An Examination of Biodata Theory-Based Constructs in a Field Context

Michelle A. Dean
San Diego State University

Craig J. Russell
University of Oklahoma

This study examined whether items from a biodata inventory were consistent with theory-based constructs as suggested by the ecology model. The model posits five constructs explain biodata predictive ability. Items were sorted using the theory-based construct domains. The resulting scale scores were assessed for evidence of content, criterion-related, and construct validity in a sample of 6032 automated systems controllers. Results suggested moderate support for the theory-based constructs. A notable finding was that items capturing a theoretical construct were impacted by the life stage in which they were anchored. Results further suggest the need to examine if certain life stages are more predictive than others or perhaps if certain constructs are more predictive when related to a particular life stage.

Biographical information (biodata) personnel selection inventories demonstrate high predictive validity across employment venues and criteria (Hunter & Hunter, 1984; Reilly & Chao, 1982; Reilly & Warech, 1990; Russell & Dean, 1994; Schmitt, Gooding, Noe, & Kirsch, 1984). Despite cumulative evidence of successful performance prediction, biodata research has received little praise for innovative theoretical explanations of its ability to predict criterion performance (cf. Fleishman, 1988).

Schmidt, Ones, and Hunter (1992) suggested the need for greater attention to be paid to constructs underlying biodata items to advance biodata theory and practice. They argued that lack of attention to latent construct domains prevents realization of biodata's full potential. Although evidence of criterion validity is important, Stokes and Cooper (2001) suggested that approaches in addition to criterion validation (such as construct and content validation approaches) should be used to understand biodata within the context of a theoretical framework. Fleishman (1988) suggested that the greatest opportunities for understanding human performance in organizations will come from examining relationships between life experiences and job performance. The ability to examine life experience-performance links makes biodata unique among selection devices. However, a much greater understanding of these linkages is needed in order to proactively guide life experience interventions to achieve desired levels of knowledge, skills, and abilities (KSAs).

The present study builds on past theoretical efforts by examining a biodata inventory to determine whether theory-based latent construct domains were present in a set of rationally developed items and whether scales derived from items loading onto these constructs exhibited construct, content, and criterion validity in a large-scale biodata selection application. A brief review of existing biodata theory is presented followed by a description of the current study.

Biodata Theory

Efforts undertaken to develop explanatory models for biodata's predictive ability started with Wernimont and Campbell's (1968) capstone description of the behavioral consistency principle (Owens & Schoenfeldt, 1979). Wernimont and Campbell described the notion of behavioral consistency as "that familiar piece of conventional wisdom, 'The best predictor of future performance is past performance'" (p. 372). Unfortunately, this is often where the discussion begins and ends even though this principle is not a feasible explanation for biodata (Dean, Russell, & Muchinsky, 1999). Biodata items generally do not predict future performance (or behavior) from past measures of the

*Address for correspondence: Michelle A. Dean, Department of Management, College of Business Administration, San Diego State University, 5500 Campanile Drive, San Diego, CA 92182-8238, USA. E-mail: mdean@mail.sdsu.edu

same. Instead, biodata is hypothesized to capture causal events or correlates of causal events influencing job candidates' future behavior. The consistency principle can only serve to explain predictive power for the small subset of biodata items that ask about past behavior identical to criterion behavior of interest (Dean *et al.*, 1999).

Biodata theory has moved forward incrementally from the consistency principle to address why past behaviors/performance, or "life events," predict non-identical future performance. A number of hypotheses and partial explanations have been developed. For example, Mael (1991) used social identity theory to suggest life events shared by different social groups meaningfully and causally contribute to KSA development and future performance. Alternatively, Dean *et al.* (1999) hypothesized sequences of negative life events combine with individual differences in resilience to causally influence KSA development and future performance.

Ecology Model

Perhaps the most comprehensive and well-developed explanation of biodata criterion-related validity was provided by Mumford, Stokes, and Owens' (1990) ecology model, derived from Owens' developmental-integrative model (Owens, 1968, 1971, 1976; Owens & Schoenfeldt, 1979). The ecology model describes causally recursive sequences of life events as a learning process. Specifically, Mumford *et al.* (1990) described a sequence of KSA as well as values and expectancies as shaping individuals' actions consistent with their environment at time 1 (t_1). Individual actions at t_1 yield a new environment at time 2 (t_2) including performance outcomes resulting from t_1 activities and possibly a new profile of KSAs and modified preferences or desires for outcomes, resulting from application of KSAs. This rationale also acknowledged that individuals have hereditary and environmental "baggage" that shapes their choices. Each choice situation encountered requires adaptation and is viewed as a potential developmental experience. Hence, the model describes an iterative process of choice, development, and adaptation. Over time, individuals are hypothesized to develop characteristic patterns of choices and behaviors.

