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EXTRAVERSION-INTROVERSION AS A DIMENSION OF PERSONALITY: A REAPPRAISAL

PATRICIA M. CARRIGAN¹

University of Michigan

Few personality constructs have remained as controversial and as productive of research over the years as extraversion-introversion. First established by Jung (1923) as a "dimension" of the normal personality, the construct has since been extended in many directions; it has been linked with physiological processes and morphology, with perceptual and cognitive behavior, with sociocultural phenomena, with physical and psychopathological disorders of one sort and another. Early attempts to demonstrate these relationships produced little in the way of definitive results; researchers began to doubt the validity of the construct, and in the early forties, it looked for a time as though extraversion-introversion had had its day. Like the proverbial bad penny, however, the construct has continued to turn up, notably in factor analytic studies, and over the past decade it has gradually been reinstated as an important focus in personality research. In a review of factorial studies of personality, Eysenck (1953) observed that although the picture is not as clear as one might wish . . . its main outlines are becoming more and

more definite. . . . At the type level, i.e., at a level where concepts are based essentially on the intercorrelations between traits, three main dimensions appear to have been established: Neuroticism, Extraversion-Introversion, and Psychoticism. These three dimensions appear to be relatively orthogonal to each other, and also to "g" (Thurstone's second-order factor of cognitive functioning) (p. 318).

Eysenck's conclusions as they apply to extraversion-introversion embrace two issues of longstanding concern—briefly, the unidimensionality of the construct, and its relationship to "neuroticism" or, more broadly, adjustment. These issues were not adequately resolved at the time of Eysenck's review; they have gained importance in the years since, as a result of renewed interest in extraversion-introversion. In this paper, the two issues will be examined in the light of more recent evidence, in an attempt to clarify the current status of extraversion-introversion as a personality dimension.

THE ISSUES

Is extraversion-introversion a unitary dimension? Doubt concerning the unidimensionality of extraversion-introversion was a natural consequence of the conflicting results of early research; it was reinforced by the repeated finding of low to moderate correlations (averaging about

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.35) between various measures of the so-called dimension (Bernreuter, 1934; Guilford & Hunt, 1932; Hovey, 1929; Moore & Steele, 1934; Stagner, 1932; Vernon, 1938). While recognizing that the measures were partly at fault, investigators began to suspect, in addition, that they were not dealing with a single dimension.

Unidimensionality is clearly implied in Eysenck's conclusions, above; in support of his position, he points to factors in rating and questionnaire studies (and a few objective and projective test analyses) which, though bearing different names, seem to reflect extraversion-like characteristics. However, many inconsistencies can be found in the factors, and empirical evidence for their identity is virtually nonexistent.

In the past few years, many psychologists have become increasingly convinced that extraversion-introversion is an important dimension of personality; yet there is curiously little agreement as to its essential nature. Cattell (1957b), for example, has presented evidence to indicate that extraversion-introversion is largely of environmental origin; Eysenck (1956a) is as firmly convinced by his research that heredity plays a major role. The persistence of such discrepancies strongly suggests that extraversion-introversion may *not* be a single dimension after all, and that the impression of unity may have resulted from the too hasty attachment of a familiar label to a number of quite different dimensions, on the basis of superficial similarity.

Is extraversion-introversion independent of adjustment? The relationship between extraversion-introversion and adjustment was argued at length by early theorists, some following Jung (1923) in maintaining the independence of the two dimensions, others sharing Freud's (1920)

belief that introversion was a forerunner of neurosis. Researchers generally accepted Jung's formulation, but ran into difficulty when it came to measuring the two dimensions. Guilford (1934) pointed up the problem, calling attention to

the very troublesome situation found by those who construct tests of IE [introversion-extroversion] and of "neurotic tendency," a difficulty in keeping the two types of tests from correlating significantly with one another (p. 343).

Again, the measures were suspect, but with repeated attempts to improve them, measures of extraversion continued to correlate as highly with adjustment measures as they did with each other (Bernreuter, 1934; Vernon, 1938). Thus, the possibility of an intrinsic relationship between the two dimensions could not be ruled out.

The problem has been less apparent in factorial research, where, as Eysenck has noted, orthogonal factors resembling extraversion-introversion and neuroticism frequently appear in the same analyses. In many instances, however, the characteristics associated with "introversion" continue to have a strong maladjustive flavor.

Clarification of these issues must be sought in multivariate research, examined in the light of well-defined criteria for unidimensionality and factorial independence. The following criteria appear useful; they guide the presentation of evidence, below, and provide a framework for subsequent evaluation.

1. If extraversion-introversion is a major, unitary dimension of personality, (a) it should be represented as a factor in all measures and media covering the personality domain, and (b) the factors so obtained should be interrelated.

2. If extraversion-introversion and adjustment are independent dimen-

sions, (a) factors corresponding to the two dimensions should be uncorrelated, and (b) to the extent that the same variables appear on factors of extraversion-introversion and adjustment, indicators of "good" and "poor" adjustment should as frequently be associated with extraversion as with introversion.

THE EVIDENCE

In the present discussion, attention will be focused on research which has appeared since Eysenck's 1953 review. However, exceptions will be made in the case of earlier studies which are particularly relevant to the issues outlined above. The evidence to be considered comes chiefly from the researches listed (with code symbol and reference citation) in Table 1.

Analyses of Ratings

Few factorial rating studies have been published in recent years; the one contribution of interest here is a second-order analysis by Cattell (CaD) of "life-record" data, based on observations of behavior in life situations. Cattell's second-order extraversion factor has positive loadings on F, Surgency (.70); E, Dominance (.54); A, Cyclothymia (.38); and H, Parmia (.17), the latter associated with gregarious sociability and impulsiveness. At the introvert pole, the factor is defined by M, Autia (-.54), linked with extreme subjectivity and "inner mental life."

The results of this analysis are especially noteworthy, in view of Cattell's longtime insistence that extraversion-introversion (E-I) was nothing more than a broad cluster of related trait elements, and, as such, not a very useful construct (Cattell, 1945, 1946, 1950). Having discovered second-order E-I factors in rating and questionnaire data, he now suggests that

it is perhaps worth while to make a determined attempt to rescue the label "extravert-vs-introvert" from the scientific disrepute and uselessness into which it has fallen through popular adoption (Cattell, 1957b, p. 267).

Analyses of Questionnaires

Much of the factorial research relevant to E-I is based on questionnaires which evolved from a series of early factorial studies by Guilford and Guilford (1934, 1936, 1939a, 1939b). Among these questionnaires are Guilford's Inventory of Factors STDCR (1940); the Guilford-Martin Inventory of Factors GAMIN (1943a); the Guilford-Martin Personnel Inventory (1943b); and the Guilford-Zimmerman Temperament Survey, or GZTS (1949), which incorporates 10 factors from the preceding inventories

Analyses of the Guilford Questionnaires

It can be seen in Table 2 that analyses of the Guilford questionnaires have consistently yielded E-I factors defined by a similar pattern of variables. Factors obtained by Denton and Taylor (De) and by North (No), in analyses of the STDCR inventory, have their principal loadings on R, Rhathymia (freedom from care) and S-, Social Extraversion.² R and S- also appear on Lovell's factor (Lo) along with G, General Activity, and A, Ascendance, from the GAMIN inventory. The same four variables are distributed on three of the factors obtained by Thurstone (Thu) in a reanalysis of Lovell's data. A second-order analysis of Thurstone's matrix by Baehr (Ba) pulls together R, S-, G, and A on an extraversion-like factor, Primary Function, which is defined by Thurstone's Factors VII, Impulsivity (.85) and V, Dom-

² Denton and Taylor's factor also has a loading of .29 on an objective test factor called Verbal Versatility.

TABLE 1
MAJOR CHARACTERISTICS OF MULTIVARIATE STUDIES RELEVANT TO
EXTRAVERSION-INTROVERSION (E-I)

| Investigator | Symbol | Sample | Number and Type of Variables ^a | Type of Analysis ^b | Number of Factors |
|--|--------|--|---|--|-------------------|
| Baehr (1952) | Ba | (Same as Thu, below) | 9 Q | Second-order, oblique | 6 |
| Becker (1959) | Be | 32 male, 30 female college students | 25 T ^c 15 Q | First-order, orthogonal | 8 |
| Cattell (1955) | CaA | 250 USAF pilot trainees | 64 T | First-order, oblique | 15 |
| | CaB | 500 USAF pilot trainees | 113 T 15 Q | First-order, oblique | 16 |
| Cattell (1956b) | CaC | 181 male & female college students, 227 USAF trainees | 15 Q | Second-order, oblique | 4 |
| Cattell (1957b) | CaD | 544 male & female college students | 12 R | Second-order, oblique | 6 |
| Cook & Wherry (1950) | Co | 111 naval submarine candidates | 11 Q 6 T 2 C 1 R | First-order, orthogonal | 6 |
| Denton & Taylor (1955) | De | 170 high school seniors | 8 T 5 Q | Second-order, oblique | 6 |
| Eysenck (1956a) | Ey | 104 twins (13 pairs each male identical & fraternal, female identical & fraternal) | 34 T 11 PT 2 R 2 SR 1 Q | First-order (rotational criteria not specified) | 6 |
| Foster (1955) | FoA | 54 state highway patrol officers | 8 PT 2 T 1 C | First-order, orthogonal | 4 |
| | FoB | 28 college student volunteers | 8 Q 4 PT 4 I 3 T | First-order, orthogonal | 5 |
| Franks, Souief, & Maxwell ^d | Fr | 100 male, 100 female adult volunteers | 7 Q | First-order, orthogonal ^e | 3 |
| Guilford & Zimmerman (1956) | Gu | (Same as Lo, below) | 69 Q | First-order, orthogonal (r_i , cosine-pi approximation) | 18 |
| Heron (1954) | He | 80 male unskilled factory workers | 19 T 4 I 1 C 1 R | First-order, orthogonal (Burt's simple summation) | 4 |
| Hildebrand (1958) | Hil | 95 male neurotics | 15 T 6 Q 1 I | First-order ^e | 4 |
| Himmelweit, Desai, & Petrie (1946) | Him | 64 male surgical patients | 16 T 1 Q 1 C | First-order orthogonal (r_i ; unrotated) | 2 |
| Karson & Pool (1957b) | KaA | 71 maladjusted USAF officers | 30 Q | Correlational | — |
| Karson & Pool (1958) | KaB | 71 maladjusted USAF officers | 16 Q | Second-order, orthogonal | 6 |
| Kassebaum, Couch, & Slater (1959) | Kas | 160 male college freshmen | 32 Q | First-order, orthogonal | 3 |
| Lovell (1945) | Lo | 122 male, 78 female college students | 13 Q | Second-order, orthogonal | 6 |

^a Classified as follows: C, clinical observation; I, interest or attitude inventory; PT, projective test; Q, questionnaire; R, behavioral rating; SR, self-rating; T, objective test.

^b Unless otherwise noted, all factorizations began with centroid analyses based on Pearson r , factors subsequently rotated for simple structure.

^c Plus 7 retest measures, 5 random variables, 6 items of background information.

^d Unpublished study, 1958.

^e Not rotated for simple structure; rotational criteria described in text.

