The Structure of O*NET Occupational Values

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The structure of occupational values is investigated using several analytical techniques. Data from the U.S. Department of Labor's Occupational Information Network (O*NET) describing need reinforcers for 900 occupations are examined using exploratory factor analysis, cluster analysis, and multidimensional scaling. Results indicated broadly defined values that primarily reflected elements of workplace identity and workplace structure.

Keywords: occupational values, factor analysis, cluster analysis, multidimensional scaling, structural representation

In career counseling, numerous occupational descriptors are available to clients and counselors for the purpose of facilitating career exploration. Examples include education/training requirements, income information, employment outlook, and working conditions. Descriptors are also available that involve personal characteristics of the client, and these can be used in conjunction with instruments that assess these characteristics to evaluate the "fit" of an individual to a particular occupation. The most well-known and often-studied of the latter type of descriptors involve occupational interest—that is, descriptors that identify/specify the interest domains of individuals as well as the interest domains associated with particular occupations (e.g., Holland, 1997).

Although occupational interests remain a ubiquitous and focal construct in career counseling research and clinical practice, other potentially useful descriptors also exist. One such set of descriptors, occupational values, involves an individual's evaluation of the importance of activities and work characteristics (Rokeach, 1973; Sager, 1999; Super, 1973). The theory of work adjustment (TWA; Dawis & Lofquist, 1984) conceptualizes occupational values in reference to needs and reinforcers. Specifically, reinforcers (e.g., creativity, social status, authority) are viewed in TWA as stimulus conditions associated with the maintenance of work behavior, whereas needs reflect the relative perceived importance of particular reinforcers to an individual, and values then become reference dimensions for the characterization of needs.

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Table 1
Need Reinforcers and Associated Statements as Used in the Minnesota Job Description Questionnaire (MJDQ)

Need Reinforcer	Statement: "Workers on this job . . ."
Ability utilization	make use of their individual abilities.
Achievement	get a feeling of accomplishment.
Recognition	receive recognition for the work they do.
Advancement	have opportunities for advancement.
Authority	give directions and instructions to others.
Social status	are looked up to by others in their company and their community.
Company policies	are treated fairly by the company.
Supervision—human relations	have supervisors who back up their workers with management.
Supervision—technical	have supervisors who train their workers well.
Social service	have work where they do things for other people.
Moral values	are never pressured to do things that go against their sense of right and wrong.
Coworkers	have coworkers who are easy to get along with.
Responsibility	make decisions on their own.
Creativity	try out their own ideas.
Autonomy	plan their work with little supervision.
Security	have steady employment.
Independence	do their work alone.
Variety	have something to do every day.
Working conditions	have good working conditions.
Activity	are busy all the time.
Compensation	are paid well in comparison with other workers.

Several instruments have been devised to assess individual needs as conceptualized by TWA. One of these instruments, the Minnesota Importance Questionnaire (MIQ; Rounds, Henly, Dawis, Lofquist, & Weiss, 1981) discerns an individual's needs by assessing the person's perceived relative importance of 20 need reinforcers. The MIQ is a "person-based" instrument—that is, it assesses individuals (without specific reference to occupations). In contrast, the Minnesota Job Description Questionnaire (MJDQ; Borgen, Weiss, Tinsley, Dawis, & Lofquist, 1968; Dawis, 1991; Dawis & Lofquist, 1984) is "occupation-based" and is designed to assess values-related characteristics of particular occupations by querying occupational incumbents about the need reinforcers that are important to their occupations. Twenty-one of these need reinforcers are assessed by the MJDQ (see Table 1), resulting in an occupational reinforcer pattern (ORP) for each occupation. It is noteworthy that an additional need reinforcer ("autonomy") was used in the MJDQ (for a total of 21 reinforcers compared with the MIQ's 20 reinforcers) to

accommodate the scaling method, which involved ranking descriptive statements in groups of five (Dawis & Lofquist, 1984).

