Unravelling the effect of household chaos on parenting

Andeweg, S.M.

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Prof. dr. L.R.A. Alink

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Dr. M.J.L. Prevoo
Dr. R.C.A. Rippe

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General introduction

Most people experience some degree of household chaos from time to time: losing your keys, running late for an appointment, or your children running around while you attempt to tidy the room. Household chaos is defined as a lack of family and week routines, and high levels of clutter, noise, and crowding (Evans & Wachs, 2010; Matheny, Wachs, Ludwig, & Phillips, 1995). Household chaos is related to lower quality parenting: parents in chaotic homes are less sensitive and responsive to their children's signals and use more harsh discipline (Coldwell, Pike, & Dunn, 2006; Deater-Deckard, Wang, Chen, & Bell, 2012; Dumas et al., 2005). If household chaos is causally related to lower quality parenting, this means that reducing household chaos could be a way to improve parenting. Therefore, it is important to know whether more household chaos actually leads to lower quality parenting, or whether household chaos and lower quality parenting only occur simultaneously but are both caused by a third factor. Also, the question arises whether all parents are equally affected by household chaos, or whether it only affects parenting in certain parents, for instance those who are more sensitive to stimuli or have lower self-regulation. These are questions that this dissertation aims to answer through two experimental studies in which levels of household chaos are manipulated.

The evolution of household chaos

The use of the term household chaos followed upon years of research in which separate aspects of household chaos had been studied in relation to child development and parenting. Prior to Bronfenbrenner's ecological model (Bronfenbrenner & Crouter, 1983), these studies were mostly interested in the social aspect of the micro-environment in which a child grew up (i.e., social interactions). As this model also pointed to the importance of the physical micro-environment, this aspect too received increased focus. Initially, this research centered around materials or resources for specific uses to aid children in development (such as the presence of children's books in the home) while later it focused on "potentially stressful, nonspecific background factors" (Matheny et al., 1995, p. 430), including noise, crowding, and traffic patterns in the home. Terminology such as environmental confusion or environmental chaos was introduced and lack of routines and structures was added to the definition (Matheny et al., 1995; Wachs & Corapci, 2003), eventually resulting in the current definition of household chaos.

Throughout the evolution of the concept of household chaos, studies have consistently shown that more household chaos is related to less optimal child development and parenting (for an overview, see Matheny et al., 1995 and Wachs & Corapci, 2003). This was found mostly in families with low socio-economic status (SES; e.g., Deater-Deckard, et al., 2012; Mills-Koonce et al., 2016; Vernon-Feagens, Garrett-Peters, Willoughby, Mills-Koonce, & The Family Life Project Key Investigators, 2012; Martin, Razza, & Brooks-Gunn, 2011). However, studies have shown that relations between household chaos, parenting and child development are also present in middle-class communities (e.g., Coldwell et al., 2006; Gottfried & Gottfried, 1984; Hygge, Evans, & Bullinger, 2002; Johnson, Martin, Brooks-Gunn, & Petrill, 2008), making household chaos an important subject across all levels of society.

Household chaos and child development

Household chaos has been related to child development, including wellbeing, and cognitive, social-emotional, and behavioral development. In more chaotic households, children had lower IQ scores (Deater-Deckard et al., 2009). Also, toddlers growing up in a more chaotic household showed a delay in expressive and receptive vocabulary 3 years later (Vernon-Feagans et al., 2012; Martin et al., 2011). Furthermore, children from more chaotic households showed lower scores on delayed gratification, more conduct problems and callous-unemotional behavior, and more aggression and attention problems (Coldwell et al., 2006; Deater-Deckard et al., 2009; Martin et al., 2011; Mills-Koonce et al., 2016). In adolescents, more household chaos predicted more substance abuse and worse physical wellbeing two years later (Tucker, Sharp, Van Gundy, & Rebellon, 2018).

These developmental outcomes may partly be explained by increased stress (e.g., Brown et al., 2019; Nelson, O'Brien, Blankson, Calkins, & Keane, 2009; Selander et al., 2009) or through a coping mechanism which filters out unwanted as well as developmentally important stimulation (Evans, Kliewer, & Martin, 1991). These outcomes could also be explained by parenting, with more household chaos leading to lower quality parenting, which in turn may lead to less optimal developmental outcomes. Studies have found support for mediation of the effect of household chaos on child outcomes through parenting. In a large longitudinal study, more household chaos was related to less favorable child outcomes such as conduct problems, callous-unemotional behavior, and to slower expressive language development, which was explained by more harsh parenting and less parental sensitivity (Mills-Koonce et al., 2016; Vernon-Feagans et al., 2012; Vernon-Feagans, Willoughby, Garret-Peters, & The Family Life Project Key Investigators, 2016).

Household chaos and parenting

Many studies have shown that household chaos is related to parenting. In the last two decades, higher levels of household chaos have been related to more maternal harsh parenting and overreactivity (e.g., Deater-Deckard et al., 2012; Dumas et al., 2005; Lawrence et al., 2019; Park & Johnston, 2020), and to less parental sensitivity, warmth and joy (Coldwell et al., 2006; Zvara, Lathren, Mills-Koonce & The Family Life Project Key Contributors, 2020; Coe, Parade, Seifer, Frank & Tyrka, 2019). Several mechanisms are proposed to underly this relation. One explanation may simply be that parents are less able to hear their child's bids through high noise levels (Matheny et al., 1995). Another is that parental stress or negative emotions may mediate this relation. Studies have shown that chaotic environments may be more stressful (e.g., Brown et al., 2019, Nelson et al., 2009; Selander et al., 2009), and more stress is associated with more harsh parenting (e.g., Beckerman, Berkel, Mesman & Alink, 2017). Also, more chaotic environments could affect parenting by making parents more fatigued (Matheny et al., 1995). Therefore, more chaotic households could result in more harsh parenting through increased stress or negative emotions. Moreover, more chaotic environments may interfere with cognitive capacities needed to inhibit behavior such as harsh parenting (Crandall, Deater-Deckard, & Riley, 2015). Chaotic environments may thus lead to increased harsh parenting through reduced self-regulation. Also, parental self-efficacy has been consistently related to parenting (e.g., Albanese, Russo & Geller, 2019; Jones & Prinz, 2005). As parental self-efficacy is lower in more chaotic households (Corapci & Wachs, 2002), household chaos could also affect parenting through reduced parental self-efficacy. Lastly, it is possible that child behavior plays a role in how household chaos affects parenting, as previously suggested by Dumas et al. (2005). Next to that household chaos is related to more child conduct problems through increased parenting problems (Coldwell et al., 2006), it is possible that household chaos leads to more parenting problems through increased child conduct problems.

The question of causality

Although ample research has shown that more household chaos is related to lower parenting quality, it is not known whether this is a causal relation. If household chaos does lead to lower quality parenting, interventions to reduce household chaos could lead to improved parenting and potentially to less child maltreatment. Household chaos could thus form an effective element of prevention and intervention programs aimed at improving parenting and preventing or reducing child maltreatment. Since lower quality parenting and, its extreme form, child maltreatment are known to have many negative outcomes in children on short and long term (e.g., Bradley & Corwyn, 2007; Jackson, Choi & Preston, 2019; Norman, Byambaa, Rumna, Butchart, Scott, & Vos, 2012), knowing how to improve parenting is essential in order to prevent these negative outcomes. As previous studies on household chaos and parenting were mostly correlational, as stated above, it is possible that more household chaos leads to lower quality parenting, or that lower quality parenting leads to more household chaos, or that household chaos and lower quality parenting are both the outcome of a third variable. As decades of research have pointed to the importance of household chaos in relation to parenting, it is necessary to determine whether household chaos has a causal effect on parenting.

Effect on all parents?

It would also be necessary to know if household chaos affects all parents, or only specific parents, so that prevention and intervention efforts can be successfully targeted to increase efficiency of these efforts. One parental characteristic that is of interest, is sensory-processing sensitivity (SPS). This is the extent to which a person readily notices stimuli and is aroused by stimuli (Aron & Aron, 1997; Evans & Rothbart, 2008). Aron and Aron (1997) were the first to use the term sensory-processing sensitivity (SPS) and operationalized it as a lower threshold for stimuli and being easily overaroused. They found that SPS was a construct that was separate from emotionality and social introversion, albeit with partial overlap. This was an important step in the literature, as previously SPS was often seen as part of continuum of introversion and extraversion. Aron and Aron (1997) stated that SPS was a unidimensional construct, while later studies stated that SPS was a multidimensional construct. For instance, Smolewska, McCabe, and Woody, (2006) stated it was a three-dimensional construct, consisting of aesthetic sensitivity, low sensory threshold, and ease of excitation. Evans and Rothbart (2008) found that SPS consisted of two dimensions, reflecting sensory sensitivity (reflecting a lower threshold for stimuli) and sensory discomfort (reflecting being easily overaroused), which stands more closely to the definition of Aron and Aron (1997). Parents with higher SPS are thought to be more affected by household chaos than parents with lower SPS. As people with higher SPS are more aware of and more aroused by stimuli, parents with higher SPS may be more aware and more aroused by the same level of household chaos than parents with lower SPS. Thus, household chaos may affect their parenting more strongly than that of parents with lower SPS. Wachs (2013) studied SPS in relation to household chaos and found that high observed household chaos was only reported as high household chaos by mothers with higher SPS, whereas mothers with lower SPS did not rate their household as more chaotic. This supports the reasoning that parents with higher SPS may be more aware of and affected by household chaos than parents with lower SPS. Although findings by Wachs (2013) indicate that SPS may be important when studying household chaos in mothers, no other studies to date exist on household chaos and SPS. In other fields, higher SPS has been related to a stronger response to stress (e.g., Aron, Aron, & Davies, 2005; Evers, Rasche, & Schabracq, 2008). As chaotic environments may be more stressful (Brown et al., 2019; Nelson et al., 2009; Selander et al., 2009), these studies also lend support for the idea that a potential effect of household chaos may be stronger in parents with higher SPS. The current study aims to fill the gap in scientific knowledge on whether an effect of household chaos on parenting is stronger in parents with higher SPS.

In addition to SPS, self-regulation is also of interest as a moderator of the effect of household chaos on parenting. Self-regulation refers to attentional and inhibitory control (Bridgett, Oddi, Laake, Murdock & Bachmann, 2013). Core cognitive functions that fall under self-regulation are attention shifting, working memory, and inhibition. Parents with lower self-regulation may have more trouble with refraining from harsh discipline and with implementing positive parenting strategies in light of a more chaotic environment, which may be highly distracting. More chaotic environments may require stronger self-regulation from parents and therefore affect parenting in parents with lower self-regulation more than in parents with higher self-regulation. This was confirmed by a recent correlational study, in which the relation between higher self-reported household chaos and more harsh parenting was diminished in mothers with higher self-regulation (Park & Johnston, 2020). Furthermore, it seems that stressful environments require more self-regulation in order to prevent a negative outcome. Self-regulation moderated aggressive behavior in response to stress in low-income adult community members, with more aggressive responses in low self-regulation adults (Sprague, Verona, Kalkhoff & Kilmer, 2011). As more chaotic households can be argued to be more stressful (e.g., Nelson et al., 2009; Selander et al., 2009), this study also lends support for the reasoning that effects of household chaos on parenting may be stronger for parents with low self-regulation.

Lastly, impulsivity is explored in relation to household chaos. Impulsivity is a temperamental construct that reflects response initiation and urgency in approach behavior (Eisenberg et al., 2007). Impulsivity has previously not been studied in the context of the association between household chaos and parenting. Parents with more impulsivity may find it more difficult to conduct positive instead of negative parenting practices in straining environments, such as chaotic homes, as these environments may make it more difficult to inhibit inappropriate behavior. Studies found that mothers with more impulsivity showed more harsh discipline, especially in straining situations (Rhoades, Grive, & Del Vecchio, 2017; Park, Hudec, & Johnston, 2017). A chaotic household could be considered a straining environment. Thus, the negative effect of household chaos on parenting quality may be stronger for more impulsive parents, as inhibiting harsh parenting in a chaotic environment is especially difficult for them.

Current study

This dissertation focuses on two research questions. The first is whether household chaos has a causal effect on parenting. The second is whether the effect of household chaos on parenting is stronger for parents with certain characteristics, such as high SPS, low self-regulation, and more impulsivity (see Figure 1). Two studies were conducted to answer these questions. Both studies used an experimental design in which household chaos was manipulated to test causality.

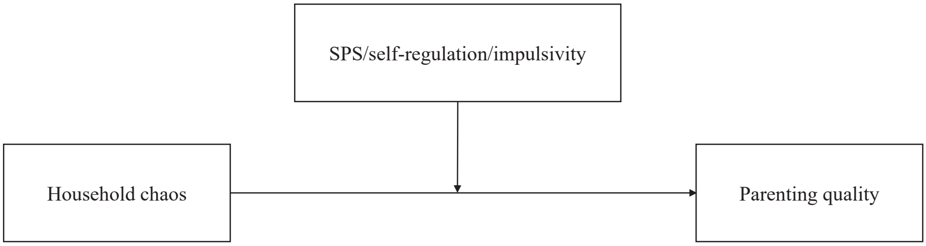

Figure 1. Model of the effect of household chaos on parenting quality, moderated by parental characteristics.

The first study was a lab study in which a living room setting was created in a lab room at Leiden University that was furnished as a living room. Two conditions were created within the living room: a neutral condition and a chaotic condition (see Supplemental material Chapter 2, Figure A1 and A2). In the chaotic condition, part of the room was closed off with a curtain, music and commercials were playing continuously, bold colors and prints were used, and clutter was added to the room in the form of papers, magazines, and baby clothes. The neutral condition was calm and orderly, while still being inviting. Non-parent, female young adults attended two lab visits two months apart to take care of an infant simulator for 45 min in both conditions (order counterbalanced). The infant simulator was programmed to cry at the same moments during both lab visits and participants were non-parents, which eliminated possible child effects on parenting and previous parenting experiences. Self-report and objective measures were used to measure SPS, self-regulation, and impulsivity. This study was executed in a highly controlled setting, which allowed for a very precise measure of the effect of the chaos manipulation on parenting.

The second study tested the potential causal effect of household chaos on parenting in a more ecologically valid situation, namely in families. The goal of the study was to test whether a change in household chaos resulted in a change in parenting. To this end, we aimed to decrease household chaos in the experimental group through a direct intervention, while not manipulating household chaos in the control group, and to subsequently test whether parenting improved in the experimental group compared to the control group. Participants were primary caregivers from Dutch families with a child between the age of 1.5-2 years old (twins or multiples were excluded). Based on a screening questionnaire (the Confusion, Hubbub And Order Scale, Matheny et al., 1995), families with elevated levels of household chaos were invited to participate in this study. The study was a randomized, controlled trial, in which one group of families was randomized to the intervention condition, and the other group was randomized to the control condition. During the pre- and posttest household chaos and parenting were measured using self-report as well as objective measures, such as observations of the primary caregiver and the participating child. Self-report questionnaires and computer task were administered to measure SPS and self-regulation.

