Re-assessing the validity of the Attachment Q-sort: An updated meta-analysis.

Keywords: Attachment Q-Sort, Attachment Q-Set, AQS, Attachment, Meta-analysis

Abstract

Background: A 2004 meta-analysis reported good validity for the observer Attachment Q-Sort (AQS), but poor validity for the parental self-report version. Despite this the self-report AQS is still widely used, with researchers arguing that providing additional training can improve its validity. The aim of this study was to update the 2004 meta-analysis. Method: 245 studies from 1987 to 2016 were included (n=32,426). Separate meta-analyses were conducted to examine validity and reliability. Results: The observer AQS showed moderate convergent validity with the SSP (r=0.25; r=0.39 for long observation periods) and good predictive validity in terms of associations with sensitivity (r=0.32). It showed a relatively weak association with infant temperament (r=0.21), suggesting some discriminant validity. The self-report version showed comparable convergent validity with SSP (r=0.18); but significantly weaker correlations with sensitivity (r=0.25) and stronger correlations with temperament (r=0.33). There was no evidence that providing additional training improved the validity of the self-report version. Conclusion: This study corroborates the previous finding that the observer AQS is a valid measure of infant attachment, especially after long periods of observation. The self-report version showed significantly weaker discriminant and predictive validity.

Introduction

Since its introduction in 1985, the Attachment Q-Sort (AQS; Waters & Deane, 1985) has become an established measure of infant attachment alongside the Strange Situation Procedure (SSP; Ainsworth et al., 1978). This has been a positive development for a field which for a long period of time relied on only one established measure. The AQS assesses the interaction between the child and the primary caregiver in a routine situation, normally in the home. Whilst the SSP provides information about the infants' expectation of parental availability under attachment-related stress situations, the AQS examines attachment behaviours in safe, low-stress settings (Cassidy & Shaver, 2008). The AQS has several advantages compared to the Strange Situation Procedure. In particular, while the strange situation cannot be repeated within relatively short periods of time (e.g., less than three months), the AQS can be repeated as often as required. It also has the advantage of not involving separation, which may be problematic in some clinical contexts. Furthermore, the AQS can be used consistently over a much wider age range than the Strange Situation Procedure, which allows greater comparability of measurement over time in longitudinal studies or clinical trials.

The AQS is comprised of 90 cards with statements about infant behaviour, which are sorted into nine piles ranging from 'most descriptive of this child' to 'least descriptive of this child'. The AQS includes items not only describing prototypical secure base behaviour (defined as a balance between exploration and proximity-seeking) but also behaviours such as dependency, affectivity, social interaction, object manipulation and social perceptiveness. An overall security score is calculated by correlating the sort for each child with a criterion sort, created from an expert consensus on the ideal or prototypical behaviours of a securely attached child. In the original version the sort was completed by an observer after a period of observation. However, the AQS has been increasingly been used as a self-report measure with the parent reporting on behaviours of their child.

An important earlier meta-analytic study assessed the validity of the AQS (Van IJzendoorn et al., 2004). The authors reported good psychometric properties for the observer version, concluding that "this attachment measure belongs to the small set of gold standards in our field, in the same league with the SSP and the Adult Attachment Interview" (Van IJzendoorn et al., 2004, p. 1204). Based on results from 130 studies, they reported moderate correlations with the SSP and measures of maternal sensitivity and child socioemotional development. These correlations became significantly stronger when the period of observation was greater than three hours. They also reported good discriminant validity indicated by small correlations with child temperament.

By contrast the authors reported the relatively poor performance of the self-report version of the AQS, concluding that "the convergent and discriminant validity of the self-reported AQS does not yet warrant its use as a measure of attachment security." (Van IJzendoorn et al., 2004, p.1206). In comparison to the observer version, the self-report AQS showed significantly weaker correlations with SSP classifications and sensitivity, and significantly higher associations with infant temperament. The authors hypothesised that mothers of insecurely attached children may lack the observational skills necessary to adequately report on their child's behaviours, and may be more defensive about their child's behaviour (Van IJzendoorn et al., 2004).

There is also evidence that the self-report AQS may be particularly biased when other outcome measures are also rated by the parent. Vaughn and colleagues reported that the strongest correlations between the AQS and temperament were in studies where both measures were rated by the same parent (Vaughn et al., 2008b). Similarly, in a recent meta-analysis, the largest correlations between attachment and social competence were in studies where the parent rated both the AQS and their child's social competence (Groh et al., 2014). This led the authors to conclude that "the mother-reported AQS may artificially inflate associations between

attachment and social competence when mothers are also relied upon to report on their child's social competence" (Groh et al., 2014, p.126). In the present study we have therefore included as a moderator whether or not the parent rated both the AQS and the other outcome.

Despite this, the self-report version has continued to be widely used in research studies. This is most likely because it is easier and less costly to use than the observer version, which requires a lengthy period of observation by trained raters. Contrary to the above findings a number of authors have argued that the self-report version *can* be a valid measure if parents are provided with adequate time to familiarise themselves with the items along with sufficient training and supervision (e.g. Waters et al., 2010). A study by Teti & McGourty (1996) is frequently cited in support of this, which reported high inter-rater reliability with observers when such procedures were employed (such as ensuring researchers supervised the sorting process and were available to answer questions). However, to date there have been no experimental studies assessing the effect of providing this extra training. One of the primary aims of the current study is to investigate whether including the studies published since the previous meta-analysis more than a decade ago offers any additional support for the validity of the self-report AQS.

There have also been a number of other developments concerning the AQS since the 2004 meta-analysis. It has continued to be translated into different languages (e.g. De Falco et al., 2014) and used in a wider range of countries (Posada et al., 2013). A number of shortened versions of the AQS have been developed (e.g. De Schipper et al., 2006), most notably the TAS-45 (Kirkland et al., 2004). Shortened versions of the AQS are a promising development which could potentially offer a valid yet resource-efficient alternative to the self-report or full observer versions of the AQS. The previous meta-analysis reported that abbreviated versions of the AQS performed comparably to the full version, though these analyses were based on a

comparatively small number of studies. Another aim of the current study is to update this finding in the light of a number of subsequent studies using short-form versions.

There were also a number of questions that it was not possible to adequately answer in the 2004 study. First, it was not possible to assess the validity of the AQS with fathers or other caregivers as the vast majority of studies were conducted with mothers. This is important to examine as it has been argued that due to different traditional roles for fathers in child-rearing, secure attachment may manifest differently in fathers to mothers and require a different approach to measurement (Grossmann et al., 2008). Second, the 2004 analysis reported a significant moderating effect of country, with studies conducted in North America reporting significantly smaller correlations with sensitivity and SSP classification than studies conducted in other countries. This difference remained significant even after controlling for other potential moderators (Van IJzendoorn et al., 2004). Given that the majority of studies in attachment are conducted within North America it is important to examine whether this effect has persisted and if so to understand why.

The present paper includes all of the studies from the previous meta-analysis, as well as all relevant studies subsequently published. To enable comparison with the previous meta-analysis a broadly similar analytic strategy was used in this study, with certain caveats. Convergent validity was assessed by examining the association between the AQS and the SSP, one of the 'gold-standard' measures of attachment. Predictive validity was primarily assessed by examining correlations between the AQS and parental sensitivity. 'Sensitivity' refers to the ability of the parent to understand their baby's signals and respond appropriately, for example with warmth, comfort and an absence of intrusiveness or hostility (De Wolff & Ijzendoorn, 1997). Studies have shown a minimal genetic effect on attachment and a strong influence of shared environment, with an abundance of correlational and experimental evidence showing

that sensitive parenting is one the key environmental factors in attachment security (Bakermans-Kranenburg et al., 2003; Belsky & Fearon, 2008).

Discriminant validity will be assessed by examining correlations between AQS security and infant temperament. 'Temperament' can be defined as 'affective, motivational and cognitive' traits which are grounded in neurophysiology, and include mood, attention and response to change in environment (Vaughn et al., 2008a). Infant temperament has a strong heritable component and shows only modest associations with attachment (especially when measured with the SSP) and can thus be considered a distinct construct (Belsky & Fearon, 2008; Vaughn et al., 2008a). Previous studies have found that the AQS tends to show higher correlations with temperament than the SSP. This is most likely because the AQS assesses a wider range of infant behaviours, and has questions arguably related to temperament (e.g. "Child is light-hearted and playful most of the time" and "Child is fearless"). Nevertheless, it is notable than when the AQS is sorted against a temperament-related prototypical sort (in order to assess temperament) the dimension that results shows quite distinctive properties relative to the security dimensions – most notably demonstrating substantial heritability, while security shows strong evidence of environmental influence, which suggests discriminant validity of the AQS-derived security scores.

In the 2004 meta-analysis Van IJzendoorn and colleagues also reported on the ability of the AQS to predict 'socioemotional development', understood as a composite of both externalising behaviours and social competence (Van IJzendoorn et al., 2004). Whilst these are separate constructs, treating them as a combined outcome may be justified on both empirical and conceptual grounds. First, there is meta-analytic evidence that both are correlated with attachment security and show a similar strength of association (Fearon et al., 2010; Groh et al., 2014). Second, a plausible mediating pathway between attachment and both of these outcomes is through the development of internal working models (Berlin et al., 2008). This is the

hypothesis that infants form internal representations of early interactions with caregivers and use these as templates to predict and navigate future interpersonal relationships (Bowlby, 1982). Securely attached infants are hypothesised to have a representation of others as safe, supportive and reliable, which manifests in stable interpersonal relationships. By contrast, insecurely attached children may have experienced their caregivers as either unavailable or over-intrusive and developed coping strategies to compensate for this (Cassidy & Berlin, 1994). These expectations and coping strategies are then carried to future relationships and can manifest as externalising behaviours, over-dependence, or distancing behaviours which may be alienating to peers (Berlin et al., 2008).

However, some caution should be applied in using these outcomes as evidence of the validity of the AQS. As discussed above with temperament, the AQS contains questions covering a broad range of infant behaviour, including a number of items referring to externalising (e.g., defiance) and sociable infant and toddler behaviours. It could therefore be argued that associations between the AQS and measures of externalising reflect in part overlap between the items used in the measures rather than a causal relationship between different constructs. This is partly supported by the finding that the association between attachment and externalising is significantly greater for the AQS than the SSP, though this could also be related to the older age at which the AQS is normally measured (Fearon et al., 2010). However, to enable comparison with the 2004 analysis the same strategy was followed with these caveats held in mind. It should also be noted that internalising behaviour could be considered an aspect of socioemotional development. However, to maintain comparison with the previous analysis this was not included in the current study.

Additionally, the agreement between observer and self-report ratings was assessed by a meta-analysis of studies which included correlations between both ratings. Finally, the stability

of the AQS was assessed by examining the correlation between AQS measurement at different time points.

