

State Trust in Middle Childhood: An Experimental Manipulation of Maternal Support

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Abstract

Attachment representations have traditionally been considered a stable trait, although evidence is found that attachment varies over time and situations conditional upon exposure to life-events and diverse contextual factors. This suggests that attachment consists of both trait and state like components. The current study aimed to evaluate if experiences with maternal support modulate children's state trust in mother's availability. For this purpose, we set up an experimental procedure. First, children watched a negative mood inducing video to activate negative emotions. In the following experimental phase, mothers were randomly assigned to one of three conditions. In condition one, mothers were instructed to provide secure base support to the distressed child. In the second condition, mother

was only physically present and did not offer the child emotional support. In the last condition, children had no contact with mother. After this experimental phase, all mothers were instructed to provide secure base support in the recovery phase to study if secure base support could restore the decreased trust states. In total, 120 mother-child dyads participated the study. Results indicated that distressed children whose mother was absent or only physically available during the experimental phase, had significantly lower scores on state trust in comparison with children who did receive secure base support. After receiving secure base care, no more differences in state-trust across the secure base support and non-support conditions were found. Temperament could not explain these effects, pointing at the impact of interactions with a support providing mother on the activation of trust states.

Keywords

Attachment

Middle childhood

State

Maternal support

Introduction

Although attachment representations have traditionally been considered a fairly stable trait (Bowlby 1969/1982), evidence suggests that attachment varies over time and situations conditional upon life-events and diverse contextual factors (e.g., Gillath et al. 2009). This suggests that attachment representations consist of trait and state like components (Thompson and Raikes 2003). Theoretically, acknowledging a state component might help to explain within subject variation in attachment representation. In adult research, state attachment has already been empirically researched (Gillath et al. 2009). However, research on the existence of state attachment and the antecedents of state attachment fluctuations are understudied in children. One core element of the complex attachment construct is the extent to which children trust that they can rely on mother (Ridenour et al. 2006). Diary research has found evidence that also trust consists of state- and traitlike components and that the state components correlated with changes in the quality of the interactions with mother (Bosmans et al. 2014a). However, the latter study was limited because of its correlational nature.

Trust is a core feature of the attachment construct. Infants are biologically predisposed to form attachments with adult caregivers (Bowlby 1969/1982). The caregiver functions both as a safe haven and secure base for the child. A core assumption of attachment theory is that repeated experiences with the caregiver as safe haven and secure base are stored into cognitive representations or Internal Working Models (IWM). Securely attached children have an internal working model of their caregivers as sensitive and responsive to both their attachment and exploration needs (Main et al. 1985). In contrast, insecurely attached individuals either have internal working models of their parents as consistently failing to provide a safe haven in times of need (insecurely-avoidant attachment), or as unpredictable caregivers who should be kept nearby to increase the likelihood of gaining access in times of need (insecurely-resistant attachment) (Ainsworth 1985; Main et al. 1985).

Waters and Waters (2006) demonstrated that the IWM consists at least partly of a cognitive script about the attachment figure (a secure base script). In congruence with this script, children build related robust cognitive attachment-related expectations about whether or not they can trust in their mother's availability for support (Ainsworth 1985). Recent work provides evidence for the presence of a script-like representation of the attachment relationship in middle childhood (Waters et al. 2015). This secure base script knowledge is predicted by observations of maternal sensitivity across childhood and adolescence (Steele et al. 2014; Waters et al. 2017). According to Waters and Waters (2006), the cognitive script concept predicts stability of the specific attachment representations over the life span and across different contexts. Cognitive scripts influence and bias the attachment-related information processing (Dykas and Cassidy 2011; Zimmermann and Iwanski 2015). In middle childhood, Bosmans and colleagues experimentally confirmed information processing biases. These interpretation (De Winter et al. 2016), attentional (Bosmans et al. 2009), and memory biases (Dujardin et al. 2014) exclude the processing of incongruent attachment information, assuming that once trait trust (or lack of trait trust) is established, this becomes a stable feature of the attachment relationship.

However, the stability hypothesis of attachment representations could not be fully supported (e.g. Steele et al. 2014). A large longitudinal study targeting a risk sample of children revealed that in childhood attachment is not stable (Weinfield et al. 2000). A meta-analytic review revealed only moderate stability of attachment style, with an overall correlation between infant

attachment and early adulthood attachment of .39 (Pinquart et al. 2013). Groh et al. (2014) conducted the largest sample investigation of the stability of attachment and showed that attachment security was not a stable construct from infancy to adolescence. Moreover, in intervals larger than 15 years no significant stability was found. Interestingly, changes in attachment style were already observed in infancy. Vaughn et al. (1979) used the strange situation procedure to classify infants as secure, anxiously, or avoidantly attached at 12 and at 18 months. Over these 6 months, 38% of the attachment classifications changed. These findings suggest that attachment relationships are only stable to a certain degree. This made researchers hypothesize that part of this instability is due to state fluctuations in the content of attachment and trust representations (Baldwin et al. 1996; Gillath et al. 2009; Bosmans et al. 2014a).

