# The First 20,000 Strange Situation Procedures: A Meta-Analytic Review

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## Abstract

The Strange Situation Procedure (SSP) was developed five decades ago to assess infant-parent attachment relationships. Although the procedure itself has remained relatively constant in over 285 studies (20,720 dyads) conducted to date, there have been vast sociological changes during this time, and research foci shifts to studying diverse populations. Since its inception, the SSP has also been adopted in over 20 countries. In this meta-analysis, we collate this large body of work, with the objectives of producing reliable estimates of the distribution of the four SSP attachment classifications, assessing temporal trends and geographical differences, and determining if and when distributions are different across various populations. Results revealed that the global distribution of SSP attachment was 51.6% secure, 14.7% avoidant, 10.2% resistant, and 23.5% disorganized. There were no differences in the distribution among mothers and fathers, and no child age or sex differences. We found a temporal trend in which there was less avoidant attachment over time and there were attachment distribution differences between samples from North America versus other regions of the world, particularly Asia, Australia/New Zealand, and South America. Compared to secure attachment, we found higher rates of avoidant and disorganized attachment in populations with socio-demographic risks and in child maltreatment samples, higher rates of disorganized attachment in samples where parents had psychopathology and when the child was in foster care or adopted from foster or institutional care. The implications of these findings for future research and practice are discussed.


## Public Significance Statement

This meta-analysis suggests that, worldwide, one in every two infants develops a secure attachment relationship with their caregiver. Secure attachment is more likely to develop when fewer stressors are imposed on the infant-parent dyad.

## The First 20,000 Strange Situation Procedures: A Meta-Analytic Review

The Strange Situation Procedure (SSP), first introduced by Ainsworth and Wittig in 1969, has been one of the most widely used and relied upon paradigms in child development over the last half-century. The SSP is a 21-minute observational procedure that involves two separations from, and reunions with, an infant and its parent or another caregiver. It assesses individual differences in attachment behavior by presenting mild cues to danger (i.e., presence of a stranger; separation from a caregiver) in a semi-naturalistic but standardized context, which are expected to activate the 'attachment system'. These differences in attachment behavior are thought to capture dyad-level differences in expectations about the caregiver's availability in times of stress, sometimes also referred to as internal working models of attachment. Infant attachment relationships are classified as secure, avoidant, resistant, or disorganized (Ainsworth et al., 1978; Main & Solomon, 1990) based on their behavioral response to separation from, and especially reunion with, the caregiver in this procedure. Later attachment-based measures have more or less been based on the theoretical underpinnings and associated attachment categories derived from the SSP. Further, research on the developmental sequelae of infant attachment has proliferated since the introduction of the SSP, which has been important for the field of child development and developmental science more broadly.

The Strange Situation Paradigm has remained constant over the last 50 years. The consistency of measurement has been an important strength of the attachment paradigm as it allows for robust replication and comparisons across time and context. In that regard, the SSP has been instrumental in building up a large corpus of coherent evidence regarding the prevalence, causes, and consequences of different patterns of attachment over many decades. However, the legacy of the SSP has also seen criticism for holding back attachment research in

certain ways (Ziv & Hotam, 2015). It is, therefore, timely to take stock. Accordingly, the Child Attachment Studies Catalogue and Data Exchange (CASCADE; Madigan, 2020) was developed, a comprehensive database of studies published to date using the SSP. Using this catalogue as a backdrop, the current study provides a comprehensive summary of the distribution of attachment classifications in the thousands of infants who have been observed in the SSP, as well as temporal trends over the last 50 years. Moreover, now that the SSP has proliferated with studies conducted in over 20 countries, it is also important to examine geographical differences in the SSP given the ongoing debate as to its universality across cultures. Finally, although the SSP was initially used with infant-mother dyads from low-risk samples (Ainsworth et al., 1978), the SSP has now been used across a number/variety of caregivers (e.g., fathers, foster caregivers, adoptive parents), in racially minoritized groups, as well as various clinical groups, and in both high- and low-risk socio-demographic contexts. An examination of the distribution of the SSP classifications across these groups is of epidemiological interest but also addresses the foundational theoretical claim of attachment theory that infant-parent attachment is responsive to contexts of risk, such as parent psychopathology and socio-economic deprivation (Van IJzendoorn et al., 1992). Thus, in this comprehensive meta-analysis, the distributions of the SSP classifications across 285 samples and over 20,000 parent-child dyads are synthesized and described, and differences across distributions of classifications are examined in relation to various indicators of risk, as well as to temporal and geographical trends.

**Development of the Strange Situation Paradigm**

The originator of attachment theory, John Bowlby (1907-1990), proposed that the *attachment system* predisposes the human infant to seek proximity to specific caregivers, while a variety of observable *attachment behaviors* (e.g., crying, seeking contact, approaching) allow the

child to achieve and maintain proximity when in need of comfort or protection (Bowlby, 1969). Bowlby's crucial insights regarding the evolutionary value of attachment provided a powerful theoretical model for understanding the nature of infants' ties to their caregivers.

The observations of Ainsworth and colleagues (Ainsworth et al., 1978) put the study of attachment on sound empirical footing through the development of a reliable paradigm for measuring attachment behavior. In the SSP, the caregiver, infant, and an unfamiliar but friendly figure interact in seven episodes of approximately 3 minutes in duration in a laboratory playroom containing age-appropriate toys, featuring two separations and reunions between the infant and parent. Separations are curtailed if the infant becomes too distressed. The SSP is recorded and later reviewed by trained and reliable coders for classification into one of the four categories of infant attachment. The premise of the SSP is that the separations from the mother and interaction with an unfamiliar individual will "activate" the infant's stress response about the availability of the attachment figure, making it possible to observe how the child navigates exploring a new environment and how the child uses the caregiver at the reunion as a source of comfort and protection when under alarm (Duschinsky, 2015; Weinfield et al., 2008). The laboratory-based SSP provides a functional analogue of instances of caregiver availability and/or unavailability, offering a window on the infant's history with their primary caregiver, and specifically their expectations about the availability of their caregiver when needed.

## Categories of Infant Attachment Derived in the SSP

### *Secure, Avoidant, and Resistant Attachment*

Initially, three categories of attachment were identified by Ainsworth and Wittig (1969) in a small sample of 26 middle-class Caucasian mothers from Baltimore: the majority of infant-mother dyads were secure attachment relationships (65%), and smaller subsets were either

insecure-avoidant (22%) or insecure-resistant (13%). Infants in *secure* relationships often protested at the parent's departure from the room, approached and sought comfort from the parent to help manage their distress, and were able to use their parent as a secure base to explore the environment. In contrast to secure attachment, there are two distinct patterns of insecure attachment behavior, named/classified as *insecure-avoidant* and *insecure-resistant*. Infants in *avoidant* relationships appeared engaged with exploring their environment, rarely bid for contact, and actively avoided contact. Infants in *resistant* relationships were typically quite upset before separations and upon the parent's return, were unable to be comforted, expressed passivity or anger, and were unlikely to actively explore their surroundings, even in the parent's presence. Ainsworth (1979) thought/hypothesized that prompt and responsive caregiving to infant cues and signals over the first year of life—what she called caregiver 'sensitivity'—was a primary driver of a secure versus insecure infant-parent attachment.

Following the exploratory work by Ainsworth and colleagues, many more SSP studies were conducted, both in the US (e.g., Belsky et al., 1984; Easterbrooks & Lamb, 1979; Egeland & Farber, 1984), as well as across the globe (e.g., Durrett et al., 1984; Grossmann et al., 1981; Lamb et al., 1982; McMahan True et al., 2001). The majority found similar distributions of infant-parent attachment to that of Ainsworth & Wittig (1969). The test-retest reliability of the SSP over one month is robust (e.g., Goossens et al., 1986; Waters, 1978), and extensive research exists on the predictive validity of the SSP. Specifically, it has been repeatedly shown that infants in secure attachment relationships have more positive behavioral, cognitive, and interpersonal outcomes compared to their insecure counterparts (e.g., Dagan et al., 2021; Deneault et al., 2021; Deneault, Hammond, & Madigan, 2022; Fearon et al., 2010; Groh et al., 2017; Madigan et al., 2013; Van IJzendoorn et al., 1999).

### *Disorganized Attachment*

Main (1977) noted that some infants could not be readily classified as having classically secure, avoidant, or resistant attachment relationships. In the sample from her doctoral research, she found that five of 49 infants (10%) were "difficult to classify" as they displayed conflict or extreme stress behaviors on reunion with their caregiver in the SSP (Main, 1977). As the SSP became a more popular experimental paradigm, and was being applied to various populations, including those from high-risk environments (e.g., socio-economic deprivation; young parenthood; family violence), other "difficult to classify" cases were identified. Main and Solomon (1990) conducted a review of 200 anomalous SSPs from various research teams to determine whether there were any behavioral consistencies across these cases. This review led to the development of the disorganized/disoriented attachment classification (hereafter referred to as disorganized).

Main and Solomon (1990) suggested that disorganized attachment should be coded when infants exhibit conflicted, confused, or apprehensive behavior towards their caregiver, especially when a pattern of attachment behavior might otherwise be expected. Because disorganized behaviors are often brief, infants classified as disorganized are also classified as having an underlying organized attachment classification of secure, avoidant, or resistant. Ultimately, disorganized attachment is said to develop when a child finds him or herself emotionally and physically dependent on someone who is also, at times, a source of alarm (Duschinsky, 2018). This may be due to a variety of reasons, among which include abuse, maltreatment, or anomalous parenting behaviors (Lyons-Ruth et al., 1999; Madigan et al., 2006; Main & Hesse, 1990). Alarming parenting behaviors are often referred to as "FR" (Frightened or Frightening; Hesse & Main, 2006), "disconnected" (Out et al., 2009), or "disrupted" (Lyons-Ruth et al., 1999)

behaviors. A plethora of studies has demonstrated that infants from dyads classified as disorganized are at increased risk for various problematic outcomes, such as externalizing problems (Fearon et al., 2010), academic difficulties (Moss et al., 1999), and interpersonal problems (Verschueren & Marcoen, 1999).

**Previous Meta-Analyses of the Strange Situation Paradigm**

From the 1980s, the Strange Situation was adopted worldwide as the primary means to assess the quality of the parent-child attachment relationship. Approximately twenty years after its emergence into developmental science, Van IJzendoorn and Kroonenberg (1988) published a meta-analysis on the first 2,000 SSPs emerging from several geographical regions, including the USA, the UK, Germany, Israel, Japan, the Netherlands, Sweden, and China, with a goal of determining the global distribution of parent-child attachment. At that time, only distributions of avoidant, secure, and resistant attachment were available. Consistent with the original study by Ainsworth and Wittig (1969), the majority of infants in the meta-analysis were assigned a classification of secure (65%), and a minority received a classification of avoidant (21%) or resistant (14%). Following the emergence of the disorganized attachment classification, Van IJzendoorn, Schuengel, and Bakermans-Kranenburg (1999) conducted a meta-analysis on 80 studies involving more than 6,000 infant-caregiver dyads. The distribution of attachment amongst these studies was 52% secure, 17% avoidant, 11% resistant, and 21% disorganized.

The study of parent-child attachment has continued to proliferate in the last two decades and has relied upon the SSP as both its foundational measure and for its conceptual underpinnings to examine behavioral differences in child attachment. For example, as of January 2023, citations of Ainsworth et al.'s (1978) seminal book describing the SSP is approximately 35,000. In the last several decades, the methodological rigor of attachment research has also

increased, consistent with developmental science more generally. Accordingly, the sample size in individual studies has climbed, which is critical for the replicability of findings across studies. Comprehensive meta-analyses facilitate the estimation of true effects in psychological research and protect against overinterpretation of differences across studies based on small sample sizes (Maxwell et al., 2015). Thus, the first objective of the current study is to provide a meta-analytic summary of the distribution of SSP classifications from over 50 years of research.

