TESTING THE DIMENSIONALITY OF PLACE ATTACHMENT IN RECREATIONAL SETTINGS

GERARD KYLE *is an assistant professor in the Department of Recreation, Park & Tourism Sciences at Texas A&M University.*

ALAN GRAEFE *is an associate professor affiliated with the Department of Recreation, Park and Tourism Management at The Pennsylvania State University.*

ROBERT MANNING *is a professor in the Rubenstein School of Environment and Natural Resources at the University of Vermont.*

ABSTRACT: The purpose of this investigation was to examine the psychometric properties of a place-attachment scale using data collected from visitors to the Appalachian Trail in the United States. These data supported a correlated three-factor model consisting of place identity, place dependence, and social bonding. Multigroup confirmatory factor analysis was used to cross-validate the model using two subsamples of the data. Latent factor means were also compared. Although these analyses provided mixed evidence indicating the scale to be a valid and reliable measure of place attachment, there remains some concern about the performance of several indicators (i.e., low factor loadings, low reliability). Latent mean differences were also observed between the two groups on the place identity dimension. The analyses presented in this investigation provide an example of the utility of covariance structure analysis for testing the psychometric properties of scales and for comparing latent mean differences among groups within populations.

Keywords: *place attachment; structural equation modeling; scale testing; latent mean differences*

Research on place attachment has been the focus of considerable theoretical development and empirical research within several disciplines. Most conceptualizations of the construct have attempted to describe the range of feelings humans associate with specific environments. In their review of the place-attachment literature, Low and Altman (1992) suggested that there are

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several important elements underlying the study of place attachment. First, most analyses of human-place bonding have illustrated that “affect, emotion and feeling are central to the concept” (p. 4). Second, the attitude object or focus of feelings, affect, and emotions are directed toward specific environments and settings that can “vary in several ways—scale or size and scope, tangible versus symbolic, known and experienced versus unknown or not experienced” (p. 5). Although the environmental psychology literature has focused primarily on individuals’ attachment to place, sociologists, cultural anthropologists, and human geographers have noted that “dyads, families, community members, and even whole cultures often consensually or collectively share attachments to places” (p. 6). Other scholars have also suggested and/or observed that “attachment to places may be based on or incorporate other people—family, friends, community, and even culture” (p. 7). In this sense, the social relationships that a place signifies may be the focus of an individual’s attachment. Finally, Low and Altman noted that place attachment is subject to temporal variation (i.e., fluctuates, cyclical). This complexity, along with the diversity of theoretical approaches, has contributed to the development of several analogous concepts. These have included community attachment (Kasarda & Janowitz, 1974), sense of place (Hay, 1998), place identity (Proshansky, 1978), place dependence (Stokols & Shumaker, 1981), and rootedness (Hummon, 1992).

Operations of the construct have been equally diverse. Several authors have, however, recently attempted to demonstrate the adequacy of a place-attachment scale developed by Williams and Roggenbuck in 1989 (Jorgensen & Stedman, 2001; Williams & Vaske, 2003). Their efforts have demonstrated that the scale is a valid and reliable measure of the place-attachment construct. In this article, we extend this work by examining the measurement properties associated with their scale using hikers along the Appalachian Trail (AT) in the United States. In so doing, we address issues of substantive and methodological interest. Substantively, we examine the construct validity and reliability of Williams and Roggenbuck’s (1989) scale while testing an additional dimension within a hypothesis-testing framework. Methodologically, we also demonstrate the use of structural equation modeling (SEM) procedures in testing measurement invariance and latent mean structures.

AUTHORS’ NOTE: *The authors wish to thank Rita Hennessy for her assistance in the development of this study.* *Correspondence concerning this article should be addressed to Gerard Kyle, Department of Recreation, Park & Tourism Sciences, Texas A&M University, 2261 TAMU, College Station, TX 77843-2261; email: gerard@tamu.edu.*

RELATED LITERATURE

The concept of place attachment focuses on the phenomena of human-place bonding. Although a number of terms have been used to describe this phenomena (e.g., sense of place, rootedness, insidedness), most conceptualizations have noted that affect, emotion, and feeling are central to the concept (Low & Altman, 1992). Low and Altman noted, however, that these emotional qualities are also accompanied by cognition (thought, knowledge, and belief) and practice (action and behavior). Thus, place attachment involves an interplay of affect and emotions, knowledge and beliefs, and behaviors and actions. This conceptualization stresses the interaction between humans and places. Several authors have captured this sentiment by noting that physical space becomes the object of place attachment through our interactions with the setting. Place attachment often emerges as individuals get to know the setting and endow it with value (Milligan, 1998; Relph, 1976; Tuan, 1980).

Our conceptualization of place attachment draws from the work of Schreyer, Jacob, and White (1981) and of Williams and Roggenbuck (1989), who considered the human-place bond in terms of two components: place identity and place dependence. Proshansky (1978) conceptualized place identity in terms of the cognitive connection between the self and the physical environment. He defined place identity as “those dimensions of self that define the individual’s personal identity in relation to the physical environment by means of a complex pattern of conscious and unconscious ideals, beliefs, preferences, feelings, values, goals, and behavioral tendencies and skills relevant to this environment” (p. 155). In this sense, settings offer individuals the opportunity to both express and affirm their identity. Place dependence, on the other hand, concerns how well a setting serves goal achievement given an existing range of alternatives (Jorgensen & Stedman, 2001). Stokols and Shumaker (1981) indicated that a place can be considered important to an individual because of its functional value. In the context of many recreational settings, users of specific resources can also be dependent on them because of their unique ability to facilitate desired experiences. Thus, in the context of many recreation settings, a place can be valued by an individual because it is a good place to undertake a particular activity, or it can be valuable because it is seen as special for emotional or symbolic reasons or for both (Moore & Graefe, 1994). Moore and Graefe used the example of a hiker in the White Mountains of New England who might be attached to the setting because it provides the steep, rugged trails he or she prefers, whereas another person might be equally attached to the same area because of nostalgic memories of early trips with his or her family.