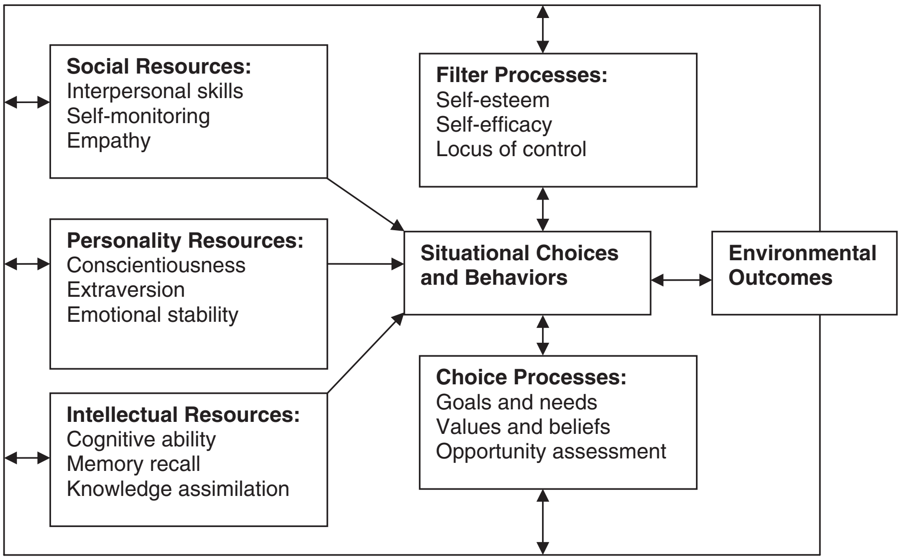
In an attempt to pinpoint possible dimensions underlying the model, Nickels (1990) developed a framework of characteristics and individual differences posited to influence performance by reviewing the individual differences literature and research on known predictive relationships between past behavior/experience and later performance. Three general categories of individual differences emerged and were labeled: "Personality Resources," "Social Resources," and "Intellectual Resources." Biodata items labeled "Personality Resources" glean information from past experiences regarding the respondents' emotional attributes. Items labeled "Social Resources" capture past experiences that suggest an ability to engage in self-monitoring behavior and be socially sensitive. Biodata items labeled "Intellectual Resources" tap past experiences demonstrating the ability to assimilate and retain knowledge. Two additional categories related to motivational processes (e.g., goals, needs) and beliefs/attitudes thought to influence subsequent decisions and actions (e.g., locus of control, self-esteem, self-efficacy) were labeled "Choice Processes" and "Filter Processes," respectively.

The ecology model suggested that these five latent construct domains "facilitate the attainment of desired outcomes while conditioning future situational choice by increasing the likelihood of reward in certain kinds of situations" (Mumford & Stokes, 1992, p. 81). The ecology model is graphically portrayed in Figure 1.

Prior to the first formal descriptions of the ecology model, Mumford, Wesley, and Shaffer (1987) hypothesized that, over time, individuals "manifest an internally consistent pattern of environmental transactions resulting in systematic activity selections and formation of a stable developmental trajectory" (p. 294). Formation of a predictable pattern of environmental interaction was said to lead to a "crystallized," or stable, adaptive style. Mumford *et al.* (1987) tested their hypothesis by administering four biodata inventories to over 750 undergraduate college students between the ages of 18 and 30. Results indicated stable developmental trajectories could be identified by late adolescence and that certain later experiences inconsistent with the individual's adaptive style could derail or alter an individual's previously stable adaptive style. Factors or dimensions used to operationalize adaptive styles included the five ecology model domains. Although Mumford *et al.* (1987) did not examine whether these life experiences exhibited criterion validity, they did find evidence suggesting that latent constructs in the ecology model evolve systematically over time.

Mumford, Costanza, Connelly, and Johnson (1996) described and tested a method of developing construct-valid biodata items originally suggested by Russell (1994). Like Mumford *et al.* (1987), Mumford *et al.*'s (1996) purpose was not to directly test the ecology model. However, Mumford *et al.* (1996) did develop biodata items tapping aspects of Filter Processes, Social Resources, Personality Resources, and Choice Processes and found evidence for the construct and criterion validity of the scale scores.

The ecology model posits that the five latent construct domains influence one another as well as subsequent outcomes of interest. Further, the theory suggests that events and behaviors related to the latent ecology model construct domains are dependent on environmental "opportunities" conditioned by life tasks and developmental stages (Mumford, Snell, & Reiter-Palmon, 1994). Although multiple theories of developmental life stages exist (e.g., Erickson, 1963; Kegan, 1982; Magnusson, 1988), none have been explicitly linked (theoretically or empirically) to ecology model construct domains or their



Adapted from Mumford, M. D. & Stokes, G. S. (1992). Developmental determinants of individual action: Theory and practice in applying background measures. In M. D. Dunnette and L. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., vol. 3, pp. 61–138). Palo Alto, CA: Consulting Psychologists Press.

