The role of factor analysis in the development and evaluation of personality scales

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Abstract

The purpose of this paper is to examine the usefulness of factor analysis in developing and evaluating personality scales that measure limited domain constructs The approach advocated follows from several assumptions that a single scale ought to measure a single construct, that factor analysis ought to be applied routinely to new personality scales, and that the factors of a scale are important if it can be demonstrated that they are differentially related to other measures A detailed study of the Self-Monitoring Scale illustrates how factor analysis can help us to understand what a scale measures A second example uses the self-esteem literature to illustrate how factor analysis can clarify the proliferation of scales within a single content domain Both examples show how factor analysis can be used to identify important conceptual distinctions Confirmatory techniques are also introduced as a means for testing specific hypotheses It is concluded that factor analysis can make an important contribution to programmatic research in personality psychology

One of the major research traditions in personality psychology has been the measurement of individual differences Rather than attempting to create variance between groups through the use of experimental manipulation and control, personality researchers typically focus instead on measuring existing variation across individuals Consequently, statistical analyses more often involve measures of relationship (e g , correlation coefficients) than tests of mean differences (e g , analysis of variance) In the terminology of Cronbach's (1957) classic article, personality is part of the "correlational" (as opposed to the experimental) discipline of psychology

Consistent with this emphasis on a correlational or differential research strategy, personality psychologists have gravitated toward statistical techniques that allow them to examine more thoroughly and more rigorously the relationships in multivariate data sets Factor analytic pro-

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cedures have proven to be useful and important tools in this regard because they allow an investigator to augment, refine, and test (in some cases statistically) his or her intuitive grasp of an area and because they provide a means by which to deal with variables that are not only unobserved but usually unobservable (latent variables)

Factor analysis was first introduced by Spearman (1904) in his studies of intelligence, and much of the early work with factor analysis dealt with the structure of intelligence and the development of performance measures Personality measurement has always been somewhat of a younger sibling to the field of ability testing, and thus it was not long before factor analytic procedures were also being used to develop and refine global personality measures and to define the structure of the trait universe Although personality theorists still disagree as to the central dimensions of personality, there now seems to be at least some agreement as to the nature of the disagreement Studies using adjective lists to describe peers generally suggest that there are five or six dimensions that are central to the trait universe (e g , see Digman & Inouye, in press, Digman & Takemoto-Chock, 1981, Goldberg, 1981, Hogan, 1983, McCrae & Costa, in press, and Wiggins & Broughton, 1985), whereas studies that employ self-report inventories tend to yield a larger number of primary dimensions (e g , Cattell's 16 dimensions or Guilford's 13) which can in turn be summarized in terms of 2 or 3 higher-order dimensions or superfactors (Eysenck & Eysenck, 1969, Royce & Powell, 1983)

In recent years, personality researchers have seemed less interested in the development of global measures of personality and have instead focused their attention more intently on single psychological constructs of limited domain (Maddi, 1984) Popular topics have included locus of control, masculinity and femininity, need for achievement, machiavellianism, authoritarianism, sensation-seeking, loneliness, self-esteem, self-consciousness, and self-monitoring to name but a few *The purpose of this paper is to examine the usefulness of factor analysis as a methodological tool for advancing research on these constructs of limited domain*

A Brief Overview of Factor Analytic Methods

The term *factor analysis* refers to a family of statistical procedures which can be used to identify the redundancy in a set of correlated variables and to reduce the set to a smaller number of derived variables called factors For a particular set of variables, such as personality questionnaire items, each factor will consist of items that correlate more highly among themselves than they correlate with items not included in that factor Loosely speaking, then, factor analysis is a way of grouping

correlated variables, a way of reducing a set of redundant variables, and a way of identifying what it is that a set of variables shares in common

Descriptions of the various factor analytic procedures are readily available elsewhere as are discussions of the mathematics underlying these techniques (e g , Gorsuch, 1983, Kim & Mueller, 1978 a and b) For our purposes, however, a few basic distinctions will suffice One of the most common procedures is called *principal components factor analysis*, although some writers prefer not to classify it as a type of factor analysis In this form of analysis, the derived variables are linear combinations of the original variables and can be calculated directly from them Each principal component (or factor) that is extracted acts to maximally discriminate among subjects with the restriction that it be uncorrelated with previous components In its complete form, as many principal components are extracted as there are original variables

In other forms of factor analysis (e g , principal axis factoring), the variance associated with scores on a variable is decomposed into *common* variance (variance held in common with other variables) and *unique* variance (systematic variance associated only with that variable as well as error) These *common factor* solutions assume that the intercorrelations among the original variables can be summarized in terms of a smaller number of *latent* variables Thus they work to provide a more parsimonious explanation of the interrelationships Factors are extracted initially according to certain mathematical specifications For instance, principal axis factoring requires that each successive factor account for the maximum possible amount of variance common to a group of variables while also not correlating with any factor extracted previously This requirement generally results in a unique solution, but one that is rarely of theoretical interest By relaxing these initial restrictions, an investigator can rotate the factors to a solution that is conceptually more meaningful, however, by rotating the solution its uniqueness is lost and a degree of indeterminacy is introduced Thus, different researchers can analyze the same set of correlations and arrive at entirely different interpretations based on such decisions as the number of factors retained, the type of rotation employed, and the names of factors (Comrey, 1978)

For example, it is indeterminacy of this sort which explains how—in describing the factor structure of personality—Cattell's large number of correlated factors (which are lower-order or narrow in range) can be mathematically interchangeable with Eysenck's small number of independent dimensions (higher-order factors which are broad in range) Similarly, it is this indeterminacy that explains how Gray (1981) can advocate a 45 degree rotation of Eysenck's higher-order factors (from Extraversion and Neuroticism to Impulsivity and Anxiety) As Gray puts it "there appear to be no nonarbitrary mathematical criteria for deciding where to rotate one's factors, at whatever level (higher- or lower-order)

one chooses to work the decision where to place factors or dimensions in the space that they define is a *theoretical* one it is to play a hunch that it is here, not there, that the causal influences will be found" (p 250, italics original) In addition, individuals' scores on derived factors cannot be calculated directly within the common factor model They can only be estimated and hence there is also a degree of indeterminacy in factor scores (see McDonald & Mulaik, 1979) Thus, one of the common criticisms of factor analysis has to do with its inherent mathematical or logical indeterminacy Critics contend that this subjectivity reduces factors to fictions (e g , Lykken, 1971, Revelle, 1983), whereas proponents argue that factors are simply inferences that always require further validation (e g , Howarth, 1972)

Traditional factor analysis, as described above, is an exploratory process, typically, researchers examine multiple solutions in their search for a structure that seems conceptually meaningful This exploratory approach can be contrasted with the more recently developed strategy of confirmatory factor analysis, which is first and foremost a hypothesis-testing procedure Based on a priori theoretical expectations, investigators impose certain restrictions on the factor solution, and after the factors are extracted (using the maximum likelihood method to estimate the unspecified parameters), statistical tests are conducted on the residual matrix to determine whether it still contains significant covariation Confirmatory factor analysis was made possible by advances in the area of causal modeling (for a nontechnical review, see Bentler, 1980), and in particular by the groundbreaking work of Karl Joreskog (e g , Joreskog & Sorbom, 1979), who developed a computer program capable of estimating structural equation models containing unobserved variables (the most recent version of which is *LISREL VI*) The *LISREL* program allows one to specify various parameters (e g , the number of factors, the correlations between factors, specific factor loadings, etc) Confirmatory factor analysis does not avoid all of the problems of indeterminacy noted earlier, but it does represent a significant advance over exploratory methods in that it allows us to test more directly hypotheses concerning specific parameters derived from previous research or conceptual work As a final note, we should add that although the maximum likelihood method is most often used within a confirmatory framework, it can also be used in an exploratory fashion Of course, goodness of fit statistics will have less meaning when used this way since they will capitalize heavily on chance

Some Assumptions about Scale Development

Much of what we have to say in this paper rests on an important assumption *that a single scale ought to measure a single construct* This is not a novel or idiosyncratic point, nor one that we can attempt to take

credit for Guilford made the point 30 years ago "any test that measures more than one common factor to a substantial degree yields scores that are psychologically ambiguous and very difficult to interpret" (1954, p 356) McNemar (1946) also speaks clearly on this issue "Measurement implies that one characteristic at a time is being quantified The scores on an attitude scale are most meaningful when it is known that only one continuum is involved Only then can it be claimed that two individuals with the same score or rank can be quantitatively and, within limits, qualitatively similar in their attitude towards a given issue" (p 268)

Although we believe this premise to be quite reasonable, and one with which most scale developers (as well as most readers) will be able to agree, it raises two sorts of problems First, there is the problem of how to specify the notion of a single construct both conceptually and operationally Several concepts are typically used when evaluating the adequacy of a scale unidimensionality, internal consistency, and homogeneity These concepts are all related to the notion that a scale ought to be focused on a single construct, and they are often used interchangeably when in fact they are not synonymous (McDonald, 1981) For instance, a scale can achieve a generally acceptable level of internal consistency (as measured by coefficient alpha) and yet be relatively heterogeneous (as measured by the mean correlation across pairs of items) Similarly, a scale can reach generally acceptable levels of internal consistency and homogeneity and still yield multiple factors We will explore this issue more fully in a later example, but for now the point is that there is some disagreement as to what specific indices and decision criteria are appropriate when evaluating the adequacy of a scale (Hattie, 1984, McDonald, 1981)

The second problem is that a number of well known and widely used scales seem to run contrary to our assumption that single scales ought to measure single constructs For example, popular scales such as the Eysenck Personality Questionnaire, the Marlowe-Crowne Social Desirability Scale, and the Hogan Empathy Scale all have mean interitem correlations of less than 10 In fact, Fiske (1971) suggests that the mean correlation between pairs of items for the typical test is less than 10 Furthermore, many popular scales (including the three listed above) are known to be multifactorial (e g , see Howarth, 1976, Johnson, Cheek, & Smither, 1983, Paulhus, 1984)

In part, this tendency for scales to be heterogeneous and multifactorial has to do with the breadth or level of the construct being measured This issue can be well illustrated using the dimension of extraversion-introversion Eysenck (1983) points out that "One of the central problems in personality research has been the question of whether higher-order factors such as extraversion can be regarded in any meaningful sense as

unitary or whether there are several independent factors such as 'sociability' and 'impulsivity', which should not be combined" (p 5, italics original) Eysenck goes on to note correctly that sociability and impulsivity themselves can be subdivided into components (e g , impulsivity can be decomposed into constructs such as risk-taking, nonplanning, and liveliness) He then comments "if we factor analyze a large number of items we would almost certainly be able to show that each factor in turn could be subdivided into smaller subfactors, and so on ad infinitum There would presumably be little interest in doing this, but the possibility has to be borne in mind" (p 7) Thus, Eysenck would seem to agree with our initial premise—that a single scale ought to measure a single construct—but he raises an additional issue What is the appropriate level of a construct? Is it extraversion, or sociability and impulsivity, or some more limited component still?