This conceptualization of place attachment is also supported by several studies that have used Williams and Roggenbuck's (1989) measure (Bricker & Kerstetter, 2000; Kyle, Absher, & Graefe, 2003; Moore & Graefe, 1994; Vaske & Kobrin, 2001). Recently, Williams and Vaske (2003) also tested the validity and generalizability of this conceptualization and confirmed the existence of a two-dimensional structure (i.e., place identity and place dependence) for place attachment across several settings.

Recently, Jorgensen and Stedman (2001) suggested that sense of place is a broad and encompassing attitudinal construct consisting of three dimensions: place attachment, place dependence, and place identity. They also suggested sense of place should be considered as an attitudinal construct, and as such it is composed of three components: affect, cognition, and conative elements. They indicated that place attachment was reflective of the affective component, place identity was reflective of the cognitive component, and place dependence was equated with the conative component. Similarities also exist between Jorgensen and Stedman's operation of sense of place and the items used by Williams and Roggenbuck (1989) to measure place attachment. The main difference between the two approaches lies in Jorgensen and Stedman's (2001) inclusion of place attachment as a distinct dimension (i.e., first-order component) rather than as an overarching concept (second-order component), as suggested by Schreyer et al. (1981) and Williams and Roggenbuck (1989). Williams and Roggenbuck's measure of place identity included indicators of both place identity and of items similar to that used by Jorgensen and Stedman (2001) to measure place attachment. Although Jorgensen and Stedman found empirical support indicating that sense of place was best represented as an overarching concept (i.e., second-order factor) consisting of place attachment, place identity, and place dependence (first-order factors), the superiority of this model over a first-order, three-correlated factor model was only marginal. In fact, a chi-square difference test (Byrne, 1998) would indicate this superiority was not statistically significant ($\Delta\chi^2 = .7$, $\Delta df = 1$). Although we concur with Jorgensen and Stedman's (2001) suggestion that "place-related constructs can be considered attitudes" (p. 237), empirical evidence supporting their tripartite conceptualization of sense of place remains scant.

We have also included a social bonding dimension that has been discussed by several authors in the environmental psychology literature (Hidalgo & Hernández, 2001; Low & Altman, 1992; Mesch & Manor, 1998) in our measure of place attachment. If meaningful social relationships occur and are maintained in specific settings, then it should also be likely that these settings share some of this meaning given that they provide the context for these relationships and shared experiences. Mesch and Manor (1998) observed that respondents' social investments within their neighborhood affected their sentiments toward the neighborhood. Respondents with more close friends living in their neighborhood expressed stronger attachments to the neighborhood. Hidalgo and Hernández (2001) reported similar findings. They observed that social attachments were stronger than setting attachments along three spatial contexts: houses, neighborhoods, and cities.

METHOD

STUDY SETTING

The AT stretches 2,168 miles over 14 states along the eastern United States. It passes through more than 60 federal, state, and local parks and forests. The AT began as a vision of forester Benton MacKaye and was developed by volunteers, opening as a continuous trail in 1937. It was designated as the first National Scenic Trail by the U.S. National Trails System Act of 1968. The AT is currently protected along more than 99% of its course by federal or state ownership of the land or by rights-of-way. Social and environmental conditions vary considerably along the length of the trail, ranging from relatively pristine settings with few encounters with other users to heavily impacted areas with regular encounters. Current estimates provided by the National Park Service suggest that the trail attracts approximately 4 million visitors each year.

DESIGN AND SAMPLE

Data were collected over the summer and fall of 1999. Sampling occurred along the entire length of the trial. Two sampling techniques were employed. First, a stratified, systematic sampling technique was used to obtain a representative sample of all AT hikers, with the exception of through hikers (Babbie, 1995). Sampling intensity was stratified (i.e., time and day of the week) in accordance with use estimates[1] provided by staff from the National Park Service and the Appalachian Trail Conference.[2] Consequently, most sampling occurred on weekends. Every third trail user over the age of 18[3] was intercepted by volunteers or paid staff, who requested the name and address of the hiker so that he or she could be sent a survey instrument. Because we were interested in including through hikers who had completed the entire length of the trail in a single season, through hikers intercepted along the trail were initially excluded. Instead, through hikers were purposively sampled at the northern end of the AT[4] to ensure a sufficient number of cases for this group of hikers (Babbie, 1995). To capture these hikers, staff and volunteers in Baxter State Park in Maine asked through hikers to complete the mail-back instrument onsite before they commenced the final ascent to the trail's end on Mount Katahdin.

A total of 2,847 AT visitors agreed to participate (approximately 95% response rate) in the study and were mailed a questionnaire within 2 weeks after their visit. And 2 weeks after the initial mailing, visitors were mailed a reminder and thank you postcard. Visitors who did not return a completed questionnaire within 4 weeks of the initial mailing were mailed a second copy of the questionnaire. Finally, nonrespondents were sent a third survey reminder. This sampling procedure yielded 1,879 completed questionnaires (66% response rate).

MEASUREMENTS

We adapted eight items from Williams and Roggenbuck's (1989) measure of place attachment. Four items measured place identity, and four items measured place dependence. Place identity corresponded with the emotional-symbolic meanings people ascribe to place proposed by Schreyer et al. (1981). Alternately, place dependence was consistent with Schreyer et al.'s suggestion that places can also be valued for their functional utility and their dependence on settings for supporting desired leisure experiences. Also, on the basis of past research, we included four items measuring an additional dimension of place attachment called social bonding. These items were designed to capture the respondent's socially derived attachment to the AT (see Table 1).

