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A Taxometric Study of the Adult Attachment Interview

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This study is the first to examine the latent structure of individual differences reflected in the Adult Attachment Interview (AAI; C. George, N. Kaplan, & M. Main, 1985), a commonly used and well-validated measure designed to assess an adult's current state of mind regarding childhood experiences with caregivers. P. E. Meehl's (1995) taxometric methods (i.e., MAXCOV-HITMAX) were applied to data from 504 AAIs. Analyses revealed that the variation underlying secure versus dismissing states of mind was more consistent with a dimensional than a taxonic model. (Taxometric analyses of preoccupation were indeterminate.) In addition, variation in secure adults' (n = 278) reports about their early experiences revealed little evidence for qualitative groups of earned- and continuous-secures. Rather, the inferred life experiences of secure adults appeared to be distributed continuously. Findings are discussed in terms of their theoretical implications regarding the phenomenon of earned-security specifically and variation underlying secure and insecure states of mind more generally. The consequences of these analyses for AAI reliability training and coding are also explored.

Keywords: Adult Attachment Interview, taxometrics, MAXCOV-HITMAX, principal components analysis

Over the past four decades, attachment theory (Bowlby, 1969/1982) has emerged as one of the leading frameworks for the study of parent–child relationships and their role in shaping adaptation over the life course. Researchers have used the theory as a way to understand the role of early experiences in shaping social and emotional development (Sroufe, Egeland, & Kreutzer, 1990), examining the ways in which patterns of security are carried forward both across time (Fraley, 2002; Roisman, Collins, Sroufe, & Egeland, 2005; Waters, Hamilton, & Weinfield, 2000) and across generations (Belsky, 2005; Dozier, Stovall, Albus, & Bates, 2001; van IJzendoorn, 1995). Perhaps most provocatively, the theory has served as a unifying thread in an otherwise fragmented psychological science, bringing together researchers interested in evolution, child development, parenting, physiological processes, romantic relationships, and clinical theory and practice (Cassidy & Shaver, 1999).

One reason attachment research has been so influential is that the assessment tools used for studying individual differences have been thoughtfully developed and validated. For example, Ainsworth's Strange Situation procedure was constructed, in part, on the basis of hundreds of hours of detailed observations of parent–child relationships (see Ainsworth, Blehar, Waters, & Wall, 1978). The development of the Adult Attachment Interview (AAI; George, Kaplan, & Main, 1985; Main, Kaplan, & Cassidy, 1985), the most widely used and well-validated instrument in developmental research for studying attachment in adults, was based on a concerted effort to understand how adults organize their discourse when reflecting upon their early childhood experiences. Through careful analysis, researchers were able to discover which aspects of parents' narratives regarding their childhood experiences predict whether their children will be classified as secure or insecure in the Strange Situation. This knowledge is used to classify adults into one of several categories (e.g., secure-autonomous, preoccupied, dismissing) that reflect the interviewee's *state of mind* with respect to attachment. To become a certified AAI coder, a researcher must attend an intensive workshop and undergo a rigorous series of reliability checks—a process that ultimately ensures that adult attachment researchers are making the same fundamental distinctions, regardless of who is making them and where in the world they are made.

In research on adult attachment there has been some attention devoted to the question of whether categories are the most appropriate way to demarcate individual differences. For example, Kobak (1993) developed the AAI Q-set, which operationalizes attachment-related variation continuously along two principal axes: security versus insecurity and deactivation versus hyperactivation. That said, categorical coding is clearly regarded as the gold standard in the field and is the only method that is used to certify a coder's reliability. Resolving the issue of whether categories or continua best reflect the underlying variation in the AAI is important because many methodologists have highlighted the problems that arise when researchers assign people to groups for the purpose of statistical analysis (Cohen, 1983; MacCallum, Zhang, Preacher, & Rucker, 2002). When groups are created on

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the basis of artificial cut-points (e.g., thresholds placed on an underlying continuum), both measurement precision and statistical power can be severely compromised. The issue of taxonicity, however, has more than just methodological consequences. The focus on categories has led to the development of conceptual distinctions in the adult attachment literature, such as that between earned versus continuous security (Pearson, Cohn, Cowan, & Cowan, 1994), that are explicitly rooted in the assumption that there are differences in kind, rather than just degree, among secure people. Thus, categories have played a role not only in the assessment of adult attachment but also in shaping the kinds of theoretical issues addressed by attachment researchers.

In this article we examine the question of whether individual differences in adult attachment, as assessed via the AAI, reflect differences in degree or kind. Specifically, we report the first analysis of the AAI using taxometric methods developed by Meehl and his colleagues (Meehl, 1995; Waller & Meehl, 1998). The primary goal of taxometric analysis is to determine whether individual differences in a latent variable reflect naturally occurring categories or continuous variation (Meehl, 1992). One of the advantages of taxometric methods is that instead of forcing a distributional model on the data, as is the case with some techniques (e.g., cluster analysis), taxometric methods are designed to uncover the underlying structure of individual differences (see Waller & Meehl, 1998). Over the past decade these methods have been applied successfully in many psychological domains (see Haslam & Kim, 2002, for a review), including dissociation (Waller, Putnam, & Carlson, 1996), personality disorders (Trull, Widiger, & Guthrie, 1990), depression (Hankin, Fraley, Lahey, & Waldman, 2005), and infant attachment (Fraley & Spieker, 2003a). By applying these methods to a large sample of AAIs, we hoped to make headway in examining whether the latent structure of individual differences in adult attachment is best conceptualized as categorical or continuous and, thereby, to advance both measurement and theory in adult attachment research. Before reporting our analyses, we begin with a brief review of the AAI and its scoring.

The Adult Attachment Interview

The AAI is an hour-long interview in which adults are asked a set of questions regarding their childhood experiences and provide memories relevant to loss, separation, rejection, and trauma. Based exclusively on their verbal responses, individuals are typically classified by trained coders into one of three primary categories that reflect the coherence of the discourse they produce. The majority of adults, described as *secure–autonomous*, freely and flexibly evaluate their childhood experiences, whether described as supportive or malevolent in nature. In contrast, a large minority of adults are described as *dismissing*. Dismissing individuals defensively distance themselves from the emotional content of the interview by normalizing harsh early memories, for example, or by idealizing their caregivers. Least common are *preoccupied* adults, who are unable to discuss their childhood without becoming overwhelmed by their prior relationship experiences (see Hesse, 1999, for more details). In addition to classifying adults into one of these three mutually exclusive groups, coders also categorize individuals as *unresolved* if their discourse becomes disorganized while talking about loss or abuse experiences.