This brings us to our second assumption *that the components of a scale are important if they are differentially related to other measures* In other words, it makes sense to continue subdividing a large global factor into smaller, more precise subfactors as long as the distinctions are conceptually meaningful and empirically useful The decision as to what level of construct is most appropriate is first and foremost an issue of construct validity It is also necessary to demonstrate the replicability of a factor structure, but as Lanyon and Goodstein (1982) correctly comment "Usefulness, in any predictive sense, is not an intrinsic property of factorially derived scales, but must be demonstrated empirically" (p 93) The validity of factor scales must be demonstrated in the same way as any other new scale Many kinds of evidence can be offered in support of a measure's validity, but critical readers apparently find some forms of data more convincing than others Thus we can talk about *levels of validation* In a later example we will refer to three levels, listed here in ascending order conceptual validation, validation by self-report, and behavioral validation

Our third and final assumption is borrowed from Nunnally (1978, particularly Chapter 8) who argues *that factor analysis ought to be applied routinely to new personality scales* immediately after they are constructed We believe that it is best to have an instrument with a known factorial composition before attempting to validate it empirically In terms of the traditional strategies of test development, we advocate a rational and homogeneous approach rather than an empirical or criterion-oriented approach Certainly the empirical approach produces inventories that successfully predict a specific criterion (or set of criteria), but these measures are generally so heterogeneous (by design) and so amorphous that they add little to our understanding of the construct that they presumably represent

In his defense of the empirical strategy of test development, Gough (1965) argues that the first task in the conceptual analysis of a scale is to establish its empirical validity (in a *primary evaluation*), and that only then are you ready for a *secondary evaluation* to understand how the test works and "to uncover and hence illuminate the underlying dimensionality that is inherent in any test or measure possessing primary utility" (p 295) The problem as we see it is that the factor structure of such scales tends to be exceedingly complex and one can never be sure which component or components of a scale were responsible for previous sets of findings Furthermore, analyses of empirically developed scales often reveal "messy" factor structures where none of the derived factors closely resembles the original construct, where single items sometimes seem to be unrelated to anything else, and where knowledge of the factor structure of the individual items adds little to our understanding of the construct being measured (e g , see Johnson et al , 1983, analysis of the Hogan Empathy Scale)

In the next two sections of this paper, we want to focus on how factor analysis can help us to refine our constructs and the way we measure them Specifically, we want to examine two issues (1) How can we understand what it is that a scale measures? and (2) How can we know whether different scales with the same name measure the same thing (or whether different scales with different names measure different things)? Our basic position is that factor analysis is one of the tools that enables us to understand what it is that a scale measures and that allows us to assess the extent to which the items on a scale share common variance The emphasis of our paper will be on factor analysis as a means to an end, the end being the development of scales that further our understanding of the constructs they measure We should briefly note what is perhaps already obvious, that our intention is not to provide a detailed review of the latest technical developments in the art of factor analysis, rather, we hope to highlight the role of factor analysis in the construction, evaluation, and refinement of measures of limited domain constructs To this end, we want to take an extended look at two case histories self-monitoring and self-esteem

The Case of Self-Monitoring

In this portion of the paper, we use self-monitoring as an example of how factor analysis can lead to insights about a single construct and its measurement The Self-Monitoring Scale provides a useful "case study" of a limited domain measure for three reasons First, it is a well known and widely used measure The scale has been employed in more than 100 studies, and a recent review (Snyder, 1979) was one of the most referenced articles in 1982 (Perlman, 1984)

Second, the Self-Monitoring Scale was designed specifically to be an internally consistent measure of a single dimension of individual differences (Snyder, 1972, pp 18 and 19) As Lanyon and Goodstein (1982) point out in their text on personality assessment, the application of factor analysis is especially appropriate when scales are developed from a pool of items with the goal of maximizing internal consistency (more so than when scales are developed using purely rational or empirical methods of test construction)

Third, a number of factor analytic investigations of the Self-Monitoring Scale have been published, and the factor analytically derived subscales have been examined in several empirical studies Thus, we can evaluate both the replicability and utility of the factor solution Self-monitoring provides a useful object lesson, therefore, because it is a prominent and popular measure, because it was developed in a way that is consistent with the goals of factor analysis, and because the literature contains plenty of grist for the evaluative mill

The Construct

The construct of self-monitoring belongs to the family of self theories that emphasize the variability of the presented self Its intellectual ancestry can be traced back to the "many social selves" of William James, to the societal origins of self as set forth by the symbolic interactionists, and to the life-as-theater metaphor elaborated by Erving Goffman Present in all of these approaches is the notion that individuals actively strive to influence what others think of them by carefully orchestrating the impressions they give off Mark Snyder contributes to this tradition by pointing out that there are "striking individual differences in the extent to which individuals can and do monitor their self-presentation, expressive behavior, and nonverbal affective display" (1974, p 526–527) Snyder's description of the high self-monitor illustrates the richness of the construct

> The prototypic *high self-monitoring individual* is one who, out of a common concern for the situational and interpersonal appropriateness of his or her social behavior, is particularly sensitive to the expression and self-presentation of relevant others in social situations and uses these cues as guidelines for monitoring (that is, regulating and controlling) his or her own verbal and nonverbal self-presentation (1979, pp 89)

In order to test empirically his notions about self-monitoring, Snyder constructed a self-report instrument with which he could assess the ability of individuals to tailor their performances to the demands of a situation Thus, the inception of the Self-Monitoring Scale was consistent

with Nunnally's (1978) assertion that "a measure should spring from a hypothesis regarding the existence and nature of an attribute" (p 277)

The Scale

Interitem Relationships

Snyder constructed his scale from a pool of 41 self-descriptive items which he culled to 25 using an index that discriminates individuals with high total scores from those with low total scores This procedure provides a type of item-total correlation, and it is designed to *maximize internal consistency* (Nunnally, 1978, Snyder, 1972) Unfortunately, however, Nunnally also points out that this type of procedure does not necessarily result in a homogeneous set of items

> Indeed, the major criticism that can be made of selecting items in terms of correlations with total scores is that the method apparently works as well when several groups of items relate strongly to different factors as when all items relate only moderately to the same factor Thus if there are several prominent factors in the items, the problem is not so much that the item analysis will fail, but rather that it will work deceivingly well (pp 284–285)

The Self-Monitoring Scale seems to be a case in point Although the scale satisfies the usually accepted standards for internal consistency with Kuder-Richardson Formula 20 coefficients of around 70 (e g , Snyder, 1974), even a simple reading of the scale suggests a fundamental dissimilarity in the content of the items For instance, compare item 18 (I have considered being an entertainer) with item 19 (In order to get along and be liked, I tend to be what people expect me to be rather than anything else) True answers to both are scored in the direction of high self-monitoring, even though the first clearly involves social self-confidence whereas the second suggests a dependency on others or a lack of interpersonal assurance Moreover, this item heterogeneity can be documented statistically The mean of the 300 possible pairwise correlations among the 25 items is only about 08 (Briggs, Cheek, & Buss, 1980) In part, this average coefficient is near zero because roughly one-quarter of the interitem correlations are *negative* The correlations vary from around − 30 to about + 50

Thus, we are confronted with a paradox The Self-Monitoring Scale meets the normal requirements for internal reliability, yet many of its items are unrelated This apparent contradiction occurs because standard reliability estimates of internal consistency are not pure measures of item homogeneity Kuder-Richardson Formula 20 is a conventional index of internal consistency, the most general form of which is Cronbach's

coefficient alpha Reliability coefficients of this sort estimate how scores on a scale would correlate with those from a hypothetical scale of the same length, constructed in the same way but with a different set of items (but see McDonald, 1981) This estimate is directly related to the mean interitem correlation but is also a function of the length of the test (Green, Lissitz, & Mulaik, 1977) Reliability estimates can be improved by increasing the number of items on a scale or by selecting items that are more cohesive so as to raise the average correlation among items Thus, the mean interitem correlation differs from a reliability estimate in that it is not influenced by scale length (because "Spearman-Browning" has not occurred), and it is therefore a clearer measure of item homogeneity

With respect to the Self-Monitoring Scale, an alpha of 7 tells us that this sample of items would probably correlate around 7 with another sample of items drawn from the same population At the same time, a mean interitem correlation of 08 suggests that we have a very disparate set of items Such a finding can occur when we attempt to assess a construct that is itself broad and polymorphous The problem with broad constructs of this sort is that they tend to gloss over important distinctions In the words of one psychometrician