ANALYTICAL FRAMEWORK

Although research has indicated that multidimensional conceptualizations of place attachment are best suited (Bricker & Kerstetter, 2000; Jorgensen & Stedman, 2001; Lalli, 1992; Moore & Graefe, 1994), use of unidimensional scales remains prevalent (Hay, 1998; Sugihara & Evans, 2000; Williams, Patterson, Roggenbuck, & Watson, 1992). Consequently, we tested three models of place attachment; (a) a single factor model where 12 manifest items loaded onto one dimension of place attachment (see Figure 1); (b) a first-order, three-factor correlated model that allowed the three dimensions of place attachment to differ within individuals (see Figure 2); and (c) a second-order model consisting of three first-order factors loading onto a single second-order factor (see Figure 3).

TABLE 1
Means and Standard Deviations of Observed Variables

	Overall[a]		*Group 1*[b]		*Group 2*[c]	
Items[d]	M	SD	M	SD	M	SD
Place identity (PI) α = .87						
PI_1 This trail means a lot to me.	4.08	0.823	4.06	0.796	4.10	0.816
PI_2 I am very attached to the Appalachian Trail.	3.48	0.952	3.45	0.994	3.52	1.000
PI_3 I identify strongly with this trail.	3.32	1.021	3.32	1.019	3.31	1.058
PI_4 I feel no commitment to this trail.	3.74	0.984	3.71	1.000	3.78	0.963
Place dependence (PD) α = .86						
PD_1 I enjoy hiking along the Appalachian Trail more than any other trail.	3.19	0.971	3.16	0.989	3.22	1.050
PD_2 I get more satisfaction out of visiting this trail than from visiting any other trail.	2.98	0.991	2.96	0.988	3.00	1.040
PD_3 Hiking here is more important than hiking in any other place.	2.68	0.950	2.64	0.967	2.71	1.005
PD_4 I wouldn't substitute any other trail for the type of recreation I do here.	2.48	0.787	2.48	0.827	2.48	0.852
Social bonding (SB) α = .62						
SB_1 I have a lot of fond memories about the Appalachian Trail.	4.15	0.827	4.15	0.810	4.14	0.843
SB_2 I have a special connection to the Appalachian Trail and the people who hike along it.	3.32	0.999	3.32	0.979	3.32	1.019
SB_3 I don't tell many people about this trail.[e]	3.88	0.798	3.86	0.792	3.90	0.804
SB_4 I will (do) bring my children to this place.	3.93	0.824	3.93	0.804	3.93	0.844

a. *N* = 1,630.
b. *n* = 813.
c. *n* = 817.
d. Measured using a Likert-type format where 1 = *strongly disagree* and 5 = *strongly agree*.
e. Reverse coded.

To further examine the psychometric properties of the final model emerging from the comparative analysis, we split our sample and randomly assigned respondents into one of two groups and tested for the equivalence of factor covariance and mean structures across these two subsamples (See Appendix Table 1). This method of cross-validation provides a stringent examination of the scale's psychometric properties (Byrne, Shavelson, &

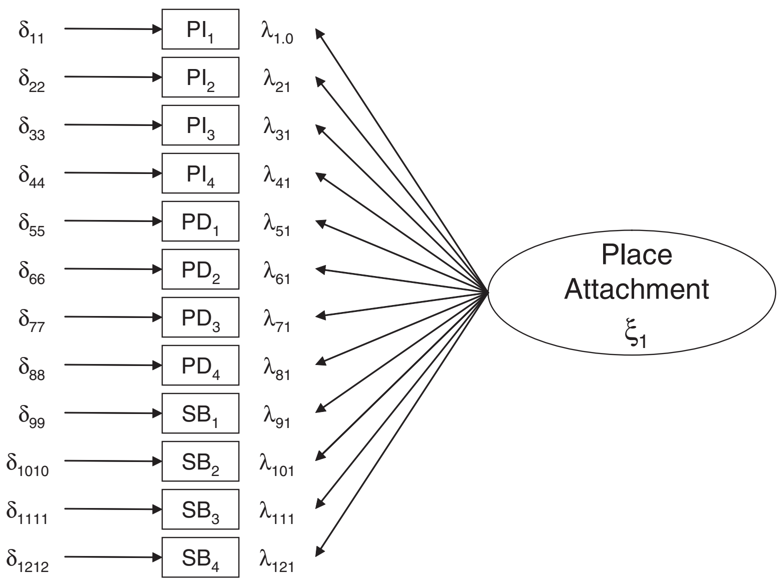

Figure 1: Model A

Muthén, 1989; Cudeck & Browne, 1983). Just as the reliability of a measure's scores can vary depending on the sample, an instrument can have a different structure (i.e., measure different constructs) in every sample (Whiteside-Mansell & Corwyn, 2003). Thus, observed differences in means or variances may reflect the fact that the same instrument is measuring different constructs in the various groups rather than indicating that the groups vary on the same constructs. The procedure we employed for examining measurement and structural equivalence among our two groups is referred to as invariance testing. In the context of this investigation, the procedure allowed us to address several questions concerning the measurement properties of the scale across our subsamples. First, do items comprising the scale operate equivalently? Second, is the factoral structure of the scale equivalent across groups? Finally, do the latent means of the place-attachment measure vary across populations?

