







Configurations of mother–child and father–child attachment relationships as predictors of child language competence: An individual participant data meta-analysis

Or Dagan¹  | Carlo Schuengel²  | Marije L. Verhage² | Sheri Madigan³  |
 Glenn I. Roisman⁴  | Kristin Bernard⁵ | Robbie Duschinsky⁶  |
 Marian Bakermans-Kranenburg⁷  | Jean-François Bureau⁸ | Abraham Sagi-Schwartz^{9,10} |
 Rina D. Eiden¹¹ | Maria S. Wong¹² | Geoffrey L. Brown¹³ | Isabel Soares¹⁴ |
 Mirjam Oosterman² | R. M. Pasco Fearon⁶ | Howard Steele¹⁵ | Carla Martins¹⁴ |
 Ora Aviezer¹⁰ | The Collaboration on Attachment to Multiple Parents and Outcomes Synthesis

¹Long Island University-Post Campus, New York, Brookville, USA

²Vrije Universiteit Amsterdam, Amsterdam, The Netherlands

³University of Calgary, Alberta, Calgary, Canada

⁴University of Minnesota Twin Cities, Minnesota, Minneapolis, USA

⁵Stony Brook University, Stony Brook, New York, USA

⁶University of Cambridge, Cambridge, UK

⁷ISPA - Institute of Applied Psychology, Lisboa, Portugal

⁸University of Ottawa, Ontario, Ottawa, Canada

⁹University of Haifa, Haifa, Israel

¹⁰Tel Hai College, Qiryat Shemona, Israel

¹¹Pennsylvania State University, Pennsylvania, State College, USA

¹²Endicott College, Massachusetts, Beverly, USA

¹³University of Georgia, Georgia, Athens, USA

¹⁴University of Minho, Braga, Portugal

¹⁵New School for Social Research, New York, New York, USA

Correspondence

Or Dagan, Clinical Psychology Doctoral Program, Long Island University-Post, Brookville, NY 11548, USA.
 Email: or.dagan@liu.edu

Abstract

An individual participant data meta-analysis was conducted to test pre-registered hypotheses about how the configuration of attachment relationships to mothers and fathers predicts children's language competence. Data from seven studies (published between 1985 and 2014) including 719 children (M_{age} : 19.84 months; 51% female; 87% White) were included in the linear mixed effects analyses. Mean language competence scores exceeded the population average across children with different attachment configurations. Children with two secure attachment relationships had higher language competence scores compared to those with one or no secure attachment relationships ($d = .26$). Children with two organized attachment relationships had higher language competence scores compared to those with one organized attachment relationship ($d = .23$), and this difference was observed in older versus younger children in exploratory analyses. Mother–child and father–child attachment quality did not differentially predict language competence, supporting the comparable importance of attachment to both parents in predicting developmental outcomes.

Abbreviations: ABC, Attachment and Biobehavioral Catch-up; AQS, Attachment Q-Sort; CAMPOS, Collaboration on Attachment to Multiple Parents and Outcomes Synthesis; CASCADE, Child Attachment Studies Catalog and Data Exchange; D-D, disorganized with both parents; $D_M\text{-non}D_F$, disorganized with mother, organized with father; I-I, insecure with both parents; $I_M\text{-}S_F$, insecure with mother, secure with father; IPD, individual participant data; $\text{non}D_M\text{-}D_F$, organized with mother, disorganized with father; $\text{non}D\text{-non}D$, Non-Disorganized (i.e., organized) with both parents; PAA, Preschool Assessment of Attachment; PACS, the MacArthur Preschool Attachment Coding System; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analysis; $S_M\text{-}I_F$, secure with mother, insecure with father; S-S, secure with both parents; SSP, Strange Situation Paradigm.

A substantial body of literature indicates that early caregiving qualities—such as parental responsiveness, contingency, and warmth—have far-reaching implications for children's language competence (i.e., receptive and/or expressive language; for reviews, see Brady et al., 2009; Hoff, 2006; Madigan et al., 2019; Rodrigues et al., 2021; Tamis-LeMonda et al., 2014). Given that attachment theory (Bowlby, 1969) largely deals with the quality of early parent–child relationships, it may offer an important framework for understanding the contexts in which variability in children's language competence arises. The current study used an individual participant data (IPD) meta-analysis, which collates raw data from individual studies, to examine how children's attachment relationships with mothers and fathers relate to their receptive and/or expressive language skills, which hereafter we refer to as language competence.

Parent–child attachment and language competence

Attachment theory predicts that consistent experiences of parental availability and responsiveness at times of need lead children to develop secure attachment relationships. A secure relationship with a specific parent is taken to mean that a child expects that their caregiver will be available when they are alarmed (e.g., when emotionally or physically hurt; Ainsworth et al., 1978). In contrast, children who are uncertain about the availability of their caregivers in times of need are likely to form an insecure attachment pattern (i.e., insecure-avoidant or insecure-resistant attachment). Secure, insecure-avoidant, and insecure-resistant classifications are referred to as “organized” attachment since children classified with such attachment relationship qualities are thought to rely on organized behavioral strategies to regulate proximity to their caregivers and hence attenuate their distress (Main & Solomon, 1990). This is in contrast to disorganized attachment which is manifested in children's conflicted, apprehensive, or disoriented behavior toward their caregivers when under presumed distress during the Strange Situation (Main & Solomon, 1986). Disorganized attachment is thought to be associated with experiences of parental frightening, frightened, or disruptive behaviors (Lyons-Ruth et al., 1999; Madigan et al., 2006; Main & Hesse, 1990; Schuengel et al., 1999) that can (but need not be) related to an accumulation of socioeconomic risks (Cyr et al., 2010).

Although most commonly linked to aspects of socioemotional development, security of attachment relationships is also anticipated by some thinkers to facilitate cognitive development, including language competence (De Ruiter & van IJzendoorn, 1993; Meins, 1997). Van IJzendoorn et al. (1995) hypothesized that a child's cognitive skills, including language competence, may develop differently in secure child–parent dyads compared to insecure dyads. Compared to their securely attached

counterparts, children with insecure attachment relationships may experience increased preoccupation with attachment-related concerns or anxieties (e.g., concerns about whether a parent will be available if the newly explored book which otherwise may become a vocabulary expanding experience—becomes scary). As a result, children with insecure attachment relationships may be less prone to exploration of language-promoting stimuli (e.g., a speaker or a book) and thus linguistic competence may be adversely affected.

There are further reasons to suspect early attachment relationships may influence language competence. Securely attached children are more motivated to explore and engage with their learning environments compared to their insecure counterparts (Drake et al., 2014; Moss & St-Laurent, 2001). In addition, the trust children with secure attachment relationships show toward their parents may enable them to better elicit and accept assistance from their parents in the context of cognitive tasks, including language acquisition (e.g., reading a book; Bus & Van IJzendoorn, 1988), relative to their insecure counterparts. Securely attached children may also be more effective than insecurely attached children at involving parents in the exploration of objects in the world by directing parents' attention to their needs (e.g., pointing to an object that the child is interested in, or asking a question regarding a situation the child is curious about) and using their parents as a reference point (Meins, 1997).

Thus far, no theory has been proposed for the potential associations between early disorganized attachment relationships and language competence. However, Moss et al. (2005) integrated multiple findings on parent–child disorganized attachment relationships to propose a post hoc explanation for the observed links between attachment disorganization and low cognitive performance. They suggested that the disrupted communication and coordination occurring between a child and their parent in a disorganized attachment relationship (Moss et al., 1998), as well as difficulties with task orientation and self-regulation in children with disorganized attachment relationships (Schieche & Spangler, 2005), may lead to decreased cognitive performance compared to children who have organized (i.e., secure, insecure-avoidant, or insecure-resistant) attachment relationships with their caregivers.

Taken together, insecure and disorganized attachment relationships may limit the child's attentional resources that would otherwise be oriented to language acquisition. Additionally, secure and organized parent–child dyads may allow for more enriching language-learning experiences compared to insecure or disorganized attachment relationships, respectively. Thus, it is plausible to hypothesize that secure parent–child attachment relationships will predict better language competence compared to insecure attachment relationships, and similarly, organized attachment relationships will predict better language competence compared to disorganized attachment relationships.