The scientific yield of research exploring developmental questions using the AAI categories is substantial (see Hesse, 1999, for a comprehensive review). For example, the AAI has been critical in providing evidence that (a) relationship experiences with primary caregivers in childhood are internalized and carried forward into adulthood (Roisman, Madsen, Hennighausen, Sroufe, & Collins, 2001), (b) adults' discourse can provide researchers with leverage in terms of understanding childhood experiences with malevolence and support (Allen & Hauser, 1996; Fraley, 2002; Waters et al., 2000), and (c) the way that parents talk about their early experiences with caregivers reliably predicts the quality of their adult relationships (Cohn, Silver, Cowan, Cowan, & Pearson, 1992; van IJzendoorn, 1995). Nonetheless, due to the resource-intensive nature of AAI administration and coding, the samples that typify work of this kind are often too small to examine differences among insecure adults (Roisman, 2007). In addition, some AAI transcripts paradoxically appear to combine elements of secure and insecure categories (i.e., unresolved-secures) or different forms of insecurity (i.e., *cannot classify* transcripts that mix dismissing and preoccupied strategies), a fact that presents conceptual challenges for the Main and Goldwyn (1998) categorical coding system.

Although the categories described above are often the focus of empirical reports published in the developmental literature, it is important to note that AAI coders actually use a set of continuous rating scales to inductively sort participants into attachment groups. Two kinds of variables are quantified by coders. The first set, known as the *inferred experience* scales, reflects AAI coders' impressions of participants' experiences with caregivers during childhood, including assessments of maternal and paternal love, rejection, neglect, pressure to achieve, and role reversal. Although such information is conceptually orthogonal to the assessment of security versus insecurity in the AAI, several investigators have made use of a subset of these scales to distinguish between secure individuals with putatively negative early relationship experiences with at least one parent (i.e., earned-secures) and secure adults with largely positive experiences with their caregivers (i.e., continuous-secures; see Pearson et al., 1994). It is important to point out that these subcategories carry with them two critical assumptions—first, that they accurately reflect the reality of secure adults' childhood experiences, and second, that early experience can be characterized as qualitatively positive or negative in nature.

The second set of ratings made by AAI coders reflects the coherence of participants' discourse regarding their childhood attachment experiences (i.e., their state of mind). For example, per Main and Goldwyn's (1998) coding system, 9-point scales are used to rate the participant's tendency to idealize and/or normalize childhood experiences with caregivers (*mother idealization* and *father idealization*), the inability to recall events from childhood (*lack of memory*), the extent to which one or both caregivers are derogated (*derogation*), the expression of unreasonable fears that their child may die (*fear of loss*), current active resentment toward parents (*mother anger* and *father anger*), and passive or rambling attachment-related discourse (*passivity*).

These state of mind scales are used to assist the coder in classifying participants into one of the two major insecure categories. Main and Goldwyn (1998) contend that a dismissing state of mind is reflected in any combination of high scores on scales that tap a participant's tendency to idealize parents, derogate them, or show failures of memory (according to the categorical coding system, dismissing adults also occasionally fear the loss of their own child). Preoccupation is identified through signs of anger and/or passivity. Security, in contrast, is defined not only by the relative absence of high scores on these indicators but also by clear signs that an adult is able to explore his or her thoughts and feelings about childhood experiences without becoming angrily or passively overwhelmed while discussing them. By definition, such an ability to freely evaluate one's experiences is reflected in the overall *coherence of mind* and *coherence of transcript* scales. Adults who are able to modify their outlook on their childhood experiences during the interview are given high scores on *metacognitive monitoring*, another indicator of security. Note that participants receive a primary unresolved classification (irrespective of whether they are classified as secure, dismissing, or preoccupied) when they score at or above the midpoint on either the *unresolved loss* or *unresolved abuse* scales, which reflect the degree to which individuals' discourse becomes disorganized while discussing loss or abuse experiences, respectively.

Types and Dimensions in Attachment Theory and Research

Although coders evaluate a number of narrative qualities when coding AAI transcripts, the primary categories of secure, dismissing, preoccupied, and unresolved are often the focus of both theory and statistical analyses. However, at present there is no evidence regarding the latent structure of individual differences in the AAI. Understanding whether variation reflected in the interview is categorical or continuous can have significant implications for empirical research. As discussed earlier, it is now well-known that imposing a categorical structure on dimensional data can attenuate predictive validity (MacCallum et al., 2002). Cohen (1983), for instance, noted that when categorical models are used to represent continuous variation, 36% of the reliable variance is lost. Moreover, for researchers interested in studying the continuity of attachment across time, the use of categories can lead to underestimates of stability. For example, if the true test–retest stability is high ($r = .90$) across two time points, the expected stability for categorical measures (i.e., two-category secure vs. insecure) is as low as $\kappa = r = .71$.

As a second illustration, consider the issue of statistical power—the probability of correctly rejecting a null hypothesis when there really is an effect. It is well-known that statistical power is a function of three parameters: the true effect size, the sample size, and the alpha level (usually set to .05). There is another factor, however, that is rarely accounted for in applied power analyses: measurement precision or reliability (Cohen, 1988). If individual differences are continuously distributed but are modeled categorically, then measurement precision is reduced and the ability to detect true effects is compromised. The consequences of this problem were quantified by Fraley and Spieker (2003a), who simulated data using a two-dimensional model across a variety of effect sizes using a modest sample size that is characteristic of much research on adult attachment. Using these simulated data, they tested the statistical significance of parameters from (a) a continuous two-dimensional model, (b) a two-category (secure–insecure) model, and (c) a three-category model. The resulting power curves over a range of effect sizes (R^2s from 1% to 99%) for the three kinds of models revealed that the statistical power for each kind of analysis was poor when the effects to be detected were weak and high when the effects to be detected were high. In between these two extremes, however, there were marked differences in the power curves for the different kinds of analysis. For example, if the true model explained 25% of the variance, then the statistical power of the two-dimensional model was 80%, but the power of the two-category model was only 50%. These findings suggest that, given the typical sample size used in attachment research—and assuming the true effects to be substantial—researchers have only a 50–50 chance of discovering the real developmental implications of adult attachment patterns by using categorical measurement models! If the kinds of individual differences captured by the AAI are truly continuous, using a dimensional measurement model would greatly improve the empirical yield of developmental research on adult attachment.

