To cite this article:

Bosmans, G., Verschueren, A., Cuyvers, B., Budniok, S., van IJzendoorn, M. H., Rowe, A., Ceulemans, E., & Bakermans-Kranenburg, M. (in press). Brief report: Priming attachment memories affects attachment states of pre-adolescents. *The Journal of Early Adolescence*. https://doi.org/10.1177/02724316261437270

Running Head: ATTACHMENT PRIMING

Brief Report: Priming attachment memories affects attachment states of pre-adolescents

Abstract

Priming or activating memories of (in)secure interactions with parents is expected to activate in-the-moment attachment feelings (aka state-like attachment, as compared to trait-like attachment). In this study, we tested whether priming secure and avoidant attachment memories affected state attachment security, anxiety, and avoidance and whether prime effects depended on trait attachment in 56 early adolescents (42.9% boys; 57.1% girls) aged 10-12 years (M = 10.75, SD = 0.61). Results showed that the primes affected secure and anxious state attachment, but not avoidant state attachment. Only one effect emerged after adjustment for multiple testing: secure state attachment decreased after the avoidant prime. Trait attachment did not moderate the prime effects on state attachment. Although effects are subtle, attachment states do seem to change depending on experimentally activated attachment memories.

Priming attachment memories affects attachment states: A follow-up study

Secure versus insecure attachment, or the extent to which children learn (or do not learn) to trust in the support of parents during distress has long been studied from a trait-like perspective, ignoring the possibility that attachment states might fluctuate in the moment, in response to cues in the environment (Cuyvers et al., 2023). These are in-the-moment emotional feelings regarding levels of trust in caregiver support during distress which can fluctuate from moment to moment depending on what happens in each moment in interaction with caregivers (Gillath et al., 2009; Verhees et al., 2023). State attachment has been more frequently studied in adults (e.g., Gillath et al., 2009), with research in children emerging only more recently (Cuyvers et al., 2023; Verhees et al., 2023). Theory and emerging evidence suggest that long-term trait attachment development reflects the accumulation of momentary state attachment fluctuations (Verhees et al., 2021). Therefore, advancing knowledge on the mechanisms underlying state attachment fluctuations across situations is crucial. Accumulating adult research (e.g., Gillath et al., 2022) has demonstrated that activating or priming memories of past attachment experiences can trigger changes in state attachment. Research on the effects of priming on state attachment with children, however, is scarce. Yet, attachment in childhood and early adolescence is malleable at the trait level, as evidenced by longitudinal studies (e.g., Waters et al., 2019) and taxometric analyses (Houbrechts et al.,2024). This developmental plasticity makes it important to examine how state attachment fluctuations and priming effects operate at younger ages, when trait attachment may still be undergoing significant reorganization.

According to attachment theory (Bowlby, 1969), experiences with supportive parents result in the development of secure attachment, which reflects trait-like trust in the support of parents during distress and Secure Base Script (SBS) knowledge. The SBS is a cognitive script about how successful care-related experiences unfold (Waters & Waters, 2006). This script reflects expectations about a chain of events that starts with exposure to distress, which is communicated to the attachment figure through support seeking or expression of negative emotions like sadness or agitation. This is noticed and correctly interpreted by the caregiver who responds with emotional support and practical help,

thereby facilitating the distressed individual to return to the pre-distress feelings of security (Waters & Waters, 2006). When caregivers fail to provide support during distress, children are at increased risk of becoming insecurely attached. They may either develop anxious attachment strategies reflected in fear of rejection and heightened attempts to elicit care, or avoidant attachment strategies, reflected in creating distance and an exaggerated focus on autonomy (Cassidy, 2016). These individual differences are typically considered relatively stable, trait-like characteristics (Bowlby, 1969). However, longitudinal research showed that stability of attachment across childhood and adolescence is rather modest (Groh et al., 2014; Waters et al., 2022).

Moving beyond a mere trait-like perspective, Bosmans et al. (2020) proposed that attachment consists of state and trait-like components. State attachment refers to in-the-moment feelings of trust felt during interactions with attachment figures (Gillath et al., 2009). Research shows that positive interactions (e.g., receiving comfort) activate higher levels of state trust, while negative interactions (e.g., conflicts) activate higher levels of state attachment anxiety and/or avoidance (e.g., Bosmans et al., 2014; Tammilehto et al., in press; Verhees et al., 2023). Bosmans et al. (2020) proposed that these experiences are stored in the brain in the form of memories and then feed into trait-like secure or insecure attachment. This explains why a growing number of studies find that trait attachment develops in a prototype-like fashion: old memories of attachment experiences are never fully erased but trait attachment is updated by novel experiences (Jones et al., 2018; Waters et al., 2022).