Indeed, a meta-analysis on the predictive power of early mother–child attachment relationship on language competence (Van IJzendoorn et al., 1995) reported that children with a secure attachment relationship with their mothers had significantly higher language competence compared to insecurely attached children ($k=7$; $N=303$; $d=.59$). These meta-analytic findings were later replicated in a large birth cohort study ($N=946$), reporting that children who were securely attached to their mothers at age 15 months had greater language comprehension ($d=.28$) and expressive language skills ($d=.20$) at age 3 years compared with insecurely attached children (Belsky & Fearon, 2002). Similar longitudinal results were also reported in a low-income sample (Spieker et al., 2003), with mother–child attachment security at age 19 months predicting language competence at age 3 years. Whereas genetic factors may inflate the association between parent–child attachment relationships and language competence in observational studies, recent randomized clinical trials that examined the efficacy of a brief attachment-based intervention (Attachment and Biobehavioral Catch-up, or ABC; Dozier & Infant Caregiver Project Lab, 2013) offered experimental evidence for environmentally mediated effects. Findings from these studies showed children whose foster parents (mostly mothers) received the ABC intervention later demonstrated more advanced receptive vocabulary skills compared with those whose parents received a control intervention (Bernard et al., 2017; Raby et al., 2019). To date, there is no empirical evidence to support the expected associations between parent–child disorganized attachment relationships and children's language competence. However, longitudinal links between disorganized attachment and lower general cognitive performance at school age, which included language-based tasks, have been demonstrated (Moss & St-Laurent, 2001; Stams et al., 2002; West et al., 2013).

It is noteworthy that the vast majority of the research conducted to date has been on mother–child dyads. However, most children develop in a multiple caregiver environment that includes multiple attachment figures, most often mothers and fathers. It stands to reason that children's developmental trajectories are likely to be influenced by a network of attachment figures (Dagan & Sagi-Schwartz, 2021; Van IJzendoorn & Tavecchio, 1987). Furthermore, recent meta-analyses indicated comparable effect sizes for the associations between maternal and paternal sensitivity and language competence ($d=.56$ for maternal sensitivity, Madigan et al., 2019 and $d=.43$ for paternal sensitivity, Rodrigues et al., 2021). Given the significant increase in paternal child rearing investment in the past half a century (Bakermans-Kranenburg et al., 2019; Craig & Mullan, 2010), and the comparable predictive power for both caregivers with regard to children's language competence and sensitive caregiving, a more ecologically valid approach to assessing the association between attachment and language competence should include both mothers and fathers.

From a single attachment relationship to attachment networks

Three decades ago, Van IJzendoorn et al. (1992) highlighted the “multiple caretaker paradox,” wherein attachment to a single caregiver was thought to be predictive of socioemotional development despite the acknowledgment that children develop simultaneous and independent attachment patterns with multiple caregivers (hereafter referred to as “attachment network”). They proposed the Integration model, which posits that attachment relationships with multiple caregivers *jointly* predict developmental outcomes better than attachment to one caregiver alone. Despite calls for assessment of attachment networks as predictors of socioemotional outcomes, only a few (and underpowered) studies have applied the Integrative model proposed by Van IJzendoorn et al. (1992) to predict developmental outcomes, and none to date have focused explicitly on language competence outcomes. Empirical support for the inclusion of fathers alongside mothers when predicting children's language competence comes from findings that indicate that fathers' sensitive parenting not only directly predicts children's language competence (see Rodrigues et al., 2021), but also uniquely predicts language competence above and beyond maternal sensitivity (Shannon et al., 2002; Teufl et al., 2020).

Recently, Dagan and Sagi-Schwartz (2018, 2020) proposed a research framework to advance the investigation of the influence of attachment networks on children's socioemotional outcomes. Expanding on the Integration model, they identified four mutually exclusive integrative models that are most likely to represent the association between attachment networks and socioemotional outcomes (see Table 1). If we model attachment relationships as either secure/insecure or organized/disorganized, children raised by a mother and a father fall in one of four configurations (insecure with both parents [I-I]; secure with mother, insecure with father [S_M-I_F]; insecure with mother, secure with father [I_M-S_F]; secure with both parents [S-S]), and four configurations of organized/disorganized attachment networks (disorganized with both parents [D-D]; organized with mother, disorganized with father [$nonD_M-D_F$]; disorganized with mother, organized with father [D_M-nonD_F]; organized with both parents [$nonD-nonD$]). Given the need for substantial sample sizes to test for associations with attachment networks that distinguish between organized insecure attachment subtypes (i.e., insecure-avoidant and insecure-resistant) and secondary classifications when the primary classification is disorganized (i.e., whether a disorganized attachment relationship receives a ‘forced’ secure or insecure subclassification), we followed (consistent with our pre-registration) the dichotomous secure/insecure and organized/disorganized attachment classifications, without further secondary and subclassifications.

Each integrative model entails one of two hypotheses regarding the *number* of secure or organized attachments

TABLE 1 Model-based outcome predictions for secure/insecure attachment networks (based on Dagan & Sagi-Schwartz, 2018).

Integrative model	Prediction	Brief description
Additive-hierarchical ^a	$S-S > S_M-I_F > I_M-S_F > I-I$	Secure attachment to mother (but not to father) leads to more adaptive outcomes than insecure attachment to both parents, but less adaptive outcomes than secure attachment to both parents
Additive-horizontal	$S-S > S_M-I_F = I_M-S_F > I-I$	A single secure attachment to either parent leads to more adaptive outcomes than insecure attachment to both parents, but less adaptive outcomes than secure attachment to both parents
Buffering-hierarchical ^a	$S-S = S_M-I_F > I_M-S_F > I-I$	Secure attachment to mother (but not father) leads to comparable outcomes to those with secure attachment to both parents
Buffering-horizontal	$S-S = S_M-I_F = I_M-S_F > I-I$	A single secure attachment to either parent leads to comparable outcomes to those with secure attachment to both parents, all more adaptive than insecure attachment to both parents

Note: Given the limitation of space, this table only depicts the different secure/insecure attachment networks. These models apply to organized/disorganized attachment networks.

Abbreviations: I-I, insecure-insecure; I_M-S_F , insecure/mother-secure/father; S_M-I_F , secure/mother-insecure/father; S-S, secure-secure.

^aIt is possible in principle that the parental hierarchy is such that secure attachment only to father leads to better outcomes than secure attachment only to mother.

that a network needs to have in order to be consistently associated with better developmental outcomes: the *Additive Hypothesis* (i.e., children with more secure or organized attachment relationships have more adaptive outcomes than children with fewer) or the *Buffering Hypothesis* (i.e., children with a secure or organized attachment relationships with one parent have comparable outcomes to children having two secure or organized attachment relationships, as one secure or organized attachment relationship buffers against the other insecure or disorganized attachment relationship). In addition, each integrative model specifies two hypotheses about whether the identity of the parent with whom the child has a secure or organized attachment relationship matters for predicting developmental outcomes. According to the *Hierarchical Hypothesis*, a secure or organized attachment relationship to one parent (either mother or father), but not the other, increases the likelihood of obtaining adaptive development. Alternatively, the *Horizontal Hypothesis* predicts that children with a secure or organized attachment relationship to either their mother or their father exhibit comparable developmental outcomes.

The present study

The current study seeks to advance understanding of a critical, yet untested question: In what ways are attachment networks associated with variation in children's language competence? We aim to answer three specific research questions, as specified in a pre-registered protocol (<https://osf.io/a3qs9>). First, we examined whether the number of secure or organized attachment relationships with mothers and fathers is important in predicting children's language competence (i.e., Research Question 1). Given that the quality of the securely attached parent-child relationship may provide children with more effective language-oriented learning experiences, we expected to find a “dose-response” relationship between

the number of secure attachments and language competence, consistent with the *Additive* (but not the *Buffering*) *Hypothesis*. Due to limited theoretical and empirical evidence, we did not specify a hypothesis (beyond limiting it to either the Additive or the Buffering Hypothesis) regarding the link between organized/disorganized attachment networks and language competence; thus, this analysis was exploratory in nature.

Second, we assess whether the quality of the attachment relationship with one caregiver predicts language competence better than the quality of the attachment relationship with the other caregiver (i.e., Research Question 2). Given meta-analytic evidence indicating comparable effect sizes for the associations between maternal and paternal sensitivity and language competence, we hypothesized that data on the secure/insecure attachment networks in this study will corroborate the *Horizontal* (but not the *Hierarchical*) *Hypothesis*. Given no sufficient evidence to suggest otherwise, we anticipated organized/disorganized attachment networks would follow the same patterns as the secure/insecure attachment networks. We thus predicted that the *Horizontal Hypothesis* will hold for the comparison between children with a single disorganized attachment relationship to either mother or father.

Our last research question regarding which attachment network model accounts best for children's language competence (i.e., Research Question 3; see Table 1 for a list of these models) merges the hypotheses from the first two research questions. Consistent with the *Additive-Horizontal* integrative model, we expected that children with a secure attachment relationship with one parent (regardless of which one) would have better language competence than children with two insecure attachment relationships and worse language competence than children with two secure attachment relationships. We did not specify a hypothesis (beyond the four models specified in Table 1) regarding the association between organized/disorganized attachment networks and language competence; rather, this analysis was considered exploratory.