Outline of this dissertation

In Chapter 2, we test whether the chaos manipulation in the lab setting leads to lower caregiver sensitivity and whether this effect is stronger in participants with higher SPS. In Chapter 3, we extend these results by also studying harsh caregiving as a caregiving outcome, and we test whether the effect of the chaos manipulation on parenting is stronger for participants with lower self-regulation and more impulsivity. In Chapter 4, we test whether our intervention to decrease household chaos, the Structuring the Home to Induce a Nurturing Environment (SHINE) intervention, leads to improved parenting, measuring both sensitivity and harsh discipline. In Chapter 5, we test whether reducing household chaos leads to a stronger improvement in parenting for parents with higher SPS or lower self-regulation. In Chapter 6, the findings are integrated with the existing literature, and the strengths and limitations of the used methodology are considered. Implications for practice and future research on household chaos and parenting are discussed.

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2

Does sensory-processing sensitivity moderate the effect of household chaos on caregiver sensitivity? An experimental design

Suzanne M. Andeweg, F. Fenne Bodrij, Mariëlle J. L. Prevoo, Ralph C. A. Rippe, Lenneke R. A. Alink

Education and Child Studies
Leiden University
The Netherlands

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Abstract

Previous research has linked higher levels of household chaos to parenting problems, but it is not clear whether household chaos actually *causes* parenting problems. In this study, we used an experimental design in which levels of household chaos were manipulated to test the effect of household chaos on caregiver sensitivity. As sensory-processing sensitivity has been linked to the perception of household chaos, we also tested whether household chaos has a stronger effect on participants with higher sensory-processing sensitivity. Ninety-six young adults (non-parents) visited our lab twice and took care of an infant simulator in a lab furnished like a living room. In the neutral condition the room was orderly and calm, and in the chaos condition it was cluttered, noisy and smaller (order counterbalanced). Caregiver sensitivity was observed and sensory-processing sensitivity was measured through questionnaires and observational data. Multilevel modeling showed caregiver sensitivity decreased over time in both conditions and that condition had a small effect on caregiver sensitivity, with sensitivity being lower in the chaos condition. We found that participants with higher sensory sensitivity decreased faster in the chaos condition than in the neutral condition. According to our findings, household chaos leads to less positive caregiving behavior and parents with higher sensory sensitivity may be more affected by household chaos. Thus, reducing household chaos may be effective in promoting positive parenting.

Keywords: household chaos, parenting, sensitivity, sensory-processing sensitivity, experiment

Introduction

Always running late, not being able to find your keys and not being able to hear yourself think in your own home - these are examples of chaotic moments in the household. A lack of family and week routines, high noise levels, material disorganization, and crowding are all aspects of household chaos (Evans & Wachs, 2010; Matheny, Wachs, Ludwig, & Phillips, 1995). Higher levels of household chaos are known to be related to more negative parenting (e.g. Coldwell, Pike, & Dunn, 2006; Deater-Deckard, Wang, Chen, & Bell, 2012; Dumas et al., 2005), however, there is no clear evidence of a *causal* effect of household chaos on parenting. In addition, the relation between household chaos and negative parenting may not be the same for everyone, as the perception of household chaos is related to sensory-processing sensitivity (Wachs, 2013). In this study, we used an experimental design to test whether household chaos has a causal effect on caregiving behavior and whether this relation is stronger for people with higher sensory-processing sensitivity.

Household chaos, parenting, and child outcomes

Ample research has linked household chaos to various negative child outcomes. Higher levels of household chaos have been related to more child conduct problems and lower IQ (Coldwell et al., 2006; Deater-Deckard et al., 2009; Mills-Koonce et al., 2016). There is also evidence for a relation between household chaos and child language development: more household chaos during the first three years of life was related to less child expressive and receptive language at 36 months (Vernon-Feagans, Garrett-Peters, Willoughby, Mills-Koonce, & The Family Life Project Key Investigators, 2012). In another longitudinal study, more household chaos measured when the child was two years old was related to lower receptive vocabulary of children at age five (Martin, Razza, & Brooks-Gunn, 2011). In the same study, higher levels of household chaos were also related to lower delayed gratification and to more aggression and attention problems.

Household chaos has also been related to negative parenting outcomes. Using self-report measures, household chaos was correlated with maternal harsh parenting-negativity (Deater-Deckard et al., 2012) and dysfunctional discipline (Dumas et al., 2005). In line with this, Coldwell et al. (2006) found that higher self-reported household chaos was related to less parental warmth and joy and to more parental anger and hostility measured with child puppet interviews, and to more self-reported maternal and paternal negativity. Furthermore, there is evidence that the association between household chaos and child outcomes is (partially) mediated by parenting. A large longitudinal study showed that more harsh parenting and less parental sensitivity mediated the relation between more household chaos and less favorable child outcomes in conduct problems, callous-unemotional behavior, and expressive language development (Mills-Koonce et al., 2016; Vernon-Feagans et al., 2012).

Causal effect of household chaos

Previous research mostly used correlational designs and suggested that household chaos is related to sensitive and to negative parenting. Although previous research has suggested that household chaos is the predictor in this relation (e.g., Mills-Koonce et al., 2016), the directionality of this relation is not known. Therefore, it is not known whether more household chaos results in more negative parenting, whether negative parenting results in more household chaos, possibly through an effect on child problem behavior, or whether household chaos may be a byproduct of more negative parenting or of a latent variable related to both household chaos and parenting. An answer to this question is needed to better understand the role of household chaos in parenting. This knowledge can be used to inform prevention and intervention programs. If a causal relation between household chaos and negative parenting exists, then reducing household chaos may indeed lead to an improvement in parenting. To address the causal effect of chaos on parenting, an experimental research design is needed, which we employed in the current study.

Sensory-processing sensitivity

Although previous research has established a clear relation between household chaos and negative parenting, this relation may not be equal for all parents. Sensory-processing sensitivity seems to be an important factor in the perception of the level of household chaos (Wachs, 2013). Sensory-processing sensitivity is defined as the awareness of stimuli and arousal by stimuli (Aron & Aron, 1997; Evans & Rothbart, 2008). People with more sensory-processing sensitivity may notice the higher number of stimuli in chaotic households more readily and be more affected by these stimuli than participants with low sensory-processing sensitivity, and thus be more susceptible to the effects of household chaos. Wachs (2013) found that higher levels of observed household chaos were only related to self-reported household chaos for mothers with high levels of sensory-processing sensitivity, but not for mothers with lower sensory-processing sensitivity. Other studies, although not (directly) related to household chaos, also underline the importance of sensory-processing sensitivity. Aron, Aron and Davies (2005) found in an experimental study that students with high sensory-processing sensitivity reported more negative affect after a stress-inducing task than students with low sensory-processing sensitivity. In the work context, more sensory-processing sensitivity was related to experiencing more work stress (Evers, Rasche, & Schabracq, 2008). These findings imply that the negative effects of household chaos on parenting may be stronger for parents with higher sensory-processing sensitivity. Knowing who is most affected by household chaos, could help improve prevention and intervention efforts.

Previous research is mixed on whether sensory-processing sensitivity should be seen as a unidimensional or two- or three-dimensional construct. Aron and Aron (1997) - who were the first to state that sensory-processing sensitivity is a separate personality trait and is not part of other traits, such as neuroticism - considered sensory-processing sensitivity to be a unidimensional construct. Smolewska, McCabe, and Woody (2006) found sensory-processing sensitivity to be a three-dimensional construct, reflecting awareness for aesthetics, negative arousal by external stimuli, and the extent to which a person is overwhelmed by external and internal demands. Evans and Rothbart (2008) found a two-dimensional construct, and named the two dimensions sensory sensitivity (reflecting the threshold for awareness of stimuli) and sensory discomfort (reflecting to what extent someone is negatively affected due to stimuli). More research is needed to answer whether the construct of sensory-processing sensitivity is unidimensional or multidimensional, and if so, whether different components of sensory-processing sensitivity have different effects on, for instance, the relation between household chaos and negative parenting.

Current study

In the current study we addressed the question of whether there is a causal effect of household chaos on caregiving behavior, specifically caregiver sensitivity, and whether sensory-processing sensitivity moderates this relation. Caregiver sensitivity is defined as the caregiver's ability to observe and interpret child signals and respond promptly and appropriately (Ainsworth, Bell, & Stayton, 1974). We used an experimental design in which we manipulated a lab room to look like either an orderly, neat living room (the neutral condition), or a cluttered, noisy and crowded living room (the chaos condition). We controlled for variation in child behavior by using an infant simulator, which can be programmed to cry at certain times, so the demands on the caregiver were equal for all participants. We controlled for previous child rearing experiences by including non-parents.

Our first hypothesis was that caregiver sensitivity towards the infant simulator would be lower in the chaos condition than in the neutral condition. Our second hypothesis was that the effect of chaos on caregiver sensitivity would be stronger for participants with high sensory-processing sensitivity. Next to exploring the dimensionality of the construct sensory-processing sensitivity, we investigated whether different components of sensory-processing sensitivity played a different role in the relation between household chaos and caregiver sensitivity. Lastly, we tested both our hypotheses exploratively for an interaction with the duration of caring for the infant simulator.

Method

Participants

Participants were 96 Dutch, female students enrolled at schools for vocational education (in Dutch: MBO; *N* = 21) or colleges (in Dutch: HBO; *N* = 75). The mean age of the participants was 20.31 years (*SD* = 1.93). Of the participants, 96% were born in The Netherlands. Vocational students (*M* = 19.19, *SD* = 1.50) were significantly younger than college students (*M* = 20.64, *SD* = 1.93; t (94) = -3.15, p = .002), which follows from the average age of entry into each of the levels within the Dutch education system. College students mostly came from intact families (84%), whereas only 38% of vocational students came from intact families. There was no difference in self-reported household chaos in the current living situation between vocational and college students (t (88) = -0.04, p = .967, respectively *M* = 2.42 , *SD* = 0.39 and *M* = 2.43, *SD* = 0.55) as measured by the Confusion, Hubbub, And Order Scale (Matheny et al., 1995). No differences in birth country, current living situation or social status were observed between vocational and college students. The first lab visit was completed by 96 participants, of whom 90 (94%) also completed the second lab visit. There were no differences between participants who completed one or two visits on education (X^2 (1) = 2.96, p = .116). Participants who only completed one lab visit were younger (*M* = 19.00, *SD* = 1.10) than the participants who completed both lab visits (*M* = 20.40, *SD* = 1.95; t (94) = 2.85, p = .024). Of the participants who did complete both visits, 4% reported a country other than The Netherlands as their birth country, against none of the participants who completed one lab visit. No significant differences in caregiver sensitivity and in sensory-processing sensitivity were found between participants who completed only one lab visit and participants who completed both lab visits.

Participants were recruited between December 2015 and August 2017 through messages on their school's digital learning environment, presentations during classes, and advertisements on Facebook targeting women between 18- and 25-years old living in cities nearby the lab. People interested in participation filled out an online questionnaire and were then contacted by the researchers to further inform them about the study and to confirm whether they met the inclusion criteria (female, age between 18-25 years, and vocational or college student). Participants were excluded if they had a child, had been or were pregnant at the time of recruitment, or had mental (e.g. depression, autism) or physical problems (e.g. hearing problems, paralysis). Students from educational programs in which child rearing was an important part of the curriculum, such as vocational education for childcare practitioner, were excluded. Participants reported whether they had experience with taking care of children below the age of two years. Most participants indicated they had experience with this (58%), which included experience through relatives and babysitting. Vocational students had significantly less experience than college students, with 62% of vocational students indicating no experience versus only 32% of college students indicating no experience ($X^2(1) = 5.60$, $p = .018$).

Procedure

The research project was approved by the ethics committee of the Institute of Education and Child Studies of Leiden University and preregistered in the Open Science Framework (Prevoo, Alink, Bodrij, & IJzendoorn, 2015). Participants attended two lab visits of two hours each at the university, separated by two months. At the start of the first lab visit participants gave informed consent. During both visits participants took care of an infant simulator to elicit caregiving behavior from participants (Voorthuis et al., 2013) in a lab room furnished as a living room. The infant simulator is a lifelike baby doll, which can be programmed to make sounds on certain moments, such as crying, burping, fussing and laughing (Realityworks, Eau Claire, WI, USA). During the first phase no other tasks were given (12 min). During the second and third phase participants were asked to fill out a questionnaire and play a game and were instructed to progress as far as possible (12 min and 13 min, respectively). The infant simulator was programmed to cry for 5 min during each phase and to not respond to caregiving behavior.

The living room had two conditions, namely the neutral condition and the chaos condition. The order of conditions was counterbalanced and assignment to condition of the first phase was randomized. In the neutral condition (see Supplemental material Chapter 2, Figure A1) the living room looked neat and orderly, with calm music playing (average level of 43.4 dB). In the chaos condition, the living room was very unorganized, with baby clothes, magazines, letters, notes and toys scattered around the room, the TV playing loud music videos and commercials (average level of 58.1 dB), and there were a lot of colorful and bold prints in the room. To increase crowding, the room was made smaller in the chaos condition by pulling a see-through curtain to close off part of the room (see Supplemental material Chapter 2, Figure A2). This chaos manipulation tapped into multiple aspects of household chaos, namely material disorganization, high noise levels, and crowding, or person-to-square meter ratio (Evans & Wachs, 2010; Matheny et al., 1995). In both conditions participants were asked to not make changes to the room. Our manipulation was successful: participants rated the chaos condition as less spacious, noisier, busier and dirtier than the neutral condition (with $ts(89)$ between 9.62 and 49.07, $ps < .001$).

Before and after taking care of the infant simulator, participants came to a different lab room where they completed multiple questionnaires and computer tasks. In addition, saliva was collected during both visits to measure salivary alpha-amylase. Data from the computer tasks and salivary alpha-amylase were not used in the current report. Participants' responses to the sound of a squeaky door and a high-pitched tone were filmed before the start of the neutral condition to code for responsivity to noise as part of the sensory-processing sensitivity measure. At the end of the second visit participants received €40 as a reward for their participation and participants were debriefed about the goal of the study.

Measures

Caregiver sensitivity

The Ainsworth Sensitivity Scale (Ainsworth et al., 1974) was slightly adapted to the use of the infant simulator and was used to code caregiver sensitivity (Voorthuis et al., 2013). This scale considers the caretaker's awareness and interpretation of signals and the appropriateness and promptness of the response. A score on a scale of 1 to 9 was given, with 1 highly insensitive and 9 highly sensitive. Each phase was scored separately. Five coders were trained and reached good inter-coder reliability with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .79 (range .74 - .83, $N = 15$). Coders met regularly to prevent coder drift. The two lab visits were coded by two different coders who had not met the participant.

