

The person-environment fit approach to stress: Recurring problems and some suggested solutions

JEFFREY R. EDWARDS

Colgate Darden Graduate School of Business Administration, University of Virginia, U.S.A.

AND

CARY L. COOPER

University of Manchester Institute of Science and Technology, U.K.

Summary

The person-environment (P-E) fit approach to stress has gained widespread acceptance in the organizational stress literature. However, current research into the P-E fit approach to stress is repeatedly plagued with serious theoretical and methodological problems. Taken together, these problems severely threaten the conclusiveness of available empirical evidence and suggest that the current widespread acceptance of the P-E fit approach may be unwarranted. This article highlights theoretical and methodological problems characteristic of much P-E fit research and offers some solutions to these problems.

Introduction

In recent years, the person-environment (P-E) fit approach to stress has become widely accepted among organizational stress researchers (Eulberg, Weekley and Bhagat, 1988). The P-E fit approach characterizes stress as a lack of correspondence between characteristics of the person (e.g. abilities, values) and the environment (e.g. demands, supplies). This lack of correspondence is hypothesized to generate deleterious psychological, physiological, and behavioral outcomes, which eventually result in increased morbidity and mortality. This basic framework forms the core of many current theories of organizational stress, such as those presented by French and his colleagues (French, Rogers and Cobb, 1974; French, Caplan and Harrison, 1982), McGrath (1976), Karasek (1979), Schuler (1980), and others.

There are several reasons for the widespread acceptance of the P-E fit approach to stress. First, the available alternatives, particularly the stimulus and response approaches, have serious shortcomings, as aptly described by McGrath (1970), Lazarus and Folkman (1984a), and Schuler (1980). Second, P-E fit as a general framework has a long tradition in psychology, tracing its origins to such influential writers as Lewin (1938, 1951) and Murray (1938). Third, viewing the person and the environment as joint determinants of stress-related outcomes has a certain intuitive appeal, capturing the common-sense notion that one person's pleasure is another person's pain. However, upon reviewing the P-E fit literature, it becomes apparent that these theoretical, traditional, and intuitive arguments for the P-E fit approach are far more abundant than arguments based on empirical evidence. This is not to say that empirical evidence is not available. Indeed, many large-scale studies have adopted the P-E approach as a guiding

The authors wish to thank Martin G. Evans, A. J. Baglioni, and two anonymous reviewers for their helpful comments on an earlier version of this paper.

framework (e.g. Caplan, Cobb, French, Harrison and Pinneau, 1980; French *et al.*, 1982). However, studies of the P-E fit approach to stress are repeatedly plagued with serious theoretical and methodological problems which severely limit the conclusiveness of their findings. Until these problems are recognized and rectified, we will be unable to accumulate a sound body of empirical evidence to support or refute the P-E fit approach to stress.

The purpose of this article is to identify recurring problems in the P-E fit approach to stress and to recommend some solutions to these problems. These problems include inadequate distinction between different versions of fit, confusion of different functional forms of fit, poor measurement of fit components, and inappropriate analysis of the effects of fit. Taken together, these problems have hindered research into the distinct mechanisms associated with different versions and forms of fit, narrowed the range of fit dimensions included in empirical investigations, and generated statistical analyses which do not correspond to stated hypotheses or, worse yet, clearly violate known methodological recommendations. As a result, most empirical evidence regarding the P-E fit approach to stress is extremely limited in scope or, in some cases, largely inconclusive. These problems are particularly pressing in the field of organizational stress because, though the P-E fit approach is the most widely cited model in the field (Eulberg *et al.*, 1988), we have been unable to locate a single study that is free from pitfalls discussed in this article. Therefore, in order to accumulate a valid body of knowledge regarding the P-E fit approach to stress, it is crucial for researchers in this area to attend to the problems addressed in this article¹.

Overview of the P-E fit approach to stress

Before addressing the problems summarized above, we will first summarize the fundamental elements of the P-E fit approach to stress. Perhaps the most comprehensive treatment of the P-E fit approach is provided by French and his colleagues (e.g., French *et al.*, 1982). Their treatment involves two distinct versions of P-E fit. One version focuses on the correspondence between environmental supplies and personal motives, goals, and values (i.e. S-V fit). The other version focuses on the correspondence between environmental demands and personal skills and abilities (i.e. D-A fit). French *et al.* (1982) further indicate that P and E can be described both objectively and subjectively. That is, objective P and E refers to these variables as they exist independently of the individual's perceptions, whereas subjective P and E refers to these variables as they are perceived by the individual. The central thesis of the French *et al.* (1982) approach is that subjective S-V or D-A misfit will produce negative psychological, physiological, and behavioral outcomes, collectively labeled 'strain'.

Though French *et al.* (1982) provide the most explicit treatment of the P-E fit approach to stress, numerous other discussions of stress implicitly incorporate concepts of P-E fit. For example, S-V fit is implicit in Schuler's (1980) conceptualization of stress, which involves a dynamic condition that potentially prevents the individual from being, having, or doing what he or she desires. Similarly, the cybernetic framework presented by Cummings and Cooper (1979) indicates that a disparity between an individual's preferred and actual state will result in strain. D-A fit is apparent in McGrath's (1976) model of stress, which indicates that stress involves a

¹We should emphasize that we have specifically chosen a model that is currently widespread in *organizational* stress research. In the broader stress literature, the transactional model presented by Lazarus and his associates (e.g. Lazarus and Folkman, 1984b) has perhaps received greater attention. However, as we shall later demonstrate, the Lazarus model implicitly incorporates concepts of P-E fit. Therefore, the problems we address in this article may interest proponents of the Lazarus model and, with some modification, may help empirical investigations into the model.

perceived environmental demand which threatens to exceed the person's capabilities and resources. Similarly, the job demands model presented by Karasek (1979) indicates that strain occurs when high demands are combined with low ability to influence tasks and procedures at work (i.e., low decision latitude).

