Using Relative Weights to Reanalyze Research on the Job Characteristics Model

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In this study, I re-analyze data from a meta-analysis of research on the job characteristics model (Hackman & Oldham, 1980), using relative weights analysis (Johnson, 2001). This analytic technique is particularly well-suited for analyses in which one wants to most accurately determine the proportion of explained variance in a dependent variable among several independent variables, while avoiding common problems with traditional regression analysis. Some of the results of this re-analysis run counter to the established predictions of the job characteristics model, indicating that this classic model of job design and intrinsic motivation could benefit from further research and rethinking.

INTRODUCTION

According to a framework developed by Reichers and Schneider (1990), a good deal of organizational behavior literature can be considered as being in the "consolidation and accommodation" stage of scientific inquiry, which occurs after stage 1- "introduction and elaboration", in which new models are proposed and tested, and stage 2- "evaluation and augmentation", in which models are subjected to scrutiny, tested against alternate models, and are expanded upon. In the "consolidation and accommodation" stage, there is a reduction in controversies and an agreement on definitions, antecedents and consequences. This is especially true of the Job Characteristic Model and other models of the motivational effects of job design, , which began in earnest in the 1970's and 1980's. While this means that the basic tenets of job design have become established and codified into management practice, academic reviews and college textbooks, there is a danger that established areas of agreement are no longer questioned or critically reanalyzed. The goal of the present research is to critically reanalyze the research on the Job Characteristics Model using comprehensive meta-analytic data and a recently-developed statistical technique best suited towards this type of investigation. In this way, the continued validity of this foundational organizational behavior models can either be supported or called into question.
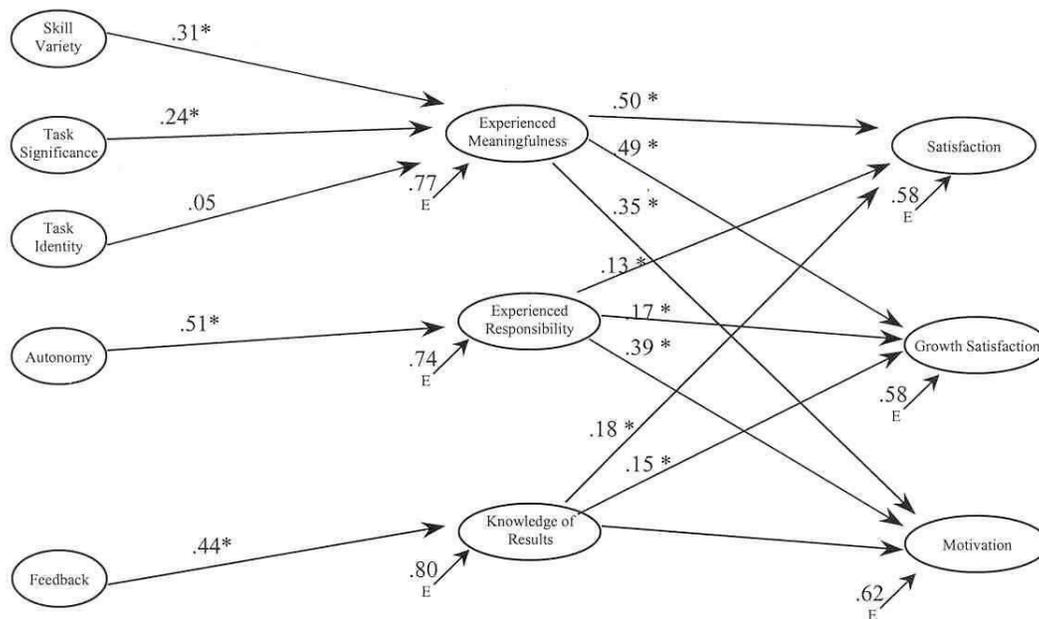
THE JOB CHARACTERISTICS MODEL

Hackman and Oldham's (1975, 1976, 1980) Job Characteristics Model (JCM) is one of the most influential theories ever presented in the field of organizational behavior. It has served as the basis for scores of studies and job redesign interventions (over 750 citations, as found in a search of the PSYCinfo database) over the past three decades, and this research has been extensively reviewed (Fried & Ferris 1987; Loher, Noe, Moeller & Fitzgerald, 1985; Taber & Taylor, 1990). The majority of research has

supported the overall validity of the JCM, although critiques and modifications have been offered (Roberts & Glick, 1981; Salancik & Pfeffer, 1978), and the role of the CPS has been questioned (Boonzair & Ficker, 2001).