Sensory-processing sensitivity

Sensory-processing sensitivity was measured using self-report questionnaires, informant-reported questionnaires, and an observational measure of responsivity to noise. The Orienting Sensitivity scale of the Adult Temperament Questionnaire Short form (ATQ-OS) measures awareness of and affect associated with stimuli (Evans & Rothbart, 2007). The original version consisted of 15 items, but for the current study some items were separated to make these items easier to interpret for the participants (for example, the original item "I dream of lively, detailed situations that do not resemble anything I have experienced in real life" was split into "I dream about lively situations" and "I dream of situations that resemble what I have experienced in real life"). This resulted in a version with 22 items. The items were answered on a five-point Likert scale, ranging from "never" to "always"; an additional answering option was available to indicate that one had never been in that situation, in which case the item was treated as missing. The ATQ-OS was administered during both lab visits. The average scores did not differ significantly between the two lab visits ($t(79) = 0.55$, $p = .585$) and were highly correlated ($r = .79$, $p < .001$). Scores were thus averaged across lab visits. Cronbach's alphas were .84 in the first visit and .83 in the second visit. Higher scores indicated higher orienting sensitivity.

The Noise Sensitivity Scale (NSS) measures sensitivity to noise (Weinstein, 1978). The original version consists of 21 items, but some items were split so that they were easier to interpret. The modified version consisted of 24 items. An example of an item is "I find whispering at the cinema annoying". A six-point Likert scale was used, ranging from "totally disagree" to "totally agree", and with an additional option to indicate that one had never been in that situation. Cronbach's alpha was .84. Higher scores indicated more sensitivity to noise.

The Highly Sensitive Person Scale (HSPS) measures sensory-processing sensitivity as thresholds for processing and excitability by sensory stimuli (Aron & Aron, 1997). The original version consisted of 27 items. Again, some items were split, resulting in a version of the HSPS with 38 items. An example of an item is "I notice subtle sounds". A five-point Likert scale was used, ranging from "not at all applicable" to "completely applicable". Cronbach's alpha was .89. Higher scores indicated more sensory-processing sensitivity.

Informant-report versions were used for the ATQ-OS and the NSS (Evans & Rothbart, 2007; Weinstein, 1978). These were filled out after the first lab visit about the participant by someone who knew them well. Informants were mostly relatives (71%) or friends (27%), or roommates or partners. Cronbach's alphas were .83 and .81 respectively. The informant reports were significantly correlated with the self-reports (NSS: $r = .31$, $p = .005$; ATQ: $r = .39$, $p < .001$) and no differences between relative versus non-relative informants were observed ($t(76)=-1.69$, p .094, $t(76)=-0.48$, $p = .63$, respectively). Higher scores indicated more orienting sensitivity and more noise sensitivity.

In addition, an observational coding system was used to code responsivity to noise from the observations of responses to the sounds of a squeaking door and a high-pitched bleep. This coding system was based on the emotional intensity scale and the body movement scale of the behavioral coding system developed by Gross and Levenson (1993). Emotional expression, intensity of body movement and latency in seconds between the onset of the sound and the most intense behavioral response were coded. For both sounds combined, intercoder reliability between the two coders was .68 for emotional intensity, .86 for body movement, and .46 for latency in seconds (intraclass correlations, single measure, absolute agreement, $N = 15$). Because of the low intercoder reliability for latency and the fact that it was not significantly correlated with emotional intensity and body movement, latency was not included in the score for observed responsivity to noise. Emotional intensity for the high tone correlated significantly with emotional intensity for the squeaking door and body movement for both sounds (correlations between .22 and .33, *p*s between .001 and .033). The emotional intensity and body movement scales were averaged for both sounds to compute a score for responsivity to noise.

To explore how measures could be combined into a sensory-processing sensitivity construct, a principal component analysis (PCA) was executed with the self-reported ATQ-OS, NSS, and HSPS, the informant-reported ATQ-OS and NSS and observed responsivity to noise. The scree criterion indicated two components. A second PCA was conducted with the number of components set to two using oblique rotation. The pattern matrix indicated that the ATQ-OS, the NSS, the HSPS and observed responsivity to noise loaded high on component 1, explaining 37% of the variance, whereas the informant ATQ-OS and NSS loaded high on component 2, explaining 23% of the variance (see Supplemental material Chapter 2, Table B1). Thus, component 2 seemed to reflect a measurement type (namely informant reports) rather than a salient aspect of sensory-processing sensitivity. Therefore, the informant measures were not used in the final construct. Z-scores of the self-reported ATQ-OS, NSS, and HSPS and observed responsivity to noise were averaged and this mean was standardized. Cronbach's alpha was sufficient at .64. Higher scores indicated more sensory-processing sensitivity.

Previous research has suggested that sensory-processing sensitivity is a multidimensional construct (e.g. Smolewska et al., 2006). We conducted PCAs using the predefined subscales of the ATQ-OS (Evans & Rothbart, 2007) and the subscales defined by Smolewska et al. (2006) for the HSPS. For the NSS, no subscales have been described (Weinstein, 1978). Based on the scree criterion a PCA was conducted with a three-component solution with direct oblimin rotation (see Supplemental material Chapter 2, Table B2 for pattern matrix). The first component explained 48% of the variance and reflected arousal by stimuli in general and the threshold for perception of stimuli. This component was named sensory sensitivity (Cronbach's alpha = .84). The second component explained 14% of the variance and reflected being overwhelmed or negatively aroused by stimuli and was named sensory discomfort (Cronbach's alpha = .74). Observed responsivity to noise did not load on either component 1 or 2 and seemed to reflect a measurement type in component 3 rather than a different component, so we decided to leave observed responsivity to noise out of additional analyses with components of sensory-processing sensitivity. The standardized means of the subscales were averaged and this mean was standardized. Higher scores on sensory sensitivity and sensory discomfort reflected more sensitivity. Cronbach's alpha was .84 for sensory sensitivity and .74 for sensory discomfort.

Analyses

Preliminary analyses were performed to compute correlations between caregiver sensitivity for the separate phases, condition, sensory-processing sensitivity, caregiving experience, and demographic variables. As our data was nested (i.e., three measurements per condition and two conditions per participant), observations were not independent within these levels, and therefore multilevel modeling was used. First, we fitted the unconditional means model, unconditional growth model 1, and unconditional growth model 2. Next, covariates were added to the model along with a main effect for condition to test our first hypothesis. In the next model, we added an interaction between condition and sensory-processing sensitivity to test our second hypothesis. Exploratively, we tested a model with a three-way interaction between condition, sensory-processing sensitivity, and phase. The latter two models were also tested for both components of sensory-processing sensitivity separately. See Table B3 for an overview of the tested multilevel models. To predict power, we used G*power 3.1.9.4 and the repeated measures ANOVA with within-between interaction, and entered an expected power of .80, alpha level of .05, effect size of .40, with two groups and three repetitions. The required sample size was 62, indicating our sample was large enough to detect significant interactions.

For the multilevel modeling we used a dataset in which all missing values were multiply imputed. As five out of six participants who did not complete the second lab visit started with the chaos condition, drop out may not be random. According to Van Ginkel, Linting, Rippe, and Van der Voort (2019), multiple imputation is also a fitting solution when data are not missing at random, and equivalent or better compared to complete cases analysis. Therefore, this method was used in this study. To correct for an effect of the order of conditions in the lab visits on caregiver sensitivity and its development over time, we controlled for the main effect of order of condition and the interaction between order of condition and phase.

All analyses were performed in R version 3.5.1, on a Dell XPS 9370 with an i7 8550U processor overclocked at 2.0Ghz, with 16GB of RAM. Stability of multilevel imputations was evaluated by comparing four methods: the MI function in the Amelia package, with the mice function from the mice package, and the panImpute and jomoImpute functions from the mitml package. The (required) number of iterations varied per method, due to differences in implementation, but all lead to equivalently imputed datasets. A fixed starting seed was set for reproducibility. Pooling of results on 100 imputation sets was performed using the summary functions from mitml and miceadds, as well as using the summary and modelRandEffStats from the merTools package. A series of multilevel models were estimated, incrementally comparing nested models using the anova function from mitml and merTools (which yielded equivalent results). Model comparisons and effect estimates were evaluated at 5% alpha level.

Table 1
Descriptive statistics and correlations between caregiver sensitivity, sensory-processing sensitivity, caregiving experience and demographic variables (*N* between 80 and 96).

		M (*SD*)	1	2	3	4	5	6	7	8	9	10	11	12
Neutral condition														
1.	CS phase 1	6.03 (1.55)	-											
2.	CS phase 2	4.74 (1.92)	.54***	-										
3.	CS phase 3	4.09 (1.92)	.43***	.83***	-									
Chaos condition														
4.	CS phase 1	5.75 (1.54)	.43***	.18	.22*	-								
5.	CS phase 2	4.37 (1.96)	.25*	.50***	.53***	.46***	-							
6.	CS phase 3	4.03 (1.89)	.25*	.50***	.58***	.41***	.81***	-						
7.	Sensory-processing sensitivity	-0.003(0.69)	.01	.09	.25*	.04	.18	.11	-					
8.	Sensory sensitivity	0.01 (0.82)	-.04	.08	.22*	-.04	.00	-.05	.79**	-				
9.	Sensory discomfort	-0.03 (0.88)	-.05	.08	.21*	.05	.16	.11	.79**	.54**	-			
10.	Caregiving experience	-	.04	-.13	-.13	.16	-.07	.01	.03	.03	-.05	-		
11.	Age	20.31 (1.93)	.19	.11	.06	.23*	.17	.17	.01	-.00	.08	.04	-	
12.	Education level	-	.19	.00	.04	.21*	.19	.14	.10	.06	.07	.25*	.31**	-

Note. CS = caregiver sensitivity. Sensory-processing sensitivity, sensory sensitivity, and sensory discomfort are the standardized means of the standardized scores of the sensory-processing sensitivity measures. * $p < .05$, ** $p < .01$, *** $p < .001$.

Results

Preliminary analyses

Correlations between caregiver sensitivity, sensory-processing sensitivity, caregiving experience, age and education level are shown in Table 1. All caregiver sensitivity scores were significantly correlated, apart from phase 1 of the chaos condition and phase 2 of the neutral condition. Caregiver sensitivity scores were significantly lower for consecutive phases (see Table 1), for both the neutral and the chaos condition (with a range of $t(89)$ between 2.62 and 9.78, p-values between <.001 and <.010). Sensory-processing sensitivity was significantly correlated with caregiver sensitivity in the third phase of the neutral condition, with higher rates of sensory-processing sensitivity being related to higher scores on caregiver sensitivity. Age correlated significantly with caregiver sensitivity in the first phase. Education level showed this pattern as well. Caregiving experience was only related to education level. As education level and age were related to caregiver sensitivity scores, we included both as covariates, alongside the interaction between condition of the first lab visit and phase.

Explaining caregiver sensitivity

All results from multilevel analyses hereafter are based on the pooled results of the imputed datasets (see Table 2), with the exception of the intra-class correlation and explained variance. The unconditional means model (Model 1) showed an intra-class correlation of .37, meaning that 37% of the variance in caregiver sensitivity was within-subject variance. This indicates sufficient dependency in the data to warrant the use of multilevel modeling. In Model 2, phase was added as a numeric predictor, since a linear functional form provided an adequate representation, which showed caregiver sensitivity scores significantly declined over time (t = -13.05, p < .001). Model 2 fit the data significantly better than Model 1 (X^2 (1) = 144.43, p < .001) and the main effect of phase explained 28% of the within-subject variance in caregiver sensitivity. In Model 3, random intercepts and random slopes were added for phase, allowing for different slopes in caregiver sensitivity per phase. The main effect of phase remained significant, with caregiver sensitivity declining over time (t = -11.17, p < .001). Model 3 fit the data significantly better than Model 2 (X^2 (2) = 10.85, p < .001), indicating that allowing for different slopes per phase is necessary. The main and random effect of phase explained 37% of the within-subject variance in caregiver sensitivity.

Causal effect of household chaos

To test our first hypothesis, that caregiver sensitivity was lower in the chaos than in the neutral condition, a main effect for condition was added in Model 4. Age, education level, and the interaction between order of condition and phase were added as control variables. Condition had a significant effect on caregiver sensitivity (t = -2.18, p = .030), with lower caregiver sensitivity in the chaos than in the neutral condition. Model 4 fit the data significantly better than Model 3 (X^2(5) = 2.64, p = .022) and explained 21% additional variance in intercepts in comparison to Model 3 and 1% additional variance in slopes.

Moderation by sensory-processing sensitivity

To test our second hypothesis, that the effect of household chaos on caregiver sensitivity was stronger for participants with higher sensory-processing sensitivity, we added the interaction between condition and sensory-processing sensitivity in Model 5. The interaction was not significant (t = -0.07, p = .945), meaning sensory-processing sensitivity did not moderate the effect of condition on caregiver sensitivity. Model 5 did not fit the data significantly better than Model 4 (X^2(2) = 0.25, p = .780).

Interaction with phase

Exploratively, we tested whether there was an interaction between condition and sensory-processing sensitivity over time. Thus, a three-way interaction of phase, condition and sensory-processing sensitivity was added in Model 6. The three-way interaction was not significant (t = -1.16, p = .248) and the model did not fit significantly better than Model 5 (X^2 (3) = 1.76, p = .153) nor Model 4 (X^2 (5) = 1.52, p = .330). This means that the decrease in caregiver sensitivity due to condition was not stronger over time for participants with higher sensory-processing sensitivity. The interaction between phase and sensory-processing sensitivity nearly reached statistical significance (t = 1.78, p = .075), with participants with higher sensory-processing sensitivity tending to have a slower decrease in caregiver sensitivity than participants with lower sensory-processing sensitivity.

Table 2
Overview of fitted models for caregiver sensitivity with coefficients, *SE*'s and significance per parameter.

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	4.84 (0.14)***	6.65 (0.19)***	6.65 (0.17)***	3.55 (1.31)**	3.60 (1.31)**	3.84 (1.36)**
Phase		-0.91 (0.07)***	-0.91 (0.08)***	-0.87 (0.12)***	-0.87 (0.12)***	-0.99 (0.23)***
Condition				-0.25 (0.11)*	-0.25 (0.11)*	-0.43 (0.28)
Sensory-processing sensitivity					0.09 (0.21)	-0.57 (0.46)
Condition*Sensory-processing sensitivity					-0.01 (0.11)	0.30 (0.29)
Phase*Condition*Sensory-processing sensitivity						-0.15 (0.13)
Phase*Sensory-processing sensitivity						0.38 (0.22)
Age				0.13 (0.07)*	0.13 (0.07)*	0.13 (0.07)*
Education level				0.43 (0.31)	0.41 (0.31)	0.41 (0.31)
Phase*Condition first visit				-0.07 (0.16)	-0.07 (0.16)	-0.11 (0.16)
σ_0^2 (ID)	1.44	1.57	0.96	0.76	0.82	0.74
σ_1^2			0.26	0.26	0.27	0.24
σ_e^2 (Resid)	2.42	1.74	1.53	1.51	1.51	1.50
$\rho_{01\ phase}$			-0.20	-0.18	-0.22	-0.14
LogLikelihood	-1109.8	-1034.0	-1021.0	-1014.1	-1013.4	-1010.2
Deviance	2219.5	2067.9	2042.1	2028.1	2026.9	2020.5

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. The values for σ_0^2, σ_1^2, σ_e^2, $\rho_{01\ phase}$, LogLikelihood, and Deviance are based on complete cases.