Figure 1. The ecology model.

criterion validity. Theories that may be useful for explaining include constructive/developmental theory (Kuhnert & Lewis, 1987; Kuhnert & Russell, 1990; Russell & Kuhnert, 1992) and developmental time windows (Rovee-Collier, 1995).

Kuhnert and colleagues proposed a constructive/developmental theory of leadership development in which individuals go through six stages. Kuhnert and Russell (1990) borrowed Kegan's (1982) metaphor of an object being viewed through a lens to describe the key characteristics of successive developmental stages. The objects being viewed through the lens were hypothesized to change as individuals grow and develop through different life stages. The values, beliefs, and needs constituting an early life "lens" were not available to be viewed initially by the individual. As individuals grow into later developmental stages, the values, beliefs, and needs constituting the earlier "lens" would become viewable.

Rovee-Collier (1995) proposed the concept of developmental time windows as critical periods where information about a current event is integrated with information and knowledge acquired from previous events. The same information encountered outside of the time window is less likely to be integrated. Findings cited by Rovee-Collier (1995) suggested information gleaned from life events encountered outside of key developmental time windows may never approach the level of influence achieved when the events are encountered within the window, are not assimilated into the reservoir of collective memory, and are less likely to impact future behavior. For example, the same event "A" that might be highly developmental if it occurs in high school (e.g., "mostly A's" in response to the question "what kinds of grades did you receive in science classes?") may not have the same effect if encountered in college. Meaning ascribed to event A is dependent on brief alignments and configurations of events, the confluence of which generates the requisite motivation, attention, abilities, and environmental circumstances for personal development and change. Proper alignment of all of these episode characteristics may tend to occur at only certain life or career stages. The absence of other early context events when event A occurs may preclude any developmental influence (i.e., timing is everything). Rovee-Collier (1995) speculated that developmental time-windows might be the cornerstone of individual differences in cognitive domains used when integrating successive experiences.

Given that development is dependent on successive life events and stages, it becomes important to consider the role that life stages may play in explaining biodata predictive ability. Recent biodata research has taken a construct-oriented approach for measuring constructs tied to a specific job (Allworth & Hesketh, 1999, 2000; Karas & West, 1999; Stokes & Cooper, 2001; Stokes & Searcy, 1999). Ecology model constructs may be useful for explaining biodata predictive ability across a wide range of jobs.

Current Study

The purpose of the current study is to determine whether items from a biodata inventory designed for personnel selection display psychometric characteristics (e.g., factor structure, internal consistency reliability) and associations (e.g., convergent, discriminant, and criterion validity) consistent with ecology model-based construct domains. The degree to which evidence shows that biodata item content is related to ecology model domains and these domains explain variance in criterion performance would jointly constitute support for the ecology model and the constructs it proposes as a sound theoretical framework for future biodata personnel selection efforts.

Method

Sample

Data were collected from a sample of 6032 newly hired automated systems controllers for a governmental agency who completed a biodata inventory as part of the selection process over a period of 6 years. This particular job requires the ability to multitask several duties including monitoring radar screens, making decisions to manage air space, and directing those in the air space. The sample was 90% white and 83% male. The size of the sample was beneficial for generating stable empirical weights and cross-validating the inventory.

Measures

Biodata. Biographical information was collected using a 142-item biodata questionnaire. Each item had five response options, and respondents were instructed to choose only one response option per item. Where applicable, an escape response option was included to allow applicants to opt out of the question if they had no prior experience on the topic the item addressed. Only applicants who responded to all 142 items ($N = 4767$) were included for keying and cross-validating the inventory. Each applicant's overall biodata score was a weighted sum of his/her chosen response options. The biodata inventory was scored using response option empirical keying (Kluger, Reilly, & Russell, 1991), which treats each individual item response option as a single dichotomous "item" coded "0" or "1." Each individual response option is weighted by its point biserial correlation (r_{pb}) with the criterion as estimated in the 80% ($N = 3787$) of the sample randomly assigned for key development. Each applicant's biodata score was the simple sum of point biserial correlations associated with the response options s/he chose added to a base score of 100. The response option scoring weights developed from the key development sample were subsequently applied to the holdout sample ($N = 980$) to estimate cross validities.