Specifically, the JCM proposes that the satisfaction and intrinsic motivation an employee feels at work is directly related to their experience of three critical psychological states (CPS) (i.e., experienced meaningfulness, experienced responsibility, and knowledge of results). In turn, these CPS can be elicited by five core job characteristics (CJC) (i.e., skill variety, task identity, task significance, autonomy, and feedback from the job itself). All of these relationships are hypothesized to be moderated by a personal characteristic known as growth need strength, which describes the extent to which one is looking for intrinsic rewards at work, as opposed to focusing solely on extrinsic rewards. It has often been described as a fully mediated model (Behson, Eddy & Lorenzet, 2000). This model is pictured in Figure 1.

FIGURE 1
HACKMAN & OLDHAM'S (1976) ORIGINALLY-CONCEIVED JOB CHARACTERISTICS MODEL WITH THE META-ANALYTIC AND STRUCTURAL EQUATION MODELING RESULTS FROM BEHSON, EDDY & LORENZET (2000) INCLUDED.

Interestingly, an evaluation of the research that has been conducted on the JCM suggests that few researchers have tested the model the way in which it was originally proposed. The vast majority of studies have omitted the growth need strength moderator. Further, most studies using the JCM framework have omitted the CPS, and have instead investigated only the direct relationships between the CJC and a number of outcomes. (Renn & Vandenberg, 1995). This seems to have occurred despite no theoretical or practical rationale for this practice (Fried & Ferris, 1987; Hogan & Martel, 1987; Renn & Vandenberg, 1995). This consistent omission of the CPS from empirical investigations of the JCM could lead to erroneous predictions (Fox & Feldman, 1988).

Further, this lack of available data has prevented two of the three major meta-analytic reviews of the JCM from making definitive statements about the CPS. While Fried and Ferris (1987) included 76 studies in their meta-analysis of the JCM, they could find only eight studies that examined the entire JCM (i.e., including the CPS) and only three that tested the mediating effects of the CPS. Thus, Fried and Ferris (1987) were unable to make definitive conclusions as to the validity or importance of the CPS, although

they stated in their qualitative discussion that there was suggestive evidence that the CPS are critical to the model. The Loher et al. (1985) meta-analysis did not address the critical psychological states at all. Rather, it focused solely on the relationships between the CJC and satisfaction.

Behson, et al. (2000) conducted a meta-analysis including only studies that included all elements of the JCM and tested alternative models (i.e., the JCM with and without including the CPS) using their meta-analytic data as input to a structural equations modeling analysis (using a procedure described by Viswesvaran & Ones, 1995). They found evidence that the full JCM model explained more variance in the dependent variables and contained a greater percentage of statistically significant causal pathways than the abridged version of the JCM, but that the full model represented a poorer fit to the data. This supported the importance of utilizing the full JCM over partial models.

Further, all of the studies that have investigated the JCM (including Behson et al., 2000) have done so using correlational and regression techniques. However, due to the noted problems with using regression analysis to determine the relative strength of prediction among independent variables (Nunnaly & Bernstein, 1994), regression-based techniques (including factor analysis and structural equation modeling) do not represent the most appropriate analytic strategy for determining the amount of criterion variance that is uniquely attributable to each of the independent variables. Thus, to date, no research on the motivational approach to job design (and little research in organizational behavior generally) has used analytic strategies specifically constructed to validly test such hypotheses (see Behson, 2005, Budescu 1993, and Johnson, 2004, for details and examples).

Therefore, it remains unclear whether (a) each of the five core job characteristics make a unique contribution to the explained variance in the three critical psychological states, (b) each of the three CPS make a unique contribution to the explained variance in the three most commonly studied important dependent variables (job satisfaction, satisfaction with growth opportunities, and intrinsic motivation), or (c) if each of the five CJCs make a unique contribution to the explained variance in the three dependent variables. In this paper, I use Johnson's (2000) Relative Weight procedure to provide a statistical test of these research questions, using the comprehensive meta-analytic results of Behson, et al. (2000) as my data set.