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Components of sensory-processing sensitivity

Sensory sensitivity

Next, we tested the models discussed above for both components of sensory-processing sensitivity separately (see Table 3). In Model 5a, an interaction between condition and sensory sensitivity was added, while keeping the covariates. The interaction for condition and sensory sensitivity was not significant, meaning the effect of condition on caregiver sensitivity was not moderated by sensory sensitivity (t = -1.24, p = .215). Model 5a did not fit the data significantly better than Model 4 ($X^2(2)$ = 0.70, p = .499).

In Model 6a we exploratively tested the interaction between condition, sensory sensitivity and phase. The three-way interaction reached statistical significance (t = -2.15, p = .032). In Figure 1, lines for low (< M – 1 SD), medium (between 1 SD +/- M), and high (> M + 1 SD) sensory sensitivity were drawn. Next to a main effect of condition, the Figure shows that in the neutral condition, participants with higher sensory sensitivity had a slower decrease in caregiver sensitivity compared to participants with lower sensory sensitivity, whereas in the chaos condition there was no interaction between phase and sensory sensitivity. For participants with low sensory sensitivity, the decrease in caregiver sensitivity over time does not appear to differ between conditions, whereas participants with high sensory sensitivity appear to have a stronger decrease over time in the chaos condition. The model did not fit the data significantly better than Model 5a ($X^2(3)$ = 1.91, p = .125) or Model 4 ($X^2(5)$ = 1.49, p = .191).

Sensory discomfort

To test whether the effect of condition on caregiver sensitivity was stronger for participants with higher sensory discomfort, we entered the interaction between condition and sensory discomfort in Model 5b, while keeping the covariates in the model. The interaction for condition and sensory discomfort was not significant (t = 0.36, p = .719), meaning sensory discomfort did not moderate the effect of condition on caregiver sensitivity. Model 5b did not fit the data significantly better than Model 4 ($X^2(2)$ = 0.13, p = .882).

In Model 6b we exploratively tested the interaction between condition, sensory discomfort and phase, while keeping the covariates in the model. The three-way interaction was not significant (t = -1.34, p = .181), meaning the decrease in caregiver sensitivity due to condition was not stronger over time for participants with higher sensory discomfort. The interaction between phase and sensory discomfort nearly reached statistical significance, with participants with higher sensory sensitivity tending to have a slower decrease in caregiver sensitivity than participants with lower sensory sensitivity (t = 1.89, p = .059). Model 6b did not fit the data significantly better than Model 5b ($X^2(3)$ = 1.72, p = .160) or Model 4 ($X^2(5)$ = 1.09, p = .3625).

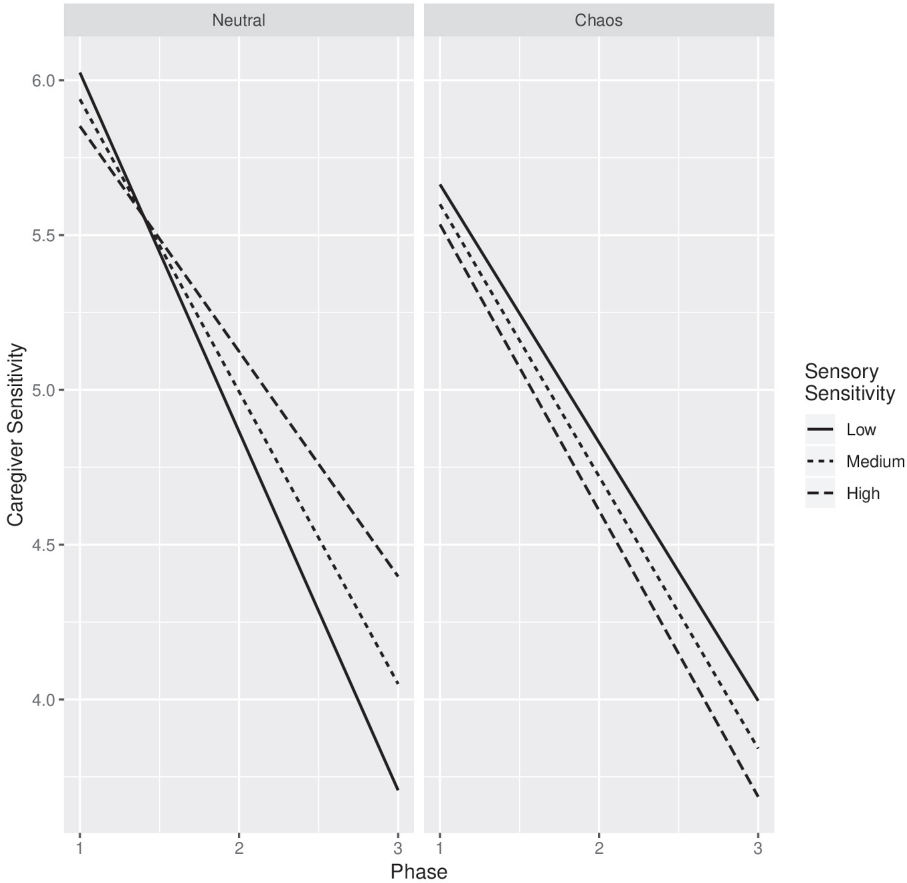

Figure 1. Three-way interaction between condition, phase, and sensory sensitivity on caregiver sensitivity.

Table 3
Overview of fitted models for caregiver sensitivity with coefficients, *SE*'s and significance per parameter.

Parameter	Model 5a	Model 6a	Model 5b	Model 6b
Intercept	3.56 (1.31)**	3.78 (1.37)**	3.60 (1.32)**	3.86 (1.37)**
Phase	-0.87 (0.12)***	-0.98 (0.23)***	-0.87 (0.12)***	-1.00 (0.23)***
Condition	-0.25 (0.11)*	-0.41 (0.28)	-0.25 (0.11)*	-0.42 (0.28)
Age	0.13 (0.07)*	0.13 (0.07)*	0.13 (0.07)*	0.13 (0.07)*
Education level	0.43 (0.31)	0.43 (0.31)	0.42 (0.31)	0.42 (0.31)
Phase*Condition first visit	-0.07 (0.16)	-0.09 (0.16)	-0.07 (0.16)	-0.08 (0.16)
Sensory sensitivity	0.23 (0.22)	-0.71 (0.46)		
Condition*Sensory sensitivity	-0.15 (0.12)	0.41 (0.29)		
Phase*Condition*Sensory sensitivity		-0.28 (0.13)*		
Phase*Sensory sensitivity		0.50 (0.22)*		
Sensory discomfort			-0.02 (0.22)	-0.76 (0.47)
Condition*Sensory discomfort			0.04 (0.12)	0.40 (0.29)
Phase*Condition*Sensory discomfort				-0.18 (0.13)
Phase*Sensory discomfort				0.42 (0.22)
σ_0^2 (ID)	0.87	0.86	0.78	0.70
σ_1^2	0.30	0.29	0.26	0.23
σ_e^2 (Resid)	1.52	1.51	1.51	1.51
$\rho_{01\ phase}$	-0.33	-0.31	-0.20	-0.10
LogLikelihood	-894.4	-891.7	-1013.8	-1010.9
Deviance	1788.7	1783.4	2027.7	2021.9

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. The values for σ_0^2, σ_1^2, σ_e^2, $\rho_{01\ phase}$, LogLikelihood, and Deviance are based on complete cases.

Discussion

In the current study, we used an experimental design with a neutral and chaotic lab setting to test whether household chaos had a causal effect on caregiver sensitivity. In both conditions caregiver sensitivity decreased over time. Caregiver sensitivity was significantly lower in the chaos condition than in the neutral condition, confirming our first hypothesis. Our second hypothesis was that sensory-processing sensitivity would moderate the relation between household chaos and caregiver sensitivity. We did not find support for this hypothesis in the current study. We did find a significant three-way interaction, which showed that the chaos condition led to a stronger decrease in caregiver sensitivity over time compared to the decrease in the neutral condition for participants with higher sensory sensitivity than for participants with lower sensory sensitivity.

Causal effect of household chaos

Previous correlational and longitudinal research has shown a relation between higher levels of household chaos and negative parenting and caregiver sensitivity (e.g., Coldwell et al., 2006; Deater-Deckard et al., 2012; Dumas et al., 2005; Mills-Koonce et al., 2016; Vernon-Feagans et al., 2012). With our experimental design we were able to confirm a causal effect of household chaos on caregiver sensitivity: caregiver sensitivity was lower in the chaos condition than in the neutral condition. It is possible that more household chaos makes a bigger demand on parental self-regulation, which is the regulation of behavior and attention (Deater-Deckard, Chen, Wang, & Bell, 2012; Deater-Deckard & Bell, 2017). Parents with lower self-regulation may have more trouble regulating their parenting behaviors in the face of household chaos than parents with higher self-regulation, leading to less positive and more negative parenting. A second explanation may be that stress and negative emotions mediate the causal effect of household chaos on parenting. The distracting and unpredictable nature of more chaotic households may evoke stress and negative emotions (Nelson, O'Brien, Blankson, Calkins, & Keane, 2009; Selander et al., 2009), which in turn may lead to more negative parenting (Stith et al., 2009). Thirdly, as we asked participants not to change the chaos manipulation, the level of household chaos was uncontrollable. This may have led to a feeling of diminished control, which may lead to a feeling of less parental efficacy (Corapci & Wachs, 2002). A lower sense of parental efficacy has been linked to less positive parenting (Albanese, Russo, & Geller, 2019). Outside the lab, this uncontrollable nature can be seen as chaos caused by others in the household and as levels of crowding and exterior noise. Lastly, the increased noise levels may simply make it more difficult to notice infant signals, leading to less prompt responses as more subtle infant signals may be missed. Higher observed noise levels were related to more non-verbal responsiveness in caregivers (Corapci & Wachs, 2002), which gives less opportunity to show caregiver sensitivity than verbal responses.

Although we found that household chaos does have a causal effect on caregiving behavior, the effect of household chaos was small: condition only had an effect of 0.25 on the 9-point scale measuring caregiver sensitivity. Previous research showed moderate to large effect sizes for the relation between more household chaos and more negative parenting and less parental sensitivity (e.g., Coldwell et al., 2006; Dumas et al., 2005; Vernon-Feagans et al., 2012). The difference in magnitude of the effect was probably not due to types of measurement, as these studies also included observational measures. One possible explanation is that chronic exposure to household chaos is needed to find a larger effect on parenting. As household chaos is relatively stable over time (e.g., Deater-Deckard et al., 2009), causal effects of chronic exposure may be highly relevant and should be further investigated. It would also be interesting to investigate whether a two-way interaction is present after chronic exposure to high levels of household chaos. A second explanation is that household chaos also acts on parenting through other pathways than just through a direct effect. Future research should focus on whether there is an interplay between household chaos and parenting characteristics, leading to parenting problems. Parents with certain characteristics may have more trouble maintaining an orderly home and with choosing positive parenting strategies. The increased level of household chaos may also have a direct effect on parenting and further impede on parent characteristics. Following this line of thought, the interplay of parent characteristics with household chaos and parenting may result in a negative spiral, leading to increased parenting problems.

Sensory-processing sensitivity

To add to the existing body of research on the dimensionality of sensory-processing sensitivity, we used PCAs to determine whether this was a unidimensional construct or consisted of multiple components. Our data fit the notion of a two-dimensional construct, supporting previous findings by Evans and Rothbart (2008). The two components reflected how readily stimuli are noticed and if a person is in general affected by stimuli (sensory sensitivity), and how overwhelmed or negatively aroused a person is by stimuli (sensory discomfort).

We expected that the effect of household chaos on caregiver sensitivity would be stronger for participants with higher (components of) sensory-processing sensitivity. In this study, we found that participants with higher sensory sensitivity decreased faster in caregiver sensitivity in the chaos condition than in the neutral condition, whereas the decrease over time was similar in both conditions for participants with low sensory sensitivity. Due to having a lower threshold for noticing stimuli, it may be more difficult for these participants to endure chaotic environments. Interestingly, these participants showed more caregiver sensitivity in the neutral condition than participants with medium or lower sensory sensitivity. Parents who are high in sensory sensitivity may thus lose their advantage in a chaotic environment over time due to overstimulation, as child and environmental stimuli compete for attention. Future studies should test whether a loss of advantage is also true for other parenting characteristics, as Deater-Deckard et al. (2012) already showed for self-regulation. For participants with lower sensory sensitivity, no differences were found over time between conditions. Also, we did not find a three-way interaction for the overall construct of sensory-processing sensitivity or the component sensory discomfort. The amount of discomfort in response to environmental stimuli is apparently not related to caregiving behavior or may only exist when studying the effect of chronic exposure to household chaos. Another explanation is that our measure of sensory discomfort, which only explained 14% of the variance in sensory-processing sensitivity, did not adequately reflect sensory discomfort.

Strengths and limitations

The current study had multiple strong aspects, such as its experimental design, the use of an infant simulator to ensure there was no variability in caregiver demands, and the use of multiple types of data to form a measure of sensory-processing sensitivity. There were also some limitations. First, as proof of principle, this study was executed in a highly controlled lab setting with female students and an infant simulator and participants were asked not to alter the manipulation. This impedes generalizability in multiple ways. At home, parents are able to influence levels of household chaos, such as noise levels, while participants were asked to not alter our manipulation. Parents interacting with their children already have experience and expectations regarding parenting and their child, which influence parenting. While we deliberately used the infant simulator to rule out a child effect, in real families children may respond to the chaotic environment and thus also affect parenting (e.g., Dumas et al., 2005). Also, our infant simulator was programmed not to respond to caregiver behavior, which could mean that our results are mostly generalizable to infants who are more difficult to sooth, such as infants with negative temperaments (Yoo & Reeb-Sutherland, 2013). Participants were in our manipulation for 45 min, which may not be comparable to effects of chronic exposure to household chaos. Also, we studied women, meaning results may be only generalizable to mothers. Second, we did not manipulate levels of family and week routines, thus not testing the entire definition of household chaos. Using a non-transparent movable wall or room divider instead of a see-through curtain may also increase ecological validity, although our see-though curtain was enough to affect spaciousness ratings. Last, the coders of caregiver sensitivity could not be blind to the condition of the living room, as the condition was visible in the videos, potentially leading to biased coding of caregiver sensitivity (either lower in the chaos condition in line with the study hypothesis or higher in sympathy with the participants).