> Unfortunately, it is not always recognized that a criterion of a good test is that the correlations among the item scores shall be as large as possible The argument is frequently made that it might be desirable for a given test to sample a large number of different variables which are not highly correlated so that one gets a wider sampling of whatever it is that he is trying to measure If a person is attempting to measure a large number of things, then he should specify as accurately as he can what each of the things is and should attempt to measure them separately by separate groups of highly correlated items (Horst, 1966, p 147)

This is not to say that broad constructs are unimportant, but rather that one must be mindful of the components of which they are built We should also point out that Horst overstates the case when he insists that the correlation between items be as large as possible We believe that the optimal level of homogeneity occurs when the mean interitem correlation is in the 2 to 4 range Lower than 1 and it is unlikely that a single total score could adequately represent the complexity of the items, higher than 5 and the items on a scale tend to be overly redundant and the construct measured too specific The 2 to 4 range of intercorrelations would seem to offer an acceptable balance between bandwidth on the one hand and fidelity on the other

Table 1 Representative items from the factors of the Self-Monitoring Scale

Acting factor
I would probably make a good actor
I have considered being an entertainer
I have never been good at games like charades or improvisational acting (R)
"Extraversion" factor
I feel a bit awkward in company and do not show up quite as well as I should (R)
At a party I let others keep the jokes and stories going (R)
In a group of people I am rarely the center of attention (R)
Other-directedness factor
In different situations and with different people, I often act like very different persons
In order to get along and be liked, I tend to be what people expect me to be rather than anything else
I guess I put on a show to impress or entertain people

Notes —(R) denotes items to be recoded for scoring in the direction of high Self-Monitoring Items based on Briggs, Cheek, and Buss (1980)—see also Leary et al (1982), Sparacino et al (1983), and Tobey & Tunnell (1981)

Factor Structure

Given that the items of the Self-Monitoring Scale are only minimally related on average and given the heterogeneity of the item intercorrelations, we can use factor analysis to detect patterns in the correlations among items Analyses of the Self-Monitoring Scale have demonstrated that items can indeed be grouped together into several distinct factors In our own research, we identified three replicable factors and labelled them *acting*, *"extraversion,"* and *other-directedness* (Briggs et al , 1980) Representative items from these factors are presented in Table 1 Scales formed from the highest loading items on each of the factors were relatively independent (for extraversion and other-directedness, $r = -11$, for extraversion and acting, $r = 31$, and for other-directedness and acting, $r = 13$) The items on these subscales also proved to be more homogeneous than the items on the full Self-Monitoring Scale The mean interitem correlations for the total sample in the Briggs et al study was 29 for acting, 27 for extraversion, and 18 for other-directedness compared to 08 for the full scale Gabrenya & Arkin (1980) identified a similar factor structure although they settled on a four-factor solution These basic factors have now been replicated in a number of published studies (Cegala, Savage, Brunner, & Conrad, 1982, Edelmann, 1985, Furnham & Capon, 1983, Leary, Silver, Darby, & Schlenker, 1982, Penner & Wymer, 1983, Riggio & Friedman, 1982, Sparacino, Ronchi, Bigley, Flesch, & Kuhn, 1983, and Tobey & Tunnell, 1981)

These investigations reach surprisingly similar conclusions given the number of investigators involved and the variety of techniques em-

ployed Although the studies differ with respect to at least four procedural issues—type of item format, type of factor solution, type of rotation, and the number of factors retained in the final solution—as shown in Table 2 interpretations as to the nature of the derived factors show a decided resemblance

The first difference concerns what type of response format to use when administering the Self-Monitoring Scale—dichotomous or multipoint Snyder introduced the scale with a true-false format and most of the subsequent empirical research has retained that format In our study, however, we employed a 5-point format in order to avoid limiting the size of the correlations among items due to skewed frequencies of endorsements (see Nunnally, 1978, pp 141–146) The correlation between total scores on the true-false form and total scores on the 5-point form (administered 45 days apart) is roughly equivalent to the reliability of the item sample as measured by the alpha coefficient (both hover around 70)

The second source of variation in Table 2 involves the method of extraction Although the various methods employed (e g , principal component analysis, principal axis factoring, and maximum likelihood) differ markedly in terms of their fundamental assumptions and computational algorithms, apparently the factor structure of the Self-Monitoring Scale is sufficiently robust to emerge regardless of the particular procedures employed This finding is not unusual, the different procedures represented often seem to yield similar solutions (e g , Velicer, Peacock, & Jackson, 1982)

The third type of difference involves rotation of the extracted factors Recall from our earlier discussion that there is no unique solution to the problem of rotation in factor analysis Various statistical criteria have been introduced to assist in the rotation to a "correct" solution, but no one method is appropriate for all situations The various methods can be divided into those which require that the factors be orthogonal or independent (e g , Varimax) and those which allow factors to correlate somewhat (e g , Direct Oblimin and Promax) Because the variables in this case all belong to the same scale (and thus should be related despite the fact that the mean interitem correlation is low), an oblique form of rotation would seem more appropriate since any factors to emerge would presumably be somewhat correlated The similarity in findings across the studies in Table 2 despite variations in the method of rotation suggests that the factors are not highly correlated since forcing the factors to be independent did not alter the results in any meaningful way

The final difference among these various studies concerns the method for extracting the "proper" number of factors from a correlation matrix A number of objective procedures have been suggested for use with ex-

Table 2 A comparison of Factor Analytic Studies of the Self-Monitoring Scale

Article	Sample size	Response format	Type of solution	Type of rotation	# of factors	Decision rule
Briggs, Cheek, & Buss (1980)	536 579	1–5	maximum likelihood [principal axis]	direct oblimin [varimax]	3	—replicability —scree test —variance explained —eigenvalues > 1 0
Gabrenya & Arkin (1980)	210M 527F 290M 480F	T–F (phi)	Principal component [principal axis]	promax	4	—scree —interpretability —eigenvalues > 1 0
Tobey & Tunnell (1981)	320F	T–F	principal axis	varimax	3 (4th factor discarded as unreliable)	—based on 4-factor solution of Gabrenya & Arkin
Leary, Silver, Schlenker, & Darby (1982)	237	T–F (tetrachoric)	principal axis	varimax [oblique]	3	—variance explained —interpretability
Riggio & Friedman (1982)	150	T–F (parcels of items)	principal components	promax [varimax]	3	—based on 3-factor solution of Briggs, Cheek, & Buss
Furnham & Capon (1983)	230	T–F	principal components	varimax	4	—eigenvalues > 1 5
Penner & Wymer (1983)	221	1–5	principal components	varimax	3	—based on 3-factor solution of Briggs, Cheek, & Buss
Sparacino, Ronchi, Bigley, Flesch, & Kuhn (1983)	594	T–F	principal components	oblique [varimax]	2 (acting & extraversion factors combined)	—based on 3-factor solution of Briggs, Cheek, & Buss
Edelmann (1985)	103	T–F	principal components	varimax	3	—eigenvalues > 1 5

Note —Brackets [ ] indicate other types of analyses performed but not reported in detail

ploratory factor analysis, these procedures are based on characteristics of the data itself rather than on any a priori hypotheses (Gorsuch, 1983, Chapter 3) Unfortunately, these decision rules often do not yield the same answer One common rule—retaining for rotation any eigenvalue (or latent root) greater than 1 0—generally seems to overestimate the number of underlying factors by retaining from one-third to one-fifth the original number of variables (e g , see Zwick & Velicer, 1982) Many factor analysts currently spurn this procedure when factoring items, even though it is the default option on some statistical packages (e g , *SPSS-X*) and even though not all of the evidence is negative (Hakstian, Rogers, & Cattell, 1982) Eigenvalues represent how much variance is explained in terms of the average original variable, an eigenvalue of 1 0 means that a factor accounts for as much of the variance as the average original variable

Principal component analyses of the Self-Monitoring Scale generally produce seven to nine factors with eigenvalues greater than 1 0 (roughly one-third of the scale's 25 items) These factors can be further evaluated using Cattell's (1966) scree test which plots the incremental variance accounted for by each successive factor to determine the point at which the explained variance levels out Scree tests suggest that three factors should be extracted from the correlation matrix of self-monitoring items, and previous research suggests that the scree test is a relatively accurate decision rule (Zwick & Velicer, 1982)

In our view, however, one of the chief considerations should always be the *replicability* of the factor structure Factors that do not replicate are of little value Multiple samples, therefore, should be a prerequisite for exploratory factor analysis Everett (1983) presents a factor comparability coefficient that can be used to determine the number of reliable factors that should be retained for rotation

In our original study of the Self-Monitoring Scale (Briggs et al , 1980), we examined solutions containing between two and seven factors before deciding on a three-factor solution The three-factor solution revealed meaningful components (see Table 1), but more importantly it was replicable whereas the four-factor solution was not *Coefficients of factor congruence* (an index of the degree of similarity for factor loadings from independent samples, Harman, 1960) were all above 94 in that study, suggesting substantial correspondence across samples Although the coefficient of congruence provides a relatively weak test for relating factors across samples (Gorsuch, 1983, pp 282–288, describes other methods), the studies reported in Table 2 attest to the reproducibility of the basic factors underlying the Self-Monitoring Scale

