

UC Davis

UC Davis Previously Published Works

Title

Development and validation of an observational measure of symptoms of Reactive Attachment Disorder

Permalink

<https://escholarship.org/uc/item/0wt6z14q>

Journal

Attachment & Human Development, 21(2)

ISSN

1461-6734

Authors

Corval, Raquel
Belsky, Jay
Baptista, Joana
et al.

Publication Date

2019-03-04

DOI

10.1080/14616734.2018.1499209

Peer reviewed

ORIGINAL ARTICLE

The Brief Attachment Scale (BAS-16): A short measure of infant attachment

Tim Cadman¹  | Jay Belsky²  | Richard M. Pasco Fearon¹ 

¹Department of Clinical, Educational and Health Psychology, University College London, London, UK

²Department of Human Ecology, University of California, Davis, California

Correspondence

Pasco Fearon, Department of Clinical, Educational and Health Psychology, University College London, WC1E 7HB WC1E 6BT, UK.
Email: p.fearon@ucl.ac.uk

Abstract

Background: Insecure attachment in infancy is associated with a range of later socioemotional problems; therefore, it is important to identify at-risk children so that support can be provided. However, there are currently no well-validated brief measures of infant attachment. The aim of this study is to create a brief version of the Attachment Q-Sort (AQS), one of the gold-standard measures of attachment.

Method: Data was used from the National Institute of Child Health and Development Study of Child Care and Youth Development ($N = 1,364$). The factor structure of the AQS was explored, and Item Response Theory was used to select a reduced number of items. Convergent validity of the shortened measure was assessed through associations with the Strange Situation Procedure. Correlations with sensitivity, externalising, and social competence were also examined.

Results: The Brief Attachment Scale (BAS-16) was created consisting of two scales of eight items, relating to (a) harmonious interaction with the caregiver and (b) proximity-seeking behaviours. The BAS-16 showed comparable convergent, discriminant, and concurrent validity to the full AQS.

Conclusion: This brief version of the AQS shows potential as a screening measure for insecure attachment in infancy. Further development and validation is required in separate samples.

KEYWORDS

AQS, attachment, Attachment Q-Set, Attachment Q-Sort, Brief Attachment Scale, Strange Situation Procedure; SSP; TAS-45

1 | INTRODUCTION

A growing body of research chronicles the negative long-term socioemotional correlates of insecure and disorganised attachment in childhood (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010; Groh et al., 2014; Groh, Roisman, van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012). Furthermore, there is an evidence that interventions to improve parental sensitivity are effective at fostering security, especially in high-risk populations (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2005). Accordingly, it is important to identify infants at risk of insecure attachment at an early age so that interventions can be offered (Allen, 2011).

At present, there are two “gold-standard” measures of attachment for infants—the Strange Situation Procedure (SSP; Ainsworth, Blehar, & Waters, 1978; Main & Solomon, 1990) and the Attachment Q-Sort (AQS; Waters & Deane, 1985). The SSP is a laboratory procedure involving two brief periods of separations and reunion between the infant and their attachment figure. On the basis of time-consuming and video coding of their behaviour in these periods, the infant is classified as either Secure, Avoidant, Resistant, or Disorganised.

By contrast, the AQS is based on naturalistic observation of the interaction between the child and the primary caregiver in a routine situation, normally in the home. Following observation, raters sort cards describing child behaviour into nine piles ranging from “most

descriptive of this child" to "least descriptive of this child." A security score is calculated by correlating the individual sort with a criterion sort created from an expert consensus on the behaviours of the prototypically securely attached child. Support for the validity of the observer, AQS has been provided by two meta-analyses (Cadman, Diamond, & Fearon, 2017; Van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Marianne Riksen-Walraven, 2004).

Despite the strengths of the SSP and AQS, in their current form, these measures are arguable not suitable for use in routine clinical settings, as both require considerable time and resources to administer. The SSP requires a laboratory setting, video recording, and well-trained coders, whereas in its present form, the AQS requires a long observation period followed by a lengthy period of sorting items.

A shorter measure, the Toddler Attachment Sort-45 (TAS-45), was developed to address this issue (Andreassen, 2007; Kirkland, Bimler, Drawneek, McKim, & Schölmerich, 2004). Eight clusters of items were derived from the original AQS along with six new items to assess disorganised attachment. Two studies provide initial support for the validity of the measure (Roisman & Fraley, 2008; Spieker, Nelson, & Condon, 2011).

Although the TAS-45 shows promise, it has potential limitations. First, it is unknown whether it shows convergent validity with the SSP. Second, there are limitations with the methodology used to develop the measure. The eight clusters were identified on the basis of the *perceived* semantic similarity between items; however, empirical approaches to examine the factor structure of the AQS have reported between three and five dimensions (Bailey, Moran, Pederson, & Bento, 2007; Bailey, Waters, Pederson, & Moran, 1999; Howes & Smith, 1995; Pederson & Moran, 1995; Posado, Waters, Crowell, & Lay, 1995). The TAS-45 therefore may contain redundant dimensions, making the instrument longer and of less clinical utility than it could be.

A promising alternative analytic approach is to use Q-factor analysis to explore the latent structure of the AQS (Bailey et al., 1999; Bailey et al., 2007). Because the Q-sort procedure requires cards to be sorted in a forced normal distribution, conventional principal component analysis (PCA) cannot be used because of violations of the assumption of independence of measurement. Q-factor analysis identifies clusters of subjects with similar response patterns and can be conceptualised as "inverted" factor analysis (with variables entered as subjects and subjects as variables) (Brown, 1980; Kline, 2014). Using this approach, Bailey and colleagues identified three clusters in the AQS: (a) "Interacts Harmoniously with Mother," (b) "Prefers Visitors," and (c) "Socially Withdrawn" (Bailey et al., 1999; Bailey et al., 2007).

The research presented herein builds on the work of Bailey and colleagues to develop a shortened version of the AQS with robust psychometric properties. The first task is to replicate previous psychometric work with the AQS to reliably identify its latent structure. The second task concerns how to move from this identified structure to create a shortened measure.