Future research and implications

Our results imply the need for further experimental research in family home environments to test whether the causal effect of household chaos on parenting holds outside the lab. Potentially, our findings may be amplified when taking chronic exposure to household chaos into account. Future research should therefore take into account participants' chronic exposure to household chaos and examine whether this numbs the participant to the effect of household chaos (e.g., habituation) or makes the participant more susceptible (e.g., sensitization). If our findings are replicated outside the lab, then this may be reason to include reducing household chaos in interventions aimed at improving parenting. Future studies should further explore in light of which parental characteristics, in addition to sensory sensitivity, we should see household chaos as a particularly difficult environment for parenting, and should explore the potential negative spiral between household chaos and parent characteristics in explaining parenting. Lastly, studies on sensory-processing sensitivity should distinguish between sensory sensitivity and sensory discomfort, as these may yield different results.

Conclusion

In conclusion, our experimental lab study was the first to show that household chaos has a causal effect on caregiving behavior, although the effects were small. As correlational and longitudinal studies tend to find larger effects, it may be valuable to study the importance of chronic exposure to household chaos and whether there is a negative interplay between household chaos and parent characteristics in predicting parenting. Using an RCT in a highly chaotic sample and reducing household chaos to a lower level over a longer time period may be informative. For parents with higher sensory sensitivity household chaos may have a more pronounced effect on parenting quality. More research is needed to understand the mechanisms through which household chaos exerts an influence on parenting, particularly outside the lab, to inform prevention and intervention and to ultimately lead to improved parenting and child development.

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Self-regulation and impulsivity: Moderators of the effect of household chaos on parenting?

Suzanne M. Andeweg, F. Fenne Bodrij, Mariëlle J. L. Prevoo, Ralph C. A. Rippe, Samantha Vermeulen, Lenneke R. A. Alink

Education and Child Studies
Leiden University
The Netherlands

Submitted

Abstract

Previous studies have shown that higher levels of household chaos are related to more parenting problems. This relation may be particularly strong for some parents. Self-regulation and impulsivity have been related to household chaos, parenting, and negative responses to stressful environments. Thus, we expected that an effect of household chaos on parenting would be stronger for participants with lower self-regulation and more impulsivity. Using an experimental design, we manipulated levels of household chaos by asking participants to take care of an infant simulator in a neutral and in a chaotic living room (order counterbalanced). Participants were 96 young adults (all female, non-parents). Self-regulation was measured using a self-report questionnaire and computer task on inhibition. Impulsivity was measured by a computer task on delay of gratification. We found a causal effect of household chaos on caregiver sensitivity and not on harsh caregiving. No moderation by self-regulation and impulsivity was found. Furthermore, effects of household chaos on parenting did not depend on self-regulation and impulsivity. Directions for future research concerning moderation of the effect of household chaos on parenting by self-regulation and impulsivity are discussed.

Key words: household chaos, sensitivity, harsh caregiving, self-regulation, experiment, impulsivity

Introduction

More household chaos has been related to parenting problems, including harsh discipline and less parental warmth (e.g., Coldwell, Pike & Dunn, 2006; Deater-Deckard, Wang, Chen & Bell, 2012b). Household chaos is defined as a lack of family routines and week structure, high noise levels, material disorganization, and crowding (Evans & Wachs, 2010; Matheny, Wachs, Ludwig & Phillips, 1995). While there clearly is a relation between more household chaos and lower parenting quality, this may not be present in all parents: parents with lower self-regulation and more impulsivity may be more susceptible to the effects of household chaos on parenting, whereas parents with higher self-regulation and less impulsivity may be better able to cope with household chaos and thus not experience its negative effect on parenting. Previous studies have shown that the effects of stressful environments on behavior were moderated by self-regulation and parent temperament (e.g., Chen, Deater-Deckard & Bell, 2014; Karreman, Van Tuijl, Van Aken & Deković, 2008; Sprague, Verona, Kalkhoff & Kilmer, 2011). Therefore, in the current study we examine whether self-regulation and impulsivity moderate the relation between household chaos and parenting.

Household chaos and parenting

Household chaos has been related to many negative outcomes among parents and children. Higher levels of household chaos have been related to lower child cognitive development, including language development and IQ, more stress, and more behavior and attention problems (e.g., Coldwell et al., 2006; Deater-Deckard et al., 2009; Martin, Razza & Brooks-Gunn, 2011; Mills-Koonce et al., 2016; Vernon-Feagans, Garrett-Peters, Willoughby, Mills-Koonce & The Family Life Project Key Investigators, 2012; Wang, Deater-Deckard, Petrill & Thompson, 2012). Also, parents living in more chaotic households experience more physiological and self-reported stress and report a lower sense of parental efficacy (e.g., Blair, Berry, Mills-Koonce, Granger, & The FLP Investigors, 2013; Corpaci & Wachs, 2002; Deater-Deckard et al., 2009; Selander et al., 2009).

Ample research has related household chaos to parenting problems. Higher levels of household chaos have been related to maternal harsh parenting and negativity, dysfunctional discipline, including overreactivity and laxness, and parental anger and hostility towards the child (Coldwel et al., 2006; Deater-Deckard et al., 2012b; Dumas et al., 2005). Household chaos is also related to less parental warmth and joy, less parental responsiveness and acceptance of the child, and less stimulating parenting (Coldwel et al., 2006; Corapci & Wachs, 2002; Vernon-Feagans, Willoughby, Garrett-Peters & The FLP Investigators, 2016). Moreover, in our previous report on the current experimental study, we found that chaos negatively influenced caregiver sensitivity (Andeweg, Bodrij, Prevoo, Rippe &

Alink, 2020). Lastly, results of another experimental study showed that parents who received an intervention to reduce household chaos showed less harsh discipline post intervention compared to the control group (Chapter 4).

The moderating role of self-regulation and impulsivity

Self-regulation, effortful control (EC), and executive functioning (EF) have been subject to different conceptualizations, operationalizations, and terminologies throughout developmental research (e.g., Bridgett, Oddi, Laake, Murdock & Bachmann, 2013; Crandall et al., 2015; Rothbart & Rueda, 2005). Self-regulation reflects attentional and inhibitory control, and both EC and EF are seen as aspects of self-regulation. EC is mostly viewed as a temperamental construct, encompassing the activation and inhibition of behavior and attention focusing, and EF is mostly viewed as referring to cognitive capacities, including working memory, attention shifting, and inhibition (Bridgett et al., 2013). As EC and EF largely overlap and have very similar developmental trajectories, neurobiological bases and common correlates, researchers are increasingly calling to integrate these constructs under the term self-regulation (Bridgett et al., 2013; Zhou, Chen & Main, 2012). Therefore, in this study we use the integrative term self-regulation. Related to self-regulation is impulsivity, with more impulsivity relating to less self-regulation (e.g., Fino et al., 2014; MacKillop et al., 2016; Rothbart & Rueda, 2005). This temperamental construct refers to how fast a response is initiated and to urgency in approach behavior (Eisenberg et al., 2007). Although impulsivity is related to self-regulation, it predicts different behavioral outcomes, indicating that these are different constructs (e.g., Eisenberg et al., 2004; Eisenberg et al., 2007).

Based on previous research, it is possible that self-regulation and impulsivity are both moderators of the effect of household chaos on parenting. Lower inhibition and attention shifting skills and a faster response initiation may make it more difficult to cope with a chaotic environment and to choose positive parenting practices over harsh parenting practices. A recent study found that the relation between household chaos and harsh parenting was attenuated in parents with higher self-regulation (Park & Johnston, 2020). Also, stress was related to more aggressive behavior in low-income adult community members with low self-regulation but not with high self-regulation (Sprague et al., 2011). Chaotic environments may be more challenging for individuals with low self-regulation and high levels of impulsivity and as such can be more stressful (e.g., Nelson, O'Brien, Blankson, Calkins, & Keane, 2009; Selander et al., 2009). More parental extraversion, which predicts impulsivity (Helmers, Young & Pihl, 1997), was related to lower parenting quality in high-demand parenting situations (Karreman et al., 2008). Deater-Deckard et al. (2012b), however, found that parents with high self-regulation used less harsh discipline in non-chaotic households, but found no difference between high and low self-regulation on harsh discipline in chaotic households. This suggests that more chaotic households may be challenging regardless of self-regulation and impulsivity. It is important to know whether low self-regulation and more impulsivity make parents more susceptible to the effects of household chaos on parenting so that (preventive) parenting interventions can be tailored to these characteristics.

Current study

Using an experimental design, we studied whether the negative effect of household chaos on parenting was stronger for participants with lower self-regulation and higher impulsivity. Studying whether the effect of household chaos on parenting is especially detrimental for parents with lower self-regulation and more impulsivity could serve as an indicator to determine the subgroup of parents that could particularly benefit from reducing household chaos. The experimental design included a lab setting resembling a living room, and the creation of a chaotic and neutral condition in this lab setting (see Andeweg et al., 2020). Participants were asked to care for an infant simulator, which was programmed to cry inconsolably at specific times during the lab sessions (e.g., Voorthuis et al., 2013). Caregiver sensitivity and harsh caregiving behavior were measured. Caregiver sensitivity was defined as the caregiver's ability to observe and interpret child signals and respond in a prompt and appropriate manner (Ainsworth, Bell & Stayton, 1974). Harsh caregiving was defined as physically harsh behavior, verbal and non-verbal overreactivity, and lack of physical support of the infant simulator. We expected that participants would show lower caregiver sensitivity and more harsh caregiving in the chaos condition compared to the neutral condition, and that this effect would be stronger in participants with lower self-regulation or more impulsivity. We also explored the effect of duration of taking care of the infant simulator on the development of caregiver sensitivity and harsh caregiving over time.

Method

Participants

Ninety-six Dutch, female students participated in this study, of whom 21 were enrolled in vocational education (in Dutch: MBO) and 75 in college (in Dutch: HBO). Participants were 20.31 years old (SD = 1.93) on average and vocational students (M = 19.19, SD = 1.50) were significantly younger than college students (M = 20.63, SD = 1.93; t (94) = -3.15, p = .002), which follows from the structure of the Dutch education system. The study included two lab visits. Participants who only completed the first lab visit (N = 6; M = 19.00, SD = 1.10) were significantly younger than participants who finished both lab visits (N = 90; M = 20.40, SD = 1.95; t (94) = 2.85, p = .024) but did not differ in education level (X^2 (1) = 2.96, p = .116). Participants were mostly born in The Netherlands (96%). None of the participants who only completed the first lab visit reported a country other than the Netherlands as their birth country against 4% of the participants who completed both lab visits. Scores on caregiver sensitivity did not differ between participants who completed only one or both lab visits. Five out of six participants who dropped out started with a lab visit with the chaos condition. Data of all participants were used and missing data were imputed using multiple imputation.

Participants were recruited through public messages on their school's digital learning environment, through classroom presentations and Facebook advertisements targeted at women living near the lab between the ages of 18 and 25 years. Students indicated their interest in participating by answering an online questionnaire about demographics. They were then asked additional questions concerning inclusion criteria and were further informed about the study. Exclusion criteria were mental (e.g. depression, autism) or physical problems (e.g. hearing problems, paralysis) and being pregnant at or having been pregnant prior to time of inclusion. Educational programs with attention to child rearing, such as vocational education for childcare practitioner, were also excluded.

Procedure

The research project was approved by the ethics committee of the Institute of Education and Child Studies of Leiden University and preregistered in the Open Science Framework (Prevoo, Alink, Bodrij, & Van IJzendoorn, 2015). The study consisted of two lab visits at Leiden University of two hours each, with two months in between visits. During both visits participants took care of an infant simulator in a lab setting that was designed as a living room. The living room was neat and orderly during the neutral condition, and unorganized and chaotic during the chaos condition (see Andeweg et al., 2020). The order of these conditions was counterbalanced over the two lab visits. Participants rated the chaos condition as more busy, noisy and dirty and less spacious than the neutral condition (with *t*s (89) between 9.62 and 49.07, *p*s < .001), but not as less inviting ($t(89) = -1.45$, $p = .150$). Participants were asked not to make changes in the room during both lab visits.

At the start of the first lab visit participants gave informed consent. Prior to taking care of the infant simulator participants filled out questionnaires in a regular lab room that did not look like a living room. Afterwards participants entered the living room setting and were asked to take care of the infant simulator as they would take care of a real infant. This was divided into three phases. During phase 1 (12 min) participants were asked to take care of the infant simulator. During phase 2 (12 min) they were asked to fill out a questionnaire and finish as far as possible. During phase 3 (13 min) participants were asked to play a game and finish as far as possible. The three participants with the highest score would receive a prize at the end of the study, which was rewarded after data collection was completed. All three phases included a pre-scheduled 5 min crying episode of the infant simulator. The crying episodes were the same during both lab visits and the infant simulator was programmed not to respond to participant caregiving, ensuring there was no variability in child demands between conditions.

After taking care of the infant simulator participants went back to the regular lab room and filled out additional questionnaires. They also completed computer tasks during the visits. Saliva was collected during both lab visits, but these data were not used in the current report. Participants were asked to fill out additional questionnaires between the two visits. At the end of the second lab visit participants were debriefed about the goal of the study and asked not to discuss this with classmates, who might participate as well. They received €40 as a reward for their participation.

Measures

Caregiver sensitivity

Observations of the participant with the infant simulator were coded for caregiver sensitivity using the Ainsworth Sensitivity Scale (Ainsworth et al., 1974), which was slightly adapted to the use of the infant simulator (Voorthuis et al., 2013). This 9-point scale measures the awareness and interpretation of infant signals and assesses whether the response is appropriate and prompt. A score of 1 indicates poor caregiver sensitivity and a score of 9 indicates excellent caregiver sensitivity. Caregiver sensitivity scores were assigned to each phase. Five coders were trained and reached good inter-coder reliability with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .79 (range .74 - .83, N = 15). To prevent coder drift regular meetings were scheduled. The two lab visits per participant were coded by different coders who had not met the participant.

Harsh caregiving

Harsh caregiving was coded from the same observations with the infant simulator. An adapted version of the discipline rating scales by Joosen, Mesman, Bakermans-Kranenburg and van IJzendoorn (2012) was used. This included a five-point rating scale for the use of physical harsh caregiving (e.g., pulling an arm or leg too hard, shaking the infant simulator) and a five-point rating scale for the use of verbal or non-verbal over-reactivity (e.g., angry or impatient tone, rolling with eyes). A three-point scale for the lack of physical support (e.g., not supporting the head, holding the infant simulator by its arm or leg) was added. Per phase, a score was given for each scale of harsh caregiving, with higher scores indicating more harsh caregiving. The two lab visits per participant were coded by different coders who had not met the participant. Intercoder reliability was obtained using four scores for each participant (three phases) on each scale (harsh, over-reactivity, and lack of support). Good inter-rater reliability was established, with a mean intraclass coefficient of all different pairs (single measure, absolute agreement) of .77 (range .71 - .87, N = 15). The lack of physical support scale was rescaled to a 5-point scale. All scales were then log-transformed to reduce skewness and kurtosis. In the neutral condition, lack of physical support was significantly and positively correlated to overreactivity and to physical harsh caregiving in phase 3, and in the chaos condition physical harsh caregiving was significantly and positively correlated to lack of support and overreactivity in phase 3. The log-transformed scales were summed, resulting in a score for harsh caregiving per phase with higher scores indicating more harsh caregiving.