The transactional model of stress and coping presented by Lazarus and his associates (Lazarus, 1966; Lazarus and Folkman, 1984a, 1984b; Lazarus and Launier, 1978) is noteworthy in that it incorporates elements of both D-A and S-V fit. In particular, D-A fit underlies Lazarus' notion that stress involves a relationship between the person and the environment in which environmental demands are appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being. The values component of S-V fit is apparent in the concept of commitments, which reflect the pattern of goals, motives, and values held by the person. According to the transactional model, situations where demands tax or exceed resources (i.e. D-A misfit) are characterized as stressful only when meeting these demands will enhance or preserve a person's commitments (i.e. resolve or prevent S-V misfit (cf. Harrison, 1978)). Thus, the transactional model integrates D-A and S-V fit, indicating that stress-related transactions between the person and the environment involve *both* D-A and S-V misfit.

Concepts of P-E fit are also apparent in other areas of organizational behavior research. For example, S-V fit is reflected in Locke's (1976) theory of job satisfaction, which indicates that job satisfaction results from the perception that one's job fulfills important job values. Similarly, the theory of work adjustment presented by Dawis and Lofquist (1984) indicates that satisfaction results from a correspondence between one's values and the reinforcer patterns available at work. S-V fit is also incorporated into job characteristics theory (Hackman and Oldham, 1980; Kulik, Oldham and Hackman, 1987), which indicates that, when individuals with a strong desire for personal growth are combined with enriched jobs, motivation and satisfaction result. D-A fit underlies most models of personnel selection, in which the generally accepted paradigm is to analyze job demands, define abilities required to meet these demands, and hire individuals with the requisite abilities (Schneider, 1978; Smith and Robertson, 1989).

As the preceding discussion illustrates, the concept of P-E fit is ubiquitous not only in stress research, but also in many areas of organizational behavior research. In this paper, we are specifically concerned with applications of P-E fit in organizational stress research, and the problems we identify are drawn primarily from this literature. However, we should note that other areas of investigation that address concepts of P-E fit typically share a similar set of problems. Therefore, much of the following discussion is relevant not only to studies of the P-E fit approach to stress, but also to other areas of investigation which address concepts of P-E fit.

Theoretical issues

This section concerns two general theoretical issues that deserve serious consideration in studies of the P-E fit approach to stress. The first concerns the specific components of the person and the environment examined in P-E fit research. The second concerns the forms of P-E fit presented in the literature.

Versions of P-E fit

As indicated earlier, there are two basic versions of the P-E fit approach to stress, one involving the fit between environmental supplies and personal motives, goals, and values (S-V fit), and the

other involving the fit between environmental demands and personal skills and abilities (D-A fit). Though S-V and D-A fit are often discussed together under the rubric of P-E fit (Dawis and Lofquist, 1984; French *et al.*, 1982), they are fundamentally different, both in terms of their underlying processes and their associated outcomes. Differences in process are implicit in the components that constitute S-V and D-A fit. That is, S-V fit suggests a process in which the individual draws from his or her personal value structure to cognitively evaluate the surrounding environment. In contrast, D-A fit suggests a process in which the individual musters his or her skills and abilities to meet the demands of the environment. Though these processes may be causally related, as when the individual must satisfy environmental demands in order to achieve valued states, the processes themselves are conceptually distinct. Differences in outcomes are reflected in numerous theoretical discussions regarding components of S-V and D-A fit. For example, when environmental supplies deviate from individual values, dissatisfaction (Locke, 1969, 1976), negative affect (Diener, 1984), and other symptoms of negative well-being are likely to emerge. In contrast, when environmental demands exceed individual abilities, performance decrements are likely to occur (Hackman and Oldham, 1980; Naylor, Pritchard and Ilgen, 1980; Porter and Lawler, 1968). In some cases, D-A fit may indirectly influence well-being, as when meeting environmental demands is inherently valued by the individual (thereby producing S-V fit), or when resolving a D-A discrepancy is instrumental to achieving S-V fit on a related dimension (French *et al.*, 1982; Harrison, 1978; Lazarus and Folkman, 1984b). In contrast, existing evidence suggests that S-V fit is unlikely to influence performance (*cf.* Greene, 1972; Schwab and Cummings, 1970).

Though S-V and D-A are conceptually distinct versions of P-E fit, both in terms of their underlying processes and associated outcomes, studies of P-E fit often minimize these distinctions or, in some cases, overlook them entirely. For example, French and his colleagues have clearly emphasized the conceptual distinctions between S-V and D-A fit (French *et al.*, 1974; French *et al.*, 1982; Harrison, 1978), but associated empirical investigations have minimized these distinctions by posing S-V and D-A fit as alternative predictors of the same set of outcomes, i.e. psychological, physiological, and behavioral strain (Caplan *et al.*, 1980; French *et al.*, 1982). These investigators justified this procedure by arguing that the effects of both S-V and D-A fit are based on the extent to which motives are satisfied (French *et al.*, 1982, p. 31). If D-A fit is indeed a proxy for motive satisfaction, then it becomes essentially isomorphic with S-V fit, and the utility of D-A fit as a distinct concept becomes questionable. Other studies have used S-V and D-A fit interchangeably, apparently ignoring the distinctions between them altogether. For example Stokols (1979, p. 27) defined stress as a state of imbalance between environmental demands and coping abilities, but later operationalized stress as the extent to which the environment accommodates a person's needs and goals (p. 36). Similarly, Blau (1981, p. 280) initially defined stress as a situation where environmental demands either exceed or fall short of a person's capabilities, but later defined (and ultimately operationalized) stress as a situation where environmental supplies either exceed or fall short of individual preferences (p. 282).

The use of S-V and D-A fit as alternative or, in some cases, interchangeable versions of P-E fit has obscured important distinctions between them. This has stalled investigation into the processes and outcomes that purportedly distinguish S-V and D-A fit and, in some cases, has produced studies which claim to test one version of fit but, in fact, actually test another. This problem may be alleviated by recognizing the distinct processes and outcomes associated with S-V and D-A fit and maintaining these distinctions in theoretical and empirical investigations. For example, rather than using D-A fit as a proxy for S-V fit (French *et al.*, 1982), investigators should directly measure S-V fit along the dimension that is presumably dependent on D-A fit. This would maintain the distinction between D-A and S-V fit *and* provide a means to test whether there is, in fact, a relationship between these two forms of fit, as assumed by French *et al.* (1982).