The types versus dimensions issue is not simply of methodological interest. Imposing categorical structure where none exists can impede theoretical advances as well. For instance, there is currently active debate as to whether the retrospective system developed for identifying earned- and continuous-secure adults based on participants' inferred life experience scales provides a valid method of operationalizing change in attachment security over time (Roisman, Fortuna, & Holland, 2006; Roisman, Padrón, Sroufe, & Egeland, 2002). Such work has shown that earned-secures, so defined, paradoxically have supportive childhood experiences, at least with their maternal caregivers (Roisman et al., 2002). In addition, a recent experiment was successful in manipulating earned- versus continuous-security via mood induction (Roisman et al., 2006). In the Roisman et al. (2006) study, secure adults asked to think about a sad autobiographical memory while listening to emotionally evocative music showed increased rates of earned-security. In contrast, secure participants in a happy condition were more likely to be classified as continuous-secures. Fundamentally, the debate over the significance of the earned- versus continuous-secure distinction rests on the untested assumption that childhood experiences with caregivers (at least as reported retrospectively) become organized in the mind in qualitatively distinct ways, leading some people to view their early experiences favorably and others less favorably. No data yet exist to address this issue.

Overview of the Present Investigation

This study is the first to examine the latent structure of individual differences as assessed in the AAI. In principle this analysis could have been conducted on any large AAI data set. For the purposes of this study, we assembled all data available from the earned-security literature (Paley, Cox, Burchinal, & Payne, 1999; Pearson et al., 1994; Phelps, Belsky, & Crnic, 1998; Roisman et al., 2002, 2006). We focused on the earned-security literature because we have been particularly interested in understanding this distinction in our work (e.g., Roisman et al., 2002, 2006). Moreover, this sampling strategy serves as a means to address the types versus dimensions question concerning variation in AAI security and insecurity more generally. Although it should be noted from the outset that attachment theory is essentially indifferent to the taxonic status of individual differences in attachment (Fraley & Spieker, 2003b; Waters & Beauchaine, 2003), how the AAI is coded can have substantial consequences for statistical power, as well as conceptual advances in the area of adult attachment.

Method

Literature Search

To identify data sources we searched PsycINFO (www.apa.org/psycinfo) for studies relevant to earned-security using the terms "earned-security," "earned-secure," "continuous-security," "continuous-secure," and "Adult Attachment Interview." This process resulted in the identification of five empirical publications (Paley et al., 1999; Pearson et al., 1994; Phelps et al., 1998; Roisman et al., 2002, 2006) and one dissertation (Grich, 2002). (Theoretical articles featuring discussion of the earned-secure classification also emerged from this literature search: Hesse, 1999; Sroufe, Carlson, Levy, & Egeland, 1999; Watson & Sweney, 2003.)

After identifying these empirical publications we requested the raw AAI data from the original investigators. Although we received AAI data sets from all of the studies listed above, some of them did not include key variables (in some cases because the variables were not yet part of the AAI coding system at the time the study was conducted). Ultimately, we identified three complete data sets that could be used for this analysis: Phelps et al. (1998; a study of 135 mothers of 27-month-old boys, 98% Caucasian, mean age = 29 years), Paley et al. (1999; an investigation of 138 married couples[1] expecting their first child, 97% Caucasian, mean age = 28 years for husbands, mean age = 27 years for wives), and Roisman et al. (2006; a study of 100 young adults, 50% female, 60% Caucasian, mean age = 19 years).

The resulting sample included 511 adults. To conservatively examine whether a dimensional or categorical model fit the data best, we omitted 7 cases that had a primary classification of cannot classify from the data set, thus reducing the sample to 504 participants (unresolved/cannot classifies were retained). This final sample included 278 (55.5%) secure, 132 (26.2%) dismissing, 43 (8.5%) preoccupied, and 51 (10.1%) unresolved adults. More detailed information regarding these samples can be found in the publications from which the data were drawn. (Although ethnic differences in attachment security as assessed by the AAI have not yet been identified, the ethnic homogeneity of two of the samples on which this analysis is based suggests the importance of replicating the results obtained in this study in other, more diverse samples. In addition, as studies aggregated in this report are based on convenience samples, it is impossible to know how generalizable such data are to more representative samples).

Adult Attachment Interview

In each of the studies combined for the present report, adult participants completed the AAI, a semistructured protocol used to characterize individuals' current state of mind with respect to past parent–child experiences (George et al., 1985). The AAI is an hour-long interview that requires participants to describe their early relationships with their parents, provide specific memories that support these general characterizations, revisit salient separation episodes, explore instances of perceived childhood rejection, recall encounters with loss, and speculate about their expectations regarding raising their own children. According to established protocol, each interview was transcribed verbatim and all identifying information was removed from the transcripts. The transcripts were then coded by judges trained through and reliable with the lab of Dr. Mary Main using her AAI Scoring and Classification System (Main & Goldwyn, 1998).

Ultimately, transcripts received primary attachment classifications of secure-autonomous, insecure-dismissing, insecure-preoccupied, or unresolved, according to the criteria outlined by Main and Goldwyn (1998) in their coding manual for the AAI. Narratives coded as secure showed evidence of an autonomous state of mind with respect to attachment. Secure participants explored their thoughts and feelings about earlier parent–child experiences, whether described as good or ill, in an open, contained, and coherent manner. Narratives coded as insecure, in contrast, provided strong evidence of dismissing, preoccupied, or unresolved states of mind with respect to attachment. Respectively, these participants idealized/minimized attachment relationships, seemed currently entangled/enmeshed in their relationships with parents, or became disorganized in their discourse when describing loss or abuse events. In preparation for making an overall judgment regarding participants' primary AAI classifications, trained and reliable coders characterized the narrative coherence of each transcript along thirteen 9-point state of mind rating scales (see the introduction). These scales are viewed as indicators of each of the attachment classifications described above and, importantly, are used in an inductive fashion by coders making the final classification.

In addition to rating participants' states of mind with respect to attachment, AAI raters also provided an overall depiction of participants' experiences with their primary caregivers in childhood using a set of 10 inferred experience scales. These scales included mother and father love, rejection, neglect, role reversal, and pressure to achieve. Following established guidelines (see Pearson et al., 1994), the original investigators used the mother and father love, rejection, and neglect ratings to subdivide secure participants into two groups: those who coherently described negative childhood experiences with one or both caregivers (earned-secures) and those who coherently described positive childhood experiences (continuous-secures). Although several critiques of the earned- and continuous-secure classifications have emerged in recent years (Roisman et al., 2002, 2006), no study has yet examined whether such a categorical distinction between these forms of security is justified by the data. To address this issue, we conducted a taxometric analysis on the inferred experience ratings within a subsample of participants classified as secure (n = 278). Note that unresolved-secure participants were not included in this particular analysis because such adults cannot be unambiguously described as having a secure state of mind regarding attachment (Phelps et al., 1998; Roisman et al., 2002, 2006).

Taxometric Procedures

To address the types versus dimensions question, we used a taxometric procedure developed by Meehl and his colleagues, known as MAXCOV-HITMAX (MAXCOV; Meehl, 1973; Meehl

[1] Husbands' and wives' attachment classifications were uncorrelated in the Paley et al. (1999) sample. As such, participants drawn from couples were treated as independent units for the analyses presented in this article.