Increasingly, Item Response Theory (IRT) is being used in the behavioural sciences to develop new assessment tools (For an accessible explanation of IRT, see Fraley, Waller, & Brennan, 2000). IRT is a statistical approach for modelling the relationship between a latent trait (θ) and responses on test items (Reise & Waller, 2009). The two-parameter model expresses the probability of an individual

Key messages

- We have developed a brief screening measure of attachment—the BAS-16—which in this sample comparable validity to the full AQS. This has the potential to be a useful screening measure for insecure attachment in clinical settings.
- Further research is needed to test this measure in clinical samples and to develop items to measure disorganised attachment.

endorsing a particular response on a survey item as a function of the individual's level of the underlying trait (e.g., attachment security), the difficulty of the item (β), and item's discrimination properties (α). The key advantage of IRT over classical test theory is that it allows one to model, for each individual item, the relationship between these variables. This allows one to select items that discriminate most effectively at the required trait level. For our purposes, IRT offers the potential to construct a measure containing items that are most effective at identifying very insecurely attached infants.

To summarise, although the AQS is a well-validated measure of attachment, it is arguably not suitable for routine clinical use. The current study therefore aimed to use modern psychometric techniques to develop a short-form version of the AQS that could serve such purposes. It had three main aims: first, to use Q-factor analysis to identify the factor structure of the AQS and compare this with previous findings and second, to use IRT to create a shortened version based on the identified factor structure. Finally, to evaluate the validity of this shortened measure by examining correlations with relevant outcomes, including the SSP.

2 | METHOD

2.1 | Sample

Data from the National Institute of Child Health and Development (NICHD) Study of Early Child Care and Youth Development was used (NICHD Early Child Care Research Network, 1997). Analysis was based on the 1,197 participants for whom there was complete AQS data.

2.2 | Measures

2.2.1 | Attachment Q-Set

The AQS was completed by trained raters at 24 months. Raters observed the child interacting with their mother in the home for a period of 2 hr. The 90 statement cards were then sorted using a forced normal distribution into nine piles, ranging from "most describes this child" to "least describes this child." An overall security score, ranging from -1.0 to 1.0 , is calculated by correlating the individual sort with an expert criterion sort (Waters, 1987). Scores for subscales defined in previous studies were calculated by summing the scores for individual items (i.e., the pile number in which the item is

placed), reverse-scoring where necessary (Howes & Smith, 1995; Pederson & Moran, 1995; Posado et al., 1995).

2.2.2 | Strange Situation Procedure

The SSP (Ainsworth et al., 1978) was administered at 15 and 36 months, with a modified procedure used at the later time point (Cassidy et al., 1992). Videotapes of the SSP were coded independently by two trained raters with children classified into one of four categories: *Avoidant (A)*, *Secure (B)*, *Resistant (C)* or *Disorganised (D)*; Ainsworth et al., 1978; Main & Solomon, 1990). The present analysis excluded infants who were unclassifiable (U).

2.2.3 | Maternal sensitivity

Maternal behaviours were assessed at 24 months using videotaped mother-child interactions during the completion of interactive tasks. Behaviour was coded on 4-point Likert scales measuring Supportive Presence, Respect for Autonomy, and Hostility (reverse-scored). A composite maternal sensitivity score was calculated by summing the three scales, with a possible range of 0–12.

2.2.4 | Child externalising behaviour

The externalising subscale of the Child Behaviour Checklist was completed by parents at 24 months (Achenbach, 1991). The subscale contains 50 questions rated on a 3-point Likert scale.

2.2.5 | Social competence

Social competence was rated by teachers at 54 months using the Social Skills Rating System (Gresham & Elliott, 1990). The Social Skills Rating System contains 30 questions rated on a 3-point Likert scale. A standardised score is calculated using included age and gender norms.

2.2.6 | Temperament

The Early Infant Temperament questionnaire was completed by mothers at six months (Medoff-Cooper, Carey, & McDevitt, 1993). The Early Infant Temperament questionnaire contains 76 items measure assessing child behaviour on a 6-point Likert scale.

2.3 | Data analysis

2.3.1 | Q-factor analysis

To identify the latent structure of the AQS, Q-factor analysis was conducted using PCA with varimax rotation. The number of factors was chosen on the basis of scree plot analysis. The conceptual theme for each factor was identified by examining the 10 items most and least descriptive of individuals loading on the factor, identified by their weighted aggregate sort (For further details, see Bailey et al., 1999 and Brown, 1980).

In contrast to traditional ("R") factor analysis, it is not advantageous to use a large number of participants for Q-factor analysis. With R-factor analysis, the standard error of factor loadings decreases in proportion to sample size, meaning that larger samples yield more stable solutions (MacCallum, Widaman, Zhang, & Hong, 1999). However, as Q-factor analysis inverts variables and participants, analysis conducted with a much greater number of subjects than variables would

theoretically yield unstable solutions. To address this issue, Q-factor analysis was therefore performed on a randomly identified subset of 200 participants.

2.3.2 | Reliability of factor structure

The reliability of the identified factor structure was assessed through comparison with previous findings. First, the items most and least descriptive of the identified factors were compared qualitatively with those identified by Bailey and colleagues (Bailey et al., 1999; Bailey et al., 2007). Correlations were also calculated between participants' factor loadings and scores on previously identified AQS subscales.

2.3.3 | Item Response Theory

For the remainder of the analysis, the entire dataset was randomly split in two, with the first half ($N = 598$) used for the IRT analysis and the second half ($N = 599$) used to assess the validity of the new measure.

Initial pools of items for IRT were chosen on the basis of the Q-factor analysis. To maximise reliability, items from subscales identified by other researchers were also included in the relevant pools if they correlated highly with participants' factor scores ($r \geq 0.5$).

Item parameters were estimated using Samejima's Graded Response Model (Samejima, 1969), an extension of the two parameter logistic model (Birnbaum, 1968) to items with more than two response categories. Items for the shortened measure were selected on the basis of their discrimination and difficulty, with preference given to items that discriminate most effectively at the low end of the trait range.

2.3.4 | Validity of shortened measure

The second half of the dataset was used to explore the validity of the shortened scale in comparison with the full AQS. Convergent validity was assessed by exploring the relationship with SSP classification at 15 and 36 months. Concurrent validity was assessed by examining the associations with maternal sensitivity and measures of peer competence and behavioural problems (Belsky & Fearon, 2008; Fearon et al., 2010; Schneider, Atkinson, & Tardif, 2001; Wolff & IJzendoorn, 1997). Discriminant validity was assessed by examining associations with infant temperament, which should only be weakly related to attachment (Groh, Fearon, IJzendoorn, Bakermans-Kranenburg, & Roisman, 2017; Vaughn, Bost, & van IJzendoorn, 2008).