More generally, the interrelationship between S-V and D-A fit, and their effects on well-being and performance, would be considerably illuminated by investigations which incorporate both forms of fit within the same taxonomic domain (i.e. studying S-V and D-A fit regarding the same set of job characteristics) (Caplan, 1987).

Forms of P-E fit

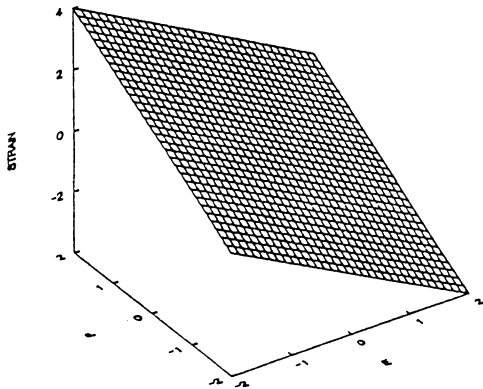
Research into the P-E fit approach to stress presents three basic forms of fit. One form focuses on the discrepancy between P and E, indicating that strain increases as the characteristics of the environment deviate from characteristics of the person. This form is represented by French *et al.* (1982), McGrath (1976), Pervin (1967), Tannenbaum and Kuleck (1978), Alutto and Vredenburg (1977), and others, who operationalized P-E fit as the difference between commensurate P and E components². A second form focuses on the interaction between P and E, indicating that strain occurs when environmental characteristics are combined with certain person characteristics. This form has been adopted by Cherrington and England (1980), Lyons (1971), O'Brien and Dowling (1980), and others, who operationalized P-E fit as the product of commensurate P and E components. A third form focuses on the proportion of P that is fulfilled by E (or, in some case, by the difference between E and P), indicating that strain increases as this proportion becomes lower. This form is exemplified by French *et al.* (1982) and Stokols (1979), who operationalized P-E fit as the ratio of commensurate P and E components.

A review of studies of P-E fit suggests that the discrepancy, interactive, and proportional forms of fit are often viewed as compatible, if not interchangeable. For example after noting problems with the use of difference scores, O'Brien and Dowling (1980) used the interactive form of fit as an alternative to the discrepancy form. Conversely, Kahana, Liang and Felton (1980) described drawbacks for the interactive form and opted instead for a modification of the discrepancy form, consisting of the squared difference between commensurate P and E components. French *et al.* (1982) argued that the proportional form should be chosen over the discrepancy form when ratio scales were available, but that empirical findings for these two forms would not differ appreciably. A more explicit example is presented by Harrison (1978), who cites Cronbach (1958) as stating that, after multiplying by a constant, the absolute value of the difference between P and E equals the negative of their product, yielding the discrepancy and interactive forms equivalent.

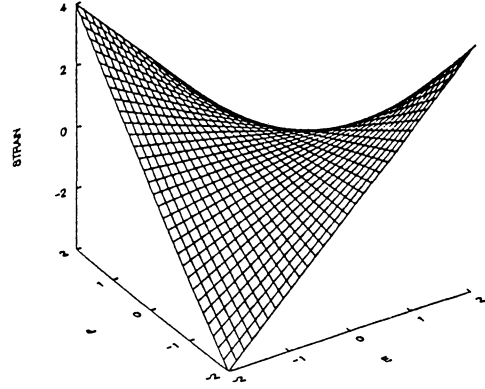
A closer examination of the discrepancy, interactive, and proportional forms of fit suggests that they represent different theoretical perspectives on the relationship between P-E fit and strain. The discrepancy form implies that P represents a standard by which E is compared, such that larger deviations of E from P are associated with increased strain. In contrast, the interactive form implies that P influences the strength of the relationship between E and strain, such that, rather than operating as a standard, P modifies the effects of E on strain. The proportional form shares characteristics of both the discrepancy and interactive forms, in that P operates as a standard by which E is compared *and* influences the strength of the relationship between E and strain. However, unlike the interactive form, the proportional form implies that the effect of P on the strength of the relationship between E and strain becomes progressively smaller as P increases.

Though the distinctions among the discrepancy, interactive, and proportional forms of fit are primarily theoretical, they also carry important methodological implications. This is because these three forms of fit describe fundamentally different functional relationships between P, E, and strain. These relationships are best described as surfaces in three dimensions, where P and E represent perpendicular horizontal axes and strain represents the vertical axis. Consider Figure 1,

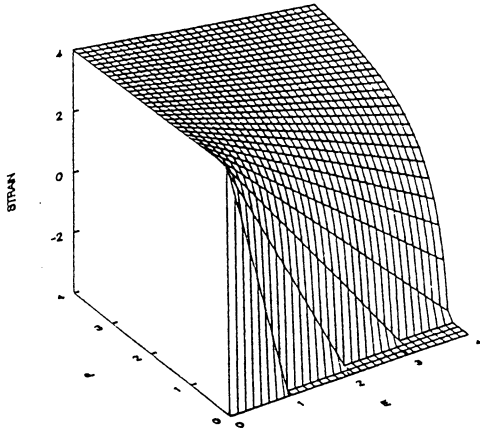
²The methodological implications of using the difference between P and E to predict outcomes will be discussed in the following section.