& Yonce, 1996). MAXCOV is one of the most widely used taxometric methods for addressing questions about taxonicity (for a detailed overview of MAXCOV, see Meehl, 1973, or Waller & Meehl, 1998). In MAXCOV, one examines the covariance between two indicators of a latent construct as a function of a third indicator. The function characterizing these conditional covariances is called a MAXCOV function and its shape depends on the taxonic 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. In samples in which the base rate is less than .5, the peak will be shifted to the right; in samples in which the base rate is larger than .5, the peak will be shifted to the left. If the latent variable is continuous, however, the MAXCOV curve will tend to resemble a flat line (see Fraley & Spieker, 2003a, for graphical illustrations).

In our MAXCOV analyses, we computed the conditional covariances between all pairwise variables as a function of a composite of the remaining variables. Because multiple MAXCOV curves can be generated from the same set of variables, the MAXCOV procedure produces multiple tests of taxonicity for a given set of indicators. Meehl's approach therefore emphasizes the consistency of results from multiple, nonredundant tests, rather than the statistical significance of a single test. If a latent class actually exists, the various MAXCOV functions observed for a set of indicators should have a similar form. Furthermore, the taxon base rate estimates derived from each MAXCOV analysis should converge on a single value (i.e., the true base rate of the latent class). Support for a taxonic interpretation of a construct is strengthened when these consistency tests are passed.

Table 1
Descriptive Statistics for AAI State of Mind Scales and AAI Inferred Life Experience Scales

AAI scale	Distributional properties *M*	*SD*	Skew
State of mind scales (full sample, $N = 504$)			
Coherence of mind	5.07	1.95	−0.11
Metacognitive monitoring	1.87	1.27	2.05
Fear of loss	1.36	0.90	2.89
Idealization (father)	2.99	2.01	0.71
Idealization (mother)	3.24	1.99	0.47
Lack of memory	2.93	2.04	0.85
Overall derogation	1.76	1.47	2.36
Anger (father)	1.67	1.45	2.66
Anger (mother)	1.59	1.33	2.67
Passivity	2.20	1.66	1.51
Unresolved abuse	1.43	1.21	2.98
Unresolved loss	2.51	1.77	1.07
Inferred life experiences (secure adults only, $n = 278$)			
Father love	5.54	2.03	−0.39
Mother love	6.52	1.73	−0.77
Father rejection	3.24	2.01	0.87
Mother rejection	2.41	1.57	1.38
Father neglect	3.06	2.22	1.02
Mother neglect	1.76	1.48	2.59

Note. For purposes of taxometric analyses, several scales (metacognitive monitoring, coherence of mind, father love, mother love) were reverse coded so that all variables in each analysis were keyed in the same direction. Descriptive data above are presented for the original scales. AAI = Adult Attachment Interview.

Simulation of Taxonic and Dimensional Comparison Data

The interpretation of taxometric results is not clear-cut when indicators are skewed, as is the case for the indicators used in this report—especially those of preoccupation and unresolved status (see Table 1). Specifically, when indicators are skewed, the resulting MAXCOV curves will be consistent with those expected when there is a low base rate taxon—even if the data were generated in accordance with a dimensional model. To aid in drawing valid inferences, it is helpful for researchers to evaluate MAXCOV curves with respect to those that would be expected both in taxonic and dimensional situations in which skew is present. To do so, we simulated skewed data under taxonic and dimensional models following an iterative procedure highly similar to that developed by Ruscio, Ruscio, and Keane (2004; see also Hankin et al., 2005). Specifically, we simulated data for hypothetical subjects by generating scores in which the latent variable was either normally distributed (i.e., dimensional) or taxonic. This code is freely available from R. Chris Fraley upon request.

We began each simulation by generating observed scores under a dimensional or taxonic model. (For the taxonic simulations we assumed a base rate that was equal to that suggested by the empirical MAXCOV analyses.) Next, the distribution of each of the simulated indicators was skewed and scaled to conform to the distribution of empirical indicators by sorting the values and replacing them using the same values and frequencies observed in the empirical data (see Ruscio et al., 2004, for more information). Next, the discrepancies between the inter-item correlation matrices based on the simulated indicators and the empirical ones were calculated, and the vector of loadings was adjusted to minimize this discrepancy. The iterations proceeded until the average squared discrepancy, quantified as the root-mean-square error of approximation, was .15 or less. In short, this method allows us to capture the surface-level statistical properties of the observed variables (i.e., their means, standard deviations, skew, and inter-item correlations) while allowing us to vary the latent structure that generated them (Hankin et al., 2005; Ruscio et al., 2004).[2]

[2] It should be noted that we did not model *nuisance covariance* (i.e., the covariation that may exist between indicators within a group due to continuous sources of variation that are common to the indicators) in our simulations for two reasons. First, to the extent to which indicator covariance exists within a group it is because (a) the group is not exclusively composed of taxon (or nontaxon) members or (b) there is an additional factor common to the indicators—presumably one that does not covary with the taxonic variable—that generates indicator covariation. In this latter case, the appropriate model is not a pure taxonic one and does not map well onto the categorical assumptions made by the AAI coding system. If, for example, the covariation among indicators is a weighted function of both taxonic and dimensional sources of variation, then a continuous model is necessary to conceptualize and assess that variation appropriately (see Fraley & Spieker, 2003b). A second reason that we did not model nuisance covariance is that doing so necessarily makes the taxonic model more flexible than a dimensional one. In other words it is possible to reproduce any empirical MAXCOV function by adding just the right combination of taxonic and dimensional sources of influence. Thus, to avoid this kind of looseness, we chose to evaluate strong versions of both models: a dimensional model that assumes no taxonic variation and a taxonic model that assumes no dimensional variation (i.e., variation that would give rise to nuisance covariance).

Table 2
Component Loadings From Two- and Three-Component Solutions of Principal Components Analyses (Varimax Rotation) of AAI State of Mind Rating Scales

	Two-component solution		Three-component solution		
AAI state of mind scale	I	II	I	II	III
Secure indicators					
Coherence of mind	**−.71**	−.54	**−.74**	−.42	−.30
Metacognitive monitoring	**−.56**	−.06	**−.57**	−.07	.05
Dismissing indicators					
Fear of loss	.02	**.32**	.00	−.02	**.65**
Idealization (father)	**.79**	−.13	**.78**	−.24	.08
Idealization (mother)	**.82**	−.11	**.81**	−.17	.01
Lack of memory	**.70**	−.09	**.70**	−.04	−.17
Overall derogation	.14	**.31**	.19	**.57**	−.35
Preoccupied indicators					
Anger (father)	−.20	**.59**	−.15	**.72**	−.02
Anger (mother)	−.14	**.67**	−.10	**.70**	.16
Passivity	.16	**.61**	.17	.37	**.56**
Unresolved indicators					
Unresolved abuse	−.06	**.63**	−.03	**.55**	.32
Unresolved loss	−.08	**.41**	−.10	.03	**.73**

Note. Indicators are sorted by the AAI categories they best denote conceptually according to Main and Goldwyn (1998). Values in bold are the factors that each variable loaded most strongly on for each solution. AAI = Adult Attachment Interview.