State attachment achanges are also predicted to follow after the reactivation of old positive or negative attachment memories (Bosmans, Bowles et al., 2014; Bosmans et al., 2020; Gillath et al., 2009). Priming, or the activation of memories and its impact on thoughts, behavior, and mental states has been documented extensively in other areas of research (Janiszewski & Wyer, 2014). In adults, secure attachment memory primes were found to have a positive impact on emotional well-being and secure state attachment (Bosmans, Bowles et al., 2014; Carnelley & Rowe, 2007; Gillath et al., 2020; Rowe et al., 2020).

Stupica et al. (2019) carried out the first attachment prime study in children, but did not test effects on state attachment. Cuyvers et al. (2023) were the first to test the impact of secure and avoidant attachment primes on children's state attachment. Results suggested that a secure prime increased children's state trust. However, no effects of a secure prime were found on state anxious and avoidant attachment. Moreover, the avoidant prime had no effect on state trust, state anxious and state avoidant attachment, and Cuyvers et al. (2023) suggested that a better avoidant prime was needed.

Notably, prime effects may depend on children's trait attachment. While novel interactions with attachment figures or primes can affect state attachment, it is likely that the trait-like attachment expectations enhance or reduce prime effects. For example, previous studies showed that trait attachment affects the way attachment information is processed, biasing information processing such that the processed information converges with the expectations (Dujardin et al. 2014, Dykas & Cassidy, 2011). As a result, high levels of trait secure attachment might be associated with enhanced positive secure attachment prime effects reflected in stronger increases in state trust and stronger decreases in state anxious and avoidant attachment. Moreover, high levels of trait secure attachment might be linked with reduced negative avoidant attachment prime effects.

With regard to these moderating effects, Cuyvers et al. (2023) found that high levels of trait trust were linked with higher increases in state trust after the secure prime, but only in children who reported low levels of state trust at the start of the experiment. In other words, children with higher trait trust were more likely to benefit from the secure attachment prime, showing greater increases in state trust — but this effect emerged only among those who started out with low state trust levels. No moderating effects were found for SBS knowledge on the prime effects.

The current study

First, we investigated whether secure and avoidant attachment primes affect state attachment in early adolescents (Research Question 1; RQ1). Based on research of Carnelley and Rowe (2007), we predicted that attachment security priming would lead to an increase in state trust

and decreases in state anxious and avoidant attachment. Inversely, we predicted that attachment avoidance priming would lead to a decrease in state trust and increases in state anxious and avoidant attachment.

Second, we explored whether children's responsiveness to attachment primes at the state attachment level is linked to trait attachment (RQ2) at baseline. Prior research suggests that trait attachment reflects both more explicit and more implicit components and that both probably tap into different aspects of the same underlying construct (Bosmans & Kerns, 2015). Therefore, we measured trait attachment using both self-report (a more explicit measure) and a narrative measure (i.e., the Secure Base Script assessment, a more implicit measure). We tested these hypotheses using a within-subject design (three primes administered over the course of three weeks: a neutral, a secure, and an avoidant prime).

Although attachment research has often been criticized for its historical overemphasis on mothers, there are still compelling reasons to focus on the mother–child relationship in early adolescence. Like fathers, mothers remain important attachment figures for most children in this developmental period (Bosmans & Kerns, 2015). Moreover, there are strong theoretical grounds to assume that prime effects reflect general psychological mechanisms rather than being specific to one attachment figure. Specifically, prime effects may emerge for any category of information that has been encoded and stored in memory representations (Molden, 2014).

Method

Participants

Participants were recruited through flyers distributed at schools in Flanders, Belgium. Families interested in participating responded to the flyers, were contacted by the researchers, and were informed about the content of the study. Out of the 60 children that originally agreed to participate, four had missing data for at least one measurement moment . We had complete data for 56 children (42.9% boys; 57.1% girls), aged 10-12 yrs (M = 10.75, SD = 0.61). All participants had Belgian nationality. Of these children, 73.2% lived with both biological parents, 10.7% lived with one parent

and 5.4% lived in a blended family. Further, 5.4% of the children had an alternated living arrangement with both divorced parents, 3.6% lived with two mothers, and 1.8% lived in a birdnesting arrangement (in which children remain in the family home while parents alternate living there). Of the mothers, 41.1% had a university degree, 37.5% had a professional bachelor degree, 17.9% had a high school degree, and 1.8% had a secondary school degree.

Procedure

There were four measurement points per participant, spread over three in-person timepoints during which measures were obtained at school or at home with an experimenter present (see Figure 1). The first (timepoint 1) started with providing information about the study and signing the informed consent forms of both child and parent. This first measurement point was meant to capture baseline levels of trait attachment security (People In My Life questionnaire, Secure Base Script assessment) and state attachment (in)security (SAQ) in counterbalanced order (measurement 1). Afterwards, participants were exposed to the neutral prime, after which state attachment security was measured again (SAQ) (measurement 2), to control for effects resulting from just the priming procedure. After 1 week, during a second in-person timepoint (timepoint 2) children were presented with either the secure or the avoidant attachment prime (counterbalanced order). After the prime, children filled out the SAQ again (measurement 3). One week later, children were exposed to either the avoidant or secure attachment prime respectively (timepoint 3). Afterwards, they completed the SAQ again (measurement 4). Then, children and their mothers were debriefed and the child received a voucher of 40 euros as a reward for participation. The procedure was approved by the Ethical Committee of KU Leuven (G-2018 12 1438).