TABLE 1 (Continued)

| Investigator | Symbol | Sample | Number and Type of Variables | Type of Analysis | Number of Factors |
|-------------------------------------|--------|---|------------------------------|---|-------------------|
| R. D. Mann (1958) | MaA | 100 male college students | 26 Q 8 T 5 I 1 R | Second-order, ¹ orthogonal | 7 |
| R. D. Mann ² | MaB | 100 male college students | 26 Q | Second-order, orthogonal | 5 |
| | MaC | 100 female college students | 26 Q | Second-order, orthogonal | 5 |
| Nelson & Shea (1956) | Ne | 19 male, 33 female college students | 15 Q | Correlational | — |
| North (1949) | No | 155 male, 15 female college students | 5 Q | Second-order, orthogonal | 2 |
| Royal (1950) | Ro | 100 male college students | 12 PT 3 Q | Correlational (r_{pb}) | — |
| Scheier & Cattell (1958) | Sc | 86 male college students | 90 T 17 Q 6 R | First-order, oblique | 15 |
| Singer, Wilensky, & McCraven (1956) | Si | 100 male schizophrenics | 9 PT | First-order, oblique (r_{ψ}); second-order, oblique | 4 |
| | | | 9 T 4 R 1 SR | | 2 |
| Thornton & Guilford (1936) | Tho | 75 male, 25 female college students | 5 Q 5 PT | Correlational | — |
| Thurstone (1951) | Thu | (Same as Lo, above) | 13 Q | First-order, oblique | 9 |
| Tyler (1951) | Ty | 107 female graduate students | 15 Q | First-order, orthogonal & oblique | 5 |
| Welsh (1956) | We | 150 male VA medical & surgical patients | 16 Q | First-order, orthogonal (unrotated) | 3 |
| Wheeler, Little, & Lehner (1951) | Wh | 112 male college students (matrix 1) | 12 Q | First-order, orthogonal | 4 |
| Williams & Lawrence (1954) | Wi | 100 male VA neuropsychiatric patients | 17 PT 14 Q 1 T | First-order, orthogonal & oblique (r_t for T & PT variables) | 4 |
| Wood (1957) | Wo | 56 male & female college students | 18 Q | Correlational | — |

¹ With respect to Q variables only. However, factors discussed here have no important loadings except on Q variables, hence are essentially second-order factors.

² Unpublished analyses, Univer. of Michigan, 1959. Based on data obtained by Weitzenhoffer (1956).

inance (.80). However, Thurstone's first factor, Reflectiveness, with its principal loading on T, appears instead on Baehr's Emotionally Unstable factor. From this analysis—and from the preceding ones—it looks as if T, Thinking Introversion, is essentially a maladjustment factor,³ and that the core of E-I as measured by the Guilford questionnaires consists of Factors R, S, G, and A.

A question about the relationship of R to extraversion has been raised

³ However, its GZTS counterpart, Thoughtfulness, loads several extraversion-like factors obtained in joint analyses of the Guilford and Cattell questionnaires, discussed subsequently.

by Guilford and Zimmerman, who have recently carried out another analysis (Gu) of Lovell's data. In order to have several variables representing each factor, they divided each of the factor scales into three or more short "tests," by sorting the items into apparently homogeneous subgroups. Sixty-nine "tests" or variables were obtained in this manner; another—the subject's sex—was added. The matrix of intercorrelations for the 70 variables yielded fairly good approximations of the 13 original questionnaire factors, along with a second C factor—C2—and four residuals. Minor changes in meaning

TABLE 2
QUESTIONNAIRE FACTORS: GUILFORD AND CATTELL FACTORIAL QUESTIONNAIRES

| Variable ^a | Factor Identification (Analysis & Factor in Series) | | | | | | | | | | | | | | | |
|--|---|---------|----------|-----|-----|------|-----------|-----------|----------------------|-----|------|-----|------|-----|------|------|
| | De V | Lo I | No II | Thu | | | CaC II | KaB II | Be V ^c | MaA | | MaB | | MaC | | |
| | | | | I- | V | VII | | | | III | IV | III | IV- | II | III- | IV |
| Guilford factors^b | | | | | | | | | | | | | | | | |
| G, General Activity | | 73 | | -02 | -04 | 60 | | | | 60 | 04 | 62 | 02 | 64 | -07 | 29 |
| R, Restraint (R, Rhathymia) | 71 | 71 | 75 | 41 | 07 | 45 | | | 81 | -07 | -64 | -25 | -67 | -48 | -51 | -26 |
| A, Ascendance | | 70 | | -03 | 55 | 00 | | | | 56 | 02 | 83 | -21 | 77 | -19 | -15 |
| S, Sociability (S, Social Introversion) | -51M | -70M | -75M | -29 | -42 | -06M | | | | 70 | 06 | 77 | 00 | 80 | 11 | -22 |
| E, Emotional Stability (C, Cycloid Tendency) (D, Depression) | 42M | -02M | 01M | -26 | 00 | 05M | | | | 18 | 10A | 19 | 00A | 29 | 03 | 01A |
| O, Objectivity | 01M | -23M | -24M | -35 | -12 | 01M | | | | 06 | 04A | 09 | 05A | 19 | -17 | -05A |
| F, Friendliness (Ag, Agreeableness) | | 25A | | 08 | 00 | 13 | | | | 07 | -31A | -28 | 01A | -25 | 07 | 04A |
| T, Thoughtfulness (T, Thinking Introversion) | -03M | -08A | | -03 | -01 | -03 | | -17A | | 04 | -51 | 23 | -72 | -08 | -58 | -17 |
| P, Personal Relations (Co, Cooperativeness) | | -08M | -03M | -76 | 00 | -02M | | -61 | | 11 | -11A | -01 | 05A | 03 | -08 | -10A |
| M, Masculinity (I, Inferiority) | | 06 | | 03 | 07 | -03 | | 09A | | 06 | 08A | 09 | 13A | 19 | -41 | -04A |
| -, (N, Nervousness) | | -02 | | 00 | 01 | -04 | | -07 | | | | | | | | |
| | | -38M | | 05 | -04 | -17 | | | | | | | | | | |
| | | 00M | | -01 | 00 | -05M | | | | | | | | | | |
| Cattell factors | | | | | | | | | | | | | | | | |
| A, Cyclothymia | | | | | | | 45 | 51 | | 22 | 05 | 31 | 08 | 30 | 23 | -04 |
| B, General Intelligence | | | | | | | 03 | 03 | -08 | 03 | -13 | -15 | 05 | -02 | -15 | 02 |
| C, Emotional Stability | | | | | | | 10A | 24A | | 11 | -02A | -11 | 23A | -03 | -04 | 08A |
| E, Dominance | | | | | | | -01 | 54 | | 36 | 28 | 51 | 06 | 55 | -30 | 23 |
| F, Surgency | | | | | | | 48 | 75 | | 31 | 57 | 49 | 50 | 55 | 27 | 09 |
| G, Super-Ego Strength | | | | | | | -01 | -06 | -39 | 22 | -28 | 20 | -45 | -11 | 06 | -45 |
| H, Parmia | | | | | | | 33A | 84A | | 68 | 09 | 85 | 00 | 86 | 01 | -12 |
| I, Premsia | | | | | | | 01 | -23M | -18 | 10 | -35 | -06 | -37 | -11 | 03 | 25 |
| L, Protension | | | | | | | -13M | -02M | | -22 | 33M | 11 | -05M | -10 | -10 | 01M |
| M, Autia | | | | | | | -51 | 02M | -15 | -08 | 13M | 11 | -11M | 30 | -10 | 33M |
| N, Shrewdness | | | | | | | -09 | 11 | 06M | 21 | 34M | 05 | -05 | 02 | -18 | -01 |
| O, Guilt-Proneness | | | | | | | -07M | -34M | | -30 | -17M | -29 | 09M | -15 | -04 | 19M |
| Q1, Radicalism | | | | | | | -42 | 02M | -08 | 09 | 02 | 01 | -05 | 09 | -52 | 17 |
| Q2, Self-Sufficiency | | | | | | | -38 | -23 | | -30 | 11 | -32 | -23 | -34 | -38 | 31 |
| Q3, Will Control | | | | | | | -01A | -19A | | 06 | -34 | -15 | -51A | 01 | -07 | -59A |
| Q4, Ergic Tension | | | | | | | -09M | -06M | | 05 | 01M | -03 | 07M | -07 | -03 | -14M |

Note.—In this and subsequent tables, decimal points omitted, factor loadings reported to two decimal places. Vacant cells indicate variables not represented in study. A and M (attached to factor loadings) indicate variables appearing on "adjustment" factors ($\geq .30$) in same analysis, and direction of loading (A=adjustment, M=maladjustment).

^a Loadings reflected where necessary to agree with direction indicated by factor scale title.

^b Listed by title in Guilford-Zimmerman Temperament Survey. Earlier equivalents, if different, given in parentheses. Note change in direction for R and S.

^c Additional loadings: Maudsley Personality Inventory E, Extraversion, 82; N, Neuroticism -28M; 16 PF second-order Anxiety -14M; 16 PF second-order Extraversion (sum A, E, F, and H), 68.

were indicated for several factors, and rather substantial ones for R. Half of the "tests" from the R scale went to other factors: reticence to A, impulsivity to C2, and rapport with the environment to O. In view of these modifications, particularly the last, Guilford and Zimmerman have questioned the relationship of R to Jung's extraversion, with which it has generally been identified. However, the remaining attributes of R—carefreeness, unconcern, and liking for action, along with the cheerfulness and energy formerly associated with Factors D and G—seem in a broad sense, at least, to be consistent with extraversion.

Analyses of the 16 PF Test

Cattell's E-I questionnaire factor emerged from a second-order analysis (CaC) of the Sixteen Personality Factor Questionnaire, or 16 PF test (Cattell, 1957a). This factor, shown in Table 2, is similar to the previously discussed rating factor, differing chiefly in the omission of E, Dominance, and the addition at the introvert pole of two primary factors unique to questionnaire data—Q1, Radicalism, and Q2, Self-Sufficiency.

The 16 PF extraversion factor obtained by Karson and Pool (KaB) resembles Cattell's in F, Surgency, and A, Cyclothymia, but the two factors are otherwise quite different. As seen in Table 2, Karson and Pool's factor adds E, drops Q1, and has a negligible Q2 loading; more important discrepancies are found in H, Parmia, and M, Autia. Cattell's factor has its highest loading on M, and a relatively small one on H; Karson and Pool's E-I factor, on the other hand, has its highest loading on H and no loading on M, which appears on their anxiety factor (.72). Similarly, M contributes little to the extraversion-like factors obtained in

joint analyses of the Guilford and Cattell questionnaires, but in three of these analyses (MaA, MaB, MaC) it has substantial loadings—.44, .59, .54—on maladjustment. Furthermore, Wood's 16 PF intercorrelations (Wo) show M to be virtually uncorrelated with the other extraversion primaries, but closely related to the major components of Cattell's second-order anxiety factor (L, O, Q3, Q4). Contrary to Cattell's results, then, these studies suggest that M is primarily a maladjustment factor.