Fraley's (2007) connectionist model provides a framework to understand these state fluctuations. In his model, the representations of several independent relationships are stored in units within a cognitive network and knowledge of different relationships is distributed across the network. Interestingly, Fraley (2007) showed that the network represented both global and more specific or context-related features of relationships, depending on specific internal and external cues that could activate a specific relational pattern. Based on this connectionist model, it is theoretically assumed that different trust states can arise as a function of interpersonal features of the context.

In adult research, an increasing number of studies investigated the hypothesis that changes in relationship contexts are linked with fluctuations in the content of attachment representations. Priming attachment-related events was related to changes in state attachment security (Gillath et al. 2009; Pepping et al. 2015). Asking adults to recall a situation during which they felt secure, anxious, or avoidant, led to the activation of specific attachment states (Baldwin et al. 1996; Baldwin and Holmes 1987). Also, Bosmans et al. (2014a) primed young adults with a secure, insecure, or neutral prime and revealed that these primes significantly changed state attachment security towards partners. Based on longitudinal data on adults' secure attachment states towards their partner, Hammond and Fletcher (1991) concluded that secure attachment states were malleable and influenced by experiences like relationship satisfaction. Furthermore, particularly the subjective negative impact of these relational experiences seemed to be related to insecurity on a day-to-day basis (Davila and Sargent 2003). These studies in adults suggested

that at least for secure attachment towards romantic partners, state-like fluctuations in response to specific relational cues can be demonstrated.

Thus far, little research focused on fluctuations in the content of attachment representations regarding parents in general and in trust states in specific. In adults, Bosmans et al. (2014a) found no context-related fluctuations in parent-attachment states. To investigate context-related fluctuations in the content of attachment representations regarding parents, one might better focus on middle childhood. At this age, parents remain the primary attachment figures and children's state trust in parental support might be more sensitive to context manipulations. Moreover, middle childhood might be a particularly important period to study state attachment because it is a developmental switch point in the development of life history. This is characterized by growing autonomy, the emergence of new relational behavior patterns and the enhanced development of cognitive relational scripts (Del Giudice et al. 2009). As attachment differences at this age become increasingly apparent at the cognitive level (Main et al. 1985) in terms of whether or not they trust in the availability of their attachment figures (Kerns et al. 2006), middle childhood is a potentially important period to investigate state attachment towards mother.

Only one previous study investigated state attachment in middle childhood (Bosmans et al. 2014b). In the latter study, children reported day-to-day fluctuations in state trust in maternal support and whether or not they experienced conflicts with their mother during the past day. The occurrence of conflicts with the mother indeed temporarily reduced the level of trust in maternal support. However, the latter study was limited because its design did not allow drawing causal conclusions about the relation between parental behavior and state trust.

Children and adults vary considerably in the extent to which attachment styles remain consistent over time (Bosmans et al. 2014b; Thompson 2000). Besides specific contexts, Davila et al. (1997) found that also specific personality characteristics accounted for the degree of change in adult attachment representations over a 2-year time period. In (middle) childhood, consensus is that both personality and temperament could be studied to investigate those inborn child-characteristics that determine the development of the parent-child relationship (De Pauw and Mervielde 2010). Some research suggests that the impact of temperament becomes more tangible in middle childhood, because an early sexual maturation stage that typically occurs at around 10–11 years of

age (andrenarche) sets of a chain of biological events that might increase the impact of temperament on attachment development (Del Giudice et al. 2009). Therefore, one could argue that temperament might affect state fluctuations of attachment in middle childhood. Three broad dimensions of temperament can be distinguished; negative affectivity (NA), positive affectivity (PA), and effortful control (EC) (Rothbart and Bates 2006; Rothbart 2007). All three dimensions are linked with developmental outcomes, like positive relationships with parents (Kochanska et al. 2007), behavior problems (Rothbart and Bates 2006), and social development (Eisenberg et al. 2004).

We aimed to investigate the causal effect of experiencing maternal support during distress on children's state trust in the mother as a resource to help regulate distress. The children were first exposed to mild distress to activate the need for their mother's support. In the Experimental Phase the effect of receiving no maternal support after exposure to distress on state trust was studied. After this Experimental Phase, all the mothers were instructed to provide secure base support to study if secure base support can restore decreased trust states. First, to investigate the manipulation effects of the mother's behavior on state trust, we researched if there were differences in state trust after the manipulation depending on which condition the child was in. We hypothesized that the children in the non-support conditions would have significant lower state trust scores in comparison with the children whose mother was sensitive and responsive. Second, we expected that state trust in the children who did not receive secure base support would recover after receiving secure base support; leading to no significant differences in state trust scores at the end of the experiment. Third and last, we researched if temperament moderated the effects of the manipulation on the state trust scores.

Method

Participants

The sample consisted of 120 children (54% girls) with ages ranging from 9 till 13 years old ($M = 10.47$, $SD = .97$) and their mothers. Subjects were randomly assigned to one of the three conditions, resulting in 40 dyads each condition. Ninety five children (79.17%) lived together with both parents (married or cohabiting partners), 17.5% had divorced parents, and three children (2.5%) had irregular or no contact with father due to father's profession or on police order. One child's father (0.83%) was deceased and

lived with mother in a blended family. All children had been primarily raised by their mother from birth onwards, except for one child that was primarily raised by its father. For two children this information was lacking. All children reported attachment towards their biological mother except for one child that was adopted since birth. Regarding parental level of education, 0.8% of the mothers had an elementary school degree, 33.3% had a high school degree, 40.8% had a post-high school technical training or a technical bachelor degree, and 25% had a master's degree. Furthermore, 4.2% of the fathers had an elementary school degree, 32.5% had a high school degree, 33.3% had a post-high school technical training or a technical bachelor degree, and 28.3% had a master's degree. For 1.7% of the fathers responses regarding level of education were missing. All children and their mothers signed an informed consent. The current study was approved by the university's ethical committee.