In addressing this last question, we also demonstrate an alternate method for examining group differences among populations relating to their mean scores for particular psychological constructs. Much of the past literature

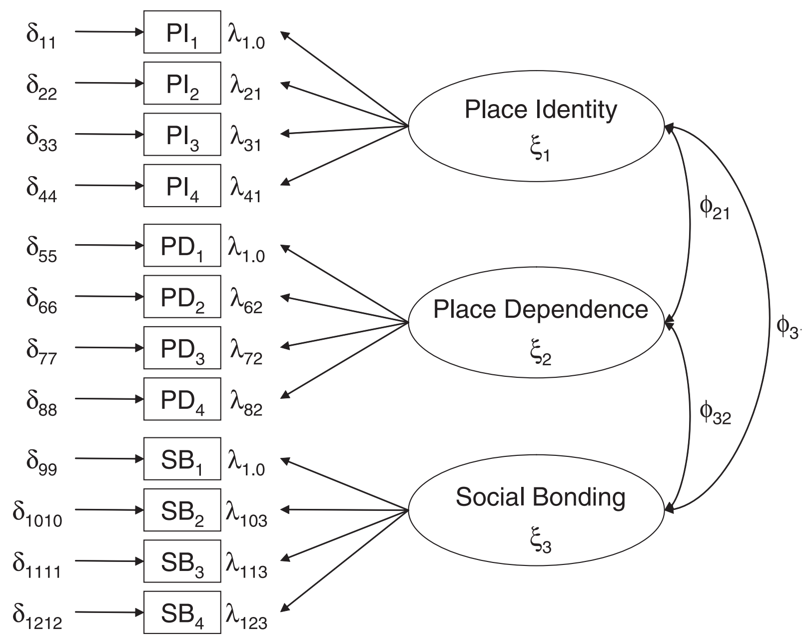

Figure 2: Model B

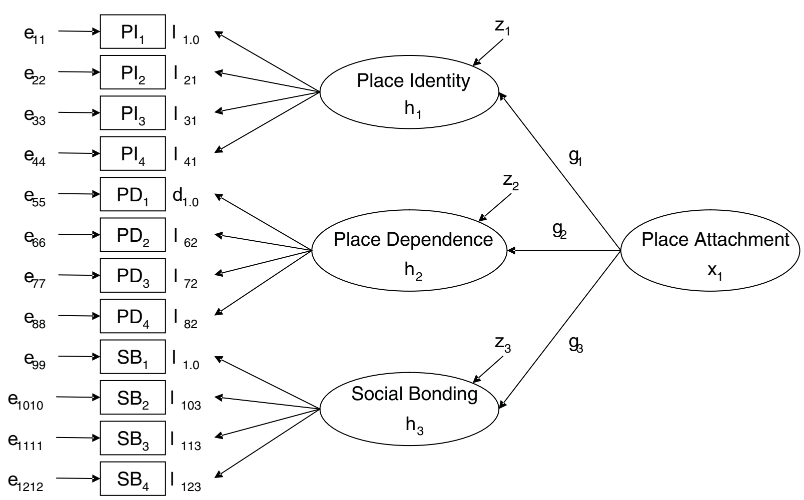

Figure 3: Model C

that has tested for mean differences between groups with regard to their levels of setting attachment has primarily relied on factor scores without prior examination of factor structure (e.g., Bricker & Kerstetter, 2000; Confer, Graefe, Absher, & Thapa, 1999; Hidalgo & Hernández, 2001; Lalli, 1992; Williams et al., 1992). Interpreting mean differences may be inappropriate because a necessary condition in testing for mean differences is that the measurement and the structure of underlying constructs should be equivalent across groups. Thus, interpreting mean differences in place attachment may be problematic unless the underlying constructs have the same structure across samples (Byrne, 1998).

Although existing research has provided good support for Williams and Roggenbuck's (1989) measure suggesting a potentially reliable and valid scale (Jorgensen & Stedman, 2001; Williams & Vaske, 2003), more construct validity and substantive research appears to be warranted. In this regard, at least two considerations from previous work are evident. First, although claims of a validated factor structure of the Williams and Roggenbuck (1989) place-attachment scale with various samples have been reported, examination of the invariance of the factorial structure of the place-attachment scale among subsamples within populations is lacking. Many studies have tended to treat their samples as homogenous units without exploring characteristics of subsamples that are indicative of units within the population. Li, Harmer, and Acock (1996) have suggested that this issue is especially important because it is not meaningful to discuss differences in levels or correlates of a specific construct if the scale of interest is not measuring the same constructs among subsamples.

Finally, to date, no attempt has been made in an SEM context to assess the latent mean structures of Williams and Roggenbuck's (1989) measure of place attachment. The majority of group comparison studies have been based on observed rather than latent variable means (e.g., Bricker & Kerstetter, 2000; Confer et al., 1999; Hidalgo & Hernández, 2001; Lalli, 1992; Williams et al., 1992). Li et al. (1996) have suggested that such analyses may be limited because (a) observed means may be contaminated with measurement error; (b) the analysis implicitly assumes factoral invariance of observed variables; and (c) the adequacy of the measure (i.e., validity and reliability) can only be partially evaluated. These limitations can be addressed in latent mean structure analysis. Once measurement invariance across groups is established, the examination of latent means is of substantive value in examining individual differences in place attachment to natural settings.

RESULTS

TESTING OF COMPETING MODELS

Consistent with the general practice in covariance structure analysis applications, in addition to a priori specification of the factor structure derived from theory, specification of various alternative models as potential explanations of the structure of the observed data was undertaken (Breckler, 1990; MacCullum, Wegener, Uchino, & Fabrigar, 1993; Mulaik et al., 1989). Thus, the first phase of our analysis involved testing three competing models. For this phase, model testing was based on the entire sample's covariance matrix.[5] Model superiority was based on goodness-of-fits indices and the chi-square difference test for nested models (Byrne, 1998). As shown in Table 2, the goodness-of-fit indices for the first-order, three-factor correlated model (Model B) and the second-order model (Model C) were superior to the single-factor model (Model A).[6] No empirical distinction, however, can be made between Model B and Model C. The fit indices for each of these models were identical (χ^2 = 370.12, *df* = 49, RMSEA = .065, SRMR = .040, NFI = .96, CFI = .97).