Measures

State Attachment Security. State attachment security was measured with the State Attachment Questionnaire (SAQ, adapted from Bosmans, Bowles, et al., 2014), including 9 items measuring secure, anxious, and avoidant state attachment (3 items each). Participants rated the applicability of every statement on a continuous scale (a line of 100 mm) ranging from “not at all

true" to "very true" resulting in a score between 0 and 100 (mm). Example items are: "at this moment, I feel that I'm important to my mother" (secure state attachment); . "at this moment, I feel that if I would show my mother how much I love her, she won't love me as much" (anxious state attachment); "at this moment, I feel I would rather solve my problems alone" (avoidant state attachment). As an index of internal consistency, the Composite Reliability (CR) was computed rather than Cronbach's alpha, given the limited number of items per subscale (three items). Composite reliability provides a more accurate estimate of reliability in such cases, as it is less sensitive to the number of indicators (Peterson & Kim, 2013). All scales were sufficiently reliable: secure CR = .81; anxious CR = .83; avoidant CR = .82.

Trait attachment Security. To measure trait attachment security levels in children, the Dutch version of the trust subscale of the People In My Life questionnaire was administered (PIML; Ridenour et al., 2006). This self-report scale consists of 10 statements gauging children's trust in their mother. Participants rated each statement on a 4-point Likert-scale ranging from 1 = "almost never or never true", to 4 = "almost always or always true". An example is: "my mother accepts me for who I am According to Jewell et al.'s (2019) systematic review, the PIML is of sufficient quality and validity to use for attachment-related hypothesis testing. Moreover, research has shown that the trust scale predicts increased observed proximity seeking in distressed children, supporting the validity of the trust scale (Bosmans et al., 2015).In the current study, the internal consistency was good: Cronbach's $\alpha = .87$.

Additionally, the middle childhood version of the Attachment Script Assessment (ASA; Waters et al., 2015) was used to capture trait attachment security in a different way. The ASA is an attachment related storytelling task that measures SBS knowledge (Waters & Waters, 2006). On the basis of 12 word prompts, children were asked to tell a story. The most coherent storyline was one in which the child experiences distress, the mother provides support and the child is able to go on with previous activities. The task is designed to measure children's knowledge of the SBS by means of how well children can tell a coherent and detailed story that fits with the SBS.

Waters and Waters (2006) created a scoring system ranging from 1 = “poorly developed SBS knowledge” to 7 = “completely developed SBS knowledge”, based on the occurrence of six SBS elements in the story: (1) Constructive interaction, (2) a problem is occurring, (3) the child signals for help or proximity/the mother detects the need for help, (4) the mother provides effective help, (5) the problem is solved, and (6) child and mother are back on track engaging in constructive interaction again. First, under the supervision of the experimenter, the children completed two practice stories with themes unrelated to attachment. Then, three sets of attachment related word prompts were presented and the child was asked to tell an as-if story pretending that it was happening at that point in time. The order of the three attachment-related stories was randomized across participants to avoid order effects. All stories were coded by two trained coders. The interrater reliability was high, ranging from .80 to .97.

Priming Procedure. During the first assessment, a neutral attachment-unrelated prime was presented in which children read a description of a watering can. Then, they were asked to describe a shovel in a similar way (see Appendix). This was done to control for mere priming effects on state attachment security. At the second and third sessions, with intervening periods of 1 week, children were exposed either to a secure attachment prime or an avoidant attachment prime, in counterbalanced order. In both scenarios, children read a story about a child called Erik. In the secure attachment prime condition, the child was bullied at school and felt bad about it. Then, the child sought proximity to his mother who provided effective support to make the child feel better again (see Appendix).

The reading of the story was deemed to stimulate recollection of similar autobiographical experiences (Baldwin et al., 1996). Then, children were asked to tell the experimenter a similar autobiographical story, in which they experienced distress but support from their mother was helpful, to strengthen the priming effect. The avoidant attachment prime was analogue to the secure attachment prime except that in the story the child did not share the distress and did not want help from the mother to avoid an unhelpful maternal response (see Appendix). Participants were then

again asked to recount a similar autobiographical experience in which they did not want their mother's help. We abstained from using an anxious attachment prime because of ethical reasons regarding the emotional charge of such primes. The secure prime was the same as the one used by Cuyvers et al. (2023). Following Cuyvers et al.'s recommendation, we altered the avoidant prime to highlight the expectation that the maternal response would be unhelpful.