As might be expected, the simulated MAXCOV curves generated under each model varied from one simulation to the next because of random sampling errors. To quantify this variation, we simulated data under each kind of model (dimensional and taxonic) 100 times to approximate sampling distributions for MAXCOV curves expected under each model. In the analyses that follow, we report the averaged empirical MAXCOV functions (denoted as a solid line in the figures), as well the upper and lower 95% bounds of sampling distributions (demarcated by the dashed lines in the figures). This latter region captures the range of MAXCOV functions that are expected under each theoretical model under conditions of sampling error. We note that these simulations should be regarded as supportive, rather than definitive, regarding the likelihood of taxonomic structure.

Results

Data Reduction

The MAXCOV procedure is based on a psychometric model that assumes that the indicators of a latent construct are positively correlated in mixed samples (i.e., samples comprised of both taxon and nontaxon members). In order to ensure that this assumption was met in the present analyses and to identify the optimal indicators for each of the attachment constructs, we conducted a principal components analysis (PCA) with Varimax rotation on the state of mind scales. These analyses revealed that both two- and three-component solutions accounted for the data reasonably well (see Table 2).[3]

It is noteworthy that the PCA carved the variation in a way that resembles the system proposed by Main and Goldwyn, 1998, with two exceptions. As expected, the first component in both the two- and three-component solution contained AAI state of mind scales typically used to differentiate secure from dismissing participants (The order of loading was as follows: mother idealization, father idealization, coherence of mind, lack of memory, and metacognitive monitoring). The two-component solution generated a second dimension primarily reflecting scales used to identify preoccupation and unresolved status. These scales included (in order of loading) mother anger, unresolved abuse, father anger, passivity, unresolved loss, fear of loss, and overall derogation. Somewhat surprisingly, two of the scales that are often used to arrive at a dismissing classification (i.e., derogation and fear of loss; Main & Goldwyn, 1998) did not load most highly on the first component (i.e., the component that, conceptually, best differentiated dismissing from secure individuals).

The three-component solution helps to clarify why this was the case. The traditional classification scheme may overlook an important distinction between two forms of preoccupation. One variant reflects an active, traumatic preoccupation (as indicated by high ratings on the father anger, mother anger, derogation, and unresolved trauma scales), whereas the other reflects a passive, loss-related preoccupation (as indicated by high ratings of unresolved loss, fear of loss, and passivity). Because fear of loss and overall derogation load on these different factors, these indicators may be less relevant to capturing the essence of what makes a person dismissing in the Main and Goldwyn (1998) system.

[3] In one case in which indicators were essentially redundant (i.e., coherence of mind and transcript correlated .93 in this sample), we only used one indicator (i.e., coherence of mind).

MAXCOV Analyses

Secure versus dismissing. To examine whether variation in secure versus dismissing states of mind was more compatible with a categorical or a dimensional model, we conducted MAXCOV analyses on the five indicators of secure versus dismissing states of mind described above, based on the full data set of 504 participants (the metacognitive monitoring and coherence of mind scales were reverse coded prior to this analysis). The averaged empirical MAXCOV curve was most similar to that expected under a dimensional model as opposed to a taxonic one (see Figure 1). The empirical curve falls within the region expected if the data were generated from a dimensional model but deviates markedly from what would be expected under a taxonic model.

Table 3 summarizes the base rate estimates derived from our empirical analyses and our simulations. Overall, there was quite a bit of variation in the empirical estimates ($SD = .26$), with a mean estimate of .47. To determine the kinds of estimates that should be expected based on dimensional and taxonic models, we examined the average base rate estimates obtained in our simulations, as well as the (average) of the standard deviation of those estimates. As is indicated in Table 3, the amount of variability observed in the empirical base rate estimates (.26) was more consistent with that expected under a dimensional (.26) than a taxonic (.05) model.

Preoccupied versus not preoccupied. The PCA revealed that there were several ways to combine indicators to differentiate preoccupied adults from those who are not. We explored three distinct ways of combining these indicators, one based on the scales that loaded on the second component in the two-component solution, one based on indicators that loaded on the second component in the three-component solution (i.e., angry preoccupation), and one based on indicators that loaded on the third component in the three-component solution (i.e., passive preoccupation; see bold items in Table 2). Results of each of these analyses suggested that it was not possible to distinguish between taxonic and dimensional hypotheses. For the purposes of illustration, Figure 2 shows the results of MAXCOV based on fear of loss, overall derogation, mother anger, father anger, passivity, unresolved abuse, and unresolved loss.

Table 3 summarizes the base rate estimates derived from this analysis. Overall, there was quite a bit of variation in the empirical estimates ($SD = .24$), with a mean estimate of .25. The variations in base rates expected under taxonic and dimensional models were similar: .16 and .18, respectively. Taken together, these data do not provide a means to rule out either model.

Earned versus continuous security. To determine whether the distinction between continuous and earned security represents a categorical one, we conducted MAXCOV analyses on the six indicators of continuous security used in the literature to identify these groups (mother and father love, rejection, and neglect) within the subsample of 278 cases that had been given primary classifications of secure. Overall, the empirical MAXCOV curves were most similar to those expected under a dimensional model as opposed to under a taxonic one. In Figure 3 we have illustrated the averaged MAXCOV curve for the empirical data. The dashed lines illustrate the upper and lower bounds of MAXCOV functions that should be observed under dimensional (left-most panel) and taxonic (right-most panel) situations, based on the simulated data. Notice that the averaged MAXCOV curve falls well within the region expected if the data were generated from a dimensional model, but is subject to sampling fluctuations. In contrast, the empirical curve deviates considerably from what would be expected under a taxonic model.