The r_{pb} is a special case of the Pearson product–moment correlation (r) applicable when correlating a truly dichotomous variable (e.g., response options either chosen or not) with a continuous variable (e.g., a performance measure) and is the most efficient means (i.e., best linear unbiased estimator) of capturing the strength of the relationship between an item response option and the criterion of interest. In the only published direct comparison of alternative biodata keying procedures (Devlin, Abrahams, & Edwards, 1992), response option-based scoring yielded the highest criterion validities. A similar scoring method that generates weights approximating point biserial correlations, but requiring substantially less computational resources, is known as the "vertical percent difference" method. This method is described in detail by Kluger *et al.* (1991) and Russell, Mattson, Devlin, and Atwater (1990).

The biodata inventory was administered to applicants as part of research undertaken to develop new procedures for possible future use in competitive selection examinations. Applicants completed the inventory voluntarily and were aware that their biodata responses were not being used for selection purposes. This, in addition to the use of response option empirical keying, lessened the possibility of response inflation. Regardless, Kluger *et al.* (1991) found response inflation does not influence criterion validities exhibited by response option-scored biodata.

The biodata items were rationally developed using approaches outlined by Mumford and Owens (1987). These included a review of qualification standards for the job, job analyses, previous biodata efforts at this governmental agency, interviews with training personnel to determine characteristics of successful candidates, and interviews with supervisors to ascertain characteristics differentiating good and poor employees.

General Mental Ability Measure. Data were available on a 110-item Office of Personnel Management (OPM) test that was also administered to these applicants as part of the selection process. This test measured traditional cognitive aptitudes such as arithmetic reasoning, data interpretation, table reading, and spatial relations.

Criterion. The criterion used in this research was a composite performance measure gathered from applicants during a 9-week training/screening program. Successful program completion was a precursor to placement in this position. The program focused on basic job rules and procedures and then tested candidate knowledge through written exams and laboratory simulations. The criterion was a weighted combination of three performance assessments: (1) paper and pencil multiple-choice tests administered throughout the program that assessed candidate ability to acquire and retain basic job knowledge, (2) job simulation ratings on six 30 min laboratory simulations scored using instructor technical assessments of number of errors and instructor assessments of trainee performance, and (3) a final paper and pencil examination that assessed trainees' ability to apply job rules and procedures. These categories were weighted 20%, 60%, and 20%, respectively, and summed to form an overall composite score.

Analyses and Results

Content Validity

The biodata inventory's content validity was examined relative to the hypothesized ecology model construct domains using a Q-sort procedure. Five individuals with

Table 1. Means, standard deviations, and correlations for the cross-validation sample[a]

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1. Criterion	70.86	11.48											
2. Entire Biodata Inventory	100.51	1.06	.36/.43[b]										
3. Social Resources Items	100.01	.21	.18	.07									
4. Personality resources items	100.01	.09	.16	.44	−.11								
5. Intellectual Resources Items	100.07	.87	.31	.92	−.11	.27							
6. Choice Processes Items	100.31	.27	.23	.54	−.10	.44	.27						
7. Filter Processes Items	99.99	.03	−.01	.38	−.16	.21	.30	.27					
8. Cognitive Ability Test	71.10	11.50	.16/.41	.14	.08	−.04	.13	.01	.05				
9. Mid-term Examination	93.14	6.98	.54	.22	.05	.08	.21	.16	.03	.11			
10. Skills Test	90.32	7.30	.83	.31	.22	.09	.29	.18	.00	.21	.44		
11. Behavioral Ratings	62.66	14.26	.98	.29	.16	.14	.28	.22	.02	.14	.47	.69	
12. Final Examination	74.89	14.41	.52	.24	.04	.09	.23	.16	.02	.08	.42	.44	.43

[a]All correlations above ± .075 are significant at $p < .05$, $N = 741$.
[b]Correlations reported after forward slash are corrected for range restriction on the cognitive ability test.

knowledge of biodata applications (one Ph.D. and four advanced doctoral students in industrial/organizational psychology and human resource management) read the latent construct definitions, examined biodata item content, and Q-sorted the inventory's 142 items onto the five construct domains. The Q-sort instructions are presented in the Appendix A. Agreement on the construct domain categorization of an item among all Q-sort judges was achieved on 116 items (82% agreement). Eleven of the 142 items were not sorted onto any of the five ecology model construct domains. Group discussion among the Q-sort judges was used to resolve initial disagreement on the categorization of 26 items. Discussion continued until all judges agreed on the appropriate categorization of each these disputed items. One hundred thirty-one items were eventually sorted into one of the five ecology construct domains. The high level of agreement of the Q-sort procedure provided initial evidence of the content validity of this biodata instrument in terms of its ability to capture ecology model domains.

Of the 131 items sorted onto the construct domains, 19 had categorical response options and were thus excluded from subsequent factor analysis given that scales scores on categorical responses are uninterpretable. Hence, 112 items were deemed appropriate for factor analysis. In terms of how these items were sorted into ecology model categories, 21 were Q-sorted onto the Social Resources domain, 10 onto the Personality Resources domain, 37 onto the Intellectual Resources domain, 42 onto the Choice Processes domain, and two onto the Filter Processes domain, respectively.