In addition to examining the distribution of SSP classifications in studies amassed to date, we also explore several potential moderators that may account for between-study variation. Specifically, we examine theoretical tenets and hypotheses derived by the pioneers of attachment theory (Ainsworth et al., 1978; Bowly, 1969), as well as subsequent theorists (e.g., Main & Solomon, 1990; Sroufe, 2005) that attachment develops similarly across male and female infants, with both mothers and fathers, that it can be measured any time during the infant's second year of life, and that populations and groups with known risks may be less likely to develop secure attachment. Finally, we examined temporal and geographical trends over 50 years of research. Each potential moderator will be reviewed in detail below.

## Potential Moderators of Infant-Parent Attachment

### *Parameters within which Infant-Parent Attachment May Vary in the SSP*

**Child Age**. Although Ainsworth and Wittig (1969) examined infant attachment in the SSP at 11 months, the SSP coding system in infants is a valid assessment of attachment in infants between the ages of 11-24 months (De Wolff & Van IJzendoorn, 1997). It has been argued that expectations about the caregiver's availability become more consolidated in the child's first 2000 days of life (Bowlby, 1982). The association between caregiver sensitivity and attachment security has been found to strengthen as the child ages (De Wolff & Van IJzendoorn, 1997). By

extension, it is plausible that distributions of attachment may vary as the child grows older, which is something we examine in this paper.

**Child Sex**. Although sex differences can be found in most areas of developmental science and psychological research (Maccoby, 1990), very few sex differences have been found in terms of the distribution of girls' versus boys' attachment relationships with caregivers (Bakermans-Kranenburg & Van IJzendoorn, 2009b), which is consistent with the notion that attachment develops similarly in male and female infants. Nonetheless, some theorists have proposed that attachment may develop in sex-specific ways (Del Giudice & Belsky, 2010); therefore, the distribution of SSP classifications based on child sex will be examined in this meta-analysis.

**Socio-Demographic Risk**. Initially, studies using the SSP were largely conducted on middle-class or community samples. However, as the study of infant attachment began to flourish, opportunities for studying the nature of the parent-child relationship in samples with known risks increased. Both parent- or family-related risks and child-related risks have been examined in terms of predicting variation in the distribution of attachment classifications. Parent- or family-related risks include poverty or low socio-economic status as well as adolescent and/or single parenthood (Verhage et al., 2020). Theoretically, it is anticipated that insecure, especially disorganized attachment, would be more likely to develop in infants in such high-risk environments because their parents are burdened by many other life stressors (e.g., community violence; financial stress) and are therefore hampered in their potential for displaying responsiveness in their interactions with the child (e.g., less caregiver sensitivity and potentially more FR or disrupted parenting behaviors; Lyons-Ruth et al., 1999; Main & Hesse, 1990). The general patterning of findings has been that higher rates of insecure (i.e., avoidant, resistant, and

disorganized) attachment relationships have been observed in samples with parent- or family-related risks, compared to those without such risks (see Van IJzendoorn et al., 1992). When the parent demonstrates more severely disturbed parenting behaviors, such as physical abuse, or when a manifold of demographic risks are in the way of adequate parenting, disorganized attachment has been shown to be more likely to develop (Cyr et al., 2010).

**Race/Ethnicity.** The notion of what constitutes "attachment security" and "caregiver sensitivity" may be ethnocentrically biased toward Western beliefs and values of optimal ways of being and behaving. The most-used attachment measures have been initially developed based on White middle-class samples and much of the initial validity testing in the field was consistent with that narrow demographic. When lower proportions of children with secure attachment are found in racially minoritized groups, the issue of validity should be raised. Bakermans-Kranenburg et al. (2004) examined whether security of attachment as assessed with the Attachment Q-Sort (Waters & Deane, 1985) varied as a function of children being White versus Black using the NICHD Early Childcare Research Network data set. They found that ratings of attachment security were indeed lower in Black versus White children, as were measures of caregiver sensitivity. However, the pattern of covariation between attachment security and predictor variables was similar in both groups, and mean level differences in parenting were explained by differences in socio-economic status (lower income was related to lower parental sensitivity, in line with the family stress model). While this does not exclude the possibility that racial bias may exist for attachment and parenting measures, these findings still increase the plausibility that attachment theory and its central measures apply across ethnic and racial boundaries. In the current synthesis, we will further examine how patterns of attachment are distributed across racially minoritized groups.

**Child Maltreatment**. The etiology of disorganized attachment broadly has been proposed to be the child's experience of 'fright without solution' (Hesse & Main, 1999), leading to disorganized and/or disoriented attachment behavior. In maltreating families in particular, it is proposed that the maltreating caregiver is simultaneously the attachment figure providing safety when the attachment system is activated and also the source of fear. It is suggested that this pattern may lead to a breakdown at the level of the behavioral strategy, resulting in misdirected, confused, and contradictory attachment behavior. Maltreatment includes physical, sexual, and emotional abuse, as well as neglect. Parents who engage in maltreatment are also more likely to demonstrate parenting behaviors that are characterized as hostile and controlling (Savage et al., 2019). These acts toward the child can instigate stress, fear, and alarm, and as they often occur within the context of the caregiving relationship, can also serve to significantly disrupt and jeopardize the attachment relationship. A meta-analysis by Van IJzendoorn et al. (1999) of 5 studies (with 323 parent-child dyads) demonstrated that infants who endure maltreatment (versus those who do not) are three times more likely to develop disorganized attachment. Given the relevance of maltreatment and disorganized attachment on infants' later life outcomes, it is important to revisit whether maltreatment confers risk for disorganized attachment in a larger set of studies.

**Child Medical Risks and Prematurity**. Child risks include medical risks such as premature birth or chronic medical illnesses (e.g., congenital heart disease). In contrast to parent- or family-related risks, the hypothesis for child-related risks has been that sensitive parents are likely to compensate for the potentially atypical ways of infants communicating distress due to their medical condition and find ways to stimulate the development of secure attachment (Van IJzendoorn et al., 1992). In a meta-analysis examining the distribution of attachment in samples

with child-related risks, Van IJzendoorn et al. (1992) found that infants born premature ($k$ = 6, $N$ = 229), as well as infants with medical risks ($k$ = 3, $N$ = 122), had similar rates of secure attachment as compared to infants without such risks. The expectation, therefore, is that parent- or family-related risks (e.g., parenting stress) may play a more important role in the unfolding of the quality of the attachment relationship than child-related risks.

**Clinical Status**. Another factor proposed to explain variation in the distribution of SSP classifications is the clinical status of the parent and/or child. It is well-established that parental psychopathology can place the child's well-being and optimal developmental trajectory in jeopardy (Connell & Goodman, 2002; Goodman et al., 2011; Hentges et al., 2020; Madigan et al., 2018; Smith & Farrington, 2004). It may also pose a risk to the parent-child attachment relationship, as caregivers burdened by their own mental illness may have difficulty perceiving or attending to the infant's signals and cues for contact and need, which in turn may interfere with the promotion of secure attachment.

Women with depression, for example, may be less responsive, and more inattentive, hostile, intrusive, and/or withdrawn in their parenting behavior (Bernard et al., 2018; Gelfand & Teti, 1990). Although some studies with infants of parents with depression, bipolar disorder, anxiety, and substance abuse have indicated increased rates of insecure attachment (DeMulder & Radke-Yarrow, 1991; Hobson et al., 2005; Manassis et al., 1994; Radke-Yarrow et al., 1985; D. M. Teti et al., 1995), findings have been mixed (Wan & Green, 2009). For example, while some studies have found that disorganized attachment was more probable under conditions of maternal mental health risk, others have found that the development of insecure-avoidant and insecure-resistant attachment was also more likely to occur (Espinosa et al., 2001; Manassis et al., 1994).

Thus, the current meta-analysis will examine parent psychopathology as a potential moderator of the distribution of SSP classifications.

The study of child-parent attachment has been investigated in both typically developing samples, as well as atypically developing samples, such as infants with Autism Spectrum Disorder (ASD), intellectual disability, and failure to thrive (Gordon & Jameson, 1979; Koren-Karie et al., 2009; Van IJzendoorn et al., 2007). The distributions of infant-parent attachment in these atypically developing samples with a neurodevelopmental condition have varied considerably and are dependent on the child's mental capacities. Thus, this inconsistency in findings signals a need to meta-analytically examine whether the distribution of attachment differs in atypically versus typically developing infants.

**Attachment to Other Caregivers.** The SSP was developed based on extensive home and laboratory observation of infant-mother dyads, where the infants' primary caregivers were mothers (Ainsworth et al., 1978). Research on parent-child attachment has largely been conducted with mothers, although there have also been studies of attachment with other caregivers, including fathers, adoptive or foster parents, and professional caregivers (e.g., Goldberg & Easterbrooks, 1984; Lamb, 1977; Madigan et al., 2011; Steele & Steele, 2017). This practice is consistent with the foundational premise that attachment relationships can be formed across different contexts (e.g., foster care) and developmental periods (e.g., toddlerhood) (Howes & Spieker, 2008). In terms of infant-father attachment, Lamb (1977) demonstrated early on that infants develop direct attachment behaviors toward fathers and can also be soothed by fathers when distressed. While some degree of concordance between attachment classifications is expected for mothers and fathers, for example, within the same household due to 'assortative mating' (Van IJzendoorn & De Wolff, 1997), differences in attachment across caregivers are

also observed (Fox et al., 1991). Moreover, meta-analytic research on the developmental correlates (e.g., internalizing and externalizing behavior problems) of infant-mother and infant-father attachment have also shown similar magnitudes of association (Deneault et al., 2021). In direct comparison, an individual participant data meta-analysis established equivalent predictive associations for infant-mother and infant-father attachment quality (Dagan & Sagi-Schwartz, 2021). Thus, in the current meta-analysis, we will compare the distributions of infant-mother and infant-father attachment to determine if they are similar or statistically different.

In terms of foster care and adoptive families, it was initially suggested that a sensitive period in infancy existed for forming attachment relationships (e.g., Smyke et al., 2012; Tizard & Rees, 1975; Van den Dries et al., 2009; Yarrow & Goodwin, 1973); however studies with infants who have been adopted from foster or institutional care in the first two years of life have shown similar rates of secure attachment compared to infants raised with their birth parents (e.g., Singer et al., 1985; see for meta-analytic evidence Van den Dries et al., 2009). That said, adopted infants from institutional settings who are exposed to conditions of structural neglect (Van IJzendoorn et al., 2020), or who have experienced maltreatment, may have predisposing challenges in forming secure attachments with later foster caregivers or adoptive parents (Cyr et al., 2010; Dozier & Rutter, 2016; Howes & Spieker, 2008). For example, in a study of 50 infants placed with foster caregivers (Dozier et al., 2001), 52% of infants developed a secure attachment with foster caregivers, which is consistent with early meta-analytic estimates (51.5% secure; Van IJzendoorn et al., 1999). However, amongst the insecure categories, a large proportion of infants in foster care developed disorganized attachment (34% versus 21% in the Van IJzendoorn et al., 1999 meta-analysis). Together, these findings warrant further investigation into the distributions of attachment amongst biological and foster/adopted infant-caregiver attachment.

### *Temporal and Geographical Trends in Infant-Parent Attachment*

**Temporal Trends**. There are several reasons to examine temporality as a potential moderator of changes in the distribution of attachment. First, it is possible that coding practices have changed over the last five decades. Originally, SSP classifications were derived based on extensive notetaking of infant attachment behaviors in the SSP. With advancing technology, SSPs were later videotaped and extensively reviewed to determine SSP classifications, albeit using the same classification protocol as Ainsworth et al. (1978). Moreover, the psychometric properties of the SSP may have changed over time. Greater expectations to demonstrate fidelity to measurement use (i.e., become a trained and reliable coder based on expert ratings) and to establish inter-rater reliability among coders may have increased classification precision and affected distributions of attachment. Second, there have been drastic changes in the last 50 years in family stressors and resources (Cabrera et al., 2000), such as moving from single to dual working families, later age of childbearing, and increases in divorce rates, which may have impacted distributions of attachment.