Statistical Analyses

To examine whether attachment priming has an impact on state attachment security (RQ1), we used repeated measures ANOVA's in R (version 4.3.2). The analysis assessed the overall effect of priming condition on all three subscales of the SAQ (secure, avoidant or anxious state attachment). Next, the separate contrasts were inspected to assess the effect of the primes separately (secure and avoidant) on all three subscales of the SAQ with the neutral SAQ measurement as the reference level. The overall analyses as well as the post-hoc pairwise comparisons were Bonferroni corrected for multiple comparisons. Additionally, they were adjusted using the Greenhouse-Geisser method due to the violation of the sphericity assumption. Power analysis (G*power) suggested that with 56 children, we had a power of .80 to find an effect size in the small-to-medium range ($f \geq .16$).

To investigate whether trait attachment (Self-reported trait trust; SBS knowledge) moderated priming effects on state attachment (RQ2), we used linear mixed-effects models in R. Six separate linear mixed-effects models were tested to evaluate the interaction effect between trait attachment and priming condition on the three subscales of the SAQ (with the neutral SAQ measurement as the reference level) with both self-reported trait trust and SBS knowledge as moderators. The random-effects structure of these models initially included the maximal random-effects configuration (Barr et al., 2013). However, as the model did not converge with the maximal structure, it was iteratively simplified until only a random intercept for participant number was retained for all analyses. To control for multiple comparisons, Bonferroni correction was applied setting the significance threshold at $\alpha = .008$. Because power analysis (G*power) suggested that with 56 children, we only had

sufficient power (.80) to find a medium effect size of f^2= .15 or higher, we considered this analysis as exploratory.

Results

Preliminary Analyses

We identified outlying values on all the state attachment subscales (2.08%), on trait trust (1.78%), and on SBS knowledge (1.78%) that exceeded three standard deviations from the mean within each priming condition, and we winsorized these extreme values to avoid excessive influence on the results. Out of the 60 children that originally agreed to participate, four had missing data for at least one measurement moment. We opted to only present the more conservative analyses using listwise deletion. However, we also conducted analyses controlling for missing data (see below)

Table 1 shows that self-reported trait trust was positively correlated with secure state attachment at baseline as anticipated. SBS knowledge did not correlate significantly with any of the state attachment scores. Secure state attachment was negatively correlated with anxious state attachment, but not with avoidant state attachment. Table 2 gives an overview of the means and standard deviations on all state attachment subscales in each condition.

As presented in Table 1, the distributions of the state attachment subscale scores deviated from normality, showing moderate skewness. Tests of normality (Shapiro–Wilk) and inspection of skewness and kurtosis values indicated that the assumption of normality was not met for all subscales. Levene's tests revealed that the assumption of homogeneity of variances was violated for the secure ($F(3, 220) = 2.72$, $p = .045$) and anxious ($F(3, 220) = 2.75$, $p = .044$) state attachment subscales, but met for the avoidant state attachment subscale ($F(3, 220) = 0.38$, $p = .770$). Furthermore, Mauchly's test of sphericity indicated that the assumption of sphericity was violated. Accordingly, all *p*-values reported below were adjusted using the Greenhouse–Geisser and Huynh–Feldt corrections. To ensure robustness, parallel non-parametric analyses were conducted using the Friedman test.

Research Question 1: Does attachment priming alter state attachment in early adolescence?

When testing the overall effect of priming condition on secure state attachment, a significant effect with medium size was found ($F(2.07, 165) = 4.45$, $p = .012$, $\eta_p^2 = .075$). Pairwise comparisons revealed a medium size significant negative effect of the avoidant prime on secure state attachment compared to the neutral prime ($t(55) = -3.57$, $p = .005$, $B = -4.56$, $SE = 1.28$, $|d| = 0.47$). No significant effect was found for the secure prime compared to the neutral prime ($t(55) = -2.65$, $p = .064$, $B = -4.53$, $SE = 1.71$, $|d| = 0.35$).

Against predictions, the secure prime seemed to have had a negative effect on secure state attachment. Inspection of the secure state attachment scores (Table 2) suggested that this effect may have been a statistical artefact due to a ceiling effect in our secure state attachment scores. Because pairwise comparisons indicated no significant difference in secure state attachment between the secure and avoidant prime conditions ($t(55) = 0.024$, $p = .999$, $B = 0.05$, $SE = 1.90$, $|d| = 0.003$), we could not rule out the possibility that the significant avoidant prime effect was at least partly driven by ceiling effects. To evaluate the extent to which the avoidant prime effect we found was driven by ceiling effects, we repeated the analyses selecting the children who scored below the median on secure state attachment after the neutral prime ($n = 29$). In this group, repeating the analysis continued to show a significant main effect of prime condition on secure state attachment (*$F(2.32, 65.08) = 3.11$, $p = .044$, $\eta p^2 = .10$*) after applying Greenhouse–Geisser corrections. Additionally, pairwise comparisons still revealed a significant negative effect of the avoidant prime on secure state attachment compared to the neutral prime ($B = 5.85$, $SE = 1.87$, *$t(28) = 3.12$*, $p = .025$), while the previously observed negative effect of the secure prime was no longer significant ($B = 4.76$, $SE = 2.18$, *$t(28) = 2.19$*, $p = .224$). These findings suggest that only the secure prime effect, but not the avoidant prime effect on secure state attachment was likely attributable to a ceiling effect.