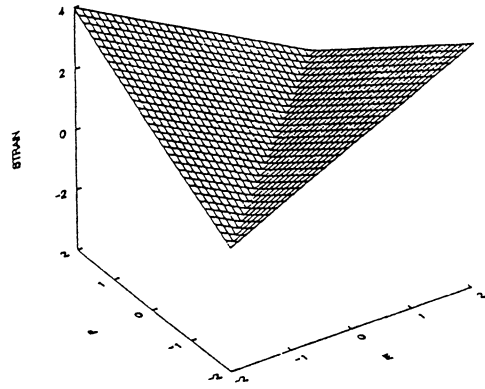
(a) Discrepancy



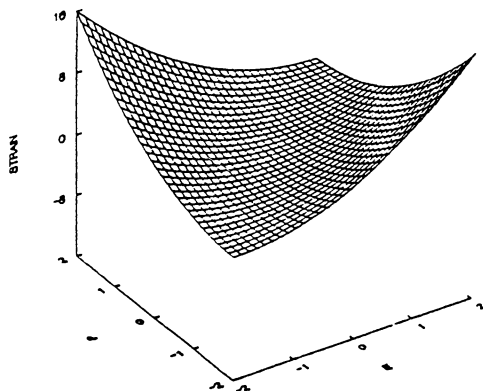
(b) Interactive



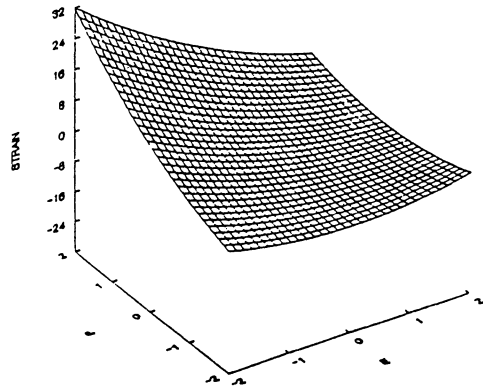
(c) Proportional



(d) Absolute Value



(e) U-Shaped



(f) Asymptotic

Figure 1. Functional forms relating P, E, and strain

which depicts various relationships between P, E and strain. The discrepancy form implies a plane, reflecting a negative relationship between E and strain combined with a positive relationship between P and strain (Figure 1a). Thus, increases in P do not affect the slope of the relationship between E and strain, but instead shift this relationship upward vertically. In contrast, the interactive form implies a saddle-shaped surface that intersects both the P and E axes, with the surface increasing where P and E differ in sign and decreasing where P and E share the same sign (Figure 1b). Thus, variation in P does not affect the vertical positioning of the relationship between E and strain, but instead alters its slope. The proportional form implies a curved surface, reflecting a negative relationship between E and strain whose slope is steeper for smaller levels of P (Figure 1c). Thus, variation in P influences the slope of the relationship between E and strain, but this influence gradually decreases as P increases.

Though the discrepancy, interactive, and proportional forms of fit are fundamentally distinct, various mathematical transformations presented in the literature may unintentionally obscure or remove these distinctions. For example, as noted above, Kahana *et al.* (1980) attempted to test the discrepancy form by using the squared difference between P and E to predict strain (see also Betz, 1968; Caplan *et al.*, 1980; Dawis and Lofquist, 1984; Scarpello and Campbell, 1984). However, because the squared difference between P and E is mathematically equivalent to the sum of P^2 and E^2 minus twice their product, this transformation implicitly changes the discrepancy form to a combined curvilinear and interactive form (Figure 1e). Other transformations are intended to equate two forms of fit when, in fact, they do not. For example, taking the absolute value of the difference between P and E does not yield the negative of their product (i.e. the interactive form), as claimed by Harrison (1978). Instead, the absolute value of the difference resembles a V-shaped surface, symmetric about the line where P equals E and increasing in either direction (Figure 1d). This surface differs substantially from that implied by the interactive form (Figure 1b). Furthermore, these two surfaces reflect fundamentally different assumptions regarding the impacts of P-E fit on strain. In particular, the V-shaped surface in Figure 1d implies that strain is minimized when P and E are equivalent. In contrast, the saddle-shaped function in Figure 1b implies that, for strain to be minimized, P and E must not only be equivalent, but they must also be large in absolute magnitude. Theoretical discussions of the effects of P-E fit on strain (e.g. French *et al.*, 1982; Dawis and Lofquist, 1984) clearly suggest that the former surface should be preferred over the latter.

In sum, the discrepancy, interactive, and proportional forms of P-E fit are distinct, both theoretically and mathematically, and should not be considered interchangeable. Failure to recognize these distinctions generates statistical tests that do not correspond to stated hypotheses and encourages inappropriate generalizations from one study to another. Researchers should recognize these distinctions and select a form that is consistent with their theoretical assumptions. Whenever possible, these theoretical assumptions should override justifications cited in previous research, such as difficulties in analyzing difference scores and the availability of ratio scales. If no *a priori* basis for preferring one form is available, alternative forms may be tested simultaneously in an exploratory fashion to determine which provides the best representation of the relationship between P-E fit and strain (*cf.* French *et al.*, 1982; Kahana *et al.*, 1980).

Methodological issues

This section focuses on two important methodological issues in the study of P-E fit approach to stress. The first concerns the measurement of P and E components. The second concerns the analysis of relationships between P, E, and strain.

Measurement of fit components

The measurement of person and environment components in P-E fit research raises several important issues. First, measures of P and E components should be commensurate, meaning that they should reflect the same theoretical dimension. French *et al.* (1974) argue that commensurate measures are necessary for calculating difference scores, a procedure commonly used in P-E fit research (e.g. Caplan *et al.*, 1980). However, these difference scores are often subjected to various transformations, such as taking the absolute value or assigning all positive or negative scores to zero, that require the identification of the point of 'perfect fit' (Caplan *et al.*, 1980). When these procedures are used, P and E measures must not only be commensurate, *they must also share the same zero point*. Otherwise, the point of 'perfect fit' cannot be unambiguously identified, and transformations that rely on identifying the point of 'perfect fit' become meaningless. Because few psychological measures contain a logical zero point, it is unclear whether the requirement of a shared zero point among commensurate P and E measures is ever satisfied. Fortunately, statistical procedures are available to estimate the effects of P-E fit without the use of difference scores, as described later in this article. Nonetheless, commensurate measures should be regularly used for theoretical reasons. For example, when measuring a S-V discrepancy regarding work load, it makes little sense to pair a question regarding actual work load with any question other than one measuring desired work load. This logic permeates the bulk of P-E fit research (e.g. Caplan *et al.*, 1980; Dawis and Lofquist, 1984), and the superiority of commensurate measures over noncommensurate measures has been demonstrated empirically (Cherrington and England, 1980).