Criterion-Related Validity

Means, standard deviations, and correlations for the study variables generated from cross-validation sample are presented in Table 1. The overall cross-validity obtained for the biodata instrument was $r = .36$. Response options from items Q-sorted onto Intellectual Resources and Choice Processes ecology model construct domains yielded the highest subscale cross-validities ($r = .31$ and $r = .23$, respectively).

Construct Validity

The 112 items that were Q-sorted and appropriate for factor analysis were subjected to common factor analysis using oblique rotation to create item parcels within each Q-sort item grouping. Notably, factor analysis results suggested the items Q-sorted onto ecology model construct domains tended to be reflected by a number of homogeneous factors that were interpretable and reflected different "eras" or "life stages." This suggested that perhaps meaningfully different chronological developmental opportunities existed within ecology model construct domains. For example, factor analysis results suggested responses to items tapping life events related to intellectual resources were clearly delineated into high school, college, and early career developmental time periods. A total of 11-item parcels were identified via common factor analysis across all ecology model domains and were used as indicators in subsequent confirmatory factor analyses (CFA). Six parcels emerged from ecology model domains tapping early career life events, two parcels emerged from ecology model domains tapping college era events, and three parcels emerged from ecology model domains tapping high school era events. Factor analysis results are available from the first author upon request.

Correlational analyses provided some evidence for the ecology model construct validity. General cognitive ability scores correlated more highly with the intellectual resources items ($r = .13$) than with any other ecology

Table 2. Item parcel correlations[a]

Parcel content	1	2	3	4	5	6	7	8	9	10	11	12
Early Career/Job												
1. Criterion	–											
2. Social Resources/job	.05	.80[b]										
3. Personality Resources/job	.03	.49	.55									
4. Intellectual Resources/job	.18	.59	.55	.86								
5. Choice Processes/job	.13	.44	.33	.43	.78							
6. Filter Processes1/job	.03	.26	.20	.30	.14	–						
7. Filter Processes2/job	.03	.32	.20	.22	.17	.24	–					
College												
8. Intellectual Resources/college	.19	.08	.15	.14	–.10	.16	.14	.94				
9. Choice Processes/college	–.03	.07	.09	.09	–.07	.14	.16	.82	.83			
High School												
10. Social Resources	.05	.30	.19	.16	–.03	.12	.16	.38	.39	.67		
11. Intellectual Resources	.21	–.06	.16	.28	.06	.22	.15	.20	.08	.01	.86	
12. Personality Resources	.08	.50	.15	.30	.28	.17	.26	–.06	–.04	.19	.08	.56

[a]All correlations above ±.075 are significant at $p<.05$, $N=741$.
[b]Parcel coefficient αs are presented on the diagonal.

model construct domain item group. Although the intellectual resources items are not substitutes for standardized cognitive ability tests, these correlations provide some evidence of construct validity for this subgroup of items.

Table 2 reports correlations among unit-weighted parcel scale scores. Correlations within and across item parcels suggested that biodata items sorted as being consistent with a specific construct but anchored in different life stages captured something meaningfully about the particular construct over time. Correlations among parcel scale scores tapping a particular life stage (e.g., high school, college, and early career) were relatively high (average $r=.41$), constituting evidence of biodata item convergent validity around life stages. The average correlation between parcel scale scores tapping a particular ecology model construct domain was $r=.17$. An average across-life stage parcel correlation of .15 suggested item responses exhibited discriminant validity across life stages. The average correlation among ecology model construct domains was $r=.23$. These results provide initial discriminant and convergent validity evidence supporting a model integrating life stage construct domains within the ecology model.

Additionally, items were grouped by life stage and correlated with the criterion. *A priori* we suspected that items tapping earlier life stages (e.g., high school) would have a lower correlation with the job performance measure compared with items tapping later stages closer to the current job (e.g., college or early career). Instead, we found that the correlations were not significantly different from each other. Specifically, the high school, college, and job scales correlated $r=.23$, .20, and .19, respectively, with the criterion. Correlations among the life stage item groupings are presented in Table 3.

Finally, CFA using LISREL were performed in order to test the ecology model's ability to explain relationships within these data. Typical CFA practice uses averages of item groupings, or parcels, as indicators of latent construct domains (Schau, Stevens, Dauphine, & Del Vecchio, 1995). Hall, Snell, and Foust (1999) suggested item parcels are more reliable and likely to be normally distributed relative to individual items and hence preferred as CFA indicators. Therefore, items were grouped into the 11 parcels identified in exploratory factor analyses for input as indicators in CFA.