From the previous section we can extract two well documented conclusions (1) the Self-Monitoring Scale does not consist of a homogeneous

set of items, even though the scale was developed so as to maximize internal consistency, and (2) part of the item heterogeneity can be explained in terms of several factors that are present in the items In this context, it is interesting to note the origin of some of the items At least one third of the items on the Self-Monitoring Scale can be traced back to other published inventories Three of the items (6, 16, and 19) were acquired from items 14 and 26 of Berger's (1952) Expressed Acceptance of Self Scale Two others (3 and 17) resemble items 4 and 8 from a self-esteem scale by Phillips (1951) and four more (4, 5, 8, and 21) derive from measures of internality and externality reported by Collins, Martin, Ashmore, and Ross (1973) In fact, *all nine* of the borrowed items were included in the study by Collins et al which identified dimensions of internal and external orientation For our purposes, the important finding from their study is that the nine items loaded on two distinct factors One factor included items 19, 6, 16, 17, and 3 from the Self-Monitoring Scale All of these items load on our other-directedness factor (Collins et al also labelled their factor Other-directedness, a remarkable coincidence) The other factor included items 5, 8, 21, and 4 from the Self-Monitoring Scale Two of these items load on our Acting factor, one on the Extraversion factor, and one not at all Collins et al labelled their factor *lack of constraints on behavior* and showed that it correlated 37 with Eysenck's Extraversion Scale As in our research, these two factors were relatively unrelated It would seem, therefore, that the multidimensionality of the Self-Monitoring Scale can be traced directly back to the pool of items from which it was constructed

As we pointed out earlier, however, identifying a replicable factor structure in no way ensures the importance or usefulness of those factors (Lanyon & Goodstein, 1982) The validity of the factors must be demonstrated in the same way as any other new scale Evidence supporting the validity of the factors of the Self-Monitoring Scale is presented in the next three sections, each summarizing a different level of validation

Conceptual Validation

When examining a factor structure we want to know whether the items that load on separate factors form meaningful and distinct groups Our confidence in a solution is bolstered by coherent and explicable factors For instance, early analyses of the Self-Consciousness Scale revealed a meaningful distinction in item content—private vs public self-consciousness, and social anxiety—which resulted in three separate subscales (Feningstein, Scheier, & Buss, 1975) Similarly, Collins (1974) was able to show that Rotter's Locus of Control Scale consisted of four interpretable factors or four types of externality belief that the world is difficult, unjust, governed by "luck," and politically unresponsive

As we pointed out earlier, several replicable factors have emerged from the Self-Monitoring Scale (see Table 1) Although some disagreement exists as to the exact number of factors, this discord is trivial compared to the amount of accord evident in the names assigned to factors derived One factor has been labelled variously other-directedness, other-directed self-presentation, social sensitivity, and public impression management, another factor has been called acting, theatrical acting ability, expressive self-control, and performance, and the last factor has been named "extraversion," sociability/social anxiety, social stage presence, charisma, and (the opposite of) social insecurity Although procedures have been suggested for reducing the subjective element in naming factors (Meehl, Lykken, Schofield, & Tellegen, 1971), the similarity of these terms surely implies a meaningful and interpretable factor structure

Sometimes, however, the apparent or face validity of a measure can be misleading Conceptual distinctions may not result in any pragmatic benefit A second level of validation, therefore, involves the relationships between factors and other self-report measures

Validation by Self-Report

A number of studies have reported such correlations for the factors of the Self-Monitoring Scale A sample of these correlations is presented in Table 3 This sample is biased in two ways First, it involves only those studies which have used the three factors identified by Briggs et al (1980) (This limitation greatly simplifies the organization of the table and is not terribly self-serving since that solution is currently the one most commonly used) Second, other self-report dimensions are reported only if there is a significant correlation with the total score on the Self-Monitoring Scale or with at least one of the factors Many self-report variables do not correlate with the Self-Monitoring Scale or its factors, nor is there any reason to expect that they should

The table is divided into several parts The top section of the table contains measures of poor adjustment (e g , anxiety and neuroticism) The next section down involves measures of extraversion and social surgency, whereas the third section consists of self-esteem and self-confidence measures The last part contains measures that are conceptually related to the construct of self-monitoring such as machiavellianism and empathy Also included at the bottom of the table is the Crowne-Marlowe measure of social desirability

Three things should be apparent from the table First, consistent with Snyder's earlier assertions (1974, 1979), total scores on the Self-Monitoring Scale are relatively uncorrelated with other personality measures

Table 3 Correlations of relevant self-report measures with the Self-Monitoring Scale and its factors

Self-report measures	Sample size	Self-Monitoring Scales: Total score	Acting	Extra-version	Other-directed
Adjustment measures					
Shyness	1020	− 10	− 23	− 56	37
Social anxiety	221	*ns*	− 27	− 48	20
Manifest anxiety	82	30	08	− 11	49
Trait anxiety	70	*ns*	*ns*	− 28	26
PRF social recognition	67	16	− 05	− 25	41
Neuroticism	67	12	− 01	− 38	45
[2nd sample]	55	30	*ns*	*ns*	48
Social surgency measures					
Extraversion	55	41	25	51	*ns*
[2nd sample]	67	19	20	43	− 19
Sociability	1020	20	12	36	05
PRF affiliation	67	12	03	37	− 14
PRF dominance	67	29	43	42	− 16
PRF exhibition	67	34	40	54	− 17
Persuasive ability	72	26	36	46	00
Communication effectiveness	72	38	46	43	14
Self-esteem measures					
Self-esteem	1020	− 17	*ns*	38	− 49
Texas Social Behavior Inventory	778	27	38	65	− 32
Coopersmith SEI	82	− 24	− 05	21	− 47
Janis-Field self-esteem	138	− 03	24	35	− 34
Rosenberg self-esteem	138	− 11	11	23	− 31
Measures conceptually related to self-monitoring					
Machiavellianism	77	24	23	02	28
Affective Communication Test	67	19	31	56	− 29
Empathy	81	20	32	38	− 10
[2nd sample]	221	25	31	31	*ns*
Ring performance scales					
People	100	− 48	− 39	− 61	− 09
Roles	100	35	45	57	− 09
Chameleon	100	03	− 15	02	09
Social desirability	82	− 24	− 13	06	− 22
[2nd sample]	100	− 26	− 01	− 06	− 36

Only 5 of 29 correlations exceed 30 Second, correlations between the acting subscale and the various measures are also modest As one would predict, acting correlates most highly with measures of social surgency (dominance and exhibition) and performance (the person and role subscales from Ring and Wallston's performance measure) Acting also correlates with the Affective Communication Test (ACT)—a measure of emotional expressiveness—and Hogan's Empathy Scale Hogan's scale is itself factorially complex (Johnson et al , 1983), and their analyses show that the acting subscale of Self-Monitoring is related to Empathy ($r =$ 42, $p <$ 01) almost entirely because of its relationship to a social self-confidence factor ($r =$ 57, $p <$ 01)

Our third point concerns the size and pattern of correlations for the extraversion and other-directedness subscales Both factors show moderate to large correlations with a number of the personality measures, but often the correlations are in *opposite* directions For instance, extraversion is inversely related to the measures of poor adjustment and positively related to the measures of social competence and self-confidence, whereas other-directedness is positively related to the measures of poor adjustment, inversely related to the self-esteem measures, and generally unrelated to the extraversion or social competence measures (although the signs are again mostly negative) Thus, other-directedness and extraversion work at cross-purposes, even though the two subscales are virtually independent (the correlation in our original sample was − 11 and in an unpublished replication sample of 778 students, $r =$ 01) *The apparently inconsequential correlations between the Self-Monitoring Scale and other personality measures are misleading insofar as they conceal contradictory and often rather substantial relationships between the components of self-monitoring and these same personality variables* Quite simply, then, our third point is that the Self-Monitoring Scale is "a house divided unto itself"

With this point in mind we are better able to see how the Self-Monitoring Scale is related to measures with which it bears a conceptual resemblance Total scores on the Self-Monitoring Scale are unrelated to the *ACT*, a measure of expressiveness and dramatic flair All three of the factors, however, are related to the *ACT*, with extraversion and acting showing a positive correlation and other-directedness a negative one This pattern of results locates the *ACT* alongside the other measures of social surgency (e g , *PRF* exhibition and dominance), a conclusion that is entirely consistent with research on the *ACT* (cf Friedman, Prince, Riggio, & DiMatteo, 1980) Total scores on the Self-Monitoring Scale are only modestly related to measures of machiavellianism and empathy The correlation with machiavellianism is due to the other-directedness

and acting factors, whereas the relationship with empathy involves the extraversion and acting factors

Finally, total scores on the Self-Monitoring Scale are substantially related to two of the three Ring and Wallston Performance Scales Snyder (1974) reports a nonsignificant correlation with the chameleon (*c*) scale ($r = -\ 25$), but does not mention the role (*r*) or person (*p*) scales A study by Dabbs, Evans, Hopper, & Purvis (1980) found a substantial correlation between self-monitoring and both the role scale ($r = \ 52$, $p < \ 01$) and the person scale ($r = -\ 51$, $p < \ 01$) Similar findings are presented in Table 1, but here it is clear that the extraversion and acting factors are responsible for the substantial overlap in these two measures, the other-directedness factor is unrelated to all three performance measures

One other set of findings, not reported in Table 1, deserves attention In recent years, Jerry Wiggins (1979, 1980) has advocated a circumplex model for the representation of interpersonal behavior He has developed a set of interpersonal adjective scales which form a 2-dimensional circle that can be partitioned into eight octants One of the principle advantages of this model is that it provides a conceptual framework for describing the universe of interpersonal constructs, although this approach is not without its critics (e g , Jackson & Helmes, 1979) Wiggins & Broughton (1985) have attempted to locate the factors of the Self-Monitoring Scale within the Interpersonal Circle The acting subscale falls squarely in the ambitious-dominant octant, and the extraversion subscale lands close by between the ambitious-dominant octant and the gregarious-extraverted octant In contrast, other-directedness is located on the other side of the circle and off of the circumference It falls closest to the aloof-introverted octant, directly opposite from the gregarious-extraverted octant (as well as the other two factors) Wiggins and Broughton conclude that "Although it is not clear what is measured by the items of the Other-directedness Scale, it is clear that such items should not be combined with those from the other two subscales to form a single scale" (p 31)