Q-factor analysis was conducted using PQMethod 2.35 (Schmolck, 2014), IRT was conducted using R-Studio 3.03 (R Studio, 2015), and all other analyses were conducted using SPSS version 22 (IBM Corp, 2013). Missing data was handled using pairwise deletion.

3 | RESULTS

3.1 | Latent structure of AQS

Q-Factor analysis revealed four factors, explaining in total 45% of the variance (Appendix A). There was a large correlation between Factors 1 and 3 ($r = 0.66$), a moderate correlation between Factors 1 and 2 ($r = 0.45$), and small correlations between all other factors ($r = 0.22$ – 0.39 ; all p values < 0.001).

Factor 1, labelled "Harmonious Interaction," accounted for 19% of the variance with 95 subjects (48%) loading on this factor, including one who loaded negatively. Items most descriptive of children loading on this factor indicate that the child is generally happy and obedient, whilst items least descriptive of children loading on this factor describe children who are often angry and upset. This factor was similar to the first factor described by Bailey et al. (1999), labelled "interacts harmoniously with mother." Participant loadings on this factor also correlated highly with AQS subscales related to cooperation and difficult interactions (Table 1).

Factor 2, labelled "Proximity-seeking," accounted for 10% of the variance with 42 subjects (21%) loading on this factor, including three who loaded negatively. Items most descriptive of children loading on this factor indicate children who maintain close proximity to their caregivers, enjoy physical contact with them, and prefer them to strangers. Items least descriptive indicate children who are independent, like exploring, but who also can become upset easily. This factor also showed similarity to the second factor reported by Bailey et al. (1999), labelled "prefers visitors." Participant loadings on this factor also correlated highly with AQS subscales describing a preference for proximity to and physical contact with the mother.

Factor 3 accounted for 10% of the variance, with 39 subjects (20%) loading on this factor. Children loading on this factor were characterised as being even-tempered and sociable. This factor

showed considerable similarity to the third factor described by Bailey et al. (1999) labelled "Socially Withdrawn."

Factor 4 accounted for 6% of the variance, with 27 subjects (14%) loading on this factor. However, the items most and least descriptive of children loading on this factor failed to display any particular coherence.

3.2 | Item response analysis

3.2.1 | Item pool

Out of the four identified factors, the first two showed clear conceptual coherence and convergence with previous psychometric work on the AQS. Whilst results also indicated a third factor, this contained significant overlap with the first factor both in terms of the correlation between factor scores and the items most and least descriptive of individuals loading highly on that factor. In order to produce an abbreviated measure with distinct subscales, it was therefore decided to conduct IRT on pools of items relating to the first two factors only.

The first pool consisted of the 10 items most and least descriptive of the Harmonious Interaction factor identified above and in the two studies by Bailey and colleagues (Bailey et al., 1999; Bailey et al., 2007), and the items from the Smooth Interaction, Compliant, and Fussy/difficult (reverse scored) subscales. The second pool consisted of the 10 items most and least descriptive of the proximity-seeking factor identified above and in the Bailey studies and the items from the Enjoys Physical Contact, Proximity to Mother, and Physical Contact with Mother subscales (Pederson & Moran, 1995; Posado et al., 1995). Duplicate items and items with unused response categories ($N = 4$) were removed, leaving pools of 37 and 40 items, respectively.

TABLE 1 Correlations between factor loadings and previously defined subscales ($N = 200$)

Subscale	Harmonious Interaction	Proximity seeking	Sociable	Factor 4
Howes and Smith (1995)				
Secure base	.10	.36**	-.10	-.13
Avoid	.01	-.50**	-.37**	.47**
Seek comfort	-.10	.66**	.24**	-.50**
Positive negotiate	.56**	.24**	-.32**	-.28**
Difficult negotiate	-.71**	-.28**	.30**	.56**
Pederson and Moran (1995)				
Secure base	.41**	.17*	.08	-.25**
Affective sharing	.00	.17*	.03	-.03
Enjoyment of physical contact	-.14	.66**	.27**	-.49**
Compliance	.60**	.28**	-.33**	-.27**
Fussy/difficult	-.84**	-.13	.22**	.51**
Posado et al. (1995)				
Smooth interactions with mother	.82**	.25**	-.32**	-.49**
Proximity to mother	-.15*	.73**	.16*	-.37**
Physical contact with mother	-.05	.64**	.18**	-.47**
Interactions with other adults	.61**	-.56**	.60**	-.57**

Note. Correlations >0.5 marked in bold.

*Significant at $p < 0.05$,

**Significant at $p < 0.01$,

***Significant at $p < 0.001$.

3.2.2 | Model assumptions

PCA and scree-plot analysis were used to assess unidimensionality for both pools of items (Hambleton, 1991). Both pools showed a clear first factor but some evidence of a second factor. Items with loadings >0.4 on the first factor or < 0.1 were therefore removed. This left 29 items in the first pool and 27 in the second. PCA was repeated resulting in clearer unidimensionality in both pools (Figures 1 and 2). Whilst there was still evidence of a small second factor in the second pool, IRT models may be robust to small violations of unidimensionality with sufficient test length and sample size (De Ayala, 2009; Kirisci, Hsu, & Yu, 2001).

3.2.3 | Model fit

Model fit was assessed through examination of item residual plots (DeMars, 2010; Hambleton, 1991; Hambleton & Swaminathan, 1985) and using the $S-X^2$ statistic (Kang & Chen, 2011; Orlando & Thissen, 2000). No items showed signs of significant misfit.