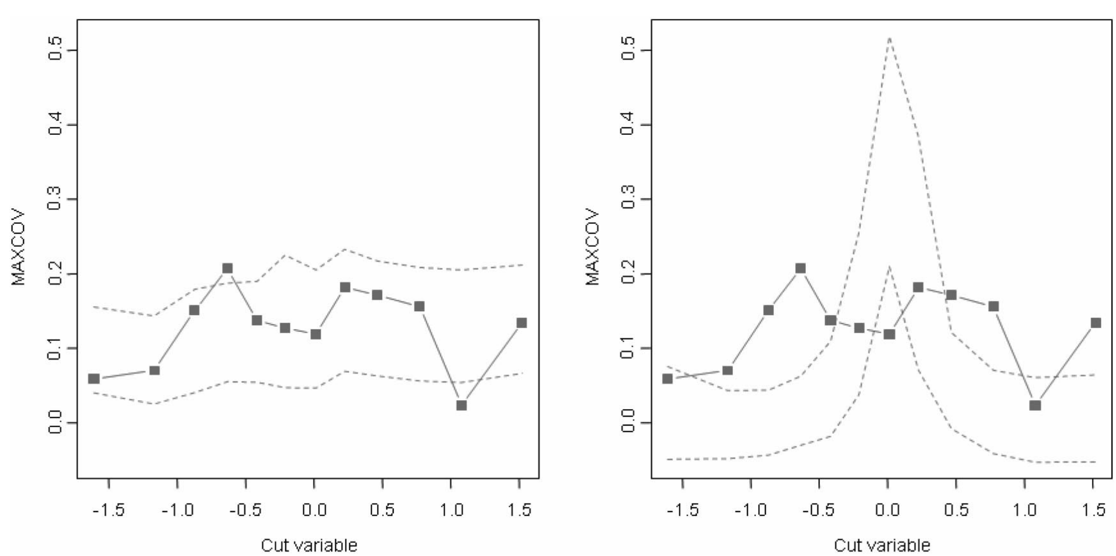

Figure 1. MAXCOV-HITMAX (MAXCOV) functions for indicators of secure versus dismissing states of mind. The left-hand panel shows the averaged empirical MAXCOV function (connected dots) as well as the range of MAXCOV functions, depicted by the dashed lines, that would be expected 95% of the time if the data had been generated by a dimensional model. The right-hand panel shows the same averaged empirical MAXCOV function and the range of MAXCOV functions, depicted by the dashed lines, that would be expected if the data had been generated by a categorical model.

Table 3
Taxon Base Rate Estimates Derived From the Empirical Data and From Simulated Dimensional and Taxonic Models

	Empirical MAXCOV-HITMAX estimates			Simulated dimensional estimates		Simulated taxonic estimates	
Domain	*M*	*SD*	Range	*M*	*SD*	*M*	*SD*
Secure vs. dismissing	.47	.26	.09–.75	.46	.26	.48	.05
Preoccupied vs. not preoccupied	.25	.24	.04–.73	.19	.16	.29	.18
Earned-vs. continuous-secure	.45	.32	.07–.94	.29	.19	.35	.11

In Table 3 we summarize the base rate estimates derived from our empirical analyses. Overall, there was quite a bit of variation in these estimates ($SD = .32$), with a mean estimate of .45. To determine the kinds of estimates that should be expected based on dimensional and taxonic models, we examined the average base rate estimates obtained in our simulations, as well as the (average) of the standard deviation of those estimates. The amount of variability observed in the empirical base rate estimates (.32) was more similar to a dimensional model (.19) than to a taxonic model (.11).

Discussion

This article reports the first empirical examination of the latent structure of the Adult Attachment Interview (AAI; George et al., 1985), a commonly used and well-validated measure for assessing an adult's current state of mind regarding his or her childhood experiences with caregivers. Our taxometric analyses suggest that the primary distinction made by AAI coders between secure and dismissing states of mind is more consistent with an underlying dimensional rather than taxonic model. Moreover, this study does not support the claim that there exists a qualitative distinction between adults who coherently talk about negative versus positive childhood experiences (i.e., earned- and continuous-secures; Pearson et al., 1994). Rather, the inferred life experiences of secure adults appear to be distributed continuously. Of note, taxometric analyses of indicators of preoccupation and unresolved status were indeterminate due to the highly skewed nature of relevant indicators. Taken together, these findings have both important theoretical implications regarding the phenomenon of earned-security specifically and variation underlying secure and insecure states of mind more generally. This work also has practical consequences for AAI reliability training and coding, which we explore below.

Theoretical Implications

MAXCOV analyses focused on variation in the inferred life experiences among secure adults extend a growing literature critiquing retrospective assessments of early experiences designed to

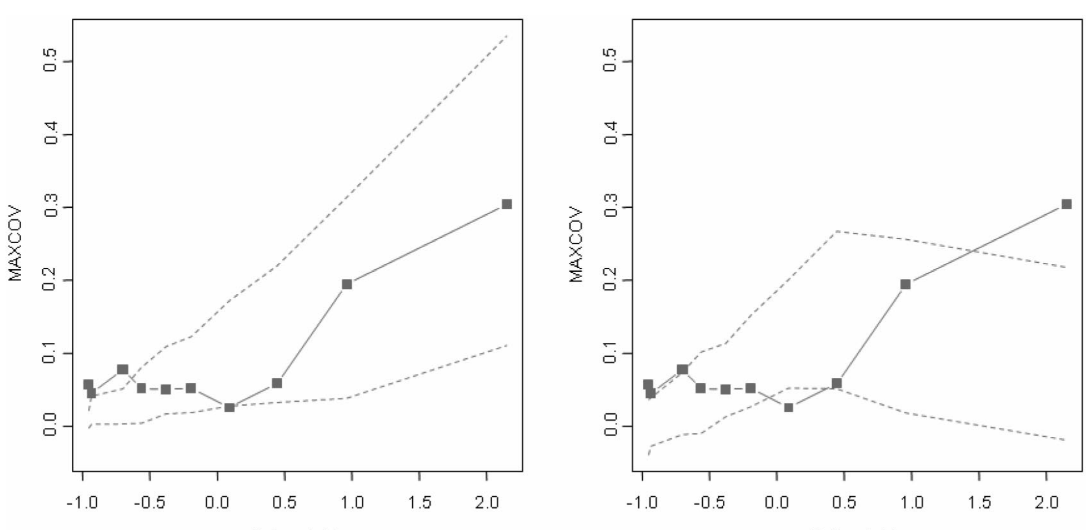

Figure 2. MAXCOV-HITMAX (MAXCOV) functions for indicators of preoccupation. The left-hand panel shows the averaged empirical MAXCOV function (connected dots) as well as the range of MAXCOV functions, depicted by the dashed lines, that would be expected 95% of the time if the data had been generated by a dimensional model. The right-hand panel shows the same average empirical MAXCOV function and the range of MAXCOV functions, depicted by the dashed lines, that would be expected if the data had been generated by a categorical model.