The various studies do differ in several respects, and while the discrepant results are not adequately accounted for by these differences, it is well to mention them. In the first place, Cattell's factors are oblique, Karson and Pool's factors—and factors from the joint analyses—are orthogonal. The use of different rotational criteria might be expected to result in somewhat different factor patterns; it is not a sufficient explanation, however, for the correlation matrices themselves are quite dissimilar. Cattell's matrix shows M, for example, to be a relatively independent factor, having its highest correlation (−.36) with F. On the other hand, Karson and Pool, Mann, and Weitzenhoffer (1956)—whose matrices were used in Mann's B and C analyses—found M to be substantially correlated with several factors, notably the adjustment primaries. It should be noted, too, that Cattell's matrix consists of correlations between the primary *factors*, the others of correlations between *factor scores*. However, for the sample on which Cattell's analysis is based, the correlations between factor scores do not differ greatly from the primary factor intercorrelations (Cattell, 1957a). Finally, the various analyses are based on somewhat different pop-

ulations—i.e., Karson and Pool's on Air Force personnel, Mann's on college students, Cattell's on a combined group of college students and Air Force trainees. On the basis of population differences, then, it would be expected that the greatest discrepancies would be found between Karson and Pool's analyses and Mann's. Quite the contrary, these studies yielded the most comparable intercorrelations, and the Karson and Pool E-I factor is closely paralleled by one factor from each of Mann's analyses (MaA and MaB III, MaC II). Moreover, these studies unanimously fail to support M as a major E-I variable. Thus, while some of Cattell's primary factors—notably F and H—seem well-established as nuclear parts of the extraversion pattern, the role of M remains unclear.

Joint Analyses: Guilford and Cattell Questionnaires

Inasmuch as the questionnaires of Guilford and Cattell cover a wide range of personality characteristics, it might be expected that the measures would overlap to some extent, and that the two sets of extraversion factors would be closely related. The nature of the relationship can be seen in Table 3, in the GZTS-16 PF intercorrelations obtained by Weitzenhoffer. It is interesting to note that the questionnaire scales with consistently high loadings on E-I factors—Guilford's R, S, G, and A, and Cattell's F and H—form a highly correlated "cluster," and that except for E, Dominance, the remaining extraversion primaries from the two inventories are only tangentially linked with the cluster.

Of greater interest is what happens to the cluster when the intercorrelations for the Guilford and Cattell scales are jointly factored. Relevant factors from Mann's analyses (MaA,

MaB, MaC), and Becker's (Be), appear in Table 2. One of the first things to be noted is that only one of the joint analyses yielded a factor which clearly corresponds to the cluster described above: Factor II in Analysis MaC, which has its principal loadings on 16 PF E, F, and H, and GZTS G, R-, A, and S. The MaA and MaB analyses split the cluster and distributed its variables on two factors—Factor III, Social Extroversion, which combines GZTS S, G, and A with 16 PF H and E, and Factor IV, Lack of Self-Control, which links GZTS R- (and T-, one of the "fringe" variables) with 16 PF F. Becker's factor seems most closely related to the latter, by virtue of its loadings on Guilford's R- and T- and 16 PF G-, Lack of Internal Standards. Unfortunately, comparison is hindered by the fact that 16 PF A, E, F, and H are represented by a single score in Becker's analysis (see footnote, Table 2). Finally, looking again at the MaC analysis, it will be noted that Factor II, despite its sizeable loadings on all of the cluster variables, is most heavily weighted by GZTS S, G, and A, and 16 PF H; in short, it is most similar to the Social Extroversion factors from the MaA and MaB analyses. MaC Factor III-, with its GZTS R- and T- loadings, and Factor IV, defined principally by 16 PF G- and Q3-, Lack of Will Control, may be a further split of the Lack of Self-Control factors obtained in the MaA and MaB analyses.

From Mann's analyses, then, it appears that two or more factors are required to account for the intercorrelations between E-I variables from the Guilford and Cattell questionnaires. Moreover, the factors show remarkably little overlap; only F, Surgency, has loadings as great as .30 on the two factors from the MaA and MaB analyses. It would seem, there-

TABLE 3
 INTERCORRELATIONS BETWEEN E-I VARIABLES:
 GZTS AND 16 P. F. QUESTIONNAIRES
 (From Weitzenhoffer, 1956)

| Variable | GZTS | | | | |
|----------|------|-------|-------|-------|-------|
| | G | R | A | S | T |
| 16 P. F. | | | | | |
| A | 16 | -15 | 19 | 28** | -05 |
| | 07 | -27** | 20* | 29** | -05 |
| E | 29** | -26** | 44** | 37** | 17 |
| | 39** | -07 | 47** | 34** | -04 |
| F | 30** | -60** | 26** | 44** | -17 |
| | 40** | -54** | 28** | 41** | -29** |
| H | 47** | -36** | 74** | 74** | 06 |
| | 45** | -40** | 69** | 81** | -02 |
| M | 10 | 06 | 04 | -18 | 32** |
| | 33** | -30** | 17 | 05 | 15 |
| Q1 | 13 | 29** | 19 | -14 | 37** |
| | 06 | 06 | 11 | 06 | 40** |
| Q2 | -19 | 23* | -11 | -45** | 28** |
| | -08 | 26** | -28** | -44** | 17 |

Note.—Intercorrelations based on 100 males, 100 females, respectively. Italicized coefficients indicate reversals of expected sign.
 * Significant at .05.
 ** Significant at .01.

fore, that these factors represent relatively distinct dimensions.

As to the nature of the dimensions, Mann (1958), in a discussion of his MaA factors, has suggested the possibility that

Factor III corresponds to the American conception of extroversion, with its emphasis on sociability and ease in interpersonal relations, while Factor IV corresponds to the European conception of extroversion, with its emphasis on impulsiveness and weak super-ego controls (p. 108).

Mann's distinction appears to be a valuable one; perhaps, however, it can be more precisely tied down in terms of the major variables defining the two factors.

Looking first at Social Extroversion, the vitality and enthusiasm associated with GZTS G, the aspiration to leadership and interpersonal interaction reflected in A and 16 PF E, the seeking of (and pleasure in) social contacts described by GZTS S and 16 PF H, all appear

to be ingredients of response to the environment and its "objects," i.e., people. A dimension described by these variables might then be broadly conceptualized as one of response to external stimuli, with the extremes characterized as approach vs. avoidance. Thus defined, Social Extroversion would seem to approximate Jung's (1923) conception of extraversion, the essence of which is the relative importance accorded the "object" and objective events. The negative pole of the factor might likewise be identified with Jung's introversion—emphasis on the self and inner, subjective processes—to the extent that avoidance of the external world can be viewed as a consequence of such self-preoccupation.

Mann's Lack of Self-Control factor, on the other hand, suggests a very different conception of E-I. Among the variables defining this factor, GZTS R- contrasts happy-go-lucky unconcern with seriousness and

self-control; T- is associated with mental disconcertedness, as opposed to reflectiveness and self-observation; 16 PF F reflects carefreeness vs. introspectiveness and brooding;⁴ G- is associated with lack of dependability and indolence, as opposed to perseverance and conscientiousness; Q3- contrasts laxity with control. The essence of these characteristics seems to be their relevance to the handling of impulses; the dimension they describe might be thought of as one of response to stimuli arising from within. Viewed in this way, Mann's Lack of Self-Control factor is readily identified with Eysenck's conception of E-I. In his *Dynamics of Anxiety and Hysteria*, Eysenck (1957) characterizes the neurotic extravert as undersocialized (schematically, id +ego > super-ego); the neurotic introvert, on the other hand, is described as oversocialized (super-ego +ego > id). An empirical link with Eysenck's viewpoint is provided by the high R loading on Lack of Self-Control. Eysenck considers R to be a good measure of his dimension; he has used it both as a research criterion and as the basis for the Extraversion (E) scale in the Maudsley Personality Inventory (Eysenck, 1956b). Of further interest is the fact that until recently, at least, Eysenck has been unwilling to include sociability as part of his extraversion constellation. In view of the independence of Social Extroversion and Lack of Self-Control, it appears that he may have been quite correct.

Several implications can be drawn from the joint analyses reported here. One concerns the relationship between E-I and adjustment. On the

⁴ F also contrasts enthusiasm, cheerfulness, and talkativeness with incommunicativeness—a contrast more relevant to response to the environment. That F loads both factors is thus not surprising.

basis of the MaA analysis, a good case can be made for identifying Social Extroversion as a factor of "well-adjusted" extraversion. It can be seen in Table 2 that the factor (III) tends to have positive loadings on variables associated with "good" adjustment, negative ones on variables related to maladjustment. On the other hand, the MaB and MaC counterparts (Factors III and II, respectively) do not reflect this tendency. It should be pointed out, however, that the highest-loading variables on Social Extroversion—GZTS S and 16 PF H—have small but consistently positive loadings on adjustment factors, in every analysis which included them. It cannot be denied, moreover, that in a culture such as ours, which places a high premium on interpersonal interaction, the characteristic avoidance of such interaction—associated here with social *introversion*—might be considered maladaptive.

On the other hand, if Mann's Lack of Self-Control factor is correctly identified with Eysenck's dimension, it would appear that *both* extremes of this factor are linked with maladjustment. Presumably the individual whose ego mediates a more harmonious relationship between the expression and control of impulses—i.e., the individual falling near the middle of the dimension—would be better adjusted than individuals at either extreme. However, to the extent that society rewards self-control and conformity to cultural standards, the factor might be looked upon as contrasting maladjusted extraversion with well-adjusted introversion. The latter interpretation is favored by the MaA analysis, where Factor IV tends to have positive loadings on "maladjustment" variables, negative ones on variables reflecting "good" adjustment (see Table 2). Again, however,

the MaB and MaC analyses do not concur.

Further implications stem from the independence of the two factors. While the relationship to adjustment requires further clarification, if it should turn out that Social Extroversion and Lack of Self-Control *do* reflect well-adjusted and maladjusted extraversion, respectively, the lack of overlap in the two factors might suggest that extraversion and introversion are differentially manifested in individuals falling at opposite ends of the adjustment continuum. Discrepancies between the MaA and MaB factors, based on male subjects, and the MaC factors, based on female subjects, suggest further a qualitative sex difference in E-I. A final implication concerns the unidimensionality of E-I. In view of the independence of Mann's factors, it is quite clear that the dimensions they represent cannot be subsumed under the same label.

Analyses of the MMPI

With a few exceptions (Abrams, 1949; Cottle, 1950; Wheeler, Little, & Lehner, 1951 [Matrix 2]), factorial studies of the Minnesota Multiphasic Personality Inventory (MMPI) have consistently yielded bipolar factors with contrasting loadings on *Ma*, Hypomania, and *D*, Depression. That these factors (Table 4) may be related to E-I is suggested by several analyses, in which the MMPI clinical scales have been supplemented by various "personality" scales developed for the inventory.

Two factors from Tyler's analysis (Ty) are relevant. As Table 4 shows, Factor II, a "hysteroid" conflict factor, adds to the *Ma-D* contrast a dimension of responsibility (*Re*) not uncommonly associated with introversion. The appearance of *Hy*, Hysteria, at the "introvert" extreme re-

quires comment, however. According to Eysenck's theory,⁵ hysteria is associated with extraversion, and the negative *Hy* loading—here, and on several other factors in Table 4—would thus seem to be inconsistent. It will be seen later, however, that the MMPI *Hy* scale is essentially unrelated to Eysenck's E-I dimension. Of the remaining variables defining Tyler's second factor, the prominence of *Pt*, Psychasthenia, and *Sc*, Schizophrenia, might suggest that the factor is one of "maladjusted" introversion, but the overall resemblance of the factor to E-I is not impressive.

