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Applying the Bradley–Terry–Luce method to P–E fit

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Abstract

This study attempted to increase the size of the correlation between person–environment (P–E) fit and job satisfaction by rescaling the instrumentation of the Theory of Work Adjustment using the Bradley–Terry–Luce method and a probability-based fit index. This approach worked as well as, but failed to outperform, the currently used correlation-based fit index. However, a probability-based fit index offers the advantage of being intuitively easier to understand than a correlation-based index. The very high correlation between the correlation-based fit index and the probability-based fit index suggests that both assess the same construct. It is argued that, considering the restriction of range common to all assessments of job satisfaction, the correlation between fit index and job satisfaction may not represent an upper limit, but rather a lower bound of the relationship between P–E fit and job satisfaction.
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Keywords: Job satisfaction; Theory of Work Adjustment; Person–environment fit; Bradley–Terry–Luce

1. Introduction

In a recent review of the person–environment (P–E) fit literature, Tinsley (2000) called P–E fit models "ubiquitous in vocational psychology" (p. 148) and concluded that the research support was overwhelming "that the P–E fit model provides a valid and useful way of thinking about the interaction between the individual and the

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environment" (p. 150). Recently, key elements from two of the most widely applied P–E fit models, Holland's RIASEC theory and the Theory of Work Adjustment were incorporated into the Occupational Information Network (O*NET), the electronic database that is the successor to the Dictionary of Occupational Titles. This inclusion will no doubt ensure that P–E fit models will continue to be central to vocational psychology for the foreseeable future.

Unfortunately, despite the widespread acceptance and success of P–E fit models, there remain significant methodological challenges to overcome. The crux of P–E fit models is the ability to make meaningful predictions about outcome based upon the quality of fit between the characteristics of a person and of an environment. Although many studies report statistically significant relationships between fit and outcome, the amount of outcome variance accounted for remains modest, usually around 10%.

In their review of the Theory of Work Adjustment literature investigating the relationship between need-reinforcer correspondence and job satisfaction, Lofquist and Dawis (1984) reported correlations that ranged from a low of .14 to a high of .55, with most values falling in the .3–.45 range. In related work that compared several indices of fit and a variety of methods for describing workplace reinforcers, Rounds (1981) reported a median correlation of .33.

1.1. Measurement assumptions

It has been suggested that the failure of P–E fit models to consistently account for more than 10% of outcome variance may be the result of their failure to meet the measurement assumptions of P–E fit models (Tinsley, 2000). Rounds, Dawis, and Lofquist (1987) list several measurement assumptions of P–E fit models:

1. The measurement of environmental characteristics and person attributes should utilize commensurate dimensions and units.
2. The level of measurement for the environmental characteristics and person attributes should be at least interval.
3. The measurement of person attributes should be independent of the measurement of the environmental characteristics.

The importance of these assumptions becomes clearer if the assessment of P–E fit is framed in terms of profile matching. In P–E fit models, a profile of the psychological attributes of an individual is compared to a profile characterizing an environment. Difference scores, involving either the simple summation of arithmetic differences or squared differences between two profiles, offer the most intuitively obvious method to characterize the degree of fit between two profiles. A small total represents similar profiles and is interpreted as representing a satisfactory fit. A large total represents dissimilar profiles and is interpreted as representing an unsatisfactory fit. The difference score approach assumes an interval level of measurement and commensurate units of measurement upon commensurate dimensions characterizing both persons and environments. For a thorough discussion of the problems and limitations of profile matching, the reader is referred to Cronbach and Gleser (1953) and Cronbach and Furby (1970).

Although some research has provided evidence of commensurate dimensions for person attributes and environmental characteristics (Seaburg, Rounds, Dawis, & Lofquist, 1976), researchers have been unable to clearly demonstrate commensurate units of measurement for persons and environments (Rounds et al., 1987). In addition, as has been recognized since Stevens's (1946) influential paper, the level of measurement in psychology rarely reaches the level of interval. However, one might be tempted to ignore violated measurement assumptions if warranted by the practical ability to effectively predict the quality of P–E fit. Unfortunately, such is not the case with difference scores. In a study comparing nineteen statistical indices of fit, including difference scores, across six occupational groups, Rounds et al. (1987) found that the best predictor of fit was a product moment correlation.

1.2. Information loss and paradox

Tinsley (2000) suggested that the true relationship between P–E fit and outcome may be underestimated due to the use of fit indices that discard information. This is certainly the case when a correlation coefficient is used to characterize the fit between person and environment. Cronbach and Gleser (1953) proposed that there are three levels of information in profile data: elevation, scatter, and shape. Elevation is the mean of all scores for a given subject. Scatter is the square root of the sum of the subject's squared deviation scores about her/his own mean. Shape is the residual information in the scores after elevation and scatter have been factored out. Shape essentially consists of rank ordering information. Difference score indices make use of all three levels of information. A correlation coefficient utilizes only shape.