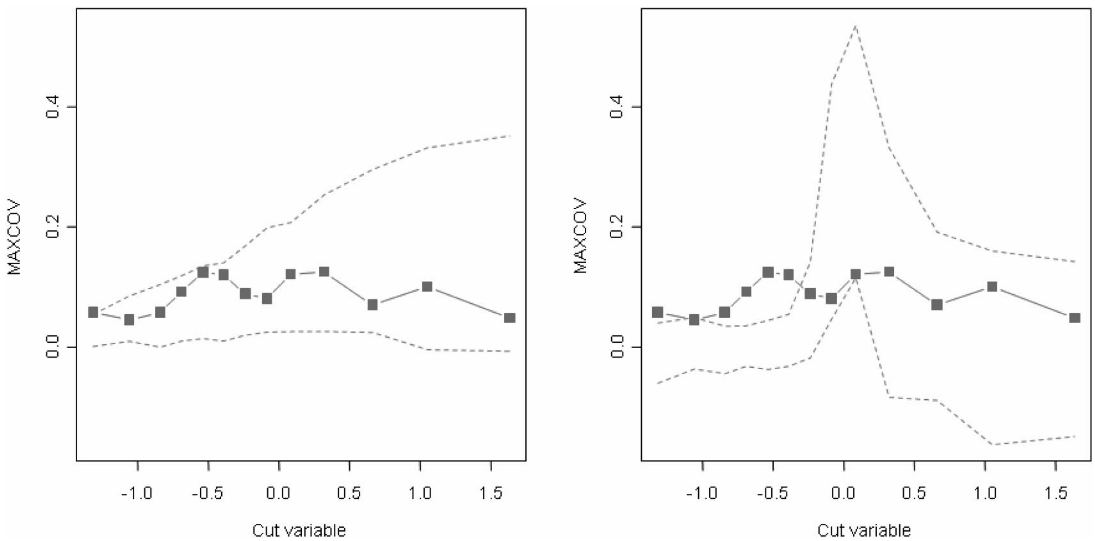

Figure 3. MAXCOV-HITMAX (MAXCOV) functions for indicators of earned versus continuous security. The left-hand panel shows the averaged empirical MAXCOV function (connected dots) as well as the range of MAXCOV functions, depicted by the dashed lines, that would be expected 95% of the time if the data had been generated by a dimensional model. The right-hand panel shows the same averaged empirical MAXCOV function and the range of MAXCOV functions, depicted by the dashed lines, that would be expected if the data had been generated by a categorical model.

distinguish earned- from continuous-secures (Paley et al., 1999; Pearson et al., 1994; Phelps et al., 1998). As discussed in the introduction, recent longitudinal data (Roisman et al., 2002) suggest that retrospectively defined earned-secures are paradoxically not more likely than continuous-secures to have been anxiously attached to their mothers in infancy and indeed experience high quality maternal parenting in childhood. In addition, a recent experiment demonstrated that rates of earned- and continuous-security (but not security vs. insecurity) can be manipulated via a simple mood induction procedure (Roisman et al., 2006), suggesting that the earned- versus continuous-secure distinction may be a function of mood-related biases.

The current study adds a new dimension to these critiques, demonstrating that no categorical distinction between individuals who coherently talk about negative versus positive childhood experiences with caregivers is reflected in these data. It is important to note that our findings are not merely an artifact of atypical or poorly coded AAIs; these data comprise a large part of the empirical literature on earned- versus continuous-security (i.e., Paley et al., 1999; Phelps et al., 1998; Roisman et al., 2006). Also of note, our MAXCOV analyses would have been sensitive to taxonicity irrespective of the “true” base rates of earned- and continuous-security. Said another way, our conclusion that variation in the reported experiences of secure adults is dimensional in nature is not tied to a particular definition of earned- and continuous-security imposed on the data. This is an important point given that Main and Goldwyn (1998) have recently advocated for extremely stringent criteria in defining earned-security retrospectively (see Roisman et al., 2006).

More generally, principal components analyses (PCAs) presented in this study shed new light on the patterns of variability that exist across AAI narratives, irrespective of their taxonic or dimensional nature. To our knowledge, this is the first article to use PCA to demonstrate that there may be two or three domains of variation that cut across the AAI (but see Shaver, Belsky, & Brennan, 2000, for a relevant discriminant function analysis of the AAI). The primary component, anticipated by Main and Goldwyn (1998), can be conceptualized as reflecting the degree to which individuals either freely evaluate or defensively present their childhood experiences with caregivers. This dimension maps nicely onto the key distinction suggested by Main and Goldwyn (1998) with respect to defining adults as secure or dismissing. In a two-component PCA, the second component generally included indicators expected to be indicative of preoccupied and unresolved discourse. Interestingly, however, the three-component solution failed to identify AAI state of mind indicators presumed to be specific to preoccupied and unresolved patterns of discourse, as might have been expected. As discussed earlier, it may be that the traditional classification scheme overlooks an important distinction between two forms of preoccupation, with one variant reflecting an active, traumatic preoccupation (father anger, mother anger, derogation, and unresolved trauma), and the other a passive, loss-related preoccupation (unresolved loss, fear of loss, and passivity).

Thus, one way to interpret the PCA results in this article is that there exist two broadband, at least somewhat independent, patterns of variation underlying individual differences in AAI narratives: one that reflects the degree to which adults either freely evaluate or defensively discuss their early experiences and the other reflected in one of two second-order forms of preoccupation (i.e., passive or active). Growing evidence drawn from large studies of infant (Fraley & Spieker, 2003a) and romantic (Fraley & Waller, 1998) attachment security suggest that these two kinds of dimensions may in fact represent the universal signature of individual differences in security as currently measured using diverse methods. In the context of research on the AAI, a recognition of two latent patterns of variation underlying adults' coherence of discourse would make certain phenomena, currently very difficult to reconcile within a categorical frame of reference, much more theoretically comprehensible. For example, as highlighted in the introduction, it has been known for some time that indicators of both dismissing and preoccupied states of mind are combined in certain AAI narratives currently labeled cannot classify. Likewise, the fact that insecure and secure strategies are reflected in (categorically) unresolved yet otherwise secure narratives is to be expected when one views security (vs. dismissing states of mind) as at least modestly independent of passive, loss-related preoccupation.

Also of note, in this sample two indicators of a dismissing state of mind in Main and Goldwyn's (1998) Classification Coding System (i.e., fear of loss and derogation) loaded on the same component as indicators of preoccupation. This somewhat unexpected finding is not completely inexplicable. First, derogation and fear of loss are both extremely low base rate phenomena with psychometric characteristics that are largely unknown. As such, the correlates of these patterns of discourse are at best speculative. Moreover, the fear of loss scale was identified as an indicator of a dismissing state of mind based on the observation that a small number of parents with avoidantly attached children in the Berkeley longitudinal sample showed this pattern of discourse during the AAI (see Hesse, 1999). The bottom line is that the current findings point to the critical importance of conducting large-scale studies of the AAI in which putative indicators of various forms of security and insecurity can be explicitly and rigorously examined empirically via factor analytic methods.[4]

Practical Implications

These findings also raise the question of how the AAI should be coded—and how reliability should be assessed or ensured. Currently, when researchers are trained to use the AAI, their reliability is gauged by their ability to achieve categorical agreement with gold standard AAI transcripts (Hesse, 1999). Although we support every effort to make certain that researchers using the AAI receive standardized training and pass reliability testing, our results raise the possibility that there may be some benefits of focusing training on the state of mind scales rather than on the categories per se.