Tyler's third factor, Social Aggressiveness, differs somewhat in the orthogonal and oblique rotations. The oblique factor links *Ma* with *Do*, Dominance, and *St*, Social Status, and has its highest loading on another scale suggestive of Eysenck's extraversion—*Pd*, Psychopathic Deviate. *D* does not appear on the factor, but the variables defining the negative pole do not seem inconsistent with introversion. The orthogonal factor, on the other hand, is less well defined, and the substantial *Pt* and *Sc* loadings suggest that it would have to be looked upon as a factor of "maladjusted" extraversion. In general, Tyler's analysis seems to confirm the presence of an extraversion-like dimension in the MMPI, but the exact nature of the dimension is by no means clear.

Welsh's analysis (We) is not strictly comparable to other MMPI analyses. It is based chiefly on *prime scales*—modified versions of the original scales containing no multiple scored items and, hence, not subject to the spurious intercorrelation introduced by item overlap. Several other special scales are included:

⁵ The reader unfamiliar with Eysenck's theory will find a brief discussion later in this paper.

Gm, consisting of items scored for at least three MMPI scales and thought, therefore, to reflect some general MMPI dimension, presumably maladjustment; *Ja*, a rational scale of anxiety; and three empirical scales—*A*, Anxiety, *M*, Mania, and *R*, Repression—made up of items found to differentiate between subjects scoring at the high and low extremes on the *Gm*, *Ma'*, and *D'* scales, respectively.

Welsh's second factor contrasts *Ma'* and *M* with *D'* and *R*, and has a small loading on *Si'*, Social Introversion; it also brings in at the "introvert" pole the rationally-derived maladjustment scales (*Gm*, *Ja*), although *Pt'* and *Sc'* do not appear on the factor. Inasmuch as Welsh's factors are unrotated, the analysis as it stands is not very satisfactory. It does, however, provide added evidence for an E-I dimension in the MMPI—a dimension which apparently transcends item overlap in the scales.

By far the most impressive results are those from Kassebaum, Couch, and Slater's analysis (Kas). Their second factor, Introversion-Extraversion, links *D* with *R*, *Si*, *Re*, and *L*, Lie Score; *Ma* appears at the extravert pole, along with *Im*, Impulsivity, and several scales suggestive of a "social" orientation. The factor thus incorporates several scales associated with the other factors in Table 4, and adds a number of "personality" scales which further identify it as an E-I factor.

In their discussion of the factor, Kassebaum et al. have called attention to the fact that two of the scales defining introversion—*R* and *L*—consist solely of items scored for a "False" response; a third "introversion" scale, *D*, likewise has a preponderance of "False" items, whereas *Ma*, associated with extraversion, contains significantly more "True"

items. On the basis of these facts, the writers suggest the possibility that

what we have labeled extraversion is associated with a general tendency to agree with any item whatever the content, while what we have called introversion involves a converse tendency to disagree or mark False (Kassebaum, Couch & Slater, 1959, p. 230).

The extent to which such a "response set" may be involved in the various E-I questionnaire factors will be considered later.

It can be seen in Table 4 that most of the MMPI scales contribute substantially to maladjustment factors. Hence, in Kassebaum, Couch, and Slater's analysis, all of the E-I variables except *R* and *L* have loadings of .48 or above on Factor I, Ego Weakness. The nature of the relationship between these two "dimensions" is clarified to some extent by a further step in the analysis. Kassebaum and his colleagues reasoned that if their first two factors were correctly interpreted as Ego Weakness (maladjustment) and Introversion-Extraversion, it should be possible to identify more precisely the characteristics of "normal" and "disturbed" extraversion and introversion by rotating the axes 45 degrees and redefining the factors in their new positions. The axes were shifted accordingly, yielding two *fusion factors*, so named because they were thought of as combinations of the primary reference axes. Fusion Factor A, contrasting maladjusted introversion with normal extraversion, was labeled Social Withdrawal vs. Social Participation. It had its principal loadings on *Si*, *D*, and *Fm*, Feminine Masochism, and, at the negative pole, on the "social" scales *Sp*, *Sy*, and *St*. Fusion Factor B, Impulsivity vs. Intellectual Control, contrasted maladjusted extraversion with well-adjusted introversion. Its largest loadings were on *Im*, *Ma*, and, negatively, on *Re*, *To*,

Tolerance, and *Ac*, Achievement via Conformance. As would be expected, the two factors shared substantial loadings on a number of scales related primarily to maladjustment.

The conceptual similarity of the fusion factors to Mann's Social Extroversion and Lack of Self-Control is apparent. And, just as Mann's analyses split the cluster of extraversion variables from the GZTS and 16 PF questionnaires, the two fusion factors obtained by Kassebaum et al. show a clear separation of the MMPI scales contributing to their E-I factor, with the exception of *R*, Repression, which has sizeable loadings on both A and B. Again, there seems to be a clear implication that differences in adjustment may be associated with qualitatively different manifestations of extraversion and introversion.

Joint Analyses: MMPI and the Factorial Questionnaires

Relationships between the MMPI and the Guilford and Cattell questionnaires have been explored in several studies. A recent analysis by Franks, Souief, and Maxwell (Fr) is based on seven scales from the MMPI and STDCR inventories, selected as likely measures of E-I or neuroticism: Guilford's *D*, *C*, and *R* scales, and MMPI *K*, *Hy*, *Pd*, and *Pt*. The second and third factors obtained in the analysis are shown in Table 4; they were rotated orthogonally to Factor I, Neuroticism, so as to obtain a zero loading for *R* on Factor II. Thus rotated, Factor II has a large loading on *Hy*, smaller ones on *K* and *Pd*, and is identified as Extraversion-Introversion. Factor III, Rhathymia, has its principal loading on *R*.

This study raises several questions which, unfortunately, go unan-

swered.⁶ Nowhere do the writers offer an explanation for the seemingly arbitrary rotation of Factors II and III. The deliberate elimination of *R* from the E-I factor is puzzling; Franks himself has used *R* as a measure of extraversion (Franks, 1956; Franks & Laverty, 1955; Laverty & Franks, 1956), and, moreover, the *R* scale was included in the present study because of its previously demonstrated relationship to the E-I dimension. The rationale for the interpretation of Factor II is equally unclear. The authors cite studies by Eriksen (1954a, 1954b) and by Eriksen and Davids (1955), which showed that college students obtaining high *Hy* and *Pt* scores, respectively, had certain characteristics in common with Eysenck's extraverted and introverted neurotics. However, these findings do not seem especially relevant; *Pt* has a small loading on Factor II, but in the same direction as *Hy*! Apparently, then, the interpretation of Factor II rests on Eysenck's association of hysteria and psychopathy with extraversion. Yet data from one of Eysenck's studies (1952) show that *Hy*—the highest-loading variable on Factor II—does not differentiate between hysterics, psychopaths, and anxiety states, the latter an "introvert" group; moreover, *Hy* correlated negatively ($-.115$) with the hysteria-anxiety dichotomy.

Franks et al. are undoubtedly wise to make a conservative interpretation of Factor III, in terms of its major variable, *R*. Nevertheless, the identification of this factor (rather than Factor II) with E-I would seem

⁶ The writer was privileged to read and comment on Franks' manuscript some time ago, and understands that it is undergoing revision before being submitted for publication. Perhaps the issues raised here will be dealt with in the revision.

to be more defensible on the basis of existing evidence.

A broader picture of the relationships between E-I variables from the MMPI and the factorial questionnaires comes from two correlational studies—one by Nelson and Shea (Ne), using MMPI and the STDCR inventories, the other Karson and Pool's study (KaA) of the MMPI and 16 PF. Relevant coefficients from the two studies are reproduced in Table 5. It can be seen that only the *Si* scale is consistently related to the extraversion primaries from the two factorial questionnaires. *Ma* and *D* tend to correlate with the principal scales from the previously described extraversion "cluster" (Guilford's R and S, Cattell's F and H) but with no others; and the remaining MMPI scales—*K*, *Hy*, *Pd*, and *L*—have little in common with the factorial measures.

Karson and Pool's data shed further light on the nature of 16 PF Factor M, Autia. M correlates not only with *K*- and *Si*, but also with

MMPI *Pt* (.48), *Sc* (.48), *Mf* (.47) and *F* (.46)—all scales which are linked with maladjustment (see Table 4). Thus, earlier indications that M may be essentially a maladjustment factor seem to be borne out here.

It is regrettable that the authors of these studies did not carry out factor analyses of their data. In Karson and Pool's publications, complex relationships between the scales are not readily disentangled by inspection of the matrix, although some clarification is provided in a separate article (Karson, 1958). Nevertheless, the two studies are of interest in providing an empirical link between MMPI *Ma*, *D*, and *Si* and the principal extraversion primaries from the factorial questionnaires.

Questionnaire Factors and Acquiescence

That E-I questionnaire factors may reflect certain response tendencies—as has been suggested by Kassebaum, Couch, and Slater in connec-

TABLE 5
INTERCORRELATIONS BETWEEN E-I VARIABLES:
MMPI, STDCR, AND 16 PF QUESTIONNAIRES
(From analyses Ne and KaA)

| Variable | MMPI ^a | | | | | |
|----------|-------------------|----------|-----------|-----------|-----------|-----------|
| | <i>K</i> | <i>D</i> | <i>Hy</i> | <i>Pd</i> | <i>Ma</i> | <i>Si</i> |
| STDCR | | | | | | |
| S | | .28* | -.24 | -.15 | -.46** | .69** |
| R | | -.39** | -.07 | -.06 | .50** | -.50** |
| 16 PF | | | | | | |
| A | .13 | -.11 | .20 | -.09 | .00 | -.33** |
| E | .23 | -.11 | .05 | .02 | .10 | -.27* |
| F | .08 | -.26* | .05 | .01 | .24* | -.48** |
| H | .27* | -.24* | .05 | .00 | .19 | -.69** |
| M | -.48** | .17 | .16 | .29* | .17 | .32** |
| Q1 | -.10 | .22 | .30* | .19 | .11 | .11 |
| Q2 | -.22 | .01 | -.03 | -.02 | .03 | .32** |

Note.—Italicize coefficients indicate reversals of expected sign.

^a *L* not included in analysis Ne, did not correlate significantly with any 16 PF extraversion primaries.

* Significant at .05.

** Significant at .01.

tion with their MMPI factor—is a possibility which merits careful consideration. Evidence has been presented to show that an E-I dimension *can* be demonstrated in the various questionnaires. However, that evidence rests on the assumption that the questionnaire factors can be validly interpreted in terms of the “psychological meaning” of the variables which define them. If the covariation among the factor variables can be accounted for on some basis other than common meaning, the label extraversion-introversion would seem to be prematurely applied, and perhaps inappropriate.

