

MEASURING ANGER OR AN AMORPHOUS CONSTRUCT?

Richard Alumbaugh¹
Central Washington University

ABSTRACT

Construct validity of anger or anger-related measures is essential to research on links of anger to illness or to treatment effectiveness of anger management techniques. The purpose of the paper is to examine construct validity of anger measures considering theoretical issues and applications of factor-analytic methods. I have concluded that test developers have used improper strategies to demonstrate construct validity. Recommendations are offered to improve construct validity studies including proper application of factor-analytic methods.

MEASURING ANGER OR AN AMORPHOUS CONSTRUCT?

Currently, a wide array of anger measures is available to researchers and health-practioners. The need for measures of anger has been augmented by the growing use of anger management techniques and the increased interest in the relationship of anger to human aggression. In addition, health researchers have isolated anger as an important component in the relationship of Type A personality to coronary heart disease (Booth-Kewley, & Friedman, 1987).

The variety of anger and anger-related measures² makes one wonder which measures accurately assess anger? Equally important, what constructs other than anger are being assessed by so-called anger measures? I will address these construct validity questions on anger by focusing on the use of theory in the development of anger measures and the application of factor analytic procedures that ostensibly assess construct validity of anger measures. A review of each anger measure included in this review is beyond the scope of my paper.

In a review of the anger-measurement literature, I found few construct validity studies other than validity studies included in the original development of the anger measures (e.g., Novaco, 1975; & Zelin, Adler, & Myerson, 1972). I attribute the lack of construct validity studies to practical constraints imposed by access to populations and some developers' view that validity research is best left for graduate students or associates. Researchers and clinicians have finite funds and limited availability of clients or subjects. Such limitations result in more cross-sectional than longitudinal studies. As I found in this review, most construct validity studies were restricted to very select populations with few longitudinal studies.

MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

Still more discouraging, the few validity studies designed to assess construct validity of anger measures leave considerable doubt about the distinction of anger from other personality measures. Modest, but significant non-zero correlations ranging from .25 to .35 are not that unusual between personality measures, e.g., comparisons of anger with hostility (Smith and Frohm, 1985) or anger with anxiety (Spielberger, Jacobs, Russell, & Crane, 1983; Collins & Hailey, 1989). Such measurement ambiguity of anger, in my judgment, has resulted in confusing reviews of the literature on anger especially reviews on the link of anger/hostility to coronary heart disease³. Much of the ambiguity about anger measures, or what I term "construct amorphism," can be traced to the strategies of developing anger measures.

ANGER THEORY AND MEASUREMENT

I will argue that the inappropriate and superficial use of anger or anger-related theory has contributed to construct amorphism. Generally, test developers have given more attention to theory after the anger instrument has been constructed rather than a priori consideration. For example, Mauger and Adkinson (1980), authors of the Interpersonal Behavior Scale (IBS), distinguish between aggressive and assertive behaviors on dubious theoretical grounds. In their manual (1980), anger subscales were included as a component of a total aggressive measure. The link of aggression to anger has been questioned by many (e.g., Averill, 1982).

Mauger and Adkinson's embrace of empirical methodologies typify methodologies used by other developers of anger measures examined in this review. Empirical methods such as used on the IBS do not really require extensive theory in the initial stages of test development. Typically, test developers match items to groups (e.g., Cook & Medley, 1954) or items to factors (e.g., Buss & Durkee, 1957) and then theoretically interpret the resulting scales.

Theory plays virtually no role in the actual wording of test items in the initial developmental stages of empirically-derived scales. Sources for the wording of the items on such anger measures are based on modified clinical statements of clients/subjects and occasionally on anger experiences of the test-developers. Occasionally, test items are selected from other tests — items that the test developer intuitively or empirically decides are good measures of anger.