**Geographical Trends.** In his seminal writings, Bowlby (1982) strongly emphasized that all human infants were predisposed to develop attachments. The notion of the universality of attachment was also the foundation for Mary Ainsworth's fieldwork in Uganda in 1954-1955 where the impetus for the SSP classifications was borne out of Ainsworth's extensive observations of 28 infant-mother dyads, which she describes as either "securely attached", "insecurely attached", or "non-attached". In the urban setting of Baltimore, Ainsworth would further define these groups based on her observations of middle-class infant-mother dyads, which would become her tripartite classification system of secure, resistant, and avoidant attachment (Mesman et al., 2016). The assumption of attachment as being universal, in that

infants are wired to develop an attachment behavioral system across geographical regions, has been repeatedly tested and supported in cross-cultural studies conducted since the seminal work by Ainsworth.

Initially, SSP studies following Ainsworth et al. (1978) were primarily conducted in North America and to this day, a large proportion of the published literature originates from WEIRD countries (Western, Educated, Industrialized, Rich, and Democratic). In 1988, Van IJzendoorn and Kroonenberg examined 32 studies (2000 dyads) across a limited group of countries and found both cross-cultural similarities and differences. Specifically, secure attachment was the dominant classification across all cultures (Mean = 65%), compared to avoidant (21%) and resistant (14%) classifications. For example, in Van IJzendoorn and Kroonenberg's (1988) meta-analysis, insecure attachment was generally of an avoidant pattern in one German sample. By contrast, in one sample from Israel and another from Japan, the frequency of resistant attachment was higher. Van IJzendoorn and Kroonenberg concluded that additional data were needed to establish a global distribution of infant attachment classifications and to adequately address potential cross-cultural variation. For instance, their meta-analysis included no studies at all from the Global South. Furthermore, the importance of additional data was signaled by apparent cultural differences that generated considerable discussion at the time, but in fact, have not been replicated in subsequent samples. For example, in a German study from Bielefeld, the proportion of avoidant attachment was higher (48%; Grossmann et al., 1985), but this has not been found by subsequent research (e.g., 27.5% avoidant; Wartner et al., 1994). In an early Japanese study, the proportion of resistant attachment was higher (32% resistant; (Takahashi, 1986). This higher proportion has not been found by subsequent studies in Japan (e.g. 16% resistant; (Kondo-Ikemura et al., 2018). The early Japanese findings appear to have

been due to coding errors; when the Strange Situations were reanalyzed by researchers with inter-lab reliability, no difference was seen (11% resistant; (Grossmann & Grossmann, 1989). Duschinsky (2020) has argued that cultural stereotypes about Germany and Japan have contributed to an over-emphasis on the early findings and attenuated awareness of growing evidence of lack of replication. Moreover, with the emergence of the disorganized attachment classification, an updated examination of the cross-cultural variability of the disorganized attachment category, which has not been formally conducted, is warranted.

**The Current Study**

Today, the SSP has been conducted in approximately 20,000 dyads, across 21 countries, with representation from each populated continent in the world. Thus, the current study will synthesize 50 years of research on the use of a staple measure for evaluating the quality of infant-parent attachment relationship to produce reliable estimates of the distribution of the four attachment classifications derived in the SSP: secure, avoidant, resistant, and disorganized. In addition to examining the distributions of the SSP classifications, a series of moderator analyses will be conducted to determine if and when distributions of attachment are different.

Previous meta-analytic work on the SSP attachment classifications, published decades ago, pooled frequencies to derive the prevalence estimates of each attachment classification. In such analyses, average effect sizes are computed based on standard conversion formulas for each contrast (e.g., avoidant versus secure + resistant + disorganized) and subjected to standard random effects meta-analysis. However, these analyses do not capture the multinomial nature of the data, and hence estimated proportions will not, for example, sum to 1 (or 100% when avoidant, secure, resistant, and disorganized attachment are tallied), as they should. The multinomial multilevel approaches adopted in the current study addresses both these issues and

provides a flexible framework for meta-analyzing multinomial data, including categorical and continuous moderators and multivariable analyses.

## Method

### Cataloguing Studies on Parent-Child Attachment

Data from the current study was extracted from the newly developed Child Attachment Studies Catalogue and Data Exchange (CASCADE; Madigan, 2020) Project, which has compiled data gathered on all published attachment studies to date up to August 2020. CASCADE serves as a comprehensive database that contains information relevant for researchers interested in examining parent-child attachment relationships, such as attachment distributions in different populations and the related variables assessed in various studies. Data from all relevant studies have been extracted and catalogued for ease of conducting conventional meta-analyses, and if needed, informing researchers as to relevant studies for Individual Participant Data (IPD) meta-analyses. By creating an inventory of available data amassed in the field of observational measures of parent-child attachment to date, CASCADE is intended to expedite meta-analyses in the field of attachment by reducing time spent on abstract review and data extraction.

### Search Strategy

This meta-analysis was conducted following the recommendations and standards set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher et al., 2009). A science librarian conducted searches in PsycINFO, MEDLINE, EMBASE, Web of Science[1], and Dissertation Abstracts International for published and unpublished studies from

[1] Web of Science citation indexes included: Science Citation Index Expanded (SCI-EXPANDED) --1900-August 5, 2020; Social Sciences Citation Index (SSCI) --1900- August 5, 2020; Arts & Humanities Citation Index (A&HCI) --1975- August 5, 2020; Conference Proceedings Citation Index- Science (CPCI-S) --1990- August 5, 2020;

1967 to August 5, 2020. Database-specific headings and text word fields were searched for concepts of "strange situation" and "attachment", with truncation symbols used to capture variant endings and spellings (e.g., infant*). Synonymous terms were combined with the Boolean "OR", and the concepts were combined with the Boolean "AND". No language or publication restrictions were applied. A total of 24,980 non-duplicate abstracts were identified across the various databases (see PRISMA flow diagram in Figure 1). In addition, meta-analyses in the field were screened for additional relevant studies, which resulted in the addition of 22 studies not identified by the search strategy.

**Inclusion and Exclusion Criteria**

Studies were screened by three independent coders for the following inclusion criteria: (a) attachment was assessed in the Strange Situation Paradigm; (b) the study reported the distribution (i.e., *n* for each attachment classification and total sample *N*) for each of avoidant, secure, resistant, and disorganized attachment, (c) the SSP was conducted with fathers, mothers, or adoptive/foster caregivers; and (d) language was assessed in English, French, and Spanish. Studies that went beyond the typical age of the SSP (i.e., ~11-24 months) up to 48 months were included if justified by the study authors due to exceptional circumstances (e.g., sample of infants with developmental disabilities or Autism Spectrum Disorder). Intervention studies were included only for pre-intervention (i.e., baseline) assessment of parent-child attachment in the SSP. Exclusion criteria were (a) did not present data for disorganized attachment (i.e., only provided distributions for secure, avoidant, and resistant); (b) use of modified versions of the Strange Situation Paradigm designed for older (i.e., preschool- or school-aged) children (Cassidy

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Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH) --1990- August 5, 2020; Emerging Sources Citation Index (ESCI) --2015- August 5, 2020.

et al., 1992; Main & Cassidy, 1988), as these paradigms have classifications of attachment beyond those used in the traditional Ainsworth et al. (1978) coding system, and accordingly, different coding protocols for classifying attachment; (c) infant attachment was assessed with professional caregivers, grandparents and/or older siblings. In the event that titles and abstracts were insufficient to determine meeting or excluding eligibility criteria, full texts were retrieved.

## Data Extraction

A standard coding proceduing was developed by the research team to extract data from each study on measurement characteristics, as well as study-level and sample-level moderators (see Table 1). One coder extracted all distribution data and potential moderator variables from the studies meeting inclusion criteria. A second independent coder performed data extraction on 22% of randomly selected studies to determine inter-rater reliability. Percent agreement for categorical moderators was 93% ($\kappa = .77$), for continuous moderators, agreement was ICC = .90, and agreement on the extraction of SSP distributions was 99%. Any discrepancies were resolved by review and discussion, and consensus coding was used in data analysis.

Categorical moderators (such as parent gender, SES, etc.) were determined based on 80% or more of the sample falling in a given category. If the information for any given moderator was missing, it was coded as 'not specified,' unless indicated below. Three general categories of moderators were examined: general study characteristics, temporal trends, and regional factors.

## Potential Moderators

### *General Study Characteristics*

**Child Age and Sex.** Child age in months at the time of the SSP was recorded. Child sex was recorded as a percent of the sample that was indicated as male. Consistent with other studies,

if no information was provided regarding the sex distribution of the child sample, sex was coded as 50% male.

**Demographic Risk.** Categorized as a demographic risk when samples were considered to have low socio-economic status versus middle to upper SES and/or diverse samples. These classifications were typically based on how samples were defined by the authors (e.g., a low-income sample, a middle to high SES sample). Yet, if the authors did not provide a classification, SES was determined based on the reported income and education of participants.

**Race**. A two-category variable was created to represent samples where the proportion of sample emerged from a minoritized racial or ethnic group versus White. Samples were only considered to be racially minoritized if they emerged from countries where the majority race was White (e.g., USA, Canada, UK, Europe).

**Child Maltreatment.** A two-category variable was created to represent samples where the child had experienced maltreatment, such as physical abuse, sexual abuse, or neglect (yes/no).

**Child Neurodevelopmental Condition.** A two-category variable was created to represent child neurodevelopmental condition or disorder (yes/no). This could include Autism Spectrum Disorder, Down Syndrome, cerebral palsy, hearing impairment, and intellectual disability.

**Child Medical Condition.** A two-category variable was created to represent samples that had infants with medical conditions or diagnoses (yes/no), such as sleep problems, cystic fibrosis, congenital heart disease, craniofacial abnormalities, and failure to thrive.

**Prematurity.** A two-category variable was created to represent whether the child was born premature or not (yes/no) as defined by individual samples.

**Parent Sex.** Categorized as father-child or mother-child samples.

**Adopted or Foster Caregiver.** A two-category variable was created to represent the biological relatedness of the infant-parent dyads, which was coded as follows: (a) biologically related or (b) fostered/adopted.

**Parental Maltreatment Experiences.** A two-category variable was created to represent samples with parents having a maltreatment history, such as physical abuse, sexual abuse, or neglect (yes/no).

**Parent Psychopathology.** A two-category variable was created to represent parent psychopathology (yes/no). Parent psychopathology status could be based on a diagnosis, or a clinical cut-off on a validated instrument and included psychopathologies such as substance use, depression, anxiety, or other psychiatric disorder.

### *Temporal Trends*

**Publication Year.** To estimate whether distributions of attachment have changed over time, the date of publication in years was recorded.

### *Regional Factors*

**Global Geographical Region.** The country or continent in which the study took place was recorded and coded as: (a) Africa; (b) Asia; (c) Australia/NZ; (d) Europe; (e) Middle East (all studies in this region were from Israel); (f) North America; or (g) South America. We examine the Middle East as a global geographical region for two reasons: (a) it is a transcontinental region with a boundary between Africa, Asia, and Europe; and (b) early research on attachment classifications in infants in Israel suggested more distinctive distribution of SSPs, with fewer avoidant and more resistant attachment relationships. As all studies conducted in the

Middle East were conducted in Israel, we henceforth refer to this geographical region as Israel rather than the Middle East.

**Data Synthesis**

Each sample was only represented once. Several steps were taken to ensure that each dataset contained independent samples. First, we extracted any notable characteristics pertaining to sample and recruitment, including if the sample was part of a longitudinal study or resource study (e.g., NICHD Study of Early Child Care and Youth Development). Next, we cross-referenced authors across studies, using the first and last authors as a reference point. If sample overlap was identified, the study with the largest sample size and/or most comprehensive information available for data extraction was selected for inclusion. Some studies had assessed the SSP at multiple time points with the same caregiver. In these samples, we selected the latest assessment of SSP as the later age of attachment was less represented in our dataset. In some studies, results were presented separately for infant-mother and infant-father attachment. In such cases, we selected infant-father over infant-mother attachment distributions as fathers were less represented in our dataset.