CFA results suggested a model in which item parcels were loaded onto their respective ecology model domains did not fit the data well (Model 1: χ^2 [34, $N=6036$] = 8145.78, $p<.001$; Goodness of Fit Index (GFI) = .81, Comparative Fit Index (CFI) = .19, Normed Fit Index (NFI) = .56, Parsimonious Goodness of Fit Index (PGFI) = .56, and Root Mean Square Error of Approximation (RMSEA) = .35). The resulting fit indices were not acceptable using commonly used guidelines (e.g., Medsker, Williams, & Holahan, 1994). Therefore, the ecology model as conceived via the model's construct domains did not provide a good fit to these data. Given the literature on life stages and their important role in individual development, and because of the fact that exploratory analyses suggested different stages of development existed within the ecology model construct domain items, this led us to examine the viability of a *post hoc*, alternative "life stages" ecology model.

Based on these results and the theoretical rationale provided by Kuhnert and Russell (1990) and Russell and Kuhnert (1992), the latent measurement model was reconfigured around developmental periods associated

Table 3. Correlations between high school, college, and early career domains[a]

Variable	1	2	3
1. Criterion	–		
2. High school domain	.23		
3. College domain	.20	.18	
4. Early career domain	.19	.08	.17

[a]All correlations above are significant at $p < .05$, $N = 741$.

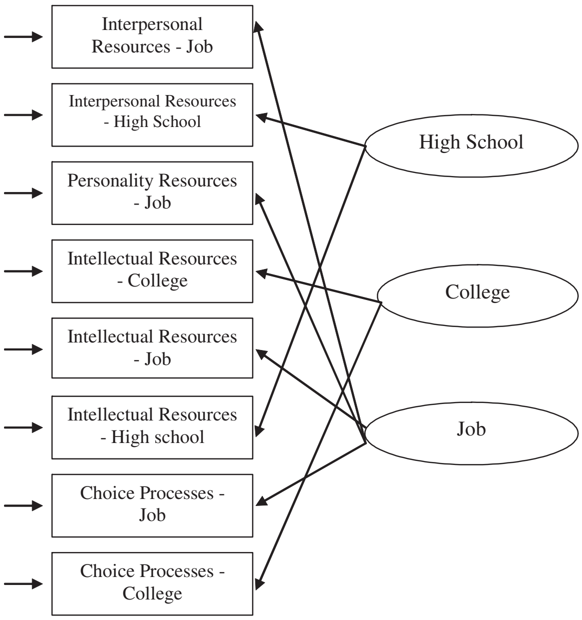


Figure 2. Relationship of ecology model-based item parcel indicators with life stages latent constructs (Model 3).

with high school, college, and early career experiences. This proposed modification is also consistent suggestions by with Mumford *et al.* (1987) and Mumford and Stokes (1992) that the ecology model framework is dependent on environmental opportunities that are conditioned by developmental life stages, and Rovee-Collier's (1995) work on developmental time windows, which suggested that there are critical periods that influence individuals' abilities to integrate information from successive life experiences.

The proposed life stages ecology model was tested by arranging item parcels as indicators of the life stage captured. This model fit the data better than the original ecology model formulation (Model 2: χ^2 [41, $N = 6036$] = 2148.22, $p < .001$; GFI = .94, CFI = .89, NFI = .88, PNFI = .58, and RMSEA = .09). Modification indices generated in the test of Model 2 were examined in an attempt to achieve better fit. One of the three Personality Resources parcels initially loaded onto the "high school" factor, although some but not all items in this parcel addressed a singular point in time. This parcel had a very low CFA loading (.05) on the high school factor and a low λ–χ modification index (consistent with the fact that no single developmental time period was tapped). Additionally, the two Filter Processes parcels had high error terms relative to other indicators (which was likely because of the fact that each parcel contained only one item). Therefore, the three above-mentioned parcels were subsequently removed from the model. Model 3, as illustrated in Figure 2, generated slightly better model fit indices: (Model 3: χ^2 [17, $N = 6036$] = 1347.62, $p < .001$; GFI = .95, CFI = .92, NFI = .92, PGFI = .45, and RMSEA = .11). Examination of fit indices across the models suggested the life stages ecology model yielded a better fit to the data compared with the ecology model as originally proposed. Further inspection of the life stages model showed that the high school and college factors were highly correlated (.73). Given they both tapped educational experiences, these two factors were combined to form an "educational experiences" factor to see if a more parsimonious model would provide a better fit to the data. However, this modification did not improve model fit: (Model 4: χ^2 [19, $N = 6036$] = 2104.32, $p < .001$; GFI = .92, CFI = .88, NFI = .87, PNFI = .49, and RMSEA = .13.