One way in which distinct values have been identified from need reinforcers is through strategies of dimensional analysis. Gay, Weiss, Hendel, Dawis, and Lofquist (1971) carried out several factor analyses to assess the dimensionality of data resulting from the MIQ. They used (separately) samples of college students, vocational rehabilitation clients, employed workers, and a heterogeneous group of individuals (made up of the three previously mentioned groups in addition to some vocational-technical school students). A principal factor solution was specified, with an orthogonal (varimax) rotation. In each analysis, six meaningful dimensions resulted, which the authors labeled safety, autonomy, comfort, altruism, achievement, and status. In the combined (i.e., heterogeneous) group, 53% of the data variation was accounted for by the six dimensions. Seaburg, Rounds, Dawis, and Lofquist (as summarized in Dawis & Lofquist, 1984, pp. 84-85) repeated the factor analytic procedures of Gay et al. (1971) for subgroups of vocational rehabilitation clients and obtained the same six value dimensions and similar variance-accounted-for. Multidimensional scaling analyses carried out by Rounds (1981) suggested that the six identified values could be modeled as three dimensions, where each dimension included polar opposite occupational values. Specifically, these dimensions were altruism versus status, autonomy versus safety, and achievement versus comfort.

The U.S. Department of Labor (2000, 2002), as part of the Occupational Information Network (or O*NET), has developed two assessment instruments based heavily on the MIQ/MJDQ that assess occupational values. These instruments, the Work Importance Profiler (WIP; McCloy et al., 1999b) and the Work Importance Locator (WIL; McCloy et al., 1999c), both assess the 20 need reinforcers posited by the MIQ. The WIP and WIL differ from one another only in mode of administration and scoring (computerized administration and scoring for the WIP, card sort administration and hand-scoring for the WIL). Each of the 20 need reinforcers assessed by these instruments is categorized into one of six major value orientations: achievement, independence, recognition, relationships, support, and working conditions. An examinee who completes either instrument receives a values profile made up of scores in each of these six categories. Reliability and validity studies carried out on the WIP (McCloy et al., 1999b) included a confirmatory factor analysis using data resulting from this instrument. Results suggested that the posited six values (achievement, independence, recognition, relationships, support, and working conditions) were not supported (rather, a seven-factor solution was indicated). McCloy et al. suggest that this may have been at least in part due to wording changes that were incorporated into the instrument items during the O*NET development.

This study extends this line of research by seeking to explore the structure of occupational values by applying several analytical techniques to the U.S. Department of Labor's (2004) O*NET 6.0 values data.

METHOD

Data

This study makes use of the work values data contained within the U.S. Department of Labor's (2004) O*NET 6.0 database. The O*NET work values data include mean ratings (across raters) on 21 need reinforcers, where the ratings were carried out by trained analysts on 1,122 occupational units (OUs). An OU is a somewhat broad occupational class (e.g., mechanical engineer, pharmacist, restaurant cook) that may encompass more specific occupations. Specifically, for the O*NET values data, the extent to which each of the 21 occupational needs was reinforced by the 1,122 OUs was rated by 16 occupational analysts and industrial/organizational graduate students. The 1,122 OUs were divided into two sets of 561, and each analyst rated one of the two sets. A rating scale from 1 to 5 was used, where anchor occupations were added to the rating scale to represent occupations that were low, medium, or high on the indicated need reinforcer. The rated statements associated with the O*NET need reinforcers were adapted from the MJDQ (Borgen et al., 1968) and the MIQ (Rounds et al., 1981), with some changes to the original wording. The developers of the O*NET values data (McCloy et al., 1999a) report mean and median interrater reliability coefficients in the .80s. The mean correlation between the need profiles generated by the raters and those obtained from occupational incumbents, however, was relatively low ($r = .37$). Incumbents also tended to rate their occupations higher on the needs than did the analysts. McCloy et al. (1999a) provide additional details on the development of these scales and rating methodology.

