Will the Real Factor of Extraversion–Introversion Please Stand Up? A Reply to Eysenck

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Eysenck insisted that his Extraversion (E) factor is a second-order variable, resting on two first-order factors: S (Sociability) and R (Rhathymia, or impulsiveness as opposed to seriousness and self-restraint). Evidence is presented in this reply for the independence of S and R, as shown when proper measurement scales are used. Evidence is also provided for the affiliation of R with Factor T (Thoughtfulness), which serves as the basis for a different second-order factor that has a better claim to the label of Extraversion. Eysenck's own factor-analytic results fail to support his claimed second-order factor.

H. J. Eysenck's (1977) response to my treatment (J. P. Guilford, 1975) of his factor of Extraversion–Introversion (E) was not unexpected; it was very critical. I did not, as he said, reject extraversion as "a meaningful dimension of personality," but rather Eysenck's conception of it, which I assume he had in mind in making the statement. I did, and do, reject his conception, and I proposed instead that Extraversion is a second-order factor involving first-order factors R (Restraint vs. Rhathymia) and T (Thoughtfulness) rather than R and S (Sociability), which he maintains. Evidently Eysenck was not sufficiently impressed with the limited, although strong, evidence provided.

In this presentation I emphasize this major issue, supply additional evidence for the proper components of my dimension of extraversion (in my paper it was called introversion–extraversion), and react to some minor points at issue. I do not attempt to make this reply comprehensive, but devote most of the limited space to my topical question.

On Sources of Evidence

Eysenck pointed out that in my article I had utilized only psychometric, more specifically factor-analytic, evidence regarding the personality structure considered. This was by choice, mainly because of my conviction that factor analysis, being specifically designed for the purpose, is the best of all possible procedures for determining the most distinguishable, stable, and dependable variables in personality, for descriptive and other purposes. Although for a large part of his very active research career Eysenck has also depended upon factor analysis, he said that he now yields to other approaches the status of equal value in determining the important dimensions of personality. Although I should expect factor analysis alone to be equal to the task, I do appreciate the contributions of evidence from other types of experimental studies and the desirability of having such supporting evidence. Over the years in the history of psychology, those other approaches have not especially distinguished themselves in reaching the same goals, when used alone. Only passing reference is made here to evidence derived from investigations with demographic, biological, or behavioral variables.

Some Differences in the Use of Factor Analysis

On matters of factor analysis, Eysenck and I seem to agree that, as much as possible, rotations of axes should be orthogonal. Orthogonal factors provide the maximum amount of information and the least redundancy. But even with this agreement, orthogonal axes representing the same data can be located in different places. A most striking example is given below, with data from one of Eysenck's own factorial solutions.

Eysenck expressed his belief in the goal of achieving Thurstone's simple structure in rotation of axes, with which I also agree. Although Thurstone's definition of simple structure lacked precise specifications, it has been a good guide and a source of checking in making rotations toward psychological simple structure. By the latter is meant a very clean-cut assorting of test variables with meaningful clusters of high loadings on the several factors and generally zero or near-zero loadings on all other factors. Mathematical differentiation thus indicates psychological differentiation. In at least one analysis cited below, however, Eysenck achieved a location of his E axis and one other axis that by no means achieved the simplest structure.

The Duality of Eysenck's E Factor

Eysenck well recognizes that his E factor involves two components or aspects, which he labels as Sociability and Impulsiveness. I am sure that he also regards his Impulsiveness as something broader than the term implies, in fact, perhaps as broad as my factor of Rhathymia. The range and kinds of items that he uses for it justifies this conclusion. The duality of his E does not bother him, for he regards E as a second-order factor, and a second-order factor has its own more complex unity. He believes that evidence basic to the idea of a unity is a substantial correlation between the first-order factors S and R, in which he believes. This is the crux of the issue, for I believe that the correlation between S and R is zero or near zero. Eysenck asked for evidence for my conclusion that the second-order factor involving R should be RT rather than RS. The evidence is easy to find, some of it from his own research.

Perhaps Eysenck would not accept the score variables of R , S, and T from the Guilford-Zimmerman Temperament Survey (GZTS) as the best representatives of their factor traits, but I shall use them in my first source of evidence, for the items that compose those scales have been purified by item analysis and item selection over the years. The intercorrelations to be used are averages of values reported by a number of investigators and assembled in the Handbook for the GZTS (J. S. Guilford, Zimmerman, & J. P. Guilford, 1976). For males only, the pertinent averages derived from hundreds of subjects were $r_{RS} = -.11$, $r_{RT} = .37$, and $r_{ST} = .01$. Some other needed correlations, involving Factor A (Ascendance), were $r_{AS} = .64$, $r_{AR} = .00$, and $r_{AT} = .11$. Results from female subjects, not so numerous, gave very similar values.