Procedure

Flyers were distributed in the classrooms of the fourth, fifth, and sixth grade of elementary school, inviting children and their parents to participate in a study on the relationship between children and their mother. The flyer informed parents about the content of the study and asked their approval to be contacted by the experimenter. All volunteering mothers were informed about the content and the methodology of the study and chose to participate. Moreover, an appointment was made for a home visit to collect the data.

During the home visit, the mother and the child were placed in a different room at home. For an overview of the procedure, see Fig. 1. First, the mothers watched the clip under supervision of the experimenter and decided whether they wanted to continue the study. All mothers chose to continue participation and signed an informed consent. In the first phase, the mother and the child separately filled out demographics and questionnaires (t1 or the baseline measures). During the second phase, stress was induced by a negative clip selected from the 7 p.m. news. The experimenter was with the child and could assure children watched the clip. Evocative clips have been commonly used to induce mood in children (Brenner 2000). Each child was seated in a chair, 60 cm in front of the screen and was instructed to watch the news item. The duration of the clip was 81 s and concerned foreign news about the flood disaster in Pakistan. The clip recognizes the seriousness and the food shortage in the area. Moreover, very ill women and children were portrayed. After watching the clip, emotions were rated again on this second time period (Time

2). Mother was not in the room during this phase.

Fig. 1

Schematic overview of the experimental setup and the measurement after each phase

Phase one: Baseline measures.	Phase two: Stress Induction.	Phase three: Experimental manipulation.	Phase four: Recovery Phase.
	Distressing clip	C1: Secure Base C2: Physically Available C3: Absent Mother	All children: secure base mother
Trust and emotions on <u>Time 1</u>	Emotions on <u>Time 2</u>	Trust and emotions on <u>Time 3</u>	Trust and emotions on <u>Time 4</u>
<i>C1: condition 1; C2 = Condition 2; C3 = Condition 3.</i>			

After stress induction, maternal behavior was experimental manipulated (phase three). The mothers intervened for 5 min depending on the condition they were randomly assigned to. Instructions were written down and the experimenter asked to follow these instructions. Instructions varied depending on the condition the dyad was randomly assigned to. Instructions were given on a card to the mother. The experimenter supervised whether the study instructions were followed correctly and stayed with the mother during each condition.

Condition 1: Secure base mother. In this condition the mother was asked to handle according to the secure base script (Waters and Waters 2006). The mothers were instructed to talk about the clip with the child and help the child process the images for 5 min. She needed to ask the child what the clip was about and how it made him/her feel. The mother had to normalize feelings of fearfulness and sadness and tell the child that it is indeed frightening to have everything destroyed by a flood. Moreover, she was instructed to talk about what they could do if this would happen with them. All the mothers followed consequently the instructions, so all dyads were included in the analysis.

Condition 2: Physically available mother. In this condition the mother was brought to the room where the child was sitting, but she was instructed to talk with the experimenter. The experimenter talked with the mother for 5 min

about the weather and the experimenter's studies. In this condition the mother was nearby, but she did not provide emotional support. All the mothers consequently followed the instructions and talked to the experimenter, so all dyads were included in the analysis.

Condition 3: Absent mother. The experimenter told the child he/she needed some papers and left the room for 5 min. The mother, who was sitting in a separate room, was instructed to wait in the room and not to go to the child for 5 min, leaving the child alone in the room for 5 min after watching the clip. As a result, neither proximity, nor emotional support was provided. All the mothers left the child alone for 5 min thus could be included in the analysis.

After these experimental conditions, a third measurement took place (Time 3); state trust and emotions were rated again by the child.

In the fourth and last phase of the experimental procedure, the mothers were instructed to talk for five more minutes with the child. Instructions were the same like instructions in the secure base condition. So, after Phase 3, also the children in condition two and three received the secure base support from their mother. Phase 4 ended with Time 4 measurements. The mother consequently followed the instructions, so we could take all dyads into the analysis.

To end, the children watched a positive clip and a debriefing took place. The current study was approved by the university's ethical committee.

Measures

Trait secure attachment

Children reported on trust in maternal support using the Trust subscale of the People In My Life Questionnaire (PIML, Ridenour et al. 2006), which is designed to measure 10 to 12-year-old children's representations of attachment figures. Children responded on a 4-point Likert-scale ranging from 1 (almost never true) to 4 (almost always true). The PIML consists of three subscales: trust, communication, and alienation but only one subscale is used in this study. Trust is conceptualized as the positive affective/cognitive experiences of trust in the accessibility and responsiveness of attachment figures (10 items, e.g. "I can count on my mother to help me when I have a problem"). The scale has good psychometric properties (Armsden and Greenberg 1987). Since factor loadings suggested that secure attachment

largely consists of trust in an individual (Ridenour et al. 2006), the trust subscale was used in the present study to measure baseline trust in mother availability on time one. Cronbach's alpha of the total Secure Attachment in the current sample was .86.