Second, question stems used to construct measures of P and E components deserve careful consideration. For both S-V and D-A fit, stems regarding E are rather straightforward. For S, stems should ask how much of the attribute is present, while for D, stems should ask the level of demands associated with the attribute under consideration (cf. Caplan *et al.*, 1980). However, stems regarding P involve certain complexities. For V, two main approaches have been offered, one focusing on the desired level of attributes (Caplan *et al.*, 1980), and the other focusing on the importance of attributes (Dawis and Lofquist, 1984). Corresponding theoretical discussions indicate that the former approach is appropriate for the discrepancy form of fit, whereas the latter is appropriate for the interactive form of fit (French *et al.*, 1974; McGrath, 1976; Mobley and Locke, 1970; Stokols, 1979). Though many studies of fit are consistent with this distinction, a surprising number of studies of the discrepancy form measure V in terms of importance (e.g. Betz, 1968; Butler, 1983; Dawis and Lofquist, 1984; Scarpello and Campbell, 1984), and several studies of the interactive form measure V in terms of desires (e.g. Baker and Hansen, 1975; Cherrington and England, 1980). As a result, the findings of these studies offer no clear interpretation regarding the basic tenets of P-E fit theory. For A, stems typically refer to self assessments of ability or to some indirect indicator of ability, such as level of education (Caplan *et al.*, 1980). The former approach carries the advantage of closer proximity to the construct of interest, but is blatantly prone to social desirability response bias. The latter approach largely avoids this bias, but provides a much less direct assessment of the construct of interest. There is no clear solution to this dilemma, though these tradeoffs should nonetheless be kept in mind.

A third issue concerns the number of fit dimensions to include for study. Many investigators include only a very limited number of dimensions. For example, several studies have characterized fit in terms of a single dimension, such as participation in decision-making (Alutto and Acito, 1974; Alutto and Belasco, 1972; Alutto and Vredenburgh, 1977), tolerance for structure (Baker and Hansen, 1975), or the determinants of salary increases (Dyer, Schwab and Theriault, 1976; Dyer and Theriault, 1976). Even the most systematic investigation of the P-E fit

approach to date (Caplan *et al.*, 1980; French *et al.*, 1982) included only eight dimensions of fit. By focusing on a limited number of fit dimensions, these studies present two drawbacks. First, if we assume that incongruence along multiple dimensions cumulatively influences strain, then these studies necessarily omit relevant determinants of strain. Second, these studies provide only limited information regarding P-E fit as a general construct. A superior approach involves the use of comprehensive measures of the person or the environment to construct indices of fit. For example, several studies of job satisfaction have used the Work Values Inventory (WVI; Super, 1970) to derive indices of fit along 15 dimensions (e.g., Betz, 1968; Butler, 1983; Scarpello and Campbell, 1984). Other studies have interviewed job incumbents to identify relevant job-related activities and construct corresponding indices of fit (e.g. Blau, 1981). Either of these procedures will, in general, yield a reasonably comprehensive assessment of fit, and should therefore be implemented whenever practical.

Analyzing the effects of fit

Perhaps the most serious problem regarding current P-E fit research involve procedures used to analyze the effects of fit. These procedures repeatedly violate recommendations in the methodological literature, rendering their results highly suspect. For example, with very few exceptions, proponents of the discrepancy form of fit have operationalized fit as the algebraic difference (or some transformation thereof) between commensurate P and E components. Though this approach is intuitively appealing, the use of difference scores has been criticized extensively (e.g. Cronbach & Furby, 1970; Johns, 1981; Werts and Linn, 1970). Despite these criticisms, the use of difference scores persists in the P-E fit literature, even in prescriptive methodological discussions concerning the operationalization of fit (e.g. Rounds, Dawis and Lofquist, 1987). This persistence is apparently based, in part, on lack of awareness of viable alternatives combined with the assumption that fit indices based on difference scores capture something distinct from their components. French *et al.* (1974) use the latter assumption to justify difference scores as an index of P-E fit, claiming that such an index will predict strain even after controlling P and E. However, because a difference score is a simple linear combination of its components, it can *never* contain more predictive power than the combined effect of its components and, in most cases, will contain *less* predictive power. There are two main reasons for this. First, a difference score simply places a restriction on the coefficients of the component variables. Consider the following regression equations:

$$Y = b_0 + b_1 P + b_2 E + e \quad (1)$$

$$Y = b_0 + b_1 (P - E) + e \quad (2)$$

In equation 1, component scores (P and E) are entered as separate predictors of strain (Y), whereas in equation 2 the difference between component scores is entered as a single predictor (*e* represents a random disturbance term). Expanding equation 2 yields the following:

$$Y = b_0 + b_1 P - b_1 E + e \quad (3)$$

By comparing equation 1 with equation 3, it is evident that equation 3 simply restricts the coefficients of P and E to be equal in magnitude but opposite in sign (*cf.* Cronbach and Furby, 1970). Like any restriction, this *cannot* increase the amount of variance explained beyond that

taken into account by equation 1, in which the coefficients on P and E are allowed to take on whatever values maximize the amount of variance explained. Second, when component scores are positively correlated, as is often the case in field studies of P-E fit (Caplan *et al.*, 1980; Harrison, 1978), the reliability of their difference is less than the average of the reliabilities of the components themselves (Johns, 1981). Hence, the relationship between the difference score and the dependent variable will be attenuated. As a result, the amount of variance explained by the difference score will be less than that explained by the combination of P and E, even if their coefficients are, in fact, equal in magnitude but opposite in sign.

To avoid the problems inherent in difference scores, hypotheses regarding the discrepancy form of fit may be tested by entering component scores together (as in equation 1) and evaluating their *joint* contribution in predicting strain (Wall and Payne, 1973; Cronbach and Furby, 1970). Results which are consistent with the discrepancy form include: (1) a significant increase in variance explained when the component scores are entered jointly; (2) significant independent effects for both components; and (3) opposite signs on the coefficients of the components.

