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BRIEF REPORT

The Latent Structure of Secure Base Script Knowledge

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There is increasing evidence that attachment representations abstracted from childhood experiences with primary caregivers are organized as a cognitive script describing secure base use and support (i.e., the *secure base script*). To date, however, the latent structure of secure base script knowledge has gone unexamined—this despite that such basic information about the factor structure and distributional properties of these individual differences has important conceptual implications for our understanding of how representations of early experience are organized and generalized, as well as methodological significance in relation to maximizing statistical power and precision. In this study, we report factor and taxometric analyses that examined the latent structure of secure base script knowledge in 2 large samples. Results suggested that variation in secure base script knowledge—as measured by both the adolescent ($N = 674$) and adult ($N = 714$) versions of the Attachment Script Assessment—is generalized across relationships and continuously distributed.

Keywords: secure base script knowledge, attachment, taxometrics, factor analysis, Attachment Script Assessment

Building on foundational work by cognitive and developmental psychologists on event schemas and scripts (e.g., Bretherton, 1987; Schank & Abelson, 1977), Waters and Waters (2006) claimed that an individual's history of secure base support is represented in memory as a *secure base script*—that is, a temporal-causal representation of secure base use and support. According to attachment theory (Bowlby, 1969/1982), a history of reliable and effective secure base support becomes generalized as an expectation that attachment figures will consistently be available and that they will be wise and competent enough to

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restore balance to ongoing activities as difficulties arise. Thus, Waters and Waters (2006) defined the secure base script as one in which (a) the attached individual is engaged in constructive activity, (b) a challenge is encountered that disrupts this activity or leads to distress, (c) the attached individual signals for assistance, (d) the attachment figure recognizes the signal and responds in a manner consistent with the message, (e) the assistance is accepted, (f) the assistance is effective in resolving the challenge, (g) comforting behavior occurs as well, and (h) the attached individual resumes the activity or initiates a new one.

To assess individual differences in access to this secure base script (i.e., secure base script *knowledge*), Waters and Rodrigues-Doolabh (2001) developed the Attachment Script Assessment (ASA). The ASA is a word-prompt procedure in which columns of words form an outline of a beginning, middle, and end of four stories. Embedded in the story outlines are references to some distress or difficulty that an attachment figure could plausibly respond to in a sensitive and responsive manner. In the adolescent version of the measure (Dykas, Woodhouse, Cassidy, & Waters, 2006; Steele et al., 2014), participants tell two stories about maternal and two stories about paternal caregivers. In the adult version of the ASA, two of the attachment-relevant word-prompts focus on romantic partners and two on mother–child dyads (Waters & Rodrigues-Doolabh, 2001).

In most studies of the ASA conducted to date, coders rate individual differences in participants' secure base script knowledge on a Likert scale under the assumption that all of the attachment-relevant stories can be averaged to form a single, continuously distributed index of secure base script knowledge. Using this approach, recently published research demonstrates not only that the quality of parental care experienced from infancy to adolescence is associated with secure base script knowledge in late adolescence (Steele et al., 2014) but also that individual differences in secure base script knowledge are reflected in adolescents' and adults' attachment-related behaviors. For example, higher levels of secure base script knowledge in adulthood are associated with observations of higher quality parenting as well as attachment security in the next generation—even when such associations are studied among genetically unrelated caregivers and their adopted children (e.g., Coppola, Vaughn, Cassibba, & Costantini, 2006; Monteiro, Verissimo, Vaughn, & Santos, 2008; Vaughn et al., 2007; Veríssimo & Salvaterra, 2006).

Although we have learned a great deal about the correlates of secure base script knowledge in the last few years, we know almost nothing about its *latent structure*. For example, the literature provides little guidance as to (a) whether individuals generalize script knowledge across attachment relationships and (b) whether individual differences in secure base script knowledge are categorically or continuously distributed. These are significant gaps because, as we discuss next, gaining information about the factor structure and distributional properties of secure base script knowledge has important conceptual implications for our understanding of how representations of early experience are organized and generalized as well as methodological consequences related to maximizing statistical power and precision.