State trust

To measure attachment-related appraisals regarding mother during the experimental procedure, a state version of the (trait) Trust scale was developed. This state variant of the questionnaire was administered after each manipulation of mother's behavior (Time 3 and 4). All items had the same stem: "At this moment, I feel that ...". On Time 3, the same three items as in the diary study of Bosmans et al. (2014b) were used to measure state trust in maternal support (at this moment, I feel that I can count on my mother if I -encounter a problem; my mother pays attention to me; and I got along well with my mother). On Time 4, after all children received a secure base mother, ten items were selected to measure state trust (e.g., at this moment, I feel that I can count on my mother to help me when I have a problem). Cronbach's alpha of the total state security score was .70 (t3) and .86 (t4) in the current sample.

Negative and positive affect

The Dutch version of the Emotionality Activity and Sociability Temperament Survey for Children (EAS, Buss and Plomin 1984; Dutch version: Boer and Westenberg 1994) was administered from mother in order to measure NA and PA of the child. The EAS consists of 20 items on a 5-point Likert-scale ranging from 1 (not at all characterizes my child) to 5 (very well characterizes my child). The questionnaire is widely used in the psychological literature and has excellent psychometric properties (Boer and Westenberg 1994). The Emotionality subscale, distress and anxiety (e.g., "Child often fusses and cries"), was used to measure NA. PA was measured using the subscale 'Activity' of the EAS, which measures tempo and vigor (e.g., "Child very energetic"). In this study Chronbach's alpha ranged from .70 to .88 for respectively Emotionality and Activity.

Effortful control

EC was measured using a self-report questionnaire, the Effortful Control Scale (ECS; Lonigan and Vasey 2009). Children completed the ECS (Lonigan and Vasey 2009), which consists of 24 items that are rated on a 5-point scale

with regard to how much each item describes the child “most of the time”. The items tap into persistence/lack of distractibility (e.g., “Even little things distract me” and “Once I’m involved in a task, nothing can distract me from it”) and lack of impulsivity (e.g., “I can easily stop an activity when told to do so”). The items are summed in a total EC score (e.g., Verstraeten et al. 2010). Comparing the ECS to other measures of EC, research shows that the ECS is highly valuable, not only because it can be reliably administered to children, but also because the child version highly correlates with parent measures of child EC and with performance based indicators of EC (Verstraeten et al. 2010). In the current study, Cronbach’s α for EC was .68.

Affect

To check if the manipulation made children distressed, mood adjectives scales were used. Children were asked to rate the degree to which a number of different adjectives describe their current mood. The advantage of using mood adjective scales is the capability of delineating more discrete moods (Brenner 2000). Two positive (happiness, and satisfaction) and two negative (fearfulness, and sadness) stress-related states were rated on a horizontal Visual Analogous Scale (100 mm with measurement to a resolution of 1 mm) going from “not at all” to “a lot”. All items had the same stem: e.g. “At this moment, I feel ... (fearful)”. Affect was administered before the clip (t1), after the clip (t2), after experimental manipulation (t3), and after all mothers were emotional supportive (t4). Visual analog scales are proven to have a good validity and reliability (Ahearn 1997).

Data Analysis

For the comparability of the trait and state measures of trust a reference transformation was applied based on the observed values of the trait trust on the first time point. As such the mean and the variance of the transformed state trust on time point 3 are on the same scale (max. score 40) as the original trait trust on time point 1 and state trust on time point 4. Furthermore, by taking into account both the mean and the variance, this calibration assured proper comparability on all time points.

First, we investigated if stress manipulation indeed made children more distressed. Second, we preliminary investigated via multivariate analysis if the baseline measures differed across conditions to check if children were randomly assigned to the groups. Next, we looked at the effect of confounding variables (e.g., gender and age) on trait and state trust. Further, the

experimental set up (e.g., interactions between mother and the child for 5 min vs. leaving the child alone for 5 min) could have induced different residual variability over conditions. Therefore, to better model the variance/covariance structure we investigated whether variability was different across conditions to see if we needed to add the residual variability in our linear mixed model.

To test the three hypotheses of the current study, we simultaneously conducted all statistical tests in one statistical model. From a mixed regression model, the specific contrasts were analyzed. As a consequence, the Standard Error of those contrasts take into account SEs on all parameters, including trait trust in pre-manipulation. The repeated measures structure of the analysis was accounted for by using linear mixed models (output generated using SAS 9.4, mixed procedure, SAS Institute, Cary NC and R version 3.1.1 with the lme4 package) that included random intercepts per subjects and residual autocorrelation was reduced to a first order auto-correlation structure. To investigate the effect of Condition on state trust, we investigated the mean level differences in state Trust between the conditions after the experimental phase (hypothesis 1) and the recovery phase (hypothesis 2). Experimental conditions and the 3 time points were added to model the experimental setup. At last, age and gender were included in the model as confounding variables. The contrasts between trust scores on time 3 and 4 were conducted to test the hypotheses 1 and 2. To test hypothesis 3, we separately added the temperament measures to the linear mixed models to see whether the primary results were influenced by the addition of these factors. If these significantly affected the original findings and contributed as such to the explanation of the variability in Trust, we reported the results.

