Synthetic Validity: An introduction to a useful, but unused approach to establishing validity evidence

Charles A. Scherbaum, Ph.D.
Baruch College, City University of New York
&
Cielo Management Consulting, LLC

Baruch COLLEGE
The City University of New York
WEISSMAN SCHOOL OF ARTS AND SCIENCES

Goals of the Talk

- What is synthetic validity?
- When is it appropriate to use?
- How do you run a synthetic validity study?
- What are the advantages and disadvantages?
- How do synthetic validity techniques compare to other validity generalization approaches?
- What are the legal considerations or implications of using these techniques?

What Happens When Traditional Validity Techniques Will Not Work?

- There are situations where traditional techniques are not viable
  - Small numbers of incumbents in a particular job
  - New, rapidly changing, or too many jobs
  - Insufficient resources
  - Lack of high quality criterion data
- Validity generalization techniques can be applied in these situations

What is Synthetic Validity?

- Synthetic validity refers to a set of VG techniques that are rooted in job components

- Synthetic validity is a logical process of inferring validity on the basis of the relationships between components of a job and tests of the attributes that are needed to perform the job components (Balma, 1959; Lawshe, 1952; Mossholder & Arvey, 1984)

Synthetic Validity and Job Components

Job Component	Job A	B	C	D	Test	New Job E	F
1	*		*	*	W		*
2		*	*		X	*	
3			*		Y		*
4	*	*		*	Z	*	

Basic Process

1. Conduct a structured job analysis to determine the important components of a particular job or job family
   - Task or worker oriented job analysis
     - Metric needs to allow for across job comparisons
     - Level of detail that allows identification of predictors
2. Select predictors of the components
   - Prior research on the predictor-component link
   - SME judgments (e.g., criticality)

Basic Process

3. Estimate the relationship between each job component and each predictor
   - Prior research (VG strategy)
   - Empirical (criterion-related strategy)
   - Judgmental (content strategy)
     - SME ratings of importance, policy capturing, or direct estimates of validity
4. Aggregate the predictor components to estimate the *expected* validity of a test battery
   - Variety of empirical and rational weighting strategies are possible

Basic Assumptions

- When jobs have a component in common, the human attribute(s) required for performing that component will be the same across jobs

- The validity of a predictor for a particular job component is fairly constant across jobs

Job Components Validity

- General procedure for linking job analysis data with predictor mean scores and validity coefficients
  - Equation for predicting validity coefficients from job analysis ratings for a given job
- PAQ JCV Model
  - Uses the PAQ dimensions scores to predict mean scores and validity coefficients from the GATB and other commercial tests

PAQ JCV Model

1. Job analysis is conducted using the PAQ
2. The PAQ ratings are used to determine the components that are part of a given job
3. Regression analyses (based on equations from previous JCV) are used to weight the component scores and predict the mean scores validity coefficients
4. The results are used to form a battery of tests measuring the attributes necessary to perform the job components in a particular job

PAQ JCV Model

- The most indirect synthetic validity method, but the links are empirical
- The predictions for means are better than validity coefficients
  - Maybe a function of using OLS vs. WLS regression
- General issues with the PAQ
- Gravitational hypothesis assumption

J-Coefficent Approach

- J-coefficient equation (Hamilton, 1981)

$$J_{xy} = \frac{R_{xe} R_{ee}^{-1} R_{ye}}{\sqrt{R'_{xe} R_{ee}^{-1} R_{xe}} \sqrt{R'_{ye} R_{ee}^{-1} R_{ye}}}$$

  - R_{xe} is a matrix of the relationships between the predictors and job components
  - R_{ye} is a matrix of the relationships between the job components and job performance
  - R_{ee} is a matrix of the relationships between the job components
  - R_{ee}^{-1} is the inverse of the R_{ee} matrix

J-Coefficent

- Estimating R_{xe}
  - Proportion of items on a predictor judged to be relevant for each job component
  - Rated importance/relevance of a predictor for a job component
    - Averaged across raters and divided by the number of scale points to create a proportion
- Estimating R_{ye}
  - SME rating of importance or contribution of each job component to overall job performance

J-Coefficent

1. Job analysis is conducted using the job elements method
2. The JEM ratings are used to determine the components that are part of a given job
3. SME are asked to make the predictor-component links and the component-job performance links
4. The interrelations between components are estimated
5. The J-coefficent is computed

J-Coefficent

- Accuracy by rating source
  - No source is superior (Hamilton & Dickinson, 1987)
- Evidence for the J-coefficient technique in practice is limited (Mossholder & Arvey, 1984)
- Concerns heavy use of SME ratings
  - SME must be qualified and able to make the necessary ratings

Other Approaches

- Functional job analysis (Olsen, Fine, Myers, & Jennings, 1981)
- Guion (1965)
  - Empirical relationships between the measures of performance on the job components and the predictors for those components
- Hollenbeck & Whitener (1988)
  - The performance measures on the job components and the predictors for the components are aggregated within employee and then correlated

How do synthetic validity estimates compare to traditional and VG estimates?

- Conservative, but similar (Hoffman & colleagues; Johnson & colleagues; Steel and colleagues)
  - Synthetic validity estimates are typically captured by the 95% confidence intervals around traditional estimates
  - Synthetic validity estimates are generally smaller, but they are not usually corrected for statistical artifacts
- May be preferable estimates given the tight link to job analysis

Recent Developments

- Incorporation of alternative predictors
  - Personality (Brown & Harvey, 1996; D'Egidio, 2001; HPI)
  - Physical ability (Hoffman, 1999)
  - Situational judgment (Johnson, 2007)

- Incorporation of O*NET in JCV models (D'Egidio, 2001; Jeanneret & Strong, 2003; Johnson et al., 2003; Wagner & Harvey 2004)

Recent Developments

- Methodological advances
  - Use of WLS regression and standard errors as a criteria to evaluate accuracy (Steel and colleagues 2006, 2009)
- Differential predictive validity (Johnson, Carter, Davison et al., 2001)
- Use with job families (Johnson & Carter, in press)

Continuing Challenges

- Inaccessibility of the literature
  - Mostly unpublished
  - Little guidance
- Lack of disciminant validity
  - Equations are not job specific (Peterson et al., 2001)
- Lack of legal precedents (only circuit level decisions)
  - Explicitly recognized in the *Principles*, but not the *Guidelines*

Continued Challenges

- Analytical strategies
  - Use of validity coefficients in single level regression vs. multilevel modeling (McCloy, 2001)
- Specificity of predictors and criteria
- Development of a synthetic validity database