On the basis of past literature, we decided to retain Model B. Although both Model B and Model C represent plausible and empirically valid explanations of place attachment, we have found that first-order multidimensional conceptualizations provide greater insight into the nature of respondents' attachment. For example, several studies that have examined the effect of place identity and place dependence on various dependent variables in recreational contexts have shown that place identity and place dependence do not always act uniformly (Bricker & Kerstetter, 2000; Kyle et al., 2003) in spite of being moderately and positively correlated (Vaske & Kobrin, 2001; Williams & Vaske, 2003). If place attachment were truly a unidimensional measure as reflected in Model C, we would expect that the dimensions of the scale would relate to other variables in a similar manner. Referred to as external consistency or parallelism, this provides evidence of unidimensionality for the measure (Danes & Mann, 1984; Hunter & Gerbing, 1982). Failing this, the measure should be considered multidimensional (Rubio & Gillespie, 1995). Our analysis of the dimensions of place attachment's effect on other variables using these same data has shown that the place identity and place dependence dimensions, in particular, act independently. For example, Kyle, Graefe, Manning, and Bacon (2004) examined the effect of place identity and

TABLE 2
Goodness-of-Fit Indices of Competing Models Tested: Single-Group Analyses

Model	χ^2	df	*RMSEA*[a]	*SRMR*[b]	*NFI*[c]	*CFI*[d]	*AIC*[e]
Model comparison							
Model A	2007.50	52	.17	.085	.80	.80	2573.30
Model B	370.12	49	.065	.040	.96	.97	445.73
Model C	370.12	49	.065	.040	.96	.97	445.73

a. Root mean square error (Steiger & Lind, 1980). Values ≤ .08 indicated acceptable fit.
b. Standardized root mean residual (Hu & Bentler, 1995). Values ≤ .08 indicate acceptable fit.
c. Normed fit index (Bentler & Bonnett, 1980). Values ≥ .90 indicate acceptable fit.
d. Comparative fit index (Bentler, 1990). Values ≥ .90 indicate acceptable fit.
e. Akaike information criterion (Akaike, 1987). The AIC value alone has little substantive value but is used in the comparison of two or more models with smaller values representing a better fit to the hypothesized model. The AIC also allows for the comparison of non-nested (i.e., hierarchical) models and penalizes model complexity (i.e., over-parameterization). A lower AIC indicates better fit.

place dependence on hikers' evaluations of setting conditions (i.e., environmental and social) along the AT and observed that as place identity increased, respondents were more inclined to evaluate conditions as being problematic. Alternately, as place dependence increased, respondents were more accepting of varied setting conditions. Kyle, Absher, and Graefe (2003) also examined the moderating effect of place identity and place dependence on the relationship among attitudes toward spending revenue generated from entrance fees within a National Forest and visitor preferences for spending the revenue in three areas: environmental education, environmental restoration, and facility development. They found that for respondents scoring high on place identity, the relationship between attitudes toward fees and preferences for spending fee revenue in the area of environmental protection and restoration was strongest. Alternately, for those scoring high on place dependence, the relationship between attitudes toward fees and preferences for spending fee revenue in the area of facility development was strongest. Combined, these studies suggest that the dimensions of place attachment capture different place meanings. As such, we feel that it is more useful to retain the first-order correlated factors model (Model B).

RELIABILITY AND VALIDITY

The reliability of the place-attachment measure was assessed by examining the internal consistency (Cronbach's alpha) of the items for each dimension of place attachment. Although the coefficient for the social bonding factor was questionable, we concluded that in light of Cortina's (1993) .60 threshold for factors with less than six elements, it would be acceptable to retain this factor based on the previous literature supporting its existence (see Table 1).

The factor loadings and significant *t*-values ($t \geq 1.96$) reported in Table 3 provide evidence of convergent validity.[7] The significant *t* tests indicate that we can reject the null hypothesis suggesting factor loadings are equal to zero. We also observed evidence of discriminant validity.[8] When holding the latent factor correlations to 1.0, we observed a significant deterioration in the model fit indices compared to the model allowing the free estimation of these parameters (ϕ_{21}, $\Delta\chi^2 = 365.55$, $\Delta df = 1$; ϕ_{31}, $\Delta\chi^2 = 507.73$, $\Delta df = 1$; ϕ_{32}, $\Delta\chi^2 = 503.11$, $\Delta df = 1$; Ariño, 2003; Bagozzi & Phillps, 1982; Byrne, 1998; Jöreskog, 1971). The χ^2 difference test was used to assess the statistical significance of the deterioration. This test indicated that the dimensions of place are not perfectly correlated and are in fact three distinct components of place attachment.