P–E fit researchers thereby find themselves on the horns of a dilemma. The ability to estimate the degree of the fit between person and environment is undermined by using fit indices that discard relevant information. Unfortunately, it is the very fit indices (correlation coefficients) that discard the most profile information that ultimately have proven to be most predictive of the quality of P–E fit. Even less satisfying, these "best" fit indices typically only account for about 10% of the total outcome variance.

1.3. The Theory of Work Adjustment

Tinsley (2000) called the Theory of Work Adjustment (TWA) one of "the most thoroughly investigated and widely applied P–E fit models ever developed" (p. 148). The TWA views work as an interactive and reciprocal process between the individual and the work environment (Dawis & Lofquist, 1984). The individual fulfills the labor requirements of the work environment, in exchange for which the work environment fulfills a range of financial, social, and psychological needs for the individual. Twenty work-related reinforcer dimensions are used to operationalize the match between the work-related needs of the individual and the reinforcer offerings of the work environment. The work-related reinforcer dimensions used by the TWA are listed in Table 1.

Table 1
The 20 reinforcers of the Theory of Work Adjustment

Ability utilization
Achievement
Activity
Independence
Variety
Compensation
Security
Working conditions
Advancement
Recognition
Authority
Social status
Co-workers
Social service
Moral values
Company policies
Supervision—Human relations
Supervision—Technical
Creativity
Responsibility

The Minnesota Importance Questionnaire (MIQ) is used to assess an individual's preferred pattern and level of work-related reinforcers (their work related needs). The Minnesota Job Description Questionnaire (MJDQ) is used to assess the pattern and level of work-related reinforcers that are typically available to members of a particular occupational group. The resulting profile is termed an Occupational Reinforcer Pattern (ORP). The Minnesota Satisfaction Questionnaire (MSQ) is used to assess an individual's level of satisfaction with their work-related needs on their current job.

Tinsley (2000) referred to the instrumentation of the TWA as "an exemplar of commensurate measurement" (p. 152). Despite this high praise, research indicates that although the instrumentation of the TWA does demonstrate comparison of the person and the environment upon commensurate dimensions (Seaburg et al., 1976), it does not have commensurate units of measurement on these dimensions (Rounds et al., 1987). However, despite this caveat, the instrumentation of the TWA is arguably the most rigorously developed and validated operationalization of any existing P–E fit model.

1.4. Thurstone's Case V

Currently, the MIQ and the MJDQ are both scaled using Thurstone's law of comparative judgment, Case V (Rounds, Henly, Dawis, Lofquist, & Weiss, 1981). Thurstone's law of comparative judgment uses a cumulative normal distribution to determine scale values. Thurstone's Case V may be expressed as

$$s_j - s_k = z_{jk}, \tag{1}$$

in which s_j is the scale value for stimulus j, s_k is the scale value for stimulus k, and z_{jk} is the standard deviate value corresponding to the proportion of judgments in which stimulus j is chosen over stimulus k (Thurstone, 1927).

1.5. The Bradley–Terry–Luce method

The Bradley–Terry–Luce (BTL) method for paired comparisons data may be expressed as

$$u_j - u_k = -\ln\left(\frac{1 - p(j,k)}{p(j,k)}\right), \tag{2}$$

in which u_j is the scale value for stimulus j, u_k is the scale value for stimulus k, $p(j,k)$ is the proportion of judgments in which stimulus j is chosen over stimulus k $(p \neq 0, 1)$ (Baird & Noma, 1978).

Mathematically, BTL differs from Thurstone's Case V only in that it uses a logistic distribution to determine scale values. The scale values generated by Case V and BTL are linearly related over the broad range of typically scaled values (Torgerson, 1958). Haley (1952), cited in Hambleton and Swaminathan (1985), demonstrated that if Case V derived scale values are multiplied by a constant of 1.7 and are inserted into the BTL model, the choice probabilities will never differ by more than .01.

McGuire and Davison (1991) demonstrated that the BTL model could be expressed as

$$\prod\nolimits_{jk} = \frac{e^{(u_k - u_k)}}{1 + e^{(u_k - u_j)}}, \tag{3}$$

in which $\prod_{jk}$ is the proportion of trials in which stimulus k is preferred to stimulus j.

This expression of the BTL model lays the foundation for the development of a probability-based index that can be used to characterize the quality of P–E fit.

1.6. Application of a BTL fit index to the TWA

Ideally, in P–E fit modeling the measurement of environmental characteristics should be independent of the measurement of the environmental characteristics (Rounds et al., 1987). This is typically accomplished by using the responses from one group to characterize the "environment" and then using the responses of individuals in a second group to represent the "persons" for whom a prediction of fit will be calculated.