3.2.4 | Construction of the Brief Attachment Scale

Items showed minimal differences in difficulty and were therefore selected to form the shortened measure (named the "Brief Attachment Scale" [BAS-16]) based on discrimination values alone. To determine how many items to include, items were first ranked by their discrimination values and a cumulative total was calculated. This was plotted

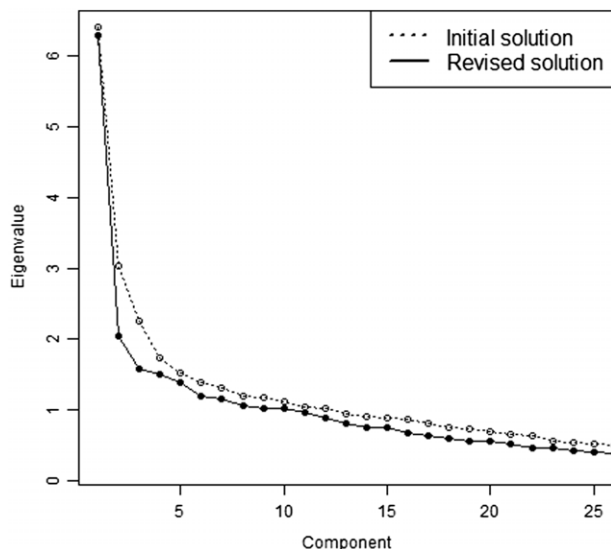


FIGURE 1 Scree plot for first pool of items

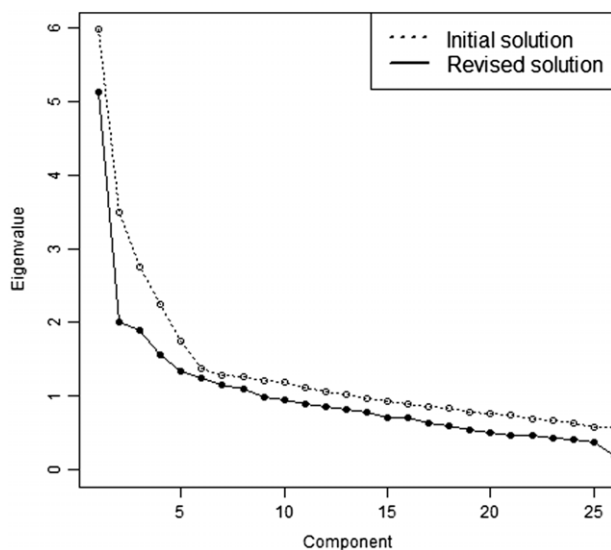


FIGURE 2 Scree plot for second pool of items

to graphically depict the relative increase in information as more items were included (Figure 3). As there were no clear points of inflection, it was decided (albeit arbitrarily) to construct a 16-item measure containing two eight-item scales (BAS-16; Table 2). Test information curves showed that the Harmonious Information scale discriminated effectively over a slightly wider trait range than the Proximity-seeking scale (Figure 4).

3.3 | Validity of the BAS-16

3.3.1 | Correlations with full AQS

The final stage of analysis was to evaluate the validity of the new scales in the second half of the dataset not used for conducting the psychometric analyses just detailed ($N = 599$). Scores for the Harmonious Interaction and Proximity-seeking scales were calculated by summing scores on the individual items, reverse scoring where necessary

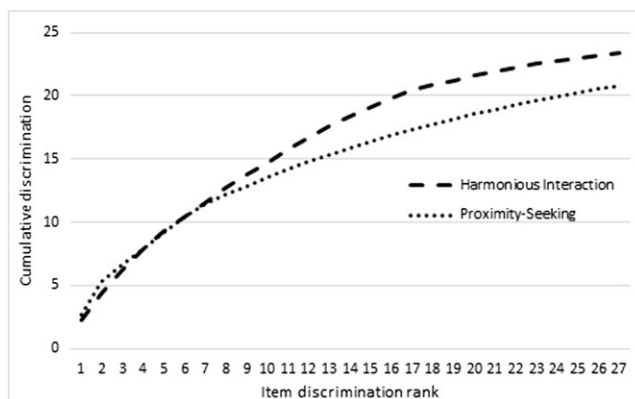


FIGURE 3 Cumulative discrimination values for each factor

TABLE 2 Items comprising the BAS-16

AQS item	α
Harmonious Interaction	
74. <i>When mother does not do what child wants right away, child behaves as if mom were not going to do it at all.</i>	2.26
38. <i>Child is demanding and impatient with mother Fusses and persists unless she does what he wants right away.</i>	2.05
79. <i>Child easily becomes angry at mother.</i>	1.92
81. <i>Child cries as a way of getting mother to do what he wants.</i>	1.64
62. <i>When child is in a happy mood, he is likely to stay that way all day.</i>	1.36
18. <i>Child follows mother's suggestions readily, even when they are clearly suggestions rather than orders.</i>	1.22
32. <i>When mother says "No" or punishes him, child stops misbehaving (at least at that time) and does not have to be told twice.</i>	1.13
19. <i>When mother tells child to bring or give her something, he obeys.</i>	1.11
Proximity seeking	
35. <i>Child is independent with mother, prefers to play on his own, and leaves mother easily when he wants to play.</i>	2.68
43. <i>Child stays closer to mother or returns to her more often than the simple task of keeping track of her requires.</i>	2.64
59. <i>When child finishes with an activity or toy, he generally finds something else to do without returning to mother between activities.</i>	1.33
11. <i>Child often hugs or cuddles against mother, without her asking or inviting him to do so.</i>	1.27
90. <i>If mother moves very far, child follows along and continues his play in the area she has moved to.</i>	1.25
44. <i>Child asks for and enjoys having mother hold, hug, and cuddle him.</i>	1.21
21. <i>Child keeps track of mother's location when he plays around the house.</i>	1.04
57. <i>Child is fearless.</i>	0.74

Note. italicised items are reverse-scored. AQS: Attachment Q-Sort; BAS-16: Brief Attachment Scale.

(i.e., high scores on the scales therefore reflect harmonious interactions and proximity-seeking behaviours). Total scores for the BAS-16 were calculated by summing the two subscale scores.

First, we examined how the new scales related to the full AQS by regressing the 90-item security score on the shortened scales. As expected, the BAS-16 correlated positively and significantly with the overall security score. The two scales of the BAS-16 collectively

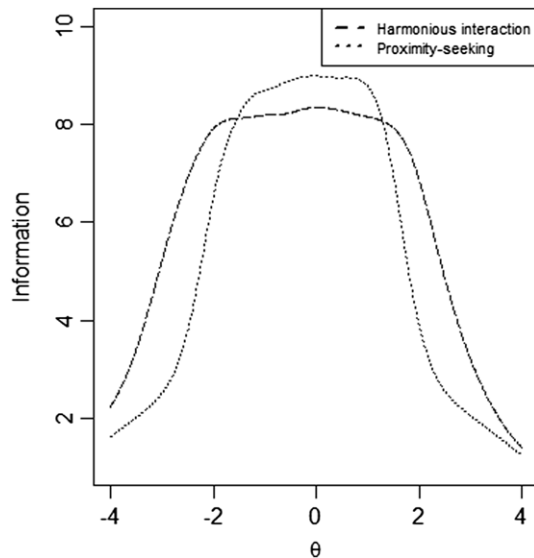


FIGURE 4 Test information function for Brief Attachment Scale

accounted for 67% of the variance in the overall security score (Table 3). Inspection of the criterion sort showed that five of the items from the Harmonious Interaction scale and two from the Proximity-seeking scale were placed in either the top or bottom of two piles.