In summary, the broad aim of this study was to update the results of the previous meta-analysis by exploring the convergent, discriminant and predictive validity of the AQS in studies published from 1987 to 2016 along with potential moderating factors. In particular we were interested in the validity of the self-report version compared to the observer version and the comparative validity of modified versions of the AQS, in particular shortened versions and versions translated into different languages. An additional aim was to examine the validity of the AQS conducted with fathers and alternative caregivers. A number of hypotheses were advanced. First, it was hypothesised that the observer AQS would continue to show moderate correlations with SSP classification, sensitivity and socioemotional development, and weak correlations with temperament. Second, it was hypothesised that the self-report AQS would show significantly poorer convergent, predictive and discriminant validity than the observer version. It was predicted that the strongest associations between the self-report AQS and other outcomes would be when both are rated by the parent. However, it was also predicted that the validity of the self-report version will be significantly improved when additional training is provided to raters. Finally, there no specific hypotheses were made in terms of the moderating effect of AQS version, language of AQS or country in which the AQS was conducted.

Method

Literature search

The authors of the previous meta-analysis provided a dataset containing all of the moderators and effect sizes from the 2004 meta-analysis. Studies published subsequent to 2004 were obtained using the same search strategy in the previous meta-analysis. A title and abstract search was conducted for relevant articles published up to April 2016 using the following

electronic databases: MEDLINE, Psychinfo, the Science Citation Index Expanded, Social Sciences Citation Index, and Art & Humanities Citation Index. Dissertations indexed in these databases were also included. The search terms used were "attachment q-set", "attachment q-sort" and "AQS + attachment". We also searched the ISI database of social science citations for articles referencing any of the validation studies for the AQS or the previous AQS meta-analysis (Van IJzendoorn et al., 2004; Vaughn & Waters, 1990; Waters, 1987; Waters & Deane, 1985; Waters et al., 1995).

This initial search yielded three partially overlapping sets of studies which when merged contained 500 unique articles. In the first instance the abstracts of the articles were examined to identify studies which included the AQS as a measure. 266 studies were discarded because they were not in English, they didn't contain the AQS or were non-empirical papers (e.g. review articles). Where it was not possible to access identified articles (e.g. unpublished dissertations) authors were contacted by email to request a copy of the study. However there remained 14 identified studies which it was not possible to access.

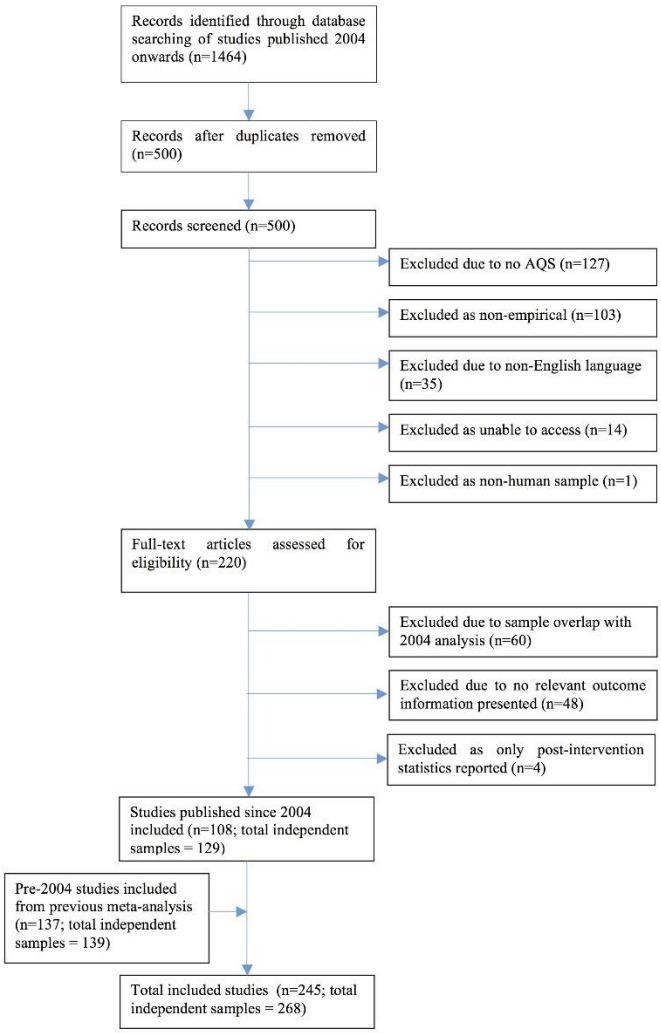
The remaining 220 articles were reviewed individually using the following inclusion criteria. Articles were included if they reported any of the following information: (i) AQS security score, (ii) correlation between AQS security scores at multiple time points, (iii) correlation between observer and self-ratings on the AQS, or (iv) correlations between AQS security score and SSP classification, sensitivity, temperament or socioemotional development (externalising or social competence). Intervention studies were only included if they presented pre-intervention statistics for either control or intervention group.

To ensure that participants were only included once in each meta-analysis, method and results sections of studies were inspected to identify overlapping samples. Where it was still unclear whether samples overlapped, the corresponding authors of the studies were contacted

by email for clarification. When studies contained overlapping samples and reported identical outcomes, the article with the larger sample size was included. Where studies contained overlapping samples and reported on partially overlapping outcomes, each outcome measure was only included once. Studies were excluded if they overlapped with samples included in the 2004 meta-analysis and reported identical outcomes. This included all articles published since 2004 reporting on the NICHD study of Early Child Care and Youth Development. Finally, where studies reported on separate groups within the same paper these were treated as independent samples.

Of the 220 articles reviewed, 60 were excluded because of sample overlap, 48 because they did not include outcome measures relevant to the aims of the study and 4 which were intervention studies and did not present pre-intervention data. This left 108 studies containing a total of 129 independent samples with a sample size of 18,591. The dataset from the 2004 meta-analysis contained 139 samples with a sample size of 13,835. The combined sample used in this paper therefore consisted of 268 independent samples with a combined sample size of 32,426 (Figure 1).

Figure 1: Flow chart of reviewed studies



Coding

To enable comparison, a similar coding system was used to the 2004 meta-analysis. All data for studies conducted post-2004 was extracted from the individual studies. Data for the studies included in the 2004 analysis was taken from the dataset provided by the authors of that study. Additional moderator information for pre-2004 studies not included in the dataset was extracted from the individual studies where possible. Security score means and standard deviations were entered. The association between AQS security and SSP classification (secure vs insecure; disorganised vs other) was recorded either as a *t*-statistic or as mean AQS scores for secure and

insecure SSP classifications. For the remaining outcomes effect sizes were coded in terms of correlation (*r*) or regression coefficients (β).

A wide range of measures were identified assessing parenting behaviour. Outcomes were categorised as 'sensitivity' if they assessed the awareness and appropriateness of the caregiver's response to their child's cues (e.g. sensitive, non-hostile, non-intrusive). Measures of sensitivity included the Maternal behaviour Q-Sort; NICHD 'Three bags' task and Emotional Availability caregiver scales (Biringen et al., 2000; NICHD Early Child Care Research Network, 1997; Pederson & Moran, 1995). Measures relating to broader parental behaviours (e.g. verbal validation, goal setting) were also included and categorised as 'Parenting', e.g. as measured by the Parent/Caregiver Involvement Scale (P/CIS; Farran et al., 1986). Indicators of temperament included traits such as mood and activity, for example as measured by the Infant Characteristics Questionnaire (ICQ; Bates et al., 1979). Outcomes were classified as 'socioemotional development' if they reported on either social competence or externalising behaviours. Social competence was measured by both parent and teacher measures of competence and peer ratings of popularity, whilst externalising behaviours were captured by measures such as the Child Behaviour Checklist (Achenbach & Edelbrock, 1980). Details of the measures included in each study are provided in Table 1. Where studies reported multiple measures of the same construct or reported multiple subscale scores for the same measure an average of these scores was used (Lipsey & Wilson, 2001). Where studies reported on correlations between the AQS and the same outcome at different time-points, the time-point closest to the age at which the AQS was conducted was chosen.

A number of other variables were coded as potential moderators. For studies including the SSP, we recorded whether they used the infant version of the measure, or the modified Cassidy-Marvin version used with older children (Cassidy et al., 1992). We also coded a number of other moderators, including the language of the AQS, whether it was the observer

or self-report version and whether it was one of the full versions of the AQS (75, 90 or 100 item) or an abbreviated version. Where the observer version was used the duration of observation period was coded. Where the self-report method was used it was recorded whether the study described using additional procedures (e.g. as described by Teti & McGourty, 1996) to improve validity. The rater for the outcomes was also coded (e.g. observer, parent). Other background variables included the interval of measurement between AQS and outcome in months, age of the child in months, the caregiver being observed, whether the child or mother were from a clinical population, the country in which the study was conducted and the type of publication (e.g. journal vs. dissertation). Ten percent of the data (27 studies) were separately coded by the second author (P.D.) and compared for inter-rater reliability. Total percentage agreement between coders was 98%.

Meta-analytic strategy

Seven meta-analyses were conducted using Comprehensive Meta Analysis (CMA) to estimate combined effect sizes for: (i) mean security score, (ii) convergent validity (SSP), (iii) predictive validity (sensitivity), (iv) predictive validity (socioemotional competence), (v) discriminant validity (temperament) (vi) agreement between observer and self-report ratings, and (vii) AQS stability. No effect sizes were identified as outliers (>3 standard deviations from the mean). *Q* statistics indicated that there was significant heterogeneity of effect sizes for all outcomes so random effects models were used throughout. Random effect models are more conservative, and assume that differences in effect sizes are due not only to subject-level sampling error but also other random variability between studies (Lipsey & Wilson, 2001). The influence of potential moderators was tested by calculating *Q* statistics and *p* values for differences in combined effect size between subsets of studies. Moderator analyses were only conducted when

there was at least four studies in each group. Effect sizes reported as r were transformed into Fisher's Z statistic for analysis, and transformed back to r for interpretation. This is the recommended procedure for treating the correlation coefficient as it corrects for problems with standard error and the distribution of the statistic at extremes (Lipsey & Wilson, 2001). For ease of comparison to the 2004 meta-analysis the difference in AQS scores between infants classified as secure and insecure on the SSP was also reported as an *r* statistic.

Two studies contained very large sample sizes which were greater than 3 standard deviations from the mean (Howes & Ritchie, 1999; Rispoli et al., 2013). To prevent undue influence on the analysis these were winsorised to the size of next biggest non outlier (NICHD study, *n*=1173). Note that this was a less strict strategy than used in the 2004 analysis, which in part accounts for the increase in sample size in this analysis.

The trim and fill method was used to assess for possible publication bias, i.e. the non-publication of non-significant results (Duval & Tweedie, 2000). Traditionally funnel-plots have been used to examine potential publication bias (Lipsey & Wilson, 2001). Funnel-plots graphically depict the relationship between effect size and sample size for the included studies. They are named 'funnel-plots', because if there is no bias there should be greater variability in effect sizes between small samples compared to large samples, and the scatterplot takes the shape of a funnel. Possible bias is indicated by the absence of studies with small sample sizes (large standard error) to the left of the combined effect size (Lipsey & Wilson, 2001). The trim-and-fill method extends this approach by statistically testing and correcting for asymmetry in funnel-plot. The number of studies in the asymmetric area of the plot are estimated, 'trimmed' (removed) and the remainder are used to calculate an estimate of the true mean. The trimmed studies are then replaced and their 'counterparts' are imputed on the opposite side of the corrected effect size (Duval & Tweedie, 2000). Separate trim-and-fill analyses were conducted for the observer and self-report versions of the AQS.