It is apparent, therefore, both in this case and in those reported in Table 3, that an analysis by subscale reveals considerably more than an analysis using the total score alone Of course, there are also instances in which the subscales have all correlated similarly with another variable For example, in one sample, Lennox and Wolfe's (1984) Ability to Modify Self-Presentation Scale correlated 45 with total scores on the Self-Monitoring Scale, 39 with acting ability, 32 with extraversion, and 28 with other-directedness (all *p*'s < 01, Johnson, Jewell, & Tirrell, 1984)

Behavioral Validation

Although personally we are persuaded by the evidence reported in the last section, we realize that for many readers behavioral evidence is the sine qua non If the factor structure has no behavioral implications, so what? The third and most compelling type of validation, therefore, involves charting the relationships between factors and behavior Several studies have provided such evidence Because the self-monitoring construct has yielded a variety of testable hypotheses, these studies can be grouped into four sections according to the kind of hypothesis being tested communication ability, self-attention, situational variability, and moderator variables

Sending messages and reading cues Four published articles have looked specifically at how communication skills are related to the factors of the Self-Monitoring Scale Two of these reports (Riggio & Friedman, 1982, 1983) provide complementary analyses of a single data set in which three types of performance measures were collected ability to send emotional messages, ability to deceive, and ability to detect nonverbal cues Total scores on the Self-Monitoring Scale did not relate to any of the behavioral or rating measures reported in these two studies Results with the factors also were modest, but they outperformed the full scale In particular, an individual's ability to convey emotional messages was related to scores on the acting factor ($r = 24$, $p < 10$), whereas scores on a measure of facial animation (speech rate, head movements, and smiling) correlated with both the extraversion factor ($r = 39$, $p < 01$) and the acting factor ($r = 28$, $p < 05$), although the facial animation measure itself did not prove to be a reliable indicator of deception In addition, the extraversion and acting factors were related to a discrepancy in the amount of nervous behavior displayed when telling a lie vs telling the truth High compared to low scorers on both the extraversion factor ($r = 30$, $p < 05$) and the acting factor ($r = 25$, $p < 05$) were more likely to inhibit the leakage of nervous mannerisms (e g , leg movements, posture shifts, and hand-to-head contacts) when fabricating a story than when speaking truthfully

A third article in this area contains two separate studies examining the relationship between self-monitoring and deception abilities (Siegman & Reynolds, 1983) In the first investigation, participants responded to a series of personal or impersonal questions and were instructed to answer truthfully to some and falsely to others The major dependent variables were measures of verbal fluency Total scores on the Self-Monitoring Scale were unrelated to the fluency measures, but

scores on the acting factor correlated significantly with temporal pacing *when lying* but not when telling the truth (although these correlations were in the same direction) Results with the extraversion scale resembled those of the acting factor but were nonsignificant In contrast, "the correlations between subjects' [other-directedness] scores and their verbal indices were nearly always in the opposite direction from what [was] obtained between the [extraversion] and [acting] scores and the verbal indices" (Siegman & Reynolds, 1983, p 1327)

The second study examined spontaneous, unfeigned lying Subjects were induced first to cheat in a pseudo-*ESP* experiment and then to lie in a face-to-face confrontation with the researcher The dependent variables were again measures of verbal fluency Total scores on the Self-Monitoring Scale correlated with only one of three fluency measures, whereas the extraversion and acting factors correlated with all three ($p < 10$) In this study the strongest results were with the extraversion factor The other-directedness factor did not correlate with any of the fluency measures

The final report in this area (Mill, 1984) also contained two studies In one study, participants listened to spoken sentences and attempted to identify which of four emotional meanings was being conveyed by the speaker Accuracy of identification correlated significantly with scores on Self-Monitoring ($r = 39$) However, this relationship was due entirely to the acting and extraversion factors (r's = 56 and 40), the correlation with other-directedness was only 08

In Mill's second study, the same participants provided a three minute audio tape demonstrating their best communication skills (e g , empathic expression and listening) Ratings of empathic expression again correlated with the full Self-Monitoring Scale ($r = -35$) Notice that the correlation is negative, high self-monitors were *less* able to convey expressions of empathy All three factors also correlated negatively with these ratings, but only other-directedness correlated significantly ($r = -36$ compared to $r = -27$ for acting and -16 for extraversion)

As a whole, the studies in this section suggest that total scores on the Self-Monitoring Scale are inconsistently related to communication abilities at best (see also Cunningham, 1977, Friedman, Prince, Riggio, & DiMatteo, 1980, and Spitzberg & Cupach, 1984) Whatever relationship exists can be assigned at least as readily to the factors (generally acting and extraversion) as to scores on the full scale

Monitoring one's own behavior As the name of the construct implies, high self-monitors should be attentive to their own unfolding performances, ready to modify them at a moment's notice in order to create and maintain a desired impression It follows then that high self-monitors should be better able than lows to predict what kind of an impres-

sion they are making on others To test this notion, Tobey and Tunnell (1981) videotaped women talking about their views on a topic and then asked them to predict the impression they would make on others The dependent measure was the extent to which an individual's predictions agreed with the judgments of raters Total scores on the Self-Monitoring Scale were unrelated to the index of agreement ($r = 08$, *ns*), but scores on the acting factor were somewhat related ($r = 25$, $p < 05$) Subsequent analyses suggested that "high actors made accurate predictions because they knew they had made *good* impressions" (p 667, italics original)

In a recent study, Miell and LeVoi (in press) asked participants to inter-act with either a friend or a stranger Participants talked together for about 10 minutes and then filled out a set of ratings, the partners anticipated a future interaction Other-directedness was positively related to participants' reports that they used their partner's behavior as a guide to what to do during the interaction, scores on the other two factors and on the total scale were not related to these reports High scores on the acting and extraversion factors, however, were negatively related to how self-conscious an individual felt

Situational variability According to the self-monitoring construct, individuals who score high on the scale should exhibit greater cross-situational variability than those who score low They should modify their behavior to fit the demands of a particular situation Evidence for this claim was reported by Snyder and Monson (1975), but several other studies have failed to corroborate this finding (Greaner & Penner, 1982, Santee & Maslach, 1982, Schneiderman, 1980, Tunnell, 1980, Zanna, Olson, & Fazio, 1980)

A study by Brookings, Flood, Hessinge, Kuhls, Miller, & Wright (1982) compared scores on the total Self-Monitoring Scale and its factors with ratings of variability by self and by others Self-related variability was significantly related to scores on the other-directedness factor ($r = 36$, $p < 001$) but not to scores on the total scale ($r = 16$, $p > 10$) Other-rated variability was not related to the total scores or the factors

A more recent study also suggests a relationship between situational variability and the other-directedness factor Johnson, Jewell, & Tirrell (1984) assessed the degree to which individuals acquiesed in an attitude change paradigm Total scores on the Self-Monitoring Scale correlated positively with acquiescence ($r = 30$, $p < 01$) as did scores on the other-directedness factor ($r = 31$, $p < 01$) Scores on the other two factors were not significantly related to acquiescence ($r = 06$ for extraversion, and $r = 18$ for acting)

A moderator variable According to Snyder's conceptualization of self-monitoring, *low* self-monitors regard themselves as "rather princi-

pled beings who value congruence between their actions in social situations and relevant underlying attitudes, feelings, and dispositions" In contrast, *high* self-monitors see themselves as "rather flexible and adaptive creatures who shrewdly and pragmatically tailor their social behavior to fit situational and interpersonal specifications of appropriateness" (Snyder & Campbell, 1982, pp 186–187) Thus, self-monitoring should moderate the relationship between internal dispositions and social acts (e g , Ajzen, Timko, & White, 1982, Snyder & Tanke, 1976)

Two recent studies of moderator variables have examined the Self-Monitoring Scale as well as its factors Cheek (1982) compared self-ratings with peer-ratings on four personality dimensions The Self-Monitoring Scale failed to show meaningful moderating effects on the relationship between self-ratings and peer-ratings The acting factor, however, did moderate this relationship, but in the direction *opposite* from that suggested by Self-Monitoring theory High scorers showed *stronger* agreements between self-ratings and peer-ratings than did low scorers Scores on other-directedness followed a similar pattern although somewhat less consistently, whereas scores on extraversion tended to work in the opposite direction (i e , in the direction predicted by the construct of self-monitoring)

Wymer and Penner (in press) not only replicated this pattern of findings, they further clarified the issue by distinguishing between (and empirically assessing) two types of predictability the congruence between self-ratings and peer-ratings and the congruence between internal dispositions (attitudes and traits) and actual behavior In their study, the two types of predictability were unrelated to each other Individuals scoring high on the acting factor displayed *more* self-peer congruence than did those scoring low on acting, a replication of the Cheek (1982) study For attitude-behavior congruence, however, high scorers on the extraversion factor as well as the other-directedness factor displayed less attitude-behavior congruence than did those who scored low Thus, two factors were related to attitude-behavior consistency in the direction predicted by the construct of self-monitoring, and the third factor was related to agreement between self and other ratings (albeit in the direction opposite to that predicted by Snyder) Interestingly, scores on the full Self-Monitoring Scale failed to moderate either kind of predictability Once again, then, we have seen how the factors of the Self-Monitoring Scale clarify the results of a study and prove more useful than the total scores alone

Summing Up

The point of this extended review has been to demonstrate the utility of the factors extracted from the Self-Monitoring Scale Simply put, the

factors work They resolve the ambiguity of the item pool and its low interitem correlations, they are interpretable, and they are related to other measures of various sorts in sensible ways Not only do factors clarify how the scale works psychometrically, they reveal something crucial about the construct itself Individuals who attend to social cues and regulate their behavior accordingly may do so for one of two fundamentally different reasons They may do so because they are comfortable in social situations and can work to maximize social interactions (perhaps in a way that is pragmatic, shrewd, or even manipulative), or they may attempt to minimize the chances of error, a self-defensive move to cover-up and fit in In his essay "On Facework," Goffman (1967) distinguishes the use of facework as an *avoidance* process (consisting of defensive and protective maneuvers) from the *aggressive* use of facework for "making points " More recently, Arkin (1981) has distinguished between self-presentational strategies that he labels protective and acquisitive