If researchers choose to focus on a dimensional framework for assessing adult attachment, the question remains as to how this should be done. We are not committed to any one solution at this point, but we offer two possibilities. One solution is for researchers to train using the state of mind scales and to use these scales in their empirical analyses. Drawing upon the dimensional framework we outlined previously, researchers could scale participants along two dimensions, one that reflects the degree to which adults either freely evaluate or defensively discuss their early experiences and the other reflecting attachment-related preoccupation. This kind of analysis would enable researchers to investigate the same kinds of questions that are currently addressed in categorical AAI research but with enhanced statistical power—and perhaps enhanced insight.

Another solution is a wider adoption of methods that already exist for coding AAI-related variation in a dimensional fashion, such as the Adult Attachment Interview Q-set (Kobak, 1993; Kobak, Cole, Ferenz-Gillies, Fleming, & Gamble, 1993). The AAI Q-sort is a promising solution because it has yielded an impressive and growing set of findings in the domains of psychopathology (Dozier, 1990; Dozier & Lee, 1995), adolescent–parent relationships (Allen et al., 2003; Kobak et al., 1993), and the psychophysiology of adult attachment (Dozier & Kobak, 1992; Roisman, 2007; Roisman, Tsai, & Chiang, 2004). In addition, all available evidence suggests that the empirical convergence between the Kobak (1993) Q-sort and Main and Goldwyn's (1998) Attachment Classification System exceeds the minimum standard of reliability used to train coders in classifying AAI transcripts (e.g., Allen et al., 2003; Kobak et al., 1993).

Limitations and Caveats

This study combined data from a well-defined literature on earned- and continuous-security, thereby producing the largest analysis of raw AAI data to date ($N = 504$; 55% secure). That said, MAXCOV requires sample sizes that are fairly large (i.e., Ns $>$ 300 and, ideally, closer to 600; Meehl, 1995). The sample size for the current study was modest by such standards and might be one of the reasons we were not able to draw any strong conclusions about the taxonic status of preoccupied discourse. Given the modest size of the sample of coded AAIs available for this analysis and the fact that no study is conclusive in isolation, it is imperative that these issues be reevaluated as larger data sets become available. Future taxometric research on the AAI would be especially useful for addressing outstanding questions related to the latent structure of preoccupied and unresolved states of mind.

Some investigators have suggested that taxometric analyses are of limited usefulness when they fail to identify categories. More specifically, Waters and Beauchaine (2003) have argued that taxometric methods were designed to test hypotheses about categorical structure; thus, when the data fail to support such structure, the proper conclusion is not that the latent variable is continuous but that there is no evidence of taxonicity. Although we agree with the spirit of this point, it is important to note that it is possible to generate quantitative predictions based on both latent dimensional and taxonic models. By comparing the data against both kinds of models, as we did in this report, both models can be tested. Our conclusion that variation in secure versus dismissing attachment is continuous, for example, is not based on the lack of evidence for taxonicity per se, but on the fact that our empirical data more closely resembled what should be expected under a dimensional model than a categorical one (see Fraley & Spieker, 2003b, for more detail).

Nonetheless, it is important to note that taxometric analyses of data sets in the future may reveal that our results were essentially

[4] Although unanticipated theoretically in Main and Goldwyn's (1998) coding manual, there is prior empirical evidence that derogation may be more strongly associated with indicators of preoccupation than markers of a dismissing state of mind. For example, in one of the few studies to provide data on the intercorrelations among AAI state of mind scales (Fonagy, Steele, & Steele, 1991; $N = 100$), the strongest correlates of mother and father derogation were mother and father anger, respectively. (It was not possible for us to conduct a formal principal components analysis of the Fonagy et al. (1991) data as the subscale intercorrelation matrix was incomplete, and several critical indicators were not yet part of the AAI coding system at the time that that study was published.)

false negatives. We have taken several steps, however, to help ensure that our analyses were as robust as possible. For example, we used items selected from PCA to focus on items that hung together most tightly. None of the item sets we studied, including alternative item sets not reported in the text, suggested taxonicity. In addition, AAI subscales within each of the three composited data sets examined in this work were associated with attachment categories in identical, theoretically coherent ways. Finally, all ratings were completed by trained and reliable AAI coders. That said, agreement on low base rate AAI scales is sometimes poor, even among experienced scorers, which can reduce sensitivity to taxonicity. Additional taxometric work on the AAI will be valuable for evaluating the conclusions we have reached here.

A final concern that might be raised in regard to this analysis, and indeed to taxometric analyses more generally, is that it may be of little practical consequence if dimensional variation is measured categorically. This argument was made, for example, by Sroufe (2003) in relation to a taxometric analysis of infant Strange Situation behavior reported by Fraley and Spieker (2003a). Sroufe (2003) suggested that, whether or not true categories exist, types can serve as "useful fictions" for theory building (p. 414).[5] We agree that there are many situations in which thinking categorically can assist the hypothesis generation process. That said, theoretical fictions can also act as impediments to advancing a field when they become reified. Unless there really is a qualitative distinction to be made between earned- and continuous-secure adults, for example, there is little reason to develop theoretical models to account for this distinction.

Conclusion

It is becoming clear that the variation underlying measures of both infant (Fraley & Spieker, 2003a) and romantic (Fraley & Waller, 1998) attachment security is distributed continuously and not categorically as was once widely assumed. The current taxometric analysis adds to this growing literature, demonstrating that secure versus dismissing discourse in the AAI reflects a dimension of variability. In addition, this work suggests that caution should be applied when identifying earned- and continuous-secures on the basis of their retrospectively reported life experiences given that such a qualitative distinction is not reflected in the data. Although the value of attachment theory does not hinge on the categorical or taxonic status of measures of security (Fraley & Spieker, 2003b; Waters & Beauchaine, 2003), we believe that wider adoption of coding procedures that map onto the natural variability reflected in such measures can only serve to strengthen the literature on attachment by addressing the fundamental questions of Bowlby's (1969/1982) theory with the greatest measurement precision possible.

[5] Sroufe (2003) also noted that, "What is clear is the criterion for evaluating the merit of a dimensional approach; namely, does it substantially increase prediction compared to the existing system?" (p. 416). Although we acknowledge that this an important point and deserves attention in future research with the AAI, it should also be emphasized that it is difficult to ascertain how many studies of infant and adult attachment using categorical systems were simply not published due to attenuated power to detect significant differences.

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