Table 1: Sample Characteristics of included studies

Study	Group	*N*	Subject	Rater	Outcome	Measure
Aber and Baker (1990)	Non-clinical	24	Caregiver	Observer	SSP	
Altenhofen et al. (2013)	Fostered children	104	Foster carer	Observer	Sensitivity	Emotional Availability Scale
Atkinson and & Tam (1996)	Down syndrome	38	Mother	Observer	Security score	
					SSP	
Badanes et al. (2012)	Non-clinical	110	Mother	Self	Temperament	Teacher-Childrens Behaviour Questionnaire
Bailey et al. (1999)	Non-clinical	83	Mother	Observer	Sensitivity	Maternal Behaviour Q-sort
Bakermans-Kranenburg et al. (2004)	Non-clinical	100	Father	Observer	Security score	
Balentine (2007)	Non-clinical	165	Mother	Self	Externalising	Behaviour Assessment System for Children
					Security score	
					Sensitivity	Bespoke measure
					Social competence	Preschool Play Behaviour Scale
Bauminger-Zvieli and Kugelmass (2013)	ASD	30	Mother	Observer	Security score	
	Non-clinical	30	Mother	Observer	Security score	
Belanger et al. (2015)	Non-clinical	62	Mother	Observer	Security score	
Belsky and Rovine (1990)	Non-clinical	98	Mother	Self	SSP	
					Temperament	Infant Characteristic Questionnaire
Bergin and McCollough (2009)	Non-clinical	41	Mother	Observer	Security score	
	Substance exposed	41	Mother	Observer	Security score	
Blicharsky (1992)	Non-clinical	52	Mother	Self	Sensitivity	ŧ
Boldt et al. (2014)	Non-clinical	100	Father	Self	Externalising	Dominic-R

					Observer-self agreement Security score	
					Social competence	Health Behaviour Questionnaire
	Non-clinical	100	Mother	Self	Externalising	Dominic-R
					Observer-self agreement Security score	
					Social competence	Health Behaviour Questionnaire
Bosso (1996)	Non-clinical	44	Mother	Self	Social competence	†
	Non-clinical	46	Mother	Self	SSP	
Bost et al. (2006)	Non-clinical	90	Mother	Observer	Security score	
Bost et al. (1998)	Non-clinical	69	Mother	Observer	Security score	
					Social competence	Social Support Interview
Bovenschen et al. (2016)	Fostered children	49	Foster carer	Observer	Security score	
					Sensitivity	NICHD sensitivity measure
					Temperament	Children's behaviour questionnaire
Bretherton et al. (1989)	Non-clinical	36	Mother	Self	SSP	
					Stability	
Bretherton et al. (1990)	Non-clinical	29	Mother	Self	Stability	
Busch-Rossnagel et al. (1994)	Non-clinical	15	Mother	Self	SSP	
		43	Mother	Observer	Stability	
Buyse et al. (2011)	Non-clinical	127	Mother	Observer	Externalising	Child Behaviour Scale
					Security score	
Caldera (1990)	14 months	52	Mother	Self	Security score	
					Sensitivity	
	18 months	52	Mother	Self	Security score	
					Stability	
Caldera (1992)	14 months	46	Father	Self	Security score	
					Sensitivity	Videod interaction

	18 months	46	Father	Self	Security score	
					Stability	
Candelaria et al. (2011)	Pre-term birth	124	Mother	Observer	Sensitivity	Maternal Behaviour Q-sort
Cassibba (1994)	Non-clinical	13	Caregiver	Observer	Observer-self agreement	
	Non-clinical	11	Mothers	Observer	Observer-self agreement	
Cassibba et al. (2004)	Bronchitus	30	Mother	Observer	Security score	
	Non-clinical	30	Mother	Observer	Security score	
Cassibba et al. (2000)	Non-clinical	85	Caregiver	Observer	Observer-self agreement	
		50			Security score	
		50			Social competence	
		74	Mother	Observer	Observer-self agreement	
		50			Security score	
		50			Social competence	
Chaimongkol and Flick (2006)	Non-clinical	110	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Q-sort
Chisholm et al. (1995)	Romanian orphans	33	Mother	Self	Social competence	Bespoke measure
Cicchetti et al. (1999)	Non-clinical	36	Mother	Self	Stability	
	Depressed mothers	45	Mother	Self	Stability	
Clark and Symons (2000)	26 months	29	Mother	Observer	Security score	
					Social competence	Pictorial Scale of Perceived Competence
	70 months	29	Mother	Observer	Security score	
					Stability	
Clements and Barnett (2002)	Congenital anomolies	72	Mother	Self	Sensitivity	Ainsworth rating scales
					SSP	
Cohen and Farnia (2011)	Adopted	70	Mother	Self	Externalising	Child Behaviour Check List

					Stability	
	Non-clinical	43	Mother	Self	Externalising	Child Behaviour Check List
					Stability	
Colonnesi et al. (2013)	Adopted	20	Mother	Observer	Security score	
Commodari (2013)	Non-clinical	279	Teacher	Observer	Security score	
Coppola et al. (2014)	Non-clinical	40	Mother	Observer	Security score	
Costantini et al. (2012)	Non-clinical	20	Mother	Observer	Security score	
	Pre-term birth	20	Mother	Observer	Security score	
Coutu et al. (1996)	Non-clinical	44	Mother	Self	Social competence	Altmann observation schedule
Coyl et al. (2010)	Non-clinical	235	Parent	Self	Sensitivity	Bespoke measure
Cutler (1996)	Non-clinical	46	Father	Self	Social competence	†
	Non-clinical	46	Mother	Self	Social competence	†
Daseiden et al. (1995)	Non-clinical	45	Mother	Self	Sensitivity	Clark observation schedule
De Falco et al. (2014)	High risk	40	Mother	Observer	Security score	
		25			Sensitivity	Emotional Availability Scale
DeRoos (1995)	Non-clinical	48	Mother	Self	Sensitivity	†
De Schipper et al. (2006)	Non-clinical	5	Parent	Observer	Security score	
De Schipper et al. (2008)	Non-clinical	48	Caregiver	Observer	Security score	
					Sensitivity	Observational Record of Caregiving Environment
					Temperament	Infant Characteristic Questionnaire
DelCarmen-Wiggins et al. (2000)	Non-clinical	46	Father	Self	Externalising	Child Behaviour Check List
					Security score	
					Temperament	Dimensions of Temperament Survey
		46	Mother	Self	Externalising	Child Behaviour Check List
					Security score	
					Temperament	Dimensions of Temperament Survey
DeMulder et al. (2000)	Non-clinical	54	Caregiver	Observer	Security score	
	Non-clinical	94	Mother	Observer	Security score	

Denham et al. (2001)	Non-clinical	110	Mother	Observer	Social competence	Peer-rating
Denham et al. (2002)	Non-clinical	91	Caregiver	Observer	Social competence	Peer-rating
	Non-clinical	91	Mother	Observer	SSP	
Diener et al. (2003)	Non-clinical	101	Mother	Self	Security score	
					Sensitivity	HOME
					Temperament	Parenting Stress Index
Digiaro (1991)	Non-clinical	138	Mother	Self	Social competence	†
Ding et al. (2014)	Non-clinical	118	Mother	Self	SSP	
Elicker et al. (1999)	Non-clinical	41	Caregiver	Observer	Security score	
					Sensitivity	Howes and Stewart's scale
					Stability	
		41	Mother	Observer	Security score	
			Caregiver	Observer	Security score	
Feldstein et al. (2004)	Post-natal depression	38	Father	Self	Security score	
		59	Mother	Self	Security score	
Forman et al. (2007)	Post-natal depression	41	Mother	Self	Security score	
Frosch et al. (2000)	Non-clinical	53	Father	Self	Sensitivity	Egeland and Sroufe scales
		53	Mother	Self	Sensitivity	Egeland and Sroufe scales
Gabler et al. (2014)	Fostered children	48	Foster carer	Observer	Security score	
					Sensitivity	NICHD sensitivity measure
					Stability	
Gartstein and Iverson (2014)	Non-clinical	47	Mother	Self	Sensitivity	Bespoke measure
					Temperament	Infant Behaviour Questionnaire - R
Goodvin et al. (2008)	Non-clinical	33	Mother	Observer	Security score	
					Stability	
Hadadian and Merbler (1996)	High-risk	33	Mother	Self	Security score	
					Temperament	Parenting Stress Index
Hall et al. (2015)	Pre-term birth	210	Mother	Observer	Sensitivity	NICHD sensitivity measure

	Full-term	75	Mother	Observer	Security score	
	Moderately pre-term	68	Mother	Observer	Security score	
	Very pre-term	67	Mother	Observer	Security score	
Heikamp et al. (2013)	Non-clinical	82	Mother	Self	Security score	
Houlihan (2011)	Adopted children	37	Parent	Observer	Security score	
					Sensitivity	Maternal Behaviour Rating Scale
Howard (2010)	Non-clinical	72	Father	Self	Security score	
Howes et al. (2013)	High risk	118	Teacher	Observer	Security score	
Howes and Guerra (2009)	Non-clinical	22	Caregiver	Observer	Security score	
					Sensitivity	Emotional Availability Scale
	Non-clinical	71	Mother	Observer	Security score	
					Sensitivity	Emotional Availability Scale
Howes and Hamilton (1992a)	Non-clinical	47	Mother	Observer	Stability	
Howes and Hamilton (1992b)	Non-clinical	217	Caregiver	Observer	Security score	
					Sensitivity	Arnett Scale of Teacher Sensitivity
		217	Mother	Observer	Security score	
		23			SSP	
Howes et al. (1994a)	Non-clinical	48	Caregiver	Observer	Security score	
					Social competence	Bespoke measure
					Stability	
Howes et al. (1994b)	Non-clinical	84	Caregiver	Observer	Social competence	Bespoke measure
Howes et al. (1992)	Non-clinical	414	Caregiver	Observer	Social competence	Peer Play Scale
Howes and Ritchie (1998)	Behaviour problems	24	Caregiver	Observer	Security score	
Howes and Ritchie (1999)	High-risk	55	Caregiver	Observer	Externalising	Child Behaviour Check List
	Mixed clinical and non-clinical	3060	Caregiver	Observer	Security score	
	Non-clinical	500	Caregiver	Observer	Externalising	Preschool behaviour questionnaire
Howes and Shivers (2006)	Non-clinical	160	Caregiver	Observer	Security score	
					Externalising	Child Behaviour Check List