Test developers are attracted to clinical-intuitive-actuarial methods of test construction for several reasons. Emerging scales are empirical, and therefore mistakenly assumed to be less risky to defend as measures of anger (e.g., Cook & Medley, 1954). If anger measures are combined with other measures, developers can confidently develop group profile descriptions based on observed group profile differences. And there may be another attraction — the study of anger is based on empirically-generated verbal expressions that are used to construct test items. These verbal expressions are based on a familiar folk-wisdom about anger that supposedly facilitates interpretation and application of the measure.

None of us are very good at explaining our anger to others especially while we are angry. Our attributions about anger, even test-developers', are likely to be based on everyday language and everyday understandings of anger experience. The link of anger experiences to theory is tenuous because everyday experiences are tied to a phenomenological language that may be unique to cultural experi-

MEASUREMENT OF ANGER

ences of the individual. Phenomenological language is not necessarily formal or rational — it is descriptive.

Such a conclusion concerning phenomenological language has not deterred researchers such as Averill (1982) from asking subjects directly to describe their experiences of anger after the fact using their own terminology. There are limitations to such methodological approaches as pointed out recently by Widom (1989) and discussed earlier by Averill (1982). Retrospective accounts to describe anger such as found in cases of child abuse and battering varies considerably between angered individuals and their victims. So why have empirical approaches been so dominant to deductive methods based on theory in the development of anger measures?

Part of the reason may be the lack of testable theories restricted to the study of anger. Most theories of anger have in the past been associated with general theories of emotion (Thompson, 1988). For example, Leventhal's (1984) perceptual-motor theory of emotion outlines the relationships between cognitive and physiological processes. However, Leventhal's theory specifies that the differentiation of emotions is determined by the interaction of innate physiological processes and cognitive scripts. A specific test of anger using the perceptual-motor theory would be complex and difficult to validate.

What has emerged? I will contend, the array of instruments reviewed cluster around "anger-states/traits" that can be best understood by atheoretical-folk-language. These measures can be described as theoretically ambiguous resulting in measures that are ontologically mixed⁴ in meaning and assumptions. The items that typically represent anger measures refer to antecedents and consequences of common anger-incidents along with the attributions made about such incidents.

There are other complexities with theoretical accounts of anger. Anger can be conceptualized as a unitary (Spielberger et al., 1983, 1985; Novaco, 1975, 1992) or multidimensional construct (Siegel, 1986). If anger is unitary or subscales are summed for a single measure, is validity improved? Novaco (1992) reports total anger scores from his scale correlating with other unitary anger measures such as the Buss-Durkee and Cook-Medley at respectably high levels (.82 and .68 respectively).

However, such results only confirm what researchers such as Averill (1982) have asserted. Namely, anger is governed by social rules. Observers including staff and patients in the Novaco study (1992) were generally in agreement. High correlations between instruments or respectable correlations between observers and instruments simply indicate the obvious — some patients are upset and most label their upset as anger. Is their upset due to anger?

Such a question illustrates yet another complexity to analysis of anger, the murky distinction between anger and other emotions involving negative affect, e.g., depression. Berkowitz (1990) has argued that negative affect is the source of anger and angry aggression. Berkowitz has questioned the distinctions between affective states of irritation, anger, and annoyance. Indeed, there is quite a debate whether anger differs from other emotions⁵.

Test developers need to resolve these types of construct complexities before, not after, the development of a particular anger measure. Theory and concomitant measurement strategies should be the starting point of anger measurement development. For example, a compelling test of theory is to examine the discriminative

MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

properties of a derived anger measure from other measures of negative affect, e.g., tests of depression⁶, anxiety, and dysphoria. Factor analytic procedures are obvious approaches to answer these types of questions; however as shown in the following discussion, the results of factor analytic studies have not clarified the dimensional properties of anger.