While I do not offer formal hypotheses for this study, the preponderance of the research on the JCM suggests that:
- o Skill variety, task identity and task significance should be the primary predictors of experienced meaningfulness
- o Autonomy should be the primary predictor of experienced responsibility
- o Feedback should be the primary predictor of knowledge of results
- o All CPS should be related to the three outcome measures, but with no particular predictions of relative weight
- o All CJC should be related to the three outcome measures, with no particular predictions of relative weight. However, the CJC should not be as predictive of outcomes as are the CPS

These predictions are made knowing that, in the past, they have only been tested largely by comparing correlation coefficients or regression-based analyses, which, as will be explained in more detail in the methods section, are prone to bias and, therefore, not the most appropriate analytic strategies for testing such hypotheses. The current study uses Johnson's (2000) relative weights analysis (RWA) procedure to provide the first test of organizational justice using the most appropriate technique for explaining the unique contribution to R^2 among multiple independent variables.

METHOD

Dataset and Measures

The Behson, et al. (2000) meta-analysis was chosen for this study because it is the most comprehensive recent quantitative review of the JCM. It includes thirteen independent studies that each contained information regarding the full JCM model and reported correlations between CPS and CJC

and/or outcome measures. By comparison, while Friend and Ferris (1987) and Loher et al. (1985) included more studies, they did not contain as many studies that examined the entire JCM. Further, because Behson, et al. (2000) used their meta-analytic results as input into a structural equation model (Viswesvaran & Ones, 1995), their results provide an excellent opportunity to compare the results of the relative weight procedure against those derived from less appropriate regression analyses. Finally, every study contained in the meta-analysis used the Job Diagnostic Survey developed by Hackman and Oldham (1975) to measures all variables in the model. As a result, this meta-analysis did not encounter the potential confound of combining various operationalizations into a single metric. Further, the use of the full Job Diagnostic Survey for all the included studies eliminates the potential problem of having different structural relationships being determined by vastly different sample sizes (Viswesvaran & Ones, 1995). The articles included in this meta-analysis are included in the references of this article, as indicated with asterisks. Please see the original article for a thorough treatment of their analytic methods.

Analytic Strategy

Traditional multiple regression maximizes prediction of a dependent variable by assigning weights to predictors in such a way that the sum of squares attributable to error is minimized (Nunnaly & Bernstein, 1994). However, multiple regression does a poor job in sorting out the relative importance of different predictors, especially in the presence of multicollinearity (Johnson, 2000). Hierarchical regression is the most common regression-based method by which tests of incremental explanation of variance or marginal utility of predictors is conducted. However, regression, including stepwise and hierarchical approaches, as well as structural equations models which rely on both factor analytic and regression techniques, are susceptible to suppressor effects, overestimate the importance of the strongest predictors, underestimate the importance of the less important predictors, and allow slight differences in inter-predictor correlations to change the pattern of derived regression weights (Budescu, 1993; Johnson, 2000).

In response to the limitations of multiple regression to reliably and accurately determine the relative importance of predictors, a number of measures of relative importance have been introduced. Instead of focusing simply on a variable's incremental contribution to R^2, as is commonly assessed in hierarchical regression, measures of relative importance focus on a variable's relative contribution to R^2, taking into account both its unique contribution and its contribution in the presence of other predictors. Of these, Budescu's Dominance Analysis (Azen & Budescu, 2003; Budescu, 1993) and Johnson's RWA (Johnson, 2000, 2001) are seen as the most valid, as both: (a) contain no logical flaws in their development, (b) are expressed as a proportion of R^2 attributable to each independent variable, and (c) consider both direct effects and effects considering the other independent variables in the model (Johnson, 2004; LeBreton, et al., 2007). In this way, these techniques correct for the effects of multicollinearity among predictors and more accurately determines each predictor's relative contributions to the explained variance of the dependent variable.