Procedures

To assess the structure of occupational values, we first considered the matrix of intercorrelations among the 21 need reinforcers contained in the O*NET values data set (described above). We then used this matrix of intercorrelations and carried out an exploratory factor analysis (EFA) of the 21 occupational needs. To ensure consistency with the methods used in previous studies (e.g., Gay et al., 1971), a principal factor solution with varimax rotation was used. Eigenvalues and variance-accounted-for were examined, as were residual values. As a second method of structural assessment, we carried out hierarchical cluster analyses of the 21 occupational needs. Because different methods of cluster analysis can yield distinct results, we chose several methods and examined the solutions for consensus. Specifically, complete-linkage and Ward's method were used. Complete-linkage clustering was chosen because this method tends to be appropriate when the underlying structure of objects to be agglomerated reflects natural groups or "clumps" (as opposed to "strings" of objects). Ward's method of clustering was chosen because it tends to create clusters of roughly equal size, and because it minimizes a specific criterion (the sums of squares between any two clusters to be

considered at each step of the algorithm). As an alternative method of clustering, we also fit an additive tree using Hubert and Arabie's (1995) IP method. The additive tree provides for a representation in which terminal lengths of the tree structure are allowed to be unequal. Also, the IP method of Hubert and Arabie is unique in that it seeks to optimize an explicit least-squares loss criterion. As a visual aid in assessing the results of these cluster analyses, tree structures were constructed indicating the hierarchical relationship among the need reinforcers. Finally, we carried out nonmetric multidimensional scaling (in two dimensions), using as input the matrix of intercorrelations among the 21 O*NET need reinforcer categories. Stress and variance-accounted-for were assessed, and a dimensional representation constructed.

RESULTS AND DISCUSSION

EFA carried out on the 21 need reinforcers suggested that a three-factor model provided the most viable model for the data. This was evident through inspection of the scree plot (see Figure 1), an examination of the variance accounted for by the three factors (70.4%), and the substantive interpretability of the model. We labeled these three orthogonal factors "self-determination," "social relations," and "workplace structure" (see Table 2). The value of self-determination loaded most strongly on needs such as ability utilization, autonomy, creativity, recognition, responsibility, achievement, and social status. These are very individually oriented needs related to a worker's sense of self-direction and self-determination. The second factor, social relations, reflected social relationships with other individuals in the workplace. It loaded most strongly on needs such as coworkers who were easy to get along with and social service. As might be expected, the social relations factor showed a strong negative relationship with the need for independence. It is interesting that the need for moral values was also negatively related to this factor. The need for authority cross-loaded on both the social relations factor and the self-determination factor, suggesting that workers interpret authority both as an issue of social relations (i.e., a need for an occupational milieu in which authority is present) as well as an issue of self-determination (i.e., a need to personally exert authority). The final factor, workplace structure, showed strong relationships with needs that involve company policies and practices, human relations supervision, and advancement. These are needs that involve the organizational makeup of the workplace and how the worker negotiates that structure.

We next assessed structure in the O*NET values data by carrying out hierarchical cluster analyses. Complete-linkage clustering and Ward's method were carried out using the matrix of intercorrelations among need reinforcers. The tree structures (dendrograms) associated with each solution are shown in Figures 2 and 3. Each of these two clustering solutions reflected a structure that was similar