Within the framework of the Theory of Work Adjustment (TWA), an Occupational Reinforcer Pattern (ORP) characterizing the workplace reinforcers typically available in a workplace is generated from the Minnesota Job Description Questionnaire (MJDQ) responses of a group of workplace incumbents. The Minnesota Importance Questionnaire (MIQ) responses from a second group of incumbents are used to generate profiles describing their individual preferences for workplace reinforcers. The level of job satisfaction for each member of the second group of incumbents is described by their responses to the Minnesota Satisfaction Questionnaire (MSQ). The match between the ORP and the individual MIQ profiles should be predictive of the individual MSQ scores.

Therefore, given two groups, let Group 1 represent those workers whose MJDQ responses are being used to generate an ORP. Let Group 2 represent those workers whose MIQ responses will be used to generate individual reinforcer preference profiles. Using Eq. (3) as a starting point, it is possible to estimate the likelihood that the MJDQ responses of Group 1 could have generated the MIQ profile of a given worker in Group 2. In other words, it is possible to estimate the probability that a given worker in Group 2 could have responded in the manner that he or she did on the MIQ and have been a member of Group 1.

Taking a given person n from Group 2, we define x_{jk} to be the responses to the paired comparison of stimulus j and stimulus k. If stimulus k is chosen over stimulus j, then $x_{jk} = 1$. If stimulus j is chosen over stimulus k, then $x_{jk} = 0$. In this instance, $x_{jk} = 1$ represents agreement in pair-wise reinforcer preference choice between the MIQ responses of person n and the MJDQ responses of Group 1. The probability that person n from Group 2 responded such that $x_{jk} = 1$ is P^n_{jk}, which may be expressed as

$$P^n_{jk} = \frac{e^{(\hat{u}_k - \hat{u}_j)}}{1 - e^{(\hat{u}_k - \hat{u}_j)}}, \tag{4}$$

where $\hat{u}_j$ is the estimated scale value for stimulus j and $\hat{u}_k$ is the estimated scale value for stimulus k.

In instances when there is disagreement in pair-wise reinforcer preference choice between the MIQ responses of person n and the MJDQ responses of Group 1, $x_j = 0$. The probability that person n will respond such that $x_{jk} = 0$ is $1 - P^n_{jk}$, which may be expressed as

$$1 - P^n_{jk} = \frac{1}{1 + e^{(\hat{u}_k - \hat{u}_j)}}. \tag{5}$$

Combining Eqs. (4) and (5) we may now predict the probability that the pattern of environmental descriptor responses from Group 1 could have generated the person descriptor responses of person n in Group 2. If $\vec{x}^n_{jk}$ is the vector of paired comparison MIQ responses from person n from Group 2, then

$$P^s(\vec{x}^n) = \Pi_{(j,k)} \left[\frac{1}{1 + e^{-(\hat{u}_k - \hat{u}_j)}} \right]^{x^n_{jk}} \left[\frac{1}{1 + e^{(\hat{u}_k - \hat{u}_j)}} \right]^{(1 - x^n_{jk})}, \tag{6}$$

where $P^s(\vec{x}^n)$ is the probability that the vector of person MIQ responses from person n could have been generated by the MJDQ responses of Group 1.

Application of Eqs. (4) and (5) to the MIQ responses of a single person n (from Group 2) will generate a vector of probabilities. Each probability represents the likelihood that person n could have responded in the manner that she or he did to a given item pair and been a member of the work environment reference group (Group 1). Application of Eq. (6) to this vector of probabilities will yield a single probability that person n's MIQ responses could have been generated by the MJDQ responses of the work environment reference group (Group 1). For the purposes of this study, this probability has been termed the P-Index.

Equations (4)–(6) are perhaps best understood if conceptualized as being somewhat analogous to the method used to calculate the probability of an event with a binomial distribution for $n = 1$, describing a Bernoulli random variable x. The formula for calculating this probability for $n = 1$ is

$$p(k) = p^k q^{1-k} \tag{7}$$

where $p(k)$ is the probability of k successes in n trials, k is 1 if a success and 0 if not, $1 - k$ is the number of failures, p is the proportion of cases in one of the categories, and q is the proportion of cases in the other category ($q = 1 - p$).

The use of the P-Index offers two advantages. One advantage is that it less directly challenges the measurement assumptions of P–E fit models than do difference score approaches. As such, it may prove more robust to violated measurement assumptions and thereby account for an increased amount of outcome variance by incorporating more levels of information into the calculation of the fit index than are used by a correlation coefficient. A second, more prosaic advantage is that a fit index based upon the probability of group membership is intuitively easier to understand, for both client and counselor, than fit indices based upon either difference scores or correlation coefficients. For example, telling vocational guidance clients that there was an 80% chance that a member of a given occupational group would have answered the questions in the same way that they did is far clearer than informing them that their reinforcer preference profile correlated .80 with the reinforcer profile for a given occupational group.