					Social competence	Social Skills Rating Scale
Howes and Smith (1995)	Non-clinical daycare	840	Caregiver	Observer	Sensitivity	Adult Involvement Scale
	Non-clinical homecare	357	Caregiver	Observer	Sensitivity	Adult Involvement Scale
Hron-Stewart (1989)	Non-clinical group 1	49	Mother	Observer	Temperament	†
	Non-clinical group 2	40	Mother	Observer	Temperament	†
Ispa et al. (2007)	High risk	173	Mother	Self	Security score	
Jacobson and Frye (1991)	Non-clinical	23	Mother	Observer	Security score	
Jarvis and Creasey (1991)	Non-clinical	32	Father	Self	Security score	
	Non-clinical	32	Mother	Self	Security score	
Kazui et al. (2000)	Non-clinical	50	Mother	Observer	Social competence	†
					Security score	
Keitel-Korndörfer et al. (2015)	Non-clinical	31	Mother	Observer	Security score	
	Obese	31	Mother	Observer	Security score	
Kennedy et al. (2015)	Non-clinical	30	Father	Observer	Security score	
					Sensitivity	Ainsworth rating scale
		30	Mother	Observer	Security score	
					Sensitivity	Ainsworth rating scale
Kerns and Barth (1995)	Non-clinical	34	Father	Self	Social competence	Preschool Behaviour Q-Set
	Non-clinical	34	Mother	Self	Social competence	Preschool Behaviour Q-Set
Kerns (2000)	Non-clinical	50	Mother	Self	Social competence	Dyadic Relationships Q-set
Kerns et al. (1998)	Non-clinical	141	Mother	Self	Security score	
Klein Velderman et al. (2006)	High risk intervention group	81	Mother	Observer	Externalising	Child Behaviour Check List
	High risk control group	26	Mother	Observer	Security score	
Kochanska (1995)	Non-clinical	103	Mother	Self	Security score	
					Sensitivity	Bespoke measure
					Temperament	Bespoke measure

Kondo-Ikemura (1996)	Non-clinical	120	Mother	Self	SSP	
Kremmel (2009)	Non-clinical	91	Parent	Self	Social competence	Bespoke measure
Kreppner et al. (2011)	Adopted children	178	Mother	Self	SSP	
Krupka (1995)	Non-clinical	61	Mother	Observer	Sensitivity	Ainsworth Global Rating Scale & MBQS
					Temperament	Infant Temperament questionnaire
Laible and Thompson (1998)	Non-clinical	40	Mother	Self	Externalising	Bespoke measure
					Security score	
Laible and Thompson (2000)	Non-clinical	44	Mother	Self	Externalising	Compliance with maternal requests task
					Security score	
					Sensitivity	Bespoke measure
Laible (2004)	Non-clinical	51	Mother	Self	Security score	
					Social competence	Child Behaviour Scale
					Temperament	Child Behaviour Questionnaire
Laible (2006)	Non-clinical	51	Mother	Self	Externalising	Child Behaviour Scale
					Security score	
					Social competence	Child Behaviour Scale
Laible et al. (2008)	Non-clinical	64	Mother	Self	Security score	
					Stability	
					Temperament	Todler Behaviour Assessment Questionnaire
Laible (2011)	Non-clinical	50	Mother	Self	Security score	
					Sensitivity	Bespoke measure
LaMont (2011)	Developmental delay	74	Mother	Self	Externalising	Child Behaviour Check List
					Temperament	Dimensions of Temperament Scale - R
Lavigne et al. (2012)	Non-clinical	796	Mother	Observer	Externalising	Child Symptom Inventory
					Sensitivity	Parent Behaviour Inventory
					Temperament	Child Behaviour Questionaire

Lay et al. (1995)	Non-clinical	48	Mother	Observer	Temperament	Bespoke measure
Lehman et al. (1992)	Non-clinical	23	Mother	Self	Security score	
					SSP	
Lieberman et al. (1991)	Non-clinical	52	Mother	Observer	Security score	
					SSP	
Lundy (2002)	Non-clinical	15	Mother	Self	Security score	
					Sensitivity	Bespoke measure
		15	Father	Self	Security score	
					Sensitivity	Bespoke measure
Mangelsdorf et al. (1996)	Low birth-weight	35	Mother	Observer	SSP	
	Non-clinical	40	Mother	Observer	SSP	
Marsh (1994)	Non-clinical	32	Mother	Self	SSP	
McCabe et al. (2006)	Non-clinical	32	Mother	Self	Security score	
McCullough (2000)	Prenatal drug use	70	Mother	Observer	Sensitivity	†
McWey and Mullis (2004)	Fostered children	123	Parent	Observer	Security score	
Miljkovitch et al. (2015)	Non-clinical	53	Mother	Self	Security score	
Monteiro et al. (2008)	Non-clinical	56	Mother	Observer	Externalising	Social Competence and Behavioural Scale
					Security score	
					Social competence	Social Competence and Behavioural Scale
					Temperament	Child Characteristics Questionnaire
	Non-clinical	56	Father	Observer	Externalising	Social Competence and Behavioural Scale
					Security score	
					Social competence	Social Competence and Behavioural Scale
					Temperament	Child Characteristics Questionnaire
Moran et al. (1992)	Developmental delay	19	Mother	Observer	Security score	

					Sensitivity	Maternal Behaviour Q-sort
Moss et al. (2006)	Non-clinical	152	Mother	Self	Externalising	Preschool Socio-affective Profile
					Security score	
					Sensitivity	Bespoke measure
					SSP	
Moss et al. (1997)	Non-clinical	37	Mother	Self	Social competence	Joint problem solving system
Munz (2011)	Non-clinical	50	Parent	Self	Security score	
					Sensitivity	Bespoke measure
Murphy and Laible (2013)	Non-clinical	69	Mother	Self	Security score	
					Stability	
Nakagawa et al. (1992)	Non-clinical	53	Mother	Observer	Security score	
Newcombe and Reese (2004)	Non-clinical	56	Mother	Self	Security score	
Niccols et al. (2015)	Disrupted parental attachment	19	Mother	Observer	Security score	
	Non-clinical	5	Mother	Observer	Security score	
NICHD Early Child Care Research Network (1997)	Non-clinical	1173	Mother	Observer	Externalising	CBCL
		1143			Security score	
		1162			Sensitivity	Bespoke
		1143			SSP	SSP
		1171			Temperament	Early infant temperament questionnaire
Niemann and Weiss (2011)	Adopted children	22	Mother	Observer	Security score	
Nijmegen University Sample						
Smeekens et al. (2009)	Non-clinical	111	Parent	Observer	Externalising	Child Behaviour Check List
					Social competence	Bespoke measure
Van Bakel and Riksen-Walraven (2004)	Non-clinical	127	Mother	Observer	Security score	
					Sensitivity	Bespoke
					SSP	

					Temperament	Toddler Behaviour Assessment Questionnaire
O'Connor et al. (2002)	Prenatal alcohol use	42	Mother	Observer	Security score	
					Sensitivity	Family interaction puzzle task
Ontai and Thompson (2008)	Non-clinical	76	Mother	Self	Security score	
Ontai and Virmani (2010)	Non-clinical	35	Mother	Self	Security score	
Oosterman and Schuengel (2008)	Fostered children	61	Parent	Observer	Externalising	Child Behaviour Check List
					Security score	
					Sensitivity	NICHD sensitivity measure
Oppenheim (1997)	Non-clinical	35	Mother	Self	Security score	
					SSP	
Pallini and Laghi (2012)	Non-clinical	72	Parent	Observer	Security score	
Panfile et al. (2012)	Non-clinical	40	Mother	Self	Security score	
					Temperament	Child Behaviour Questionnaire
Parent (1995)	Non-clinical	36	Mother	Self	Security score	
Park (1992)	Non-clinical	105	Mother	Self	Externalising	†
		105			Security score	
		41			Social competence	†
Park and Waters (1989)	Non-clinical	33	Mother	Self	Security score	
					Social competence	Dyadic Relationships Q-set
Park (2001)	Non-clinical	47	Mother	Self	Security score	
					Sensitivity	Maternal Behaviour Q-sort
					Temperament	Temperament Questionnaire
Pederson et al. (1998)	Non-clinical	60	Mother	Observer	SSP	
Pederson and Moran (1996)	Non-clinical	79	Mother	Self	SSP	
	Non-clinical	79	Mother	Observer	SSP	
				Observer	Security score	
Pederson et al. (1990)	Non-clinical	40	Mother	Observer	Observer-self agreement	
					Security score	

					Sensitivity	Maternal Behaviour Q-sort
					Temperament	Parenting Stress Index
	Non-clinical	40	Mother	Self	Sensitivity	Maternal Behaviour Q-sort
Pederson (1992)	Non-clinical	23	Mother	Observer	Security score	
					SSP	
	Pre-term	19	Mother	Observer	Security score	
					SSP	
Peterson et al. (2001)	HIV	25	Mother	Observer	Security score	
	Mixed (HIV and non-clinical)	60	Mother	Observer	Security score	
	Non-clinical	60	Mother	Observer	Security score	
					Sensitivity	Sigman observation schedule
Petrie and Davidson (1995)	Non-clinical	7	Mother	Self	Security score	
Phonyotin (1994)	Non-clinical	44	Mother	Self	SSP	
Pianta et al. (1997)	Non-clinical	55	Caregiver	Self	Social competence	Teacher Child Rating Scale
Pierrehumbert et al. (1995)	Non-clinical	28	Mother	Observer	Externalising	Child Behaviour Check List
					Security score	
					Temperament	Parent and Teacher Questionnaire
Pinto et al. (2015)	Non-clinical	45	Mother	Observer	Security score	
					Social competence	Peer acceptance scale
	Non-clinical	45	Father	Observer	Security score	
					Social competence	Peer acceptance scale
Ponciano (2010)	Fostered children	76	Mother	Observer	Sensitivity	Maternal Behaviour Q-sort
Pool et al. (2000)	Non-clinical	45	Mother	Observer	Security score	
Posada (2006)	Non-clinical	45	Mother	Observer	Security score	
					SSP	
Posada et al. (2004)	Non-clinical	30	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (1995a)	China (Non-clinical)	41	Mother	Self	Security score	

	Germany (Non-clinical)	31	Mother	Self	Security score	
	Israel (Non-clinical)	30	Mother	Self	Security score	
	Japan (Non-clinical)	29	Mother	Self	Security score	
	Norway (Non-clinical)	20	Mother	Self	Security score	
Posada et al. (1999)	Non-clinical	43	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (2002)	Non-clinical	61	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (2007)	Non-clinical group 1	50	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Pre-school Q-sort
	Non-clinical group 2	40	Mother	Observer	Security score	
					Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (2013)	Canada (Non-clinical)	63	Mother	Observer	Security score	
	Columbia (Non-clinical)	83	Mother	Observer	Security score	
	France (High risk)	30	Mother	Observer	Security score	
	Italy (Non-clinical)	39	Mother	Observer	Security score	
	Japan (Non-clinical)	45	Mother	Observer	Security score	
	Peru (Non-clinical)	30	Mother	Observer	Security score	
	Taiwan (Non-clinical)	68	Mother	Observer	Security score	
	USA (Non-clinical)	77	Mother	Observer	Security score	