In factor analyses of the Self-Monitoring Scale, this distinction emerges as the other-directedness factor vs the extraversion and acting factors (for example, recall the patterns of correlations in Table 3) We do not want to suggest, however, that these factors adequately measure this two-component model of self-presentation Factor analysis provided a basic insight, but the factors themselves are no elixir Sometimes they work, sometimes they do not (e g , Caldwell & O'Reilly, 1982, Snyder & Gangestad, 1982), which is not surprising since they never went through a process of careful scale development and refinement The proper next step would be to take the insights that now are apparent and carefully construct a new set of items that measure these concepts specifically and systematically (e g , see Lennox & Wolfe, 1984, Wolfe, Lennox, & Cutler, in press) Simply shortening the scale from 25 items to 18 or 8 items (e g , Gangestad & Snyder, 1985) does not provide an adequate solution because it does not articulate the multiple dimensions inherent in the scale and in the concept

We also want to state emphatically that we believe it is unacceptable to continue using a total score alone when to do so deliberately ignores distinctions that are conceptually meaningful and empirically useful (and Self-Monitoring is by no means the only case) The Self-Monitoring Scale is a popular measure of personality and has served as the centerpiece for a number of published articles The scale has proved successful in predicting a variety of criteria and has acted to stimulate experimental social psychologists' interest in the measurement of individual differences The problem is to understand *why* the scale works As we pointed out in our 1980 article, it is difficult to know how to interpret a high score on the Self-Monitoring Scale "One person might score high on acting and other-directedness, another on acting and extraversion, and a third

on extraversion and other-directedness The same score might represent quite different items being endorsed As a result, subjects labelled high self-monitors in one study might be different from those labelled high self-monitors in another study" (p 684) Interpretations of Self-Monitoring findings, therefore, are thrown into question by what we have learned from the studies reviewed earlier and by what appears to be at least two distinct strategies of self-presentation underlying the Self-Monitoring Scale

In this detailed look at the construct of self-monitoring and its measurement, we have tried to show why scale development ought to proceed conceptually This approach begins with a careful analysis of the construct under study followed by an attempt to create a pool of items that *systematically* reflects this conceptualization If a construct is broad and multifaceted, then each component should be specified and measured as cleanly as possible with items grouped into homogeneous item clusters We believe that this approach to scale construction is superior to the empirical approach mentioned earlier even when one attempts to predict a criterion that is factorially complex (as important, real world criteria tend to be) As Nunnally argues "If items are selected by the criterion-oriented approach, one really does not know *what* factors are being measured one knows neither what factors are involved in the omnibus test nor what weights are being given to different factors It is far better to predict a criterion with a battery of tests, each of which is homogeneous in content" (1978, p 268) This approach has been adopted successfully in an omnibus inventory recently developed by Hogan (1986) Factor analysis serves as a useful tool with which to test one's conceptualization and to explore for meaningful distinctions However, factor analysis cannot magically redress a flawed pool of items Although it can provide useful insights (sometimes serendipitously), the key to good scale development is still in conceptualization early on, followed up with rigorous validation work

The Case of Self-Esteem

The case of Self-Monitoring Scale provides a revealing example of a major use of factor analysis in personality research the evaluation of a single scale that was designed to measure a specific construct In many cases, however, the personality researcher is confronted with a bewildering array of scales all purporting to measure the same construct Nunnally (1978) has suggested that factor analysis can play an important role in clearing up the psychometric and conceptual confusion that is caused by the proliferation of personality scales within a particular con-

tent area Our example for this section of the paper is self-esteem, which is unquestionably a fundamental personality construct Coopersmith (1967) defined self-esteem as "the evaluation which the individual makes and customarily maintains with regard to himself, it expresses an attitude of approval or disapproval, and indicates the extent to which an individual believes himself to be capable, significant, successful, and worthy" (pp 4–5) Similar conceptualizations have been presented by other psychologists (e g , Rosenberg, 1965, 1979), yet research on self-esteem has been hampered by persistent measurement problems

Construct Explication

Correlations between various scales constructed to assess global self-esteem have ranged from zero to 8, with an average correlation of only 4 reported in a review of 93 attempts to demonstrate convergent validity among such measures (Wylie, 1974) To be considered alternative measuring instruments of the same psychological construct, one would expect these self-esteem scales to have intercorrelations within the range of their reliability coefficients (7 to 9) Because only 7 of the 93 cross-instrument correlations reviewed by Wylie (1974) exceeded 7, it was obvious by the mid-1970s that the status of self-esteem measurement research had become something of an embarrassment to the field of personality psychology In a thoughtful analysis of this problem, Shavelson, Hubner, and Stanton (1976) identified three categories of tasks necessary for advancing self-esteem research—logical, correlational, and experimental—which are similar to the levels of validation we introduced earlier

Factor analysis is part of the second category and has been employed in a number of self-esteem studies, but Wylie (1974) concluded that the yield from factor analytic studies up to that point was limited because "factor analysis has been used more to test hypotheses about extant self-concept tests than as a tool in the construction of new ones" (p 102) From the perspective of psychometric theory, the complete process of *construct explication* requires that results from correlational and experimental studies be used to re-evaluate the logical foundation initially used to define and operationalize the construct, and should in turn lead to revisions of the measurement instruments and to further research (Nunnally, 1978) During the past decade factor analysis has been employed in a great deal of self-esteem research, we will review some selections from this literature to illustrate the contributions and limitations of factor analysis as a technique for explicating the construct of self-esteem

The Dimensionality of Self-Esteem

The major catalyst for progress in measurement work on self-esteem came when researchers began to reconceptualize the construct as being multidimensional rather than unidimensional (Franks & Marolla, 1976, Shavelson et al , 1976) If there are several dimensions of self-esteem, the failure of various global self-esteem scales to intercorrelate highly might be explained by arguing that some assess primarily one dimension of the construct whereas others measure another dimension Franks and Marolla (1976) reviewed the theoretical work of eight writers concerning multidimensional approaches to self-esteem and concluded that two qualitatively different types of self-esteem could be identified They labelled these *inner* self-esteem or feelings of competence and *outer* self-esteem or feelings of being accepted and valued by other people After devising five semantic differential items to measure each dimension, they conducted a factor analysis on item response data from a sample of 375 junior high students and a second sample of 226 college students to test their hypothesis that the ten adjective pairs would in fact result in two distinct factors In both samples, factor analysis yielded two major factors, which they interpreted as inner self-esteem and outer self-esteem Treated as separate scales, these inner and outer dimensions of self-esteem correlated 26 with each other, and the authors concluded that the dual model of self-esteem merited further testing (Franks & Marolla, 1976)

At this point, we need to recall the distinction made earlier between *exploratory* and *confirmatory* factor analysis Exploratory factor analysis pertains to situations in which the investigators are guided by hunches or are simply examining the number and nature of factors that might exist in a particular set of variables The Briggs et al (1980) factor analysis of the 25 self-monitoring items is a relatively straightforward example of exploratory work Confirmatory factor analysis involves a priori theoretical constraints which are used to specify a model against which results from a sample of data can be tested for their "goodness of fit" (Long, 1983) Several examples of confirmatory models are discussed in the next section of this paper As Nunnally (1978) has pointed out, however, many factor analytic studies fall somewhere between the clearly defined poles of exploratory vs confirmatory investigations In the self-esteem example given above, Franks and Marolla (1976) unambiguously hypothesized that their factor analysis would yield two distinct dimensions of inner and outer self-esteem, but they did *not* employ any statistical techniques of confirmatory factor analysis The same is true of the remaining examples discussed in this section Our point is that many studies are conceptually but not statistically confirmatory, and the reader should be aware

that the textbook distinction between exploratory and confirmatory factor analysis cannot be applied neatly in the evaluation of published work

In any case, the Franks and Marolla (1976) study does support a multidimensional approach to the measurement of self-esteem, although it does not shed any light on the suggestion that existing self-esteem scales intercorrelate weakly or erratically because different scales primarily assess different dimensions of the overall self-esteem construct This issue was addressed in a subsequent study by VanTuinen and Ramanaiah (1979) They identified the Tennessee Self-Concept Scale and the Coopersmith Self-Esteem Inventory as measures of inner or global self-esteem and the revised Janis-Field Feelings of Inadequacy Scale and the Self-Esteem Scale of the Jackson Personality Inventory as measures of outer or social self-esteem These scales were administered to 204 college students in both true-false and multipoint item response formats along with simple self-ratings of global and social self-esteem and three parallel-format measures of the personality trait orderliness A 9 × 9 multitrait-multimethod correlation matrix (e g , Campbell & Fiske, 1959) was computed to permit examination of the degree of relationship among the three measures of each trait As expected, the three measures of each type of self-esteem, global vs social, correlated somewhat more highly with each other than with the measures of the other type of self-esteem, moreover, all of the self-esteem measures had weak to near-zero correlations with the measures of orderliness

VanTuinen and Ramanaiah (1979) also employed a special type of factor analytic procedure in their study, Jackson's (1975) multimethod factor analysis Jackson's procedure evaluates the overall pattern or structure of intercorrelations for the entire set of measures in a multitrait-multimethod matrix It is a form of second-order factor analysis in which factors are extracted separately from *each* monomethod matrix (e g , the correlations among the true-false format measures of the three traits in the study under discussion), and then the matrix of correlations among the complete set of the resulting first-order factors is submitted to another factor analysis The factor loadings from this second-order analysis can be examined to see whether different measures of the same trait have high loadings on one factor and low loadings on all the other factors