3.3.2 | Convergent validity

Next, we examined whether the BAS-16 distinguished between secure and insecure SSP classifications (avoidant, resistant, and disorganised) at 15 and 36 months. At 15 months, we found no significant differences in BAS-16 scores or overall security score between secure and insecure infants (Table 4). By contrast, at 36 months, infants classified as insecure on the SSP showed significantly lower scores on the BAS-16 total scale and Harmonious Interaction subscale compared with those classified as secure (Table 5). To further explore

TABLE 3 Relationship between subscales and overall security score

Independent variable	Beta	R ²
BAS-16		
Harmonious interaction	0.72***	0.67
Proximity seeking	0.36***	

Note. BAS-16: Brief Attachment Scale.

***Significant at $p < 0.001$.

TABLE 4 Differences in BAS-16 and security scores between insecure and secure infants at 15 months

	Mean (SD) Secure versus Insecure SS 15 months		T	P
	Secure (N = 340)	Insecure (N = 234)		
Security score	0.30 (0.20)	0.30 (0.19)	0.19	0.85
BAS-16 Total	86.69 (15.30)	86.50 (14.64)	-0.15	0.57
Harmonious interaction	42.66 (10.70)	43.18 (10.48)	0.57	0.42
Proximity seeking	44.03 (10.06)	43.32 (10.50)	-0.81	0.88

Note. BAS-16: Brief Attachment Scale; SD: standard deviation.

TABLE 5 Differences in BAS-16 and security scores between insecure and secure infants at 36 months

	Mean (SD) Secure versus Insecure SS 36 months		T	P
	Secure (n = 342)	Insecure (n = 221)		
Security score	0.31 (0.19)	0.26 (0.20)	-2.91	0.004
BAS-16 Total	87.92 (14.73)	84.40 (15.50)	-2.70	0.007
Harmonious interaction	43.65 (10.45)	41.49 (10.45)	-2.37	0.02
Proximity seeking	44.27 (10.17)	42.92 (10.42)	-1.52	0.13

Note. BAS-16: Brief Attachment Scale.

this latter finding, a series of one-way analysis of variance were conducted to compare BAS-16 scores between the four attachment subgroups from the SSP (Table 6). This showed only that the secure group scored higher than the disorganised group on the Harmonious Interaction subscale.

3.3.3 | Concurrent and discriminant validity

The Harmonious Interaction subscale and the BAS-16 total score were significantly correlated with sensitivity, externalising, and social competence, to a similar magnitude as the full AQS (Table 7). By contrast, the Proximity-seeking scale showed only a weak correlation with externalising. Neither the BAS-16 nor the full AQS were significantly correlated with temperament (r values between -0.07 and 0.06).

4 | DISCUSSION

The aim of this study was to develop a short form of the AQS without sacrificing validity.

Replicating the work of Bailey and colleagues, we identified two factors in the AQS relating to (a) happy and harmonious interactions and (b) proximity and physical-contact seeking behaviours. These factors showed only moderate correlations with each other, suggesting they measure distinct aspects of child behaviour. IRT was then used to create the BAS-16, which showed good information across a wide trait range. Scores from the BAS-16 showed an impressively strong association with the full AQS suggesting that removing a large proportion of the items results in only a small loss of information. However, some proportion of this correlation may be attributable to shared systematic error, as the shortened version was not administered independently from the full version (Peters, Sunderland, Andrews, Rapee, & Mattick, 2012); future work should address this issue.

Promisingly, we also found that the BAS-16 (especially the Harmonious Interaction subscale) showed comparable convergent, concurrent, and discriminant validity to the full AQS. At 36 months, infants categorised as secure or insecure on the SSP showed significant differences in BAS scores, with disorganised infants showing the lowest scores. The BAS-16 was not significantly associated with infant temperament, suggesting that shortening the measure and focusing on these specific domains does not create correlations with temperament that were not there in the original set. However, given the previously reported associations between the AQS and infant temperament (Van IJzendoorn et al., 2004), this finding may reflect

TABLE 6 One-way ANOVAs with strange situation classification at 36 months ($N = 563$)

	Mean (SD) SS (36 months)				F	Effect size (η_p^2)
	A ($N = 29$)	B ($N = 342$)	C ($N = 87$)	D ($N = 105$)		
Security score	0.31 (0.20)	0.31 (0.19) ^a	0.27 (0.22)	0.24 (0.18) ^b	3.82*	0.020
BAS-16 Total	86.83 (15.79)	87.92 (14.73)	85.10 (16.23)	83.16 (14.83)	2.99	0.016
Harmonious interaction	46.10 (11.30)	43.65 (10.45) ^a	41.20 (10.92)	40.45 (10.19) ^b	4.11**	0.022
Proximity seeking	40.72 (9.79)	44.27 (10.17)	43.90 (9.79)	42.70 (11.06)	1.50	0.008

Note. ANOVA: analysis of variance; BAS-16: Brief Attachment Scale; SD: standard deviation. Subscripts a and b represent statistically significant differences between attachment categories at $p < 0.05$.

Significant at * $P < 0.05$, ** $P < 0.01$

TABLE 7 Correlations with sensitivity, externalising, and social competence

	Sensitivity (24 months)	Externalising (24 months)	Externalising (Grade 6)	Social competence (54 months)
Security score	0.23***	-0.25***	-0.08	0.12**
BAS-16 Total	0.15**	-0.23***	-0.12**	0.10*
Harmonious interaction	0.18***	-0.24***	-0.07	0.13**
Proximity seeking	0.05	-0.10*	-0.11*	0.01

Note. BAS-16: Brief Attachment Scale.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

the large interval between measurement rather than the discriminant validity of the AQS.