The four steps to conducting a RWA are: (1) Transform predictors to uncorrelated variables that are maximally related to original predictors, (2) Regress dependent variable onto the new uncorrelated variables, (3) Regress the original predictors onto the new uncorrelated variables, (4) Combine the indices from Step 2 with the indices from Step 3. Put more simply, this technique is analogous to the use of an orthogonal rotation during a factor analysis. The development and use of RWA is more fully described by Johnson (2000, 2001) and Lebreton, et al. (2007).

In the present study, RWA is applied to the correlation matrices I derived from the Behson, et al. (2000) meta-analysis. Analyses were calculated using an SPSS syntax program composed by Dr. Jeff Johnson and run on the PASW18 (formerly SPSS) statistical software program. By using RWA, this study represents the first time this technique, the most appropriate for explaining the relative contribution to R^2 among multiple independent variables, has been applied to job design research.

RESULTS

Table 1 reports the results of the relative weights analysis. Specifically, this table lists the total variance in each dependent variable explained by the three CPS or the five CJC (the total R^2), and then lists how much of this total R^2 can be attributed to each of those constructs. Both the unique R^2 for each dimension and the percentage of the total R^2 that the unique R^2 represents are reported. Thus, looking at the first column in the first set of results, we can see that all five CJC dimensions, taken together, account for 35% of the total variance in experienced meaningfulness. Further, 7.4% of the variance in experienced meaningfulness is uniquely explained by autonomy, representing 21% of total R^2 explained by all five CJC dimensions.

TABLE 1
RESULTS OF THE RELATIVE WEIGHTS ANALYSIS FOR THE
JOB CHARACTERISTICS MODEL

	Experienced Meaningfulness		Experienced Responsibility		Knowledge of Results	
	raw RW	RW as %	raw RW	RW as %	raw RW	RW as %
Skill Variety	0.099	28.0	0.045	18.5	0.007	2.4
Task Significance	0.103	29.2	0.048	19.5	0.02	7.3
Task Identity	0.019	5.3	0.032	13.2	0.041	14.9
Autonomy	0.074	21.0	0.071	28.9	0.034	12.3
Feedback	0.057	16.4	0.049	20.0	0.175	63.1
Total R^2	0.351		0.246		0.277	

		Job Satisfaction		Growth Satisfaction		Intrinsic Motivation	
		raw RW	RW as %	raw RW	RW as %	raw RW	RW as %
Experienced Meaningfulness		0.268	57.6	0.265	57.1	0.063	12.6
Experienced Responsibility		0.110	23.6	0.124	26.7	0.199	39.6
Knowledge of Results		0.087	18.8	0.075	16.2	0.240	47.8
Total R^2		0.465		0.464		0.502	

	Job Satisfaction		Growth Satisfaction		Intrinsic Motivation	
	raw RW	RW as %	raw RW	RW as %	raw RW	RW as %
Skill Variety	0.051	20.3	0.117	27.6	0.054	22.1
Task Significance	0.031	12.4	0.053	12.6	0.049	19.9
Task Identity	0.017	6.7	0.021	5.0	0.008	3.2
Autonomy	0.092	36.6	0.15	35.2	0.031	12.8
Feedback	0.060	24.0	0.084	19.7	0.103	42.0
Total R^2	0.251		0.426		0.246	

In the first set of results in Table 1, we can see that the results are somewhat consistent with Hackman and Oldham's (1976) model, as well as the Behson, et al. (2000) results. According to the model, experienced meaningfulness should be primarily explained by skill variety, task significance and task identity. Skill variety and task significance explain 28% and 29% of the explained variance in experienced meaningfulness, but task identity explains far less. All three combine to explain 63% of the explained variance, which is not proportionately more than is explained by the two other CJC. Further, according to the original JCM model, only variety, identity and significance should be significant predictors of experienced meaningfulness; yet, 37% of the explained variance in meaningfulness is accounted for by the two other CJC. Thus, the results are mixed.

In terms of experienced responsibility, the results show that autonomy explains 29% of the variance in experienced responsibility. This is single highest result, but is not considerably more than many other CJC. Further, according to the original JCM model, only autonomy should be a significant predictor of experienced meaningfulness; yet, 71% of the explained variance in responsibility is accounted for by the four other CJC. Again, the results are mixed.