Self-regulation
To measure self-regulation, we used a self-report questionnaire and a computer task and examined these separately. The Effortful Control subscale from the Adult Temperament Questionnaire Short Form was used as the self-report measure of self-regulation and consists of three subscales: activation control (7 items), attention control (5 items), and inhibitory control (7 items; ATQ-EC; Evans & Rothbart, 2007). Examples of items are "I can keep performing a task even when I would rather not do it", "It is often hard for me to alternate between two different tasks", and "It is easy for me to hold back my laughter in a situation when laughter wouldn't be appropriate". Participants were asked to rate how often the statement was true for them on a five-point Likert scale, ranging from "never" to "always", and with an additional option that someone had never been in that situation. The questionnaire was administered during both visits. The items were averaged per visit, with Cronbach's alphas of .82 and .85, respectively. The means per visit were significantly correlated ($r = .87$, $p < .001$). The mean over both visits was computed and then standardized. A higher score reflected better self-regulation.

The Go/No-go task was used as the computer task to measure self-regulation, specifically inhibition (Braver, Barch, Gray, Molfese & Snyder, 2001). Participants were presented with stimuli of the letter x or k and were asked to press the space bar after x, but not after k. The time between stimuli was between 1000-3000 milliseconds and 20 of the 100 stimuli were k's. The number of correct rejections – in other words: when participants correctly suppressed a response – was standardized and used as a measure of executive functioning. A higher score reflected better executive functioning. The scores on the ATQ-EC and the Go/No-go were not significantly correlated ($r = .09$, $p = .400$).

Impulsivity
To measure impulsivity, participants completed a computerized Monetary Choice Questionnaire (MCQ; Kirby & Marocović, 1996). Participants were asked to choose between receiving a reward now or receiving a higher reward in the future, using 27 items. Using the Monetary Choice Questionnaire Automated Scorer by Kaplan et

al. (2016), the log-transformed overall *k* was calculated. A higher *k* reflects higher impulsivity (for further information see Kirby, 2009). The log-transformed overall *k* was reverse-coded and standardized so that a higher score would reflect less impulsivity.

Analyses

After preliminary analyses consisting of correlations among the predictors and parenting measures, multilevel models were used. Analyses were conducted for caregiver sensitivity and harsh caregiving separately. To test whether parenting quality was lower in the chaos condition than in the neutral condition, a fixed effect of condition was entered. In separate analyses, lower self-regulation and more impulsivity were tested as moderators for the effect of condition on parenting quality. Lastly, three-way interactions were tested exploratively with interactions between condition, phase and the separate measures for self-regulation and impulsivity. These analyses were conducted separately for both caregiver sensitivity and harsh caregiving. Using G*power 3.1.9.4 and the repeated-measures ANOVA with within-between interaction, we entered an expected power of .80, alpha level of .05, a small effect size of .40, with two groups and three repetitions and expected correlations between measures at .50. This gave a required sample size of 62, indicating our sample was large enough to detect significant interactions. For an overview of the evaluated models, see Table 1.

Table 1
Overview models of caregiver sensitivity and harsh caregiving

1.	Unconditional means model.
2.	Unconditional growth model: phase as fixed effect.
3.	Unconditional growth model: phase as fixed and random effect.
4.	Phase and condition as fixed effects, phase as random effect, covariates added.
5a.	Phase and interaction between condition and self-reported self-regulation as fixed effects, phase as random effect, covariates added.
6a.	Interaction between condition, self-reported self-regulation, and phase as fixed effects, phase as random effect, covariates added.
5b.	Phase and interaction between condition and computer-assessed self-regulation as fixed effects, phase as random effect, covariates added.
6b.	Interaction between condition, computer-assessed self-regulation, and phase as fixed effects, phase as random effect, covariates added.
5c.	Phase and interaction between condition and impulsivity as fixed effects, phase as random effect, covariates added.
6c.	Interaction between condition, impulsivity, and phase as fixed effects, phase as random effect, covariates added.

Five out of six participants who did not complete both lab visits started with a lab visit in the chaos condition. According to Van Ginkel, Linting, Rippe and Van der Voort (2019), multiple imputation is a fitting solution to data not missing at random and is equivalent or better compared to complete case analysis. Thus, we used multiple imputation in the current report (see Andeweg et al., 2020). To control for the effect of the order of conditions on caregiver sensitivity over time, we controlled for the order of condition as well as the interaction between order of condition and phase. All analyses were performed in R version 3.5.1, on a Dell XPS 9370 with an i7 8550U processor overclocked at 2.0Ghz, with 16GB of RAM. To pool the results on 100 imputation sets the summary functions from mitml and miceadds, as well as the summary and modelRandEffStats from the merTools package were used. A series of multilevel models were estimated, incrementally comparing nested models using the anova function from mitml and merTools (which yielded equivalent results). Model comparisons and effect estimates were evaluated at 5% alpha level.

Results

Preliminary analyses

Caregiver sensitivity scores were significantly correlated with *r*s between .22 and .92 (*p*s between <.001 and .041), with the exception of caregiver sensitivity in phase 1 of the chaos condition and phase 2 of the neutral condition (r = .18, p = .088; see Table 2). Harsh caregiving scores were also significantly correlated, with *r*s between .24 and .60 (*p*s between <.001 and .022), except for phases 2 and 3 of the chaos condition with phase 1 of the neutral condition (*r*s of .16 and .20, *p*s of .129 and .055, respectively). Measures of self-regulation and impulsivity were not significantly correlated with each other and were mostly uncorrelated to measures of caregiving. There were multiple significant correlations between education level and caregiving behavior. In addition, age was significantly correlated to caregiver sensitivity during phase 1 of the chaos condition (see Tables 2 and 3). Therefore, age and education level were added as covariates alongside the interaction between order of condition and phase.

Table 2
Descriptive statistics and correlations between caregiver sensitivity, harsh caregiving, self-regulation, impulsivity, and demographic variables (*N* between 85-96).

		M(*SD*) neutral	*M*(*SD*) chaos	1	2	3	4	5	6	7	8	9	10	11
1.	CS phase 1	6.03 (1.55)	5.75 (1.54)	.43**	.46**	.41**	-.21*	-.02	-.10	-.11	-.06	-.01	.24*	.21*
2.	CS phase 2	4.74 (1.92)	4.37 (1.96)	.54**	.50**	.81**	-.18	-.03	.06	-.07	-.15	.15	.17	.19
3.	CS phase 3	4.09 (1.92)	4.01 (1.89)	.43**.	.83**	.58**	-.12	-.04	.09	-.02	-.10	.17	.17	.14
4.	HC phase 1	.88 (.47)	.89 (.47)	-.135	.03	.06	.24*	.46**	.50**	-.11	-.01	-.18	-.03	-.12
5.	HC phase 2	.74 (.39)	.74 (.43)	-.01	.18	.17	.38**	.27*	.60**	-.07	.10	-.11	-.05	-.07
6.	HC phase 3	.78 (.48)	.71 (.45)	.03	.22*	.23*	.41**	.56**	.44**	-.02	.06	-.17	-.17	-.26*
7.	Self-reported self-regulation	0.00 (1.00)	-	-.01	-.02	-.11	.04	.03	-.03	-	-	-	-	-
8.	Computer-assessed self-regulation	0.00 (1.00)	-	-.04	-.02	-.01	-.13	.04	.10	-.09	-	-	-	-
9.	Impulsivity	0.00 (1.00)	-	-.03	-.04	-.01	-.10	-.22*	-.12	-.04	-.17	-	-	-
10.	Age	20.33 (1.98)	-	-.18	-.10	-.05	.00	.02	-.05	-.06	-.04	-.03	-	-
11.	Education level	-	-	-.19	-.00	-.04	-.26*	-.06	-.23*	-.14	-.03	-.16	-.31**	-

Note. CS = caregiver sensitivity, HC = harsh caregiving. Below the diagonal reflects the neutral condition, above the diagonal reflects the chaos condition. The measures for self-regulation and impulsivity are standardized. * p < .05, ** p < .01.

3

Caregiver sensitivity

All results from multilevel analyses hereafter are based on the pooled results of the imputed datasets (see Table 3), except for the intra-class correlation and explained variance. The unconditional means model (Model 1) gave an intra-class correlation of .37, warranting the use of multilevel modeling. Phase was added in Model 2 as a numeric predictor, as a linear functional form was an adequate representation. Phase had a significant main effect on caregiver sensitivity, which significantly decreased over time (t = - 13.05, p < .001). Model 2 fit the data better than Model 1 (X^2 (1) = 144.43, p < .001) and explained 28% of the variance in intercepts. In Model 3, phase was added as a random effect. Phase remained significant (t = -11.17, p <.001) and this model fit better than Model 2 (X^2 (2) = 10.85, p < .001), explaining 37% of the within-subject variance in caregiver sensitivity. To test whether caregiver sensitivity was lower in the chaos condition than in the neutral condition, we added condition to Model 4 along with the covariates age, education level, and the interaction between order of condition and phase. These covariates were kept in all following models. Condition had a significant effect, with lower caregiver sensitivity in the chaos condition (t = -2.16, p = .031). Model 4 fit the data significantly better than Model 3 (X^2 (5) = 2.56, p = .025) and explained 21% more of the variance in intercepts and 1% more of the variance in slopes of caregiver sensitivity than Model 3 (see also Andeweg et al., 2020).

Self-reported self-regulation

To test whether the effect of condition on caregiver sensitivity was stronger for participants with lower self-regulation, the interaction between condition and self-reported self-regulation was added in Model 5a. The interaction between condition and self-reported self-regulation was not significant (t = 0.07, p = .945) and Model 5a did not fit the data better than Model 4 (X^2 (2) = 0.05, p = .949). This means that the effect of household chaos on caregiver sensitivity was not stronger for participants with lower self-reported self-regulation. Exploratively, we tested a three-way interaction between phase, condition, and self-reported self-regulation on caregiver sensitivity in Model 6a. The three-way interaction was not significant (t = -0.33, p = .744) and the model did not fit the data better than Model 5a (X^2 (3) = 0.89, p = .446) or Model 4 (X^2 (5) = 0.56, p = .733). Our results showed no support for moderation of self-reported self-regulation on the effect of condition over time on caregiver sensitivity.

Computer-assessed self-regulation

In Model 5b the interaction between condition and computer-assessed self-regulation were added. The interaction was not significant (t = -1.65, p =.100). Model 5b did not fit the data better than Model 4 (X^2 (2) = 1.33, p = .266). In Model 6b we exploratively added a three-way interaction between phase, condition, and computer-assessed self-regulation. The three-way interaction was not significant (t = -0.14, p = .891) and the model did not fit the data better than Model 5b (X^2(3) = 0.30, p = .829) or Model 4 (X^2(5) = 0.69, p = .631). This means there was no moderation of computer-assessed self-regulation on the effect of condition over time on caregiver sensitivity.

Impulsivity

To test whether the effect of condition on caregiver sensitivity was stronger for participants with more impulsivity, we added the interaction between condition and impulsivity in Model 5c. The interaction between condition and impulsivity was not significant (t = -1.61, p =.107). The model did not fit the data better than Model 4 (X^2(2) = 1.26, p =.284). These results mean that the effect of condition on caregiver sensitivity was not stronger for participants with more impulsivity. Exploratively, we added a three-way interaction between phase, condition, and impulsivity in Model 6c. The three-way interaction was not significant (t = -0.98, p = .325) and the model did not fit the data better than Model 5c (X^2(3) = 1.05, p < .371) or Model 4 (X^2(5) = 1.12, p = .349). This means that the interaction between household chaos and impulsivity on caregiver sensitivity did not change over time.

Table 3

Overview of fitted models for caregiver sensitivity with coefficients, *SE*'s and significance per parameter.

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 5b	Model 6b	Model 5c	Model 6c
Intercept	4.84 (0.14)***	6.67 (0.20)***	6.67 (0.17)***	3.63 (1.32)**	3.60 (1.32)**	3.93 (1.38)**	3.66 (1.32)**	3.98 (1.38)**	3.63 (1.32)**	3.95 (1.38)**
Phase		-0.92 (0.07)***	-0.92 (0.08)***	-0.87 (0.12)***	-0.87 (0.12)***	-1.04 (0.23)***	-0.87 (0.12)***	-1.03 (0.23)***	-0.87 (0.12)***	-1.03 (0.28)***
Condition				-0.24 (0.11)*	-0.24 (0.11)*	-0.46 (0.29)	-0.24 (0.11)*	-0.46 (0.28)	-0.24 (0.11)*	-0.46 (0.28)
Self-reported self-regulation					-0.02 (0.21)	0.04 (0.46)				
Condition*self-reported self-regulation					0.01 (0.11)	0.09 (0.28)				
Condition*self-reported self-regulation*phase						-0.04 (0.13)				
Computer-assessed self-regulation							0.24 (0.21)	0.24 (0.46)		
Condition*computer-assessed self-regulation							-0.19 (0.12)	-0.15 (0.29)		
Condition*computer-assessed self-regulation*phase								-0.02 (0.13)		
Impulsivity									0.29 (0.22)	0.01 (0.48)
Condition*impulsivity									-0.19 (0.17)	0.08 (0.30)

Table 3
Continued.

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 5b	Model 6b	Model 5c	Model 6c
Condition*impulsivity*phase										-0.14 (0.14)
Age				0.13 (0.07)	0.13 (0.07)*	0.13 (0.07)*	0.13 (0.07)	0.13 (0.07)	0.13 (0.07)	0.13 (0.07)
Education level				0.43 (0.31)	0.44 (0.31)	0.44 (0.31)	0.43 (0.31)	0.43 (0.31)	0.43 (0.31)	0.43 (0.31)
Phase*Condition first visit				-0.09 (0.17)	-0.09 (0.17)	-0.08 (0.16)	-0.09 (0.17)	-0.09 (0.16)	-0.09 (0.17)	-0.10 (0.16)
σ_0^2	1.44	1.57	1.06	0.88	0.88	0.88	0.83	0.83	0.93	0.92
σ_1^2			1.28	1.04	1.04	1.05	1.04	1.04	1.06	1.05
σ_e^2	2.42	1.69	1.35	1.38	1.38	1.37	1.38	1.38	1.37	1.36
$\rho_{01\ phase}$			-0.01	0.20	0.20	0.19	0.20	0.20	0.14	0.15
LogLikelihood	-1109.8	-1027.5	-1004.5	-947.1	-947.0	-945.3	-912.3	-910.9	-914.7	-912.3
Deviance	2219.5	2055.1	2009.0	1894.1	1894.0	1890.6	1824.6	1821.8	1829.5	1824.7

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Condition is coded as 1 = neutral and 2 = chaos. Education level is coded as 1 = vocational education and 2 = college. The values for σ_0^2, σ_1^2, σ_e^2, $\rho_{01\ phase}$, LogLikelihood, and Deviance are based on complete cases.