**Data Analysis**

Random effects are estimated to capture between-study variability in outcomes of interest (Higgins et al., 2009). Although this is most commonly applied in the context of normally distributed outcomes, the approach can be extended to polytomous data by using a multinomial logit model with random intercepts (Skrondal & Rabe-Hesketh, 2003). In this framework, the between-study variability is estimated by $k$-1 random intercepts, reflecting variance in the contrast between one category and a reference category (in this study, we selected secure as the reference category). Estimation is by maximum likelihood with the Newton-Raphson algorithm

and adaptive quadrature. The *k*-1 random effects are assumed to correlate. To ensure the stability of the estimates and avoid local minima, the number of iterations and points of integration were gradually increased, with the final estimates of one estimation providing the starting values for the next, until consistent estimates were obtained; 95% confidence intervals (CIs) are presented around all estimates. Due to the number of analyses conducted, we set a more conservative *p*-value of .01 to assess the significance of moderators (Lakens et al., 2018). We did not conduct publication bias testing as it is not recommended for analyses of proportion meta-analyses (see Barker, Migliavaca & Stein, 2021).

### Transparency and Openness

The meta-analysis of the distribution of attachment classifications was conducted using the Stata package GLLAMM version 2.3.2 (STATA version 16), which estimates generalized linear mixed models with random effects. Analysis code and research materials relevant to this submission can be found at this link: https://osf.io/fr4e5/?view_only=2f1e35e7bebc4d28b12691a9d1a0ece4. The data approach adopted the hierarchical linear modelling framework for meta-analysis, in which individual data points are nested within studies. This review was not preregistered.

## Results

### Study Characteristics

Supplemental Table 1 presents the sample and study characteristics for all studies included in the current synthesis and Supplemental Table 2 provides the study moderator characteristics for all included studies. A total of 285 studies with 20,720 infant-parent dyads met our criteria (mean % male: 51.7%, median: 50%), with publication dates between 1987-2020. The study sample sizes ranged from 7 to 1149 infant-parent dyads, with a medium sample size of

51. In terms of publication status, 250 (87.8%) were published, and 35 (12.2%) were unpublished. Infants and parents had a mean age of 17.6 months and 29.6 years, respectively. In terms of parent gender, 273 studies (95.8%) included infant-mother dyads and 12 (4.2%) included infant-father dyads. Seventy-seven (27.0%) samples were considered socio-demographically at risk, 42 (15%) racially minoritized samples, 30 (10.5%) in which the parent had psychopathology, 10 (3.5%) were samples in which the child had been maltreated, 6 (2.1%) in which the parent had a maltreatment history, 10 (3.5%) were children placed in foster care or adopted from foster or institutional care, 6 (2.1%) were samples where infants had neurodevelopmental conditions, 14 (4.9%) were samples where infants had medical conditions, and 6 (2.1%) were samples in which the child was born premature. Finally, in terms of geographical location, the large majority of studies were conducted in North America ($k$ = 203; 71.2%), with the remaining conducted in Europe ($k$ = 57, 20.0%), Africa ($k$ = 4, 1.4%), Asia ($k$ = 5, 1.7%), Australia/New Zealand ($k$ = 5, 1.7%), Israel ($k$ = 6, 2.1%), and South America ($k$ = 5, 1.7%).

## Global Distribution of 4-Way Attachment Classifications

Prior to testing moderators, we estimated the overall prevalence of the four attachment categories and the degree of variance in their estimates across all studies. In this overall analysis (log-likelihood = 19213.5) involving 285 studies and 20,720 children, the global distribution was estimated as 14.7% Avoidant (CI [13.6%, 15.8%]), 51.6% Secure (CI [49.6%, 53.5%]), 10.2% Resistant (CI [9.3%, 11.1%]) and 23.5% Disorganized (CI [21.6%, 25.6%]). There was substantial variance in the proportions across studies for all three contrasts (A versus B: =.57, *SE* = .068; C versus B = .59, *SE* = .078; D versus B = 1.05, *SE* = .11).

### *Differences in the Global Distribution of Attachment Classifications*

**Child Age and Sex**. To estimate differences in the global distribution of attachment classifications as a function of child age, we added this variable as a moderator in the multilevel model, for each contrast of an insecure classification in relation to the secure reference category. None of the three contrasts was significant at the $p < .01$ level (Avoidant relative to Secure: $B = .009$, $SE = .005$, $p = .09$; Resistant relative to Secure: $B = .003$, $SE = .006$, $p = .62$; Disorganized relative to Secure: $B = .008$, $SE = .007$, $p = .30$). We ran a similar analysis to estimate differences in the global distribution of attachment classifications as a function of child sex. Again, none of the three contrasts was significant at the $p < .01$ level (Avoidant relative to Secure: $B = -.003$, $SE = .006$, $p = .63$; Resistant relative to Secure: $B = .001$, $SE = .006$, $p = .90$; Disorganized relative to Secure: $B = .001$, $SE = .007$, $p = .88$).

**Parent Gender.** As detailed in Table 2, for mothers, the global distribution across $k = 275$ was estimated as 14.7% Avoidant (CI [13.5%, 15.9%%]), 51.2% Secure (CI [49.2%, 53.4%]), 10.3% Resistant (CI [9.3%, 11.3%]) and 23.8% Disorganized (CI [22.0%, 25.8%]). For fathers, the global distribution across $k = 12$ studies was estimated as 13.6% Avoidant (CI [9.6%, 18.6%]), 61.2% Secure (CI [51.2%, 69.5%]), 8.8% Resistant (CI [5.8%, 12.9%]) and 16.5% Disorganized (CI [11%, 24.6%]).

To estimate differences in the global distribution of attachment classifications as a function of parent gender, we added gender as a moderator in the multilevel model for each contrast of an insecure classification in relation to the secure reference category. None of the three contrasts was significant at the $p < .01$ level (Avoidant relative to Secure: $B = -.29$, $SE = .25$, $p = .24$; Resistant relative to Secure: $B = -.36$, $SE = .27$, $p = .18$; Disorganized relative to Secure: $B = -.62$, $SE = .32$, $p = .05$).

**Temporal Trends in Prevalence of Attachment Classification**

To analyze differences in the prevalence of the four attachment classifications over time, we fitted linear time trends, based on publication year, to the multinomial multilevel model described above, with separate linear time trends for each contrast between security and the three subcategories of insecure attachment. These analyses revealed a clear negative linear trend for avoidance relative to security ($B$ = -.27, $SE$ = .06, $Z$ = 5.31, $p$ <.001). No clear differences were observed in the relative prevalence of resistance or disorganization as a linear function of publication year ($B$ = -.03, $SE$ = .057, $Z$ = .54, $p$ = .59, and $B$ = -.13, $SE$ = .066, $Z$ = 1.95, $p$ = .051 respectively). A scatterplot of the association between avoidance and publication year is shown below in Figure 2. It is notable that a small number of early studies showed quite extreme proportions, but even excluding these, the decline remained robust. Inspection of the raw data depicted in Figure 2 suggested a potential curvilinear time trend, with the steepest declines occurring in the earlier periods of research. Refitting the hierarchical model with a quadratic term provided only limited evidence of this, with a quadratic term for the relative proportion of avoidance to security of $B$ =.12, $SE$ = .06, $p$ = .03.

**Moderator Analyses**

Planned moderator analyses were conducted one by one in separate generalized multinomial random intercept models with fixed effect covariates (the moderators). All significant moderators are discussed in detail below, and results of all moderator analyses are summarized in Tables 3-6. The parameters in Table 3 indicate the distribution of attachent categories based on indicators (i.e., moderator variables) being present or absent for children. The parameters in Table 4 refer to the difference in rates between each insecure category and the secure category as a function of a 1-unit change in the moderator. The moderators that showed the most robust differences were family demographic risk and child maltreatment. To help

interpret these moderator effects, we ran separate proportion-based meta-analyses (using the logistic-normal random-effects model, Nyaga, Arbyn & Aerts, 2014) for each insecure group (proportion avoidant [versus-not], proportion resistant [versus-not], proportion disorganized [versus-not]). We opted to compare each target group to the others, rather than each insecure category to security in order to retain all cases in the analysis and maintain comparability with the majority of previous meta-analyses that have adopted this approach. In supplementary analyses, we present the same analyses with direct comparisons between each individual insecure category and security (see Supplemental Table 3).

**Demographic Risk.** These analyses showed that the proportion of avoidant infants was marginally higher in populations at increased demographic risk (17%, CI [15%, 20%)] than in populations not at demographic risk (14%, CI 12%, 15%), between group heterogeneity $Q$ = 8.45, $p < .001$). Differences were more marked for disorganization, with a rate of disorganization of 31% in the demographic risk population studies (CI [28%, 36%]), compared to 21% (CI [16%, 20%]) in studies from not at-risk populations ($Q$ = 21.16, $p <.001$). Rates of resistant attachment were essentially the same in populations at demographic risk (9%, CI [8%-11%]) compared to populations not at-risk (11%, CI [10%-12%] $Q$ = 3.65, $p$ = .06). Rates of security were lower in demographic risk samples (42%, CI [38%, 46%] than in non-risk samples (55%, CI [53%, 57%]; $Q$ = 25.92, $p < .001$). The raw data and mean proportions are shown in Figure 3 as boxplots.

**Race/Ethnicity.** Consistent with the results in Tables 3-4, no statistical differences were observed between samples of racially minoritized compared to White children for avoidance (15% CI [12%, 18%] versus 15% CI [14%, 16%]), security (50%, CI [45%, 55%] versus 52% CI [50%, 54%]), resistance (10% CI [8%, 13%] versus 10% CI [9%, 11%]) or disorganization (25%, CI [20%, 30%] versus 23% CI [21%, 23%]).

**Child Maltreatment.** There was no difference in the rates of avoidant attachment between maltreated samples (15%, CI [9%, 22%]) compared to non-maltreated samples (15%, CI [14%, 16%]; $Q = .01$, $p = .92$). Rates of disorganized attachment were much higher in maltreated samples (60% CI [48%, 71%]), compared to non-maltreated samples (22%, CI [20%, 24%]; $Q = 24.9$, $p < .001$). Rates of resistant attachment were essentially the same in maltreated samples (8%, CI [4%, 14%]) and non-maltreated samples (9%, CI [10%, 11%]; $Q = .96$, $p = .33$). The proportion of secure classifications was much lower in maltreated samples (17%, CI [11%, 25%]) compared to non-maltreated samples (53%, CI [51%, 55%]; $Q = 19.15$, $p < .001$). See also Figure 3.

**Parental Psychopathology.** Marginally higher rates of disorganized attachment were observed in samples selected for parental psychopathology (31%, CI [24%, 37%] than those not (23%, CI [21%, 25%]; $Q = 6.52$, $p = .01$). Rates of security were marginally lower in these samples (44%, CI [38%, 50%]) compared to non-selected samples (52%, CI [51%, 55%], $Q = 3.66$, $p = .06$). There were no differences in rates of avoidance (15% in both populations) or resistance (10% in both populations).

**Foster Care and Adoption from Foster or Institutional Care.** Rates of avoidant attachment were considerably lower in samples that had been adopted/fostered (6%, CI [3%, 10%], compared to non-adopted/non-fostered samples (15%, CI [14%, 16%]; $Q = 24.8$, $p < .001$). Rates of secure (47%, CI [36%, 58%] and resistant (7%, CI [4%, 13%]) were not reliably different to non-adopted/fostered samples, though confidence intervals were wide. Rates of disorganized attachment were higher in adopted/fostered children (40%, CI [27%, 52%]) compared to non-adopted/fostered children (23%, CI [21%, 25%], $Q = 6.93$, $p = .01$.

**Parental Maltreatment.** There were no differences in rates of avoidance between samples with reported parental maltreatment and those without (18%, CI [10%, 28%]) versus 15%, CI [14%, 16%]). Similarly, despite quite large numerical differences in the rate of security between those samples with reported parental maltreatment and those without (33% CI [22%, 45%] versus 52% CI [50%, 54%]), the difference was not statistically significant. No differences were observed for resistance (9% CI [ 5%, 16%] versus 10% CI [9%, 11%]), or for disorganization (39% CI [25%, 55%] versus 23% CI [21%, 25%]).