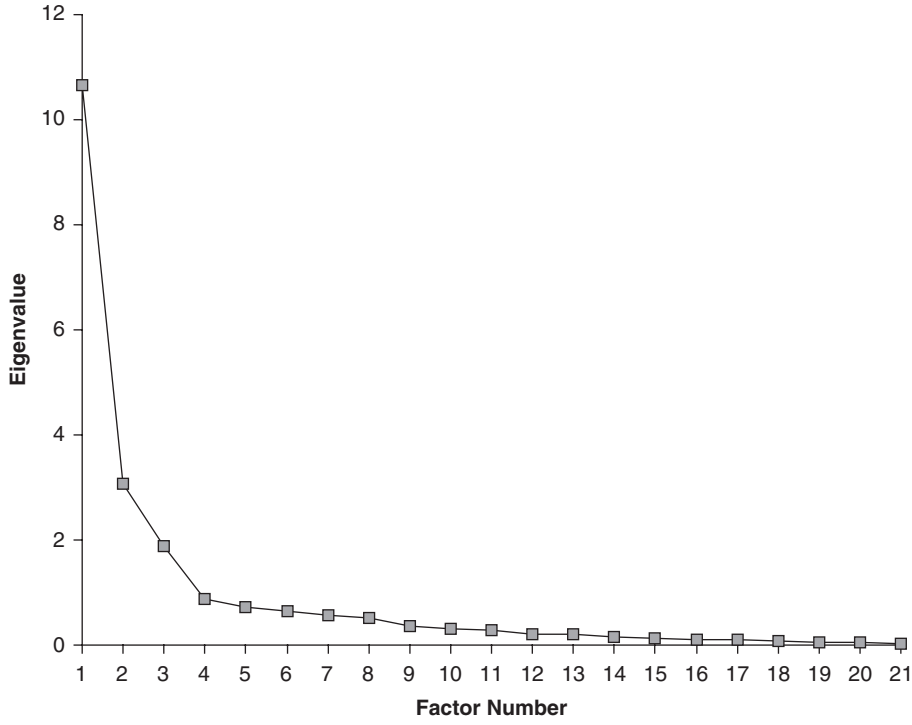

Figure 1. Scree plot for exploratory factor analysis of Occupational Information Network (O*NET) need reinforcers.

in some respects to the EFA solution discussed above. Specifically, Ward's method resulted in two primary clusters of need reinforcers, which we labeled "occupational identity" and "workplace structure." The occupational identity cluster was made up of a large set of need reinforcers that involved aspects of work (both social and personal) that contribute to one's work identity. This cluster included need reinforcers identified in the EFA as belonging to the self-determination and social relations factors (however, two need reinforcers from the latter factor—moral values and independence—were not included in this cluster). The occupational identity cluster was subdivided into two subclusters. These two subclusters included high-level, self-efficacious aspects of employment related to personal fulfillment (e.g., achievement, ability utilization, creativity) as well as aspects involving occupational "maintenance"—that is, needs that are more primary than the needs of personal fulfillment, including relationships with other workers and the core needs of activity, compensation, and security.

The second primary cluster in the representation resulting from Ward's method we labeled "workplace structure." The elements of this cluster involved an individual's relationship to an organization and (as reflected by the dendrogram in Figure 2) was further subdivided into clusters reflecting (a) external

Table 2
Rotated Factor Loadings for Three-Factor Model

	Factor			
	1	2	3	
Ability utilization	.927			self-determination
Autonomy	.920			
Creativity	.894			
Recognition	.887			
Responsibility	.880			
Achievement	.871			
Social status	.865			
Variety	.776			
Supervision—technical	–.727		.405	
Compensation	.671			
Working conditions	.652			
Security	.458			
Independence		–.888		social relations
Coworkers		.835		
Social service		.663		
Authority	.594	.625		
Moral values	–.450	–.467		
Company policies and practices			.874	workplace structure
Supervision—human relations			.848	
Advancement			.689	
Activity			.420	

Note. For clarity, only factor loadings with absolute values = .40 are shown.

structure (that is, the organizational structure of the workplace, and how the individual relates to or navigates this structure) and (b) internal structure (how an individual maintains personal boundaries in the workplace). The former cluster included needs such as company policies and practices, human relations supervision, and advancement, whereas the latter structure contained the needs of independence and moral values.

The second method of cluster analysis used in this study (complete-linkage clustering) resulted in a solution that was in many respects similar to the previously discussed clustering solution (see Figure 3). As in that solution, two primary clusters were identified—occupational identity and workplace structure. One notable difference, however, was that the activity need reinforcer was located within the workplace structure cluster, whereas in Ward's solution, it was located in the occupational identity cluster. This suggested that this need reinforcer was perhaps less stable and incorporated elements of both clusters.