Results

Stress Induction

To investigate if the stress induction was successful, VAS scales for the different emotions on time 1 were compared with emotions on time 2. After stress-induction, a significant increase was observed for both fearfulness and sadness, respectively $t(115) = 8.374, p < 0.0001$ and $t(115) = 12.75, p < 0.001$, while both happiness and satisfaction decreased significantly, respectively $t(115) = 11.68, p < 0.001$ and $t(115) = 11.17, p < 0.001$ (for means and standard deviations: see Supplementary Material). The effects did not interact with condition, all F 's < 2.88 .

Preliminary Analysis

Outliers on trust-scores were removed when further than 2.5 SD from the mean score. This resulted in a cut-off value of 23.88 with the removal of 10 data points of a total of 360 (97.22% of the data was retained).

Baseline differences between groups

Multivariate analysis was conducted on the baseline measures. No significant differences were found in age, trust, and temperamental characteristics between the three experimental conditions, all F 's < 2.04 . Moreover, no differences were found between conditions on gender, $\chi^2 = .47$, *ns*.

Confounding variables

There was no significant effect of age on Trust on the three different time moments, $F(1, 222) = 1.49$; *ns*, nor for gender, $F(1, 222) = .03$, *ns*.

Residual variability

Inspection of the individual response patterns for Trust scores over times 1, 3, and 4 revealed different variability patterns over time depending on condition during the experimental phase. From the comparison of a model allowing for the differences in variability over time and a model not allowing for this additional variability, a better fit was found when incorporating these differences, $\chi^2_{(2)} = 7.82$, $p = .02$, indicating different residual variability due to the experimental manipulation (for the estimated residual variances, see Table 1). Lowest variability was found in the group of children that were assigned to the secure base condition in the experimental phase, while the groups assigned to the other conditions were characterized by variances that were twice or three times as large as the lowest variability.

Table 1

Residual variability per group

Condition	Variability
Secure base	.17
Physically available	.49
No mother	.32

General model

Mean and standard deviations of both state and trait trust-scores are presented in Table 2. The overarching model we tested showed that there was no significant interaction between condition and time, $F(4, 222) = 1.17, p = .33$, indicating that differences between condition averages of trait and state trust did not differ on the different time points nor vice versa (see Fig. 2). No significant main effect of time was found, $F(2, 222) = 1.15, p = .32$. Finally, there was a significant main effect of condition, $F(2, 114) = 3.92, p = .026$. We further looked at the differences in trait/state trust scores within each condition. Specifically, we were interested in the changes in trust scores in the condition during which children received no support from mother. We found in this condition a significant difference in trust scores between time 1 and time 3, $t(222) = 2.06, p = .04$. On time 3, children had significantly less state trust in mother's availability than on time 1. There was no significant difference between time 1 and time 4, $t(222) = 0.71, ns$, nor between time 3 and time 4, $t(222) = 1.64, p = .10$. For the secure base and the physical condition, there were no significant differences between the time points (all $p > .15$).