**Child Neurodevelopmental Condition.** Consistent with the hierarchical multinomial model results, the meta-analysis of proportions revealed no differences in rates of avoidance in samples of children with neurodevelopmental conditions than those without (14% CI [9%, 19%] versus 15%, CI [14%, 16%]) , or similarly in the rates of security (50% CI [41%, 59%] versus 52% CI [49%, 54%]), resistance (10%, CI [6%, 15%]) versus 10% CI [9%, 11%]) or disorganization (27% CI [19%, 36%] versus 23% CI [21%, 25%]).

**Child Medical Condition.** Consistent with the results in Tables 3-4, no differences were observed between samples of children with medical conditions compared to those without for avoidance (17% CI [12%, 23%] versus 15% CI [14%, 16%]), security (55%, CI [45%, 63%] versus 51% CI [49%, 54%]), resistance (11% CI [7%, 16%] versus 10% CI [9%, 11%]) or disorganization (17%, CI [11%, 26%] versus 24% CI [22%, 26%]).

**Prematurity.** Finally, as indicated in Tables 3-4, no differences were observed between samples of children who were born prematurely versus those that were not, for avoidance (20% CI [13%, 30%] versus 15% CI [13%, 16%]), security (58% CI [46%, 69%] versus 51% CI [49%, 53%]), resistance (8% CI [4%, 14%] versus 10% CI [9%, 11%]) or disorganization (14%, CI [7%, 23%] versus 24% CI [22%, 26%]).

**Regional Differences in Distribution of Attachment Classification**

The multinomial multilevel model was run again with the global region entered as a moderator and North America categorized as the reference category. Tables 5-6 displays the results of this analysis. As can be seen from the tables, there was evidence of some differences in the distribution of attachment classifications between North America and other regions of the world, particularly Asia, Australia/New Zealand, and South America. In supplementary analyses, we present the same analyses with direct comparisons between each individual insecure category and security (see Supplemental Table 4).

Boxplots of the proportions of secure, resistant, avoidant, and disorganized attachment classifications by region are also shown in Figure 4 and model estimated regional differences in attachment distributions (with 95% Cis) are presented in Figure 5[1]. As can be seen from these figures, the highest rates of secure attachment were seen in Africa and Asia and the lowest rates in South America. It is important to consider that the numbers of samples outside North America or Europe were/are uniformly low, and the heterogeneity, both in terms of kinds of populations studied but also in the statistical sense, was higher in Europe and North America. It is also important to note that the set of South American studies included one study that focused on a malnourished population and had an extremely low rate of security.

**Multivariable Analysis**

As several moderators were associated with differences in the distribution of attachment classifications, we conducted a final analysis in which these moderators were included in a single model to estimate their independent associations with attachment. This analysis revealed no

[1] Because Figure 4 presents the raw, unweighted proportions, the average proportion displayed may not correspond perfectly with the multilevel model estimates in Figure 5, because these take sample sizes and study weights and heterogeneity into account.

substantial changes to the associations described above, except that parental psychopathology was no longer associated with a higher rate of D after adjustments for the other moderators (see Supplemental Table 5).

## Discussion

For over 50 years, the most relied upon measure to examine individual differences in attachment and exploration behaviors has been the SSP. Since its inception, the SSP has remained constant as a procedure for assessing infant-parent attachment relationships, allowing the field to accumulate a large corpus of robust research evidence on this key area of human development. At the same time, there have been extensive sociological changes in the last half-century, and the research field has also pursued numerous new avenues, as well as widening its reach across the globe. In the current study, we take stock of the data amassed to date on the SSP by examining the distribution of parent-child attachment globally, exploring temporal trends, and investigating whether attachment classifications differ based on various risk and clinical indicators. In our synthesis of 285 studies and over 20,000 parent-child dyads with data on all four attachment classifications, we found that the global distribution of infant-parent attachment was 51.6% secure, 14.7% avoidant, 10.2% resistant, and 23.5% disorganized. Time trends revealed that avoidant compared to secure attachment has decreased over time. Several moderators were identified, including socio-demographic risk, child maltreatment, adoption/foster caregiving, and parental psychopathology, as well as regional differences. Each is discussed in turn below, followed by a consideration of study limitations and future directions for attachment research.

### Temporal Trends

Temporal trends revealed that across a period of 35 years, studies have been reporting smaller proportions of avoidant child-parent attachment relationships relative to proportions of secure attachment, while time trends in proportions of resistant and disorganized attachment were not statistically significant. From 1980's onward, several research groups have been offering training for researchers and clinicians across the globe in coding the SSP and have administered a standard reliability test to trainee coders. However, one explanation for declining rates of attachment avoidance may be "coder drift" as the measure proliferated beyond the lab of its originators (Ainsworth et al., 1978). Across an overlapping period, the associations of child-parent attachment quality with parents' attachment representations (Verhage et al., 2016) have decreased, potentially indicating that the reliability or ecological validity of one or both of these measures might be decreasing as well. However, the association of child-parent attachment with parental sensitivity has not statistically decreased (Zeegers et al., 2017), rendering this possibility unlikely for the SSP.

Alternative explanations include changes in the questions being addressed by the studies (i.e., shifts in attention towards clinical populations; Schuengel et al., 2021), secular trends (i.e., coinciding drops in risk factors or forms of child maltreatment in some influential countries; e.g., Finkelhor et al., 2018), sociological trends (e.g., more dual working parents, increasing divorce rate, etc.) and other unknown factors, and/or combinations of these factors. It is tempting to speculate that normative changes toward more child-centric parenting styles could be driving this underlying reduction in the prevalence of avoidance. Nonetheless, more research is needed to investigate the nature of these time trends and whether they result from changes in the research practices, populations studied, or secular trends in parenting.

**Moderators of Attachment Distribution**

### *Socio-Demographic Risks*

Avoidant and disorganized attachment were more common in samples with low socio-economic status compared to samples with middle to upper SES (avoidant 16% vs 12%; disorganized 30% vs 18%). In contrast, the distribution of secure attachment was less common in samples with low SES compared to middle/upper SES (42% vs 56%). Sensitive parenting is a precursor to secure infant-parent attachment (De Wolff & Van IJzendoorn, 1997), and engaging in sensitive caregiving when faced with various socio-economic barriers and parenting stressors (e.g., food insecurity) may be challenging. Families with low SES may not have access to resources that can help bolster the caregiving environment (e.g., parenting books, therapeutic treatments). Adult mental health difficulties also show clear evidence of socio-economic gradients and are robustly associated with lower caregiver sensitivity (e.g., Bernard et al., 2018). Avoidant attachment may be a likely outcome in such cases, as the infant's attachment needs cannot be frequently attended to due to competing demands and/or socio-economic stressors.

Low SES is one indicator of socio-economic disadvantage. Indicators of socio-economic disadvantage often cluster together or are nested within families with low SES, such as low parental education, single parenthood, parenting stress, household chaos, as well as inter-partner and neighborhood violence. Any or all of these factors could endanger the child's sense of safety and security, chronically activate the child's fear system without adequate resolution or regulation, and/or engender parental withdrawal behaviors (Lyons-Ruth et al., 1999), which could individually or collectively increase the risk of disorganized attachment. For example, in a study of 72 low-income mothers, Zeanah et al. (1999) found that as partner violence increased, so too did the risk for disorganized infant-caregiver attachment. Further, a meta-analysis by Cyr et al. (2010) found that infants exposed to cumulative socio-economic risks were at elevated risk

of developing disorganized attachment compared to infants without such exposures. Thus, while exposure to maltreatment and anomalous parenting behaviors increase the child's risk of disorganized attachment (Cyr et al., 2010; Madigan et al., 2006), socio-economic disadvantage and multi-risk contexts may be other pathways to disorganized attachment. The unique and/or multiplicative role of these various precursors to disorganized attachment warrants concerted empirical attention in future research.

### *Attachment in Children Adopted and Fostered*

Infants who had been fostered or adopted from foster or institutional care had lower rates of avoidant attachment (4%) than non-adopted and non-fostered infants (14%). The low prevalence of avoidant attachment in adoption samples has been reported previously. Marcovitch et al. (1997) discussed several possible explanations for the absence of avoidant attachment in their sample of adopted Romanian orphans. First, avoidant attachment behavior may not be adaptive in the context of institutional care because it may exacerbate the potential for further neglect. Second, the efforts of parents within adoptions from foster or institutional care to form new relationships and connections may make it unlikely that a caregiving environment would be characterized by rejection, which is theorized to be a parenting behavior associated with avoidant attachment (Ainsworth et al., 1978). Although these are plausible explanations, they have not yet been examined empirically.

The finding that the distribution of secure attachment among adoptees and foster infants was not statistically different from biologically related infants is consistent with earlier meta-analytic work by Van den Dries et al. (2009), who showed that infants adopted before 12 months of age displayed comparable rates of secure attachment as found in normative, non-adopted samples. It should be noted that Van den Dries et al. found that more adoptees and foster infants

were classified as disorganized compared to biologically related infants, which is in contrast to the current meta-analysis. However, confidence intervals and heterogeneity indexes in the current study indicated higher variability and heterogeneity in adoption and foster care samples as compared to non-adoption and non-foster care samples. This, in combination with the finding of lower rates of avoidant attachment in adoption and foster care samples, may suggest that in cases of insecurity, disorganized attachment is the most likely outcome for infants in adoptive and foster families (e.g., Dozier et al., 2001).

Rates of disorganized attachment were higher in adopted/fostered children (38%) compared to non-adopted/fostered children (21%). Consistent with this result is the finding that severe neglect prior to changes in living circumstances, as for example observed in institutional settings, has previously been found to relate to maladaptive development outcomes in adopted and foster infants (e.g., Smyke et al., 2012), although catch-up growth of formerly institutionalized infants after the transition to family-type care is striking in almost all developmental domains (Van IJzendoorn et al., 2020).

Future research may examine the heterogeneity of findings further by including relevant moderators, such as age at placement and type and severity of previous experiences (Finet et al., 2021; Van den Dries et al., 2012). The effect of age at placement has been reported in several studies, indicating a higher risk for developing insecure and disorganized attachment for infants placed later in life (e.g., Vorria et al., 2006). The young age of the adopted and foster children in the studies included in the current analyses means that it does not capture the impact of late adoption or late entry into foster care on child-caregiver attachment security.

### *Child Maltreatment*

The consequences of maltreatment are most evident in the rates of disorganized attachment in samples with child maltreatment (60%). The overrepresentation of disorganized attachment among infants with maltreatment experiences is in line with previous meta-analytic findings (48% in Van IJzendoorn et al., 1999). The prevalence estimates of avoidant and resistant classifications did not deviate statistically from the normative distribution. The effect of maltreatment is, therefore, primarily observed in relation to disorganized attachment (although this does not mean that disorganized attachment is only or primarily caused by maltreatment, see Forslund et al. (2021)). The clinical relevance of disorganized attachment is evidently higher than that of the organized insecure classifications in view of subsequent socioemotional development (Groh et al., 2017) and psychopathology (Green & Goldwyn, 2002). For this reason, it is unfortunate that the Attachment Q-Sort (Waters & Deane, 1985), the well-validated alternative to the SSP as a measure of attachment in infancy and early childhood, does not include items for the observation of disorganized attachment.

The overrepresentation of disorganized attachment in maltreatment samples does not mean that all maltreated infants develop disorganized attachments: Almost half of the infants with maltreating parents develop organized attachment relationships. One might wonder how infants succeed in establishing organized attachments in the face of maltreating parents. Measurement error may play a role, but two substantive explanations should be considered and may be addressed in future research. First, most infants grow up in a network of attachment relationships (Bakermans-Kranenburg, 2021), and positive spillover from interactions with non-maltreating attachment figures may enhance the child's ability to develop organized patterns of attachment behavior. Second, evidence supporting the differential susceptibility paradigm shows that infants differ in how much they are affected by environmental influences, including

parenting (Bakermans-Kranenburg & Van IJzendoorn, 2007; Ellis et al., 2011). In the case of parental maltreatment, infants who are less susceptible due to their genetic, neurobiological, or temperamental characteristics may show organized attachment behavior and eventually more undisturbed developmental trajectories than expected given their unsupportive early care experiences. Furthermore, maltreatment itself is not a unitary entity, both in terms of the nature of the exposures it entails, or its chronicity, and we currently know remarkably little about how different forms or temporal patterning of maltreatment relate to attachment status.