2. Methods

2.1. The study sample

A sample of 71 nurses was recruited from a Department of Veterans Affairs medical center located in a Southwestern state. Nurses were recruited from all areas of patient care so that the research sample would reflect a cross section of the entire nursing service at the medical center. The entire sample was composed of 9 males and 62 females with a mean age of 44.8 years (*SD* 9.1), a mean educational level of 16.2 years (*SD* 1.8), and a mean of 15.9 years (*SD* 10.0) in the occupation of nursing. Fifteen of the 71 nurses who participated in this study were nurse managers. It was decided to include nurse managers in the study as staffing patterns at this medical center require that, in addition to their administrative duties, most nurse managers be frequently involved in direct patient care. Therefore, they remain very familiar with the day-to-day activities of the staff nurses whom they supervise. In addition, research conducted by the developers of the MJDQ indicates that valid Occupational Reinforcer Patterns can be generated by supervisors (Borgen, Weiss, Tinsley, Dawis, & Lofquist, 1968). Consequently, as a precaution, all of the nurse managers were assigned to the group describing the typical work environment.

2.2. The study groups

The sample was divided into two groups. With the exception of the nurse managers, who were all assigned to the Group 1, the nurses were randomly assigned to the two groups.

2.2.1. Group 1

Thirty of the nurses completed a version of the MJDQ that had been modified to use a paired comparison format. This group was composed of 6 males and 24 females with a mean age of 46.6 years (*SD* 8.8), a mean educational level of 16.8 years (*SD* 1.8), and a mean of 16.4 years (*SD* 11.3) in the occupation of nursing. The MJDQ responses from Group 1 were used to generate an ORP representing the profile and level of work reinforcers typically available to nurses at this medical center.

2.2.2. Group 2

Forty-one of the nurses completed both the MIQ and the MSQ. This group was composed of 3 males and 38 females with a mean ages of 43.3 years (*SD* 9.3), a mean educational level of 15.9 years (*SD* 1.8), and a mean of 15.6 years (*SD* 9.0) in the occupation of nursing. The MIQ responses for each nurse in Group 2 were scored to generate their individual profiles of work reinforcer preferences.

2.2.3. Comparison of the study groups

There were no significant differences between the groups in proportion of males and females ($p = .154$), age ($p = .47$), or years in the occupation of nursing ($p = .18$). However, there was a significant difference between the groups in educational level ($p = .045$). This difference likely reflects the assignment of all of the nurse managers to Group 1. As might be expected, nurse managers tend to have higher levels of education than staff nurses.

2.3. Instrumentation

The Minnesota Importance Questionnaire (MIQ) assesses an individual's preferences for 20 vocationally relevant reinforcers common, in varying degrees, to all work settings (Dawis & Lofquist, 1984; Gay, Weiss, Hendel, Dawis, & Lofquist, 1971; Lofquist & Dawis, 1984). A single item statement is used to represent each reinforcer. Thus the MIQ uses a total of 20 different reinforcer statements. These 20 statements are presented in pairs, in every possible combination, in a forced choice format. There are a total of 190 pairings. Subjects are asked to choose the statement from each pair that best describes their "ideal" job. The published version of the MIQ is scored using Thurstones's Case V. A profile is generated describing the pattern and level of these 20 reinforcers for the individual's "ideal" job.

The Minnesota Job Description Questionnaire (MJDQ) assesses work environments for the available level of the same 20 work-related reinforcers used by the MIQ (Dawis & Lofquist, 1984; Weiss, Dawis, England, & Lofquist, 1964). The responses of a group of workplace incumbents to the MJDQ are scored to generate an ORP describing the pattern and levels of work-related reinforcers typical to workers in that occupation. The published version of the MJDQ presents the work reinforcers statements in groups of 5. Subjects are asked to rank the statements from most to least descriptive of the work environment being rated. A paired comparison response matrix is then constructed from these rankings and results are scored using Thurstone's Case V. However, the BTL method assumes independence of responses for choice comparison and the paired comparison matrix generated from the ranked form violates this assumption. Therefore, for the purposes of this study, the MJDQ was reformatted into a paired comparison version.

The Minnesota Satisfaction Questionnaire-short form (MSQ) assesses an individual's current satisfaction with the levels of these same 20 work-related reinforcers on the individual's present job. A 5-point rating scale is used. The responses are scored to produce extrinsic, intrinsic and general satisfaction scores. The general satisfaction scale scores reflect a worker's job satisfaction on a global level. The extrinsic satisfaction scale contains items reflecting workplace reinforcers that, for the most part, are under the control of one's employer. The extrinsic reinforcers are: compensation, security, working conditions, advancement, recognition, company policies, supervision—human relations, supervision—technical, and co-workers. The intrinsic satisfaction scale contains items that reflect self-reinforcement and the quality of social interactions on the job. The intrinsic reinforces are: ability utilization, achievement, activity, independence, social status, social service, moral values, authority, creativity, and responsibility.