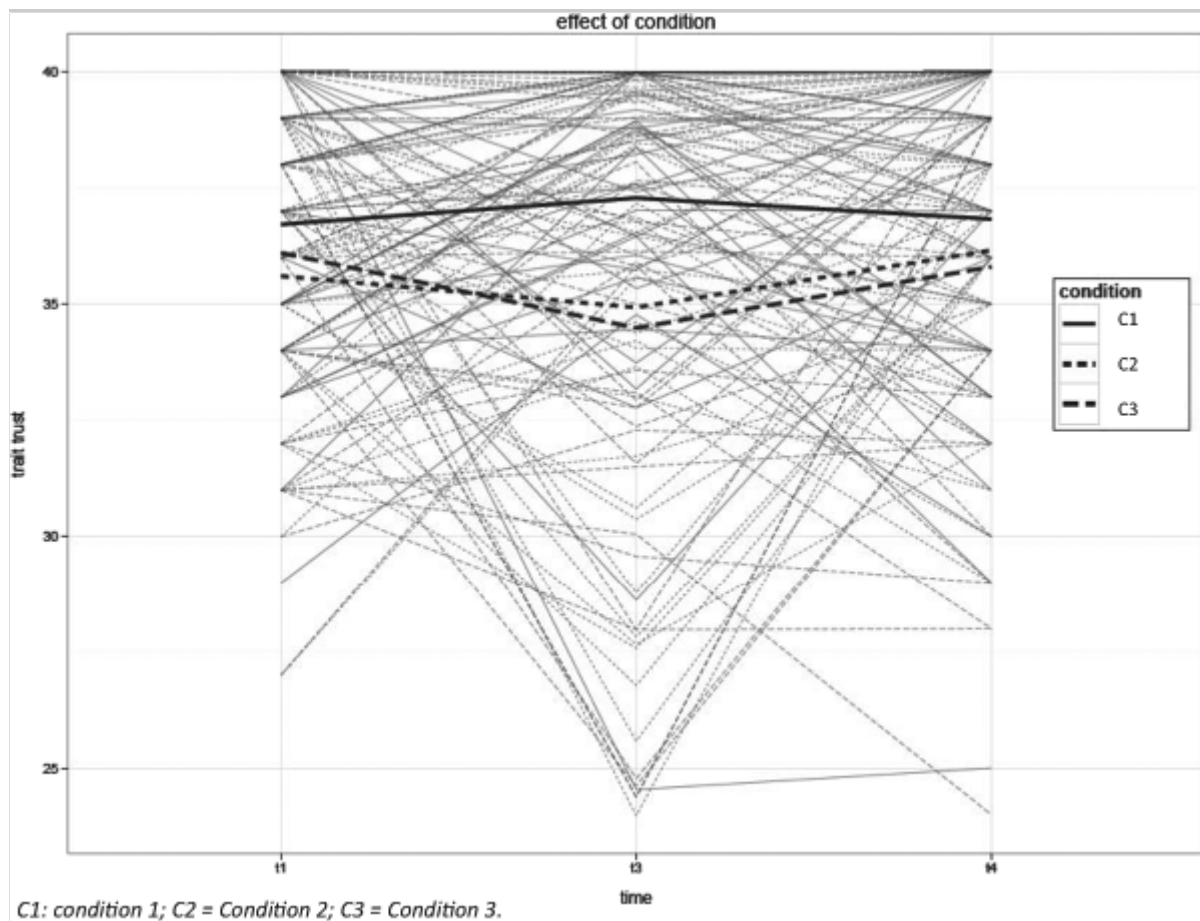
Table 2

Model based averages and model based standard error of trust over conditions and times

	Time 1	Time 3	Time 4
Secure base mother	36.85 (.58)	37.35 (.57)	36.90 (.57)
Physically available	35.62 (.64)	34.82 (.65)	35.90 (.64)
Absent mother	36.10 (.64)	34.45 (.73)	35.76 (.68)

Fig. 2

Effect of condition over time on state trust scores



Differences in State Trust after Experimental Phase

To test the first hypothesis, that the children in the non-support conditions (both Condition 2 and 3) have significant lower state trust scores in comparison with the support condition (Condition 1) after the experimental manipulation, we tested differences between conditions on time 3. As hypothesized, there was a significant difference in state trust after experimental manipulation between the secure base condition on the one hand and both the physical and no mother condition, respectively $t(222) = -3.13, p = .002$, and $t(222) = 2.92, p = .004$. The state trust in mother's availability was significantly lower in both the physically available and the absent mother condition in comparison with the secure base condition. An explorative analysis did not reveal evidence that the effect on t3 was moderated by the level of trust at baseline, $F(2, 102) = 0.51, p = 0.60$.

Differences in State Trust after Recovery Phase

We hypothesize that receiving secure base support in the recovery phase leads to an increase in state trust in children of Condition 2 and 3, reducing the differences in state trust between the three conditions on time 4. Results

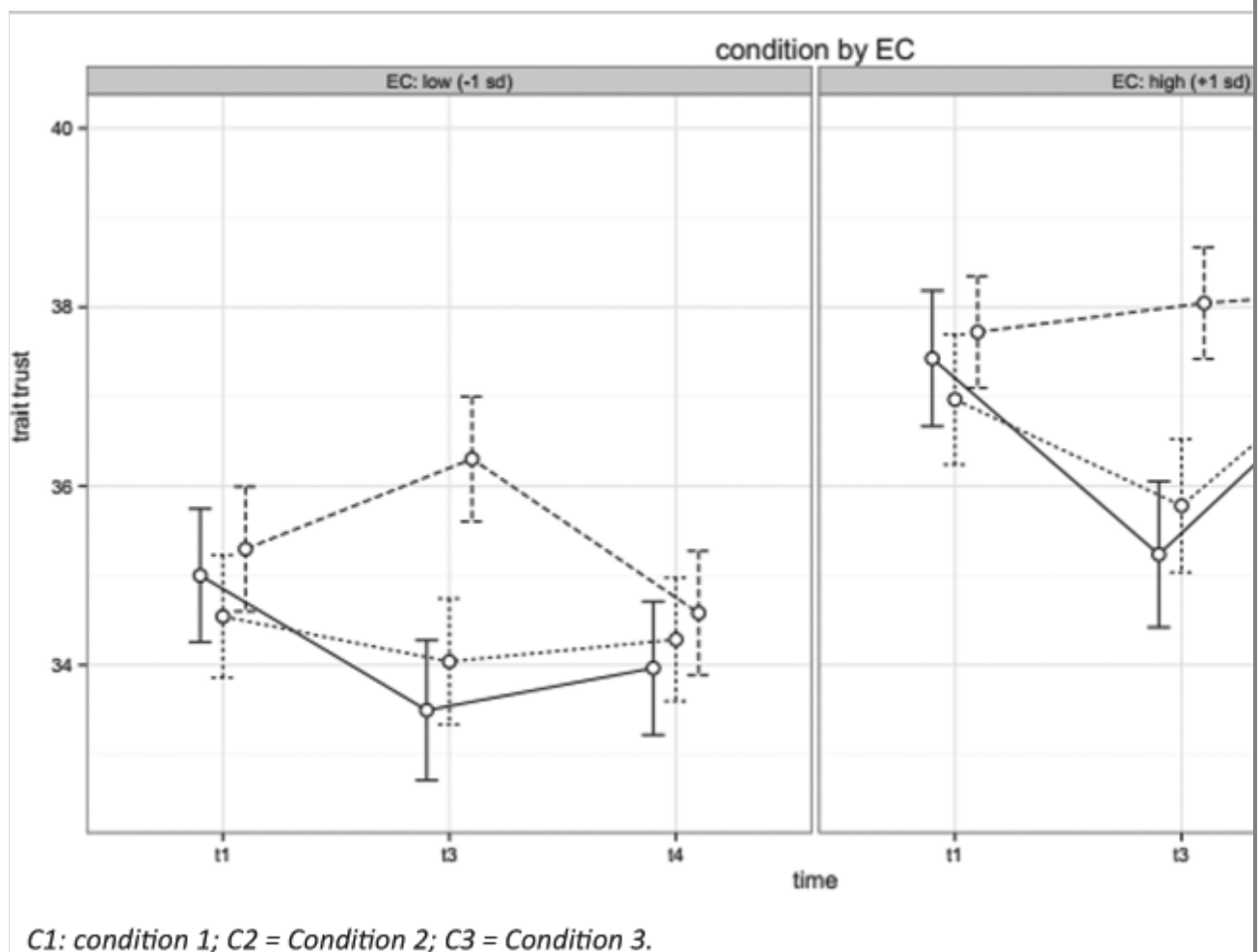
showed that at time 4, when all children had received secure base support, there were no longer significant differences in state trust between the three experimental groups; $t(222) = .14, p = .88$; for difference between absent and physically available, $t(222) = -1.28, p = .20$, for difference between absent and secure base; $t(222) = 1.17; p = .25$ for difference between physically available and secure base. So, after all children received secure base care, state trust in mother was restored in the non-supportive conditions. An explorative analysis did not reveal evidence that the effect on t4 are moderated by the level of trust at baseline; $F(2, 108) = 1.25, p = 0.29$.