As expected, VanTuinen and Ramanaiah (1979) found three distinct factors in their application of Jackson's procedure global self-esteem, social self-esteem, and orderliness They concluded that their results supported the conceptual distinction between the global or inner and social or outer dimensions of self-esteem, yet they also emphasized that these two self-esteem dimensions were much more closely related to each other than either of them was to the trait of orderliness This point is crucial because—as we noted before—it can be difficult to interpret

moderate correlations between two scales in deciding whether they are two somewhat related measures within the same family of constructs (i e , overall self-esteem) or whether the correlation is low enough to argue that the scales do not belong to the same conceptual family Inclusion of other conceptually related measures along with the dimensions of interest (e g , self-esteem) in a multitrait-multimethod design may be the best way to approach the issues of convergent and discriminant validity (see also Marsh & Smith, 1982, Watkins, 1978)

The use of existing self-esteem scales by VanTuinen and Ramanaiah (1979) is both a strength and a weakness Although their results do support the idea that existing scales often intercorrelate erratically because they measure somewhat different dimensions of self-esteem, their study is not a pure test of a multidimensional conceptualization of self-esteem The four scales selected for analysis were constructed prior to the introduction of the inner vs outer self-esteem distinction and therefore, not surprisingly, these scales tend to confound the two subconstructs, many of their items are ambiguously worded or double-barrelled As Shavelson et al (1976) have pointed out, when factor analysis and other correlational techniques such as the multitrait-multimethod matrix suggest a new conceptual model for an existing personality construct, researchers need to proceed in two directions First, logical analysis of the new model should lead to new or revised measurement instruments of the constructs that can be subjected to further correlational analyses Second, the new scales need to be tested in appropriate research designs to gather evidence of validity bearing on the hypothesized nomological network of the constructs (Cronbach & Meehl, 1955)

An important step for the first task of logical analysis and scale construction was achieved by Fleming and Watts (1980) They modified a previously revised version of the Janis-Field Feelings of Inadequacy Scale in order to develop an item pool that would assess three facets of the Shavelson et al (1976) multidimensional model of self-esteem self-regard (inner), social confidence (outer), and school abilities (academic self-confidence) Twenty-eight questionnaire items in a 7-point Likert scale format were administered to 106 college students and these data were subjected to a principal components factor analysis with oblique rotation The choice of the oblique rotation is appropriate here because the factors were expected to be moderately correlated rather than orthogonal, tests were also applied to rule out significant gender differences before the response data from males and females were combined for analysis In spite of a sample size that was too small according to most psychometric standards, the factor analysis yielded a clear pattern of loadings consistent with the three hypothesized dimensions of self-esteem Cattell's (1966) scree test supported the interpretation of three

factors in this item pool Fleming and Watts' study provides another example of a factor analysis that is conceptually but not statistically confirmatory

In a replication and extension, Fleming and Courtney (1984) examined the Shavelson et al (1976) multidimensional model of self-esteem more fully by adding items assessing self-confidence in physical appearance and physical abilities, and by slightly revising the existing items for self-regard, social confidence, and self-confidence in school abilities The 36-item questionnaire was administered to 256 college students, and these data were factor analyzed with an oblique rotation The scree test for the number of factors to be rotated was somewhat ambiguous, so the authors examined several possibilities before deciding on a five-factor solution with an oblique rotation The pattern of factor loadings clearly supported the hypothesized model of five relatively distinct dimensions of self-esteem The success of this replication and extension of Fleming and Watts' (1980) study reinforces their earlier findings and provides further evidence in favor of the Shavelson et al (1976) model of self-esteem A related study by Mamrus, O'Connor, and Cheek (1983) showed that vocational certainty as assessed by the Vocational Identity Scale (Holland, Daiger, & Power, 1980) should be added as a sixth dimension of self-esteem in college students

We have emphasized that the factors for these dimensions of self-esteem are oblique rather than orthogonal In fact, the factor pattern correlations among the five oblique factors reported by Fleming and Courtney (1984) ranged from 15 to 35, with an average of 25, five scales formed from the highest loading items on each of the factors had an average intercorrelation of 4 Similarly, the six self-esteem dimensions employed by Mamrus et al (1983) yielded an average interscale correlation of 36 Such results bear on both the convergent and discriminant validity of the multidimensional conceptualization of self-esteem The Shavelson et al (1976) model is explicitly hierarchical, which means that measures of the self-esteem dimensions should have moderate positive correlations with each other Furthermore, the dimensions should converge conceptually and statistically into a higher-order construct of general self-esteem (i e , the sum of scores on all the dimensions should be interpretable as an index of overall self-esteem) One way to look at this convergent validity issue is to conduct a *second-order factor analysis* When some or all of the first order factors obtained in an initial factor analysis with oblique rotation are found to be correlated, the matrix of correlations among these factors may be subjected to another, higher-order factor analysis. This procedure will reveal the extent to which the first-order factors share some common variance The second-order approach to self-esteem dimensions may be analogous to models of intelli-

gence which specify separable factors of intellect yet also support a single higher-order construct of "general intelligence"

For the reasons just discussed, Fleming and Courtney (1984) hypothesized that all five of their specific self-esteem factors would have substantial loadings on a single second-order factor representing the general self-esteem construct Their results, which are presented in the first column of Table 4, were consistent with this expectation Another way to examine this issue is to intercorrelate the self-esteem scale scores, rather than the first order factors, and to factor analyze that correlation matrix In the second column of Table 4, we present the factor loadings from an analysis of the six self-esteem dimensions used by Mamrus et al (1983) The interpretation of one higher-order factor of general self-esteem is supported by these results In addition, we included the Personal Identity Scale (Cheek & Briggs, 1982) as a means of looking for discriminant validity evidence That scale was designed to assess self-definition (i e , degree of personal identity orientation) rather than self-evaluation, and therefore should not load on the general self-esteem factor As may be seen in the table, this test of discriminant validity was successful

Evaluating Recent Work on the Dimensionality of Self-Esteem

In general, substantially more work has been done on the convergence of specific self-esteem dimensions into a higher-order construct of general self-esteem than has been done on the discriminant validity of the various dimensions The scales produced by Fleming and Courtney's (1984) factor analysis do have individual scale reliabilities in the 7 to 9 range that are meaningfully higher than the average interscale correlations of 4, but the latter figure is high enough to make the need for external evidence of discriminant validity salient For example, Marx and Winne (1980) have argued against the multidimensional model of self-esteem by questioning the discriminant validity of a separate academic self-confidence factor Although several studies have demonstrated that self-reported grade average correlates significantly with only the academic self-confidence dimension (Fleming & Courtney, 1984, Fleming & Watts, 1980, Mamrus et al , 1983), further investigations of the discriminant predictive validity of all the dimensions are needed Longitudinal research designs involving structural equation models may prove to be one useful way of addressing currently unanswered questions, such as whether poor self-regard is a cause, a consequence, or merely a correlate of low social self-confidence (e g , Bohrnstedt & Felson, 1983) Moreover, such applications of the self-esteem dimensions might help to clarify recent controversies over differences in self-esteem as a function of age, gender, race, and occupational status (e g , Bachman & O'Mal-

Table 4 Second-order factor loadings for dimensions of self-esteem

Dimension	Fleming & Courtney[a] (1984)	Mamrus et al[b] (1983)
Self-Regard	53	82
Social self-confidence	64	75
Academic self-confidence	35	60
Physical appearance	55	74
Physical abilities	44	42
Vocational certainty[c]	—	64
Personal identity[d]	—	04
Eigenvalue of first factor[e]	2 02	2 76

[a] Second-order coefficients, $n = 259$
[b] Factor loadings from analysis of scale intercorrelations, $n = 112$
[c] The vocational certainty dimension was not included in Fleming & Courtney (1984)
[d] The Personal Identity Scale is not a self-esteem measure and was included only for the purpose of examining discriminant validity evidence
[e] In both factor analyses summarized in this table only one eigenvalue exceeded 1 0, and only one was interpreted

ley, 1977, Gray-Little & Appelbaum, 1979, Stake & Orlofsky, 1981, Walsh & Taylor, 1982)

The point we are making here about self-esteem research applies to factor analytic research in general *factor analysis is not an end in itself but a prelude to programmatic research on a particular psychological construct* As we discuss in the section below on confirmatory factor analysis, some additional factor analytic work remains to be done in the self-esteem area The problem that we have encountered in reviewing the recent literature is that investigators are only too willing to work on the logical and correlational steps of analysis, yet seem reluctant to become involved in the empirical research necessary for establishing predictive and discriminant validity evidence As a result, we are witnessing a dramatic proliferation of scales measuring various dimensions of self-esteem (e g , Harter, 1982, Marsh, Relich, & Smith, 1983, Peterson, Schulenber, Abramowitz, Offer, & Jarcho, 1984, Phinney & Gough, 1982, Soule, Drummond, & McIntire, 1981) There are a few potentially important differences among these scales, such as whether academic self-confidence should be subdivided into reading and mathematics subscales, and some of the researchers are seeking external validity evidence—for example, the spouse ratings of typical behaviors in Phinney (1984) But it may now be time to draw the line that Crandall proposed in 1973 for the earlier generation of unidimensional self-esteem scales

"The casual generation of new scales is professionally irresponsible" (p 52)