3

Harsh caregiving

All results from multilevel analyses hereafter are based on the pooled results of the imputed datasets (see Table 4), except for the intra-class correlation and explained variance. The unconditional means model (Model 1) gave an intra-class correlation of .02. Phase was added in Model 2 as a categorical predictor, as a linear functional form was not an adequate representation. Phase had a significant main effect on harsh caregiving (t = - 3.85, p < .001), with harsh caregiving slightly decreasing from phase 1 to phase 2 and remaining stable from phase 2 to phase 3. Model 2 fit the data better than Model 1 ($X^2(1) = 14.59$, p < .001) and explained 0.36% of the variance in intercepts. In Model 3, phase was added as a random effect. Phase remained significant (t = -3.80, p <.001). This model did not fit better than Model 2 ($X^2(2) = 0.66$, p < .515). To test whether harsh caregiving was higher in the chaos condition than in the neutral condition, we added condition to Model 4 along with the covariates age, education level, and the interaction between order of condition and phase. These covariates were kept in all following models. Condition did not significantly affect harsh caregiving (t = -0.41, p = .679). Model 4 did not fit the data significantly better than Model 3 ($X^2(5) = 1.20$, p = .305).

Self-reported self-regulation

To test whether the effect of condition on harsh caregiving was stronger for participants with lower self-regulation, the interaction between condition and self-reported self-regulation was added in Model 5a. The interaction between condition and self-reported self-regulation was not significant (t = -1.28, p = .202) and Model 5a did not fit the data better than Model 4 ($X^2(2) = 1.11$, p = .331). This means that the effect of household chaos on harsh caregiving was not dependent on self-reported self-regulation. Exploratively, we tested a three-way interaction between phase, condition, and self-reported self-regulation on harsh caregiving in Model 6a. The three-way interaction was not significant (t = 0.99, p = .324) and the model did not fit the data better than Model 5a ($X^2(3) = 0.76$, p = .518) or Model 4 ($X^2(5) = 0.90$, p = .482). Our results showed no support for moderation of self-reported self-regulation on the effect of condition over time on harsh caregiving.

Computer-assessed self-regulation

In Model 5b the interaction between condition and computer-assessed self-regulation were added. The interaction was not significant (t = 0.36, p = .723); the effect of condition on harsh caregiving was not moderated by computer-assessed self-regulation. Model 5b did not fit the data better than Model 4 ($X^2(2) = 0.04$, p = .979). In Model 6b we exploratively added a three-way interaction between phase, condition, and computer-assessed self-regulation. The three-way interaction was not significant (t = -1.08, p = .282) and the model did not fit the data better than Model 5b ($X^2(3) = 1.71$, p = .164) or Model 4 ($X^2(5) = 1.06$, p = .380). This means there was no moderation of computer-assessed self-regulation on the effect of condition over time on harsh caregiving.

Impulsivity

To test whether the effect of condition on harsh caregiving was stronger for participants with more impulsivity, we added the interaction between condition and impulsivity in Model 5c. The interaction between condition and impulsivity was not significant (t = 0.51, p = .612). The model did not fit the data better than Model 4 (X^2 (2) = 1.31, p = .269); the effect of condition on caregiver sensitivity was not stronger for participants with more impulsivity. Exploratively, we added a three-way interaction between phase, condition, and impulsivity in Model 6c. The three-way interaction was not significant (t = -0.18, p = .859) and the model did not fit the data better than Model 5c (X^2 (3) = 0.478, p < .697) or Model 4 (X^2 (5) = 0.79, p = .555). This means that the interaction between household chaos and impulsivity on harsh caregiving did not change over time.

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Table 4
Overview of fitted models for harsh caregiving with coefficients, *SE*'s and significance per parameter.

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 5b	Model 6b	Model 5c	Model 6c
Intercept	0.79 (0.03)***	0.93 (0.05)***	0.93 (0.05)***	1.19 (0.33)***	1.21 (0.33)***	1.08 (0.35)**	1.19 (0.33)***	1.07 (0.35)**	1.17 (0.33)***	1.04 (0.34)**
Phase		-0.07 (0.02)***	-0.07 (0.02)***	-0.06 (0.03)*	-0.06 (0.03)*	0.01 (0.06)	-0.06 (0.03)*	0.01 (0.06)	-0.06 (0.03)*	0.01 (0.06)
Condition				-0.01 (0.03)	-0.01 (0.03)	0.07 (0.08)	-0.01 (0.03)	0.07 (0.08)	-0.01 (0.03)	0.07 (0.08)
Self-reported self-regulation					0.04 (0.06)	0.14 (0.13)				
Condition*self-reported self-regulation					-0.04 (0.03)	-0.11 (0.08)				
Condition*self-reported self-regulation*phase						0.04 (0.04)				
Computer-assessed self-regulation							-0.02 (0.06)	-0.20 (0.13)		
Condition*computer-assessed self-regulation							0.01 (0.03)	0.09 (0.08)		
Condition*computer-assessed self-regulation*phase								-0.04 (0.04)		
Impulsivity									0.02 (0.06)	0.00 (0.14)
Condition*impulsivity									0.02 (0.03)	0.03 (0.09)

Table 4
Continued.

Parameter	Model 1	Model 2	Model 3	Model 4	Model 5a	Model 6a	Model 5b	Model 6b	Model 5c	Model 6c
Condition*impulsivity*phase										-0.01 (0.04)
Age				0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)	0.00 (0.02)
Education level				-0.17 (0.08)*	-0.18 (0.08)*	-0.18 (0.08)*	-0.17 (0.08)*	-0.17 (0.08)*	-0.16 (0.08)*	-0.16 (0.08)*
Phase*Condition first visit				-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)	-0.03 (0.04)
σ_0^2	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00
σ_1^2			0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
σ_e^2	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
$\rho_{01\ phase}$			-0.02	-0.17		-0.30	-0.21	-0.34		
LogLikelihood	-354.1	-353.3	-352.8	-332.3	-331.0	-326.4	-313.4	-309.9	-319.0	-312.5
Deviance	708.2	706.6	705.7	664.6	662.1	652.8	626.8	619.7	638.0	624.9

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Condition is coded as 1 = neutral and 2 = chaos. Education level is coded as 1 = vocational education and 2 = college. The values for σ_0^2, σ_1^2, σ_e^2, $\rho_{01\ phase}$, LogLikelihood, and Deviance are based on complete cases. Correlation between random effects could not be estimated due to negligible residual random intercept variance.

Discussion

Using an experimental design, we examined whether the effect of household chaos on caregiver sensitivity and harsh caregiving was stronger for participants with lower self-regulation and more impulsivity. We found that household chaos affected caregiver sensitivity (see Andeweg et al., 2020), but not harsh caregiving. No support for moderation by self-regulation or impulsivity, nor interactions with the duration of taking care for the infant simulator were found.

We hypothesized that the chaos condition would affect both measures of parenting, i.e. caregiver sensitivity and harsh caregiving, but only found that caregiver sensitivity was affected (see Andeweg et al., 2020). It is not likely that this means that household chaos only affects caregiver sensitivity and not harsh parenting, as previous correlational studies have shown that household chaos is related to sensitive and to harsh parenting (e.g., Dumas et al.). Also, a recent experimental study found that an intervention aimed at reducing household chaos led to less harsh parenting (Chapter 4). One explanation may be that our measure of harsh caregiving was not sensitive enough to reflect smaller differences in harsh caregiving or that our adaptation to the infant simulator was not successful in distinguishing between what was harsh caregiving and what was necessary force to, for instance, move the infant simulator's leg or arm during a diaper change. However, intercoder reliability was good on all scales, indicating that coders distinguished between these behaviors in similar ways and precision issues are unlikely. Another explanation is that the crying infant is successful in eliciting caregiver sensitivity, but not in eliciting harsh caregiving. In response to infant crying, soothing can be expected, which falls under caregiver sensitivity, whereas behavior that would be considered harsh caregiving is less likely to occur in response to infant crying. However, it is important to note that nearly 6% of 6-month old infants is shaken, slapped, or smothered in response to crying, especially in case of excessive crying (Reijneveld, Van der Wal, Brugman, Hira Sing, & Verloove-Vanhorick, 2004). This incidence largely increases from 3 to 6 months, which could indicate that excessive crying over a long period of time may be a precursor to harsh caregiving. Our 2 observations of 45 min may thus not be enough to observe harsh caregiving in response to infant crying.

Self-regulation

We did not find evidence that the effect of household chaos on parenting was moderated by self-regulation, neither for harsh caregiving nor caregiver sensitivity. For harsh caregiving, this could simply be due to the task with the infant simulator not eliciting sufficient variation in harsh caregiving. We expected to find moderation by self-regulation because lower self-regulation would make it more difficult to exhibit positive instead of negative parenting practices when in a challenging environment. Part of coping with a challenging environment may be altering the environment to your needs, e.g., cleaning up clutter or turning off the loud, annoying tv. We asked our participants not to change the lab setting to keep the level of chaos constant, thereby potentially limiting the exhibition of self-regulatory behavior in challenging environments. Another explanation is that self-regulation only acts as a moderator under prolonged exposure to a chaotic environment. Our design used two 45 min episodes in a simulated environment, whereas other studies assessed self-regulation, household chaos and parenting in the home, where parents spend most of their time (e.g., Valiente, Lemery-Chalfant, & Reiser, 2007). Longer exposure than 45 min may be needed to approximate prolonged exposure of the home environment and for moderation by self-regulation to become visible. A third interpretation is that self-regulation may need to be considered in a different role in the effect of household chaos on parenting. We used the same measure for self-reported self-regulation as Valiente et al. (2007), who found that lower levels of self-reported household chaos were related to higher levels of self-reported self-regulation. As this was a correlational study, this could mean that parents with more self-regulation are better able to cope with household chaos and therefore experience lower levels of household chaos than parents with less self-regulation. This suggests that self-regulation moderates the effect of household chaos on parenting, but our results do not support this. Thus, other interpretations of this finding should be considered. For example, higher levels of household chaos may impede on self-regulation, or parents with more self-regulation may maintain lower levels of household chaos. To test these interpretations, measuring state self-regulation, reflecting self-regulation in a specific situation (Hong, 1998), in a neutral and a chaotic situation would be necessary. This would allow for testing whether household chaos impedes on self-regulation, as previously suggested by Crandall et al. (2015) and Deater-Deckard, Chen, Wang and Bell (2012a). Lastly, it may be key to investigate child behavior. It is possible that parents with more self-regulation are better armed to deal with more difficult child behavior, especially in difficult environments, such as a more chaotic household. Following this reasoning, household chaos would affect parenting and child behavior, and more challenging child behavior would in turn affect parenting (as suggested by Dumas et al., 2005), which is especially difficult to manage for parents with lower self-regulation, who in turn may show lower sensitivity and more harsh parenting. Using an infant simulator, thus keeping child behavior stable, we were not able to find moderation by self-regulation. Future research should study whether self-regulation moderates the effect of household chaos on parenting in response to different levels of challenging child behavior. To this end, adding an extra manipulation to our current design would be necessary, in which the infant simulator is programmed to be easily soothed or difficult to sooth.

Impulsivity

We did not find that the effect of household chaos on parenting was stronger for more impulsive participants. One explanation for not finding moderation is that it may be necessary to test the comorbidity of impulsivity and neuroticism. More neurotic people are more easily aroused (e.g., Brown & Rosellini, 2008; Helmers et al., 1997), and Karreman et al. (2008) found that parenting quality was lower in demanding situations for more neurotic and extraverted fathers. Thus, household chaos may affect parenting more strongly in parents with more impulsivity as well as higher neuroticism. However, it is also possible that impulsivity is not relevant regarding how people respond to their environment. Karreman et al. (2008) found that extraversion moderated parenting in response to high-demand parenting situations. In that study, the parenting situation was considered high-demand because of a difficult child temperament. Impulsivity may be more relevant to how a person responds to other people's behavior, and not relevant for how a person responds to their environment. Lastly, it is also possible that participants were able to control their response urgency and approach behavior in response to the crying infant simulator, and that our design was not taxing enough to allow for moderation in impulsivity to arise. Eisenberg et al. (2004) suggested that control over these reactive behaviors tends to improve with age. For our young-adult sample, the current design may have fallen within the ability to regulate their impulsive behavior. Testing whether impulsivity moderates caregiving in response to a more challenging environment is necessary to evaluate this assumption.

Strengths and limitations

Strengths of this study include the experimental design in which we manipulated household chaos, the use of an infant simulator to control for child effects, and the use of multiple measures for self-regulation. A limitation to the current study is that we did not measure fluid intelligence and thus could not control for this, which was recommended by Crandall et al. (2015). Furthermore, as the current study used a highly controlled lab setting with an all-female student population, results may not be generalizable to families, and to fathers. Lastly, the infant simulator was unsoothable as it was programmed not to respond to caregiving behavior. This means that our results may only be generalizable to less soothable infants, such as infants with negative temperaments (Yoo & Reeb-Sutherland, 2013).

Future research and implications

Future research should experimentally study whether household chaos affects positive and negative parenting practices by including situations in which both can be expected. Also, identifying the mechanism through which household chaos affects parenting is crucial for knowing which parents may be most affected by household chaos. Furthermore, future research should include both state and trait measures of self-regulation and extend research on the moderating role of impulsivity by combining this with neuroticism. Based on our findings, efforts to improve parenting through reducing household chaos may be effective and should not solely target parents with low self-regulation or more impulsivity. However, this implication should be taken with caution as our findings need to be replicated with real parents and children outside a highly controlled lab setting. Lastly, the effect of household chaos on parenting should be studied with an infant simulator as well as parent-child interactions to disentangle potential effects of child behavior.

Conclusion

In situations in which an infant is inconsolable, household chaos appears to affect caregiver sensitivity but not harsh caregiving. Our results indicate that the effect of household chaos on parenting did not depend on self-regulation or impulsivity. Future research should test the combined effect of impulsivity and neuroticism and should study whether child behavior partly explains how household chaos affects parenting. Ultimately, understanding how and in which parents household chaos affects parenting could inform parenting intervention and prevention programs.

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4

Reducing household chaos to improve parenting quality? An RCT using the SHINE intervention.