Effect of Temperamental Differences on Variability in State Trust

There was no main effects of Emotionality (EAS emotionality), nor interaction-effects with time or experimental exposure, respectively $F(1,216) = 0.30, p = 0.58$; $F(2,216) = 0.87, p = 0.42$; $F(2,216) = 0.26, p = 0.77$. For activity (EAS activity), also no main effects, nor interaction-effects with time and experimental exposure was found, respectively $F(1,216) = 0.89, p = 0.35$; $F(2,216) = 0.47, p = 0.63$; $F(2,216) = 0.97, p = 0.38$. There was a significant main effect of EC, $F(1,211) = 20.25, p < 0.001$. The more EC the more overall trust in the caregiver. There was also a significant interaction with time, but not with the condition, respectively $F(2,211) = 4.32, p = 0.015$ and $F(2,211) = 0.10, p = 0.90$. The effects are demonstrated in Fig. 3. If averaged over conditions, we found for children high on EC that there was a tendency to have higher state trust scores after the Recovery Phase, while for those low on EC this pattern was not observed.

Fig. 3

Effect of effortful control on trust over time



Discussion

An increasing number of studies suggest that besides a stable global representation of attachment-relations, the content of attachment representations can fluctuate as a function of external cues (e.g., Fraley 2007; Pepping et al. 2015). The current study investigated whether variation in experienced support after exposure to distress is linked with continuity and change of state trust in maternal support. The results indicated that distressed children whose mother was absent during the experimental phase, or whose mother was only physically available, had significantly lower scores on state trust in comparison with children who did receive secure base support after distress exposure. Second, after receiving secure base care in the recovery phase, no more differences in state-trust across the secure base support and non-support conditions were found.

The finding that lack of maternal secure base support decreases state trust and that receiving subsequent support restores levels of state trust confirms prior research in adults showing that apart from trait attachment components, state

attachment components can be identified that fluctuate depending on contextual change (e.g., Bosmans et al. 2014b). Contrary to the latter study's inability to demonstrate causal effects of context-related fluctuations on state trust towards the mother, the current study did find mother-related state trust manipulation effects. In middle childhood the attachment relationships are much more under development and, therefore, they might be more easily affected by fluctuations in maternal behavior. The current study's findings are also in line with Bosmans et al. (2014b) two diary studies, where the link between context variation and state trust variation could be shown at the correlational level.

The accumulating evidence that mother-related state trust levels change in response to changes in the quality of the interactions between children and their mother can introduce a new element in the study of how attachment might develop over time throughout childhood. One possible role of these trust state fluctuations might be that they contribute to the development of secure base scripts. Recent theory and longitudinal research does suggest that middle childhood is an important period of secure base script development (Bosmans et al. 2017a; Del Giudice 2015). This development seems to reflect a learning process during which children need to learn that attachment figures continue to provide support during distress, even when the nature of distress shifts in accordance to children's cognitive and social maturation over time (Bosmans 2016; Bosmans et al. 2017a). Activated state trust levels after support during distress, might have a unique reinforcing effect that increase the likelihood that children perceive their parent as a secure base and simultaneously develop a secure base script (Bosmans 2016).

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Further suggesting that trust development might still be ongoing, is the finding that children in the physical availability condition also reported lower state trust scores. This suggests that the mother is not just a discriminative stimulus that automatically activates a state of trust, but that state trust levels remain conditional upon the actual care provided by the mother, even in middle childhood. The fact that receiving delayed secure base support restored state trust scores in the children of both the physically available mother and absent mother condition again suggests substantial plasticity. In the same vein, the lack of a moderating effect of trait trust on state trust manipulations further suggests that trait trust might not yet affect children's state trust experiences. The idea that social expectations and scripts crystallize only

later in life has already been proposed by other researchers (Muris 2006) and supported by empirical research (Braet et al. 2013). Taken together, these findings add to recent longitudinal research that showed that middle childhood is a period of significant secure base script development (Bosmans et al. 2017a).