The results showed a significant overall effect of priming condition on anxious state attachment with medium effect size, $F(1.83,165) = 4.84$, $p = .012$, $\eta_p^2 = .081$. However, compared to the neutral prime, the different primes had no separate significant effects on anxious state

attachment (secure prime: $t(55) = 1.68$, $p = .589$, $B = 3.39$, $SE = 2.01$, $|d| = 0.22$; avoidant prime: $t(55) = 0.54$, $p = 1.000$, $B = 1.15$, $SE = 2.14$, $|d| = 0.07$). No overall effect of priming condition was found for avoidant attachment with small effect size ($F(2.58,165) = 0.85$, $p = .452$, $\eta_p^2 = .015$).

Research question 2: Is the Effect of Attachment Priming Moderated by Trait Attachment Security?

Using self-reported trait trust as a moderator in the linear mixed effects model, we found no significant interaction effects of priming condition * trait trust on any state attachment subscale ($t(62)$s < 1.71; ps > .254).

Similarly, when using SBS knowledge as the moderator, no significant interactions were observed between the secure prime and SBS knowledge on state attachment (|t(162)|s <1.41; ps > .159).Please refer to the supplementary file for detailed results.

Testing age and sex as possible moderators

To examine whether children's age influenced the priming effects, we conducted a linear mixed-effects model for each state attachment subscale, including prime condition, age, and their interaction as predictors. The interaction terms did not reach significance for avoidant state attachment (*all p* > .09), anxious state attachment (*all p* > .09), or secure state attachment (*all p* > .08), indicating that the effect of prime condition on state attachment scores did not vary as a function of participants' age. The same analysis was done including prime condition, sex, and their interaction as predictors in the model, and again none of the interaction terms reached significance for avoidant attachment (*all p* > .09), anxious attachment (*all p* > .09), or secure attachment (*all p* > .32). These findings indicate that the effect of condition on attachment outcomes did not differ between male and female participants.

Sensitivity analysis: non-parametric Friedman test

A detailed examination of the data revealed a highly skewed distribution in the state attachment measures (Table 1). To contextualize this skewness, we compared our distribution to that reported by Cuypers et al. (2023) and found it to be comparable, if not more pronounced in their

study. Given this skewed distribution, we conducted a Friedman test in addition to the repeated measures ANOVA for research question 1. As a non-parametric alternative, the Friedman test is an appropriate sensitivity analysis to assess the robustness of our findings. The results of the Friedman test, followed by the non-parametric Wilcoxon test for pairwise comparisons aligned with those of the repeated measures ANOVA. We still found a significant negative effect of the avoidant prime on the secure state attachment after a Bonferroni correction, further supporting the reliability of our conclusions (W = 598, n = 56, p = .006, r = .44). We reran the analyses, imputing missing data with k-nearest neighbors imputation. All the results remained the same. The only difference was for the negative effect of the secure prime on secure state attachment. While this effect did originally not reach significance (p = .06), the effect now became significant although it's size remained small (t(59) = 2.88, p = .03, B = 2.30, SE = 0.80, $|d|$ = 0.37).

Discussion

The current study investigated whether children's in-the-moment feelings of secure or insecure attachment to their mother changed when memories of past positive or negative attachment-related experiences were activated. We found overall priming effects on both state secure attachment and state anxious attachment, but not on state avoidant attachment. When further probing the effects, we could not replicate Cuyvers et al.'s (2023) positive effect of the secure prime on secure state attachment. Our result aligns with Bosmans, Bowles et al.'s (2014) findings in adults, where no effect was found of a secure prime on secure state attachment. Against predictions, there was a trend that the secure prime had a negative effect on secure state attachment. With missing data imputed, this effect became even more pronounced. However, inspection of the secure state attachment scores and follow-up analyses on children scoring below the medium on secure state attachment suggested that the negative effect might be due to a ceiling effect in secure state attachment scores.

Instead, the avoidant prime decreased state secure attachment as we predicted. This effect remained significant when excluding the high scores, suggesting that it may have been more than a

mere ceiling effect. The effect was also replicated in the non-parametrical test (controlling for the skewed distribution) and when imputing missing data. This effect, not found by Cuyvers et al. (2023), may have emerged in the current study due to our adjustment of the avoidant prime. No priming effects were found on state avoidant attachment. In all, our results suggest that activating attachment memories can affect attachment states, but that the effects are subtle.