In order to examine the susceptibility of the various “extraversion” scales to agreement response set, or acquiescence, the principal questionnaire variables have been listed

in Table 6, along with the percentages of “agreement” and “disagreement” items they contain. Looking first at the Guilford scales, it can be seen that, in general, extraversion *does* tend to be associated with a higher percentage of agreement items, the only exceptions being GZTS S, which contains equal numbers of “True” and “False” items, and T, where the trend reverses.

An attempt was made to rule out various response tendencies in the 16 PF test, by balancing the number of “Yes or a” and “No or c” items scored for each scale (Cattell, 1956c). However, many of the items are not of the simple endorsement type, requiring instead a choice between alternative statements, e.g., “I would prefer the life of (a) an artist, (b) uncertain, (c) a secretary running a so-

TABLE 6
PERCENT “TRUE” AND “FALSE” ITEMS IN THE PRINCIPAL QUESTIONNAIRE
SCALES LOADING E-I FACTORS

(Includes all items indicating agreement [True, Yes, Always, etc.] and disagreement [False, No, Never, etc.]

| Scale | No. of items | % True | % False | | No. of items | % True | % False |
|--------------------|--------------|--------|---------|-------------------|--------------|--------|---------|
| GZTS | | | | 16 PF | | | |
| G | 30 | 63 | 37 | (con'd.) | | | |
| R- | 30 | 60 | 40 | M- | 13 | 23 | 31 |
| A | 30 | 53 | 47 | Q1- | 10 | 30 | 40 |
| S | 30 | 50 | 50 | Q2- | 10 | 30 | 30 |
| T- | 30 | 23 | 77 | MMPI ^e | | | |
| STDCR | | | | L- | 15 | 100 | 0 |
| S- | 52 | 58 | 42 | D- | 60 | 67 | 33 |
| R ^a | 70 | 60 | 40 | Ma | 46 | 76 | 24 |
| GAMIN | | | | Im ^d | 26 | 85 | 15 |
| G | 24 | 87.5 | 12.5 | Do | 28 | 25 | 75 |
| A | 38 | 61 | 39 | R- | 40 | 100 | 0 |
| 16 PF ^b | | | | Re- | 32 | 75 | 25 |
| A | 10 | 10 | 0 | Si- | 70 | 50 | 50 |
| E | 13 | 46 | 38.5 | Sp ^d | 27 | 56 | 44 |
| F | 13 | 46 | 15.5 | St | 34 | 44 | 56 |
| H | 13 | 38.5 | 38.5 | Sy | 32 | 69 | 31 |

Note.—To facilitate comparison, percentages for “introversion” scales have been reversed, as indicated by minus sign, e.g., R-. Thus, percentages indicate “True” and “False” items scored for *extraversion*.

^a Items differentially weighted. Maximum score includes 53 points (62%) for *Yes*, 32 (38%) for *No* responses.

^b Excluding “neutral” items (see text).

^c Excluding scales with inconsistent factor loadings (e.g., *Hy*, *Pd*), and *Gm* and *M* (data not available).

^d Unpublished keys; percentages based on data supplied by Harrison Gough.

cial club." Such items can scarcely reflect acquiescence, but, by the same token, they cannot be counted as part of the balanced distribution of items intended to rule it out. Thus, in determining the susceptibility of the 16 PF scales to acquiescence, these "neutral" items must be disregarded and consideration given only to the items which reflect agreement or disagreement. It can be seen in Table 6 that H and Q2 are equally weighted with "True" and "False" items; A, E, M, and Q1 differ by one item only. F, however, contains enough more "True" items so that scores on the F scale might be affected to some extent by acquiescence.

Turning to the MMPI scales, it can be seen that a "response set" interpretation of the factor obtained by Kassebaum, Couch, and Slater is supported not only by *R*, *L*, *Ma*, and *D*, but by the percentages of "True" and "False" items in the *Re*, *Sy*, *Sp*, and *Im* scales as well. Contrary to such an interpretation, however, are *Do* and *St*, which, though related to extraversion, contain more "False" items than "True" ones, and *Si*, whose items are evenly divided between the two categories.

It is quite possible that "psychological meaning" and acquiescence are confounded in a number of the questionnaire scales defining E-I factors, and until some means is found for distinguishing the two components, factor interpretations must take both aspects into account. At the same time, it is apparent that the E-I factors cannot be "explained" in terms of acquiescence alone. For the present, then, interpretations based on "psychological meaning" may be considered as having some validity.

Analyses of Objective Tests

Several objective test analyses related to E-I have appeared in recent

years—some carried out by Cattell and his associates, others from Eysenck's laboratory. The latter studies rely heavily on tests of supposed or demonstrated relevance to particular dimensions of personality, whereas Cattell's analyses are based on tests intended to cover the entire "personality sphere." As might be expected, the test batteries used in the two sets of studies differ considerably, and the resulting E-I factors are not readily compared.

Analyses from Cattell's Laboratory

Cattell's objective test Factor UI 32, formerly Schizothyme Withdrawal, is now described as an extraversion factor (Cattell, 1957b); it has been renamed Exvia-Invia. One of the least confirmed objective test factors, UI 32 has appeared in only three analyses (CaA, CaB, Sc). As seen in Table 7, the loadings are generally small, and they vary somewhat from study to study. Nevertheless, there is some agreement as to the relative importance of fluency, ego strength, and inaccuracy—characteristics not infrequently associated with extraversion. A further link with E-I is provided by Cattell's CaB analysis, in which 16 PF Factors A, E, F, and H were found to correlate with UI 32. However, these findings are not supported by the more recent Scheier and Cattell analysis (Sc), in which only one of the questionnaire primaries—A—has a sizeable loading on UI 32. As Table 7 shows, F and H contribute little to the Scheier and Cattell E-I factor, and M, the highest-loading variable on Cattell's rating and questionnaire factors, has a zero loading; M appeared instead on a separate Autia factor (.40) and, negligibly, on UI 24, Anxiety vs. Dynamic Integration. M apparently failed to correlate with UI 32 in the CaB anal-

TABLE 7
OBJECTIVE TEST FACTORS: CATTELL'S LABORATORY

| Variable | Factor Identification | | |
|---|-----------------------|-----------------|----------|
| | CaA VII | CaB XV | Sc V- |
| Fluency on own characteristics | 23 | 45 | 26 |
| Fluency on self (vs. others) criticism | | | 44 |
| Fluency on dreams | 13 | 21 | |
| Rate of reading (delayed feedback) | | | -22A |
| Correctly articulated words (delayed feedback, reading) | | | -22 |
| Correct word rate in reading (delayed feedback) | | | -36A |
| Immediate memory for words | | | -21 |
| Myokinetic movement | | | -26 |
| Objects perceived in unstructured drawings | 09 | 49 | — |
| Accuracy in gestalt completion | -14 | -32 | — |
| Ratio accuracy/accomplishment..... | | | -22A |
| Slanting line errors in CMS | -10 | -31 | 29 |
| Handwriting pressure | | | -31 |
| High self-estimate of experience in various skills | | | 20 |
| Self-confidence in untried performance | 13 | 30 | 10 |
| Ego strength: Little shift to successuls | 20 | 03 | 30A |
| Authority suggestibility | -22 | 06 | |
| Ratio acquaintances/friends | | | -22M |
| Preference for familiar (vs. strange) material | | | 24 |
| Preference for weak (vs. strong) smells | | | -24 |
| Speed of regularly warned reaction time | | | -42 |
| Pupil dilation at stress | | | -28 |
| Increase in heart rate after startle | | | 24 |
| Systolic blood pressure | | | 25 |
| C: Free anxiety | | | 28M |
| Q: 16 PF A, Cyclothymia | | 39 ^a | 53 |
| E, Dominance | | 46 ^a | |
| F, Surgency | | 46 ^a | 11 |
| H, Parmia | | 43 ^a | |
| M, Autia | | — | 01 |

Note.—Tests from The Objective-Analytic Personality Test Battery (Cattell, 1956a).

^a Correlations between questionnaire scores and objective test factor.

ysis as well;⁷ at least, no coefficient is given in a recent report of the study (Cattell, 1957b). In view of Cattell's insistence that "autia, M, belongs very definitely with the 'introversion' factors" (1957b, p. 317), his identification of UI 32 with E-I would seem to require clarification.

Analyses from Eysenck's Laboratory

Before turning to the objective test analyses carried out by Eysenck and

⁷ Although it had a substantial loading (.46) on UI 24, according to Cattell and Scheier (1958).

his colleagues, it is necessary to say a few words about the underlying rationale. Eysenck's research over the years has culminated in a rather elaborate theory of extraversion-introversion (Eysenck, 1957)—essentially a rapprochement of the early views of Jung (1923) and McDougall (1926, 1929), Pavlov's concept of *inhibition*, and Hull's learning theory. Eysenck's theory has been criticized recently for its frequent failure to account for data it claims to explain (Storms & Sigal, 1958). It does, however, have much to recommend

it, one of its chief assets being the ease with which it can be operationalized. Tests of the theory have been based for the most part on comparisons of two broadly defined groups of neurotics, believed to represent the extremes of the E-I continuum—*hysterics*, a group consisting of conversion hysterics and psychopaths, and *dysthymics*, a combination of anxiety neurotics, depressives, and obsessionals. The rationale for these groupings comes chiefly from Jung and McDougall, who regarded hysteria as the characteristic neurosis of extraverts, psychasthenia (anxiety, depression) as the typical introvert disorder. Eysenck added the remaining categories, and in an early factorial study (1944), obtained a "hysteria-dysthymia" factor which seemed to describe the two criterion groups.

It was noted above that analyses from Eysenck's laboratory have generally made use of tests selected for their relevance to particular personality dimensions. Since E-I has been a major area of interest for Eysenck and his co-workers, their analyses have generally included tests found—or hypothesized—to differentiate between hysterics and dysthymics. A number of such tests were included in Eysenck's first large-scale objective test study (1952), but while several factors emerged, none could be identified with E-I. Other analyses, however, have yielded factors which are at least suggestive of Eysenck's E-I dimension; these factors are shown in Table 8. The factors obtained by Heron (He) and Himmelweit, Desai, and Petrie (Him) have been discussed at length elsewhere (Eysenck, 1952, 1953) and require only brief mention. Appearing on these factors are a few tests found previously (Eysenck, 1947) to differentiate between hysterics and dys-

thymics—tests of persistence, and a couple of measures derived from level-of-aspiration experiments. Personal tempo loads one of the factors (Him), but Eysenck, in the publication just cited, has shown that his two criterion groups do not differ in this hypothetical E-I characteristic. Other tests supposedly related to E-I have negligible loadings on the factors; a few—fluency, quick approach to timed test (He), speed/accuracy ratio (Him)—have no loadings at all. In general, then, the relationship of the two factors to Eysenck's E-I dimension is not impressively demonstrated.

In a more recent analysis (Ey), Eysenck obtained an E-I factor defined by two sociometric measures of "sociability" and an index of performance speed—all theoretically related to extraversion, although the last one, at least, does not differentiate hysterics from dysthymics (Himmelweit, 1946). Apart from these measures, there is little to identify the factor with E-I. As Table 8 shows, the remaining E-I variables⁸ have negligible loadings on the factor; others, hypothesized as measures of E-I, had essentially zero loadings: two tests of rigidity, a cognitive humor test, an affective discrepancy measure related to level-of-aspiration, and self-rated extraversion. The latter measure and teacher-rated extraversion, which has a loading of .18 on the factor, were based on rating scales adapted from Guilford's R scale—which, as noted previously, Eysenck regards as a good measure of his dimension! On the whole, then, the factor obtained in this analysis does not seem entirely consistent with E-I as Eysenck defines it.