Given the potential associations between language development and child sex, child ethnicity, parents' educational attainment, and family risk factors (Eriksson et al., 2012; Schjølberg et al., 2011; Zuckerman et al., 2014), we complemented the analyses with exploratory (non-pre-registered) examinations of the following moderators (suggested in the review process): child sex, race (i.e., White vs. non-White/multi-Racial), age at the midpoint between attachment assessment with mother and with father, maternal, and paternal education (elementary and high school education vs. post high-school education), and family risk status (whether the family included a parent with alcohol use disorder, a teenage parent, or a parent with reported heightened psychological distress at the time of the attachment assessment). To gain insight into the potential enduring versus transient nature of the expected associations between attachment networks and language competence, we also examined two methodological variables as potential moderators: attachment measure (the Strange Situation Paradigm [SSP] vs. modified SSP [the MacArthur Preschool Attachment Coding System, or PACS], and the Preschool Assessment of Attachment, or PAA), and time interval between attachment assessments (quantified as the midpoint in time between the two assessments) and language competence assessment.

METHOD

Protocol, registration, and reporting

This study is part of the Collaboration on Attachment to Multiple Parents and Outcomes Synthesis (CAMPOS), a research project that uses IPD meta-analyses to assess the predictive power of attachment networks to mother and father on multiple socioemotional outcomes. In this report, we adhered to the Preferred Reporting Items for Systematic Reviews and Meta-analysis of IPD (PRISMA-IPD) statement (Stewart et al., 2015).

Eligibility criteria

Given that self-reported attachment measures run the risk of misrepresenting the dyadic quality of the attachment relationship (i.e., the observer in this case is an active participant in the dyadic relationship), as well as absence of empirical evidence to support the validity of parent-reported measures as valid operationalization of infant-child attachment relationships (e.g., Van Dam & van IJzendoorn, 1988; Van IJzendoorn et al., 2004), we sought all available studies that measured child attachment to mothers and fathers via observational caregiver-child attachment behavior assessments (i.e., excluding parent-report, parent-observation, self-report, self-observation, and projective measures). In order to be included, studies also had to have assessed for either concurrent or later child

language competence via any validated measurement tools (e.g., parent-report or performance-based assessments).

Study identification and selection

Studies for the current project were identified through the Child Attachment Studies Catalog and Data Exchange (CASCADE; Madigan, 2020). CASCADE is a catalog of all empirical research studies published up until 2020 that have reported on observational measures of infant and child attachment. These studies were obtained through searches in the following databases: Medline, EMBASE, PsychINFO, Web of Science, and Dissertation Abstracts International. See Figure 1 for the study selection flow chart.

Data items

Authors of eligible studies were asked to provide participant data on the observational attachment assessments (i.e., attachment classifications and, if available, continuous scores for the various attachment coding scales). In this study, attachment measures included the SSP (Ainsworth et al., 1978), and two modified SSP coding systems for preschool children (PACS: Cassidy et al., 1992; PAA: Crittenden, 1988–2004). The SSP is the most frequently used procedure for classification of attachment patterns in infants and children. It entails a series of brief separations between children and their caregivers, followed by reunions. The separations in the SSP are designed to mildly distress the child, revealing their expectations about their parent's availability. Attachment patterns are classified based on observing the infant's behavior when reunited with the parent. Of note, our comprehensive literature review included studies that assessed attachment with both mothers and fathers via the observer-based Attachment Q-Sort (AQS; Waters & Deane, 1985). However, the authors of these studies (a) were non-responsive to our data sharing invitations (one study); or (b) reported assessing language competence via a non-validated parent-report instrument, which led to exclusion of this study (see details in the pre-registered harmonization procedure; osf.io/qyn5f); or (c) did not assess language competence at all. Thus, our current study does not include any AQS-based attachment assessments.

Authors were also asked for all accessible outcome data that matched any of the outcome domains that were pre-registered (see minimum detectable effect size sensitivity power analyses that justified collecting data on the outcomes in this study; osf.io/tcj45), including the focal outcome data presented in this study (i.e., language competence). In addition, study authors provided demographic data on children (i.e., sex, age at the times of first attachment and language competence assessments, and psychosocial risk status) and parents (i.e., age at the time of the first attachment assessment, education, relationship status, whether the parent was

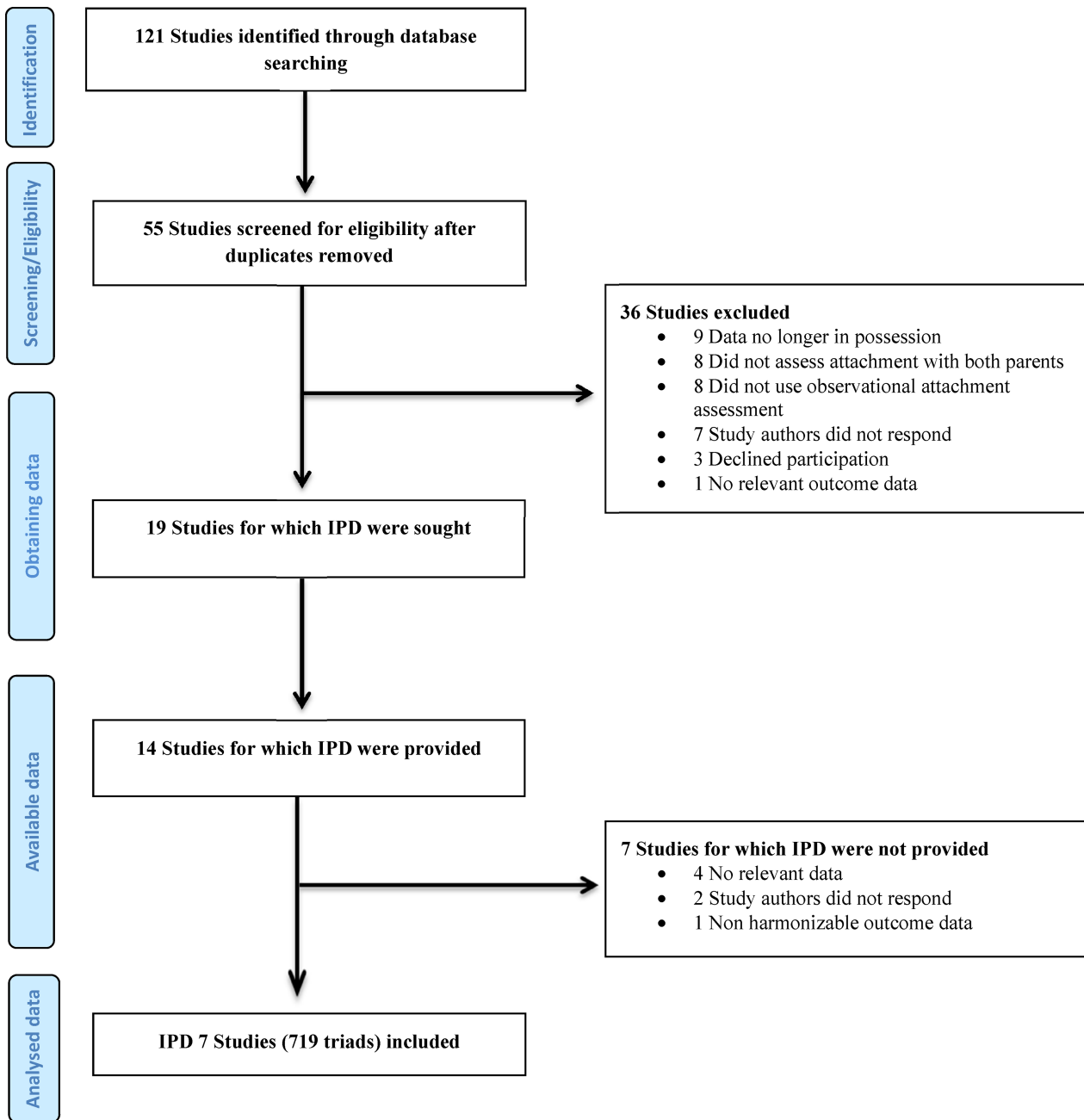


FIGURE 1 PRISMA-IPD flowchart of study selection and data selection process. PRISMA-IPD, Preferred Reporting Items for Systematic Reviews and Meta-analysis of individual participant data.

the biological parent of the child or not). When individual-level demographic data were missing, we extracted it from the study-level information in the published papers or via communication with the authors.

Data verification

All data were checked for numerical anomalies (e.g., parent age of 99). When available, the descriptive statistics of the requested variables were compared with the data reported in the publications.

IPD synthesis methods

With respect to attachment measures, we used SSP and modified SSP classifications to group children into binary Secure/Insecure and Organized/Disorganized attachment with each parent. The Secure/Insecure grouping was made regardless of whether children had a primary disorganized attachment classification or not, using the secondary subclassification of disorganized-secure (categorized as Secure), disorganized-avoidant (categorized as Insecure), and disorganized-resistant (also categorized as Insecure) classifications. Of note, 23.5% of the children

in the analytic sample ($N=169$) were not assessed for their attachment disorganization status with neither mothers nor fathers, and thus were excluded from the Organized/Disorganized attachment configurations analyses.

