered as a significant factor in the performance of these tasks, it was shown to be an extremely important factor, since it interacted with field-dependence to describe the poorest performing sub-group, field-dependent extravert. This would not have been determined by simple correlational analysis, since no significant relationships were found between extraversion and performance or extraversion and field-dependence.

In passing, it should be noted (Table 3) that afternoon performance for the anagram task was virtually unchanged from morning performance. However, all groups, but particularly the field-dependent extraverts, improved on the screw sorting task in the afternoon, to the extent that the field-dependent extraverts no longer were the poorest performing group. Whether this diurnal variation in performance is particularly meaningful with regard to field-dependent extraverts has yet to be examined.

(3) Fine and Danforth (1975) examined the relationship between field-dependence, extraversion and performance on the rod-and-frame test. Based on the literature at the time, they predicted that field-dependent extraverts would be poorest on the rod-and-frame test. This prediction proved to be correct. Mean rod deviations (degrees) from true vertical over 12 trials were 5.9 for the dependent extraverts (N=15), 3.7 for dependent introverts (N=13) and 2.3 for both the independent extraverts (N=15) and independent introverts (N=13). The correlation between field-dependence and extraversion was not determined for this group of Ss because they represented extremes of field-dependence and extraversion selected specifically for this study from a larger group; correlations without the middle section of each distribution would be misleading.

Here, again, the combination of the field-dependence and extraversion dimensions yielded something that each dimension taken separately did not. The relationship was non-linear and, in terms of rod-and-frame performance, brought extraversion ("strength") into what, at the time, was primarily thought to be the domain of field-dependence ("sensitivity"), even though, prior to that, Taft and Coventry (1958) and Fine and Cohen (1963) had demonstrated that extraverts, in fact, were poorer than introverts on the rod-and-frame. [It was partially because of the Fine and Cohen (1963) study that Eysenck concluded that field-dependence and extraversion were one and the same thing (Eysenck, 1967, p. 117, and, again, 1982), which has been disputed (Fine, 1983b). It is apparent now that the earlier results of Taft and Coventry (1958) and Fine and Cohen (1963) probably reflected a disproportionate influence of field-dependent extraverts in their samples.]

(4) Fine and Kobrick (1976) had 49 soldiers view 40 slides (at sea level and at altitude) in which a stimulus soldier (in camouflage uniform) was identically posed in a constant background but with different viewing distances and viewing angles from the observer. Accuracy of target detection was analyzed for field-dependence and extraversion separately and in combination, using the same median split as in prior examples. Data were pooled across 40 trials and collapsed across distance and viewing angle. The results are summarized in Table 4.

Insert Table 4 About Here

At sea level, the field-independent group generated proportionally more correct target detections (57.8%) than did the field-dependent group (50.5%; $p<.01$) and the introvert group (58.2%) more correct detections than the extravert group (47.9%; $p<.001$). However, the poorest performance was shown to be in the field-dependent extravert group (41%; comparisons with other three sub-groups all yield $p<.001$). It was quite obvious (see Table 4) that the differences between the field-independent and field-dependent groups and between introverts and extraverts primarily were due to the poorer performance of the field-dependent extravert sub-group. Although their performance improved, field-dependent extraverts also were least accurate at altitude ($P <.01$, all comparisons). Bear in mind that these are not the same Ss as in the previously cited study wherein the field-dependent extraverts also were found to be poorest performers.

The correlation between field-dependence and extraversion here was -.32, significant at $P <.05$, but hardly a robust enough association to account for the large divergent pattern of the field-dependent extraverts, particularly when viewed in the context of the other examples noted above.

(5) Finally, data from two unpublished experiments gathered from 60 Ss,

56 of whom were the basis of Fine (1973; relating field-dependence to color discrimination) and Fine and Danforth (1975; relating field-dependence and extraversion to performance on the rod-and-frame test), were re-analyzed for this paper.

Based on the norms from a larger population previously referred to, the 60 Ss, 15 in each of four categories (field-independent extraverts, field-independent introverts, field-dependent extraverts and field-dependent introverts) had been selected as extremes (upper or lower thirds of each distribution) from a larger group of 170 Ss on the basis of scores on the MPI and HST.