The fit between a MIQ profile and an ORP is assessed by using a product moment correlation, which is termed the C-Index. The C-Index is typically correlated around .30 with the MSQ general satisfaction score (Rounds et al., 1987).

2.4. Data analysis

For the purposes of this study, the MJDQ and the MIQ were both scored twice. The first time using Thurstone's Case V method and a second time using the BTL method. The MSQ-short form was scored in the usual manner by summing the level of endorsement for each of its items, yielding extrinsic, intrinsic and general satisfaction scores. The fit between individual and workplace was assessed in two different ways.

2.4.1. Method 1

The MJDQ responses from Group 1 were scored using Thurstone's Case V and an ORP representing the pattern and level of work reinforcers typically available to nurses at this medical center was generated. The MIQ responses for each nurse from Group 2 were also scored using Thurstone's Case V and individual profiles of work reinforcer preferences were generated. The MIQ scale scores for each nurse were then correlated with the ORP for the medical center. As discussed above, this correlation is termed the C-Index. A small C-Index is interpreted as suggesting that the individual's work reinforcer preferences are very dissimilar to the actual reinforcers present in the medical center. A large C-Index is interpreted as suggesting that the individual's work reinforcer preferences are very similar to the actual reinforcers present in the medical center. The predictive validity of the C-Index was then determined by correlating it with the MSQ general satisfaction, extrinsic satisfaction, and intrinsic satisfaction scale scores.

2.4.2. Method 2

The BTL method was also used to score the MJDQ responses from Group 1. As with Method 1, an ORP was generated. Similarly, the MIQ responses for each nurse from Group 2 were also scored using the BTL method and individual profiles of work reinforcer preferences were generated and P-Index was calculated for each nurse in Group 1. The size of P-Index is interpreted in the same manner as the C-Index.

Eqs. (4) and (5) were used on the MIQ responses of each nurse in Group 2 to generate a vector of 190 probabilities. The 190 probabilities are then multiplied together (Eq. (6)) to obtain a single probability (the P-Index) for the entire response vector. In practice, with 190 probabilities, many of them quite small, the capabilities of many statistical programs are pushed to their limits when attempting to calculate the probability of the entire response vector. Therefore, for calculation purposes, the logarithms of the 190 probabilities were taken. These 190 logarithms were summed and the antilog was taken to generate the P-index. The predictive validity of the P-Index was then determined by correlating it with the MSQ general satisfaction, extrinsic satisfaction and intrinsic satisfaction scale scores.

3. Results

The correlation between the C-Index and the MSQ general satisfaction scores was .33. This correlation was significant and in the predicted direction (one-tailed $t = 2.2$, 39 df, $p < .025$). Fig. 1 is the scatter plot of the C-Index and the general satisfaction scores.

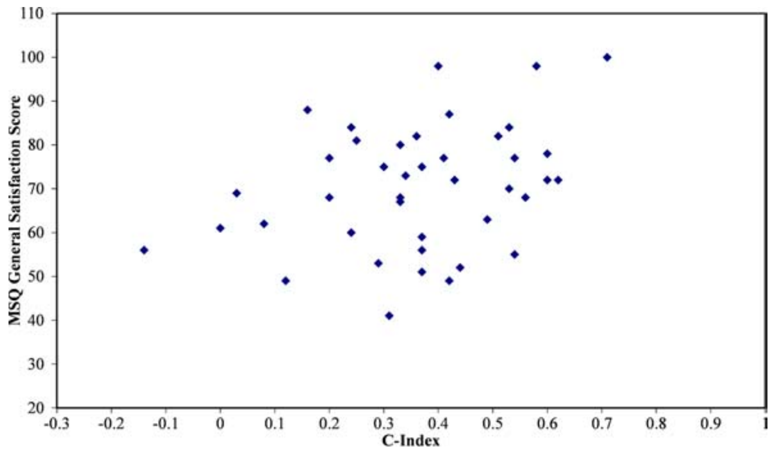

Fig. 1. Scatter plot of the MSQ general satisfaction score with the C-Index.

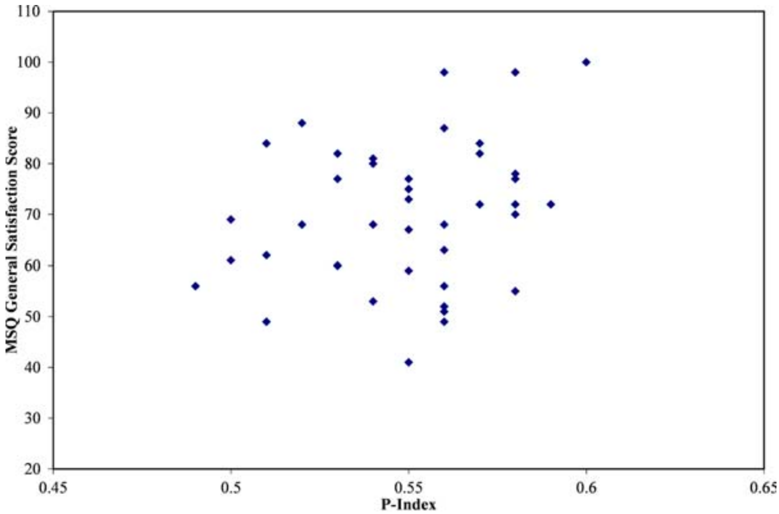

Fig. 2. Scatter plot of the MSQ general satisfaction score with the P-Index.