Our language competence harmonization process follows the three-Step strategy of IPD data harmonization procedure proposed by Verhage et al. (2022). We defined Language Competence as the understanding and production of linguistic utterances (Saxton, 2010) and operationalized it as the capacity for either expressive (i.e., production of) language and/or receptive (i.e., comprehension of) language. We then evaluated the available instruments used to measure either or both expressive and receptive language and transformed all total scores that were not standardized to reflect norm-referenced scores based on the geographical location of the participants, their sex, and their age (for a detailed harmonization procedure, see pre-registration protocol; osf.io/qyn5f). The performance-based language competence assessments in this study include: the Verbal Comprehension Index of the Wechsler Intelligence Scale for Children-3rd Edition (Wechsler, 1991); the Verbal Comprehension Index of the Wechsler Preschool and Primary Scale of Intelligence-Revised (Wechsler, 1989); the Peabody Picture Vocabulary Test-3rd Edition (Dunn & Dunn, 1997); and the Expressive Vocabulary Test- 2nd Edition (Williams, 2007). In the current sample, the average language competence scores across all attachment network groups ranged from 106.4 to 112.5. For language competence normative scores per attachment network configuration, see Table 2.

Handling missing data

We used multiple imputation with 5 imputed datasets in SPSS, version 25, and report study variables, zero-order correlations between them, and effect sizes based on the estimates of the first imputed dataset. For analyses, we used multiple imputation in R (R Core Team, 2021) to account for the multilevel structure of the data (i.e., participant within studies; for number and percentage of missing values for each variable, see Table 3). We created 10 imputed datasets, and used Rubin's rules (Rubin, 2004) to combine the multiple imputed estimates. We performed all subsequent analyses with both imputed and complete case merged datasets.

Analytic approach

To account for the clustering of mother-child/father-child triads within studies, we performed linear mixed effects analyses for the association between attachment networks and language competence using the “lme4” package (Bates et al., 2015) in R (R Core Team, 2021). We fit the data with a random effects model. Models included random intercepts for the study identity (i.e., the

TABLE 2 Standardized language competence scores per attachment network group.

S-S	S _M -I _F		I _M -S _F		I-I		nonD-nonD		nonD _M -D _F		D _M -nonD _F		D-D										
	n	SD	n	SD	n	SD	n	SD	n	SD	n	SD	n	SD									
313	112.46	16.14	135	109.36	16.94	136	109.19	16.08	135	106.33	15.16	413	112.36	16.37	57	107.53	16.51	57	109.73	17.16	23	108.10	11.84

Abbreviations: D-D, disorganized/mother-disorganized/father; DM-nonDF, disorganized/mother-organized/father; I-I, insecure-insecure; IM-SF, insecure/mother-secure/father; nonDM-DF, organized/mother-disorganized/father; nonD-nonD, organized/mother-organized/father; SM-IF, secure/mother-insecure/father; S-S, secure-secure.

TABLE 3 Correlations among number of child secure/organized attachment relationships, child language competence, and study covariates.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Total secure ¹	—																	
2. Total organized ²	.48**	—																
3. Family risk	.02	-.02	—															
4. Child age	-.03	.17**	-.22**	—														
5. Child gender	-.02	.03	-.03	.08*	—													
6. Child race	.02	.08	.10	.15**	.02	—												
7. Mother age	-.08*	.04	-.27**	.26**	-.02	-.10**	—											
8. Mother bio ³	.06	.00	-.14**	-.17**	-.06	.09*	.09*	—										
9. Mother employment	.02	-.06	.07	-.01	-.02	-.30	-.20**	-.16**	—									
10. Mother education	-.09*	.04	-.22**	.16**	.02	-.02	.39**	-.07	-.17**	—								
11. Father age	-.11**	.05	-.21**	.23**	.01	-.06	.74**	.03	-.12**	.36**	—							
12. Father bio ³	.04	.02	-.12**	-.15**	-.04	-.08**	.04	.93**	-.15**	-.10**	.00	—						
13. Father employment	.00	.08	.07	-.09*	-.01	.12	-.13**	-.06	.06	-.11**	-.10**	-.05	—					
14. Father education	-.07	.03	-.23**	.25**	.03	.04	.29**	-.15**	-.10	.35**	.32**	-.14**	-.04	—				
15. Country	.01	.05	-.41**	.45**	.00	-.13**	.33**	.28**	-.12**	.17**	.25**	.24**	-.07	.03	—			
16. Interval Att-Att ⁴	.01	-.16**	-.08**	-.44**	.05	-.20**	.10	.26**	-.05	-.02	-.00	.23**	.01	-.27**	.37**	—		
17. Interval Att-LC ⁵	.04	-.12**	-.21**	-.34**	.02	-.15**	-.03	-.02	-.05	.01	-.06	-.03	.05	-.08*	.37**	.33**	—	
18. Language comp. ⁶	-.14**	-.10**	-.25**	.02	.04	-.12**	.22**	.08	.08*	.20**	.20**	-.00	.71	.13**	.25**	.27**	.12**	—
Ms	—	—	78.6	19.84	—	—	31.31	—	—	—	32.98	—	—	—	—	1.59	2.02	110.11
SDs	—	—	0.63	14.36	—	—	5.89	—	—	—	6.95	—	—	—	—	1.90	2.92	16.24
%	43.50 ^a	57.40 ^b	—	—	51.20 ^c	86.90 ^d	—	93.60 ^e	71.80 ^f	72.50 ^g	—	92.06 ^e	94.40 ^f	58.60 ^g	52.60 ^h	—	—	—
Number of missing values imputed	—	—	—	—	—	6	289	—	151	61	292	—	156	63	—	—	1	137
% Missing values imputed	—	—	—	—	—	0.80	40.20	—	21.00	8.50	40.60	—	13.70	8.80	—	—	0.10	19.10

Note: ¹Total secure attachment relationships (0–2), $N=719$; ²total organized attachment relationships (0–2), $N=550$; ³parent biological (0) or not (1); ⁴the average time gap between attachment assessments with mother and father; ⁵the average interval between the mid-point between attachment assessments with mother and father and language competence; ⁶language competence. Family risk (1=no, 2=yes); child gender (1=male, 2=female); child race (1=White, 2=non-White/multi-racial); mother/father employment (0=employed, 1=unemployed); mother/father education (1=elementary school, 2=high school, 3=post-high school); country (0=USA, 1=non-USA).

^aPercent S-S.

^bPercent nonD-nonD.

^cPercent female.

^dPercent White.

^ePercent biological parent.

^fPercent employed.

^gPercent post-high school education.

^hPercent USA.

* $p < .05$; ** $p < .01$.

study from which the IPD originated) and fixed effects for attachment networks and covariates that were significantly associated with both attachment networks and the outcome variable (covariates included in the models testing each of the research questions are detailed below).

After pooling all complete-case datasets into a single dataset, we used the “mitml” (Grund et al., 2016) and

“mice” (Van Buuren & Groothuis-Oudshoorn, 2011) packages in R to conduct multiple imputation, while accounting for the multilevel structure of the dataset. We then used the “emmeans” package (Russell, 2020) in R to conduct planned comparisons. Given that traditional null hypothesis testing can only reject an absence of an effect but not statistically support it, we followed non-significant planned

comparisons with equivalence testing, using the “TOSTER” package (Lakens, 2017) in R, with equivalence bounds set for field-specific small effect sizes (Schuengel et al., 2021; $-.20 < d < .20$) and alpha of .05. In this study, a significant equivalence test indicates that an absence of a significant difference in language competence between the attachment network groups is indeed zero and will thus provide for more confidence in determining null effects. Effect sizes for the planned comparisons are expressed as Cohen's *d*, based on the formula provided by Lipsey and Wilson (2001).

To explore the potential moderating effect of demographic and methodological variables on the associations between attachment networks and language competence, we added the respective interaction terms (attachment network variable(s) \times moderator variable) as fixed effects. We further probed significant interaction terms with a pairwise comparison of the model's estimated marginal means to assess the difference in the simple slopes (when the moderator was continuous; e.g., age) or effects (when the moderator was categorical; e.g., attachment assessment type). To account for multiple comparisons, we adjusted *p*-values using the Tukey's method. In the Results section we report only significant moderation analyses. For results of the non-significant moderation analyses see Appendix S1. These analyses were not pre-registered.