The most impressive study coming

⁸ Excluding projective test loadings, which appear in Table 9 and are discussed in conjunction with projective test analyses.

TABLE 8
OBJECTIVE TEST FACTORS: EYSENCK'S LABORATORY

| Variable | Direction ^a | Factor Identification | | | |
|--|------------------------|-------------------------|----------|------------------|-----------|
| | | Ey II ^{b,c} | He II | Hil III | Him II |
| Measures of E-I | | | | | |
| Porteus Mazes: Starting time | Quick | | | 20 | |
| Crossed lines | Many | | | 43 ^d | |
| Lifted pencils | Many | -11 | | 01 | |
| Wrong directions | Many | 01 | | 36 ^d | |
| Track Tracer: Speed | High | 38 | -14 | | 10A |
| Accuracy | Low | 16 | | | |
| Accuracy cost | Low | | -32 | | |
| Personal tempo: Handwriting | Fast | | | | 34A |
| O'Connor Tweezer Test | Fast | | | | 26A |
| Rigidity: Alphabet test | Low | 15 | | | |
| Humor preference: Sex | High | | | 22M | |
| Orectic humor | High | 16 | | | |
| Body build: Stature/transverse chest diameter | Short-round | | -18 | 26 | |
| Sociability I | High | 63 | | | |
| Sociability II | High | 57 | | | |
| I: Interests | Few | | 28M | | |
| Q: STDCR S, Social Introversion | Low | | | 47A ^d | |
| R, Rhythymia | High | | | 56 ^d | |
| R: Extraversion | High | 18 | | | |
| Measures of E-I and Neuroticism | | | | | |
| Persistence: Leg | Poor | -23 | 44 | 07 | 17M |
| Hand | Poor | -01 | 46 | | |
| Breath | Poor | | | | 22M |
| Level of aspiration: Mean goal discrepancy | Low positive | | | | 50 |
| Absolute goal discrepancy | Low | | -24 | | |
| Judgment discrepancy | High positive | | | | 17 |
| Index of flexibility | High | -01 | | | 50 |
| Measures of Neuroticism | | | | | |
| Crown Word Connection List: "Neurotic" score | High | | 33 | | |
| Track Tracer: Performance under stress | Poor | | | | -14 |
| O'Connor Tweezer Test: Evenness of improvement | Poor | | | | 52M |
| Body sway suggestibility: Total sway | High | | | 05 | 13M |
| Reversals | | | | 26 ^d | |
| Static ataxia: Total sway | High | | -08M | 18 | 11M |
| Reversals | | | | 07 | |
| Dark vision | Poor | | | | 28 |
| Systolic blood pressure ^e | | -13 | | | |
| Diastolic blood pressure ^e | | -23 | | | |
| Pulse rate after stress ^e | | -12 | | | |
| Sublingual temperature ^e | | 20 | | | |
| Finger temperature ^e | | 30 | | | |
| I: Annoyances | Many | | -20M | -01M | |
| Q: Maudsley Medical Questionnaire (MMQ) | High | | | -26M | 24 |
| MMQ Lie Scale | High | -20 ^f | | -37A | |
| C: Mental health | Poor | | 30 | | |
| R: Neuroticism | High | 17 | | | |
| Unclassified Measures | | | | | |
| Perseveration: S-Z-SZ | Low | | 27 | | |
| 237 and reversed | Low | | 28 | | |
| Strength of grip (hand dynamometer) | Strong | | 18 | | |
| I: Food aversions | Many | | 42 | | |
| Zygoticity ^g | | 22 | | | |

Note.—Variables with no loadings $\geq .10$ omitted from table; among them, several tests of E-I (see text) and intelligence.

^a For *unclassified* measures, indicates scoring direction. For others, indicates predicted direction for *extraversion* (first two groups of variables) or *neuroticism* (third group). Variables reflected, when necessary, to agree with direction as listed here. Thus, positive loadings support prediction, negative ones do not.

^b Projective test loadings for this factor appear in Table 9.

^c No "adjustment" factor obtained in this analysis.

^d Differentiates between 45 hysterics and 45 dysthymics at .05 or better (see text).

^e Directional prediction not stated.

^f Modified for children.

^g Coded as follows: monozygotic, 1; dizygotic, 2.

from Eysenck's laboratory is the one reported recently by Hildebrand (Hil). Hildebrand tested 25 male normal subjects and a large group

of male neurotics, including 45 hysterics (25 conversion hysterics, 20 psychopaths), 45 dysthymics (25 anxiety states, 10 depressives, 10 ob-

sessionals), and 55 cases with mixed symptomatology. In accord with Eysenck's theory, the conversion hysterics and anxiety states were reserved as E-I criterion groups; these two groups, together with the normal subjects, constituted criterion groups for neuroticism. A factor analysis was then carried out, using intercorrelations based on the remaining 95 subjects. Rotational criteria are not described in Hildebrand's article, but in a personal communication,⁹ he indicates that Factor III, Extraversion-Introversion, was rotated to Guilford's R scale.

As Table 8 shows, all of the predicted E-I loadings on Hildebrand's factor are in the expected direction; some, however, are extremely small. Sizeable loadings on Guilford's R and S scales identify the factor with the previously discussed STDCR extraversion factors, but a question might still be raised about its relationship to Eysenck's dimension.

The question is answered by the second part of Hildebrand's analysis, in which E-I factor score comparisons were made for the various groups of subjects. Normal subjects were found to be the most extraverted, followed by hysterics, mixed neurotics, and dysthymics, in that order. Significant differences were obtained between conversion hysterics and anxiety states, and between the larger hysteric and dysthymic groups as well.

The results of these comparisons demonstrate convincingly the relationship of Hildebrand's E-I factor to Eysenck's dimension; they likewise seem to lend impressive support to Eysenck's theory. Not to be overlooked, however, are some important problems in the study itself and in

the interpretation of the results. In the latter category, the greater extraversion of the normal group presents some difficulties, although, as Hildebrand suggests, it may simply reflect an unfortunate choice of control subjects. However, there is considerable evidence to indicate that conversion hysterics, at least, are no more extraverted than unselected normal subjects; they have consistently been found to score at or below the "normal" mean on E-I questionnaires (Eysenck, 1959; Sigal, Star, & Franks, 1958; Storms & Sigal, 1958). Calling attention to this finding, Eysenck (1959) notes that it "is not quite in line with expectation, but has been repeated on several samples and must be accepted" (p. 6).

Concerning the analysis itself, Storms and Sigal (1958) found from Hildebrand's original data (1953) that the groups pooled for the factor analysis differed significantly in variance on some of the tests. Discriminant functions computed for Hildebrand's data by Storms (1958) distinguished between conversion hysterics and anxiety states better than the factor scores, yet showed hysterics and psychopaths to be the most widely separated groups in terms of test performance. Hamilton (1957) has called attention to a similar lack of homogeneity within the dysthymic group, noting that on a dozen or so measures used in Hildebrand's study, either anxiety states or obsessionals performed more similarly to hysterics than to the other dysthymic subgroups. It is hard to tell whether these various inconsistencies can be attributed to the particular tests used, or whether they inhere in the criterion groups themselves. What evidence is available, however, seems to favor the latter explanation. In his early studies of hysterics and

⁹ Hildebrand, H. P., Personal communication, March 4, 1959.

dysthymics, Eysenck (1947) repeatedly found larger standard deviations for the dysthymic group, leading him to suggest the possibility that "the dysthymic group contains several distinct subgroups" (p. 251). Moreover, data from a later study (Eysenck, 1952) showed no significant differences between hysterics, psychopaths, and anxiety states on tests of persistence, speed, accuracy, goal discrepancy, judgment discrepancy—all tests found previously to differentiate hysterics from dysthymics (Eysenck, 1947).

While these findings cast some doubt on the validity of the hysteric-dysthymic dichotomy, the fact remains that the two criterion groups are significantly differentiated by the major variables defining Hildebrand's factor (see Table 8) and by their E-I factor scores. Hildebrand's analysis thus establishes an important link between Eysenck's conception of E-I and the questionnaire factors defined by the Guilford scales.

Finally, brief mention should be made here of Becker's analysis (Be), discussed previously in connection with analyses of the Guilford and Cattell questionnaires. It will be recalled that Becker's E-I factor appeared to resemble the Lack of Self-Control factor obtained by Mann; its relationship to Eysenck's dimension is indicated by loadings of .81 and .82, respectively, on Guilford's R and Eysenck's E scale. The selection of objective tests for Becker's study was guided by Eysenck's recent theorizing about the relationship between E-I and "cortical inhibition" (1957). Among the tests were measures of reactive inhibition (reminiscence, response alternation), satiation (kinesthetic aftereffect, Archimedes spiral, Necker cube), and basal inhibition (GSR conditioning, aniseikonic lens tests, flicker fusion). Of

the 32 variables derived from these tests, not one had a loading as great as .35 on the E-I factor. The only crucial variable to load over .30 was a kinesthetic aftereffect decrement score, which appeared to reflect little more than noncrucial differences in baseline, and which proved to have a retest reliability of zero. Thus, while the questionnaire loadings on Becker's factor readily identify it with Eysenck's concept of extraversion, it does not lend impressive support to more recent extensions of the concept.

Analyses of Projective Tests

The search for projective test counterparts of E-I has focused on the Rorschach test—the most widely studied projective instrument, and the only one linked by theory with the E-I dimension. It might be mentioned, however, that Sirota (1957) has identified an extraversion-like factor in another projective instrument—the psychoanalytically-oriented Blacky test (Blum, 1950). Sirota's factor, Impulse Expression vs. Impulse Control, may be related to the previously discussed "maladjusted extraversion" factors, but at present no empirical comparisons can be made.

The theoretical link between E-I and the Rorschach test is provided by Rorschach's concept of *experience balance*, expressed as the ratio of human movement (*M*) to color (*Sum C*) responses given to the Rorschach inkblots. *Extratensive* subjects, with a ratio favoring color, are said to be outwardly oriented, by virtue of their responsiveness to objective reality, i.e., color stimuli present in the blots. The perception of movement, on the other hand, has no corresponding external reality, and thus requires an intervening subjective process. Consequently, *introversive* subjects,

with a preponderance of movement responses, are described as having a more active "inner life" and less concern with external, objective reality.

While Rorschach (1951) denied any relationship between his experience balance concept and Jung's extraversion-introversion, the two viewpoints seem to have much in common. Rorschach's distinction between objective and subjective orientation is the crux of Jung's theory, and descriptions of the two Rorschach "experience types" are remarkably like Jung's characterizations of the extravert and introvert. Moreover, evidence from several studies indicates that some of the empirically found differences between extratensive and introversive subjects correspond to hypothesized or observed differences between extraverts and introverts (Bash, 1955; Bieri & Messerley, 1957; Mann, 1956; Palmer, 1957; Singer & Spohn, 1954).