Last, we hypothesized that temperament would moderate the impact of our manipulation on state trust in the mother. Due to biological changes, individual differences are more likely to influence attachment expectations from middle childhood onwards (Del Giudice et al. 2009). However, in the current study, no moderating effects of NA and PA on state-fluctuations were found. Null-findings could result from the measurements we used to assess temperamental dimensions. Although the temperamental dimensions were measured with a well validated questionnaire, the use of an observational measure or genes might be more sensitive to find such effects. Moreover, Vaughn et al. (2008) argued that temperamental differences direct an insecurely attached child to either an avoidant or an anxious attachment style, while the caregivers' environment determines whether or not the child will be securely or insecurely attached. Because trust only reflects a broad secure vs. insecure attachment dimension, this argument might help explain why we found no evidence for NA/PA effects. However, more research about the role of temperament in the development and maintenance of attachment expectations from middle childhood onwards is needed.

In contrast with the NA/PA analysis, we did find a main effect of self-reported EC on state trust over time. First, in all conditions, children high in EC trusted more in mother's availability in comparison to children low in EC. These findings are in line with recent studies showing that attachment security in children is related to higher EC capacities (e.g., Heylen et al. 2015). Moreover, significantly more trust in mother's availability was observed in children with high EC after receiving secure base care from mother. Children with higher effortful control seem to benefit most from maternal secure base care. This study seems to indicate that EC is not only the result of attachment development, but that EC might also be implicated in children's attachment development. At least, current results suggests that high EC benefit more from secure base care than children low in EC. Similar effects of impaired self-regulation capacity due to epigenetic change have been found on the development of anxious attachment in the same age-group (Bosmans et al. 2017a).

Limitations

First, only one component of attachment security, namely trust in mother's availability, was measured using self-report. It has been argued that self-report is a less valid approach to measure attachment (Ainsworth 1985). However, in recent years there is a consensus that middle childhood attachment can be adequately measured using questionnaires (e.g., the Security Scale, Kerns et al. 1996). Furthermore, several recent psychometric studies (Psouni and Apetroaia 2014) indicate that self-reported attachment security is associated with narrative and interview measures of attachment representations in middle childhood. Last, it could be that state attachment can only be measured using self-report. The interviews and narratives measuring attachment are constructed to measure trait-attachment rather than state fluctuations. Second, there was no integrity check of mother's behavior. Although the mother's received cards with written instructions and the experimenter guarded the process, we did not recode the behavior of mother in terms of effectively providing support. Moreover, we did not asked children's interpretations of mother's behavior. It might be that some children interpreted the secure base behavior as supportive, whilst other children did not.

This study researched the causal effect of maternal support behavior on state attachment in childhood. A first strength of the study was the use of several ecological valid elements in the paradigm. Children were exposed to a distressing clip from the 7 p.m. news, which is something most children are daily exposed to. Moreover, the study was performed at the children's homes and their own mothers provided support. Unfortunately, we did not look whether individual differences in maternal attachment style had an effect on state-trust after the manipulation, especially for the secure base support condition. However, in the secure base condition we found a substantially smaller residual variability in comparison with the other conditions, suggesting that the manipulation had the same effect for all the children and thus leaving less room to find significant effects of moderators. Nevertheless, it is important to take the mothers attachment style into account for future research. Second, a large sample of children and their mothers participated to the experiment leading to enough power to analyze the data and to draw representative conclusions.

In spite of these limitations, causal evidence was found for the impact of secure base support on children's trust states. This line of research is important because it might have added experimental evidence for the well-

known correlational phenomenon that supportive parenting can be (longitudinally) linked to attachment development in general (Wolff and Ijzendoorn 1997) and the secure base script in specific (Steele et al. 2014). More research on attachment states and the link with developing secure base scripts is needed to identify the processes underlying attachment development in middle childhood. Most importantly, these findings might contribute to the development of novel interventions to support attachment development in middle childhood. Thus far, such interventions for middle childhood attachment problems have been surprisingly missing. The current findings suggest that the one main fact that the mothers behave according to the secure base script has an effect on children's state trust levels. This might be an avenue to follow to help children develop a secure base script over such trials, a feature that makes them more resilient against the adverse effects of distressing experiences later in life (Dujardin et al. 2016).

Electronic supplementary material

The online version of this article (<https://doi.org/10.1007/s10826-017-0954-7>) contains supplementary material, which is available to authorized users.

Author Contributions E.V. designed and executed the study, assisted with the data analyses, and wrote the paper. G.B. collaborated with the design and the writing of the manuscript. S.R. analyzed the data and wrote part of the results. A.D. designed and executed the study. C.B. collaborated the writing and editing of the final manuscript.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no competing interests.

Ethical Approval The current study was approved by the ethical committee of the Ghent University and KU Leuven.

Informed Consent All parents and children were informed about the content of the study and signed the Informed Consent.

Electronic supplementary material

Supplementary Information

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