The correlation between the P-Index and the MSQ general satisfaction scores was .30. This correlation was significant and in the predicted direction (one-tailed $t = 1.96$, 39 df, $p < .05$). Fig. 2 is the scatter plot of the P-Index and the general satisfaction scores.

The correlation between the C-Index and the MSQ extrinsic satisfaction scores was .41. This correlation was significant and in the predicted direction ($p < .01$). The correlation between the C-Index and the MSQ intrinsic satisfaction scores was .20. Although this correlation was in the predicted direction, it was not significant.

The correlation between the P-Index and the MSQ extrinsic satisfaction scores was .36. This correlation was significant and in the predicted direction ($p < .05$). The correlation between the P-Index and the MSQ intrinsic satisfaction scores was .15. As with the C-Index, this correlation was in the predicted direction, but was not significant.

4. Discussion

Although the C-Index and the P-Index are very mathematically dissimilar, both fit indices performed equally well. The correlations between the C-Index and the MSQ general satisfaction scores with the MSQ general satisfaction scores were not significantly different from one another ($z = .13$, $p = .44$). The C-Index and the P-Index were highly correlated ($r = .96$, $p < .001$). The virtually linear relationship between the two fit indices suggests not only do both assess the same construct, but are also, to borrow from the terminology of factor analysis, equally "saturated" with the construct "job fit." (Fig. 3 is the scatter plot of the C-Index with the P-Index.) If such is

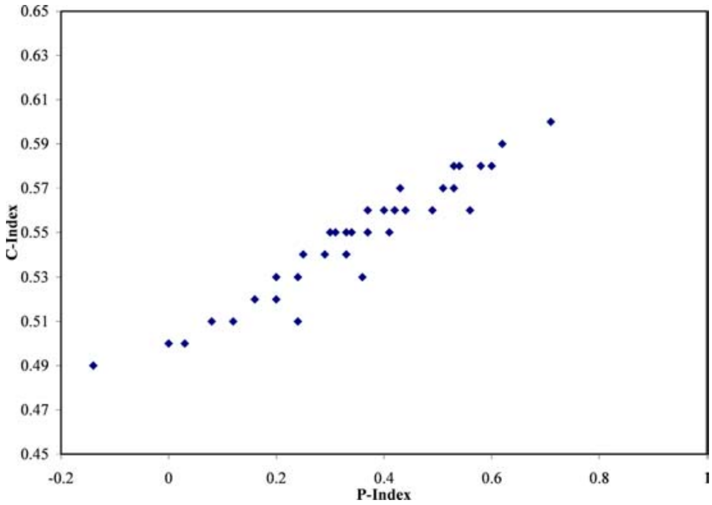

Fig. 3. Scatter plot of the P-Index with the C-Index.

truly the case, additional efforts with increasingly sophisticated fit indices will be wasted, as the humble correlation coefficient will likely perform just as well.

Given the findings of previous studies (Lofquist & Dawis, 1984; Rounds, 1981) these results might easily be interpreted as additional evidence that the upper bound of the relationship between P–E fit and job satisfaction will only account for 10% of the outcome variance. However, as Tinsley (2000) pointed out, restriction of range on key variables may contribute to a lowering of the estimated relationship between job fit and job satisfaction. The variables in this study may suffer from such restriction in ways that could serve to lower the estimated relationship between P–E fit and satisfaction.

The TWA predicts that those individuals who are most dissatisfied in a work setting tend to leave it. Those individuals who remain, no matter how disgruntled, are at least satisfied enough to remain employed at their present workplace. As a result, the distribution of both job fit and job satisfaction within any given work setting has had its lowermost tail truncated. Given that the true range on these two variables is unknown, it is difficult to correct for this restriction of range. Further complicating efforts to correct for this restriction of range is work suggesting that although the upper range of outcomes measures may meet the assumptions of linearity and homoscedasticity, the lower score ranges often do not (Brown, Stout, Dalessio, & Crosby, 1988; Law, Schmidt, & Hunter, 1994a, 1994b).

As noted above, one effect of such a restriction of range could be a lowering of the correlation between job fit and job satisfaction (Tinsley, 2000). As such, any correlation between job fit and job satisfaction may actually to be the lowermost estimate of the true size of this relationship rather than an upper limit.