When the IP method of Hubert and Arabie was applied, the additive tree representation shown in Figure 4 resulted. This representation accounted for 94.9% of the data variation and was very similar to the previous two clustering solutions

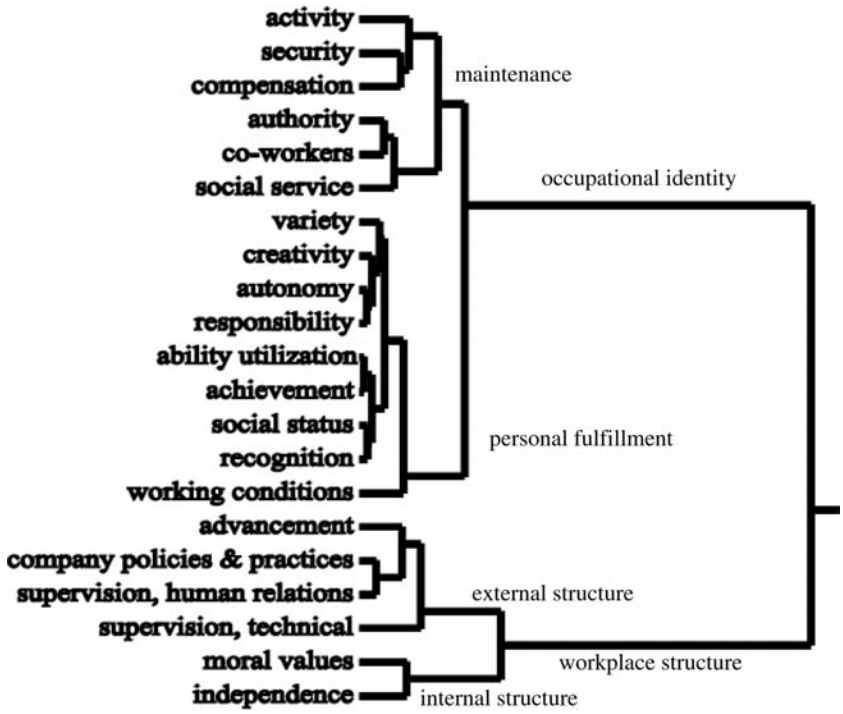

Figure 2. Dendrogram associated with Ward's method of clustering Occupational Information Network (O*NET) need reinforcers data.

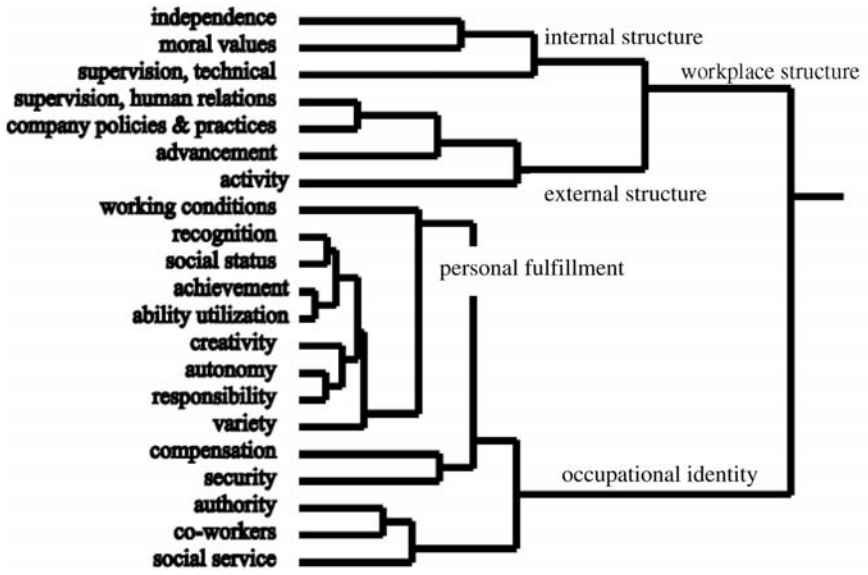

Figure 3. Dendrogram associated with complete-linkage method of clustering Occupational Information Network (O*NET) need reinforcers.