CONSTRUCT VALIDITY AND FACTOR ANALYSIS

Exploratory factor analysis is commonly used to make both qualitative and quantitative distinctions between anger measures and other measures. The purpose is to summarize relationships between measures by identifying the existence of factors that correlate with some measures and not others. In the development of anger measures, such procedures are a heuristic to assess the associative strength of items or scales to a factor thought to measure the construct, anger. If the derived "anger" factor is independent from other factors, the correlation of the measures of anger will maximally load on the anger factor and minimally on the other factors.

Test developers of anger measures typically use factor analysis in the introductory phases of test construction to sort items or scales linked to anger. Their logic is correct; anger measures should correlate with each other and any factor identified as measuring anger. Their use of factor analytic procedures, however, is flawed. How, so?

Typically, test developers use factor analysis procedures in two ways, empirical and second-order factor strategies. With the empirical strategy, items are generated that intuitively are judged by the developer to measure anger. These items are treated as variables and entered into a factor analysis. Generally the type of factor analysis, while not always specified, is a principal components analysis. The resultant components, or factors if common factor analysis is used, are then inspected for simple structure. If the factors⁷ are ambiguously defined as determined by the pattern of variable communalities, the factors may be rotated to achieve simple structure. Once factors have been rotated to some criterion(a), the developer decides the number of factors to be included in the analysis. Most developers use either the proportion of explained variance attributed to each factor (eigenvalue) or a scree test to limit the number of interpretable factors. To select items for the final measure of anger, items with communalities typically greater than .40 are selected from the factor that is identified as measuring anger.

The second use of factor analysis involves the factoring of previously defined scales (second order factor analysis). Here, test developers are interested in whether related, or in some cases unrelated, measures of anger cluster in predictable patterns on factors.

Such a procedure was used by Mauger and Adkinson (1980) in the development of the IBS (previously discussed). Their purpose was to show how each of their previously defined subscales was linked to assertion and aggression. After rotating factors using Varimax, the authors report one study identifying two factors and another study — three factors. The authors were satisfied that their subscales discriminated assertion from aggression although the study finding three factors suggested the presence of another source of variance.

MEASUREMENT OF ANGER

I find these two types of factor analyses, item-variable and test-variable strategies, flawed for reasons that center on variable-input and improper theory testing. The first application, defining anger scales based on item-variable analysis, fails on at least three counts. First, authors report no measure of item reliability, *per se*. Inter-item consistency measures are not a satisfactory index of reliability for a given item. Test-retest methods would provide a better estimate of item-stability. Better still, item-variables should be collapsed into single measures where possible to more readily examine the reliability of multi-item subscales. Low reliabilities of component items of a factor-scale potentially introduce error variance in the final factor solution. Error variance clouds interpretation of any given factor and reduces chances of replicating the findings with other samples or populations.

Secondly, I could find no instance where test developers had considered the weighting of each test-item in their analysis⁸. While authors may assume each item-variable entering the initial correlation matrix is weighted equally in the measure of anger, there are compelling reasons that the equality assumption is untenable. Items may vary other than on the hypothesized dimension of anger; item-characteristics such as difficulty level, social-desirability, and response-acquiescence may all divert from the equality assumption on item-weights. Unless these sources of variance are partialled out before the factor analysis, there is no way to judge the adequacy of a multivariate linear model to describe any anger measure in question. And, there is no way to judge which latent variable is operating to define a factor, e.g., item-difficulty or anger, and so on. Again, interpretation of factors is highly tenuous if these item-characteristics are operating.

The third consideration of item-factor analysis is the failure of developers to compare empirically established measures of anger (marker variables) with the items entering the initial analysis. Without marker variables, test-consumers cannot decide how inclusive a given anger measure is with respect to sampling domain of anger measures. Using another anger test as a marker variable is risky given the potential disparity in reliabilities of item-variables compared to scale-variables. In this case the greater number of measures included to define the scale-variable would result in an expected higher reliability.