Posada et al. (2016)	Colombia (Non-clinical)	85	Mother	Observer	Sensitivity	Maternal Behaviour Pre-school Q-sort
	Mexico (Non-clinica)	46	Mother	Observer	Sensitivity	Maternal Behaviour Pre-school Q-sort
	Peru (Non-clinical)	30	Mother	Observer	Sensitivity	Maternal Behaviour Pre-school Q-sort
	USA (Non-clinical)	76	Mother	Observer	Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (2015)	Non-clinical	292	Mother	Self	Sensitivity	Maternal Behaviour Pre-school Q-sort
Posada et al. (1995b)	Non-clinical	49	Mother	Observer	Security score	
Preski (1992)	Non-clinical	148	Mother	Self	Externalising	†
Puentes-Neuman (2000)	Non-clinical	46	Mother	Self	Social competence	†
Raikes and Thompson (2005)	High risk	63	Mother	Observer	Security score	
					Sensitivity	NICHD sensitivity measure
Rea et al. (2016)	Down syndrome	41	Teacher	Observer	Externalising	SEDS Anger subscale
					Security score	
	Non-clinical	51	Teacher	Observer	Externalising	SEDS Anger subscale
					Security score	
Rispoli et al. (2013)	Non-clinical	6850	Parent	Observer	Security score	
					Sensitivity	NICHD sensitivity measure
					Social competence	Bespoke measure
					Temperament	NICHD sensitivity measure
Roggman et al. (2009)	High risk	161	Mother	Self	Security score	
Roggman (1996)	Non-clinical group 1	68	Mother	Self	Temperament	†
	Non-clinical group 2	79	Mother	Self	Temperament	†
Roskam et al. (2011)	Behaviour problems	87	Parent	Self	Externalising	Profil Socio-Affectif
		117			Sensitivity	L'Évaluation des Pratiques Éducatives Parentales

Roskam et al. (2015)	Behaviour problems	83	Mother	Self	Social competence	Social competence scale
Rutgers et al. (2007)	Mixed (Non-clinical and developmental delay)	89	Parent	Observer	Sensitivity	Child Rearing Practice Report
Sagi et al. (1995)	Non-clinical	79	Caregiver	Self	Security score	
					SSP	
Schaaf et al. (2008)	Non-clinical	82	Parent	Self	Externalising	Child Behaviour Check List
Scher and Asher (2004)	Non-clinical	57	Mother	Self	Security score	
Schiller (1995)	Non-clinical	100	Mother	Observer	Sensitivity	†
					Temperament	†
Schmidt (1998)	Non-clinical	91	Mother	Observer	Externalising	†
Schneider Rosen and Burke (1999)	Non-clinical	41	Father	Self	Security score	
					Sensitivity	Parental Acceptance Coding Scheme
		40	Mother	Self	Security score	
					Sensitivity	Parental Acceptance Coding Scheme
Scholmerich and van Aken (1996)	Non-clinical	49	Mother	Self	Security score	
Scholmerich et al. (1995)	Non-clinical	38	Mother	Self	Sensitivity	†
Schofield et al. (2011)	Non-clinical	271	Parent	Self	Security score	
					Sensitivity	Bespoke measure
					Social competence	Bespoke measure
Seifer et al. (2014)	Non-clinical	136	Mother	Observer	Security score	
					Sensitivity	Parent/Caregiver Involvement Scale
					Temperament	Temperament Adjective Triad Assessment
Seifer et al. (1996)	Non-clinical	49	Mother	Observer	Security score	
					SSP	
Silverman (1990)	Non-clinical	37	Mother	Observer	Sensitivity	†
					Social competence	†

Solomon (1987)	Non-clinical	37	Mother	Observer	Security score	
					Sensitivity	†
Spieker et al. (2011)	High risk	55	Mother	Observer	Externalising	Brief Infant Toddler Social Emotional Assessment
					Security score	
					Social competence	Brief Infant Toddler Social Emotional Assessment
		23			Stability	
Spieker et al. (2012)	Fostered children	210	Parent	Observer	Externalising	Brief Infant Toddler Social Emotional Assessment
					Security score	
					Sensitivity	Nursing Child Assessment Teaching Scale
					Social competence	Brief Infant Toddler Social Emotional Assessment
					Temperament	Bayley-III Screening Test
Stevensonhinde and Shouldice (1990)	Non-clinical	78	Mother	Self	Security score	
					SSP	
					Temperament	Bespoke measure
Strayer et al. (1995)	Non-clinical Canada	65	Mother	Observer	Security score	
	Non-clinical USA	67	Mother	Observer	Security score	
Symons et al. (1998)	Non-clinical	46	Mother	Observer	Security score	
					Stability	
Symons (1995)	Non-clinical	51	Mother	Observer	Sensitivity	†
Szewczyk-Sokolowski et al. (2005)	Non-clinical	98	Mother	Observer	Security score	
					Social competence	Peer nomination
					Temperament	Infant Characteristic Questionnaire
Tarabulsy et al. (1997)	Mixed (pre- and -fullterm infants)	79	Mother	Observer	Observer-self agreement	
					Sensitivity	Maternal Behaviour Q-sort

					Temperament	Infant Characteristics Questionnaire
				Self	Sensitivity	Maternal Behaviour Q-sort
					Temperament	Infant Characteristics Questionnaire
Tarabulsy et al. (2005)	Mixed (Non-clinical and high risk)	64	Mother	Observer	Stability	
Tarabulsy et al. (2008)	Mixed (Non-clinical and high risk)	127	Mother	Observer	Observer-self agreement	
					Security score	
					Sensitivity	Maternal Behaviour Q-sort
					Temperament	Infant Characteristic Questionnaire
	Mixed (Non-clinical and high risk)	127	Mother	Self	Security score	
					Sensitivity	Maternal Behaviour Q-sort
					Temperament	Infant Characteristic Questionnaire
Tessier et al. (2002)	Clinical	34	Mother	Observer	Security score	
	Non-clinical	26	Mother	Observer	Security score	
Teti and Ablard (1989)	Non-clinical	53	Mother	Self	Social competence	Bespoke
Teti and Ablard (1989)	Non-clinical	40	Mother	Observer	Observer-self agreement	
					Security score	
Teti et al. (1991)	Non-clinical	45	Mother	Self	Sensitivity	Parent-Child Early Relational Assessment
					Social competence	Bespoke
					Temperament	Parenting Stress Index
Teti et al. (1996)	Non-clinical	184	Mother	Self	Security score	
					Sensitivity	Parent-Child Early Relational Assessment
					Stability	
Texas Tech University Sample						
Caldera and Hart (2004)	Non-clinical	60	Mother	Self	Temperament	Infant Characteristic Questionnaire

Caldera and Lindsey (2006)	Non-clinical	60	Father	Self	Security score	
		60	Mother	Self	Security score	
	Non-clinical				Sensitivity	Bespoke measure
Tornello et al. (2013)	Non-clinical	982	Parent	Self	Externalising	Child Behaviour Check List
Trudel (1988)	Non-clinical	74	Mother	Observer	Temperament	
University of Montreal Sample						
Bernier et al. (2012)	Non-clinical	62	Parent	Observer	Stability	
Bernier et al. (2014)	Non-clinical	130	Mother	Observer	Sensitivity	Maternal Behaviour Q-sort
Bouvette-Turcot et al. (2013)	Non-clinical	60	Mother	Observer	Temperament	Toddler Behaviour Assessment Questionnaire
University of Texas Sample						
Caughy et al. (2004)	Non-clinical control	161	Mother	Self	Security score	
	Non-clinical treatment	217	Mother	Self	Security score	
Caughy et al. (2009)	Non-clinical	318	Mother	Self	Externalising	Child Behaviour Check List
		151			Stability	
Huang et al. (2009)	Non-clinical	179	Mother	Self	Sensitivity	Parent/Caregiver Involvement Scale
		70			Stability	
Van Dam and Van Ijzendoorn (1988)	Non-clinical	39	Mother	Self	Security score	
					Sensitivity	Ainsworth Responsiveness rating scale
					SSP	
					Temperament	Infant Characteristics Questionnaire
Vaughn and Waters (1990)	Non-clinical	58	Mother	Observer	Security score	
					SSP	
					Temperament	†
Vaughn et al. (1991)	Non-clinical Canada	55	Mother	Self	Security score	
	Non-clinical USA	46	Mother	Self	Security score	
Vereijken (2004)	Non-clinical	48	Mother	Self	Observer-self agreement	

					Sensitivity	†
Vereijken (1996)	Non-clinical	70	Mother	Self	Sensitivity	†
		69			SSP	
Vereijken et al. (1997b)	Non-clinical	48	Mother	Self	Sensitivity	Erickson rating scales
					Social competence	Standardized Behavioural Descriptions
Vereijken et al. (1997a)	Non-clinical	45	Mother	Observer	Sensitivity	Ainsworth rating scales
		40			Stability	
Verissimo and Salvaterra (2006)	Adopted children	106	Mother	Observer	Security score	
Verschueren et al. (2012)	Non-clinical	113	Mother	Observer	Social competence	Peer nomination
Vittorini (2002)	Non-clinical	33	Mother	Observer	Security score	
					Social competence	†
					SSP	
Vorria et al. (2006)	Adopted children	61	Parent	Observer	Security score	
					SSP	
	Non-clinical	38	Parent	Observer	Security score	
					SSP	
Wachs and Desai (1993)	Non-clinical	56	Mother	Self	Security score	
					Sensitivity	Purdue Home Stimulation Inventory Section IV
					Temperament	Toddler Temperament Scale
Walker et al. (2014)	Children of wounded veterans	153	Parent	Self	Externalising	Social Competence and Behavioral Evaluation scale
					Sensitivity	Maternal Behaviour Pre-school Q-sort
					Social competence	Social Competence and Behavioral Evaluation scale
Waters et al. (2010)	Non-clinical	73	Mother	Self	Security score	
					Sensitivity	Bespoke measure
Waters in Vaughn et al. (1991)	Non-clinical	179	Mother	Self	Temperament	†

Weiss et al. (2000)	Low birth-weight	131	Mother	Observer	Sensitivity	Nursing child assessment feeding scale
White (1998)	Non-clinical	50	Mother	Observer	Sensitivity	†
					SSP	
				Self	Observer-self agreement	
					Sensitivity	†
					SSP	
Wong et al. (2011)	USA (Non-clinical)	38	Mother	Observer	Security score	
	Portugal (Non-clinical)	31	Mother	Observer	Security score	
	USA (Non-clinical)	52	Mother	Observer	Security score	
Wood et al. (2004)	Non-clinical	37	Mother	Self	Security score	
					Social competence	Child Adaptive Behavior Inventory/Ramsey ratings
Woods et al. (2002)	Early stuttering	8	Mother	Self	Security score	
Wu and Zou (1995)	Non-clinical	78	Mother	Self	Social competence	†
Yang and Lamb (2014)	Non-clinical	67	Mother	Observer	Temperament	Child Behaviour Questionnaire
Youngblade et al. (1993)	Non-clinical	65	Mother	Self	Social competence	†
		90	Mother	Self	SSP	
		72	Mother	Self	Stability	
		63	Father	Self	Social competence	†
		83	Father	Self	SSP	
		62	Father	Self	Stability	

† denotes missing information

Results

The results section proceeds as follows. First, an estimate of the mean security score is calculated. Separate meta-analyses are then presented for estimates of convergent validity (SSP), predictive validity (sensitivity, socio-emotional development), discriminant validity (temperament) and reliability (observer-self agreement; AQS stability over time).