Analysis of the Latent Structure of Attachment Representations

Two methods are commonly used for interrogating the latent structure of individual differences—*factor analysis* and *taxometric analysis*. Factor analysis is a statistical tool designed to both describe and infer the number of latent (i.e., unobserved) variables that account for the covariation among a set of observed indicators (Brown, 2006). Taxometric techniques allow researchers to examine whether those latent variables reflect naturally occurring categories or continuously distributed variation (Meehl, 1995; Meehl & Yonce, 1994, 1996; Waller & Meehl, 1998).

The few studies that have attempted to examine whether the attachment representations of adolescents and adults generalize across relationships have relied on resource-intensive adaptations of the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1984–1996) protocol (Furman & Simon, 2004; Owens et al., 1995). Unfortunately, however, the results of such studies are ambiguous because none have formally examined the factor structure of adult attachment representations. Instead, claims about the degree to which adult attachment representations are generalized across relationships are based exclusively on associations between the coherence of participants' discourse in separate, hour-long interviews about (a) maternal versus paternal childhood experiences (Furman & Simon, 2004) and (b) experiences with caregivers in childhood versus current romantic partners (Owens et al., 1995). In contrast, factor analyses of ASA data should provide a more direct way of evaluating the extent to which script knowledge generalizes across different kinds of relationships (e.g., mother–child vs. father–child relationships; parent–child vs. romantic relationships). More specifically, the current report uses confirmatory factor analysis (CFA) to compare the relative fit of data on secure base script knowledge to models that do versus do not assume the generalization of such knowledge across relationships.

Research in developmental psychology relevant to whether individual differences in adult attachment representations are categorically or continuously distributed has also been based exclusively on the AAI. Thus far, available taxometric evidence suggests that the primary distinction made by AAI coders between secure and dismissing states of mind is more consistent with an underlying dimensional rather than categorical model (Fraley & Roisman, 2014; Roisman, Fraley, & Belsky, 2007). There are at least two ways in which resolving the distribution of individual differences can advance research on adult attachment. First, the distribution of individual differences reveals information regarding the way in which such knowledge is acquired and organized (e.g., categorical latent structure suggests all or nothing acquisition). Second, absent empirically informed guidance regarding whether individual differences reflect latent categories or dimensions, researchers are left to resolve the issue of taxonicity by fiat or inherited theoretical orientation. However, there is much at stake in understanding how individual differences are distributed as both statistical power (Cohen, 1988; Fraley & Spieker, 2003) and measurement precision (Fraley & Waller, 1998) can be seriously compromised when an assumed latent structure differs from the actual one.

The Present Investigation

We addressed two research questions in this study. First, we used CFA to test the hypothesis that secure base script knowledge generalizes across the various stories in the ASA. Second, we used three independent taxometric techniques to study whether individual differences in secure base script knowledge reflect differences in degree or kind. We addressed these questions using data from two independent studies with sufficient sample sizes to apply taxometric methods (Ns $>$ 300, ideally closer to 600; Meehl, 1995). The first of these was the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD), a longitudinal investigation that acquired the adolescent version of the ASA ($N = 674$). The second dataset was compiled using raw data collected by multiple laboratories that administered the adult version of the ASA ($N = 714$).

Method

Participants

Sample 1: NICHD SECCYD adolescents. The first dataset consisted of ASAs collected as part of the age 18-year assessment of the SECCYD cohort ($N = 674$; Booth-LaForce & Roisman, 2014; Steele et al., 2014).[1]

At the age 18-year follow-up of the SECCYD cohort, 857 participants were administered the AAI. Afterward, the adolescent version of the ASA (Dykas et al., 2006) was acquired primarily from the subset of participants who were assessed in person (see Steele et al., 2014, for details). Fifty-two percent of the sample was female and 77.3% were non-Hispanic Caucasian.