Contrary to expectations, we failed to find any significant relationships between the Proximity-seeking scale—which describes more prototypical secure base behaviour—and SSP classification at 15 or 36-month olds. This suggests that in the home, secure attachment primarily manifests in harmonious parent-child interaction rather than safety-seeking/exploration behaviour. This fits with previous findings that questions on the AQS related to noncompliance and fussiness were most strongly associated with disorganised attachment at 15 months (Van Bakel & Riksen-Walraven, 2004).

One explanation for this is that typical secure base behaviours are most prominently displayed when the attachment system is activated—in stressful situations (Cassidy & Shaver, 1999). In nonstressful, familiar situations, these behaviours may not be observed, and related AQS items will be placed towards the middle of a sort and will thus fail to differentiate securely and insecurely attached children. Indeed, we found that a number of items describing responses to separation had few to no responses in the highest or lowest piles suggesting the events had not occurred. A promising area of research is to introduce a structured period of separation within the observation to activate the attachment system (e.g., Van Bakel & Riksen-Walraven, 2004); this may enable items related to separation to be more effective in identifying insecurely attached children.

It was also surprising that neither the full AQS nor BAS-16 significantly related to SSP classification of 15-month olds. This is despite the relatively robust associations discerned in meta-analytic reviews (Cadman et al., 2017; Van IJzendoorn et al., 2004). Given that this association was equally weak for the full AQS, it may reflect the particular methodology included in this study (e.g., the 11-month interval of measurement between the AQS and SSP at a time of rapid infant development). Further assessment of the validity of the BAS-16 against infancy SSP classifications is required using different study samples.

Taken together, our findings show that in this sample, the BAS-16 performs comparably to the full AQS. Indeed, our results suggest that a very brief measure comprising the eight-item Harmonious Interaction scale could be as effective as the full AQS at identifying insecure attachment in the home. Whilst this scale does not cover the same range of behaviours as the full measure, it appears to capture the important manifestations of insecure attachment within a nonstressful setting.

This has important clinical implications. Given its brevity, the scale could plausibly be used by healthcare professionals who have routine contact with at-risk families. It could also be used in longitudinal studies where brevity is paramount given the large batteries of measures involved.

This study had a number of strengths. It is the first study to use IRT to reduce the number of items in the AQS based on an empirically determined factor structure and was conducted on a large sample. The main limitation of the study was that despite the forced distribution of the sorting process, it was assumed that AQS items were independent. The justification for treating them as independent is the vast number of possible ordered combinations of AQS items ($90! = 1.49 \text{ E} + 145$). However, it is unknown how similar or different the pattern of responses would have been if rated on independent scales.

Future studies are therefore needed to assess the validity of these new scales when used on their own (i.e., not extracted from the total set of 90 items that was administered), for example, in a Likert-type response format and when they are applied in different populations such as clinical or at-risk groups. It should also be examined how much time (if any) a shortened measure could save, given that a lengthy period of observation may still be necessary to capture the relevant behaviours. Potential drawbacks of using healthcare professionals to assess attachment with a brief measure should also be investigated, for example, reliance on parent report or response bias. Finally, whilst the BAS-16 did successfully distinguish disorganised from secure

infants, the inclusion of specific questions to identify disorganised attachment could further improve the sensitivity of the measure.

In summary, we have developed a shortened measure of attachment based on the AQS—the BAS-16. This new measure shows good psychometric properties and could be a brief yet valid alternative to much longer existing measures of attachment.