Criticisms of the use of scale-variable factor analytic procedures, or second-order analyses, center on theoretical considerations. Generally, authors conducting second-order analyses have not selected the best factor-analytic strategies to answer the questions they pose (e.g., Hoshmand & Austin, 1987). Most authors have limited their selection to exploratory factor procedures that are not well suited to confirm the existence of constructs. While there are reasons to use exploratory analysis to establish a hierarchy of relationships between related measures (Gorsuch; 1977, 1983), exploratory methods do not include any statistical tests to validate derived hierarchical findings.

Again, the absence of testable theory is directly linked to choice of factor analytic procedures. Lacking testable models of anger, test developers start with an exploratory strategy but fail to finish the task. As Mulaik (1972) observed a few years ago,

... rather than use scientific intuition and what is already known about the properties of variables under study to construct theories about the nature of relationships among the variables and formulating these

MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

theories as factor-analytic models to be tested against empirical data, many researchers have randomly picked variables representing a domain to be studied, intercorrelated the variables, and then factor-analyzed them in the expectation that the theoretically important variables in the domain would be revealed by the analysis (p. xii).

Testable theory can be generated. Combining results of exploratory analyses with theories and findings in the literature can offer the developer the ingredients for a testable theory. To complete their task, the developer needs to take one other step — the use of confirmatory methodologies.

Confirmatory methods including confirmatory factor analysis are designed to test hypotheses that a specific subset of variables defines a specific factor. Confirmatory factor analysis differs from exploratory methods primarily in the use of inferential tests — typically chi-square. In addition, there are no rotational methods used in confirmatory analysis — therefore you cannot maximize the factorial variance after the fact. Confirmatory factor analysis tests whether your a priori hypotheses concerning factor structure maximally accounts for factorial variance (confirmatory maximum likelihood analysis).

Convergent validity of anger measures can be tested directly with confirmatory analysis. A model of factor structure of anger measures is compared with the hypothesis of no factors to find if the model significantly reproduces the data. If chi-square is significantly reduced, one can infer that the model is valid.

Testing the divergent validity of a factor model of anger measures from others with confirmatory analysis involves testing the correlation of one factor with another (Gorsuch, 1983). The chi-square tests whether the correlation between two models is significantly less than a factor structure where the correlation of the models is set at 1.0. If the difference in chi-squares between the restricted and unrestricted factor structures is significant, one can infer that the factors show divergent validity.

There are other strategies that are available to test developers where multi-trait-multi-methods can be tested with confirmatory analysis in a stepwise procedure. In addition, tests can be established for factor structures that simply specify which variables go together (“weak structures,” Bernstein, 1988), and confirmatory tests for “strong substantive” models where causality is tested. Such applications are apparent in the development of anger measures where researchers have directed much attention to the question of anger-correlates and more restrictively, the causal link, if any, of anger to physical disorders and destructive aggressive behaviors.

In my review of anger measures, I could find no studies using confirmatory methods to establish construct validity. Exploratory methods to establish construct validity are simply inadequate. I am proposing that we wipe the slate clean and create yet other measurements of anger based on contemporary theory and more advanced methodological approaches.

For instance, Zillman (1988) and Berkowitz (1990) offer a good starting point toward establishing testable anger theory. Both models emphasize the cognitive and physiological components of anger. A first step might be a “chicken-and-egg” hypothesis. Which comes first, the physiological reaction or the cognitive schemata associated with a provocative event? Confirmatory analyses could be

MEASUREMENT OF ANGER

used to test which cognitive and physiological variables go together. Then, sequence of events as discussed by Berkowitz⁹ (1990) could be tested with hypothesized path-analyses.

The use of good theory is directly linked to measurement strategies one might select to assess anger. Unfortunately, the reviewed measures of anger do not link theory to measurement strategy. We still do not know what anger is, or even if anger is differentiated from other negative affective reactions. Much of this predicament can be resolved with more attention directed to construct validation procedures and the integration of good theory.