Discussion

Four sets of analyses provided evidence of the ecology model's content, criterion-related, and construct validity. First, the Q-sort procedure in which items were sorted into ecology model construct domains provided a test of prototypic conceptions and content relevance. Q-sort judges agreed on sorting the majority of items onto the five ecology model construct domains. This high level of interjudge agreement supports inferences of content validity.

Second, biodata scores and the construct domain scores were regressed onto the criterion, thereby providing a demonstration of the biodata inventory's and the scale scores' criterion-related validity. Meaningful criterion validities were found for items falling in all but one of the five ecology model construct domains. Criterion validities associated with construct domains are consistent with the ecology model prediction that life experiences falling in these domains should causally influence subsequent KSA acquisition and job performance.

Third, results reported in Tables 2 and 3 support biodata scale convergent and discriminant validity of life stage-oriented ecology model construct domains. Specifically, factor analysis results suggested that biodata items load more highly within one life stage-specific ecology model construct domain than within the same construct at a different life stage or with other construct domains. Estimates of internal consistency reliability reached generally accepted standards for items loading within individual stages when at least six items loaded dominantly on them. Correlations among parcel scale scores tapping a particular ecology model construct domain were relatively low. However, an ecology model based around life stages suggested parcels within a life stage should exhibit convergent validity. Correlations among parcel scale scores tapping common life stages exhibited strong evidence of convergent validity. Correlations between parcels from different life stages also exhibited evidence of discriminant validity. These results suggest that construct domains hypothesized by the ecology model do explain applicant responses to biodata items when the model is modified to incorporate developmental life stages.

Finally, CFA provided construct validity evidence for a life stages configuration of the ecology model constructs. Given results of the exploratory factor analysis and convergent and discriminant validity evidence, it was not surprising that initial CFA results failed to support the *a priori* five-factor ecology model construct domain. Subsequent interpretations of item parcel content and CFA modification indices suggested an interpretable life stages ecology model fit the data well. Specifically, results suggested meaningful differences in ecology model construct domains occurred across life experiences. We chose not to portray the ecology and life stages models as competing, as we feel that the authors of the ecology model would not consider the notion of life stages as being inconsistent with the ecology model in general. Nonetheless, the ecology model does not specify when relevant life stages might occur or the developmental content of these stages.

These results suggest future ecology model research, and perhaps biodata research in general that incorporates a life stage perspective may yield a better understanding of biodata predictive ability. This suggestion is also consistent with constructive/developmental theory (Kuhnert & Russell, 1990) and Rovee-Collier's (1995) research on developmental time windows. High school, college, and early career experiences captured by the biodata items in this study may reflect key events that shape and change how individuals view themselves and their environment over time.

A theoretical contribution of this research is the suggestion that items capturing the same theoretical construct may be impacted by the life stage, or era, in which the item is anchored. For example, items tapping the Intellectual Resources domain in the college era seemed to capture a meaningfully different aspect of Intellectual Resources than those anchored in early career ($r = .14$ between scales). We believe these findings may be generalizable to any construct domain that biodata intends to tap. Whatever latent construct domain biodata items may intend to reflect, these findings suggest future investigators should generate items tapping multiple time periods across one's life history to ensure items from the key (i.e., predictive) "eras" are captured. More research is needed to examine the influence of anchoring items in a particular time context. It may be important to examine if certain life stages are more predictive than others or perhaps that certain constructs may be more predictive when anchored in a particular life stage. Additional research is also needed to see if the relationships here hold for other samples and contexts.

The finding that items capturing the same theoretical construct may be impacted by the life stage in which the item is anchored speaks to the importance of item context when developing items to measure a particular construct. This is a similar notion to research on personality tests which found that adding item context in terms of work-related activities such as "I am always on time for work" rather than "I am always on time" tended to increase criterion validity (Schmit, Ryan, Stierwalt, & Powell, 1995). The current study's findings suggest that similar consideration be given to biodata items as has been examined in the personality literature. Framing an item around a specific, hypothesized developmental time era may give insight into which developmental periods are most predictive and may help applicants provide more accurate responses by giving them a specific context to which to relate their response.

Limitations

Limitations of the current study include the fact that biodata items studied were from a typical biodata instrument not specifically based on the ecology model constructs and the non-orthogonal nature of the ecology model construct domains in general. Despite these limitations, results suggest the ecology model was useful in explaining this particular biodata inventory's explanatory and predictive ability. These findings suggest that future research is warranted examining items specifically developed to tap ecology model construct domains. Applicant responses to biodata items specifically developed to capture ecology model construct domains across different developmental stages should yield even stronger findings.