Sample 2: Aggregate sample of adults. To date, no study has administered the adult version of the ASA to a large enough cohort to conduct taxometric analyses. Following the approach taken by Roisman et al. (2007) with AAI data, we aggregated raw story-level data from the adult version of the ASA from several laboratories across North America and Europe (11 samples; total $N = 714$). Overall, 81% of participants were female (mostly mothers), and 82% self-identified as a nonminority. See Table 1 for descriptive and demographic information for each sample.

Measures

Sample 1: Attachment Script Assessment–adolescent version. The adolescent version of the ASA (Dykas et al., 2006) contains two mother and father stories. The mother stories are entitled *The Party* and either *Acne* (completed by girls) or *The Haircut* (completed by boys). The father stories are entitled *The Tennis Match* and *Studying for an Exam*. Boys and girls completed a different story for mothers (i.e., *Acne* or *The Haircut*) because of gender-related sensitivities regarding personal appearance.

SECCYD participants were given a sheet of paper with the story's title at the top and a list of 12 words that served as a word-prompt outline. They were then asked to tell the best story possible using the outline provided. To ensure that participants understood the task, they first completed a practice story entitled *A Trip to the Beach* (this story was not coded).

ASAs were digitally audiotaped and transcribed verbatim. Next, each ASA story was coded on a 7-point secure base script knowledge scale (Waters & Rodrigues-Doolabh, 2001), ranging from 1 (*no secure base script content*) to 7 (*extensive secure base script organization and elaboration*). Two sites coded approximately 50% of the ASAs each (Site 1, $n = 424$; Site 2, $n = 420$), which included an overlapping set of reliability cases that were coded by both sites ($n = 170$; 25%). First, we examined within-site reliability. For Site 1, intraclass correlation coefficients (ICCs) ranged from .88–.95 for each story. For Site 2, ICCs ranged from .89–.95. In addition, across-site reliabilities were calculated. The ICCs for each story ranged from .89–.93.

Sample 2: Attachment Script Assessment–adult version. Paralleling the adolescent version of the ASA, participants completing the adult ASA were given a set of word-prompt outlines to facilitate telling stories. Again, each word-prompt set consisted of 12 words. Participants told four attachment-related stories, two mother–child stories (*Baby's Morning*, *Doctor's Office*) and two adult–adult stories (*Jane and Bob's Camping Trip*, *Sue's Accident*). Two nonattachment stories (*Trip to the Park*, *Afternoon Shopping*) were also included to reduce hypothesis guessing but were not coded (Table 1 includes reliability statistics).

Taxometric Procedures

To assess the categorical versus dimensional latent structure of secure base script knowledge, we used three taxometric procedures developed by Meehl and his colleagues: MAXCOV-HITMAX (MAXCOV; Meehl & Yonce, 1996), MAMBAC (Meehl & Yonce, 1994), and L-Mode (Waller & Meehl, 1998). The MAXCOV procedure examines the covariance between two indicators of a latent construct as a function of a third indicator. The shape of a MAXCOV function depends on the categorical status of the latent variable under investigation. For example, if the latent variable is categorical with a base rate of .5, the MAXCOV curve tends to have a mountain-like peak. If the latent variable is dimensional the MAXCOV curve will resemble a flat line (see Fraley & Spieker, 2003).

MAMBAC (Meehl & Yonce, 1994) computes the mean difference between cases located above versus below a sliding cut score. Specifically, for any pair of indicators, one indicator is designated as the "input" and the other as the "output." The cases are then sorted from lowest to highest along the input indicator and, at various regions along that input variable, split into two groups with respect to the output indicator. The MAMBAC function is the plot of those conditional mean differences across varying values of the input variable. The function characterizing these conditional mean differences is peaked if the latent variable is categorical and concave if it is dimensional.