ORCID

Tim Cadman  <http://orcid.org/0000-0002-7682-5645>

Jay Belsky  <http://orcid.org/0000-0003-2191-2503>

Richard M. Pasco Fearon  <http://orcid.org/0000-0003-1847-8443>

REFERENCES

- Achenbach, T. M. (1991). *Integrative guide for the 1991 CBCL/4-18, YSR, and TRF profiles*. Department of Psychiatry, University of Vermont Burlington.
- Ainsworth, M., Blehar, M., & Waters, E. (1978). *Patterns of attachment: A psychological study of the strange situation*. Oxford, England: Lawrence Erlbaum.
- Allen, G. (2011). *Early intervention: The next steps, an independent report to her majesty's government by Graham Allen MP*. The Stationery Office.
- Andreassen, A. F. P. (2007). *Early childhood longitudinal study, birth cohort (ECLS-B) psychometric report for the 2-year data collection (NCES 2007-084)*. Washington, D.C.: National center for education statistics, Institute of education sciences, U.S. department of education.
- Bailey, H., Moran, G., Pederson, D. R., & Bento, S. (2007). Understanding the transmission of attachment using variable-and relationship-centered approaches. *Development and Psychopathology*, 19(02), 313–343.
- Bailey, H., Waters, C. A., Pederson, D. R., & Moran, G. (1999). Ainsworth revisited: An empirical analysis of interactive behavior in the home. *Attachment & Human Development*, 1(2), 191–216.
- Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., & Juffer, F. (2005). Disorganized infant attachment and preventive interventions: A review and meta-analysis. *Infant Mental Health Journal*, 26(3), 191–216.
- Belsky, J., & Fearon, R. (2008). Precursors of attachment security. In J. Cassidy, & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 295–316). New York: Guilford Press.
- Birnbaum, A. (1968). Some latent trait models and their use in inferring an examinee's ability. In F. M. Lord, M. R. Novick, & A. Birnbaum (Eds.), *Statistical theories of mental test scores* (pp. 397–479). Reading, Mass: Addison-Wesley.
- Brown, S. R. (1980). *Political subjectivity: Applications of Q methodology in political science*. New Haven, CT: Yale University Press.
- Cadman, T., Diamond, P. R., & Fearon, P. (2017). Reassessing the validity of the attachment Q-sort: An updated meta-analysis. *Infant and Child Development*, 27. <https://doi.org/10.1002/icd.2034>
- Cassidy, J., Marvin, R., & Group, w. t. M. W. (1992). Attachment organization in preschool children: Procedures and coding manual. Unpublished manuscript, University of Virginia, 125–131.
- Cassidy, J., & Shaver, P. R. (1999). *Handbook of attachment: Theory, research, and clinical applications*. New York: Guilford Press.
- De Ayala, R. J. (2009). *Theory and practice of item response theory*. New York: Guilford Press.
- DeMars, C. (2010). *Item response theory*. Oxford: Oxford University Press.
- Fearon, R., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Lapsley, A. M., & Roisman, G. I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: A meta-analytic study. *Child Development*, 81(2), 435–456.
- Fraley, R. C., Waller, N. G., & Brennan, K. A. (2000). An item response theory analysis of self-report measures of adult attachment. *Journal of Personality and Social Psychology*, 78(2), 350–365.
- Gresham, F. M., & Elliott, S. N. (1990). *Social skills rating system (SSRS)*. MN: American Guidance Service.
- Groh, A. M., Fearon, R., IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Roisman, G. I. (2017). Attachment in the early life course: Meta-analytic evidence for its role in socioemotional development. *Child Development Perspectives*, 11(1), 70–76.
- Groh, A. M., Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Steele, R. D., & Roisman, G. I. (2014). The significance of attachment security for children's social competence with peers: A meta-analytic study. *Attachment & Human Development*, 16(2), 103–136.
- Groh, A. M., Roisman, G. I., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development*, 83(2), 591–610.
- Hambleton, R. K. (1991). *Fundamentals of item response theory* (Vol. 2). Newbury Park, CA: Sage publications.
- Hambleton, R. K., & Swaminathan, H. (1985). *Item response theory: Principles and applications*. Boston MA: Kluwer-Nijhoff.
- Howes, C., & Smith, E. W. (1995). Relations among child care quality, teacher behavior, children's play activities, emotional security, and cognitive activity in child care. *Early Childhood Research Quarterly*, 10(4), 381–404. [https://doi.org/10.1016/0885-2006\(95\)90013-6](https://doi.org/10.1016/0885-2006(95)90013-6)
- IBM Corp. (2013). IBM SPSS Statistics for Windows (Version 22.0). Armonk, NY.
- Kang, T., & Chen, T. T. (2011). Performance of the generalized S-X2 item fit index for the graded response model. *Asia Pacific Education Review*, 12(1), 89–96.
- Kirisci, L., Hsu, T.-c., & Yu, L. (2001). Robustness of item parameter estimation programs to assumptions of unidimensionality and normality. *Applied Psychological Measurement*, 25(2), 146–162.
- Kirkland, J., Bimler, D., Drawneek, A., McKim, M., & Schölermerich, A. (2004). An alternative approach for the analyses and interpretation of attachment sort items. *Early Child Development and Care*, 174(7–8), 701–719. <https://doi.org/10.1080/0300443042000187185>
- Kline, P. (2014). *An easy guide to factor analysis*. London: Routledge.
- MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, 4(1), 84–99.
- Main, M., & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *The John D. and Catherine T. MacArthur Foundation series on mental health and development. Attachment in the preschool years: Theory, research, and intervention* (pp. 121–160). Chicago, IL, US: University of Chicago Press.
- Medoff-Cooper, B., Carey, W. B., & McDevitt, S. C. (1993). The Early Infancy Temperament Questionnaire. *Journal of Developmental and Behavioral Pediatrics*, 14(4), 230–235.
- NICHD Early Child Care Research Network (1997). The effects of infant child care on infant-mother attachment security: Results of the NICHD Study of Early Child Care. *Child Development*, 68, 860–879.
- Orlando, M., & Thissen, D. (2000). Likelihood-based item-fit indices for dichotomous item response theory models. *Applied Psychological Measurement*, 24(1), 50–64.
- Pederson, D. R., & Moran, G. (1995). A categorical description of infant-mother relationships in the home and its relation to Q-sort measures of infant-mother interaction. *Monographs of the Society for Research in Child Development*, 60(2–3), 111–132.
- Peters, L., Sunderland, M., Andrews, G., Rapee, R. M., & Mattick, R. P. (2012). Development of a short form Social Interaction Anxiety (SIAS) and Social Phobia Scale (SPS) using nonparametric item response theory: The SIAS-6 and the SPS-6. *Psychological Assessment*, 24(1), 66–76.
- Posado, G., Waters, E., Crowell, J. A., & Lay, K. L. (1995). Is it easier to use a secure mother as a secure base? Attachment Q-sort correlates of the adult attachment interview. *Monographs of the Society for Research in Child Development*, 60(2–3), 133–145.
- R Studio. (2015). R Studio (Version 3.03). Boston, MA. Retrieved from <http://www.rstudio.org/>

- Reise, S. P., & Waller, N. G. (2009). Item response theory and clinical measurement. *Annual Review of Clinical Psychology*, 5, 27–48.
- Roisman, G. I., & Fraley, R. C. (2008). A behavior-genetic study of parenting quality, infant attachment security, and their covariation in a nationally representative sample. *Developmental Psychology*, 44(3), 831–839. <https://doi.org/10.1037/0012-1649.44.3.831>
- Samejima, F. (1969). Estimation of latent ability using a response pattern of graded scores. *Psychometrika Monograph Supplement*, 34(4, Pt. 2), 100.
- Schmolck, P. (2014). PQMethod Version 2.35. from <http://schmolck.userweb.mwn.de/qmethod/>
- Schneider, B. H., Atkinson, L., & Tardif, C. (2001). Child–parent attachment and children's peer relations: A quantitative review. *Developmental Psychology*, 37(1), 86–100.
- Spieker, S., Nelson, E. M., & Condon, M. C. (2011). Validity of the TAS-45 as a measure of toddler-parent attachment: Preliminary evidence from Early Head Start families. *Attachment & Human Development*, 13(1), 69–90. <https://doi.org/10.1080/14616734.2010.488124>
- Van Bakel, H. J., & Riksen-Walraven, J. M. (2004). AQS security scores: What do they represent? A study in construct validation. *Infant Mental Health Journal*, 25(3), 175–193.
- Van IJzendoorn, M. H., Vereijken, C. M., Bakermans-Kranenburg, M. J., & Marianne Riksen-Walraven, J. (2004). Assessing attachment security with the attachment Q sort: Meta-analytic evidence for the validity of the observer AQS. *Child Development*, 75(4), 1188–1213.
- Vaughn, B. E., Bost, K. K., & van IJzendoorn, M. H. (2008). Attachment and temperament: Additive and interactive influences on behavior, affect, and cognition during infancy and childhood.
- Waters, E. (1987). Attachment Behaviour Q-Set (Revision 3.0). Unpublished instrument, State University of New York at Stony Brook, Department of Psychology.
- Waters, E., & Deane, K. E. (1985). Defining and assessing individual differences in attachment relationships: Q-methodology and the organization of behavior in infancy and early childhood. *Monographs of the Society for Research in Child Development*, 50, 41–65.
- Wolff, M. S., & IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development*, 68(4), 571–591.