The above procedure assumes that the relationship between P-E fit and strain is linear or, more precisely, represents a plane reflecting a positive relationship between P and strain combined with a negative relationship between E and strain (Figure 1a). However, the P-E fit literature suggests that the relationship between fit and strain may also be either U-shaped or asymptotic (French *et al.*, 1974; Harrison, 1978; Kulka, 1979). Unfortunately, procedures used to estimate these relationships typically rely on transformations of difference scores and, as such, are flawed. For example, the U-shaped relationship between fit and strain has been estimated using either the absolute value or the square of the difference between P and E (Caplan *et al.*, 1980; French *et al.*, 1982; Pervin, 1967). An alternative approach, which eliminates the reliance on difference scores, involves entering P^2 , E^2 , and the product of P and E *as a set* and examining the increment in variance explained by these variables after controlling for P and E. Consider the following two regression equations, the first representing this approach and the second representing the approach used by Caplan *et al.* (1980).

$$Y = b_0 + b_1 P + b_2 E + b_3 P^2 + b_4 P \cdot E + b_5 E^2 + e \quad (4)$$

$$Y = b_0 + b_1 (P - E) + b_2 (P - E)^2 + e \quad (5)$$

Expanding equation 5 yields the following:

$$Y = b_0 + b_1 P - b_1 E + b_2 P^2 - 2b_2 P \cdot E + b_2 E^2 + e \quad (6)$$

As is evident, equations 4 and 6 are equivalent, except that equation 6 imposes the following restrictions: (1) the coefficients on P and E are equal in magnitude but opposite in sign; (2) the coefficients on P^2 and E^2 are equivalent; and (3) the coefficient on the product of P and E is twice as large as the coefficients on P^2 and E^2 and opposite in sign. These restrictions are not necessary for analysis, but instead depict the pattern the coefficients in equation 4 should take if the underlying relationship is indeed U-shaped. In particular, results consistent with a U-shaped relationship between P-E fit and strain include: (1) no significant effects for P and E; (2) a significant increase in explained variance when P^2 , E^2 , and $P \cdot E$ are entered as a set; (3) coefficients on P^2 and E^2 that are positive, significant, and approximately equal in magnitude; and (4) a coefficient on $P \cdot E$ that is negative, significant, and approximately twice as large in absolute magnitude as the coefficients on P^2 and E^2 . Since P and E are entered as separate predictors of strain, this relationship is most appropriately conceived as a U-shaped surface (see Figure 1e).

Table 1. the expected pattern of coefficients for equation 4 associated with difference relationships between P-E fit and strain*

Form of relationship	P	E	P ²	P*E	E ²
Positive linear	+	-	0	0	0
Negative linear	-	+	0	0	0
U-shaped	0	0	+	-	+
Inverted U-shaped	0	0	-	+	-
Positive asymptotic	+	-	+	-	+
Negative asymptotic	-	+	+	-	+
Positive inverted asymptotic	+	-	-	+	-
Negative inverted asymptotic	-	+	-	+	-

*All analyses are conducted hierarchically, with higher-order terms entered as a set after controlling P and E. Signs on P and E refer to the first stage of the analysis, whereas signs on higher-order terms refer to the second stage of the analysis.

†For the asymptotic forms, the term 'positive' indicates that strain increases (at an increasing rate) as P increases and E decreases, whereas the term 'negative' indicates that strain decreases (at a decreasing rate) as P increases and E decreases.

Asymptotic relationships between fit and strain have typically been estimated by calculating the difference between P and E, and then setting all values on one side of the point 'perfect fit' to zero (Caplan *et al.*, 1980). Again, this procedure relies on difference scores and is therefore subject to their attendant drawbacks. An alternative which does not require difference scores again uses equation 4, but predicts a slightly different pattern of results than those associated with the U-shaped relationship. In particular, in addition to the pattern of results consistent with a U-shaped relationship, the effects of P and E are predicted to be significant, equal in magnitude, and opposite in sign. The direction of the asymptote will be reflected in the signs of the coefficient on P and E. Figure 1f depicts an asymptotic relationship between P, E, and strain in which the coefficient on P is positive and the coefficient on E is negative. This implies that increases in P and decreases in E both increase strain at an increasing rate.

The above discussion highlights the general applicability of equation 4 for determining the shape of the relationship between P, E, and strain. Results from this equation may be used to identify most relationships between P-E fit and strain discussed in the literature, including linear, U-shaped, asymptotic, and related variations. Table 1 summarizes the expected pattern of coefficients for equation 4 for different variations of linear, U-shaped, and asymptotic relationships. The entries in the table indicate the sign of coefficients expected to be significant (a zero indicates that a coefficient is expected to be nonsignificant). Thus, significant coefficients for only P and E would indicate a linear relationship, whereas significant coefficients for only P², P*E, and E² would indicate a U-shaped relationship. Significant coefficients for all five variables would indicate an asymmetric U-shaped relationship, which would approach an asymptotic relationship as the magnitude of the coefficients on P and E increases. By using this information to interpret results obtained from equation 4, the researcher can assess the form of the relationship between P-E fit and strain while avoiding the use of difference scores³. This assessment may be facilitated substantially by the use of three-dimensional plots, such as those used in Figure 1.

³It should be noted that, like any application of multiple regression, this procedure assumes that independent variables are measured without error (Pedhazur, 1982). To the extent this assumption is violated, the validity of this procedure is threatened, particularly when measurement error is multiplicative (Busemeyer and Jones, 1983).

Given existing methodological discussions decrying the use of difference scores (e.g. Cronbach and Furby, 1970; Johns, 1981; Wall and Payne, 1973; Werts & Linn, 1970), it may be argued that the above recommendations do not contribute to our body of knowledge. However, though arguments against the use of difference scores have existed for decades, most investigators of the P-E fit approach to stress either do not mention these arguments (e.g. Alutto and Vredenburg, 1977; Blau, 1981; Caplan *et al.*, 1980; French *et al.*, 1982; Kahana *et al.*, 1980; Kulka, Klingel and Mann, 1980; Dawis and Lofquist, 1984; Scarpello and Campbell, 1984; Stokols, 1979) or mention them only in passing (e.g. Rounds *et al.*, 1987). In any case, we know of no study that has analyzed the effects of fit in accordance with the recommendations presented above, even though these recommendations follow logically from the available literature. It is hoped that, by explicitly stating these recommendations, future P-E fit research will avoid analyses based on difference scores in favor of superior alternatives.

Summary and Conclusion

Current research into the P-E fit approach to stress is plagued with serious theoretical and methodological problems. Theoretical problems include inadequate emphasis of the distinctions between different versions of fit, particularly S-V and D-A, and different forms of fit, particularly the discrepancy, interactive, and proportional forms. Methodological problems include imprecise and uncomprehensive measurement of P-E fit dimensions and inappropriate analytical techniques for assessing the effects of fit. Taken together, these problems have generated empirical investigations which overlook the distinct mechanisms associated with different versions and forms of fit, consider a limited range of fit dimensions, and employ statistical tests which do not correspond to stated hypotheses or, worse yet, clearly violate known methodological recommendations. As a result, we have yet to accumulate a sound body of empirical evidence that adequately addresses the basic propositions of the P-E fit approach to stress.