CONCLUSIONS

Of the reviewed anger and anger-related measures, construct validity of anger has yet to be adequately demonstrated. Such a conclusion is based on the poor use, or occasionally non-use, of theory in the development of anger measures. Additionally, exploratory factor-analytic methods have been used inappropriately to confirm the existence of so-called anger constructs.

Current use of factor analytic techniques to validate constructs is deficient for several reasons. Generally, the problems center on variable input. Variable input is inextricably tied to theory. Good theory directs the test developer toward the selection of important variables noted in previous research. Good theory also sensitizes the developer to the measurement issues of entering variables into factor analysis.

Conclusions about anger as a variable in research studies on health or therapy will remain ambiguous until construct validity procedures are improved and test reliabilities increased (Biaggio, Supplee, & Curtis, 1981). I propose that developers start afresh and spend more time on generating a testable model of the anger construct. Further, more attention should be directed toward measurement properties of input variables including their respective ontological levels of measure.

Exploratory factor analysis can be useful if, and only if, developers use the procedure to discover the components of the construct anger rather than confirm the components of anger (Yates, 1987, p. 326). Confirmatory methods using factor analysis are in the tradition of classical hypothesis testing and are clearly shown in construct validation studies. Confirmatory methods can be used in the intermediate phase of hypothesis testing where developers need to confirm which anger measures go together. And, confirmatory methods can be used in more complex designs where multi-method-multi-measure variances are examined for convergent/divergent validity. In fact, the design potential of confirmatory analysis has probably not been fully realized given the limited exposure of researchers to these statistical approaches.

Research on the relation of anger to coronary heart disease provides a good example. Interpretation of results has been clouded by conceptual confusion over constructs of hostility, anger, and aggression and their relation to Type A personality (Yuen & Kuiper, 1991). With confirmatory methods, the causal direction, if any, of anger on aggressive behaviors or anger on coronary heart disease could be evaluated. Such findings would help clarify the amorphous-status of the construct anger. Researchers would have a clearer picture where anger has a role in the hierarchy of physical disorders and in human aggression.

MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

Too much energy of researchers has been directed toward empirical methods of anger test-construction. None of the anger measures reviewed provide convincing evidence of how anger can be distinguished from similar constructs such as annoyance, hostility, irritability, and even aggression. Definitions of these terms offered in the developmental stages, while helpful to the reader, do not establish discriminative validity. Again, theory and hypothesis testing would solve the problem. Such procedures potentially could make sense out of anger-like concepts that undoubtedly overlap (Smith, Sanders, & Alexander, 1990) and are characteristically over-inclusive.

Source of Tests Reviewed for Article

- Averill, J. R. (1982). *Anger and aggression: An essay on emotion*. New York: Springer-Verlag.
- Buss, A. H., & Durkee, A. (1957). An inventory for assessing different kinds of hostility. *Journal of Consulting Psychology, 21*, 343-349.
- Catchlove, R. F., & Braha, R. E. (1985). A test to measure the awareness and expression of anger. *Psychotherapy and Psychosomatics, 43*, 113-119.
- Cook, W. W., & Medley, D. M. (1954). Proposed hostility and pharisaic-virtue scales for the MMPI. *Journal of Applied Psychology, 38*, 414-418.
- Hoshmand, L. T., & Austin G. W. (1987). Validation studies of a multifactor cognitive-behavioral Anger Control Inventory. *Journal of Personality Assessment, 51*, 417-432.
- Knight, R. G., Ross, R. A., Collins, J. I., & Parmenter, S. A. (1985). Some norms, reliability and preliminary validity for an S-R Inventory of anger: The Subjective Anger Scale (SAS). *Personality and Individual Differences, 6*, 331-339.
- Mauger, P. A., & Adkinson, D. R. (1980). *Interpersonal behavior survey (IBS) manual*. Los Angeles, CA: Western Psychological Services.
- Novaco, R. W. (1975). *Anger control: The development and evaluation of an experimental treatment*. Lexington, M. A.: D. C. Heath & Co.
- Novaco, R. W. (1992). Anger as a risk factor for violence among the mentally disordered. In J. Monahan & H. Steadman (Eds.) *Violence and mental disorder: Developments in risk assessment*. Chicago: University of Chicago Press.
- Siegel, J. M. (1986). The Multidimensional Anger Inventory. *Journal of Personality and Social Psychology, 51*, 191-200.
- Spielberger, C. D., Jacobs, G. A., Russell, S., & Crane, R. S. (1983). Assessment of anger: The State-Trait Anger Scale. In J. N. Butcher & C. D. Spielberger (Eds.). *Advances in personality assessment* (Vol. 2, pp. 161-189). Hillsdale, N. J.: Erlbaum.
- Spielberger, C. D., Johnson, E. H., Russell, S., Crane, R. S., Jacobs, G. A., & Worden, T. J. (1985). The experience and expression of anger: Construction and validation of an anger expression scale. In M. A. Chesney and R. H. Rosenman (Eds.). *Anger and hostility in cardiovascular and behavioral disorders*. New York: Hemisphere/McGraw-Hill.