The pairwise clustering of the four score variables should leave no doubt as to which way the affiliations went. In order to encapsulate the picture, a small factor analysis was executed. An orthogonal rotation of the two axes is clearly apparent, with A and S loaded .82 and .78, where R and T are loaded .07 and −.07 on one factor and where R and T are loaded .61 and .64 on the other factor and A and S are loaded −.08 and .09. The results could hardly be more decisive regarding the independence of R and S and the affiliations in other directions.

If Eysenck wants other kinds of evidence for the independence of R and S, and also for the relationship between R and T, he could find it in abundance in examples from findings of different investigators assembled in the handbook to which I have referred. R and T tend strongly to correlate together and in consistent directions with various demographic, physiological, and behavioral variables, whereas R and S often correlate inconsistently, both as to concomitance and as to direction.

To Carrigan's (1960) skepticism of the unity of Eysenck's E factor can now be added the voice of Howarth (1976). How can Eysenck still insist upon R and S determining a unitary trait? An examination of one of his own analyses suggests that he could be misled by his own data. H. J. Eysenck and S. B. G. Eysenck (1969) reported a 1963 analysis of the items in the Eysenck Personality Inventory. From the 70 items, 4 graphically rotated, orthogonal factors were reported. The chief interest here is in two of the axes, one of which he thought to represent his Factor E and the other, a bipolar factor, to represent Sociability in one direction and Impulsiveness in the other.
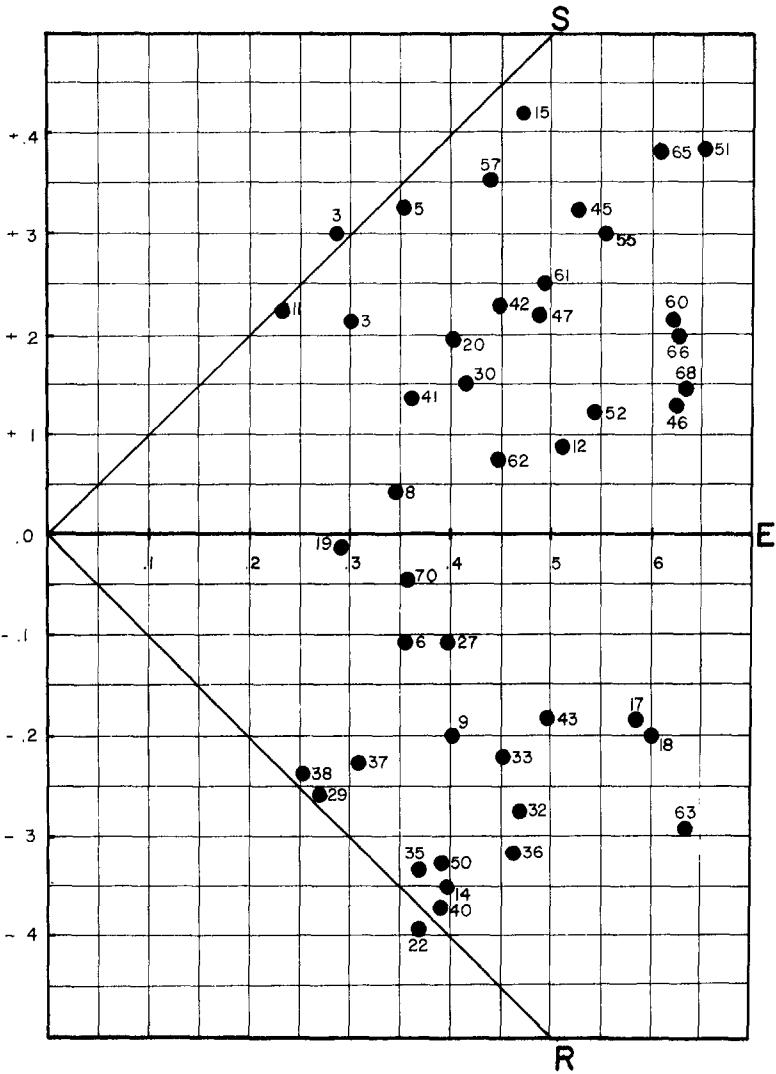
Figure 1. A plot for items from the Eysenck Personality Inventory on two of his rotated axes, showing a further rotation to better simple structure than in the Eysenck solution.