TABLE 3
Factor Loadings and Standard Errors (Model B)

	Factor Loading (λ)					Uniqueness[a]	
Variable	*Place Identity (PI)*	*Place Dependence (PD)*	*Social Bonding (SB)*	SE	t *value*	*Group 1*	*Group 2*
PI_1	.72	—	—	—	—	.48	.48
PI_2	.88	—	—	.04	46.73	.23	.20
PI_3	.87	—	—	.04	45.94	.22	.27
PI_4	.66	—	—	.03	39.39	.62	.50
PD_1	—	.84	—	—	—	.26	.33
PD_2	—	.92	—	.02	61.85	.15	.15
PD_3	—	.81	—	.02	52.50	.35	.35
PD_4	—	.46	—	.01	25.57	.78	.78
SB_1	—	—	.69	—	—	.48	.58
SB_2	—	—	.79	.05	35.39	.38	.38
SB_3	—	—	.34	.03	16.72	.88	.88
SB_4	—	—	.31	.03	15.34	.84	.98

a. Error covariance was permitted among $\delta_{11} \leftrightarrow \delta_{44}$ (δ_{41}) and $\delta_{77} \leftrightarrow \delta_{88}$ (δ_{78}). The values for δ_{41} was .16 in Group 1 and .07 in Group 2. The value for δ_{78}, which was constrained to be equal across groups, was .12.

EXAMINATION OF LATENT MEAN DIFFERENCES

In the second phase of our analysis, we further examined the psychometric properties of our place-attachment measure and our conceptualization of the scale's structure reflected in Model B. We began this by splitting our sample into two groups and comparing the scale's measurement and structural properties using multigroup confirmatory factor analysis.

Testing for latent mean differences first requires the development of a baseline model that is tested independently using the covariance matrices of each subsample.[9] Our baseline model was Model B. As indicated in Table 4, the model fit each of the subsamples well (Group 1: χ^2 = 201.32, *df* = 49, RMSEA = .063, NFI = .96, CFI = .97, IFI = .97; Group 2: χ^2 = 246.15, *df* = 49, RMSEA = .071, NFI = .95, CFI = .96, IFI = .96).

A full and thorough explanation of the procedure used to test for latent mean differences within the SEM framework is beyond the scope and intention of this article. For readers unfamiliar with this procedure, several informative pieces have been written on the technique over the past decade (Byrne, 1998; Byrne et al., 1989; Li et al., 1996; Marsh & Grayson, 1994; Vandenberg & Lance, 2000). Byrne has suggested that an important assumption in testing for mean differences is that the measurement and structure of the underlying constructs are equivalent across groups. We followed Li et al.'s (1996) testing hierarchy to establish the equivalence of the measurement and structural properties of the place-attachment scale (see Table 4). These tests place increasingly restrictive constraints upon the model to detect variation among components of their covariance matrices. The criteria that we used to evaluate each test was the χ^2 difference test (Byrne, 1998). In addition, the latent mean for Group 2 was specified to be zero, and the latent mean for Group 1 was freely estimated so that the latent means for Group 1 were scaled in relation to the latent means of Group 2 (Byrne, 1998; Li et al., 1996; Marsh & Grayson, 1994; see Table 4).

The final model that was tested simultaneously across both groups is depicted in Figure 4. Note that paths with broken lines were held invariant across both groups. All other paths were freely estimated. Specification of the model can be summarized as follows. First, all λs were constrained equal across groups. Second, all ϕs (variances and covariances) of ξs (latent exogenous factors) were held invariant in each group with the exception of ϕ_{22} (variance associated with place dependence; see Appendix Table 2). Third, variances of the measurement errors associated with the observed measures were held invariant except for δ_{22}, δ_{33}, δ_{44}, δ_{55}, δ_{99}, $\delta_{12\,12}$, and δ_{41}. Fourth, intercepts for the observed measures (τs) were held invariant across groups except

TABLE 4
Goodness-of-Fit Indices for the Hierarchy of Invariance Tests (Model B)

Model[a]	χ^2	df	$\Delta\chi^2$	Δdf	*RMSEA*	*NFI*	*CFI*	*IFI*
Baseline model (overall)	370.12	49			.065	.96	.97	.97
Group 1	201.32	49			.063	.96	.97	.97
Group 2	246.15	49			.071	.95	.96	.96
H_1 Form	447.47	98			.067	.96	.97	.97
H_2 Invariant loadings	454.63	107	7.16	9	.064	.96	.97	.97
H_3 Invariant variance/covariance[b]	460.01	112	5.38	5	.063	.95	.97	.97
H_4 Invariant uniqueness[b]	470.34	119	10.33	7	.061	.95	.97	.97
H_5 Invariant intercepts/latent means	474.74	130	4.40	11	.058	.95	.97	.97

a. The model tested was the Model B.

b. Invariance tests among individual parameters indicated that the following items were not invariant across groups: ϕ_{22}, δ_{22}, δ_{33}, δ_{44}, δ_{55}, δ_{99}, $\delta_{12\ 12}$, δ_{41}, and τ_3.

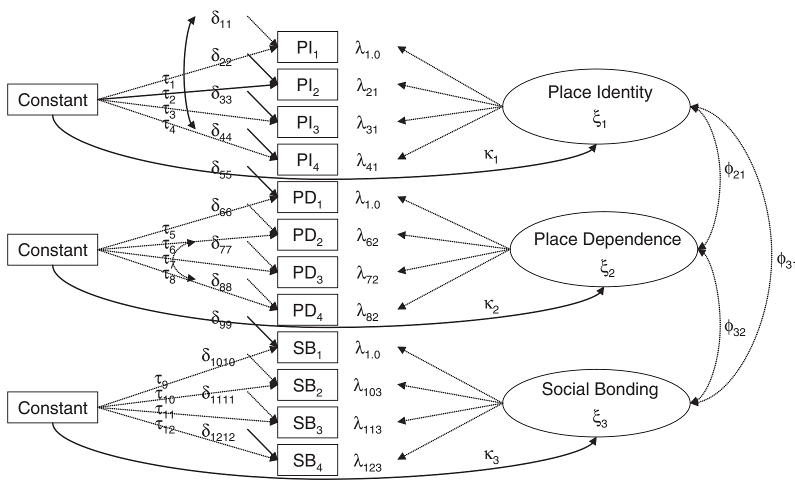

Figure 4: Multigroup Mean Structures Model

τ_3. Last, the three-factor intercepts (κ_1-κ_3) were freely estimated in one group (Group 1) and constrained equal to zero in the second group (Group 2). The latter is referred to as the reference group.