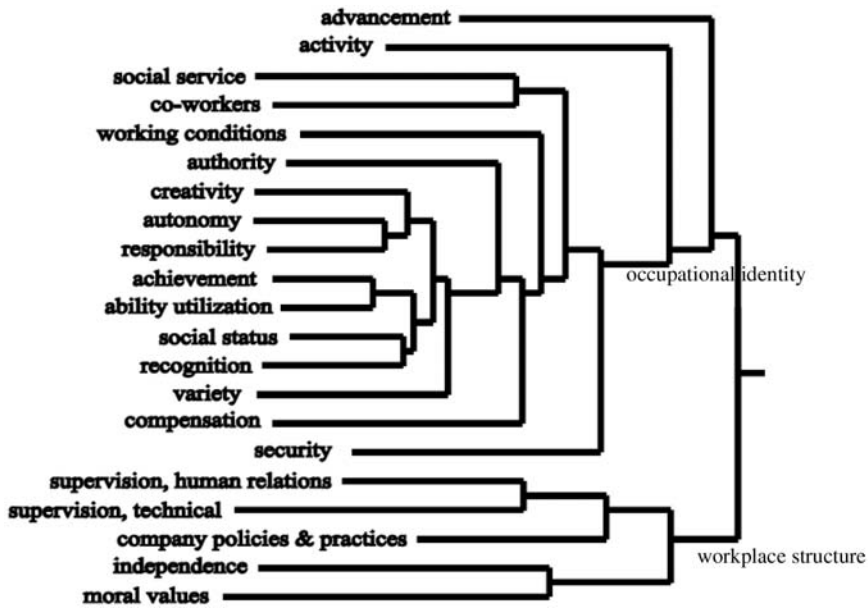

Figure 4. Additive tree representation of Occupational Information Network (O*NET) need reinforcers.

in that two primary clusters emerged. One cluster was very similar to the workplace structure cluster identified in the previous two cluster analytic solutions, whereas the second cluster was very similar to the occupational identity cluster. The additive tree representation was unique in that it suggested that three of the need reinforcers—advancement and activity—were somewhat distinct and appeared to occur as singleton need reinforcers, rather than as members of a cluster of need reinforcers.

A final approach to assessing structure in the O*NET occupational values data was carried out using nonmetric multidimensional scaling (MDS; Kruskal, 1964a, 1964b; Shepard, 1962a, 1962b). MDS seeks to represent a set of objects (in this case, the individual need reinforcers) in a dimensional space, using a matrix of proximity values as input data. This representation provides a spatial map of these needs that will aid in the interpretation of relationships among them. For this analysis, we used the same matrix of intercorrelations used in the preceding factor and cluster analyses. Results indicated that a two-dimensional representation provided good fit to the data (Kruskal's Stress = .088, variance-accounted-for = .98) as well as a readily-interpretable solution. This two-dimensional representation is shown in Figure 5. The first dimension in this representation, which we've labeled "autonomy versus guidance," separates those need reinforcers that emphasize individual choice, self-direction, and responsibility (e.g., autonomy, ability utilization, responsibility) from those that emphasize a more directed, guided, and structured work environment and lower levels of responsibility (e.g., human relations supervision, technical supervision, company policies and practices).