How to cite this article: Cadman T, Belsky J, Pasco Fearon RM. The Brief Attachment Scale (BAS-16): A short measure of infant attachment. *Child Care Health Dev.* 2018;44:766–775. <https://doi.org/10.1111/cch.12599>

APPENDIX A

ITEMS MOST AND LEAST DESCRIPTIVE OF ATTACHMENT Q-SORT FACTORS

Factor 1 (“Harmonious Interaction”)

Most descriptive

9. Child is light-hearted and playful most of the time.
48. Child readily lets new adults hold or share things he has, if they ask to.
18. Child follows mother's suggestions readily, even when they are clearly suggestions rather than orders.
77. When mother asks child to do something, he readily understands what she wants (may or may not obey).
1. Child readily shares with mother or lets her hold things if she asks to.

(Continued)

15. Child is willing to talk to new people, show them toys, or show them what he can do, if mother asks him to.
89. Child's facial expressions are strong and clear when he is playing with something.
62. When child is in a happy mood, he is likely to stay that way all day.
41. When mother says to follow her, child does so.
5. Child is more interested in people than in things.
- Least descriptive
75. At home, child gets upset or cries when mother walks out of the room (may or may not follow her).
79. Child easily becomes angry at mother.
54. Child acts like he expects mother to interfere with his activities when Mom is simply trying to help him with something.
58. Child largely ignores adults who visit the home and finds his own activities more interesting.
65. Child is easily upset when mother makes him change from one activity to another (even if the new activity is something child often enjoys).
30. Child easily becomes angry with toys.
38. Child is demanding and impatient with mother. Fussing and persists unless Mom does what he wants right away.
63. Even before trying things himself, child tries to get someone to help him.
6. When child is near mother and sees something he wants to play with, he fusses or tries to drag mother over to it
31. Child wants to be the center of mother's attention. If mom is busy or talking to someone, he interrupts.

Factor 2 (“Proximity-seeking”)

Most descriptive

11. Child often hugs or cuddles against mother, without being asked or invited to do so.
44. Child asks for and enjoys having mother hold, hug, and cuddle him.
28. Child enjoys relaxing in mother's lap.
43. Child stays closer to mother or returns to her more often than the simple task of keeping track of her requires.
1. Child readily shares with mother or lets her hold things if she asks to.
18. Child follows mother's suggestions readily, even when they are clearly suggestions rather than orders.
21. Child keeps track of mother's location when he plays around the house.
50. Child's initial reaction when people visit the home is to ignore or avoid them, even if he eventually warms up to them.
64. Child enjoys climbing all over mother when they play.
53. Child puts his arms around mother or puts his hand on her shoulder when she picks him up.

Least descriptive

35. Child is independent with mother, prefers to play on his own, and leaves mother easily when he wants to play.
54. Child acts like he expects mother to interfere with his activities when she is simply trying to help him with something.
67. When the family has visitors, child wants them to pay a lot of attention to him.
30. Child becomes easily angry with toys.
7. Child laughs and smiles easily with a lot of different people.
65. Child is easily upset when mother makes him change from one activity to another.

(Continued)

66. Child easily grows fond of adults who visit his home and are friendly to him.
52. Child has trouble handling small objects or putting small things together.
79. Child easily becomes angry at mother.
12. Child quickly gets used to people or things that initially made him shy or frightened him.

Factor 3 ("Sociable")

Most Descriptive

37. Child is very active, always moving around, and prefers active games to quiet ones.
5. Child is more interested in people than in things.
67. When the family has visitors, child wants them to pay a lot of attention to him.
44. Child asks for and enjoys having mother hold, hug, and cuddle him.
48. Child readily lets new adults hold or share things he has, if they ask to.
11. Child often hugs or cuddles against mother, without her asking or inviting him to do so.
28. Child enjoys relaxing in mother's lap.
77. When mother asks child to do something, he readily understands what she wants (may or may not obey.)
85. Child is strongly attracted to new activities and new toys.
15. Child is willing to talk to new people and show them toys.

Least descriptive

58. Child largely ignores adults who visit the home and finds his own activities more interesting.
50. Child's initial reaction when people visit the home is to ignore or avoid them even if he eventually warms up to them.
76. When given a choice, child would rather play with toys than with adults.
75. At home, child gets upset or cries when mother walks out of the room (may or may not follow her).
63. Even before trying things himself, child tries to get someone to help him.
82. Child spends most of his playtime with just a few favourite toys or activities.
04. Child is careful and gentle with toys and pets.
39. Child is often serious and businesslike when playing away from mother or alone with his toys.
32. When mother says "No" or punishes him, child stops misbehaving (at least at that time) and does not have to be told twice.
65. Child is easily upset when mother makes him change from one activity to another.

Factor 4 (Not named)

Most descriptive

81. Child cries as a way of getting mother to do what he wants.
68. On the average, child is a more active type person than mother.
77. When mother asks child to do something, he readily understands what she wants (May or may not obey)
38. Child is demanding and impatient with mother. Fusses and persists unless Mom does what he wants right away.
74. When mother does not do what child wants right away, child behaves as if Mom were not going to do it at all.
85. Child is strongly attracted to new activities and new toys.
50. Child's initial reaction when people visit the home is to ignore or avoid them, even if he eventually warms up to them.
37. Child is very active, always moving around, and prefers active games to quiet ones.
89. Child's facial expressions are strong and clear when he is playing with something.
27. Child laughs when mother teases him

Least descriptive

75. At home, child gets upset or cries when mother walks out of the room. (May or may not follow her.)
66. Child easily grows fond of adults who visit his home and are friendly to him.
11. Child often hugs or cuddles against mother, without her asking or inviting him to do so.
67. When the family has visitors, child wants them to pay a lot of attention to him.
63. Even before trying things himself, child tries to get someone to help him.
16. Child prefers toys that are modelled after living things (e.g., dolls and stuffed animals).
32. When mother says "No" or punishes him, child stops misbehaving (at least at that time) and does not have to be told twice.
52. Child has trouble handling small objects or putting small things together.
56. Child becomes shy or loses interest when an activity looks like it might be difficult.
24. When mother speaks firmly or raises her voice at him, child becomes upset, sorry, or ashamed about displeasing her.