MEASUREMENT OF ANGER

Zelin, M. L., Adler, G., & Myerson, P. G. (1972). An objective questionnaire for the measurement of aggression. *Journal of Consulting and Clinical Psychology*, 39, 340.

REFERENCES

- Berkowitz, L. (1990). On the formation and regulation of anger and aggression: A cognitive-neoassociationistic analysis. American Psychological Association Distinguished Scientific Award for the Applications of Psychology Address (1989, New Orleans, Louisiana). *American Psychologist*, 45, 494-503.
- Bernstein, I. H. (1988). *Applied multivariate analysis*. N. Y.: Springer-Verlag.
- Biaggio, M. K., Supplee, K., & Curtis, N. (1981). Reliability and validity of four anger scales. *Journal of Personality Assessment*, 45, 639-648.
- Booth-Kewley, S., & Friedman, H. S. (1987). Psychological predictors of heart disease: A quantitative review. *Psychological Bulletin*, 101, 343-362.
- Buck, R. (1985). Prime theory: An integrated view of motivation and emotion. *Psychological Review*, 92, 389-413.
- Collins, S. W., & Hailey B. J. (1989). The anger expression (AX) scale: Correlations with the State-Trait Personality Inventory and subscale intercorrelations. *Educational and Psychological Measurement*, 49, 447-455.
- Gorsuch, R. L. (1974). *Factor analysis*. Philadelphia, PA: W.B. Saunders Co.
- Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, N. J.: Lawrence Erlbaum Associates, Publishers.
- Krantz, D. S., Contrada, R. J., Hill, D. R., & Friedler, E. (1988). Environmental stress and biobehavioral antecedents of coronary heart disease. *Journal of Consulting and Clinical Psychology*, 56, 333-341.
- Leventhal, H. A. (1984). A perceptual-motor theory of emotion. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 17, pp. 117-182). New York: Academic Press.
- Mulaik, S. A. (1972). *The foundations of factor analysis*. New York: McGraw-Hill.
- Russek, L. G., King S. H., Russek, S. J., & Russek, H. I. (1990). The Harvard Mastery of Stress study 35-year follow-up: Prognostic significance of patterns of psycho-physiological arousal and adaptation. *Psychosomatic Medicine*, 52, 271-285.
- Shoemaker, O. S., Erickson, M. T., & Finch, A. J. (1986). Depression and anger in third- and fourth-grade boys: A multimethod assessment approach. *Journal of Clinical Child Psychology*, 15, 290-296.
- Spielberger, C. D., Gorsuch, R. L., & Lushine, A. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, Calif.: Consulting Psychologists Press.
- Smith, T. W., & Frohm, K. D. (1985). What's so unhealthy about hostility? Construct validity and psychosocial correlates of the Cook and Medley Ho scale. *Health Psychology*, 4, 503-520.