Figure 1 shows a plot of his pertinent items, as in a plot he also presented (p. 147). Items in the upper part pertain primarily to gregariousness, whereas items below pertain primarily to impulsiveness or rhathymia, as opposed to seriousness and self-control. He found that a score derived from items in the upper part correlated .468 with a score obtained from items in the lower part. This value he took to be the correlation between S and I (Impulsiveness), or R.

The trouble is that a large proportion of the items in either set have variances in both

S and R. In many instances an item statement has implications for *both* S and R. As demonstrated earlier, by item analysis and item selection, it is possible to eliminate such bivocal items and from the items that are left to obtain two independent total scores.

Probably most factor analysts doing graphic rotations would have an itch to rotate the two axes in Figure 1, as I have done. An excellent 45-degree orthogonal rotation is obvious. It can be noted that, as far as these two axes are concerned, the rotation achieves six new zero loadings on Factor R and eight new

ones on Factor S, thus making marked improvements in simple structure. Surely there are enough zero loadings on both factors to indicate that they can be independent and thus more clean-cut in meaning. Curiously enough, Eysenck himself has reported instances of orthogonality for two such factors (see Eysenck & Eysenck, 1969, p. 164, for example). But he concluded that such a result is "an artifact."

In his more recent factor analyses, Eysenck has employed Varimax and Promax rotations of axes. In each of several analyses, he has reported first-order factors of R and S. With oblique rotations he has gone as high as a fourth level. He has found his E factor at all these different levels. It is difficult to see how the indicated nature of the trait could remain the same at all these levels.

Some Special Issues

Some secondary points brought out in Eysenck's (1977) reply should be mentioned. It is easy to agree with him that there is more than one social factor; items on shyness are not very indicative of Sociability or lack of it. This point seems to have no bearing upon the question of the correlation between S and R, however.

I cannot agree that if a factor is to be accepted there must be evidence for its heritability. This would seem to be putting the cart before the horse. We usually establish the existence and the nature of the factorial trait first, then ask about its heritability. A heritability criterion would rule out the possibility of factors being developed entirely from environmental sources. On the other hand, there is the Ferguson (1956) hypothesis that aptitude factors are essentially over-learned, generalized skills. It is possible that more refined uses of genetic information, as by Eaves and Eysenck (1975), can be helpful in distinguishing personality traits. For example, they reported that Sociability and Impulsiveness are distinguishable, genetically, but they were apparently not sufficiently impressed by the implications of this finding. Had they used univocal measures of both S and R, they might have been led by the genetic information to a conclusion that the

two are independent. Thus, the meaning and significance of genetic information can depend upon the goodness of the psychological variables, which depends in turn upon refinement based upon psychometric information.

Eysenck's related reference to an evolutionary criterion is reminiscent of the vogue in functional psychology early in this century. The historical truth is that it has been possible to develop entire psychologies without any reference whatever to evolutionary features.

Eysenck's insistence that the psychology of personality is confined to three factors is incomprehensible, particularly in view of French's (1973) "established" list, and, indeed, in view of the many factors that Eysenck himself reported, when his analysis went beyond his own inventory for experimental material. He is, of necessity, talking about higher order factors only. He regards the measurement and use of higher order factors as most meaningful and useful in research. Having the disposition of the person who likes to get to the bottom of things and who thus tries to avoid ambiguities in connection with complex variables, I much prefer the use of first-order factors.

Recommendations

According to the picture of things as shown in Figure 1, by a proper rotation, Eysenck's Factor E just vanishes. It is rotated out of existence. No second-order factor is indicated, because of the independence of R and S.

Without his E, what could Eysenck do? The best solution would be to substitute for E the first-order factor R. I suspect that most of the correlations of other variables with his E score can be attributed to the R component of his scale. From reports of innumerable studies that have been summarized in the handbook referred to, the GZTS score for S correlates with relatively few outside variables, whereas that for R correlates with a good many. R is indeed a trait that has numerous ramifications in behavior. If Eysenck is not content with the use of a first-order factor, the alternative solution is to use a score for my second-order factor RT, which can more justifiably be used as a mea-

sure of Extraversion. The real E has thus stood up.

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