The Job-Matching Algorithm

The WRQ is capable of matching PAQ ratings from one job with all other jobs in the PAQ database, taking functional limitations or disability into account, and generating a list of jobs that match closest to ratings about the individual. For a discussion of sources of ratings about individuals see programming the WRQ to take disability into account.

With respect to each job element and across all jobs in a PAQ database, the job-matching algorithm calculates the absolute differences (i.e., the differences, taken without regard to signs) between WRQ ratings and corresponding PAQ ratings of every job in the database, and then sums those differences. The smallest sum of these absolute differences represents the closest-matching job. The second smallest sum difference represents the second closest-matching job, and so on. Thus, in the following schematic, Job K is closer to WRQ ratings on the individual than Job J, because 4 is less than 5:

Job Elements	WRQ Ratings Relevant to the Individual	Job #J Job Analysis Ratings	Absolute Differences Between WRQ Ratings and Job Analysis Ratings for Job #J	Job #K Job Analysis Ratings	Absolute Differences Between WRQ Ratings and Job Analysis Ratings for Job #K
1	4	3	|1|	4	|0|
2	2	3	|1|	3	|1|
3	5	3	|2|	4	|1|
.	.	.	|.|	.	|.|
.	.	.	|.|	.	|.|
.	.	.	|.|	.	|.|
150	2	1	|1|	4	|2|
Sum of absolute differences between WRQ ratings and PAQ database ratings			5		4

The idea in the job-matching algorithm is to set statistical filters on PAQ items on which performance would be limited by disability, and to bifurcate the list of the closest job-matching jobs according to whether or not they passed through the filters. The closest-matching jobs that pass through the filters are listed in one section of the report. The closest-matching jobs that do not pass through the filters are listed in another section of the report.

Worker Rehabilitation Associates, Inc.
david.workerrehab@gmail.com
303.581.9778

Some of these jobs may be rejected as infeasible, but some may be reasonably accommodated. For example, if a person's back pain precludes Sitting (Item # 108) for more than an hour, the occupational specialist can program the WRQ to print a list of jobs that require more than an hour of sitting in one part of the report and jobs that require an hour or less of sitting in another section of the report (see programming the WRQ to take disability into account). Another example: Setting an item limit on the Education item, #146, bifurcates the report into a list of jobs that require more education and and another list of jobs that require the same or less education than the limit. Since the WRQ consists of 150 items, item limits can be set to model virtually any impairment or limitation. When an individual has severe limitations that may include educational limitations or even dislike of performing certain elements of work, the WRQ can take these into consideration. The size of the difference between an item limit and a job requirement that exceeds the item limit may determine whether the job is infeasible or whether it can be reasonably accommodated. (See how to read a report.)

The basic statistical principle used in WRQ job-matching is maximum likelihood estimation, which is a method for comparing different sets of data (Hayes, 1963). Conceptually, the WRQ job-matching algorithm uses a nonparametric "unweighted multivariate nearest neighbor" approach. Jobs listed with characteristics in excess of item limits are the nearest neighbors in multivariate space to other jobs with characteristics in excess of limits. Similarly, jobs listed with no characteristics in excess of item limits are the nearest neighbors in multivariate space to other jobs with no characteristics in excess of item limits. The algorithm is nonparametric because it does not calculate a parameterized regression, such as a multivariate linear regression. It is unweighted because it does not weight any of the items over others. (Sometimes in nearest neighbor problems, different entities (in this case different items) would be weighted more or less than others. For example, a civil engineer predicting stream flow based on snow pack at two different locations might weight one location higher if it is nearer a stream flow station and would have more predictive power.) "Multivariate nearest neighbor" is the statistical term for listing closest matches. Applications of nearest neighbor methodology commonly employ weighted averages to calculate closeness of match for each neighbor. Returning to the stream flow example, the three nearest neighbors might be 20 cubic feet per second (cfs), 22 cfs, and 24 cfs. Instead of reporting all three data points, the engineer could calculate the mean or a weighted average based on the goodness of the match, and report just one figure, say 22.3 cfs. Rather than calculating quantitative values as in stream flow, the WRQ predicts to job titles and DOT codes, and reports the closest *N* matches (D. P. Ames, personal communication, January 15, 2004).

Since WRQ job-matching is based directly on a set of shared, work behaviors between the WRQ and PAQ, the link between individuals and occupations involves no intervening measures, such as test scores. If a person takes cognitive ability tests, the test profile can be matched with occupational aptitude requirements to produce a list of occupations. By contrast, WRQ job-matching involves estimating capabilities and tolerances of individuals to perform the same generic types of work behaviors as the PAQ uses to describe occupations in the labor force. The greater the extent to which individual and occupation are rated on the same job elements and the greater the number of job-related elements considered, the less error (or "slippage") in the prediction. Although systematic relationships between occupational requirements and aptitude and interest test scores have been established, accuracy of prediction might be significantly lower if tests alone were used as predictors than if both person and job were described on a large set of relevant job elements that are common to both, as in WRQ job-matching.

The WRQ appears to operationalize Dunnette and Borman's (1979) portrayal of an idealized counseling and job placement system (as such a system might be applicable to individuals with functional limitations):

> (a) Employers cooperate in describing all jobs with standard task checklists which are scorable according to previously derived behavioral and attribute categories. (b) 'Counselees'...use similar checklists to record previous work and nonwork experiences, preferences, and estimated capabilities. (c) Counselees' responses are scored according to the above job and attribute categories and the scores referred to a data bank for job matching; a preliminary listing of jobs appropriate for each counselee is provided. (d) Final steps in the process utilize additional assessment procedures (job samples, job knowledge tests, simulations, aptitude tests) to provide the individualized information necessary for joint decision making" (p. 485).

References

Dunnette, M. D. & Borman, W. C. (1979). Personnel selection and classification systems. *Annual Review of Psychology, 30*, 477-525.

Hayes, W. L. (1963). *Statistics for Psychologists*. New York: Holt, Rinehart & Winston, p. 213.