In this article, we have offered some solutions to problems associated with research into the P-E fit approach to stress. If these problems are resolved, we will begin to accumulate valid, comprehensive, and conclusive empirical evidence regarding the P-E fit approach to stress. However, if these problems continue to be overlooked, studies of the P-E fit approach will remain narrow and inconclusive, and opportunities to advance our understanding of the P-E fit approach to stress will be missed. For example, minimizing or overlooking the distinctions between S-V and D-A fit will conceal whether the processes and outcomes associated with these versions of fit actually differ. Similarly, confusing the discrepancy, interactive, and proportional forms of fit will prevent us from determining whether the distinct cognitive processes suggested by these different forms of fit actually operate. Furthermore, measuring a limited number of fit dimensions will prevent us from establishing the generality of P-E fit as a predictor of strain and determining whether different forms of fit are more appropriate for different dimensions (French *et al.*, 1982). Finally, failing to analyze the effects of fit in an appropriate manner will produce inconclusive results and prevent the investigation of various three-dimensional surfaces that may describe the relationship between P, E, and strain. Given these considerations, we strongly suggest that investigators of the P-E approach to stress give careful consideration to the problems and solutions addressed in this article.

We acknowledge that several of the criticisms in this article are rather pointed and may generate some controversy. However, these criticisms are the result of serious problems which we believe have stagnated theoretical and empirical advancements in P-E fit research. The examples used were not intended to denigrate the work of any given researcher, but instead were intended to

illustrate the pervasiveness of the problems identified. Moreover, we have provided alternative approaches which will help overcome the problems identified. Therefore, we hope that these criticisms are viewed as constructive, and that the proposed recommendations will benefit future research into the P-E approach to stress.

References

- Alutto, J. A. and Acito, F. (1974). 'Decisional participation and sources of job satisfaction: A study of manufacturing personnel', *Academy of Management Journal*, **17**, 160-167.
- Alutto, J. A. and Belasco, J. A. (1972). 'A typology for participation in organizational decision-making', *Administrative Science Quarterly*, **17**, 117-125.
- Alutto, J. A. and Vredenburg, D. J. (1977). 'Characteristics of decisional participation by nurses', *Academy of Management Journal*, **20**, 341-347.
- Baker, S. H. and Hansen, R. A. (1975). 'Job design and workers satisfaction: A challenge to assumptions', *Journal of Occupational Psychology*, **48**, 79-91.
- Betz, E. (1968). 'Need-reinforcer correspondence as a predictor of job satisfaction', *Personnel and Guidance Journal*, **47**, 878-883.
- Blau, G. (1981). 'An empirical investigation of job stress, social support, service length, and job strain', *Organizational Behavior and Human Performance*, **27**, 279-302.
- Busemeyer, J. R. and Jones, L. E. (1983). 'Analysis of multiplicative combination rules when the causal variables are measured with error', *Psychological Bulletin*, **93**, 549-562.
- Butler, J. K. (1983). 'Value importance as a moderator of the value-fulfillment-job satisfaction relationship: Group differences', *Journal of Applied Psychology*, **68**, 420-428.
- Caplan, R. D. (1987). 'Person-environment fit theory and organizations: Commensurate dimensions, time perspectives, and mechanisms', *Journal of Vocational Behavior*, **31**, 248-267.
- Caplan, R. D., Cobb, S., French, J. R. P., Jr., Harrison, R. V. and Pinneau, S. R. (1980). *Job Demands and Worker Health: Main Effects and Occupational Differences*, Institute for Social Research, Ann Arbor, Mich.
- Cherrington, D. J. and England, J. L. (1980). 'The desire for an enriched job as a moderator of the enrichment-satisfaction relationship', *Organizational Behavior and Human Performance*, **25**, 139-159.
- Cronbach, L. J. (1958). 'Proposals leading to analytic treatment of social perception scores'. In: Tagiuri, R. and Petrullo, L. (eds) *Person Perception and Interpersonal Behavior*, Stanford University Press, Stanford, CA, pp. 353-379.
- Cronbach, L. J. and Furby, L. (1970). 'How should we measure "change" — or should we?' *Psychological Bulletin*, **74**, 68-80.
- Cummings, T. G. and Cooper, C. L. (1979). 'Cybernetic framework for studying occupational stress', *Human Relations*, **32**, 395-418.
- Dawis, R. V. and Lofquist, L. H. (1984). *A Psychological Theory of Work Adjustment*, University of Minnesota Press, Minneapolis.
- Diener, E. (1984). 'Subjective well-being', *Psychological Bulletin*, **95**, 542-575.
- Dyer, T., Schwab, D. P. and Theriault, R. (1976). 'Managerial perceptions regarding salary increase criteria', *Personnel Psychology*, **61**, 233-242.
- Dyer, L. and Theriault, R. (1976). 'The determinants of pay satisfaction', *Journal of Applied Psychology*, **61**, 596-604.
- Eulberg, J. R., Weekley, J. A. and Bhagat, R. S. (1988). 'Models of stress in organizational research: A metatheoretical perspective', *Human Relations*, **41**, 331-350.
- French, J. R. P., Jr., Caplan, R. D. and Harrison, R. V. (1982). *The Mechanisms of Job Stress and Strain*, Wiley, London.
- French, J. R. P., Jr., Rodgers, W. L. and Cobb, S. (1974). 'Adjustment as person-environment fit'. In: Coelho, G., Hamburg, D. and Adams, J. (Eds) *Coping and Adaptation*, Basic Books, New York, pp. 316-333.
- Greene, C. N. (1972). 'The satisfaction-performance controversy', *Business Horizons*, **14** (5), 31-41.
- Hackman, J. R. and Oldham, G. R. (1980). *Work Redesign*, Addison-Wesley, Reading, Mass.
- Harrison, R. V. (1978). 'Person-environment fit and job stress'. In: Cooper, C. L. and Payne, R. (Eds) *Stress at Work*, Wiley, New York, pp. 175-205.