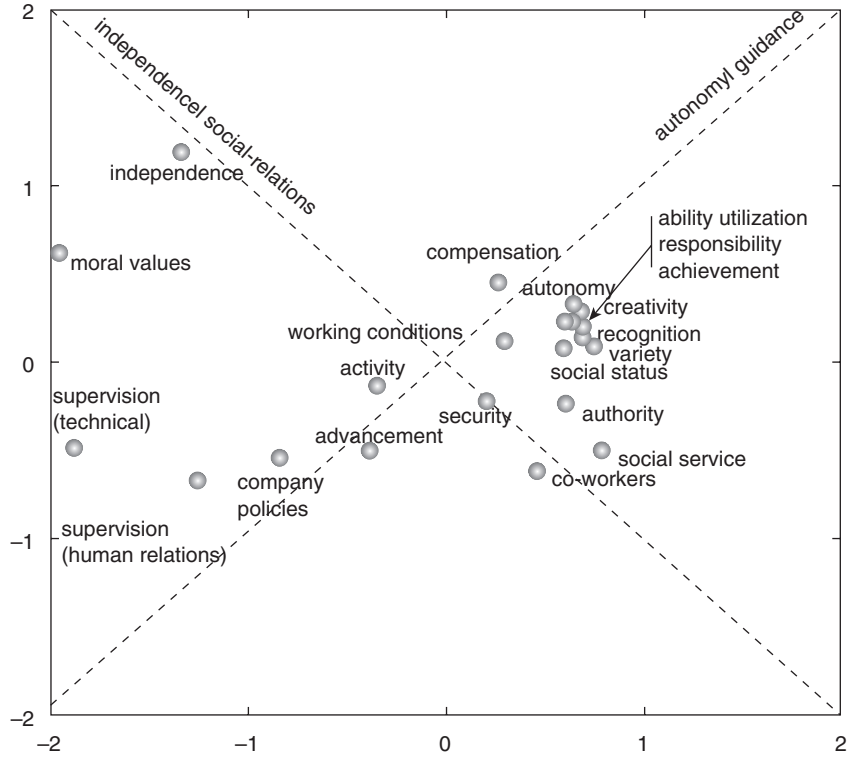

Figure 5. Multidimensional scaling solution (three dimensions) of Occupational Information Network (O*NET) need reinforcers.

A second, orthogonal dimension, which we've labeled "independence versus social relations," distinguishes need reinforcers that reflect an emphasis on individually oriented values (e.g., moral values, independence) from those that involve relationships with other individuals (e.g., social service, authority, coworkers).

The three methods used in this study—EFA, cluster analysis, and multidimensional scaling—suggest that several common themes appear to characterize the O*NET workplace values data. The EFA and cluster analyses indicated a broad and strong value of self-determination or individual identity underlying workplace needs. These needs provide the worker with a sense of self and include both low-level maintenance needs (e.g., compensation, security) and high-level needs (e.g., recognition, creativity). Another strong value that was identified with these two methods was the value of workplace structure. This value emphasizes clear delineation of workplace rules (e.g., the needs of supervision, company policies and practices) and also involves an individual's navigation through this workplace structure. The multidimensional scaling solution yielded a values dichotomy similar to the preceding methods. It indicated that two orthogonal dimensions—autonomy

versus guidance and independence versus social relations—explained the spatial relationships among the need reinforcers.

The results of these analyses did not coincide with the findings of previous research on the structure of work values (e.g., Gay et al., 1971). Specifically, these analyses identified three factors among the need reinforcers (rather than six factors). Although the developers of the O*NET values data made slight modifications to the wording of some need reinforcers' statements in the rating task (see McCloy et al., 1999a), and this may have had some effect on the resulting structure, a more likely source of distinction could be in the source of the ratings themselves. The O*NET data were obtained from expert raters (rather than occupational incumbents) and, although the obtained ratings were validated using data from incumbents, there appears to be some difference in the emergent value structure.

The results of these analyses have several implications for career counselors and clients. First, when exploring and considering occupations, individuals might consider occupational values very broadly, viewing occupations or occupational environments as satisfying (to greater or lesser extents) primary values of self-determination and occupational structure. These two values might also in some sense be seen as competing values. Individuals who value structure in their work environment might be willing to sacrifice values of individuality and self-determination. Conversely, individuals who prefer to exert individuality in the workplace may value a more fluid and less structured work environment. Given information about the degree to which particular occupations emphasize each of these values, then, counselors might direct clients toward occupations that best accord with clients' values disposition.

A second implication of importance to clients and counselors pertains to the assessment of values. The results of this study suggest that, at least when the perceptions of occupational analysts are considered, values might be viewed in a more simplified framework than earlier work has suggested, that is, as two or possibly three primary values rather than as six values. Whether this more simplified framework truly reflects the structure of occupational values or is an artifact of the particular rating methodology used by the O*NET is an avenue for further research.

Occupational values, although less prominent than occupational interests in both research and clinical practice, provide an alternative manner of describing both occupations and persons. This study sought to examine the structure of values (as characterized by specific needs) using several analytic tools. Such a structural framework is important for conceptualizing and discussing values and also for the development of instruments that might validly assess them. In addition, it might be argued that a multitiered approach to career counseling—that is, one that considers descriptors from a variety of domains (e.g., interests, values, skills)—is a more balanced and complete approach than one that focuses on any single descriptor (e.g., interests). In this sense, then, the use of values information and assessment in career counseling could both augment and complement more commonly used tools, techniques, and models.

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