Mean security score

One hundred and eighty six samples were included in this analysis with a combined sample size of 15,675 (Table 2). This represents a 480 per cent increase on the sample size used in the 2004 meta-analysis (*n*=2703). The mean security score was 0.35 (95% C.I. = 0.34-0.37), which is comparable to the mean security score of 0.31 reported in the 2004 analysis. Moderator analysis showed that security scores were significantly higher when using the self-report version compared to the observer version. Scores were also significantly higher in journals compared to other forms of publication, and for non-clinical groups and older children. No studies needed to be trimmed and filled.

Table 2: Mean security scores and moderator analysis

Moderator		*k*	*N*	Security score	Confidence interval 95% Lower	Upper	Homogeneity *Q*	Contrast *Q*	Contrast *P*
Full set		186	15675	0.35***	0.34	0.37	8168.10***		
AQS									
Rater								8.36	<0.001
	Observer	114	10786	0.34***	0.32	0.36	4694.05***		
	Self-report	72	4889	0.38***	0.36	0.41	1629.2***		
Self-report training								0.32	0.57
	Training	40	2687	0.38***	0.34	0.41	1163.74***		
	No training	32	2202	0.39***	0.37	0.42	429.37***		
Length								0.41	0.52
	Full	180	14094	0.36***	0.34	0.37	4654.25***		
	Shortened	6	1581	0.32***	0.19	0.46	1007.52***		
Language								2.36	0.12
	English	141	13170	0.36***	0.34	0.38	4687.25***		
	Other	35	2189	0.33***	0.30	0.36	1998.50***		
Duration (Observer)								1.06	0.3
	0-180	65	7875	0.33***	0.30	0.36	3295.29***		
	>180	37	2084	0.35***	0.32	0.38	464.2***		
Sample									
Subject								1.91	0.17
	Mother	143	10006	0.36***	0.34	0.38	7177.86***		
	Father	16	937	0.36***	0.34	0.39	84.52***		

	Mixed	12	2230	0.37***	0.30	0.45	350.12***		
	Other caregiver	15	2502	0.30***	0.23	0.36	486.89***		
Clinical vs Non-clinical								22.38	<0.001
	Non-clinical	145	12949	0.37***	0.36	0.39	5900.22***		
	Clinical	39	2472	0.28***	0.24	0.32	1162.52***		
	Mixed	2	254	0.27***	0.11	0.43	27.05***		
Country								0.86	0.35
	USA	94	10451	0.36***	0.34	0.38	2790.8***		
	Canada	25	976	0.33***	0.28	0.38	874.99**		
	Europe	44	3118	0.35***	0.32	0.39	783.06**		
	Other	44	1130	0.35***	0.32	0.39	783.06**		
Age								7.29	0.01
	0-30 months	89	8064	0.33***	0.31	0.35	5403.46***		
	>30 months	97	7611	0.37***	0.35	0.40	2276.17***		
Publication Source								4.11	0.04
	Journal	172	13901	0.36***	0.34	0.38	7972.49***		
	Other	14	1774	0.29***	0.23	0.36	139.24***		

Significant at **p<0.001 ***p<0.001

Convergent validity: SSP

Forty-one samples were included in this analysis with a combined sample size of 3652 (Table 3). Nineteen of these used the observer AQS and twenty-two used the self-report version. This represents an 84 per cent increase in sample size from the original meta-analysis (*n*=1,981). The combined effect size of the association with the SSP was *r*=0.20 (95% C.I. =0.12-0.28). This effect was in the expected direction and comparable to that in the previous meta-analysis (*r*=0.23). We also found a significant association between the AQS and the disorganised category compared to the other categories combined (*r*=0.17). In addition, we compared the association with studies using the infant SSP compared to the Cassidy-Marvin version for older children. In this subset of 24 studies, only the association with the infant version of the SSP was significant (*r*=0.23), although there was no significant difference in the contrast between the two versions.

There was a significant moderating effect of country and language, with a significantly greater effect size for studies conducted in Canada compared to USA, and in languages other than English. There was a trend towards a moderating effect of duration, but this fell short of significance (*p*=0.06). There was no significant difference between the observer and self-report AQS. However, there was a significant difference between studies using the observer AQS with a duration >180 mins and those using the self-report AQS (observer duration >180m =0.39 vs self-report=0.17, *q*-contrast=6.27; *p*=0.01). Meta-regression was used to test the effect of publication year on SSP association; however no significant relationship was found (*B*=0.0003, *p*=0.28). This analysis was also conducted separately on the observer and self-report versions, but again no significant effect was found. No studies needed to be trimmed or filled.

Table 3: Correlation between AQS and SSP

Moderator		***k***	***N***	***r***	**Confidence interval 95%** Lower	Upper	**Homogeneity *Q***	**Contrast *Q***	**Contrast *P***
Full set		41	3652	0.21***	0.13	0.28	193.75***		
SSP disorganised		10	1855	0.17*	0.03	0.30	24.42**		
SSP version								1.55	0.21
	Infant	17	1056	0.23***	0.11	0.35	105.57***		
	Cassidy Marvin	7	1062	0.09	-0.10	0.28	8.58		
AQS									
Rater								0.64	0.42
	Observer	19	2028	0.25***	0.12	0.36	77.46		
	Self-report	22	1624	0.18***	0.07	0.29	115.2		
Language								4.32	0.04
	English	33	3023	0.18***	0.10	0.26	113.42		
	Other	4	363	0.41***	0.21	0.58	31.91		
Duration (Observer)								3.58	0.06
	0-180	10	1624	0.16*	0.00	0.31	47.85***		
	>180	7	302	0.39***	0.20	0.55	13.46*		
Interval between measurement								1.75	0.19
	<1 month	25	1632	0.17***	0.06	0.28	68.12		
	1 month +	15	1842	0.29***	0.15	0.42	121.36		
Sample									
Clinical vs Non-clinical								1.76	0.18

	Non-clinical	35	3249	0.23***	0.15	0.31	177.07***		
	Clinical	6	403	0.08	-0.14	0.28	9.77		
Country[§]								11.27	0.01
	USA	21	2172	0.13*	0.02	0.23	37.05*		
	Canada	8	496	0.42***	0.26	0.55	37.38***		
	Europe	8	623	0.13	-0.03	0.29	22.01***		
	Other	4	361	0.33***	0.12	0.51	45.99***		
Age								0.18	0.67
	0-30	25	2616	0.22***	0.12	0.32	83.14***		
	>30	16	1036	0.19*	0.05	0.31	108.97***		
Publication Source								0.23	0.63
	Journal	29	1999	0.20***	0.10	0.29	140.64***		
	Other	12	1653	0.24***	0.08	0.39	45.07***		

Significant at *p<0.05 p**<0.001 ***p<0.001

Note moderator analysis were not conducted for AQS subject, Self-report training vs no training, or full/short AQS due to group insufficient numbers

[§]Post-hoc tests for country showed Canada > USA

Discriminant validity: Temperament

Fifty samples were included which reported on aspects of temperament (*n*=5,886). This represented a 190 per cent increase in the sample included in the 2004 meta-analysis (*n*=2,032). The combined effect size of *r*=0.27 (95% C.I. = 0.22-0.31) was in the expected direction (greater temperamental reactivity associated with lower AQS scores) and was comparable to that reported in the previous analysis (*r*=0.29). The self-report AQS showed a significantly greater association with temperament than the observer version (observer: *r*=0.21 vs self-report: *r*=0.33, *p*<0.01). Moderator analysis showed a significant omnibus effect for country; however differences between levels did not reach significance in post-hoc tests (Table 4). Studies with clinical samples showed a significantly higher association with temperament compared to non-clinical samples; no other moderators were significant. Trim-and-fill analyses suggested the removal of one study for the self-report version, yielding a corrected effect size of *r*=0.28. Trim and fill analysis also suggested the addition of one study for the observer AQS, resulting in a revised effect size of *r*=0.20. Meta-regression was used to test the effect of publication year to temperament; however, no significant relationship was found (*B*=0.002, *p*=0.11).

Table 4: Correlation between AQS and infant temperament

Moderator		***k***	***N***	***r***	**Confidence interval 95%** Lower	Upper	**Homogeneity *Q***	**Contrast *Q***	**Contrast *P***
Full set		50	5886	0.27	0.22	0.31	135.33***		
AQS									
Rater								7.61	<0.01
	Observer	25	3859	0.21	0.15	0.27	55.55**		
	Self-report	25	2036	0.33	0.27	0.38	55.70**		
Self-report training								0.14	0.71
	Yes	9	761	0.32	0.21	0.43	11.80		
	No	12	901	0.30	0.20	0.39	33.42***		
Length								0.46	0.50
	Full	45	4354	0.26	0.21	0.31	106.57***		
	Shortened	5	1532	0.31	0.17	0.44	28.75***		
Language								3.49	0.06
	English	44	5466	0.28	0.23	0.32	114.97***		
	Other	4	245	0.08	-0.09	0.28	12.11**		
Duration (Observer)								2.40	0.12
	0-120	13	2983	0.16	0.10	0.22	19.93		
	>180	5	351	0.26	0.14	0.37	7.07		
Interval between measurement								0.02	0.88
	<1 month	41	3942	0.27	0.21	0.32	111.57***		
	1 month +	9	1944	0.27	0.17	0.37	20.11**		
Sample									
Clinical vs Non-clinical[§]								9.32	<0.01

	Non-clinical	41	4790	0.24	0.19	0.29	87.72***		
	Clinical	4	366	0.46	0.33	0.58	0.98		
	Mixed	5	730	0.31	0.19	0.42	16.84**		
Country[†]								6.35	0.04
	USA	33	4848	0.29	0.23	0.34	86.58***		
	Canada	6	393	0.33	0.20	0.45	10.70		
	Europe	10	598	0.14	0.03	0.25	26.20**		
Age								0.01	0.94
	0-30	29	3756	0.27	0.20	0.32	91.99***		
	>30	21	2130	0.27	0.19	0.35	43.31**		
Publication Source								0.12	0.73
	Journal	39	4996	0.26***	0.21	0.31	117.21***		
	Other	11	890	0.28***	0.18	0.38	18.11*		

Significant at *p<0.05 **p<0.001 ***p<0.001

[†] "Other" category omitted due to insufficient group numbers

Note moderator analysis were not conducted for AQS subject or rater of outcome due to insufficient group numbers

[§]Post hoc tests for clinical showed Clinical > non-clinical

Predictive validity

Sensitivity. Ninety-five samples included measures of sensitivity or parenting with combined sample size of 11,419. This represents a 313 per cent increase on the sample size used in the 2004 meta-analysis (*n*=2,768). Analysis showed that there was no significant difference in the association between the AQS and outcomes classified as 'sensitivity' or 'parenting' (*p*=0.88), therefore the outcomes were combined for the remainder of the analysis. This yielded a combined effect size in the expected direction of *r* = 0.29 (95% C.I. = 0.26-0.33; Table 5). This is very similar to the effect size of *r*= 0.31 reported in the 2004 analysis. The observer version of the AQS showed a significantly greater association with sensitivity than the self-report version (*r*=0.32 vs 0.25). This is a similar finding to the 2004 meta-analysis which reported a significantly greater magnitude of effect for the observer version (0.39) compared to the self-report version (0.23). We also tested whether studies using the self-report AQS which described providing extra training to raters showed a greater effect size than those that did not, however there was no significant difference. We also found a significant moderating effect of duration (longer duration of AQS observation associated with greater effect), age (greater effect for younger children), country (Canada showing greater effect than USA and Europe; 'Other' showing greater effect that USA) and publication source. There was no moderating effect of subject (e.g. mother, father, caregiver) A meta-regression showed no significant relationship between publication year and effect size (*B*=0.002; *p*=0.38). Trim and fill analysis suggested the addition of 8 studies for the observer sample and one for the self-report sample, resulting in revised effects of *r*=0.27 and *r*=0.25 respectively.