There are two other elements that could have lowered the size of the estimated relationship between P–E fit and job satisfaction in this study. One is the instrumentation used to operationalize job satisfaction and the other involves situational factors in play at the data collection site during the period of data collection.

Although mathematically, the general satisfaction scale scores appear to represent an adequate range, psychologically they may be constricted. Scores of 80 or higher on the MSQ-short form general satisfaction scale indicate satisfaction with the overall level of work-related reinforcers available on one's present job. Inspection of Figs. 1 and 2 reveals that only 11 of 41 subjects (24% of the sample) in this study had MSQ general satisfaction scale scores of 80 or higher. The remaining subjects had scores indicating that they were less than fully satisfied with the overall level of work-related reinforcers available on their present jobs. However, consistent with the predictions of the TWA, none of the nurses reported being very dissatisfied. Thirty-one of the 41 nurses (76%) in this study reported their general satisfaction as being at least neutral or better. Of the remaining 10 nurses, only 3 scored closer to dissatisfied than to neutral.

The picture that emerges is somewhat murky. As expected from the prediction of the TWA, all of the workers are satisfied enough to remain in the workplace, but only 24% are clearly satisfied. The remaining 76% report anything from mild dissatisfaction to mild satisfaction. The majority might therefore be described as ambivalent. It is possible that when workers are ambivalent, their ability to make meaningful discriminations between levels of satisfaction may be compromised. If such is the case, these ratings may not be reliable and could lead to a lowering of the correlation between job fit and job satisfaction.

This interpretation is supported, in part, by the experiences of the developers of the MSQ. MSQ versions using two different sets of scale anchors have been developed (D.J. Weiss, personal communication, February 14, 2002). The earlier version used a symmetric scale with the response categories: very dissatisfied, dissatisfied, neutral, satisfied, and very satisfied. The test developers found that most workers tended to concentrate their responses in the categories of satisfied or very satisfied. They were able to increase response variability on a later version by using the asymmetric response categories: not satisfied, slightly satisfied, satisfied, very satisfied, and extremely satisfied. Unfortunately, the only available short form of the MSQ uses the symmetric response categories. In an effort to reduce participant burden, the short form was used in this study. Overall, a need is indicated for further research to investigate the impact of scale anchors on worker reports of job satisfaction, particularly in settings containing a large proportion of ambivalent workers.

The medical center was being restructured while the data for this study were being collected. As a consequence of this restructuring, several inpatient wards were closed. Many longstanding work groups were broken up and the nurses reassigned to unfamiliar work settings with new co-workers. Spontaneous comments made to the researcher at the time of this study, indicated the unfavorable reaction of most nurses to these changes. Overall, nursing morale was considered by hospital administrators to be fairly low. Support for these anecdotal comments is found by looking at the extrinsic and intrinsic satisfaction subscales from the MSQ. Recall that the extrinsic satisfaction scale contains items reflecting workplace reinforcers, which for the most

```
Sample size: 41
Occupation:  Nurse
                                Very                                    Very
                               Dissat.   Dissat.     N        Sat.      Sat.
                                 1.0       2.0      3.0       4.0       5.0
                          Score   |.........|.........|.........|........|

  ACHIEVEMENT              3.7*                                V
Ability Utilization        3.8               -------------X------------
Achievement                3.6              ------------X-----------
  COMFORT                  3.7*                                V
Activity                   4.0                     ---------X--------
Independence               3.8                   ---------X---------
Variety                    3.6              ------------X-----------
Compensation               3.5           --------------X-------------
Security                   4.2                     ----------X---------
Working Conditions         3.2          -----------X-----------
  STATUS                   3.3*                            V
Advancement                3.2        -------------X-------------
Recognition                3.0      -------------X-------------
Authority                  3.6                 ---------X--------
Social Status              3.3            ----------X----------
  ALTRUISM                 3.8*                                 V
Co-workers                 3.3.          -----------X-----------
Social Service             4.3                       ---------X--------
Moral Values               3.8                 -----------X----------
  SAFETY                   3.0*                          V
Company Policies           2.8     ------------X------------
Supervision-Human Relations3.0     ---------------X--------------
Supervision-Decision Making3.3          ------------X------------
  AUTONOMY                 3.6*                              V
Creativity                 3.5              ----------X----------
Responsibility             3.6             ------------X------------
                          Score   |.........|.........|.........|.........|
```

Fig. 4. Group 2 average MSQ profile.

part, are under the control of one's employer. The intrinsic satisfaction scale contains items that reflect self-reinforcement and the quality of social interactions on the job. Examination of the group average MSQ profile (Fig. 4) reveals that members of Group 2 reported their lowest levels of job satisfaction with 8 of the 9 extrinsic reinforcers. Conversely, they reported their highest levels of job satisfaction with 10 of the 11 intrinsic reinforcers. However, as reported earlier, only extrinsic satisfaction was significantly correlated with job fit in this study. Taken together, these findings suggest that due to the painful restructuring occurring at this medical center at the time of this study, the reinforcers associated with extrinsic satisfaction may have been more salient for these nurses than the reinforcers associated with intrinsic satisfaction.