In the first experiment, Ss performed a simple vigilance task, alone, for two hours, under optimal, non-stressful conditions. The task, in a military context, involved monitoring a video display of symbols representing friendly and hostile objects, e.g., tanks, trucks. Periodically, a new, "unknown" symbol would appear (according to a random schedule) embedded among the complex array of symbols, and the S had to press a button upon perceiving it. His responses were timed and errors of omission and commission were recorded. The only stimulation S received during the two hours was from the video screen or whatever was generated in his own mind. One would expect field-dependent Ss to do less well on this task because of their poorer disembedding ability.

ANOVA of the response latency scores yielded a significant groups effect, due to the slower performance of only the <u>field-dependent introverts</u>. This sub-group, with a mean of 2.07 seconds differed significantly from each of the other three groups whose means were very tightly clustered, ranging from 1.17 to 1.28 seconds. The <u>field-dependent introvert</u> sub-group also committed significantly more errors of omission, with approximately 5% of their possible judgments missed. The groups' poorer performance primarily was due to four Ss actually falling asleep during the experiment. No Ss in any other sub-group fell asleep! This is the same group of Ss in which field-dependent extraverts were found to be poorest on the rod-and-frame, so it is not as if it is one "set" of people who are just poorer overall on all tasks. It also should be noted that field-dependent introverts was the category shown to be most neurotic in a previous study (Fine, 1972a) cited above.

In a second experiment, the same Ss performed individually on a tapping task, designed to induce motor fatigue. Under constant exhortation from E to perform at maximum speed, S tapped a telegraph key as rapidly as possible for five one-minute periods, each separated by a 30-second rest interval. The results are shown in Table 5. Based on theory, we expected introverts to perform better than extraverts, which they did ($p<.10$) in three of the five trials (trials 3,4,5). Field-independent Ss, as a group, performed better than field-dependent Ss in two of the five trials (trials 2,3). However, of significance here, we found that field-independent introverts consistently performed significantly ($p<.06$ or less) better than the other three sub-groups (14 of 15 comparisons, i.e., 5 trials x 3 comparisons each trial), which did not differ from one another. Again, the two personality dimensions in non-linear interaction revealed performance differences not discernible using each dimension separately.

Insert Table 5 About Here

It would be very presumptuous to try to explain all of these results in terms of "strength" and "sensitivity" of the nervous system, or to indicate that all is clearly understood. Also, it must be pointed out that in certain instances in our retrospective analyses, no relationships were found or relationships only with field-dependence or only with extraversion occurred. And, certainly, we have not covered all of the research that previously has been done. However, explaining everything is not our point at this early stage. What <u>is</u> important and what has been illustrated is that it appears that a <u>combination</u> of field-dependence <u>and</u> extraversion frequently has yielded much more "powerful" and specific results than either dimension by itself.

Of the hundreds, perhaps even thousands, of studies done by followers of Eysenck and Witkin, only a small fraction (probably much less than 1%) appear to have dealt with both dimensions, and then only with linear relationships. (It is my observation that "Eysenckians" rarely ever cite Witkin and "Witkinites" rarely ever cite Eysenck.) Furthermore, in nearly every study, regardless of which dimension was used, classification of Ss into personality categories has been based only on within study test scores rather than on norms from larger data bases, a documentably erroneous and misleading procedure.

Since the MPI or its later versions only takes about 15-20 minutes to complete and the HST no longer than 5 minutes, it seems terribly wasteful not to use both measures, given the suggestive material we have presented above. It is strongly recommended that both be used, and that norms based on large groups be used for determining within-study sub-group classifications so that studies can be directly compared. Where possible, N's should be large enough to permit the upper and lower thirds of the personality score distributions to be used for classifying Ss; the use of medians allows centrally scoring Ss to "contaminate" the results.

Finally, neither the complexity nor the apparent genetic basis of each dimension can or should be ignored. How we look at human behavior determines how we proceed in our research. While biology continues to elucidate new and wondrously complex relationships between the molecular and the molar, most of psychology seems to proceed on the molar level only, either blissfully ignorant of what is transpiring below or hoping that it will go away.

But it simply cannot be ignored, and it most certainly will not go away. Rather, it is going to get even more complex. Somewhere in the beautifully mysterious and complicated RNA/DNA chains of enzymes and proteins and their precursors are markers for very complicated later neurological and other events- structural and functional- which, themselves, then become transformed into specific sub-units of behavior and, thence, into collections of increasingly complex sub-units and, ultimately, into clusters of behaviors which perceptive psychologists... the Eysencks and the Witkins... then label as extraversion or field-dependence.