Table 5: Correlation between AQS and parental sensitivity

Moderator		***k***	***N***	***r***	**Confidence interval 95%** Lower	Upper	**Homogeneity *Q***	**Contrast *Q***	**Contrast *P***
Full set		95	11419	0.29	0.26	0.33	298.90***		
								0.02	0.88
	Sensitivity	86	10265	0.29***	0.26	0.33	289.99***		
	Parenting	9	1154	0.29***	0.18	0.39	5.57		
Sensitivity + Parenting									
AQS									
Rater								4.15	0.04
	Observer	54	7924	0.32***	0.28	0.37	235.15***		
	Self-report	41	3495	0.25***	0.20	0.30	60.28*		
Self-report training								1.39	0.24
	Training	15	1468	0.24***	0.18	0.30	10.17		
	No training	20	1721	0.29***	0.24	0.35	35.37*		
Length								<0.001	0.97
	Full	85	8938	0.29***	0.26	0.33	255.74***		
	Shortened	10	2481	0.30***	0.20	0.39	42.47***		
Language								1.68	0.19
	English	77	10278	0.29***	0.25	0.33	256.33***		
	Other	12	771	0.36***	0.26	0.45	24.19*		
Duration (Observer)								10.08	<0.001
	0-180	35	6665	0.28***	0.23	0.33	134.02***		
	>180	15	908	0.44***	0.36	0.52	40.91***		
Interval between measurement								2.06	0.15

	0-1 Month	78	8938	0.28***	0.24	0.32	222.85***		
	>1 Month	16	2411	0.35***	0.27	0.43	74.53***		
Sample									
Subject								6.42	0.09
	Mother	71	7126	0.32***	0.28	0.35	189.72***		
	Father	5	171	0.19	0.00	0.38	11.77*		
	Mixed	10	2396	0.25***	0.15	0.34	31.00***		
	Other caregiver	9	1726	0.20***	0.09	0.31	16.25*		
Clinical vs Non-clinical								1.03	0.60
	Non-clinical	68	9099	0.29***	0.25	0.33	224.72***		
	Clinical	20	1549	0.29***	0.21	0.36	36.25*		
	Mixed	7	771	0.35***	0.23	0.46	26.93***		
Country[§]								14.49	<0.001
	USA	56	8909	0.26***	0.22	0.30	154.71***		
	Canada	11	786	0.42***	0.33	0.51	36.52***		
	Europe	14	981	0.26***	0.17	0.35	19.85		
	Other	14	743	0.37***	0.28	0.46	36.70***		
Age								6.24	0.01
	0-30 months	54	6467	0.33***	0.28	0.37	201.16***		
	>30 months	40	4660	0.24***	0.19	0.29	66.86***		
Rater of outcome								0.06	0.81
	Same as AQS	4	684	0.28***	0.11	0.44	6.98		
	Different	50	5967	0.30***	0.25	0.35	184.44***		
Publication Source								5.50	0.02
	Journal	75	9138	0.31***	0.28	0.35	266.12***		
	Other	20	2281	0.21***	0.12	0.29	30.83*		

Significant at *p<0.05 **p<0.001 ***p<0.001

[§]Post-hoc tests for country: Canada > USA, Europe; Other > USA

Socioemotional development. Eighty-nine samples (*n*=11,428) reported correlations between AQS scores and measures of socioemotional development. This represents a 462 per cent increase on the sample size used in the original meta-analysis (*n*=2,035). The combined effect size was *r*=0.24 (95% C.I. =0.21-0.27) in the expected direction, and was comparable with that previously reported (*r*=0.22). There were no significant differences in effect size between the self-report and observer versions of the AQS; however shorter versions showed a significantly greater effect (Table 6). No other moderators were significant. We conducted a meta-regression to explore the moderating impact of year; however, there was no significant relationship (*B*=0.0006; *p*=0.67). Trim and fill analysis suggested the addition of 4 studies to the observer sample and 9 studies to the self-report sample, resulting in revised effect sizes of *r*=0.19 and *r*=0.20 respectively.

We also repeated the above analysis treating social competence and externalising as separate outcomes. Given that the two meta-analyses partially overlapped and thus were not independent it was not possible to directly compare effect sizes. However, non-overlapping 85% confidence intervals can be taken to indicate significantly different effect sizes (Bakermans-Kranenburg et al., 2003). In this instance the confidence intervals between the two outcomes overlapped, indicating that the combined effect sizes were not significantly different (Social competence: *k*=54, *n*=5325, *r*=0.22, 85% CI=0.19-025; Externalising: *k*=35, *n*=6103, *r*=0.26, 85% CI=0.22-0.27).

Table 6: Correlation between AQS and socioemotional development

Moderator		***k***	***N***	***r***	**Confidence interval 95%** Lower	Upper	**Homogeneity *Q***	**Contrast *Q***	**Contrast *P***
Full set		89	11428	0.24***	0.21	0.27	252.56***		
AQS									
Rater								0.05	0.82
	Observer	39	6675	0.24***	0.19**	0.29	172.09***		
	Self-report	50	4753	0.24***	0.20***	0.29	78.25***		
Outcome rater (self-report)								8.04	<0.001
	Parent	16	2107	0.31***	0.26	0.36	21.79		
	Other	22	1698	0.20***	0.15	0.26	22.71		
Self-report training								0.01	0.92
	Training	11	977	0.27***	0.19	0.34	7.46		
	No training	28	2956	0.27***	0.22	0.32	48.35*		
Length								7.18	0.01
	Full	72	7842	0.22***	0.18	0.25	182.29***		
	Shortened	17	3586	0.33***	0.26	0.40	67.38***		
Language								0.68	0.41
	English	75	10498	0.24***	0.21	0.28	240.58***		
	Other	10	725	0.20***	0.09	0.30	8.06		
Duration (Observer)								0.80	0.37
	0-180	25	5392	0.24***	0.17	0.31	154.13***		
	>180	10	722	0.18***	0.05	0.30	9.25		
Interval between measurement								0.55	0.46

	0-1 Month	76	9052	0.25***	0.21	0.28	215.53***		
	>1 Month	13	2376	0.21***	0.13	0.29	19.96		
Sample									
Subject								2.20	0.53
	Mother	56	5665	0.25***	0.21	0.30	89.02***		
	Father	9	519	0.18***	0.06	0.30	12.90		
	Parent	13	3695	0.26***	0.18	0.33	38.06***		
	Other	11	1549	0.20***	0.10	0.29	110.02***		
Clinical vs Non-clinical[†]								2.72	0.09
	Non-clinical	72	9831	0.23***	0.19	0.26	201.76***		
	Clinical	16	1446	0.30***	0.22	0.37	42.36***		
Country[¥]								1.64	0.44
	USA	60	9674	0.26***	0.22	0.30	225.82***		
	Canada	7	368	0.22***	0.07	0.36	5.14		
	Europe	19	1210	0.20***	0.12	0.28	17.69		
Age								0.04	0.85
	0-30 months	27	4912	0.24***	0.19	0.30	69.07***		
	>30 months	62	6516	0.24***	0.20	0.28	179.17***		

Significant at *p<0.05 **p<0.01 ***p<0.001

[†] "Mixed" category removed due to insufficient group numbers

[¥] "Other" category removed due to insufficient group numbers

Reliability

Stability. Twenty-seven samples (*n*= 1526) reported correlations between AQS scores at different time points. This represents an 842 per cent increase on the sample size used in the 2004 analysis (*n*=162). The combined effect size was *r* = 0.50 (95% C.I. = 0.42-0.57) in the expected direction. This appeared notably larger than that reported in the previous meta-analysis (*r*=0.28). The self-report AQS showed significantly greater stability than the observer version (0.57 vs 0.41). No other moderators were significant. A meta-regression showed that longer intervals were associated with a smaller effect (*B*=-0.008, *p*=0.048). An additional meta-regression showed no significant relationship between publication year and stability (*B*=0.004; *p*=0.42). No studies needed to be trimmed or filled.

Table 7: Correlation between AQS at different time points

Moderator		***k***	***N***	***r***	**Confidence interval 95%** Lower	Upper	**Homogeneity *Q***	**Contrast *Q***	**Contrast *P***
Full set		27	1526	0.50***	0.42	0.57	84.41***		
AQS									
Rater								5.40	0.02
	Observer	13	525	0.41**	0.29	0.51	16.88		
	Self-report	14	1001	0.57**	0.48	0.64	48.10***		
Self-report training								0.02	0.89
	No training	5	248	0.58***	0.43	0.70	4.54		
	Training	7	619	0.60***	0.48	0.69	28.09***		
Length								0.59	0.44
	Full	23	1375	0.49***	0.41	0.56	82.74***		
	Short	4	151	0.57***	0.36	0.73	0.70		
Sample									
Clinical vs Non-clinical								0.41	0.52
	Non-clinical	21	1125	0.51***	0.42	0.59	71.32***		
	Clinical	4	186	0.44***	0.20	0.63	8.83*		
Country								0.20	0.65
	USA	21	1232	0.53***	0.45	0.60	52.15***		
	Canada	4	206	0.48***	0.27	0.65	19.57***		
Age								1.39	0.24
	0-30 months	22	1163	0.48***	0.40	0.55	47.85***		

	>30 months	5	363	0.58***	0.43	0.70	22.91***

Significant at *p<0.05 **p<0.01 ***p<0.001

† "Mixed" category dropped due to insufficient group numbers

§ "Europe" and "Other" categories dropped due to insufficient group numbers

Note moderator analysis were not conducted for AQS subject, language, duration or publication source due to insufficient group numbers.

Self-observer Agreement. Twelve samples (*n*=767) reported on the association between observer and self-rated q-sorts. The combined effect size was 0.43 (95% C.I. = 0.37-0.50). There were only sufficient group numbers to test the moderating effect of clinical vs non-clinical sample; however, this was not significant. Similarly, a meta-regression showed no significant effect of publication year on effect size (*B*=0.001, *p*=0.67). No studies needed to be trimmed or filled.