The ecology model domains by their nature are not perfectly orthogonal (e.g., social resources and personality resources domains). One might have expected overlap between latent ecology model construct categories to have caused Q-sorters some frustration and possible low levels of consensus. Fortunately, current Q-sorters did not report this kind of frustration in their debriefing. Additionally, it should be noted that the Personality Resource items are not appropriately viewed as "personality" measures *per se*. Rather, biodata items address life experiences deemed to be reflective of personality characteristics. Biodata items should not be considered measures of latent personality constructs or a substitute for items specifically designed to measure personality or its dimensions (e.g., the Big Five). Similarly, intellectual ability-loaded biodata items should not be viewed as a substitute for items specifically designed to assess cognitive ability.

Future Research

Future research is warranted on biodata item development efforts designed to tap construct domains proposed around developmental eras, or life stages. Researchers should use any one of a number of construct domain-targeted biodata item generation procedures (Russell, 1994) to generate items from construct domains across developmental life stages. This study also suggests future research is needed to examine stage characteristics, such as what events signal a developmental stage is beginning or ending. For example, does a life event have the same developmental influence or criterion validity regardless of the stage or time window in which it occurs (Kuhnert & Russell's, 1990, model suggests it would not)? Item generation procedures described by Mumford *et al*. (1996) and Russell (1994) should be adapted to target life stage-specific events hypothesized to influence constructs underlying the five ecology model domains. Additional research should also shed light on whether support exists for a model containing these five latent construct domains during all developmental periods or whether different domains are more pertinent during periods of rapid change and development.

In sum, this research provided support for the ecology model as a viable theoretical rationale for biodata predictive ability in an applied personnel selection context. The ecology model provides adequate explanatory power for biodata's predictive ability; however, this explanatory power might be further improved by incorporating the concept of life stages within the originally explicated construct domains. We expect further advances in biodata theory development will occur when future investigators employ developmental life stages when generating biodata items. Future research should examine whether attending to life stages in biodata theory development and subsequent biodata practice will yield stronger theoretical and empirical support for the use of biodata in personnel selection.

Appendix A

Biodata Item Q-sort Exercise

Part I: Instructions

Thank you for participating in this research study. This exercise should take approximately 45 min to complete and involves sorting 142 items into the construct domain category in which you believe a particular item most represents. The categories you will be asked to use are labeled:

1. **Social Resources**
2. **Personality Resources**
3. **Intellectual Resources**
4. **Choice Processes**
5. **Filter Processes**
6. **Other**

Please put the number of the category that best fits the item in the blank next to the respective item. If an item does not seem to fit clearly into any category, note this by choosing option "6" for "Other."

Definitions for the categories are provided on the following three pages. Please read through them and be certain of your understanding of these categories prior to participating in this exercise.

Please read through each item and place the number (1–6) of the category you think best represents that particular item in the blank by that item. For example:

______During my last year in high school, the average number of hours of I spent in extracurricular school activities per week was:

A. more than 20
B. 16–20 hours
C. 10–15 hours
D. fewer than 10 hours
E. none

For example, placing a "1" in the space available would suggest that this item most closely fits into the Social Resources category.

Part II: Category Definitions

1 = Social Resources

Place an item in this category if you believe the item has the ability to tap a person's interpersonal or social skills. Interpersonal skill is related to a person's ability to communicate with others (oral, written, etc.). Involvement in group activity may also signal ones' adeptness for interacting with others. Greater number of group memberships may suggest individual effectiveness in self-monitoring, social sensitivity, and ability to adjust behavior to match that of the group.

2 = Personality Resources

Place an item in this category if you believe the item taps aspects of a person's personality. This category represents consistent patterns of behavior and characteristics such as adaptability, persistence, extraversion (e.g., sociable, assertive, ambitious), emotional stability (e.g., secure, anxious, well-adjusted), conscientiousness (e.g., dependable, efficient, achievement oriented), and openness to experience (e.g., cultured, curious, broad-minded).

3 = Intellectual Resources

Place an item in this category if you believe the item taps a person's intellectual skills/resources. This category represents attributes that enable one to assimilate and retain knowledge affecting one's ability to make choices and perform efficiently and effectively. Items capturing past experiences requiring or aiding in the development of general cognitive ability.

4 = Choice Processes

Place an item in this category if you believe it has the ability to tap an individual's motivation. This category represents the values and choices that precede individual behavior and performance. Items dealing with motivational issues include goal orientation, personal performance standards, and desirability of the reward (e.g., "valence" in expectancy theory terms).

5 = Filter Processes

Place an item in this category if you believe the item has the ability to tap a person's self-perception. This category represents the beliefs and attitudes, which may influence self-perception and consequently decisions an individual makes. This category includes characteristics such as self-esteem, self-efficacy, and locus of control.

6 = Other

If the item does not fit into any of the above categories, place the item in the "other" category.

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