Analyses of the Rorschach Test

Several Rorschach analyses have produced factors which appear to be related to experience balance, and which also have loadings on some non-Rorschach measures suggestive of E-I. The relevant factors are shown in Table 9, as are the projective test loadings for Eysenck's E-I factor (Ey), discussed above.

Eysenck included a number of Rorschach variables in his analysis, and obtained from a Rorschach "expert" opinions concerning their relevance to E-I. As Table 9 shows, Eysenck's extraversion has loadings on Rorschach *D*, *FM:M*, *F%*, and *P*; introversion is defined chiefly by *M%* and a composite pathology score. Expert opinion concurred with all but the *F%* loading, and Eysenck concludes that, on the whole, his results support the hypothesized rela-

tionship between E-I and Rorschach's extratension and introversion. It will be noted, however, that Eysenck's analysis included no color variables; his results thus say nothing about a relationship between extraversion and extratension. Nor can such a relationship be inferred from the fact that *M%* appears at the introvert pole, for Rorschach factors defined by *M* are not necessarily related to experience balance, as will be seen presently.

More pertinent to the experience balance question are two of the factors obtained in Singer, Wilensky, and McCraven's analysis (Si). Factor III, Emotional Surgency, combines positive loadings on the Rorschach color determinants with a small negative *M* loading; Factor IV, Introspectiveness, has substantial *positive* loadings on *M* and on a related measure, movement threshold (Barron, 1955). These factors, in turn, have loadings of .50 and $-.32$, respectively, on the first of two second-order factors reported by the authors, and thus seem to reflect a bipolar dimension of some sort. The movement-color contrast suggests that the dimension may be experience balance, and that Emotional Surgency and Introspectiveness correspond to Rorschach's extratension and introversion.

Concerning the relationship of the two factors to E-I, it might be noted that the ratings which appear on Factor III reflect a responsiveness to the environment (albeit a negative one!) which might suggest extraversion; likewise, acquiescence to authority and general disinterest in external events, associated with Factor IV, do not seem inconsistent with introversion. Moreover, the small level-of-aspiration loadings agree with Eysenck's (1947) findings for hysterics and dysthymics. Addi-

TABLE 9
PROJECTIVE TEST FACTORS

| Variable | Factor Identification | | | | | | | | | | | |
|--|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------|------------------------|
| | Ey II ^a | FoA | | | FoB | | | | Si | | | Wi III ^b |
| | | I | II | III | I | II | IV | V | I | III | IV | |
| Barron Movement Threshold | | | | | | | | 56 | 01 | 62 | | |
| TAT Transcendence Index | | | | | | | | -03 | 42 | 38 | | |
| Rorschach: | | | | | | | | | | | | |
| W | | 63 | -33 | -07 | | | | | | | | |
| W _o | | | | | 32 | 02 | -47 | -26 | | | | |
| W _v | | | | | 00 | 43 | -66 | -02 | | | | |
| D | 51 | | | | | | | | | | 06, 48 ^o | |
| M | | 14 | -45 | 75 | | | | | 81 | -27 | 65 | |
| FM | | | | | 35 | -56 | -53 | -02 | -07 | 52 | 52 | |
| F _v | | 50 | 22 | -75 | | | | | | | 33, 39 | |
| C' | | | | | | | | | -19 | 57 | -14 | |
| FC | | | | | | | | | 07 | 56 | 15 | |
| CF | | | | | | | | | 02 | 37 | 06 | |
| C | | | | | | | | | | | 09, 26 | |
| P | 24 | | | | | | | | | | 65, 48 | |
| R | | 71 | 28 | 34 | | | | | | | 00, -12 | |
| Rorschach ratios, %, etc.: | | | | | | | | | 07 | 53 | 44 | |
| F+% | | 14 | -68 | 70 | | | | | 22 | -08 | 14 | |
| Special F+% (highly articulated responses) | | 18 | -24 | 86 | | | | | | | 20, -06 | |
| Sum shading | | 60 | 21 | 05 | | | | | | | 04, 35 | |
| Sum C | | 69 | 50 | 00 | | | | | | | 27, 44 | |
| M: Sum C | | | | | 36 | -53 | 08 | -09 | | | | |
| T: Wechsler-Bellevue | | | | | | | | | | | | |
| Full Scale IQ | | | | | | | | | 01 | 19 | -12 | |
| Verbal IQ | | 08 | -81 | 06 | -06 | -51 | 00 | 20 | | | | |
| Vocabulary | | 44 | -62 | 07 | -11 | -63 | 06 | 01 | | | 00, -08 | |
| Digit Span Scatter | | | | | -02 | -47 | -05 | -20 | | | | |
| Wechsler Number-Square | | | | | | | | | | | | |
| Initial performance | | | | | | | | | -18 | 18 | -07 | |
| Level of aspiration | | | | | | | | | 23 | -27 | 15 | |
| Porteus Mazes | | | | | | | | | 48 | -07 | -13 | |
| Authority Reaction Test | | | | | | | | | 04 | 11 | 57 | |
| Motor inhibition | | | | | | | | | 69 | 00 | 12 | |
| Time estimation | | | | | | | | | 17 | 28 | 02 | |
| Digit Frustration | | | | | | | | | 24 | 05 | 60 | |
| C: Anxiety | | 65 | 24 | -14 | | | | | | | | |
| R: Aggressiveness | | | | | | | | | -11 | 44 | -06 | |
| Cooperativeness | | | | | | | | | 64 | -53 | -15 | |
| Interest level | | | | | | | | | 23 | 04 | -59 | |
| Diffuse energy level | | | | | | | | | -04 | 35 | -21 | |
| SR: Planfulness | | | | | | | | | 02 | 07 | -13 | |
| Q: MMPI | | | | | | | | | | | | |
| L, Lie Scale | | | | | | | | | | | -42, -20 | |
| F, Validity Scale | | | | | | | | | | | 25, 12 | |
| K, Suppressor Scale | | | | | | | | | | | -39, -33 | |
| Hs, Hypochondriasis | | | | | | | | | | | -07, -25 | |
| D, Depression | | | | | 72 | -09 | 13 | -43 | | | -03, -40 | |
| Hy, Hysteria | | | | | | | | | | | -48, -54 | |
| Pd, Psychopathic Deviate | | | | | 52 | 25 | 13 | 44 | | | -03, -09 | |
| Pa, Paranoia | | | | | 22 | -02 | 16 | -07 | | | 07, 04 | |
| Ph, Psychasthenia | | | | | 94 | 03 | 06 | -03 | | | 14, 09 | |
| Sc, Schizophrenia | | | | | 87 | -01 | 16 | 31 | | | 22, 19 | |
| Ma, Hypomania | | | | | 14 | 27 | -18 | 77 | | | 59, 39 | |
| A, Anxiety | | | | | | | | | | | 09, -17 | |
| R, Repression | | | | | | | | | | | -51, -55 | |
| Bernreuter | | | | | | | | | | | | |
| F1-C, Confidence ^d | | | | | -80 | 24 | -01 | 26 | | | | |
| F2-S, Sociability ^d | | | | | -24 | 66 | 15 | 00 | | | | |
| I: Allport-Vernon | | | | | | | | | | | | |
| Theoretical | | | | | 27 | -64 | 16 | 22 | | | | |
| Economic | | | | | -37 | 10 | -52 | 26 | | | | |
| Aesthetic | | | | | 37 | -27 | 42 | -26 | | | | |
| Political | | | | | -10 | 67 | -24 | 44 | | | | |

Note.—Variables with no loadings >.10 omitted from table.

^a Additional loadings: Rorschach M%, -63; FM: M, 50; composite pathological score, -40; F%, 29; H+A: Hd+Ad, -19; Fm+m: Fc+c+C', -12; Rosenzweig Extrapunitiveness, 12.

^b Additional loadings: Rorschach m, 47, 49; d, 28, 35; P, -20, 37; Fc, 17, 12; K, 16, -07; c, -01, 17.

^c Orthogonal and oblique loadings, respectively.

^d Bernreuter loadings reflected to agree with direction indicated by scale title.

tional evidence might be sought in Porteus Maze performance; the quantitative score used here is essen-

tially an index of accuracy, and it ought to be closely related to the component variables—crossed lines,

wrong directions, etc.—previously associated with extraversion (Table 8). As Table 9 shows, however, the maze score contributes to neither factor above; it is found instead on Factor I, Motor Inhibition. This factor, like Introspectiveness, is suggestive of introversion; yet, despite some important similarities, the two factors are negatively correlated ($-.15$). Moreover, Motor Inhibition appears on the other second-order factor, which has zero loadings for Emotional Surgency and Introspectiveness. It would seem, then, that in addition to a pair of factors corresponding to experience balance, Singer et al. have uncovered a second, independent "introversion" factor in the Rorschach test. The latter factor, though unrelated to experience balance, seems as reasonable a match for E-I.

Singer et al. consider the three factors just discussed to be similar to Thurstone's Reflectiveness and Impulsivity factors (Table 3), and to the Emotional Drive and Inhibition factors obtained in two analyses by Foster (Table 9). Thurstone's factors can be related to Singer's only by inference, but in the case of Foster's factors, some direct comparisons can be made.

Factor I in Foster's first analysis (FoA) is called Emotional Drive; it shares with Singer's Surgency high loadings on Rorschach *R* and the color determinants (*Sum C* here). Factor III, Delay and Inhibition, appears most similar to Singer's Introspectiveness, although an important discrepancy is seen in the *F+* loadings.

In his second study, Foster used a modified Rorschach procedure to control for differential responsivity. Subjects were instructed to give at least three responses to each of the first nine cards, and at least six to

Card X; the analysis was based on the required minimum (33 responses) for each subject. As can be seen in Table 9, the factors obtained in this analysis (FoB) are quite unlike those in the first study. Factor I, Delay and Inhibition, has a small *M:Sum C* loading, but the unusually high loadings on MMPI *Pt* and *Sc*—and on the Bernreuter FI-C scale—mark it as a probable maladjustment factor. Factor IV, Emotional Drive, resembles its FoA counterpart in *W*, although the absence of the color component here argues against the identity of the two factors.

It is curious that in the search for factors comparable to their own, Singer and his associates overlooked the second factor in Foster's two analyses. These two factors have important loadings on Vocabulary and Verbal IQ, and Foster describes them as Verbal Adjustment factors. However, the prominent loadings on Rorschach *M* and *Sum C* (or *M:Sum C*) indicate that the two factors are closely allied with the experience balance concept; they seem to parallel the second-order experience balance factor obtained by Singer, Wilensky, and McCraven (1956). Some other variables appearing on the two factors (particularly the FoB factor) suggest a relationship to E-I; Bernreuter F2-S, MMPI *Ma*, perhaps the Allport-Vernon Political scale, which seems to be linked with extraversion (Eysenck, 1954). Even the strong verbal component might be looked upon as favorable evidence; Himmelsweit (1945) has shown that dysthymics do better on vocabulary tests than on nonverbal measures of intelligence, whereas the reverse is true for hysterics.