The L-mode procedure (Waller & Meehl, 1998) examines the distribution of factor score estimates for the first factor extracted from a principal axis factor analysis of the indicators of a taxon. When the data are generated by a latent categorical model, the distribution of factor scores will be bimodal and unimodal in the case of a latent dimensional model.

To evaluate the output of taxometric methods we used the Comparative Curve Fit Index (CCFI). The CCFI of the observed

[1] For detailed information regarding the Study of Early Child Care and Youth Development, see http://www.nichd.nih.gov/research/supported/Pages/seccyd.aspx

Table 1
Descriptive and Demographic Data for Participants Included in the Adult Attachment Script Assessment Sample

Sample (representative publication)	*N*	Gender (% female)	Age *M*, *SD* (range)	Ethnicity (% nonminority)	Reliability (ICC range)
Italian mothers of young children (subsample in Coppola et al., 2006)	110	100	34, 4.93 (19–44)	98	.82–.94
U.S. Midwestern mothers of young children (Groh et al., 2014)	108	100	34, 5.23 (22–46)	64	.83–.94
Portuguese mothers of young children (M. Veríssimo, laboratory)	89	100	34.9, 4.6 (22–50)	100	.84–.95
Portuguese fathers of young children (M. Veríssimo, laboratory)	70	0	36.8, 5.8 (28–63)	100	.86–.95
U.S. Midwestern nonparent college students (Groh & Roisman, 2009)	60	50	19, 1.03 (18–23)	70	.93–.99
U.S. Northeastern nonparent emerging adults (H. S. Waters, laboratory)	60	60	21.8, 1.6 (20–30)	53	.79–.89
U.S. Northeastern mothers of infants (H .S. Waters, laboratory)	55	100	33, 4 (25–42)	90	.84–.93
U.S. Southern mothers of children in daycare (Vaughn et al., 2007)	50	100	35.6, 4.4 (28–43)	80	.55–.93
U.S. Northeastern Mothers of 9–12-year-olds (Waters et al., 2015)	41	100	44.9, 3.8 (38–53)	90	.73–.85
U.S. Northeastern mothers of young children (H. S. Waters, laboratory)	40	100	35, 6.5 (27–46)	78	.85–.94
U.S. Midwestern mothers of preschoolers (Bost et al., 2006)	31	100	32.8, 4.1 (22–43)	65	.65–.91

Note. ICC = intraclass correlation coefficient.

taxometric functions quantifies whether data are more compatible with the simulated functions generated by a categorical or dimensional model (Ruscio et al., 2007). The CCFI can range from 0 to 1, with values of 0 being most compatible with a dimensional model and 1 being most consistent with a categorical model. Ruscio et al. (2007) recommended that CCFI values falling between .40 and .60 be interpreted with caution. It is important to note that the CCFI can be computed separately on the basis of the output of MAXCOV, MAMBAC, and L-mode analyses. The mean of these CCFIs is used as a robust assessment of taxonicity versus dimensionality (Ruscio et al., 2010).

Results

The results of factor and taxometric analyses are presented below. First we examined the factor structure of secure base script knowledge from the adolescent and adult versions of the ASA. Next, we present findings regarding the taxometric properties of secure base script knowledge derived from the adolescent and adult versions of the ASA.

The Factor Structure of Secure Base Script Knowledge

Sample 1. We used CFA with full information maximum likelihood estimation (FIML) to examine the relative fit of two models. Both models assume that there is latent domain-specific script knowledge that influences scores in maternal and parental stories respectively. The general-factor model (see Figure 1), however, assumes that there is generalized secure base script knowledge that shapes variation across these domains. This assumption was modeled by allowing the two latent factors to correlate. Structurally, this is identical to assuming that there is a higher order factor that gives rise to covariation between the two relational domains. The alternative model (see Figure 1) assumes that secure base script knowledge is not generalized across domains. This assumption was modeled by fixing the covariance between the domain-specific latent variables to 0.00. The relative fits of these nested models were compared using a chi-square difference test.