Exploring whether trait attachment security moderated prime effects on state attachment, we found no significant interaction effects, neither for self-reported trait trust nor for SBS knowledge. This result partly aligned with Cuyvers et al. (2023), who found a moderating effect of self-reported trait trust, but no moderating effect of SBS knowledge. Other studies found mixed support for moderating effects of trait attachment on state attachment manipulations. For example, Cuyvers et al. (2024) found no moderating effects of trait trust or SBS knowledge on children's state attachment changes after a manipulation of maternal support during distress. Neither did Vandevivere et al. (2018) find a moderating effect of trait trust on changes in state attachment after a similar manipulation. However, some diary and Experience Sampling Methodology (ESM) studies found that trait attachment moderated variation in state attachment over time (e.g., in children: Bosmans et al., 2014; in adults: Tammilehto et al. 2024). Taken together, the question of whether trait attachment modulates state attachment-focused manipulations is open but the evidence so far suggests that these effects are not easy to demonstrate. At the level of priming effects, the available data seems to point to the idea that the subtle effects of activating attachment memories on state attachment occur largely independently of children's ruling attachment expectations. Yet, it might be too early to draw strong conclusions for the following reasons. First, the power of our study was insufficient for testing moderation effects. Our power analysis and sample selection were based on testing the first research question, whether primes affect state attachment. Power analysis regarding the second research question suggested that the power was not sufficient to reliably test for moderation effects and that this part of the analyses can only be considered exploratory. Second, measures of attachment states

that rely less on self-report might lead to different results, as has been shown in adults on attachment-related attentional biases (Han & Psouni, 2025).

While the current findings are promising and add to what was previously found by Cuyvers and colleagues (2023), there are important limitations to take into account. Most importantly, a key limitation is that state attachment can only be measured via self-report measures. Consequently, informant-related response biases may affect the results. At present there are no valid alternatives to measuring state attachment. Instead, self-report currently might be the only appropriate measurement strategy as it taps directly into how the relationship with the attachment figure is experienced in-the-moment.

Second, we focused on mothers while there is an increasing awareness that fathers are equally important for children's attachment development (Dagan et al., 2021). It is currently unknown whether priming attachment memories has similar effects on state attachment to fathers (or other attachment figures). However, we for now assumed that we are testing fundamental processes that should be independent of the gender or role of attachment figures. Nevertheless, more research is needed to ensure that the effects found replicate in other attachment relationships.

Third, the data were collected either at school or at home, depending on logistic feasibility and family preference. Unfortunately, we did not record the specific location for each participant, which prevented us from testing whether context influenced attachment responses. Theoretically, context could matter, as both homes and schools may function as attachment-relevant environments that can activate attachment memories (Verschueren & Koomen, 2012). However, any potential contextual effects were likely randomly distributed across participants and locations, and thus unlikely to have systematically biased the findings. Future research may benefit from collecting data in standard settings (e.g., laboratory environments) to minimize contextual variability. Finally, different attachment questionnaires exist for this age-group and it cannot be ruled out that they each capture specific aspects of attachment. Consequently, the pattern of results we found in the current study may have looked different had we used a different measure.

In summary, the current study together with Cuyvers et al. (2023) suggest that priming effects on state attachment exist but are subtle. This is unsurprising, given that individuals constantly encounter stimuli that can activate positive or negative attachment memories. If such stimuli would have a strong effect on their attachment states, they would continuously oscillate between secure and insecure attachment states making it hard to establish stable relationships. Recent research shows that state attachment has its own temporal dynamics (Tammilehto et al., 2024; Verhees et al., 2023) with state attachment changes lingering shortly in response to positive or negative care-related experiences, but then returning to intraindividual mean levels of state attachment. One could assume though that repeated activation of trait attachment-related incongruent attachment memories would affect the content of the trait attachment prototype and shift individuals towards more secure or insecure trait attachment. More research is needed to test the tipping point at which state attachment effects feed into trait attachment changes.

Trait attachment did not moderate the prime effects. This observation is consistent with state attachment being a largely automatic response following experiences of care or rejection (Bosmans et al., 2020). State attachment changes are thought to be associated with endocrinological changes at the level of, for example, oxytocin (Cuyvers et al., 2024), and do not require learning (Bosmans et al., 2020). Instead, state attachment changes have probably a reinforcing value affecting individuals' learning to trust or fear rejection in a specific relationship.

This finding is encouraging insofar as it suggests that interventions designed to activate secure attachment memories could, in principle, affect state attachment even in individuals whose attachment prototypes are predominantly negative at the level of trust in others. More research is needed to test whether such state changes may accumulate and result in more enduring effects and whether targeting state attachment might be therapeutically beneficial.