Lastly, in this study we classified attachment disorganization based on children's primary disorganized classification, regardless of their “forced” secure or insecure subclassification. Such classification method is consistent with the original conceptualization of disorganized attachment as a momentary disruption of the underlying organized (i.e., secure, insecure-avoidant, or insecure-resistant) attachment pattern rather than a discrete category (Main & Solomon, 1990). Empirical evidence suggesting that organized attachment indicators during the SSP are orthogonal to those of attachment disorganization (Fraleigh & Spieker, 2003), and the latent structure of attachment quality observed in the SSP may be represented by two weakly correlated dimensions—an avoidant versus secure dimension and a disorganized versus secure dimension (Van IJzendoorn & Makino, 2023)—supports such conceptualization. Nevertheless, we are mindful that disorganized attachment classifications may also be conceptualized as a type of insecure attachment, and as such is sometimes treated analytically as insecure attachment regardless of these individuals' secondary organized classification (i.e., secure, insecure-avoidant, or insecure-resistant). We thus supplemented our pre-registered analyses with an exploratory analysis of the associations between secure/insecure attachment networks and language competence, in which we classified children with disorganized attachment classifications as having an insecure attachment relationship with the specific parent, regardless of their forced organized classifications. We are also mindful disorganized and organized attachment classifications may be regarded as mutually exclusive. As such, we also explored the associations between secure/insecure attachment networks and

language competence with an analytic subsample that excludes children who were classified with a disorganized attachment to either or both of their parents.

RESULTS

Participants characteristics

We report the participants' characteristics based on the first retained imputed dataset. The pooled analytic sample size ($N=719$) was composed of children from Canada, Israel, Portugal, the United Kingdom, and the USA. Approximately half (51.2%) of the children were female. On average, children were 19.84 months ($SD=14.37$) at the time of the first attachment assessment, and 44.09 months ($SD=33.04$) at the subsequent language competence assessment. The majority of the children in the pooled sample were considered “normative-risk” (i.e., no known child or parental risk factors; 78.6%). Children classified as non- “normative-risk” ($n=152$) were comprised of having at least one parent with (a) alcohol use disorder (77.92%), or (b) who was a teenager at the time of birth (14.29%), or (c) reported heightened psychological distress at the time of the attachment assessment (7.79%). The mean age of mothers at the time of the first attachment assessment was 31.31 years ($SD=5.89$) and that of fathers was 32.98 years ($SD=6.95$). Most parents were biological (93.6% of mothers and 92.6% of fathers) and shared a household at the time of the attachment assessments with their children (98.9%). Mothers and fathers were mostly White (91.4% and 90.5%, respectively), highly educated (72.5% of mothers and 58.6% of fathers had post high school education) and employed (71.8% of mothers and 94.4% of fathers). The average time gap between attachment assessments with mother and father was approximately one and a half months ($M=1.59$, $SD=1.90$, range: 0–6.01 months), and the average interval from the midpoint between attachment assessments with mother and father and language competence was approximately 2 years ($M=2.02$, $SD=2.92$, range: 0–10.79 years). For bivariate correlations between the main study variables and covariates pertaining to Research Question 1 see Table 3, and for bivariate correlations between the main study variables and covariates pertaining to Research Questions 2 and 3 see Appendix S2. For a description of the study-level characteristics see Table 4. For a complete set of the primary analyses results see Table 5.

Research Question 1: Is the number of secure or organized attachment relationships important in predicting language competence?

Primary analyses

The following variables were associated with both the independent variable (i.e., the number of secure attachments

TABLE 4 Study samples description.

First author	Year published	Country of study	Triad N	Attachment measure	LC measure	Mean interval between attachment assessments (months)	Mean interval attachment-outcome ^c (years)	Mean child age ^d (months)	% child female	Mean mother age	Mean father age
Bureau	2014	Canada	144	PACS	PPVT-4	0.00	0.00	46.89	57.60	35.14	36.98
Eiden	2002	USA	222	SSP	PPVT-3	1.00 ^b	0.44	12.57	49.50	29.45	31.25
Laurent	2008	USA	62	PAA	WPPSI-R ^a	0.56	1.43	20.89	59.70	24.06	24.55
Martins	2012	Portugal	46	SSP	WPPSI-R ^a	3.47	1.84	10.36	39.10	33.35	33.87
Schoppe-Sullivan	2006	USA	94	SSP	EVT	1.00 ^b	2.05	12.49	48.90	31.57	33.97
Sagi-Schwartz	1985	Israel	61	SSP	WISC-3 ^a	1.50 ^b	10.79	12.50 ^a	51.60	32.48	33.71
Steele	1996	UK	90	SSP	WISC-3 ^a	3.00 ^b	3.75 ^a	12.00 ^a	47.80	31.92	33.55

Abbreviations: EVT, Expressive Vocabulary Test; LC, language competence; PAA, Preschool Assessment of Attachment; PACS, MacArthur Preschool Attachment Coding System; PPVT, Peabody Picture Vocabulary Test; SSP, Strange Situation Procedure; WISC, Wechsler Intelligence Scale for Children; WPPSI-R, Wechsler Preschool & Primary Scale of Intelligence.

^aVerbal Comprehension Index was used.

^bStudy level data.

^cIntervals were calculated from the midpoint between attachment assessments with mothers and fathers to outcome assessments.

^dAt first observational attachment assessment.

TABLE 5 Planned comparisons per research question.

RQ 1 (n = 719)			RQ 2 (n = 271)			RQ 3 (n = 719)											
I-I versus S-I/S-S	S-I versus S-S		S _M -I _F versus I _M -S _F			I-I versus S _M -I _F /I _M -S _F /S-S											
df	t	p	df	t	p	df	t	p									
647	-2.66	.008	648	2.12	.03	266	0.26	.80	646	-2.16	.03	647	2.49	.01	647	0.27	.79
RQ 1 (n = 550)			RQ 2 (n = 114)			RQ 3 (n = 550)											
D-D versus nonD-I/nonD-nonD	nonD-I versus nonD-nonD		nonD _M -D _F versus D _M -nonD _F			D-D versus nonD _M -D _F /D _M -nonD _F /nonD-nonD											
df	t	p	df	t	p	df	t	p									
503	-0.60	.55	545	2.53	.01	109	0.17	.87	544	-0.59	.55	543	2.73	.007	543	0.07	.94

Abbreviations: D-D, disorganized-disorganized; I-I, insecure-insecure; nonD-I, insecure-disorganized; nonD-D, organized/disorganized; nonD-nonD, organized-organized; RQ, research question; S-I, secure-insecure; S-S, secure-secure.

a child has; 0, 1, or 2) and dependent variable (i.e., language competence), and were thus included as fixed effect covariates in the model: type of attachment assessment (SSP, PACS, or PAA), the age of the mother and the father, and the level of maternal education (Elementary, High School, or Post High School). Planned comparisons for the associations between secure/insecure attachment networks and language competence revealed that children in insecure attachment relationships with both parents had significantly lower language competence scores compared to children with either one insecure attachment relationship or two secure attachment relationships [$t(647) = -2.66, p = .008; d = -.28, 95\% \text{ CI} = -.47, -.10$]. Furthermore, children who were insecurely attached to one parent had lower language competence scores compared to children who were securely attached to both parents [$t(648) = 2.12, p = .03; d = -.20, 95\% \text{ CI} = -.37, -.03$].

Based on their significant associations between the independent variable (i.e., the number of organized attachments a child has; 0, 1, or 2) and dependent variable (i.e., language competence), fixed effects covariates of the intervals between (a) the observational attachment assessments with mother and father, and (b) the midpoint in time between attachment assessments with mother and father, and language competence assessment were included in the model for disorganization. Planned comparisons revealed a non-significant difference in language competence scores between children who were disorganized in their relationships with both parents and children who had either one or no disorganized attachment relationship [$t(503) = -0.60, p = .55; d = .21, 95\% \text{ CI} = -.21, .63$]. The equivalence test was non-significant [$t(26) = 0.22, p = .59$], suggesting that data were insufficient to draw conclusions on these groups' potential null mean differences. However, children who were disorganized with one parent had lower language competence scores than children who had organized attachments with both parents [$t(545) = 2.53, p = .01, d = -.23, 95\% \text{ CI} = .43, -.02$].

Analyses of potential moderators

Assessment of the moderators for the association between the number of organized attachment relationships and language competence revealed that the interaction term for number of organized attachments \times child age was significant [$F(2, 533) = 3.79, p = .02$]. Specifically, differences in language competence scores between children with two organized attachment relationships and children with one disorganized attachment relationship were significantly greater for children who were older compared with those who were younger at the time of the attachment assessments (see Figure 2; Appendix S3, Tables A1–A3). The interaction term number of organized attachments \times attachment assessment methodology was also significant [$F(2, 542) = 3.05, p = .04$] and remained so even when controlling for child's age. However, a

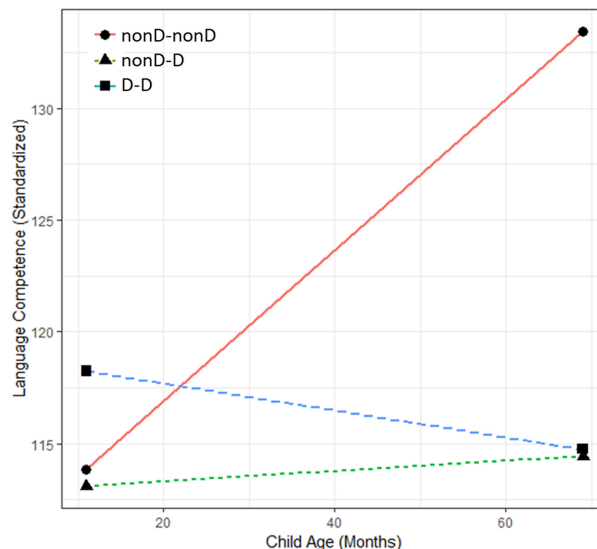


FIGURE 2 Moderating effect of organized/disorganized attachment networks on the association between child age (in months) and standardized language competence. D-D, disorganized with both parents; nonD-D, organized with one parent and disorganized with the other parent; nonD-nonD, organized with both parents.

pairwise comparison of the model's estimated marginal means revealed no significant differences between any of the attachment network groups (see Appendix S3, Tables A4–A6).