Analyses revealed that the generalized factor model fit the data well, $\chi^2(1, N = 674) = 0.911$, $p = .34$, root-mean-square error of approximation = .00, CFA = 1.00, standardized root-mean-square residual = .005. The estimated correlation between the two factors was .88. It is important to note that assuming a general factor significantly improved fit relative to a model that assumes there is not a general factor ($\Delta\chi^2 = 291.08$, $p < .001$).

Sample 2. A parallel set of CFAs with the adult-version ASA data were conducted with the two latent factors representing parent–child relationships and romantic relationships. Analyses revealed that the generalized factor model fit the data well, $\chi^2(1, N = 714) = 2.33$, $p = .13$, root-mean-square error of approximation = .043, CFA = .998, standardized root-mean-square residual = .007. The estimated correlation between the two factors was

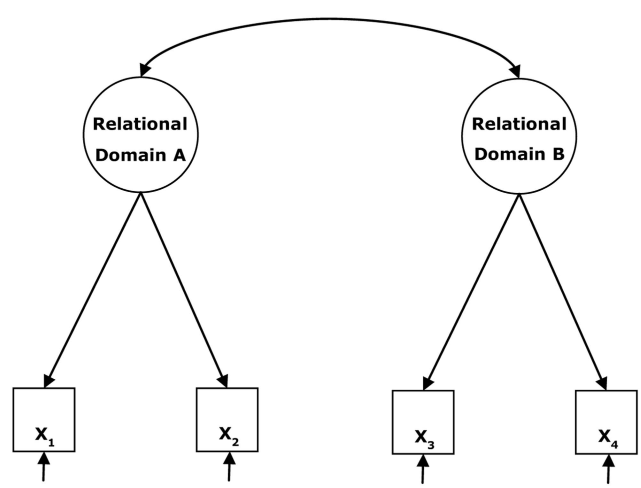

Figure 1. Model depicting the latent factor model of secure base script knowledge implemented in the confirmatory factor analyses (CFAs). In the models tested that allow for generalization of secure base script knowledge across relationship domains, the generalization path (depicted by the double headed arrow) was freely estimated. In the alternative models, which did not allow for generalization, the generalization path was fixed to zero. For the adolescent version of the Attachment Script Assessment (ASA), Relational Domain A was the mother–child relationship and Relational Domain B was the father–child relationship. For the adult version of the ASA, Relational Domain A was the parent–child relationship and Relational Domain B was romantic partnership.