***Parent Psychopathology***

Consistent with previous findings (Atkinson et al., 2000; Van IJzendoorn et al., 1999), infants of parents with psychopathology had lower rates of secure attachment (45%) and higher rates of disorganized attachment (29%) than infants of parents without psychopathology (53% secure; 20% disorganized). These studies examine the presence or absence of parent psychopathology, but other important considerations are the chronicity, timing, and severity of parent mental illness, as well as its subsequent impact on parenting behaviors implicated in the development of child attachment (e.g., sensitivity, disrupted caregiving). A study involving the NICHD Study of Early Child Care and Youth Development sample found chronic and intermittent symptoms of maternal depression predicted child disorganized attachment at 36 months of age, whereas depression within the first 15 months of the child's life was not significantly related to child attachment outcomes. Moreover, the relation between maternal depression and child insecure attachment was only statistically significant in the presence of low parenting sensitivity (Campbell et al., 2004).

Researchers have indicated that predictors and correlates of parental psychopathology, such as parents' childhood maltreatment experiences and marital discord (Atkinson et al., 2000;

Wan & Green, 2009), may precede the onset of parent mental illness and, therefore, serve as potential targets of prevention efforts against the development of insecure and disorganized attachment. For instance, prenatal prevention efforts may require multi-pronged approaches that focus on alleviating mental distress, enhancing tangible and emotional sources of social support, and addressing maladaptive prenatal caregiving representations. Meta-analytic investigations (Bakermans-Kranenburg et al., 2003; Bakermans-Kranenburg et al., 2005; Facompré et al., 2018) provide clear evidence for the utility of intervening directly on insensitive and anomalous parenting behaviors to address the impact of parent psychopathology on child insecure and disorganized attachment.

In sum, compared to secure attachment, we found higher rates of avoidant and disorganized attachment in populations with socio-demographic risks and in child maltreatment samples. We also found higher rates of disorganized attachment in particular in samples where parents had psychopathology and when the child was adopted or in foster care. One surprising finding emerging from this synthesis is that we did not find any unique predictors of resistant attachment. The behavior, prediction, and sequelae of resistant attachment have long been somewhat of a yet-to-be-solved puzzle amongst attachment researchers. In a seminal paper, Cassidy and Berlin (1994) described the resistant attachment group as the "least understood" of the SSP classifications, a notion that also underpins the results of the current meta-analysis. In part, this lack of understanding has stemmed from very few infants being classified as resistant. With the median sample size of SSP studies being $N = 51$, and on average, only 1 in 10 infants being classified as resistant, most sample sizes would be considerably underpowered to provide a deep understanding of the precursors and/or concomitants of resistant attachment. However, in the current meta-analysis, which is sufficiently powered to detect individual differences among

the four attachment classifications, we also came up short in identifying any child and family characteristics that predicted when the distribution of resistant attachment was higher or lower.

A limitation of meta-analyses broadly is the inability to address moderators that vary at the participant level. That is, our analyses for resistant attachment were constrained to measuring study-level variables only (or aggregated participant-level variables such as mean age, or % male). This limits the ability to detect factors that may be important parent and child influences on resistant attachment. Thus, as both Cassidy and Berlin (1994) and Groh et al. (2014) have noted, large data sets, multisite samples, and individual participant data meta-analyses should be initiated and/or leveraged to elucidate the development of resistant attachment. A particular focus on maternal behavioral as a distinct antecedent of resistant attachment may prove particularly useful in the quest to ascertain a "better understanding" of how resistant attachment develops. Parenting behavior may be an especially relevant target as we did not find any particular socio-demographic, parent or child characteristics herein that predicted resistant attachment. Indeed, there have been calls for further refinement on how caregiver sensitivity and disrupted communication behaviors may vary among parents of infants with resistant attachment, compared to parents of infants with disorganized attachment (Ariav-Paraira et al., 2022).

### *Additional Moderators Tested*

**Race/Ethnicity.** No different proportions of attachment among racially minoritized versus White majority samples were found. This finding stands in contrast to a large study by Bakermans-Kranenburg et al. (2004), where it was found that attachment security was lower in Black compared to White children. The study by Bakermans-Kranenburg et al., however, was based on a different measure of infant attachment, which examines attachment security along a continuum from secure versus insecure attachment, whereas the SSP derives various categories

of insecure attachment, which may restrict the variance that could be observed across minoritized groups. Thus, future research examining whether attachment is inclusive of diverse racial and ethnic populations should carefully consider the attachment paradigm and measure being used.

The current meta-analyasis was also underpowered to examine differences among minoritized racial groupings. Thus, our categorization of samples as racially-minoritized versus White is indiscriminate of likely inherent differences in attachment across racial and ethnic groups. This point is important, as increases in attachment security may be seen in some racially-minoritized groups, whereas decreases in attachment security may be observed in others. For example, in a study by Huang et al. (2012) comparing Asian-American to Hispanic-American mothers using the Toddler Attachment Sort-45 instrument (Waters & Deane, 1985), Asian-American mothers had children with high rates of attachment security whereas Hispanic-American mothers had higher rates of attachment insecurity. We recognize that racial and ethnic groups are diverse and by grouping them together as 'racially-minoritized' in our analyses, we may fail to observe qualitative differences between groups. Future research in attachment should place explicit focus on recruitment of diverse racial and ethnic groups to engender a more nuanced understanding of the development of attachment inclusive to all. Given that in the Bakermans-Kranenburg et al. (2004) study differences in attachment and sensitivity were largely explained by differences in income, it is also essential that studies on majority and minoritized racial or ethnic groups take any differences in socio-economic status into account.

**Parent Maltreatment History.** Parental history of maltreatment was not found to be related to an overrepresentation of disorganized attachment (38%) versus those without a history of maltreatment (21%). Thus, fortunately, not all parents with maltreatment experiences continue to struggle with these experiences. Stable, supportive partner relationships, as well as therapy,

can be effective to cure the wounds from early experiences (Sroufe et al., 2009). Moreover, objective and subjective experiences of childhood maltreatment only partially overlap and may differ in their prediction of maltreatment-related psychopathology and maladaptive parenting practices. Adults with a subjective, retrospective recall of childhood maltreatment were found to be at elevated risk of lifetime psychopathology, whereas adults with official records of child maltreatment without retrospectively reporting such experiences did not differ from those without subjective or objective measures of childhood maltreatment (Danese & Widom, 2020). The set of studies on samples with parental history of maltreatment may include a mix of objectively and subjectively experienced maltreatment, resulting in observable but not statistically significant effects on their offspring's disorganized attachment.

**Child Neurodevelopmental Conditions, Medical conditions, and Prematurity**. No statistically significant differences in attachment distributions were found amongst these groups or populations of infants. These results appear striking in the sense that they suggest that infant factors seem to play a limited role in determining security or insecurity of attachment. This, of course, is what theory and a previous meta-analysis had suggested, in that the determining factor is believed to be the caregiver's sensitivity to the particularities of the infant's tendencies, needs, and ways of signaling.

**Child Age and Sex.** Infant-caregiver attachment distributions did not show statistically significant differences by child age or sex. It is believed that infant-parent attachment gradually develops and takes shape over the first years of life, contingent on an accumulation of experiences with a caregiver (Bowlby, 1982). While this likely remains true, we did not find evidence that the distribution of infant attachment classifications per se varies as infants age into their second year of life. A meta-analysis of the first 10,000 adult attachment classifications

based on the Adult Attachment Interview (AAI; George et al., 1996), the adult parallel to the SSP, also did not reveal any sex differences in terms of the distribution of AAI classifications (Bakermans-Kranenburg & Van IJzendoorn, 2009a). We believe the current study provides the most definitive conclusion to date that early security of infant-parent attachment does not develop in sex- or age-specific ways, at least as captured by the distribution of the four major attachment classifications. That said, it is possible that sex differences in attachment may emerge later in childhood, at the start of the adrenarche (Del Giudice & Belsky, 2010), which warrants consideration in future research.

**Parent Gender.** The distribution for infant-mother secure attachment was 51.2%, and for fathers it was 61.2%. While these percentages vary, they were not statistically different. Our distribution results are consistent with a meta-analysis by De Wolff and Van IJzendoorn (1997) of eight studies that showed that the distribution of secure attachment among mothers and fathers was not statistically different. Combined with evidence showing that father-child attachment relationships hold comparable associations with developmental outcomes, such as behavior problems (Deneault et al., 2021), these findings suggest that attachment relationships are comparable regardless of parental gender, which is an important contribution to the literature. It is notable, however, that among the 285 non-overlapping samples included in this synthesis of studies with the four attachment classifications, only 12 (4.2%) were infant-father dyads. Although research on infant-father attachment is rapidly growing, the dearth of infant-father studies compared to infant-mother studies in the half-century history of attachment theory is striking. Mother-centric research was consistent with early sociological trends and rearing practices (i.e., mothers as the primary caregivers) and accordingly, the focus of maternal influences on child development more broadly (Cassano et al., 2006). However, fathers now play

a much larger role in child-rearing (Sayer, 2018), with a three- to six-fold increase in time spent on child care over what their own fathers typically did (Bakermans-Kranenburg et al., 2019), and therefore it is imperative for researchers to incorporate all members of the child's attachment network into their research, including grandparents (Liang et al., 2021), and to do so from a family systems perspective (Cowan & Cowan, 2019).

A founding hypothesis was that infants form attachments to multiple caregivers (Bowly, 1969), and recent research suggests that attachment relationships co-exist and co-relate to influence child development (Dagan & Sagi-Schwartz, 2021). While distributions of attachment may be similar among mothers and fathers, the behavioral parenting components that predict attachment, such as sensitivity and protective or disrupted behavior, may be different in quality and quantity for mothers versus fathers (e.g., Lucassen et al., 2018; Madigan et al., 2011; Schoppe-Sullivan et al., 2006; Volling et al., 2002). This warrants exploration in future research as it may have implications for how we target parenting and attachment-based interventions for maternal and paternal caregivers.

**Regional Differences**

Several differences in distributions across regions were noted in this synthesis, most intriguingly the somewhat higher rates of secure attachment on the African continent and in Asia. Moreover, in Asia, a relative underrepresentation of disorganized attachment was found, whereas in African countries, no single insecure attachment classification stood out in comparison with the North American distribution. Apart from these deviations from the North American distribution (where the largest number of studies has been conducted), relatively few differences could be observed, and they were possibly dependent on the large numbers of statistical tests and small numbers of studies in several regions.

Despite this appearance of uniformity of infant attachment distributions across regions, some cautionary comments should be made. First, attachment research still has been primarily conducted in North American and European countries, which are often referred to as WEIRD countries (Muthukrishna et al., 2020) and represent less than 10% of the world population (Thalmayer et al., 2021). For example, attachment research is virtually absent in densely populated countries like Indonesia, Pakistan, and India, and is only slowly emerging in China. Second, although the SSP has 'emic' roots in Ainsworth's pioneering attachment research in Uganda (Ainsworth, 1967), it might be less of a valid window to attachment patterns in some understudied regions of the world for which any research on parenting and child development is lacking. Litmus test for the validity of the Strange Situation pertains to some core hypotheses of attachment theory (Van IJzendoorn & Sagi-Schwartz, 2008) of which the competence hypothesis has been rarely studied, in particular in non-WEIRD cultures. It is the hypothesis that secure attachment might prepare children to more successful adaptation later in their development compared to insecure attachment. Yet, the issue of what competence or optimal adaptation in a specific cultural niche means and how it should be measured still is unsettled as basic 'emic' research in most non-WEIRD cultures is lacking. A third caution is that the geographic regions used in the meta-analysis do not constitute an optimal basis for cultural comparisons, in particular when these regions are as vast as whole continents such as Africa or Asia with a multitude of cultures, and where only small numbers of countries drawn from a highly diverse set of contexts are available. A more detailed approach using multidimensional characterization of cultural differences between smaller geographic regions with a large set of psychosocial and economic scales might better represent cultural niches and provide a more granular comparison of cultural attachment differences (Muthukrishna et al., 2020).