To better understand this, one should study the article by Livingstone and Hubel (1988) and overlay upon it the virtual certainty that each individual has a distinctly unique combination of all of the complex factors those authors discuss. Thus, individuals may differ markedly from one another in the accuracy of their perception of edges, of slants, of color, contrast and form and the differences between individuals may be at any level, from receptors to highest areas of the cortex. Furthermore, if we look at consistency of perception within an individual, it becomes readily understandable why a person can score very high on one test involving the perception of geometric shapes, the HST, for example, and yet do considerably poorer on what, at a molar level, appears to be a very similar test, e.g., the EFT; the two tests may require different degrees of sensitivity for edges, slants, form, etc. However, tests <u>never</u> have been compared at so basic a level. And it should be obvious that Livingstone and Hubel (1988) are discussing only perception; similar complexity probably obtains in all other systems.

Only through a very deep appreciation of this rather overwhelming complexity and a dedication to systematically "picking it apart" can we hope to arrive at an understanding of individual differences in human behavior and an explanation for the seeming contradictions that we observe when viewing that behavior solely from the molar level.

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Table 1

Group	N	Day 1: Trials 1	2	3	1-3	Day 2: 4	5	6	4-6	Days 1+2: 1-8
Field-Dependent	6	29.8	22.0	22.5	24.8	19.5	18.3	20.2	19.2	22.0
Field-Central	6	18.2	20.3	12.7	17.1	17.7	13.5	11.0	14.1	15.5
Field-Independent	5	14.4	7.2	12.4	11.4	9.8	10.8	14.0	11.5	11.5
t-test; Dep./Indep.		2.19	3.05	1.82	3.21	2.13	1.47	1.34	2.26	3.38
P (1-tail)		.03	.007	.05	.005	.03	.09	.11	.03	.004

Table 2

Group	Field-independent	Field-central	Field-dependent
Extravert	3/21 (14%)	2/23 (9%)	3/20 (15%)
Middle	7/23 (30%)	6/18 (33%)	6/17 (35%)
Introvert	4/18 (22%)	7/19 (37%)	15/19 (79%)

Table 3

Task

Group	N	Anagrams (% Correct) A.M.	Anagrams (% Correct) P.M.	Screw Sorting (# sorted/# errors) A.M.	Screw Sorting (# sorted/# errors) P.M.
Field-independent	28	90.0	88.1	264.0	337.9
Field-dependent	26	80.0	80.2	135.1	259.9
Introvert	30	85.8	85.1	197.3	300.8
Extravert	24	84.5	83.3	207.8	288.8
Independent-introvert	13	87.8	86.8	244.7	376.3
Independent-extravert	15	91.9	89.2	280.8	304.6
Dependent-introvert	17	84.2	83.8	161.1	243.1
Dependent extravert	9	72.2	73.4	86.0	262.4

Table 4

Condition	Group			
	Field-Independent		Field-dependent	
	Introvert (N=15)	Extravert (N=9)	Introvert (N=15)	Extravert (N=10)
	(% Correct)		(% Correct)	
Sea Level	59	56	58	41
Altitude	60	65	59	51

Table 5

Group	N	Trial 1	2	3	4	5
Field-independent	28	365	368	373	365	371
Field-dependent	28	356	355	355	354	359
Introvert	26	366	366	371	371	374
Extravert	30	356	357	357	350	357
Independent-introvert	13	381	384	392	391	386
Independent- extravert	15	351	354	356	343	357
Dependent-introvert	13	351	347	351	350	361
Dependent-extravert	15	361	361	359	358	357

Table Captions

1. Mean Group Error Scores and Tests of Significance for Weight Judgment Task by Field-dependence, Day, Trial and Combined Days
2. Number and Percent of Neurotic Ss Within Combined Field-Dependence and Extraversion Categories (Table 6 from Fine, 1972a; N=178)
3. Mean Group Performance Scores on Anagram and Screw-Sorting Tasks by Extraversion and Field-dependence
4. Target Detection Accuracy at Sea Level and Altitude by Extraversion and Field-dependence
5. Mean Group Tapping Scores Over Five Trials by Extraversion and Field-dependence

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