Research Question 2: Does the quality of the attachment relationship with one caregiver predict language competence better than the other?

Primary analyses

Given that no covariates were significantly associated with both the type of attachment network (secure or organized only with mother vs. only with father) and language competence, no covariates were included in the models we used to compare language competence between these groups. When comparing language competence scores between children who had secure or organized attachment relationships only with mothers to those who had insecure or disorganized attachment relationships only with fathers we did not find any statistically significant main effects [$t(266) = 0.26, p = .80, d = .01, 95\% \text{ CI} = -.23, .25$, and $t(109) = 0.17, p = .87, d = .13, 95\% \text{ CI} = -.24, .50$ respectively]. Equivalence tests were non-significant for both the secure/insecure attachment network comparison, [$t(269) = -1.59, p = .06$], and the organized/disorganized attachment network comparison [$t(112) = -0.37, p = .36$], indicating insufficient power to determine whether the parent with whom the child had an insecure or disorganized attachment relationship mattered for their language competence.

Research Question 3: Which attachment network model predicts children's language competence best?

Primary analyses

Father's age and maternal education, which were associated with both attachment networks (i.e., S-S, S_M-I_F, I_M-S_F, and I-I) and language competence variables, were included as fixed effect covariates in the model we used to assess this research question. Planned comparisons for the secure/insecure attachment networks' links with language competence revealed that children who were insecure with both parents had significantly lower language competence scores compared to the mean score of three groups of children taken together: those who had a single secure attachment relationship only with mother, those with a single secure attachment relationship only with father, and those with two secure attachment relationships [$t(646)=-2.16$, $p=.03$; $d=-.28$, 95% CI = $-.47$, $-.10$]. In addition, children with one insecure attachment relationship with either mother or father obtained lower language competence scores compared to children with two secure attachment relationships [$t(647)=2.49$, $p=.01$; $d=-.20$, 95% CI = $-.37$, $-.03$]. Children with insecure attachment relationships only with mothers did not show different language competence scores than children with insecure attachment relationships only to fathers [$t(647)=0.27$, $p=.79$; $d=.01$, 95% CI = $-.23$, $.24$], but the equivalence test was non-significant [$t(269)=-1.59$, $p=.06$]. In all, children with two secure attachment relationships had higher language competence scores compared to children with one or no secure attachment relationships ($d=.26$, 95% CI = $.11$, $.41$).

The following covariates were significantly associated with both attachment networks (i.e., nonD-nonD, nonD_M-D_F, D_M-nonD_F, and D-D) and language competence, and thus included in the model assessing this research question: the type of observational attachment assessment, the time intervals between the observational attachment assessments with mother and father, and the interval between the midpoint in time between the attachment assessments with mother and father, and language competence assessment were included in the model. When comparing the organized/disorganized attachment networks in terms of language competence we found no statistical difference in language competence scores between children with disorganized attachment relationship with both parents and the average score for children with either a disorganized attachment only with their mothers, or a disorganized attachment only with their fathers, or no disorganized attachment relationship within their network [$t(544)=-0.59$, $p=.55$; $d=.21$, 95% CI = $-.63$, $.21$]. However, the equivalence test was non-significant [$t(26)=0.22$, $p=.59$]. Children with one disorganized attachment relationship showed statistically lower language competence scores compared to those with two organized attachment relationships [$t(543)=2.73$, $p=.007$; $d=-.23$, 95% CI = $-.43$,

$-.02$]. Finally, children who were disorganized only with their mothers did not statistically differ from their counterparts who were disorganized only with their fathers [$t(543)=0.07$, $p=.94$; $d=.01$, 95% CI = $-.23$, $.24$], but the equivalence test was non-significant as well [$t(112)=-0.37$, $p=.36$]. Overall, children with two organized attachment relationships had higher language competence scores compared to children with one or no organized attachment relationships ($d=.23$, 95% CI = $.04$, $.43$).

Analyses of potential moderators

We found a significant interaction for secure/insecure attachment networks \times child age at the assessment of language competence [$F(3, 704)=3.27$, $p=.02$]. However, a pairwise comparison of the model's estimated marginal means revealed no significant differences between any of the attachment network groups (see Appendix S3, Tables A7–A9).

Sensitivity analyses: Complete-case dataset

In the following, we report only on results that differed from the imputed analytic dataset. For the complete set of complete-case results refer to Appendix S4. When assessing Research Question 1 (“Is the Number of Secure or Organized Attachment Relationships Important in Predicting Language Competence?”), we found that unlike our imputed dataset results, children with two insecure attachment relationships did *not* exhibit significantly lower language competence scores compared to children with either one or no insecure attachment relationships [$t(333)=-1.92$, $p=.06$; $d=-.28$, 95% CI = $-.47$, $-.10$]. Similar results were also obtained when assessing Research Question 3 (“Which Attachment Network Model Predicts Children's Language Competence Best?”); unlike the analysis conducted on the imputed dataset, children with insecure attachment relationships did not exhibit significantly lower language competence scores compared to children with either one insecure attachment relationship or two secure attachment relationships [$t(336)=-1.56$, $p=.12$; $d=-.28$, 95% CI = $-.47$, $-.10$].

Supplementary analyses 1: Attachment disorganization regarded to as insecure attachment

We conducted a supplementary analysis in which we analyzed the secure/insecure attachment network configurations based on the categorization of disorganized parent-child attachment relationships as insecure attachments. We obtained similar results to the ones we reported based on the categorization of disorganized parent-child attachment relationships based on their secondary

organized classification (i.e., secure or insecure). For language competence normative scores per attachment network configuration and full set of results see Appendix S5.

Supplementary analyses 2: Attachment disorganization excluded from secure/insecure attachment configurations

We also conducted an exploratory analysis wherein we excluded all children with one or two disorganized attachment relationships from the analytic sample with which we evaluated the associations between secure/insecure attachment network configurations and language competence. After excluding all children with at least one disorganized attachment relationship within their attachment network ($N=139$), and children whose disorganized classifications were not assessed ($N=169$), the analytic sample consisted of $N=414$ triads. We present here analysis for Research Question 3; for language competence normative scores per attachment network configuration and full set of results for all three Research Questions see Appendix S6.

Similar to the primary analyses, planned comparisons indicated that (a) children who were insecure with both parents had significantly lower language competence scores compared to children who had a single secure attachment relationship with one or two parents [$t(404)=-2.46, p=.01; d=.38, 95\% CI=.08, .68$], and (b) children with an insecure attachment relationship only with mothers did not show different language competence scores compared to children with a secure attachment relationships only with fathers [$t(405)=-0.17, p=.87; d=-.13, 95\% CI=-.50, .24$], though the equivalence test was non-significant [$t(110)=0.38, p=.35$]. Unlike the primary analysis, planned comparisons conducted with the current subsample revealed that children with one insecure attachment relationship with either mother or father did not statistically differ from their counterparts who had two secure attachment relationships [$t(405)=0.30, p=.76; d=.07, 95\% CI=-.16, .29$], but the equivalence test was non-significant [$t(219)=-1.19, p=.12$].

DISCUSSION

Commensurate with the calls for an increased emphasis on the role of fathering on child development (Ahner & Schoppe-Sullivan, 2020; Bakermans-Kranenburg et al., 2019; Cowan & Cowan, 2019) are calls to consider the network of children's early attachments as predictors of child outcomes (Dagan et al., 2021; Sroufe, 2016; Van IJzendoorn et al., 1992; Van IJzendoorn & Tavecchio, 1987). In this study, we sought to heed these calls by assessing the predictive power of children's early attachment networks to mother and father on child language competence. In the current sample, all attachment network groups had language competence scores above

the mean for the population (i.e., above a standardized score of 100). Nonetheless, as expected, we found that (a) two secure or organized attachments were associated with higher language competence scores compared to having only one or no secure or organized attachment within the child's network, and (b) mother-child and father-child attachment quality did *not* differentially predict children's language competence, although data were inconclusive as to whether the predictive value was equivalent due to limitations in statistical power. Findings from this work support and complement recent IPD meta-analytic results reporting similar patterns of findings between attachment networks and internalizing and externalizing behavioral problems (Dagan et al., 2022).