References

Baldwin, M. W., Keelan, J. P. R., Fehr, B., Enns, V., & Koh-Rangarajoo, E. (1996). Social-cognitive conceptualization of attachment working models: Availability and accessibility effects. Journal of Personality and Social Psychology, 71(1), 94–109. https://doi.org/10.1037/0022-3514.71.1.94

Bowlby, J. (1969). *Attachment and loss: volume I: attachment. In Attachment and Loss: Volume I: Attachment.* London: The Hogarth Press and the Institute of Psycho-Analysis.

Bosmans, G., & Kerns, K. A. (2015). Attachment in middle childhood: Progress and prospects. New Directions *for Child and Adolescent Development, 2015*, 1-14.

Bosmans, G., Braet, C., Heylen, J., & De Raedt, R. (2015). Children's attentional processing of mother and proximity seeking. *PLoS One, 10(4),* e0124038.

Bosmans, G., Bakermans-Kranenburg, M. J., Vervliet, B., Verhees, M., & van IJzendoorn, M. H. (2020). A learning theory of attachment: Unraveling the black box of attachment development. *Neuroscience and Biobehavioral Reviews,113,* 287–298. https://doi.org/10.1016/j.neubiorev.2020.03.014

Bosmans, G., Bowles, D. P., Dewitte, M., De Winter, S., & Braet, C. (2014). An experimental evaluation of the state adult attachment measure: The influence of attachment primes on the content of state attachment representations*. Journal of Experimental Psychopathology.* https://doi.org/10.5127/jep.033612

Carnelley, K. B., & Rowe, A. C. (2007). Repeated priming of attachment security influences later views of self and relationships. *Personal Relationships, 14,* 307–320. https://doi.org/10.1111/j.1475-6811.2007.00156.x

Cassidy, J. (2016). The nature of the child's ties. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research and clinical applications* (3rd ed., pp. 3–24). New York, NY: The Guilford Press.

Cuyvers, B., Verhees, M. W. F. T., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J.,

Rowe, A. C. M., Ceulemans, E., & Bosmans, G. (2023). The Effect of Attachment Priming on State Attachment Security in Middle Childhood: The Moderating Roles of Trait Attachment and State Attachment Volatility. *The Journal of Early Adolescence, 43,* 164-193. https://doi.org/10.1177/02724316221099871

Cuyvers, B., Ein-Dor, T., Houbrechts, M., Freson, K., Goossens, L., van den Noortgate, W., van Leeuwen, K., Bijttebier, P., Claes, S., Turner, J., Chubar, V., Bakermans-Kranenburg, M.J., & Bosmans, G. (2024). Exploring the role of *OXTR* gene methylation in attachment development: A longitudinal study. *Developmental Psychobiology*, *66* (5), Art.No. ARTN e22496. doi: 10.1002/dev.22496

Dagan, O., Schuengel, C., Verhage, M. L., … Collaboration on Attachment to Multiple Parents and Outcomes Synthesis (2021). Configurations of mother-child and father-child attachment as predictors of internalizing and externalizing behavioral problems: An individual participant data (IPD) meta-analysis. *New directions for child and adolescent development*, *2021*, 67–94. https://doi.org/10.1002/cad.20450

Dykas, M. J., & Cassidy, J. (2011). Attachment and the processing of social information across the life span: theory and evidence. *Psychological bulletin*, *137*, 19.

Dujardin, A., Bosmans, G., Braet, C., Goossens, L. (2014). Attachment-related expectations and mother-referent memory bias in middle childhood. *Scandinavian Journal of Psychology*, *55*, 296-302. doi: 10.1111/sjop.12129

Gillath, O., Hart, J., Noftle, E. E., & Stockdale, G. D. (2009). Development and validation of a state adult attachment measure (SAAM). *Journal of Research in Personality*, *43*, 362-373.

Gillath, O., Karantzas, G. C., Romano, D., & Karantzas, K. M. (2022). Attachment Security Priming: A Meta-Analysis. *Personality and Social Psychology Review, 26,* 183-241. https://doi.org/10.1177/10888683211054592

Groh, A. M., Fearon, P. R., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Steele, R. D.,& Roisman, G. I. (2014). The significance of attachment security for children's social competence with peers: a meta-analytic study. *Attachment & Human Development, 16*, 103–136. https://doi.org/10.1080/14616734.2014.883636

Han, G., & Psouni, E. (2025). Primed into security: can attachment security priming affect attachment-related biases on early attention?. *Journal of Cognitive Psychology, 37*, 144-156.

Houbrechts, M., Waters, T. E., Facompré, C. R., Bijttebier, P., Goossens, L., Van Leeuwen, K., ... & Bosmans, G. (2024). Evidence of a developmental shift in the nature of attachment representations: a longitudinal taxometric investigation of secure base script knowledge from middle childhood into adolescence. *Attachment & Human Development, 26,* 464-481.