- Holland, J. L. (1985). *Making Vocational Choices: A Theory of Careers*, 2nd edn, Prentice-Hall, Englewood Cliffs, NJ.
- Johns, G. (1981). 'Difference score measures of organizational behavior variables: A critique', *Organizational Behavior and Human Performance*, **27**, 443-463.
- Kahana, E., Liang, J. and Felton, B. J. (1980). 'Alternative models of person-environment fit: Prediction of morale in three homes for the aged', *Journal of Gerontology*, **35**, 584-595.
- Karasek, R. A., Jr. (1979). 'Job demands, job decision latitude, and mental strain: Implications for job redesign', *Administrative Science Quarterly*, **24**, 285-308.
- Kulik, C. T., Oldham, G. R., and Hackman, J. R. (1987). 'Work design as an approach to person-environment fit', *Journal of Vocational Behavior*, **31**, 278-296.
- Kulka, R. A. (1979). 'Interaction as person-environment fit'. In: Kahle, L. R. (Ed.) *New Directions for Methodology of Behavioral Science*, Jossey-Bass, San Francisco, pp. 55-71.
- Kulka, R., Klingel, D. M. and Mann, D. W. (1980). 'School crime and disruption as a function of student school fit: An empirical assessment', *Journal of Youth and Adolescence*, **9**, 353-370.
- Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*, McGraw-Hill, New York.
- Lazarus, R. S. and Folkman, S. (1984a). 'Coping and adaptation'. In: Gentry, W. D. (Ed.) *Handbook of Behavioral Medicine*, The Guilford Press, New York, pp. 282-325.
- Lazarus, R. S. and Folkman, S. (1984b). *Stress, Coping, and Adaptation*, Springer, New York.
- Lazarus, R. S. and Launier, R. (1978). 'Stress-related transactions between person and environment'. In: Pervin, L. A. and Lewis M. (Eds) *Perspective in Interactional Psychology*, Plenum, New York, pp. 287-327.
- Lewin, K. (1938). *The Conceptual Representation and Measurement of Psychological Forces*, Duke University Press, Durham, NC.
- Lewin, K. (1951). *Field Theory in Social Science*, Harper, New York.
- Locke, E. A. (1969). 'What is job satisfaction?' *Organizational Behavior and Human Performance*, **4**, 309-336.
- Locke, E. A. (1976). 'The nature and causes of job satisfaction', In: Dunnette, M. (Ed.), *Handbook of Industrial and Organizational Psychology*, Rand McNally, Chicago, pp. 1297-1350.
- Lyons, T. (1971). 'Role clarity, need for clarity, satisfaction, tension, and withdrawal', *Organizational Behavior and Human Performance*, **6**, 99-110.
- McGrath, J. E. (1970). 'A conceptual framework for research on stress'. In: McGrath, J. E. (Ed.) *Social and Psychological Factors in Stress*, Holt, Rinehart, and Winston, New York, pp. 10-21.
- McGrath, J. E. (1976). 'Stress and behavior in organizations'. In: Dunnette, M. (Ed.) *Handbook of Industrial and Organizational Psychology*, Rand McNally, Chicago, pp. 1351-1395.
- Mobley, W. H. and Locke, E. A. (1970). 'The relationship of value importance to satisfaction', *Organizational Behavior and Human Performance*, **5**, 463-483.
- Murray, H. (1938). *Explorations in Personality*, Oxford University Press, New York.
- Naylor, J. C., Pritchard, R. D. and Ilgen, D. R. (1980). *A Theory of Behavior in Organizations*, Academic Press, New York.
- O'Brien, G. E. and Dowling, P. (1980). 'The effects of congruency between perceived and desired job attributes upon satisfaction', *Journal of Occupational Psychology*, **53**, 121-130.
- Pedhazur, E. G. (1982). *Multiple Regression in Behavioral Research*, Holt, Rinehart, and Winston, New York.
- Pervin, L. A. (1967). 'A twenty-college study of student x college interaction using TAPE (Transactional Analysis of Personality and Environment): Rationale, reliability, and validity', *Journal of Educational Psychology*, **58**, 290-302.
- Porter, L. W. and Lawler, E. E. (1968). *Managerial attitudes and performance*, Homewood, IL: Dorsey Press.
- Rounds, J. B., Dawis, R. W. and Lofquist, L. H. (1987). 'Measurement of person-environment fit and prediction of satisfaction in the Theory of Work Adjustment', *Journal of Vocational Behavior*, **31**, 297-318.
- Scarpello, V. and Campbell, J. P. (1984). 'Job satisfaction and the fit between individual needs and organizational rewards', *Journal of Occupational Psychology*, **56**, 315-328.
- Schneider, B. (1978). 'Person-situation selection: A review of some ability-situation interaction research', *Personnel Psychology*, **31**, 281-297.
- Schuler, R. S. (1980). 'Definition and conceptualization of stress in organizations', *Organizational Behavior and Human Performance*, **25**, 184-215.
- Schwab, D. P. and Cummings, L. L. (1970). 'Theories of performance and satisfaction: A review', *Industrial Relations*, **7**, 408-430.

- Smith, M. J. and Robertson, I. T. (1989). *Advances in Selection and Assessment*, Wiley, Chichester.
- Stokols, D. (1979). 'A congruence analysis of human stress'. In: Sarason I. G. and Spielberger, C. D. (Eds) *Stress and Anxiety*, Hemisphere, Washington, DC, pp. 27-53.
- Super, D. E. (1970). *Work Values Inventory*, Houghton-Mifflin, Boston.
- Tannenbaum, A. S. and Kuleck, W. J., Jr. (1978). 'The effect on organization members of discrepancy between perceived and preferred rewards implicit in work', *Human Relations*, **31**, 809-822.
- Wall, T. D. and Payne, R. (1973). 'Are deficiency scores deficient?' *Journal of Applied Psychology*, **58**, 322-326.
- Werts, C. E. and Linn, R. L. (1970). 'A general linear model for studying growth', *Psychological Bulletin*, **73**, 17-22.