5. Conclusions

Although this study failed to increase the amount of outcome variance accounted for by P–E fit, the high correlation ($r = .96$) between the correlation based C-Index and the mathematically dissimilar P-Index argue that both are assessing the same construct. This finding suggests that any other efforts, using even more sophisticated fit indices, will likely be doomed to similar failure. Although the P-Index performed no better than the C-Index, the interpretive ease of a probability-based index, as compared to a correlation-based index, argues in its favor.

It has long been recognized in the vocational literature that job satisfaction scores suffer from a restriction of range. The lowermost end of the distribution of job satisfaction scores in any work setting is typically truncated, for the simple reason that the most dissatisfied individuals quickly leave a work setting and therefore are not available to be assessed. One likely consequence of such a restriction of range is a lowering of the size of the correlation between P–E fit and job satisfaction. As such, it is possible that the results of this and similar studies, do not represent an upper limit on the size of the relationship between P–E fit and job satisfaction, but rather a lower bound estimate of the true size of this relationship.

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References

Baird, J. C., & Noma, E. (1978). *Fundamentals of scaling and psychophysics*. New York: Wiley.

Borgen, F. H., Weiss, D. J., Tinsley, H. E. A., Dawis, R. V., & Lofquist, L. H. (1968). *Minnesota studies in vocational rehabilitation: XXV. The measurement of occupational reinforcer patterns*. Minneapolis: Vocational Psychology Research.

Brown, S. H., Stout, J. D., Dalessio, A. T., & Crosby, M. M. (1988). Stability of validity indices through test score ranges. *Journal of Applied Psychology, 73*(4), 736–742.

Cronbach, L. J., & Furby, L. (1970). How we should measure "change"—Or should we? *Psychological Bulletin, 74*, 68–80.

Cronbach, L. J., & Gleser, G. C. (1953). Assessing similarity between profiles. *Psychological Bulletin, 50*(6), 456–473.

Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment*. Minneapolis: University of Minnesota Press.

Gay, E. G., Weiss, D. J., Hendel, D. D., Dawis, R. V., & Lofquist, L. H. (1971). *Manual for the Minnesota Importance Questionnaire. Minnesota studies in vocational rehabilitation: XXVIII*. Minneapolis: University of Minnesota.

Haley, D. C. (1952). Estimates of the dosage mortality relationship when the dosage is subject to error (Technical Report No. 15), Stanford University Applied Mathematics and Statistics Laboratory, Stanford, CA.

Hambleton, R. K., & Swaminathan, H. (1985). *Item response theory: Principles and applications*. Boston, MA: Kluwer-Nijhoff.

Law, K. S., Schmidt, F. L., & Hunter, J. E. (1994a). Nonlinearity of range corrections in meta-analysis: Test of an improved procedure. *Journal of Applied Psychology, 79*(6), 425–438.

Law, K. S., Schmidt, F. L., & Hunter, J. E. (1994b). A test of two refinements in procedures for meta-analysis. *Journal of Applied Psychology, 79*(6), 978–986.

Lofquist, L. H., & Dawis, R. V. (1984). Research on work adjustment and satisfaction: Implications for career counseling. In S. D. Brown, & R. W. Lent (Eds.), *Handbook of counseling psychology* (pp. 216–237). New York: Wiley.

McGuire, D. P., & Davison, M. L. (1991). Testing group differences in paired comparisons data. *Psychological Bulletin, 110*, 171–182.

Rounds, J. B. (1981). The comparative and combined utility of need and interest data in the prediction of job satisfaction. Unpublished doctoral dissertation, University of Minnesota.

Rounds, J. B., Dawis, R. V., & 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.

Rounds, J. B., Henly, G. A., Dawis, R. V., Lofquist, L. H., & Weiss, D. J. (1981). *Manual for the Minnesota Importance Questionnaire*. Minneapolis, MN: University of Minnesota, Vocational Psychology Research.

Seaburg, D. J., Rounds, J. B., Dawis, R. V., & Lofquist, L. H. (1976). *Values as second order needs*. Paper presented at the 84th annual meeting of the American Psychological Association.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science, 103*, 677–680.

Thurstone, L. L. (1927). A law of comparative judgment. *Psychological Review, 34*, 273–286.

Tinsley, H. E. A. (2000). The congruence myth: An analysis of the efficacy of the person–environment fit model. *Journal of Vocational Behavior, 56*, 147–179.

Torgerson, W. S. (1958). *Theory and methods of scaling*. New York: Wiley.

Weiss, D. J., Dawis, R. V., England, G. W., & Lofquist, L. H. (1964). *The measurement of vocational needs. Minnesota studies in vocational rehabilitation: XVI*. Minneapolis: University of Minnesota.