Cross-cultural validation of the SSP needs further testing, especially in terms of some core hypotheses in attachment theory that go beyond the mere comparison of attachment distributions. The sensitivity hypothesis suggests a causal relation between early parental sensitive interactions and later infant attachment security, and the competence hypothesis predicts that early attachment security leads to later social competence and lower chances of behavior problems (Van IJzendoorn & Sagi-Schwartz, 2008). Research into these substantive hypotheses in non-WEIRD countries still is largely lacking, despite some notable examples (McMahan True et al., 2001; Valenzuela, 1990; Zevalkink et al., 2008). Such research is complicated by the assumption of Life History Theory, which states that the same social competencies might not be equally adaptive in every culture, or that behavior problems defined by standard assessments would not be equally maladaptive in every social niche (Hinde, 1982; Hochberg & Belsky, 2013). Although the current evidence base is not incompatible with the universality claim of attachment theory, additional research on the outstanding questions and issues noted above is needed to make more definitive conclusions about the role of regional differences in the distribution of infant-parent attachment.

**Limitations**

Several limitations related to the current synthesis are worthy of note. First, we have limited our synthesis to studies that have measured all four attachment classifications (avoidant, secure, resistant, and disorganized) and, therefore, SSP studies conducted prior to the adoption of the disorganized classification may not be represented. This decision was made to ensure we presented data based on the most contemporary coding system commonly used by researchers globally. Second, our synthesis focused on studies measuring attachment observationally in the SSP. The SSP was the originally designed assessment measure for describing the quality of the

infant-parent attachment, and the most frequently used observational measure of child attachment to date. However, other measures have been developed to assess parent-child attachment in the home (Attachment Q-Set; Waters & Deane, 1985), and the SSP has also been adapted to assess attachment in preschoolers (Cassidy et al., 1992) and school-aged children (Main & Cassidy, 1988). Although these are observational measures of parent-child attachment, we did not include these measures for several reasons, including that they have been summarized elsewhere (e.g., Cadman et al., 2018; Van IJzendoorn et al., 2004), are distributed continuously versus categorically (i.e., Cadman et al., 2018; Waters & Deane, 1985), and include additional attachment classifications (e.g., controlling-punitive; controlling-caregiving) beyond the four classifications described in detail herein. As research on preschool- and school-aged attachment has rapidly increased over the last decade, a fruitful endeavor for future research will be to synthesize the distributions of the attachment classifications emerging from these observational measures and compare the results with the current findings.

Third, as noted above, although we aggregated data from 25 countries and 6 continents, the majority of studies emerged from North America (71%) and Europe (19.5%). Thus, studies from Australia, Africa, Asia, and South America were highly underrepresented in our data. Most importantly, there are vast cultural, geographic, and socio-economic differences between countries within these major regions, and we were only able to review a small number of (likely non-representative) samples from a modest number of countries within them. Our analysis should therefore certainly not be considered representative of these regions. Encouragingly, there is a growing body of researchers studying attachment in these geographic regions, and additional research studies on the SSP are therefore likely to emerge over the next decade. Thus, it may be

important to revisit the current analyses in the future to ascertain a more representative global estimate of the distribution of the SSP classifications.

Fourth, we present the distribution of the SSP in which samples were taken at one point in time in the infancy period; however, it is important to point out that the short-term test-retest reliability of the SSP is satisfactory (Goossens et al., 1986; Waters, 1978) but this psychometric reliability does not preclude discontinuity of attachment security over time, for example, due to changing child-rearing circumstances ('law-ful discontinuity'; Chris Fraley, 2002). Parallel assessments of such environmental changes and the development of attachment are needed, as Lamb et al. (1985) already suggested.

Fifth, while our testing of moderator variables was comprehensive, including whether attachment distributions differed based on child neurodevelopmental conditions, one moderator we could not examine was child psychopathology. Neurodevelopmental conditions, such as intellectual deficits, Down Syndrome, and cerebral palsy, can be evident in the infant's earliest days of life. However, evidence of child psychopathology, such as clinically significant anxiety, depression, and/or oppositional behavior, typically emerges later in childhood (Tremblay et al., 2004; Whalen et al., 2016), and it would be rare to receive a diagnosis of one of these disorders in the infancy period. Nonetheless, there are a plethora of studies that have prospectively examined whether infants with insecure versus secure attachment as assessed in the SSP, are more likely to develop internalizing (i.e., depression, anxiety) and/or externalizing (i.e., aggression) problems later in childhood (Deneault et al., 2021; Fearon et al., 2010; Groh et al., 2017; Madigan et al., 2013).

Lastly, we note that this meta-analysis was not preregistered. The idea for this particular meta-analysis, meant to be a central output of CASCADE, was crafted in 2017, and although

authors have been writing about preregistration of meta-analyses of studies before that time (e.g., Quintana, 2015), the idea to preregister meta-analyses such as ours has taken time to spread, with general purpose templates suitable for correlational meta-analyses appearing only by 2020 (see Van den Akker et al., 2021; https://osf.io/by27q/). By the time these templates appeared and opportunities for preregistering correlational meta-analyses were created, we already had run analyses on preliminary extractions of the data. In future CASCADE projects, however, we plan to register the systematic reviews. We will also require this from others who use CASCADE (which is open source to anyone who wishes to request data from the first author), as we are indeed in strong support of this standard of practice.

**Future Directions**

This meta-analysis brings together half a century of research using the SSP. The SSP was originally developed in the 1960s to establish attachment research as an approach within developmental science. The SSP allowed for attachment behavior to be studied rigorously in a laboratory setting, using reliable observations and replicable inquiry. Half a century of research with the same measure has supported a vibrant tradition of replication and meta-analytic research, including the recent use of individual participant data meta-analyses to examine moderators and mediators of the intergenerational transmission between parent and child attachment (Verhage et al., 2020). Research using the SSP also continues to make important contributions, for instance, in evaluating family interventions (see Steele & Steele, 2017). For example, teaching and coaching parents to enhance secure attachment by bolstering their sensitive caregiving behaviors is a prevention and intervention strategy used around the globe,

with demonstrated empirical support for its effectiveness (Facompré et al., 2018; Sokolovic et al., 2021; Van IJzendoorn et al., 2022).

It is important to acknowledge that while the SSP has many strengths, it has also been argued that, like other available parent-child attachment measures, it was not built or validated for individual diagnostics in clinical or social work or for court procedures (Granqvist et al., 2017). Despite the absence of evidence for such use, this has sometimes led to misunderstandings and misapplications of the SSP and related instruments (Forslund et al., 2021). However, the assessment of parenting behavior, which can be done in many settings (e.g., home, community agencies, clinics), and with a variety of measures mostly well-validated for research purposes, may show more promise for use in clinical and community settings (e.g., (Haltigan et al., 2019; Mesman & Emmen, 2013). Indeed, bolstering caregiver sensitivity and reducing caregiver harsh or disrupted parenting is the target focus of most clinical interventions seeking to increase attachment security and reduce disorganized attachment, respectively (Bakermans-Kranenburg et al., 2003). This approach has proven to be fruitful, as many randomized controlled trials have provided evidence that changing caregiver behaviors can lead to changes in the child's attachment classification (Tereno et al., 2017; Van IJzendoorn et al., 2022; Yarger et al., 2020). It is also critical to note that the SSP and its associated coding systems are highly unlikely to capture all the important aspects of attachment behavior, such as its individual developmental trajectory, its context-dependence, or how attachment is expressed in the presence of multiple caretakers.

There is also reason for considerable optimism about the value of continued use of the SSP, and the potential for evolution of the instrument. Ultimately, the presumed underlying mechanism is relatively straightforward: the SSP ratings are hypothesized to tap the flexibility

and direction of the child's attention and behavior towards—or away from—attachment figures in the context of moderate alarm, intended to serve as a window into the child's expectations about the caregiver's availability as a safe haven. The disorganized attachment classification signals disruption in the coordination of this attention and behavior (Main & Solomon, 1990). We anticipate that further investigation, including the use of machine learning approaches and/or wearable technologies, validated through comparison with existing approaches, may eventually allow us to pick out these mechanisms more sharply, strengthening continuous attachment ratings (but see Deneault, 2021), pruning the coding systems and permitting their automation. In turn, this sharper articulation of underlying mechanisms by the coding system can be anticipated to support greater dialogue with other disciplines and achieve improved prediction of relevant developmental (endo-)phenotypes, benefiting research as well as clinical and policy practice.

Even if the SSP as an instrument may see further refinement and automation, the basic phenomenon that it was developed to tap infants' expectations of the availability of a caregiver as a safe haven for comfort and support when needed can be anticipated to remain of fundamental importance to research, policy, and practice. These expectations can and have been measured effectively for research purposes in various ways beyond the SSP, such as with the Attachment Q-Sort (Cadman et al., 2018). Caregiver behavior relevant to safe-haven provision can also be measured directly, for instance through assessments of sensitivity (see Ainsworth et al., 1974), or anomalous caregiver behaviors (e.g., Disrupted parenting behaviors; Lyons-Ruth et al., 1999; Frightening/frightened behaviors; Main & Hesse, 1990). Our hope is that our work in this paper characterizing the epidemiology of the SSP will represent a firm basis for this wider endeavor.

## Conclusions

This comprehensive meta-analysis used an epidemiological approach to examine the global distributions of SSP classifications across 285 infant-parent attachment studies that have been conducted over the last 50 years in 21 different countries. Paying particular attention to temporal trends, clinical indicators, and various risk factors that have been highlighted in the literature on attachment, this synthesis did not reveal that infant-caregiver attachment distributions differ by child age or sex or between mothers and fathers. Key moderators of infant-caregiver attachment include socio-demographic risks, child and parent history of maltreatment, and parent psychopathology, all decreasing the prevalence of secure attachment, temporal trends to less avoidance, and some regional differences. These findings both support aspects of attachment theory, where risks to secure parent-child attachment have been well-documented and elucidate factors in attachment research that have not been previously examined within a similar scope.

This meta-analytic review contributes to the field of attachment research by synthesizing findings across a vast body of empirical research and identifying gaps that remain for future work. Additionally, the methodological rigor of this review facilitates a better understanding of true effects and key moderators in infant-caregiver attachment, thereby providing insight into the foundational theoretical claims of attachment theory and the continued relevance of the SSP as a pivotal measure to examine behavioral differences in infant-parent attachment. Future directions include increased attention to multi-caregiver assessments, particularly infant-father attachment, as well as research into the cross-cultural validity of the SSP, and the validation of alternative instruments that can be used at scale.