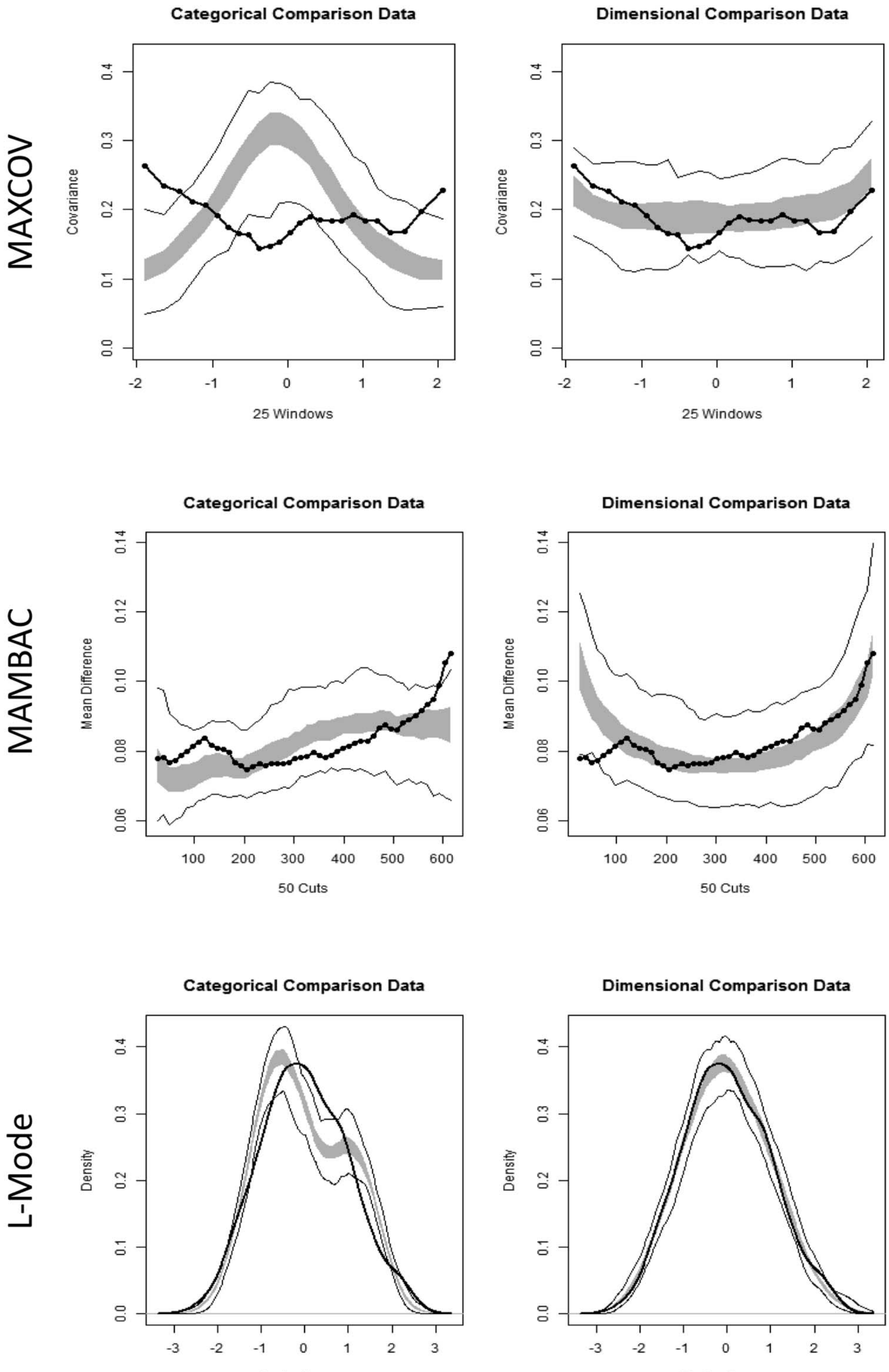

Figure 2. Taxometric functions for indicators of secure base script knowledge as measured by the adolescent version of the Attachment Script Assessment administered to Sample 1 (Study of Early Child Care and Youth Development). The dark line in each panel represents the empirical function. The shaded region represents the range of values that would be expected 50% of the time under categorical (left column) or dimensional (right column) models. MAXCOV = maximum covariance; MAMBAC = mean above minus below a cut; L-Mode = latent mode analysis.