In terms of knowledge of results, feedback does explain by far the largest amount of variance (63%), which is consistent with the model. Overall, results provide some support for the model and prior findings, but demonstrate that expected relationships may not be as strong or consistent as commonly hypothesized. In particular, this analysis reveals that the five CJC do not exhibit the degree of discriminant validity proposed by Hackman & Oldham (1976) or Behson, et al. (2000). Thus, the impact of one particular CJC is more difficult to distinguish from the impact of the others. Thus, the five CJC, taken collectively, may be a better predictor of overall reactions than each CJC is in predicting its corresponding CPS.

In the second set of results, we offered no particular expectation for the relative importance of the three CPS on the outcome variables. Results show that experienced meaningfulness is the most important in predicting job satisfaction and growth satisfaction (accounting for 57.6% and 57.1% of explained variance in those outcome variables, respectively). However, meaningfulness plays a much lesser role in explaining variance in intrinsic motivation, which is better explained by the other variables (experienced responsibility explains 39.6% of explained variance in intrinsic motivation and knowledge of results explains 47.8%).

The third set of results examines the job characteristics model as it is commonly tested- without the CPS included. These results show that autonomy plays a prominent role in explaining job and growth satisfaction, while feedback plays a primary role in explaining variance in intrinsic motivation. Task identity explains little variance in any of the dependent variables studied. As expected, the CJC collectively do not explain as much variance in the outcome variables as the CPS do. Further, similar to the first set of results, this analysis reveals a lack of discriminant validity among CJC. Taken together, these results provide some support for the model and prior findings, but demonstrate that expected relationships may not be as strong or consistent as commonly hypothesized.

DISCUSSION

Much of the JCM remains robust, and the results of this analysis confirm the importance of such bedrock principles as experienced meaningfulness, autonomy and feedback in explaining reactions to one's work. However, the model suffers from the fact that many of the elements in the model are closely related and the three-stage model can be considered somewhat redundant (for example, are separate measures of feedback and knowledge of results both needed?). The JCM is an important theory because it illuminates a handful of important concepts, and has been built on by researchers and practitioners for decades.

However, its broad applicability can also be seen as a reason for the muddled and sometimes contradictory results found by many researchers, including those of this study. For example, what would be considered high skill variety for a factory worker would probably pale in comparison to what a white-collar employee considers low-to-medium skill variety. The Behson, et al. (2000) meta-analysis combined

the results from such varied samples as teachers, engineers, sales professionals, enlisted US Navy troops, and work-study students. While their moderator analyses did not uncover any differences among sample types, it is likely that such combinations of samples led to lowered reliability of measures and more muddled responses. The same could be said for the Fried & Ferris (1987) and Loher, et al. (1985) meta-analyses.

Further, the JCM's rapid ascendance as the dominant theory in job design research may have had unintended consequences. Because of the respect and deference many had towards the JCM, other models and alternate theories were slow to develop (Parker & Ohly, 2009). Johns (2010) contends that the field of job design research has been stuck in the past, and has not adapted to changes in the workplace due to overly strict adherence to the JCM, which was proposed 34 years ago, before the advent of major technological advances.

Oldham and Hackman (2010) themselves have written that they never intended the JCM to be the final word on job design research, and they encourage researchers to expand the scope of their inquiries. This is especially true given how the workplace has changed. The JCM does not take into account several now-common forms of work organization and job design, including telecommuting, virtual teams and distributed work groups. The cultures of many workplaces have made a shift from top-down command-and-control approaches to those that emphasize collaboration and employee decision-making. In a more interconnected world, many jobs are now performed with greater interdependence and constant communication with co-workers, customers, and liaisons from a broad network of other companies. Thus, one would expect the influence of the interpersonal situation of one's work to be paramount in shaping one's satisfaction, growth and intrinsic motivation (Grandey & Diamond, 2010, Morgeson, Dierdorff & Hmurovic, 2010).

For all of these reasons, job design researchers need to expand the scope of their research beyond the JCM. Karasek's (1979) approach to job design and motivation, which emphasizes one's job demands, as well as the amount of control and the amount of support given to meet those demands, may be particularly well-suited to exploring the modern workplace. This model also explores how stress and well-being influence one's reactions to one's job. In one example of a useful extension of the JCM, Grzywacz and Butler (2005) have examined how autonomy and skill variety influence one's ability to manage work-family conflict. More research extending the reach of job design through alternate models and an expanded set of antecedents/outcomes is needed to better examine the effects of job design in the modern workplace.