The foregoing studies seem to support the validity of the experience balance concept, and they at least hint at a relationship between this

concept and E-I. On both points, however, there is equally impressive evidence to the contrary. Several extensive Rorschach analyses have failed to produce anything resembling an experience balance factor (Borgatta & Eschenbach, 1955; Karson & Pool, 1957a; Wittenborn, 1950a, 1950b), and inasmuch as these analyses do not seem to differ from the preceding ones in any consistent way, the discrepant results leave some doubt about the dimensionality of experience balance. In a similar vein, Williams and Lawrence (1953) obtained *two* factors with small contrasting loadings on *M* and *C*; in both cases, *FC* appeared at the "introvert" (i.e., *M*) extreme, and *CF* had no loading at all. Even the appearance in Singer, Wilensky, and McCraven's analysis of an "introversion" factor unrelated to experience balance muddies the waters considerably, although it does not, of course, rule out a relationship between E-I and experience balance. Finally, there is the evidence from comparisons of Rorschach measures with the various multidimensional questionnaires, below.

Joint Analyses: Rorschach and Questionnaire Measures

In an early attempt to demonstrate a relationship between E-I and experience balance, Thornton and Guilford (Tho) correlated various measures from the Rorschach test with Guilford's factors S, E, M, R, and T. They obtained no significant correlations between these factors and Rorschach *M*, *M*%, *C*, *C*%, or *log M/C*. Later, Royal (Ro) undertook a similar task, using the S, T, and R scales from the STDCR inventory. He was unable to find a single significant correlation between the three scales and a dozen potential Rorschach indices of E-I, including *M*, *Sum C*, and *M: Sum C*.

Similar results have been obtained with the MMPI. Palmer (1956) reports that chi square comparisons of the MMPI scores for 30 extratensive and 30 introversive subjects indicated no relationship between experience type and *Si* scores; other differences were "so few as to be of doubtful significance" (p. 208). Williams and Lawrence in a joint factor analysis (*Wi*) of the Rorschach and MMPI, obtained an "expressive-repressive" factor, shown in Table 9. The MMPI loadings on this factor are reminiscent of the E-I factor obtained by Kassebaum, Couch, and Slater. The Rorschach loadings, however, certainly do not correspond to experience balance. Foster's second analysis (*FoB*) is also relevant here. Of the three factors discussed above, only Factor I, Delay and Inhibition, has any sizeable MMPI loadings. The appearance of MMPI *D* on the factor is consistent with introversion, but equally so with maladjustment—a more reasonable interpretation in terms of the other loadings. Factor V in Foster's analysis, (Hypo)Manic-Depression, has not been mentioned previously. This factor, shown in Table 9, resembles the MMPI E-I factors considered earlier, but it has no important Rorschach loadings.

The projective test studies reviewed here attest to the unreliability of "apparent similarity" as a basis for matching factors. Some of the Rorschach factors appear to reflect certain characteristics associated with E-I; the identification is strengthened by occasional small loadings on E-I variables from other media. None of the evidence is very impressive, however, and the results of the joint analyses just discussed indicate that E-I questionnaire factors, at least, have little in common with the extraversion-like factors obtained from the Rorschach test.

EVALUATION

To what extent has the nature of extraversion-introversion been clarified by recent multivariate research? What more—if anything—can be said about the unidimensionality of the construct, or its relationship to adjustment, on the basis of this research? These questions can perhaps be answered best by summing up the evidence in terms of the criteria set forth at the outset.

Extraversion-Introversion and Unidimensionality

The foregoing analyses indicate that it is possible to identify in all extensively studied measures and media at least one factor which bears some resemblance to traditional conceptions of E-I. The favorable results of early rating studies find confirmation in Cattell's discovery of an E-I factor in data from behavioral observation. Clear-cut factors have likewise emerged from analyses of various multidimensional questionnaires. Objective test batteries have in most cases yielded factors suggestive of E-I; in general, however, the factor loadings have been small, and interpretations somewhat uncertain. In the realm of projective tests, an extraversion-like factor has been found in the Blacky test, and factors identifiable with Rorschach's experience balance have appeared sporadically in analyses of the Rorschach test; the latter factors are linked by theory, at least, with E-I. In the various media, then, the situation remains essentially as Eysenck found it in 1953, with well-defined E-I factors appearing in questionnaire and rating studies, suggestive ones in analyses of objective and projective tests. True, a great deal more evidence has accumulated, particularly in the questionnaire medium, and much of it is favorable. Nevertheless, in terms of the first

criterion—the consistent appearance of E-I factors in all media of observation—the unidimensionality of extraversion-introversion has not been conclusively demonstrated.

In terms of the second criterion—the interrelatedness of the obtained factors—the evidence is meager. No empirical comparisons have been reported for the objective or projective test factors obtained by different investigators; similarities have been noted in some cases, but the diversity of the variables, procedures, and populations represented in these studies makes speculation hazardous. Evidence from questionnaire studies shows that, in general, repeated analyses of the same instrument yield similar-appearing factors which, on the basis of "psychological meaning," can be identified with E-I. Such factors have been found in the questionnaires of Guilford and Cattell, and in the MMPI. Factor loadings vary from study to study, and variables are sometimes added or dropped, but there remains in each of the questionnaires a "core" of variables which appear consistently on E-I factors, regardless of the population studied, or the factorial procedure employed. Moreover, evidence from several studies shows that the core variables from the various questionnaires are at least moderately interrelated. Weighing against these very favorable findings, however, are the results of several joint analyses of the Guilford and Cattell questionnaires, showing that at least *two* independent factors are required to account for the intercorrelations between the E-I variables.

Little information is available concerning the relationships between E-I factors from different media. Cattell's rating and questionnaire factors appear similar, and a few of the questionnaire variables are re-

lated to his objective test E-I factor, although inconsistently. Objective test factors from Eysenck's laboratory are linked by one study with the Guilford questionnaire factors, by another—though less certainly—with some of the Rorschach variables. On the other hand, joint analyses of the Rorschach test and various questionnaires suggest that the extraversion-like factors from these instruments are probably unrelated.

It appears, then, that despite an impressive accumulation of relevant multivariate research, the unidimensionality of extraversion-introversion has not been unequivocally demonstrated.

Extraversion-Introversion and Adjustment

Except for the projective test analyses, where what constitutes an "adjustment" factor is not readily ascertained, virtually every analysis which has produced an extraversion-like factor has also yielded a factor identifiable with some aspect of adjustment. The latter factors, known variously as ego strength, general adjustment, neuroticism, anxiety, etc., appear to be essentially independent of E-I. The independence resulting from orthogonal rotation, while itself not impressive, tends to be supported by the few analyses employing oblique rotation. Cattell's second-order questionnaire factors of E-I and anxiety, for example, correlate $-.02$. Thus, according to the criterion of *uncorrelated factors*, extraversion-introversion and adjustment appear to be independent.

In many cases, however, it has been noted that the E-I factors seem to incorporate elements of adjustment. A glance at the factor patterns (Tables 2, 4, 7, 8) shows that most E-I factors share at least a few variables with adjustment fac-

tors from the same analyses. Looking at the questionnaire factors, it can be seen further that in analyses which have yielded a *single* E-I factor, the shared variables tend to align with that factor in such a way that "good" adjustment is associated with extraversion, "poor" adjustment with introversion. The tendency is most apparent in analyses of the Guilford and Cattell questionnaires (Table 2); in only one instance (Factor C in Analysis De) is an important *extraversion* variable linked with *maladjustment*. As might be expected, the tendency is less pronounced in the case of the MMPI factors (Table 4), where many of the variables are intrinsically related to maladjustment. Nevertheless, only two conspicuous exceptions are found—the *Ma* and *Pd* scales, which tend to be related to both extraversion and maladjustment. It is doubtful whether *Pd* should be counted; the *Pd* loadings on E-I factors are somewhat inconsistent. And while the *Ma* scale does appear consistently at the "extravert" extreme, there is some evidence that it may be related only to *maladjusted* extraversion. In the case of questionnaire analyses yielding more than one extraversion-like factor, there are some indications that adjustment may be involved in the split. It has been noted in connection with these analyses that one of the factors generally bears some resemblance to "well-adjusted" extraversion, while another appears to reflect *maladjusted* extraversion. It has also been noted that such pairs of factors share few E-I variables, and thus seem to represent qualitatively different dimensions.

Turning to the factors from other media, it should be mentioned that none of the variables defining Cattell's E-I rating factor have loadings

as great as .30 on his second-order anxiety factor. However, the extraversion factor has a substantial negative loading on M, Autia, and if this primary rating factor is a true counterpart of questionnaire factor M, there is reason to suspect that introversion and maladjustment may be confounded in the E-I rating factor. By the same token, the apparent absence of M from Cattell's objective test factor UI 32 favors the independence of the latter factor from adjustment. Indeed, it can be seen in Table 7 that the few "adjustment" variables which appear on UI 32 are about evenly divided between the two poles of the factor. Unfortunately, the absence of M also raises a question about the relationship of UI 32 to Cattell's E-I factors in other media. Among the objective test analyses represented in Table 8, Eysenck's study yielded no adjustment factor, but his E-I factor links introversion with "pathology" as reflected in the Rorschach test. The remaining factors shown in Table 8 are similar to Cattell's UI 32 in the division of "adjustment" variables. As was the case with UI 32, however, the identification of some of these factors with E-I might be questioned.

If it is asked, then, whether extraversion-introversion and adjustment are independent, in the sense that *variables reflecting "good" and "poor" adjustment are as frequently associated with extraversion as with introversion*, a clear-cut answer cannot be given. It is evident that many of the questionnaire factors do not meet this second criterion, and for most of the factors which *are* independent in this sense, there is some doubt about their relationship to E-I.

CONCLUDING REMARKS

The present review was prompted

by the recent burgeoning of interest in extraversion-introversion, and by the fact that current assumptions about the unidimensionality of the construct, and its independence from adjustment, cannot be justified in terms of the research covered by the last comprehensive review (Eysenck, 1953). An examination of more recent research has shown the evidence on both issues to be equivocal, and the status of extraversion-introversion as a dimension of personality thus remains somewhat tenuous.

In concluding, it is well to point out what appear to be the major implications of the research reviewed here. First, the "nomological network" developing from Eysenck's earlier review has begun to be tied down to observable data—a replicated factor here, a series of intercorrelations there—and, while a great many gaps remain, there is reason to believe that further research along these lines will not be wasted. Second, the most profitable directions for such research seem to be clearly indicated. There are variables whose relationships to extraversion and adjustment need to be clarified. There are factors whose widely differing patterns across studies need to be accounted for. There are areas which have not been—or are just beginning to be—systematically explored. There are hints that extraversion-introversion may be differentially manifested in males and females, and in well-adjusted and maladjusted individuals; both possibilities need to be followed up. Finally, and perhaps most important, there is a need for broadly conceived analyses oriented toward extraversion-introversion and its relationship to adjustment. Such analyses would necessarily include a wide array of variables from all media—variables

selected for their relevance to the two dimensions, and, when possible, variables of known factorial composition, so that the resulting factors could be compared empirically with previously discovered ones. Until such further steps are taken, the issues raised here are not likely to be resolved.

In the meantime, a word of caution seems in order. If the term *extraversion-introversion* is to con-

tinue in psychological usage—and, judging from past history, there is little likelihood that it will not—care must be taken to specify its conceptual and operational referent. What appear to be minor distinctions between the various conceptions may in fact be crucial ones; to discard them too hastily is likely only to propagate the illusion of a unity not yet established.

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