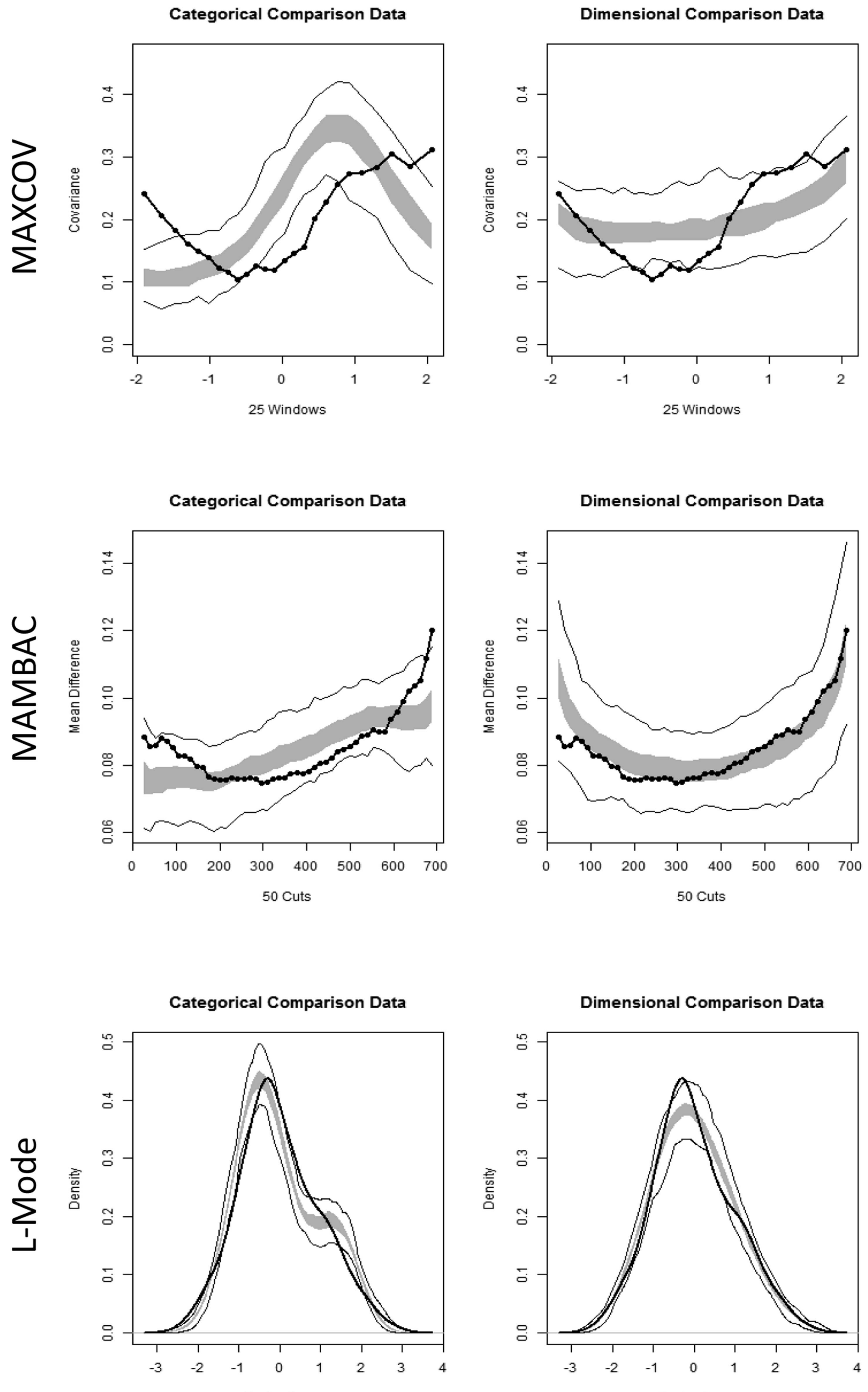

Figure 3. Taxometric functions for indicators of secure base script knowledge as measured by the adult version of the Attachment Script Assessment administered to Sample 2 (aggregate sample described in Table 1). The dark line in each panel represents the empirical function. The shaded region represents the range of values that would be expected 50% of the time under categorical (left column) or dimensional (right column) models. MAXCOV = maximum covariance; MAMBAC = mean above minus below a cut; L-Mode = latent mode analysis.

.91. Further, assuming a general factor significantly improved fit relative to the model that did not assume a general factor ($\Delta\chi^2 = 355.30$, $p < .001$).