Secure/insecure attachment networks and language competence: The more secure attachment relationships, the better

When categorizing attachment relationships on the binary secure/insecure level, it appears that the *Additive-Horizontal Model* best described the association between attachment network and language competence (Dagan & Sagi-Schwartz, 2018, 2020; $S-S > S_M-I_F = I_M-S_F > I-I$; see Figure 3a). That is, children with two secure attachment relationships were likely to perform better in a standardized language evaluation compared to children who had only one secure attachment to either the mother or the father; in turn, children with one secure attachment relationship with either parent were likely to obtain higher language competence scores than children with no secure (i.e., two insecure) attachment relationships with their.

These results expand previous meta-analytic findings which demonstrated that children with a secure attachment relationship with their mother demonstrated greater child language competence than children with an insecure attachment relationship with their mother ($d=.59$; Van IJzendoorn et al., 1995). Our findings suggest that attachment relationship quality with fathers may be equally important to those of mothers in two ways. First, it takes developing a secure attachment relationship with *both* parents to increase the likelihood of maximizing language competence. Second, the findings suggest that it is relatively unimportant which parent the child develops a secure attachment relationship with; attachment security to either the mother or the father helps children obtain higher language competence.

The positive association between the number of secure attachment relationships and language competence may be explained via characteristics that secure attachment relationships may confer for the child and reflect in the parent. Children with two secure attachment relationships may develop enhanced motivational capacities that facilitate higher number and quality of language-learning opportunities (e.g., higher motivation to explore and engage with reading materials, and strong tendencies to seek assistance

from caregivers during challenging language related tasks; Van IJzendoorn et al., 1995). Parents with whom children develop a secure attachment relationship may themselves be better facilitators of language-learning opportunities compared to parents of insecurely attached children (e.g., by showing greater responsivity to the child's language cues, exhibiting more encouragement for children's comprehension of information and acquisition of knowledge, O'Connor & McCartney, 2007, or by using more words to do so, Costantini et al., 2012).

Whereas the developmental mechanisms that underlie the association between early attachment networks and language competence are still understudied and were not assessed in the current investigation, this study's results are significant since language competence variability is associated with school achievement (Duff et al., 2015; Durham et al., 2007) and socioemotional outcomes (Clegg et al., 2015; Hentges et al., 2021; Salmon et al., 2016). Given that interventions that aim to increase attachment quality with a single caregiver have already proven successful in enhancing language competence (e.g., ABC; Bernard et al., 2017; Raby et al., 2019), future research should explore if a similar pattern of findings is evident or bolstered further when interventions are provided to multiple caregivers in the child's attachment network.

Of note, when we excluded children with disorganized attachment relationships with any of both of their parents, the exploratory analysis of the associations between secure/insecure attachment configurators and language competence revealed a similar pattern to the primary

pre-registered analysis. That is, insecure attachment relationships conferred the least optimal language competence outcome compared to all other children, and children with an insecure attachment relationship only with mothers and only with fathers did not differ in their language competence scores. Unlike the primary pre-registered analysis, this exploratory analysis revealed a non-significant difference in language competence scores between children with one versus two secure attachment relationships within their attachment networks. However, the results obtained via this analysis should be interpreted with caution given that the size of the analytic sample fell short of meeting our pre-registered minimum detectable effect size sensitivity power analyses that justified collecting data on the outcomes in this study (i.e., below the estimated power of 80%).

Organized/disorganized attachment networks and language competence: Is having one disorganized attachment relationship as problematic as having two?

This study is the first to assess the predictive power of organized/disorganized attachment networks on language competence. When assessing these associations, we obtained partial support for the *Additive-Horizontal Hypothesis* ($\text{nonD-nonD} > \text{nonD}_M\text{-D}_F = \text{D}_M\text{-nonD}_F = \text{D-D}$; see Figure 3b). In accordance with the results for secure/insecure attachment networks, children with two organized attachments exhibited higher language competence scores than all other attachment network groups, and no

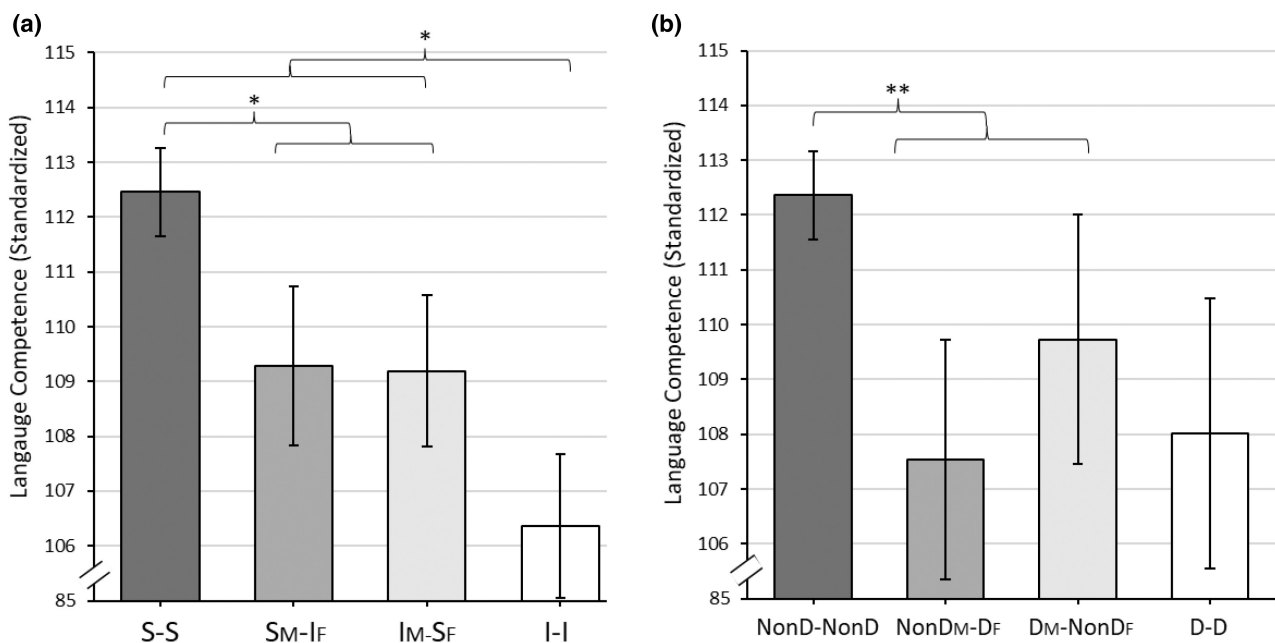


FIGURE 3 Bar charts depicting differences in normative language competence scores between (a) the integrative secure/insecure and (b) the organized/disorganized attachment network groups. D-D, disorganized/mother-disorganized/father; $\text{D}_M\text{-nonD}_F$, disorganized/mother-organized/father; I-I, insecure-insecure; $\text{I}_M\text{-S}_F$, insecure/mother-secure/father; $\text{nonD}_M\text{-D}_F$, organized/mother-disorganized/father; nonD-nonD , organized/mother-organized/father; $\text{S}_M\text{-I}_F$, secure/mother-insecure/father; S-S, secure-secure. * = $p < 0.05$; ** $p < 0.01$.

significant difference in scores emerged between children who were disorganized only with their mother and those who were disorganized only with their father. Moderator analyses showed that the gap in language competence between children with two organized attachment relationships and children with disorganized attachment relationship with mothers, but not with fathers, increased with children's age at the time that attachment was assessed. Such a pattern of results may suggest a cumulative advantage in language competence development over time, such that with age, children with two organized attachment relationships may expand their relative advantage in language competence compared with children with disorganized attachment relationships with mothers.

Inspecting the overlapping 95% confidence intervals, it appears that children with one disorganized attachment relationship with either parent perform comparably to children with two disorganized attachment relationships. Whereas we did not expect such a pattern of results, post hoc equivalence tests comparing the three groups to one another (i.e., nonD_M-D_F, D_M-nonD_F, and D-D) were non-significant, suggesting that these comparisons were statistically underpowered ($N_s=23-57$), and thus the results obtained here need to be replicated with larger group sizes.

Previous studies have found that children with disorganized attachment relationships show significantly lower joint attention skills (i.e., decreased ability to initiate and coordinate attention with another toward an object) when interacting with both their mothers and the experimenters (Claussen et al., 2002; Schölmerich et al., 1997). Lower joint attention, in turn, predicts lower language competence (Bottema-Beutel, 2016; Mundy & Jarrold, 2010), which may explain the associations between children with at least one disorganized attachment and lower language competence compared to children with no disorganized attachment. In addition, disorganized attachment relationships are associated with accumulation of socioeconomic risk factors (e.g., low income and parental substance use; Cyr et al., 2010), which themselves are known precursors of decreased language competence (Pace et al., 2017). It is unclear, however, why children with a single disorganized attachment relationship with either the mother or the father showed similar language competence scores compared to children with two disorganized attachment relationships. Once again, such a pattern of results should be interpreted with caution since the post hoc equivalence tests that compared these three attachment network groups were non-significant.