The fit indices for the final model analyzed are reported at the bottom of Table 4 and indicate an acceptable fit ($\chi^2 = 474.74$, $df = 130$, RMSEA = .058, NFI = .95, CFI = .97, IFI = .97). The κ estimates indicated that there was a significant difference between Group 1 and Group 2 in the latent mean score for place identity, with Group 1 scoring significantly lower than Group 2 (place identity: $\kappa = -.04$, $t = -2.09$; place dependence: $\kappa = -.05$, $t = -1.45$; social bonding: $\kappa = -.00$, $t = -0.05$). It appears that the intercept for item PI_3 (τ_3), which was permitted to be freely estimated across groups, was driving much of the latent mean variation between the two groups for this factor. When this item was constrained, the kappa estimate declined to –.02, with a *t*-value of –1.27. Given that intercept terms "can be interpreted the same as the constant terms in regression equations" (Bollen, 1989, p. 354), it appears that Group 2 is responding to the item PI_3 systematically higher (i.e., expressed a stronger identification with the AT) than is Group 1. Apart from this, there was little variation between these subsamples with regard to the manner in which they have interpreted the items in the scale.

DISCUSSION

The purpose of this investigation was to examine the psychometric properties of a place-attachment measure using a sample of visitors to the AT in the United States. We also demonstrated the use of SEM to test measurement invariance and latent mean structures among two subsamples. Tests of the place-attachment measure demonstrated the validity (i.e., convergent and discriminant) and reliability (i.e., internal consistency) of a first-order, three-factor correlated model (Model B). Although our initial tests also suggested the plausibility of a second-order model (Model C), our decision to retain Model B was grounded in previous work that has indicated that the influence of the place-attachment dimensions on other variables is not always uniform (see Bricker & Kerstetter, 2000; Kyle et al., 2004). The integrity of the factor structure for Model B was also confirmed following cross-validation of the model among subsamples of users using multigroup confirmatory factor analysis.

Although Williams and Roggenbuck's (1989) original scale did not include indicators of social bonding, we feel that this is an important component of human-place bonding. Although supported in the literature, it has seldom been incorporated in quantitative measures of the construct. For example, Milligan (1998), working within a symbolic interactionist framework, observed that the meanings a sample of college students ascribed to a college cafeteria were socially derived. That is, the emotional bonds formed by the informants were the product of an interactional process between the individuals and their social environment. Hay (1998) also observed that the strength of his informants' attachment to a rural community in New Zealand was, among other things, determined by the extent of their social ties to the region. Similarly, Mesch and Manor (1998) observed that residents' community attachment to an urban area in Israel was influenced by social ties in the community. These findings suggest that the meanings individuals associate with settings can extend beyond the importance of physical characteristics or attributes of the setting. In fact, in some contexts, social bonds are the primary source of meaning. In these instances, the importance of a setting is often tied to memories of experiences shared with significant others over the life course (Hay, 1998; Kyle, 2001). We would encourage investigators to more strongly consider the incorporation of social bonds in their conceptualizations of place attachment. Given the validity and reliability concerns associated with this dimension (i.e., low factor loadings and *t*-values, low internal consistency), it may also be necessary to consider other additional items.

From a methodological perspective, several psychometric issues were addressed in this study. The measurement model (for Model B) showed good fit to the data with only minor parameter respecification (i.e., correlated uniqueness). Models of this form are considered to be a priori models given that they are defined by substantive theory. Thus, we are confident that the measurement model imposed for the sample is consistent with place-attachment theory. In addition to establishing the reliability of the scale, the SEM approach also allowed us to examine its convergent and discriminant validity. Although there was some concern relating to the scale's ability to discriminate between place identity and social bonding, our testing indicated that the scale displayed both forms of validity. Naturally, we would encourage further testing in varied contexts. To date, most research that has utilized various forms of Williams and Roggenbuck's (1989) scale has examined place attachment in recreational contexts. We agree with Manzo's (2003) suggestion that greater heterogeneity in study contexts is required not only for the testing of this instrument but also for understanding the nature of human-place bonding.

We also extended our analysis to examine latent mean variation across two subsamples of our data. Upon establishing a valid measurement model, the assumption of equivalence in measurement and structure of the scale was tested. By taking into account measurement error and explicitly testing the factorial invariance of observed variables across each group, the invariance tests extended prior research that has relied solely on the observed means to examine individual differences in respondents' attachments to natural settings. Although several authors have indicated that, prior to comparing latent means among groups, invariance of the observed variable intercepts (τs) and factor loadings (λs) must be established (Byrne, 1998; Li et al., 1996), other authors have indicated that meaningful comparisons can still be made after establishing partial invariance (Byrne et al., 1989; Marsh & Grayson, 1994). This was the case in this investigation. We observed variation across groups in several elements of the measurement and structural components of the model. First, variation between the two subsamples was observed in the variance of place dependence (ϕ_{22}), indicating that the concept of place dependence does not equally capture the variation in meaning depicted in the observed measures among the two groups. Second, we also observed variation among the groups with regard to the variance of the error terms associated with the observed measures. This would indicate that there is some variation with regard to the manner in which the observed measures were interpreted across each of the groups. Finally, we observed variation between the groups with regard to the intercept for PI_3 (τ_3), with Group 1's intercept significantly lower than Group 2's. The free estimation of this parameter across the two groups also drove the significant difference observed in the latent mean for place identity; Group 2 was significantly higher than was Group 1. These findings further emphasize the need for continued investigation.