Janiszewski, C. A., & Wyer, R. S. (2014). Content and process priming: A review. *Journal of Consumer Psychology, 24,* 96–118. https://doi.org/10.1016/j.jcps.2013.05.006

Jewell, T., Gardner, T., Susi, K., Watchorn, K., Coopey, E., Simic, M., ... & Eisler, I. (2019). Attachment measures in middle childhood and adolescence: A systematic review of measurement properties. *Clinical psychology review, 68,* 71-82.

Jones, J. D., Fraley, R. C., Ehrlich, K. B., Stern, J. A., Lejuez, C. W., Shaver, P. R., & Cassidy, J. (2018). Stability of attachment style in adolescence: An empirical test of alternative developmental processes. *Child development*, *89*, 871-880.

Molden, D. C. (2014). Understanding priming effects in social psychology: What is "social priming" and how does it occur?. *Social cognition*, *32*, 1-11.

Ridenour, T. A., Greenberg, M. T., & Cook, E. T. (2006). Structure and validity of People in my life: A self-report measure of attachment in late childhood. *Journal of Youth and Adolescence, 35*, 1037–1053. https://doi.org/10.1007/s10964-006-9070-5

Rowe, A. C. M., Gold, E. R., & Carnelley, K. B. (2020). The effectiveness of attachment security priming in improving positive affect and reducing negative affect: A systematic review. *International Journal of Environmental Research and Public Health, 17,* 968. https://doi.org/10.3390/ijerph17030968

Sroufe, L. A., and Waters, E. (1977). Attachment as an Organizational Construct. *Child Development, 48,* 1184–1199.

Stupica, B., Brett, B. E., Woodhouse, S. S., & Cassidy, J. (2019). Attachment security priming decreases children's physiological response to threat. *Child development, 90(4), 1*254-1271.

Tammilehto, J., Kaurin, A., Bosmans, G., Kuppens, P., Flykt, M., Vanska, M., Peltonen, K., Lindblom, J. (in press). Everyday State Attachment: Dynamic Features and Role of Trait Attachment. *Journal of Personality.* doi: 10.1111/jopy.12975

Verhees, M. W. F. T., Ceulemans, E., Bakermans-Kranenburg, M. J., & Bosmans, G. (2021). State Attachment Variability: Between- and within-Person Level Associations with Trait Attachment and Psychological Problems. *Brain sciences*, *11*, 1264. https://doi.org/10.3390/brainsci11101264

Verhees, M. W., Ceulemans, E., Finet, C., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Bosmans, G. (2023). Exploring everyday state attachment dynamics in middle childhood. *Development and Psychopathology*, *35*, 652-661.

Waters, H. S., & Waters, E. (2006). The attachment working models concept: Among other things, we build script-like representations of secure base experiences. *Attachment & Human Development, 8,* 185–197. https://doi.org/10.1080/14616730600856016

Waters, T. E., Facompré, C. R., Van de Walle, M., Dujardin, A., De Winter, S., Heylen, J., ... &

Bosmans, G. (2019). Stability and change in secure base script knowledge during middle childhood and early adolescence: A 3-year longitudinal study. *Developmental Psychology*, *55*, 2379.

Waters, T. E., Yang, R., Finet, C., Verhees, M. W., & Bosmans, G. (2022). An empirical test of prototype and revisionist models of attachment stability and change from middle childhood to adolescence: A 6-year longitudinal study. *Child Development*, *93*, 225-236.

Table 1

Correlations between trait attachment and state attachment at baseline and Mean, SD, Skewness and Kurtosis of all scales at baseline.

	1	2	3	4	5
1. Self-reported trait trust					
2. SBS knowledge	.05				
3. Secure state attachment	.53***	.14			
4. Anxious state attachment	-.05	.05	-.27 *		
5. Avoidant state attachment	.03	-.06	-.01	.25	
M	3.74	3.66	94.33	15.29	21.67
SD	0.24	0.50	8.53	21.97	25.10
Skewness	-0.983	0.633	-2.102	1.637	1.157
Kurtosis	3.510	3.625	7.189	5.204	3.387

Note. * p < .05, *** p < .001

Table 2

Means and standard deviations of secure, anxious and avoidant state attachment per priming condition, self-reported trait trust and SBS knowledge.

Variable	Condition	*Mean*	*SD*
Secure State Attachment	Baseline	94.33	8.53
	Neutral	95.80	6.32
	Secure	91.27	15.44
	Avoidant	91.23	12.73
Anxious State Attachment	Baseline	15.29	21.97
	Neutral	9.92	16.41
	Secure	6.53	12.23
	Avoidant	8.78	15.24
Avoidant State Attachment	Baseline	21.67	25.10
	Neutral	20.89	25.34
	Secure	18.59	21.68
	Avoidant	23.02	28.37