Study limitations and future research

Despite taking advantage of a comparatively large, pooled sample ($N=719$) to assess, with considerable statistical power, previously unsettled questions regarding the associations between attachment networks and language competence, limitations remain. First, the set of available studies consisted mostly of above-average educated, White families.

Relatedly, the average language competence scores across all attachment networks groups were within one standard deviation ($SD=15$) of the normative population mean ($M=100$). As such, the findings of this study are limited in their generalizability, especially when it comes to at-risk child populations, where children are more vulnerable to problematic language development (Lum et al., 2015). Future studies are encouraged to expand the current findings by evaluating the degree to which language competence of children from multicultural and non-traditional families (e.g., same-sex parents; Golombok, 2015) and at-risk populations can be predicted by their attachment networks.

Second, we were unable to assess the degree to which insecure attachment subtypes (i.e., insecure-avoidant and resistant) and disorganization secondary classifications (i.e., whether a disorganized attachment relationship is simultaneously assigned with a secure or insecure attachment classification) influenced the observed associations between attachment networks and language competence. Attachment theory and research have long emphasized the qualitative difference between the insecure attachment subtypes; yet, despite calls for investigations of the influence of insecure attachment subtypes on cognitive skills (e.g., De Ruiter & van IJzendoorn, 1993), little progress has been made. Relatedly, meta-analytic evidence (Van IJzendoorn et al., 1995) indicated larger effect sizes for the links between mother-child attachment relationship and cognitive abilities (including, in some studies, language competence) when samples had higher percentages of insecure-ambivalent children. Support for such findings came from a large birth cohort study (the NICHD Study of Early Care and Youth Development; O'Connor & McCartney, 2007). This study (Frosch et al., 2001) showed that insecure-resistant children are indeed more prone to exhibit lower cognitive skills, as indicated by intelligence tests that include language competence components, compared to children with insecure-avoidant attachments to their mothers. Insecure-resistant children, but not insecure-avoidant ones, also had mothers who exhibited less cognitive development stimulation (i.e., verbally responding to, or expanding on the child's verbalizations or vocalizations, and relating events in the story to the child's personal experiences) during a storybook interaction, which may explain the meta-analytic and longitudinal patterns of results. Relatedly, evidence suggests that infants in insecure-avoidant relationships tend to initiate more joint attention with a stranger (i.e., an experimenter) than those in insecure-resistant relationships (Meins et al., 2011). These results suggest a potential compensatory mechanism through which infants in insecure-avoidant relationships cultivate social contact and opportunities for language learning, and thus obtain better language competence compared to infants with insecure-resistant relationships. Future studies will need to use significantly larger sample sizes to further assess sub-groups in an attachment networks framework, which may be crucial in fine-tuning potential etiological models of language competence variability.

Third, all language competence assessments included in this study were performance-based, and as such were conducted by an individual who was not familiar to the child undergoing the assessment. Van IJzendoorn et al. (1995) suggested that such circumstances may pose more distress to insecurely attached children compared to securely attached children. This hypothesis entails the possibility that the differences we observed between the attachment network groups and language competence could be in fact contributed, at least in part, to differences in test performance rather than language competence. Future studies that contrast assessments of language competence via performance-based versus observable parent-child interactions or parental reports within the same children can significantly assist in disentangling the potential overlap between secure and insecure children's language competence and performance capacities.

Of note, we are mindful of an alternative explanation to the attachment-language competence associations we observed in the current study. It is possible that an underlying cognitive ability may drive the observed associations between attachment networks and language competence, as it may affect the development of both attachment relationship qualities (for review, see Del Giudice & Haltigan, 2023) and language skills (Roth et al., 2015). As such, intelligence may be a confounding factor in the observed associations between attachment networks and language competence. We thus encourage future studies to control for cognitive ability, to rule out this alternative explanation.

Finally, whereas the majority of the imputed dataset results were replicated in the complete-case dataset sensitivity analyses, one comparison obtained via the imputed dataset results was not robust against results derived from the complete-case dataset. Complete-case dataset results showed that children with insecure attachment relationships did not exhibit significantly lower language competence scores compared to children with either one or no insecure attachment relationships (although, like the imputed dataset results, children with two secure attachment relationships exhibited higher language competence compared to those only with one secure attachment relationship with either parent). Given the discrepancies between some of the analytic subsamples, replication of the results we obtained in our main analyses is needed in larger samples.

CONCLUSIONS

Research on the association between early attachment patterns and language competence has been relatively scarce and was never conducted when considering the configuration of mother-child and father-child attachments on such cognitive outcomes. The aim of this study was to fill this gap in the literature. Using an IPD meta-analytic methodology, we found that early attachment relationships with mother and father predicted language

competence. Thus, the current study provides support for the equal importance of attachment to mothers and fathers in predicting developmental outcomes.

Specifically, children with two secure or organized attachments were more likely to achieve higher scores on language evaluation tasks compared to those with two insecure or disorganized attachments, respectively. Introducing a single insecure attachment relationship into children's attachment networks decreases the likelihood of having as high a language competence as children with two secure attachment relationships, and having two insecure attachment relationships lowers such likelihood even further. However, when it comes to organized/disorganized attachment networks, children with one disorganized attachment relationship with either the mother or the father had comparable language competence to children with two disorganized attachment relationships.

Future research is needed to better understand the mechanisms that explain the observed associations between early attachment networks and language competence, as well as expanding the attachment networks beyond non-parental caregivers. Nevertheless, findings from this study advance our understanding of the etiology of differences in children's language competence development that can be traced to the early multiple caregiving environment.

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The members of Collaboration on Attachment Transmission Synthesis are provided in [Appendix](#).

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None.

DATA AVAILABILITY STATEMENT

The data necessary to reproduce the analyses presented here are not publicly accessible. The analyses presented here were pre-registered and are available at <https://osf.io/a3qs9>. The analytic code necessary to reproduce the analyses presented in this paper is available from the first author. The materials necessary to attempt to replicate the findings presented here are not publicly accessible.

ORCID

Or Dagan  <https://orcid.org/0000-0002-4674-5425>
 Carlo Schuengel  <https://orcid.org/0000-0001-5501-3341>
 Sheri Madigan  <https://orcid.org/0000-0002-7536-3258>
 Glenn I. Roisman  <https://orcid.org/0000-0002-6941-6560>
 Robbie Duschinsky  <https://orcid.org/0000-0003-2023-5328>
 Marian Bakermans-Kranenburg  <https://orcid.org/0000-0001-7763-0711>

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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APPENDIX

The Collaboration on Attachment to Multiple Parents and Outcomes Synthesis (CAMPOS) consists of 29 members. Group author members are as follows: Ora Aviezer, University of Haifa, Israel; Marian Bakermans-Kranenburg, ISPA Instituto Universitário, Portugal; Kristin Bernard, Stony Brook University, NY; Geoffrey L. Brown, University of Georgia, GA; Jean-François Bureau, University of Ottawa, Canada; Or Dagan, Long Island University- Post Campus, NY; Robbie Duschinsky, University of Cambridge, UK; Rina D. Eiden, Penn State University, PA; R. M. Pasco Fearon, University of Cambridge, UK; Sheri Madigan, University of Calgary, Canada; Carla Martins, University of Minho, Portugal; Mirjam Oosterman, Vrije Universiteit Amsterdam, The Netherlands; Glenn I. Roisman, University of Minnesota Twin Cities, MN; Abraham Sagi-Schwartz, University of Haifa, Israel;

Carlo Schuengel, Vrije Universiteit Amsterdam, The Netherlands; Isabel Soares, University of Minho, Portugal; Howard Steele, New School for Social Research, NY; Marinus H. Van IJzendoorn, University College London, UK; Marije L. Verhage, Vrije Universiteit Amsterdam, The Netherlands; Maria S. Wong, Endicott College, MA.

Nonauthor collaborators are as follows: Julie Braungart-Rieker, Colorado State University, CA; Deborah M. Capaldi, Oregon Social Learning Center, Eugene, OR; Cristina Colonesi, University of Amsterdam, The Netherlands; E. Mark Cummings, University of Notre Dame, IN; Diane Lickenbrock, Western Kentucky University, KY; Sarah Mangelsdorf, University of Rochester, NY; Eva Inês Costa Martins, University of Porto, Portugal; Ana Osório, Higienópolis Campus, São Paulo, Brazil; Susana Tereno, Université de Rouen, France; Brenda L. Volling, University of Michigan, MI.