Although the advantages of SEM are well-known, Li et al. (1996) have noted that its additional capacity for examining the consistency of a model across groups of respondents has received little attention in psychology-related journals.[10] The present study illustrated some of the advantages of applying SEM to multisample analysis. First, it allows tests of implicit factor structures underlying a priori theoretical constructs and determination of the equivalence of these factor structures across distinct groups or even across time (e.g., longitudinal data). Second, SEM provides a comparison of means in latent constructs that have been appropriately corrected for measurement error and between-group variability in the measurement model. This approach is superior to traditional methods such as univariate and multivariate statistical procedures that focus on examining differences among group means. Because the measurement error is estimated and the between-group variability is controlled in latent means structure analysis, parameter estimates (i.e., error-free latent variables) and assessments of relationships among the latent constructs across groups are more accurate (Li et al., 1996). Finally, although the present study focused on the measurement model, the SEM approach to multigroup analysis can also be applied to structural models involving analysis of covariances and latent mean structures. Given the precondition that the key measurement parameters (i.e., factor form and loadings) are invariant across groups, structural parameters and latent mean structures can be examined within the SEM framework to determine difference or changes in regression coefficients and latent variable means across groups and time. For example, using data collected from several settings (e.g., this data, data collected from boaters along the South Fork of the American River in California, and data collected from anglers in New England), we examined variation in models of the relationship between leisure activity involvement and place attachment across resource contexts. We observed that the effect of activity involvement varied across each of these settings in terms of the strength of the effects and the variance accounted for in place identity and place dependence (Kyle, Bricker, Graefe, & Wickham, 2004).

Both Byrne (1998) and Li et al. (1996) have noted, however, that the SEM approach to multisample analysis is not without its limitations. First, large samples often make it possible to detect fairly minor differences between models, and exclusive reliance on the chi-square test may lead to limited conclusions or even confusion about overall measurement reliability. Second, invariance testing requires well-fitting initial a priori models. Although this precondition was satisfied in the present study, there are many applications when this will not be the case.

APPENDIX TABLE 1
Item Correlations

	Group 2											
	PI_1	PI_2	PI_3	PI_4	PD_1	PD_2	PD_3	PD_4	SB_1	SB_2	SB_3	SB_4
Group 1												
PI_1	1.00	.69	.60	.58	.46	.42	.35	.14	.51	.50	.32	.30
PI_2	.64	1.00	.77	.61	.54	.55	.48	.22	.52	.63	.28	.29
PI_3	.61	.76	1.00	.56	.56	.61	.56	.27	.51	.62	.28	.27
PI_4	.61	.56	.55	1.00	.34	.38	.34	.04	.45	.51	.23	.29
PD_1	.42	.58	.53	.36	1.00	.78	.68	.43	.28	.35	.27	.18
PD_2	.42	.61	.59	.40	.78	1.00	.76	.44	.33	.34	.24	.21
PD_3	.35	.54	.60	.34	.65	.73	1.00	.52	.24	.33	.16	.11
PD_4	.14	.27	.27	.07	.39	.39	.46	1.00	.13	.19	.08	.06
SB_1	.52	.51	.52	.45	.30	.30	.27	.05	1.00	.55	.25	.26
SB_2	.56	.57	.61	.49	.31	.35	.33	.11	.56	1.00	.25	.23
SB_3	.29	.24	.27	.26	.21	.19	.16	.05	.29	.27	1.00	.22
SB_4	.24	.23	.21	.20	.20	.21	.17	.03	.25	.15	.20	1.00

NOTE: PI = place identity; PD = place dependence; SB = social bonding.

APPENDIX TABLE 2
Factor Variance or Covariance (Model B)

	ξ_1			ξ_2[a]			ξ_3		
	ϕ	SE	t *value*	ϕ	SE	t *value*	ϕ	SE	t *value*
ξ_1	1.00	.01	22.13						
ξ_2	0.72	.01	25.30	0.93-1.09	.03-.03	25.37-24.77			
ξ_3	0.88	.01	24.75	0.50	.01	18.88	1.00	.01	19.65

NOTE: Values reported first are for Group 1; values reported second are for Group 2.
a. ϕ22 was freely estimated across the groups.

NOTES

1. Use estimates were estimates based on staff and volunteer heuristics.

2. The Appalachian Trail Conference is a volunteer-based, not-for-profit organization dedicated to the preservation, management, and promotion of the trail.

3. This was required by the National Park Service.

4. To complete the trail over a single summer (approximately 2 to 3 months), most hikers start in the south to avoid potentially cold northern weather and finish in the north to avoid the heat extremes of the south. In 1999, 2,625 hikers began the hike from Georgia with only 376 completing the hike (49 hikers completed the north-to-south route).

5. The covariance matrix was calculated using SPSS' (version 11.5) listwise deletion procedure, leaving us with 1,630 cases.

6. For all models, LISREL's modification indices indicated that significant improvement in model fit could be attained by allowing the uniqueness of several items to covary. Consequently, error covariances between $\delta_{11} \leftrightarrow \delta_{44}$ (δ_{41}) and $\delta_{77} \leftrightarrow \delta_{88}$ (δ_{78}) were estimated. Our decision was based on the likelihood that the common source of error (method error) stemmed from similarity in item wording, questionnaire format, and level of measurement.

7. The extent to which independent measures concur in their assessment of the same construct (Byrne, 1998).

8. The extent to which independent measures of latent constructs diverge in their assessment of these constructs (Byrne, 1998).

9. The listwise deletion procedure left us with 813 cases for Group 1 and 817 cases for Group 2.

10. See Bechtel, Corral-Verdugo, and Pinheiro (1999) for a notable exception.

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