Discussion

In the twelve years since the publication of the first meta-analysis of the AQS by Van IJzendoorn and colleagues over 200 new studies including the AQS have been published. This provides an opportunity to update the previous analysis and address a number of outstanding issues. In particular, we were interested in the validity of the self-report measure, which despite the cautionary findings from the previous meta-analysis has continued to be widely used within attachment research. We also wanted to examine the validity of modified versions of the AQS and address outstanding issues arising from the 2004 analysis.

Our results broadly replicate the previous findings and show that the observer AQS is a valid measure of attachment. In terms of convergent validity, we found a modest association with the SSP (*r*=0.25), somewhat lower though broadly comparable to that of the previous analysis (*r*=0.31). The observer AQS continued to show reasonable discriminant validity in terms of modest correlations with temperament (*r*=0.21; compared to *r*=0.15 in the previous meta-analysis). In terms of predictive validity, we found also moderate correlations with sensitivity (*r*=0.32), which compares well with the estimated association between the SSP and sensitivity (*r*=0.24; De Wolff & Ijzendoorn, 1997).

We also found a significant moderating effect of duration of observation for the association with sensitivity, and a trend towards the same effect with the SSP. When the period

of AQS observation was greater than 180 minutes, the associations with SSP and sensitivity were r=0.39 and r=0.44 respectively. This effect was also found in the previous meta-analysis, and fits with previous research. These findings underscore the important role that measurement unreliability may have in the performance of the AQS – which of course is unlikely to be unique to this measure (Fearon & Belsky, 2016)

We also found moderate correlations between the observer AQS and socioemotional development (r=0.22), although it should be noted that this correlation was comparable to that found with temperament. In line with previous findings, this effect size appears higher than that reported in studies using the SSP (Fearon et al., 2010). Recent meta-analyses have estimated associations between attachment and social competence and externalising of d=0.27 (r=0.13) and d=0.18 (r=0.09) when measured by the SSP (Fearon et al., 2010; Groh et al., 2014). This stronger association may reflect the fact that the sample of behaviour captured by the AQS is greater (i.e., longer) than the SSP, or that the later age of assessment tends to produce stronger predictive associations. However, it was notable that within the albeit smaller age-range included in the AQS studies, age was not a significant moderator of attachment-outcome associations. Another possible explanation is that given the AQS is a continuous measure it has greater power than the SSP.

However, another important explanation for the strength of both this association and the association with temperament is the inclusion of questions describing a broad range of child behaviours, not just secure base behaviour. The AQS includes items describing social behaviours (e.g. “When given a choice, child would rather play with toys than with adults”) externalising behaviours (e.g. “Child easily becomes angry with toys”) and temperament factors (e.g. “Child is light hearted and playful most of the time). This wide range of questions may mean the measure has less specificity that the SSP, which assesses more tightly defined and controlled attachment behaviours.

A promising avenue of research is to employ factor analytic techniques to identify dimensions within the AQS, and use these dimensions as outcomes rather than the overall security score (Bailey et al., 2007; Bailey et al., 1999; Pederson & Moran, 1995). Excluding items which measure other constructs may improve the discriminant validity of the measure and reduce correlations with outcomes such as temperament. However, to date there is sparse information about the validity of these approaches, as different authors have identified different dimensions and published only limited information on validity. This is an important area for the future development of the AQS.

As with the 2004 analysis, we report mixed findings for the self-report version. In terms of strengths, we found comparable convergent validity to the observer version (SSP association r=0.18). This is in contrast with the previous meta-analysis, which found superior convergent validity for the observer form. It is not clear how to account for this difference: we found no significant moderating effect of publication year to suggest that the effect has changed over time. We also found comparable associations to the observer version with socioemotional development (r=0.24), and superior stability over time (self-report r=0.63, observer r=0.44). The self-report AQS also showed modest convergence with observer reports, when these were used concurrently in the same study (r=0.43).

However, we also found important weaknesses for the self-report version. When the observer AQS was conducted over a long period of observation, it showed significantly higher convergent validity than the self-report version (observer >180min: r=0.39 vs self-report: r=0.18). We also found significantly lower correlations with sensitivity (observer: r=0.32 vs self-report: r=0.25) and significantly higher correlations with temperament (observer: r=0.21 vs self-report: r=0.33). These findings are consistent with studies including both self-report and observer AQS within the same design, which have reported significantly higher correlations between the AQS and temperament for the self-report version. (Tarabulsy et al., 1997;

Tarabulsy et al., 2008). We also found that the mean security score for the self-report version was significantly higher than the observer version. This may imply that parents over-rate the security of the attachment, perhaps due to a lack of insight or social desirability (Van IJzendoorn et al., 2004).

We also found no evidence to support the claims of a number of authors that providing extra support and training for the raters improves the validity of the self-report AQS (for example using the measures described in Teti & McGourty, 1996). There were no significant differences in the associations with sensitivity, socio-emotional development or temperament between studies which reported providing extra training to those that did not. A limitation is that these moderator analyses were based only on qualitative descriptions provided in the methods sections of the papers: it is of course possible that some studies supplied extra training to raters but did not state this. To fully determine whether differences in administration improve the self-report version this would need to be tested experimentally.

The most marked weakness of the self-report AQS was its poor discriminant validity. How do we explain this finding? It has previously been suggested that this might be due to defensiveness on the part of the informant (Van IJzendoorn et al., 2004). However, another hypothesis is that it is due in part to reporter bias. There is considerable evidence that when multiple constructs are measured by the same rater this can inflate any shared variance (Podsakoff et al., 2003). Possible explanations for this effect include the desire for consistency on the part of the rater or the common influence of transitory mood states (Podsakoff et al., 2003; Podsakoff & Organ, 1986). It was notable in this analysis that in all but three studies where temperament was measured together with the self-report AQS, the parent also reported on their child's temperament. Whilst we were therefore unable to test the reporter-bias hypothesis with temperament, we did find that the correlation between self-report AQS and socioemotional development was significantly higher when the parent rated both measures

(*r*=0.31) compared to when they only rated their child's attachment (*r*=0.20). This fits with the meta-analytic findings of Groh et al. (2014) who reported that correlations between AQS and social competence was highest when the parent rated both outcomes. Vaughn et al. (2008a) also reported similar findings for the association between self-report AQS and temperament. Reporter bias may also account for the finding that the self-report AQS showed greater stability over time, as it will have been rated by the parent both times, whilst the observer version may have been rated by different raters. Taken together these findings raise concern about the ongoing use of the self-report AQS in conjuncture with self-report measures for other outcomes. This highlights the need for further investigations in which temperament is measured directly using observational methods.

Another aim of the present study was to explore the performance of modified versions of the AQS, e.g. shortened versions or versions translated into different languages. We found that studies using versions of the AQS with fewer than 90 items showed comparable associations with temperament and sensitivity, and a significantly greater association with socioemotional development compared to those including the full version. There are a number of limitations in this analysis however. First, there were insufficient studies to explore the validity of shortened versions of the self-report and observer AQS separately. Second, all studies with less than 75 items (version 1 of the AQS) were grouped together, ranging from ultra-short 5 item measures (e.g. Rutgers et al., 2007) to versions including 62 items (Coyl et al., 2010). Different versions may have differed markedly in the items they included. More development and evaluation of specific shortened measures is required before firm conclusions can be drawn about their validity.

A further avenue for future research could be to use one parent as the rater of the other parent (e.g. Bakermans-Kranenburg et al. 2004). Whilst the convergence between observer and self-report reported in this analysis was relatively modest (*r*=0.43), convergence between other-

parent report and observer may be higher. If the validity of other-parent report was similar to the observer AQS, this could offer a viable alternative to self-report which requires less resources than the traditional observer AQS.

In terms of the performance of translated versions of the AQS, there were no significant differences compared to the English version in terms of temperament, sensitivity or socioemotional development. However, we did find that studies using non-English versions of the AQS showed a significantly higher association with the SSP; but this may have been influenced by one study with a very large effect size (Ding et al., 2004, r=0.72).

We also sought to address some anomalous findings from the previous meta-analysis. Van IJzendoorn and colleagues reported significantly higher associations with SSP and sensitivity when the study was conducted outside of the USA. We also found a similar effect, with Canada showing significantly higher associations than USA for SSP and sensitivity. These effects may represent differences related to research groupings that have developed particular expertise in using the AQS, as well as possible differences in its use in different countries.

We also tested the association between the AQS and specific elements of the SSP, including the disorganised category and different versions of the SSP. We found a significant association between the disorganised category on the SSP and the AQS (r=0.17). This is important as disorganised attachment is associated with some of the poorest outcomes for infants, so it is important for an attachment measure to be sensitive to it (Fearon et al., 2010). We also found that whilst there was a significant association between the AQS and infant SSP, there was no significant association with the Cassidy-Marvin version used for older children. Interpreting this finding is not straightforward because of the confound of age. It may reflect a comparative weakness of the Cassidy-Marvin SSP, but it may also indicate that the convergent validity of the AQS is weaker when used with older children.

It was notable that when the studies examining the validity of the AQS against the standard Strange Situation were separated into those that used the observer AQS and those that used the self/parent report, each set of studies was homogeneous. In other words, the evidence suggested that for these sets of studies there was considerable consistency in the effect size estimates, despite a range of methodological differences, which lends confidence in the robustness of the findings.

Some caution should be applied in generalising from the findings of this meta-analysis. There was significant heterogeneity between studies in all of the meta-analyses, suggesting that methodological differences between studies exert an important influence on the reliability of the measure. For example, in the SSP meta-analysis, effect sizes for the observer version ranged between r= -0.18 (Posado, 2006) and r=0.73 (Pederson et al., 1992), whilst effect sizes for the self-report version ranged between r= -0.29 (Marsh et al., 2004) and r=0.72 (Ding et al., 2014).

In summary, our results provide further evidence for the validity of the observer version of the AQS, especially when the duration of observation is greater than 180 minutes. The measure showed moderate to good convergent validity, good predictive validity (especially in terms of the association with sensitivity), moderate discriminant validity, and improved stability over time compared to the previous analysis. We also found mixed results for the self-report AQS. Whilst the measure showed comparative convergent validity with the observer AQS (when the period of observation for the observer version was less than 180 minutes), and associations with socioemotional development, it showed significantly worse predictive validity (sensitivity) and discriminant validity. We also found no evidence that providing additional training increased the validity of the measure. In the previous meta-analysis Van Izjendoorn and colleagues concluded that because of its relatively poor predictive, convergent and discriminant validity, it was not clear exactly what the self-report AQS measured and thus it was not warranted as a measure of infant attachment (Van IJzendoorn et al., 2004, p.1206).

Our findings of higher convergent validity for the self-report AQS than in the last meta-analysis is reason for some optimism that this measure may prove beneficial. However, we also note that the relatively poor discriminant validity and weaker associations with sensitivity caution against the use of the self-report AQS in attachment research.

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