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**Table 1**

*Coding System for the Variables Extracted for the Purpose of this Meta-Analysis*

| Variable | Coding description |
|---|---|
| General study characteristics | |
| Publication year | Date of study publication in years |
| Geographical region | 1 = Africa<br>2 = Asia<br>3 = Australia/New Zealand<br>4 = Europe<br>5 = Middle East (all studies in this region were from Israel)<br>6 = North America<br>7 = South America |
| Sample characteristics | |
| Child age | Age of child (in months) at time of SSP |
| Child sex | Percentage of child sample that is male (percentage entered as 50% if study does not indicate sex distribution) |
| Demographic risk (SES) | low = ≥80% of sample characterized as low SES<br>mixed = SES distributed across different levels<br>mid-high = ≥80% of sample characterized as mid-high SES<br>unspecified = study does not provide info on SES (SES determined based on reported income and education level) |
| Race (minority sample) | no = ≥80% of sample are white<br>yes = ≥80% of sample are non-white (racial/ethnic minority)<br>Samples were only considered to be racially minoritized if they emerged from countries where the majority race was White (e.g., USA, Canada, UK, Europe). |
| Parent sex | SSP conducted on father-child or mother-child dyad |
| Child risk factors | |
| Child maltreatment | yes = ≥80% of sample experienced maltreatment (e.g., physical abuse, sexual abuse, or neglect)<br>no = <80% of sample experienced maltreatment |
| Neurodevelopmental condition | yes = ≥80% of sample has a neurodevelopmental condition or disorder (e.g., Autism, Down Syndrome, cerebral palsy, hearing impairment, intellectual disability)<br>no = <80% of sample has a neurodevelopmental condition |
| Prematurity | yes = ≥80% of sample characterized as born premature<br>no = <80% of sample characterized as born premature<br>Premature status was determined by what individual studies reported. |
| Adopted or foster caregiver | 1 = biologically related infant-parent dyads (≥80% of sample)<br>2 = foster/adopted infant-parent dyads (≥80% of sample) |

| | |
|---|---|
| Parental risk factors | |
| History of maltreatment | yes = ≥80% of sample experienced maltreatment (e.g., physical abuse, sexual abuse, or neglect)<br>no = <80% of sample experienced maltreatment |
| Psychopathology | yes = ≥80% of sample characterized as having a risk of psychopathology (e.g., diagnosis or clinical cut-off on a validated instrument of a psychopathological condition such as substance abuse, depression, anxiety, or psychiatric disorder)<br>no = <80% of sample characterized as having a risk of psychopathology |

**Table 2**. Distribution of Infant Attachment Across Parent Gender

| | Distribution Across Parent Gender | | | |
|---|---|---|---|---|
| | Secure | Avoidant | Resistant | Disorganized |
| Mother and Father-Infant Dayds Combined | 51.6 [49.6, 53.5] | 14.7 [13.6, 15.8] | 10.2 [9.3, 11.1] | 23.5 [21.6, 25.6] |
| Mother-Infant Dyads | 51.2 [49.2, 53.4] | 14.7 [13.5, 15.9] | 10.3 [9.3, 11.3] | 23.8 [22.0, 25.8] |
| Father-Infant Dyads[a] | 61.2 [51.2, 69.5] | 13.6 [9.6, 18.6] | 8.8 [5.8, 12.9] | 16.5 [11.0, 24.6] |

Distributions are reported in %, followed by 95% CI.

[a]No significant differences in the distribution of mother-infant and father-infant attachment were evident for any of the categories.

**Table 3.** Distribution of attachment across indicators

| Indicators | Avoidant | Secure | Resistant | Disorganized | Avoidant | Secure | Resistant | Disorganized |
|---|---|---|---|---|---|---|---|---|
| | Presence of Indicator [95% CI[a]] | | | | Absence of Indicator [95% CI] | | | |
| Demographic risk | 17.6 [15.3, 20.0] | 42.0 [38.1, 45.8] | 9.1 [7.6, 10.9] | 31.3 [27.7, 35.5] | 13.6 [12.4,14.9] | 55.2 [52.9,57.4] | 10.6 [9.5, 11.9] | 20.6 [18.6, 22.7] |
| Minoritized race/ethnicity | 15.2 [12.5, 18.2] | 49.7 [44.7, 55.0] | 10.3 [8.0, 12.8] | 24.8 [20.1, 29.9] | 14.6 [13.5,15.9] | 51.9 [49.7,54.0] | 10.2 [9.3, 11.2] | 23.3 [21.2, 25.5] |
| Child maltreatment | 14.8 [9.0, 22.0] | 16.6 [10.7, 25.2] | 8.2 [4.6, 14.2] | 60.4 [47.6, 71.3] | 14.7 [13.6,15.8] | 53.0 [51.0,54.9] | 10.3 [9.4, 11.3] | 22.0 [20.4, 23.9] |
| Parental psychopathology | 14.8 [11.5, 18.8] | 44.2 [37.7, 50.2] | 10.2 [7.5, 13.7] | 30.8 [24.4, 37.0] | 14.7 [13.5, 5.9] | 52.4 [50.5,54.5] | 10.2 [9.3, 11.2] | 22.7 [20.8, 24.7] |
| Foster/adopted | 5.9 [3.3, 9.8] | 47.3 [35.8, 58.4] | 7.3 [4.1, 12.5] | 39.5 [27.4, 52.2] | 15.1 [13.9,16.2] | 51.7 [49.5,53.7] | 10.3 [9.4, 11.3] | 22.9 [21.2, 24.9] |
| Parent maltreatment | 18.0 [10.3, 27.5] | 33.2 [21.7, 44.8] | 9.4 [4.9, 16.3] | 39.4 [24.9, 54.9] | 14.6 [13.6,15.8] | 52.0 [49.9,53.8] | 10.2 [9.3, 11.3] | 23.2 [21.4, 25.2] |
| Child neurodevelopment condition | 13.7 [9.4, 18.7] | 49.9 [41.0, 58.9] | 9.5 [6.1, 14.6] | 26.9 [18.6, 35.9] | 14.8 [13.7,15.9] | 51.7 [49.3,53.8] | 10.2 [9.4, 11.3] | 23.3 [21.3, 25.4] |
| Child medical condition | 17.1 [12.1, 23.1] | 54.5 [45.1, 62.5] | 11.1 [7.3, 15.7] | 17.3 [11.2, 25.7] | 14.6 [13.5,15.8] | 51.4 [49.3,53.5] | 10.2 [9.2, 11.2] | 23.8 [22.0, 26.0] |
| Prematurity | 20.4 [13.0, 29.6] | 58.3 [46.4, 68.9] | 7.8 [4.2, 14.0] | 13.5 [6.5, 23.0] | 14.5 [13.4,15.7] | 51.4 [49.2,53.4] | 10.3 [9.4, 11.3] | 23.8 [22.0, 25.7] |

CI = Confidence Intervals

**Table 4**

*Multilevel Multinomial Analyses of Moderator Effects on Attachment Distributions*

| **Moderator** | ***B*** | ***SE*** | ***Z*** | ***p*** | **CIs** | |
|---|---|---|---|---|---|---|
| | | | | | ***LCI*** | ***UCI*** |
| **Demographic risk (*k* = 77)** | | | | | | |
| Avoidant | .54 | .10 | 5.32 | <.001 | .34 | .73 |
| Resistant | .12 | .11 | 1.05 | .29 | -.10 | .34 |
| Disorganized | .78 | .12 | 6.35 | <.001 | .54 | 1.03 |
| **Race** | | | | | | |
| Avoidant | .08 | .15 | 0.58 | .56 | -.20 | .37 |
| Resistant | .06 | .16 | 0.38 | .70 | -.25 | .36 |
| Disorganized | .12 | .18 | 0.66 | .51 | -.24 | .48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parental psychopathology (*k* = 30)** | | | | | | |
| Avoidant | .21 | .18 | 1.15 | .25 | -.15 | .56 |
| Resistant | .19 | .19 | 1.00 | .32 | -.18 | .57 |
| Disorganized | .55 | .22 | 2.56 | .01 | .13 | .97 |
| **Child maltreatment (*k* = 10)** | | | | | | |
| Avoidant | 1.26 | .32 | 3.99 | .00 | .64 | 1.87 |
| Resistant | .98 | .35 | 2.84 | .01 | .30 | 1.65 |
| Disorganized | 2.46 | .34 | 7.16 | .00 | 1.79 | 3.13 |
| **Adopted/fostered (*k* = 10)** | | | | | | |
| Avoidant | -.86 | .33 | -2.64 | .01 | -1.50 | -.22 |
| Resistant | -.25 | .33 | -.78 | .44 | -.89 | .39 |
| Disorganized | .75 | .35 | 2.15 | .03 | .07 | 1.44 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Parental history of maltreatment (*k* = 6)** | | | | | | |
| Avoidant | .72 | .35 | 2.04 | .04 | .03 | 1.41 |
| Resistant | .40 | .38 | 1.05 | .29 | -.35 | 1.14 |
| Disorganized | 1.14 | .44 | 2.58 | .01 | .27 | 2.00 |
| **Child neurodevelopmental condition (*k* = 15)** | | | | | | |
| Avoidant | -.04 | .25 | -.17 | .87 | -.53 | .45 |
| Resistant | -.04 | .27 | -.15 | .88 | -.57 | .49 |
| Disorganized | .21 | .30 | .69 | .49 | -.38 | .79 |
| **Child medical condition (*k* = 15)** | | | | | | |
| Avoidant | .10 | .24 | .40 | .69 | -.38 | .57 |
| Resistant | .03 | .26 | .10 | .92 | -.49 | .54 |
| Disorganized | -.44 | .31 | -1.41 | .16 | -1.05 | .17 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Prematurity (*k* = 7)** | | | | | | |
| Avoidant | .22 | .32 | .67 | .50 | -.41 | .84 |
| Resistant | -.43 | .36 | -1.22 | .22 | -1.13 | .26 |
| Disorganized | -.78 | .43 | -1.83 | .07 | -1.62 | .06 |

*Note.* Secure attachment as the reference group

**Table 5.** Distribution of attachment across global regions

| **Region** | Avoidant | Secure | Resistant | Disorganized |
|---|---|---|---|---|
| Africa | 10.7 [5.1, 19.4][a] | 59.6 [39.1, 74.1] | 7.3 [3.2, 14.9] | 22.4 [10.5, 40.5] |
| Asia | 8.9 [4.8, 15.6] | 62.2 [47.3, 73.0] | 19.2 [11.0, 30.7] | 9.7 [4.2, 19.9] |
| Australia/NZ | 9.5 [5.3, 16.1] | 54.7 [41.4, 66.9] | 17.4 [10.4, 26.4] | 18.4 [9.8, 30.9] |
| Europe | 14.8 [12.5, 17.4] | 56.6 [52.2, 61.0] | 8.4 [6.8, 10.3] | 20.2 [16.9, 24.1] |
| Middle East (Israel) | 5.6 [2.9, 10.0] | 54.9 [41.9, 67.1] | 18.7 [11.1, 28.0] | 20.8 [10.9, 33.7] |
| North America | 15.2 [13.8, 16.5] | 49.7 [47.4, 52.3] | 9.7 [8.8, 10.7] | 25.4 [23.1, 27.7] |
| South America | 22.9 [13.9, 34.9] | 44.2 [30.6, 57.0] | 21.7 [11.9, 32.3] | 11.2 [5.0, 21.5] |

[a] 95% Confidence Intervals

**Table 6**

*Results of Multinomial Multilevel Analysis of Regional Differences in Attachment Distributions*

| **Geographical Region** | ***B*** | ***SE*** | ***Z*** | ***p*** | ***CI*** | |
|---|---|---|---|---|---|---|
| | | | | | ***LCI*** | ***UCI*** |
| **Europe (*k* = 57)** | | | | | | |
| Avoidant | -.55 | .46 | -1.18 | .24 | -1.46 | .36 |
| Resistant | -.49 | .49 | -.99 | .32 | -1.46 | .48 |
| Disorganized | -.35 | .55 | -.64 | .52 | -1.42 | .72 |
| **Asia (*k* = 5)** | | | | | | |
| Avoidant | -.80 | .38 | -2.09 | .04 | -1.54 | -.05 |
| Resistant | .46 | .36 | 1.28 | .20 | -.24 | 1.17 |
| Disorganized | -1.33 | .49 | -2.71 | .01 | -2.28 | -.37 |
| **Africa (*k* = 4)** | | | | | | |
| Avoidant | -.56 | .38 | -1.48 | .14 | -1.29 | .18 |
| Resistant | .51 | .36 | 1.42 | .16 | -.20 | 1.22 |
| Disorganized | -.48 | .47 | -1.01 | .31 | -1.40 | .45 |
| **Middle East/Israel (*k* = 6)** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Avoidant | -.16 | .13 | -1.28 | .20 | -.42 | .09 |
| Resistant | -.28 | .14 | -2.02 | .04 | -.56 | -.01 |
| Disorganized | -.38 | .16 | -2.36 | .02 | -.70 | -.07 |
| **Australia/NZ (*k* = 5)** | | | | | | |
| Avoidant | -1.13 | .36 | -3.11 | <.01 | -1.84 | -.42 |
| Resistant | .58 | .33 | 1.73 | .08 | -.08 | 1.23 |
| Disorganized | -.34 | .43 | -.80 | .42 | -1.18 | .50 |
| **South America (*k* = 5)** | | | | | | |
| Avoidant | .57 | .37 | 1.53 | .13 | -.16 | 1.29 |
| Resistant | .97 | .38 | 2.59 | .01 | .24 | 1.70 |
| Disorganized | -.78 | .51 | -1.51 | .13 | -1.78 | .23 |

*Note.* North American as the reference region, *k* = 20