Fortunately, there has been a recent uptick in job design research that has begun to expand the scope of examination and more specifically addresses the modern workplace. Specifically, Grant (2008) and Grant and Parker (2009) have proposed frameworks in which the relationships within and the inherent interdependence of the modern workplace impact the outcomes associated with job design. They also examine boundary conditions- that is, situational variables that affect how job design affects motivation and performance.

Parker and Ohly (2010) review a wide array of organizational literature and reframe job design not only in terms of the JCM, but also integrate such frameworks as social information processing, emotions and stress, and job control and empowerment. They further explore critical job design issues for the modern workplace in which knowledge-based work, distributed work, workplace flexibility, distance-based work and communication technology are all addressed. Finally, Grant, Fried and Juillerat (2011) present a framework comparing the classic and contemporary approaches to job design. All of these new frameworks and perspective hold promise for advancing the field of job design research and practice.

Overall, this paper's critique of job design research is not as much a critique of the JCM as it is how others have reacted to this model. JCM is still useful, albeit imperfect. The way in which it has been used as the default "final word' in job design research has kept this field from contributing as much as it could have to management research and practice (Oldham & Hackman, 2010), and this problem has only recently begun to have been addressed. Only by critically re-analyzing JCM research do these shortcomings become more apparent, demonstrating the value of such critical re-analysis.

This study provides a methodological contribution to the field of organizational behavior as it is one of only a handful of studies in this field (see Behson, 2002, 2005, 2011 and Johnson & LeBreton, 2004) to revisit prior research using a recently developed and superior analytic technique for determining the unique contribution of independent variables to explained variance of a dependent variable.

The fact that the results of these studies are inconsistent with past findings is most likely attributable to the use of an analytic technique best suited for determining the unique contributions of various independent variables on the explained variance of outcomes. The relative weights procedure corrects for multicollinearity and avoids many of the biases associated with regression-based techniques. However, it is also possible that there were flaws both in the present study and in the Behson et al. (2000) meta-analysis from which the data are taken. Further, while this meta-analysis represents the most recent comprehensive review in on the JCM, it is about a decade old, and necessarily excludes more recent literature.

Another limitation of both studies is that there is no easily calculable method for determining statistically significant differences among relative weights (Johnson, 2001). Instead, Johnson (2004) and Tonidandel, LeBreton, & Johnson (2009) describe a boot-strapping procedure in which one could create a large population of datasets based on the data set in use, and then calculate confidence intervals around relative weight results. The use of this procedure is beyond the scope of this paper, especially considering that this procedure has never been applied to meta-analytic data, and it has not been established that it is valid to do so. I have attempted to be conservative in interpreting these findings and encourage the reader to be similarly conservative so that we do not overstate small differences in relative weight.

In conclusion, this study will hopefully encourage more researchers to utilize relative weights and other analytic techniques that are most appropriate for testing hypotheses of comparative and marginal utility. Multiple regression maximizes the prediction of a dependent variable using a set of data, but is not nearly as useful is determining the differential effects of each of the included independent variables. It is recommended that researchers who are interested in investigating the relative importance (i.e., contribution to explained variance) of predictors utilize the most appropriate methods to do so. Dominance (Budescu, 1993) and relative weights (Johnson, 2000) are two appropriate choices to suit this purpose. Clearly, there are many areas of organizational research in which the relative importance of predictors would be extremely interesting (Johnson, 2001). For example, a measure of relative importance would be appropriate if one is comparing the predictive validities of various employment selection tests and criteria, making decisions for reducing the number of items in a scale, or comparing the contributions of various proposed antecedents to employee turnover.

Finally, this study highlights the importance of re-examining classic organizational behavior theories. Such critical re-analyses are an important but all too infrequently performed part of the scientific process, especially as they relate to research streams in the "consolidation and accommodation" stage of development (Reichers & Schneider, 1990). If researchers fail to question the conceptual underpinnings of their work, potential flaws may not be brought to light, holding back scholarly advancement.

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* Indicates that this study was included in the Behson, et al. (2000) meta-analysis