MULTIVARIATE EXPERIMENTAL CLINICAL RESEARCH

- Smith, T. W., Sanders, J. D., & Alexander, J. F. (1990). What does the Cook and Medley Hostility scale measure? Affect, behavior, and attributions in marital conflict. *Journal of Personality and Social Psychology*, *58*, 699-708.
- Thompson, J. G. (1988). *The Psychobiology of emotions*. New York: Plenum Press.
- Tomkins, S. S. (1962). *Affect, imagery, consciousness (Vol. 2). The positive affects*. New York: Springer.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychological Review*, *92*, 548-573.
- Widom, C. S. (1989). Does violence beget violence? A critical examination of the literature. *Psychological Bulletin*, *106*, 3-28.
- Yates, A. (1987). *Multivariate exploratory data analysis: A perspective on exploratory factor analysis*. New York: State University of New York Press.
- Yuen, S. A., & Kuiper, N. A. (1991). Cognitive and affective components of the Type A hostility dimension. *Personality and Individual Differences*, *12*, 173-182.
- Zillmann, D. (1988). Cognition-excitation interdependencies in aggressive behavior. Special Issue: Current theoretical perspectives on aggressive and antisocial behavior. *Aggressive Behavior*, *14*, 51-64.

Footnotes

1. Paper is based on presentation at the 1991 Southwestern Psychological Association at workshop sponsored by the Society of Applied Multivariate Research. Reprints can be obtained by writing to the Psychology Department, Central Washington University, Ellensburg, WA 98926.
2. Anger measures considered in this review are listed separately in the bibliography.
3. The relationship of anger to coronary heart disease is unclear. Some reviewers such as Krantz, Contrada, Hill, and Friedler (1988) have concluded that components of Type A behaviors such as anger-in have been related to coronary disease. Others such as Russek, King, Russek, and Russek (1990) reviewing a 35-yr prospective study on psychophysiological patterns of responses to laboratory stress experiments found that neither anger-in nor anger out was linked to coronary heart disease. It is important for the reader to note that a variety of anger and anger-related measures have been used in coronary research. Construct validity of anger measures is an obvious issue in evaluating the role of anger in coronary illness.
4. When such items of anger measures lack a theoretical basis, the resulting measure may contain items that measure events at a different ontological status. The most common confusion about ontological status of anger-test items relates to inquiries about physiological and cognitive events. A person's blood pressure may go up when told his tennis-serve was out by the linesman, but his cognitive processing of these events could range from the conclusion that he is angry with the linesman, self — or indeed, report no anger. Cognitive and physiological

MEASUREMENT OF ANGER

events are parallel but logically cannot be causally linked. Causality can only be established between measures of a similar ontological status.

5. Currently, there is an extensive debate regarding the extent that anger can be differentiated from other emotions. Tomkins (1962) and Buck (1985) have postulated that anger is primarily an underlying biological experience where cognitive attributions of such experiences do not play a causal role in anger. Others such as Weiner (1985) argue that anger can be reduced to an attribution analysis and there are no exclusive underlying biological experiences that are necessarily linked to anger.

6. Such a demonstration study is offered by Shoemaker, Erickson, and Finch (1986) where they implemented a multimethod assessment approach contrasting measures of depression and anger among third- and fourth-grade boys. While their anger measures demonstrated convergent validity, anger measures **failed** to show discriminative validity from measures of depression.

7. The term "factor" will be used to refer to components or synthetic or latent variables for simplicity of discussion.

8. Bernstein (1988) offers a good discussion on how factor analytic procedures along with other multivariate methods are affected by variable weightings.

9. Leonard Berkowitz (1990) in his theory on cognitive-neoassociational analysis of anger views negative affect as bodily reaction which can activate cognitive components including attributions, appraisals, and schematic conceptions. His theory is very close to the James-Lange theory that has been debated for years.