Confirmatory Factor Analysis

As we mentioned previously, exploratory factor analysis has often been used to provide conceptual support for a hypothetical model It is also true that statistically confirmatory techniques can be applied in studies that are more exploratory than explicitly hypothesis-testing (Long, 1983) Nevertheless, a basic distinction can be drawn between these two groups of factor analytic procedures In exploratory factor analysis the investigator employs a stepwise analysis involving the examination of various solutions, whereas in confirmatory factor analysis the researcher employs a direct solution that has been identified a priori to represent a specific hypothesis For example, Fleming and Courtney (1984) explored both a five- and a six-factor oblique rotation of their dimensions of self-esteem data before deciding that a five-factor solution *looked* most appropriate, if their work had been statistically confirmatory, they would have specified a model or target matrix in advance and then *tested* the goodness of fit of their sample data to that model and to competing alternative models The availability of such statistical tests for specified models substantially reduces the element of subjective interpretation that is commonly used as a whipping-boy by critics of factor analysis Although there are other approaches to confirmatory factor analysis (e g , the multiple group method and the Procrustes method), the maximum-likelihood approach is clearly the "state of the art" method and the only one that is used widely Readers interested in presentations of the relevant statistical procedures should consult the monograph by Long (1983) or recent textbooks such as Gorsuch (1983) For the purposes of this paper, we discuss two applications of confirmatory factor analysis in recent work on the measurement of self-esteem

Shavelson and Bolus (1982) investigated one part of a complete multidimensional model of self-esteem, the distinction between general self-esteem and academic self-confidence They selected two scales to measure each of five self-esteem dimensions general self-esteem, overall academic self-confidence, and subject-specific confidence in English, mathematics, and science They administered these ten scales to a sample of 130 junior high school students Four competing hypothetical models were identified to encompass the range of likely outcomes in factor analyzing this matrix, namely a null model of complete independence of all scales, a single factor model of general self-esteem, a two-factor model of general self-esteem and overall academic self-confidence, and a five-factor model representing general vs academic self-esteem that also specified three additional factors for the specific academic subjects

Confirmatory factor analysis of these data was conducted using the *LISREL* statistical package for analysis of covariance structures (Joreskog & Sorbom, 1984) A goodness-of-fit test that provides a rough indication of the degree to which a hypothesized model fits the sample data is provided by the ratio of the Chi Square to its degrees of freedom According to Wheaton, Muthen, Alwin, and Summers (1977, but see Hoelter, 1983), a ratio of 5 or less suggests a model of adequate fit, with a lower ratio indicating a better fit [1] The obtained ratios in this study were 15 97 for the null model, 10 10 for the single-factor model, 8 01 for the two-factor model, and 3 95 for the five-factor model The authors concluded that the five-factor model provided the best fit for their data Ninety-nine of the students were retested four months later, and the confirmatory factor analysis was replicated successfully Shavelson and Bolus (1982) also constructed correlation matrices to examine the convergent and discriminant validity of the scales across the two testing sessions They concluded that their study provided further support for the Shavelson et al (1976) hierarchical facet (i e , multidimensional) model of self-esteem More complete confirmatory tests of self-esteem dimensions are now being conducted (e g , Marsh, Smith, & Barnes, 1984, Song & Hattie, 1984), and we believe that more of this type of work, rather than further scale construction efforts, should be the focus of correlational work on self-esteem in the immediate future

Shavelson and Bolus (1982) also used their test-retest design to examine the causal relationship between self-esteem and academic achievement They employed a set of cross-lagged panel models to test whether self-confidence about specific subject matter measured in February would affect actual grades given in June, and they concluded that these self-esteem dimensions had causal predominance over actual academic achievements These non-factor-analytic techniques are beyond the scope of this paper (instead, see Kenny, 1979, Kenny & Campbell, 1984), but this example serves to emphasize our theme that factor analysis, even the most sophisticated confirmatory procedures, should be viewed as only one important part of any program of psychological research

Within the realm of factor analysis itself, techniques that can be applied to a multitrait-multimethod matrix appear to be especially promising In our earlier discussion of the self-esteem study by VanTuinen and Ramanaiah (1979), we described Jackson's (1975) multimethod factor analysis The multimethod approach can be incorporated within the

1 This fit ratio can be misleading since it does not take sample size into account, more recent and more sophisticated indices that reflect both the sample size and the degrees of freedom have largely supplanted the fit ratio (see Bentler & Bonett, 1980; Hoetler, 1983, Sobel & Bohrnstedt, 1985)

framework of confirmatory factor analysis as well (Schmitt, Coyle, & Saari, 1977), and our final example from the self-esteem literature demonstrates this approach

Watkins and Hattie (1981) administered two scales measuring each of four personality traits—general self-esteem, extraversion, anxiety, and flexibility—to 275 university students The first measure of each trait was a standard personality scale and the second was a self-rating using paragraphs to describe each trait They identified six hypothetical models to be tested through confirmatory factor analysis

Model I	Two method factors (i e , scale responses and simple self-ratings)
Model II	One general and two method factors
Model III	Four trait factors (correlated)
Model IV	One general and four trait factors (correlated)
Model V	Two method and four trait factors (all uncorrelated)
Model VI	Two method (uncorrelated) and four trait (correlated) factors

The goodness of fit of the sample data to each model was tested by a transformation of the Chi Square Significance Test suggested by Muliak (1975) These tests indicated that Model VI provided the best fit, and the authors concluded that "significant additional information about the underlying multitrait-multimethod matrix was provided by this method of analysis" (Watkins & Hattie, 1981, p 282)

One limitation to the multimethod and confirmatory factor analytic work of Watkins and Hattie (1981) and VanTuinen and Ramanaiah (1979) is that both studies employed two forms of self-reports as their *multiple* methods The primary methods for assessing personality characteristics not only include self-reports on questionnaires or inventories, but also encompass observers' evaluations, data derived from objective measures in more or less artificial laboratory settings, and "real life" outcomes such as grades, promotions, or heart attacks (Cattell, 1946, Fiske, 1971) Therefore, we hope that future self-esteem research using confirmatory factor analysis will involve maximally distinct methods in constructing multitrait-multimethod matrices and will investigate *predictive* convergent and discriminant validity through the application of causal models to longitudinal data A substantial portion of this demandingly ideal research design has been approximated by Paulhus (1983) in a study of locus of control dimensions, and his paper is worth reading as a methodological example of the role of confirmatory analysis as one part of a larger research effort

Our suggestion that confirmatory factor analysis of multitrait-multimethod matrices will succeed in bridging the gap between traditional exploratory factor analysis and modern measurement models is clearly a speculation about future developments in the field Although this procedure permits the formulation and testing of alternative hypotheses about the latent trait and method factors in a set of personality data, its ultimate usefulness remains to be demonstrated In an informative discussion of new directions in this area, Marsh and Hocevar (1983) point out that at least three traits and three methods are necessary for identifying all parameters in a confirmatory model of a multitrait-multimethod matrix Such a full-scale test of self-esteem data has not yet been conducted Nevertheless the factor analytic work completed on this topic so far has improved what was previously a very sad state of affairs (cf Shavelson et al , 1976, Wylie, 1974), and it seems likely that continuing work on multidimensional models of self-esteem will yield further progress

Conclusion

In this paper we have evaluated the usefulness of factor analysis as a method for advancing personality research by telling the tale of two constructs, self-monitoring and self-esteem In the first case, we documented why Nunnally (1978) was right to argue that factor analysis should be applied routinely to new personality tests immediately after they are constructed Because this was not done, personality psychologists are now confronted with a sizeable body of research on self-monitoring that is empirically acceptable but that is also—to borrow Guilford's expression—"psychologically ambiguous and difficult to interpret" The process of scale revision has just begun (Gangestad & Snyder, in press, Lennox & Wolfe, 1984), which means that old studies will have to be reanalyzed and new work planned We are confident that by 1990 factor analyses of the Self-Monitoring Scale will be recognized as a constructive contribution to both the theory and measurement of self-presentation

In the second case, we showed how the application of factor analysis to multidimensional conceptualizations of self-esteem has advanced that important yet problematic area of personality research More work remains to be done, especially in the testing of hierarchical facet models through confirmatory factor analysis and causal modeling, but the conclusion that factor analysis has contributed successfully to our understanding of self-esteem is amply supported in the research we reviewed

We believe that factor analysis is one important link in the chain of logical, correlational, and experimental analyses necessary for the full explication of any personality construct The argument that thorough

conceptual analysis should precede data collection is an old one that bears repeating

> We spend more time in designing the experimental tests for a factor study than on all of the computational work, including the correlation, the factoring, and the analysis of the structure If we have no psychological ideas, we are not likely to discover anything interesting because even if the factorial studies are clear and clean, the interpretation must be as subjective as in any other scientific work (Thurstone, 1948, p 402)

The advent of high-speed computers along with software packages for factor analysis has permitted the proliferation of the thoughtless factor analytic work that has earned this technique the scornful epithet of "garbage in—garbage out" (Long, 1983) We believe that this problem has been caused by uninformed usage rather than by inherent deficiencies in factor analytic models Newcomers should pay special attention to Comrey's (1978) "Common methodological problems in factor analytic studies" and Nunnally's section "How to fool yourself with factor analysis" (1978, pp 433–436) Even new and promising methods of data analysis such as maximum likelihood factor analysis must be tempered with the well-worn principles of scientific inference (Cliff, 1983)

A major theme in our presentation has been the argument that factor analysis is only one important part of programmatic research on any personality construct and not an end in itself Measurement and theory are always interdependent and factor analysis is not limited to just one part of the research process Thus, factor analysis can be used to refine and clarify measures as well as to identify important distinctions and to test specific hypotheses In this regard, multimethod confirmatory factor analysis promises to be of interest to personality and social psychologists because it provides a framework within which to assess the validity of both our measures and our constructs (Long, 1983, pp 29–33, Watkins & Hattie, 1981) It makes as little sense for critics to dismiss factor analysis as mere psychometric details as it would for psychometricians to argue that control groups are dispensable in laboratory experiments Just as factor analysis can serve as a prelude to fully explicating a psychological construct, we hope that current factor analytic studies are a prelude to better models and applications in future work that will be even more useful in advancing personality psychology

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