The Taxonicity of Secure Base-Script Knowledge

Sample 1. To examine whether secure base script knowledge is more consistent with a categorical or dimensional latent structure, we conducted taxometric analyses on the four secure base-script stories collected with the adolescent ASA in the SECCYD. The averaged empirical MAXCOV curve (see top panel of Figure 2) did not exhibit a strong peak as would be expected under a categorical model. Instead, it was more consistent with the expected curve derived from a dimensional model. The CCFI value was .20, indicating that on average the data were more compatible with a dimensional model of individual differences. The averaged empirical MAMBAC function was more ambiguous (middle panel of Figure 2); the empirical MAMBAC function was largely U-shaped, with a higher elevation on the right side. Although this pattern is more consistent with a dimensional model, the empirical function did deviate from the predicted dimensional pattern at the far left and the resulting CCFI was .51. Thus, the interpretation of the MAMBAC analysis was ambiguous with respect to the latent distribution of secure base script knowledge. Finally, as seen in the bottom panel of Figure 2, the empirical L-mode function was unimodal and more compatible with expectations under a dimensional model. The CCFI based on this analysis was .16. The average CCFI value across the three taxometric procedures was .29. Thus, overall, taxometric analysis of secure base script knowledge as measured by the adolescent version of the ASA suggested an underlying dimension rather than latent categories.

Sample 2. The averaged empirical MAXCOV curve is presented in the top panel of Figure 3. Similar to results using the adolescent ASA, the empirically derived curve was more consistent with the expected curve derived from a dimensional model. The CCFI value was .37, which also indicated that the data were more compatible with a dimensional model. The averaged empirical MAMBAC function was also consistent with a dimensional model (middle panel of Figure 3). The empirical MAMBAC curve was U-shaped, with a higher elevation on the right side, and produced a CCFI value of .39. Finally, the empirical L-mode function was unimodal and therefore more compatible with expectations under a dimensional model. The CCFI based on the L-mode procedure was .37. The average CCFI value across the three taxometric procedures was .38. Taken together, taxometric analysis of secure base script knowledge in adulthood suggested that the data reflect an underlying dimension rather than latent categories.

Discussion

Evidence that attachment representations are mentally organized as a secure base script is mounting. To date, however, the latent structure of secure base script knowledge has gone unexamined, a gap that we addressed in this article. Using two large samples and both the adolescent and adult versions of the ASA, the factor and taxometric analyses reported here revealed that secure base script knowledge is generalized across relationships and continuously distributed. In addition to supporting current coding practices for the ASA, our findings suggest that there are at least two unresolved issues in this area that would benefit from renewed attention by developmental psychologists.

First, building on prior work (e.g., Furman & Simon, 2004; Owens et al., 1995), our factor analytic results indicated that, by late adolescence, secure base script knowledge is generalized and brought to bear across a variety of attachment relationships, including those between romantic partners. However, we recognize that in both samples the associations between the two latent factors was not 1.0. This suggests that there is some relationship specific variation in ASA performance or coding. These results are especially significant in light of the fact that attachment representations for mothers and fathers are clearly differentiated in early childhood (Van IJzendoorn & De Wolff, 1997). This underscores the need for research that examines (a) when and by what mechanisms this process of convergence and extension occurs normatively and (b) whether this process characterizes all individuals along the same developmental timetable (e.g., in the context of father absence).

Second, since the introduction of factor analytic and taxometric techniques to attachment scholarship, accumulating evidence suggests that individual differences in attachment representations, both during infancy and during adulthood, are continuously rather than categorically distributed (Fraley & Spieker, 2003; Fraley & Roisman, 2014; Roisman et al., 2007). The results of the present study are consistent with such research. Even so, a large gap remains in our understanding of the latent structure of attachment representations in *childhood* through *early adolescence*. A variety of measures have been used in this age range but their latent structure has largely gone unexplored (see Kerns & Seibert, in press, for a review of measures; see also Waters et al., 2015). The continued development, validation, and standardization of methods probing individual differences in attachment representations in childhood and early adolescence is therefore vital given that the initially independent attachment representations for maternal and paternal caregivers apparently converge sometime during this period of life, and ultimately generalize to include script-like expectations for romantic partners.

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