Suzanne M. Andeweg, F. Fenne Bodrij, Mariëlle J. L. Prevoo, Ralph C. A. Rippe, Lenneke R. A. Alink

Education and Child Studies
Leiden University
The Netherlands

Submitted

Abstract

It is necessary to understand the etiology of parenting problems and child maltreatment in order to design effective prevention and intervention programs. One factor that has repeatedly been related to more harsh and less sensitive parenting is household chaos (i.e., high noise levels, clutter, and a lack of family routines). A recent lab study showed that increased household chaos is causally related to less sensitive parenting. The current study employed an RCT design and aimed to decrease household chaos in family homes and thereby improve parenting quality. In total, 125 primary caregivers of children around age 1.5 years with relatively high levels of household chaos were enrolled in the RCT. Questionnaires, video-observations, a diary app, and a decibel meter assessing noise were used to measure household chaos and parenting. We were not able to analyze effects on child maltreatment, as the prevalence was too low in our sample. According to our results, the intervention did not lead to reduced household chaos. We did find reduced harsh discipline in the intervention group but found no effects on sensitivity. As we controlled for generic intervention elements, the effect on harsh discipline may be due to an unmeasured effect on household chaos. More sensitive measures may be necessary to detect a significant reduction in household chaos. Our results indicate that household chaos may be a salient factor in demanding parenting situations. Future research should investigate underlying mechanisms of the effect of chaos.

Keywords: household chaos, harsh discipline, sensitive parenting, RCT, intervention

Introduction

Understanding the etiology of parenting problems in general and child maltreatment as its most extreme form is necessary to inform prevention and intervention. Previous studies have shown that parenting is more harsh and less sensitive in more chaotic households (e.g., Coldwell, Pike & Dunn, 2006). As these studies are mostly correlational, directionality of this association is unclear. A recent experimental lab study among female young adults showed that household chaos had a causal effect on sensitive caregiving for an infant simulator (Andeweg, Bodrij, Prevoo, Rippe & Alink, 2020). However, for both stability and generalizability reasons, replication of these results in real families is needed. The current study uses an RCT design to test whether reducing household chaos leads to improved parenting quality and less child maltreatment. Findings could indicate whether reducing household chaos should be included in prevention and intervention programs to improve parenting.

Studies have consistently related more household chaos to lower quality parenting (e.g., Coldwell et al., 2006). Household chaos is defined as a lack of family routines and week structure, high noise levels, material disorganization and crowding (Evans & Wachs, 2010; Matheny, Wachs, Ludwig & Phillips, 1995). As most parent-child interactions take place at home, particularly with children of young age, household chaos may be a salient factor for parenting. Indeed, in more compared to less chaotic households, parents display more negative parenting, such as dysfunctional discipline (i.e., laxness, overreactivity, and verbosity), and anger and hostility (Coldwell et al., 2006; Dumas et al., 2005). Parents also show less positive parenting, are less responsive, less able to understand and respond to child social cues, and show less warmth, enjoyment and stimulating parenting (Coldwell et al., 2006; Corapci & Wachs, 2002; Dumas et al., 2005; Matheny et al., 1995). More harsh and insensitive parenting is related to a slower cognitive development and to more externalizing and internalizing problems in children and adolescents (Bradley & Corwyn, 2007; Wolford, Cooper & McWey, 2018; Firk, Konrad, Herpertz-Dahlmann, Scharke & Dahmen, 2018; Treyvaud et al., 2015). Child maltreatment, which is an extreme form of low quality parenting, also has many negative outcomes on short as well as long term (e.g., Alink, Cicchetti, Kim, & Rogosch, 2009; Alink, Cicchetti, Kim, & Rogosch, 2012; Vachon, Krueger, Rogosch, & Cicchetti, 2015; Danese & Tan, 2014; Norman, Byambaa, Rumna, Butchart, Scott, & Vos, 2012).

Unfortunately, most studies on the associations of household chaos with parenting and child development are correlational and therefore no conclusions about causality can be drawn. It is essential for experimental studies to address causal pathways and to henceforth develop effective prevention and intervention programs to improve parenting quality. A recent study was the first to use an experimental manipulation of household chaos in a lab setting with non-parent females taking care of an infant simulator, and showed that household chaos had a small causal effect on sensitivity (Andeweg et al, 2020). These results need to be replicated in real families. When a causal effect of household chaos on parenting quality and on child maltreatment is replicated in families, then interventions to reduce household chaos may form a new, effective way to improve parenting quality and reduce child maltreatment.

To examine the causality of household chaos in parenting, we designed an intervention to reduce household chaos in families experiencing elevated levels of household chaos. This intervention was based on an intervention on changing family routines to reduce obesity (Haines et al., 2013). This resulted in the Structuring the Home to Induce a Nurturing Environment (SHINE) intervention (Bodrij, Prevoo, Andeweg, & Alink, 2017), during which parents set goals to decrease clutter and noise levels and to improve family routines and week structure. An important aspect of the SHINE intervention is motivational interviewing, in which the intervener and client engage in a partnership and the intervener elicits motivation for change and resolves ambivalence with the client, rather than convincing the client to change by posing rational arguments as an expert (Emmons & Rollnick, 2001).

Current study

The current study aimed to test the causal effect of household chaos on parenting quality and child maltreatment by reducing household chaos in families with relatively high levels of household chaos. To do this, a randomized controlled trial (RCT) was conducted among primary caregivers (male or female) of children around the age of 1.5-2 years old. These families were screened for elevated levels of household chaos. During the pre- and posttest multiple measures of household chaos and parenting were administered, using self-report as well as observational and other more objective measures. The SHINE intervention created for this study was used to reduce household chaos (Prevoo et al., 2020). We expected that the intervention would lead to decreased levels of household chaos (i.e., observed household chaos, noise, family routines, and self-reported household chaos) and as a result to less harsh discipline and child maltreatment and to higher levels of sensitivity. Additionally, to control for generic intervention elements we measured perceived effectiveness and therapeutic alliance (Vîslă, Constantino, Newkirk, Ogrodniczuk & Söchting, 2016; Flückiger, Del Re, Wampold, Symonds & Horvath, 2012).

Method

Participants

For the current study, primary caregivers (i.e., the parent who spent the most time with the child) of singleton children around the age of 1,5 were recruited (see Prevoo, Bodrij, Andeweg & Alink, 2020). Dutch municipalities in the province of South Holland provided contact details for families that fit this description. Letters were sent to 7550 families (see Figure 1), inviting the primary caregiver to fill out a screening questionnaire in which we gathered demographic information and measured the level of household chaos. We received 2010 completed questionnaires. Exclusion criteria were psychopathology and/or physical problems of the primary caregiver and/or participating child (e.g. depression, autism, chronic diseases affecting everyday life), and a child living in the same household of above the age of 12. Inclusion criteria were that the child lived with the primary caregiver and that the primary caregiver was fluent in Dutch. Those who rated at least one of the 15 statements of the Confusion, Hubbub And Order Scale (CHAOS; Matheny et al., 1995) questionnaire as true or completely true for their family were invited to participate in our study with the target child. This resulted in 792 invited families.

In total, 125 families participated in our study. Primary caregivers were the biological mother (89%) or biological father (11%) of the target child. All children lived with both parents. The average age of the primary caregiver was 34.32 years (*SD* = 4.13). The children (54% boys) were on average 19.17 months old (*SD* = 1.90). Our sample mostly had a high socio-economic status. Sixty percent of the participants had a monthly family income of above €3500, 22% earned between €3000-3500, 11% earned between €2500-3000, 5% earned between €2000-2500, and 2% earned between €1500-2000. The average gross monthly family income in 2018 in The Netherlands was €2662 according to the Netherlands Bureau for Economic Policy Analysis (CPB, 2019). Of the primary caregivers, 74% indicated their highest level of education was college or university, 21% indicated vocational education, and 5% indicated high school as highest level of education. Seven participants did not reach the posttest, for whom no differences on demographic variables were found compared to participants who completed the posttest.

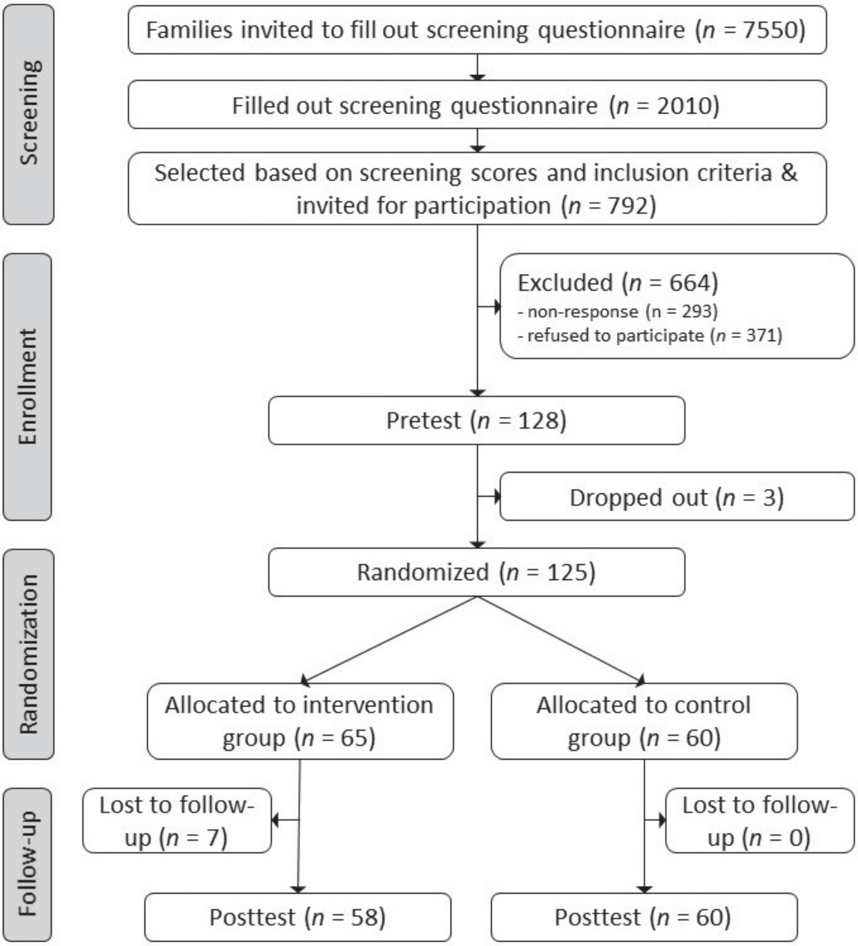

Figure 1. Flow chart of the recruitment and inclusion of participants.

Procedure

Pre and posttest

The current study was approved by the ethics committee of the Institute of Child and Education Studies from Leiden University (number ECPW 2015-090) and preregistered in the open science framework (Prevoo et al., 2020). Participation included two home visits as pretest, randomization to the intervention or control group, and two home visits as posttest. During the first home visit informed consent was obtained. During the pre- and posttest, parent-child observations were video-taped alongside videotapes of the living room and the child's bedroom for chaos observations. Parent-child observations included a structured play task (5 min), a don't touch task (2 min not allowed to play with a set of toys, 2 min play with the least interesting toy) and a naturalistic play task (5 min) in which parents were asked to play with their child as they would normally do at a location in their house where they would normally play with their child. During all visits questionnaires were filled out. Perceived effectiveness and therapeutic alliance were assessed in the first posttest home visit using a questionnaire. In between the home visits of the pre- and posttest, a diary app was used to measure family routines. In addition, a decibel meter was placed in the living room to measure decibel level during multiple days. Other aspects of participation included collecting saliva and hair samples to measure physiological stress, observations of parents with an infant simulator, and computer tasks. These data were not used in analyses for the current report. During the last home visit participants received €75 as a reward and children received small gifts during the two home visits in which they participated.

Intervention

After the pretest, participants were randomized to the intervention (*n* = 60) or control group (*n* = 65). The SHINE intervention consisted of four home visits and three follow-up phone calls, scheduled with one week in between (see Prevoo et al., 2020). During the first visit, a Q-sort was used to assess the importance of the different aspects of household chaos (clutter, noise levels, and routines) were for individual parents. Based on this q-sort, the participant chose the sequence of the themes of the home visits. The next three home visits were focused on these themes - one per home visit - and the follow-up phone calls were aimed at reflecting on all prior discussed themes. This intervention used similar techniques to aid in altering household routines as the Healthy Habits, Happy Homes intervention (Haines et al., 2013), such as motivational interviewing, printed information, and text messages. The interveners received extensive training in motivational interviewing (Emmons & Rollnick, 2001), including feedback on videotapes from training intervention sessions. Drift of the techniques of motivational interviewing was prevented by scheduling regular intervision sessions. Using motivational interviewing and printed information, the parent selected a goal from a predetermined list of goals fitting the specific theme (between 12 and 16 options per theme). Examples are putting away toys before bedtime (clutter), turning off the TV if no one is watching (noise level), and getting dressed before waking up the child (family routines). Parents were also allowed to set an additional goal that was not included in the list. Parents received a cardboard box to help declutter, a family planner whiteboard to help with family routines, and borrowed a traffic light that responded with a red light to high decibel levels to help with noise levels. Parents wrote down their goals on cards that were placed in a visible place in their home to remind them of their goal in between contact moments. Two text messages were sent weekly that also served as reminders of their goal.

Control group

Participants in the control group received seven weekly phone calls asking how the child was developing. This number of contact moments was equal to that in the intervention, so that the amount of attention was comparable across conditions. Parents in the control condition also received a booklet with general information about child development concerning physical, cognitive, social and emotional development (Van Zeijl et al., 2006). These topics were revisited during the phone calls and parallel to the intervention condition, parents received two text messages a week with reminders about the information that was discussed during the phone call. Household chaos was not discussed during the phone calls and no specific parenting advice was given.

Measures

Self-reported household chaos

The self-report questionnaire used to measure household chaos was the Confusion, Hubbub, and Order Scale (CHAOS; Matheny et al., 1995) and consisted of 15 items such as "We almost always seem to be rushed". Items were answered on a five-point Likert scale with 1) Completely not true, 2) Not true, 3) Sometimes true, sometimes not true, 4) True, 5) Completely true, and with a sixth option for not applicable. This option was coded as system missing and some items were reverse coded so that higher scores always reflected higher levels of chaos. Parents who indicated a 4 or 5 for at least one item were included in the study. Mean scores were calculated for the screening and for the posttest (Cronbach's alphas of .71 and .80, respectively).

Clutter

The video-observations of the living room and child's bedroom were coded with a coding scheme based on the Purdue Home Stimulation Inventory (PHSI; Wachs, Francis & McQuiston, 1979) and the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984). This resulted in seven items which were coded for both rooms, such as whether items on surfaces impeded the use of that surface (e.g., items stacked on a chair, making it impossible to sit on the chair), the ratio of visible to closed storage space, and the amount of stimulation based on spaciousness, clutter, amount of decoration, and use of bold colors. Inter-coder reliability was good with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .76 (range .61 - .97, N = 20). Coding was discussed regularly to prevent coder drift. The 14 items were standardized and means were calculated for the pre and posttest. Higher scores indicated higher observed household chaos.

Family routines

A diary app was used to measure family routines. Four days in between the two pretest home visits were chosen when the parent was home with the child most of the day or the entire day. Parents received questions about mealtime and bedtime. We calculated the standard deviation in the time the child woke up, had lunch, went to bed, the light was turned off, and the child fell asleep. These scores were standardized and then averaged for the pretest and posttest. A higher score reflected more variation in the timing of mealtime and bedtime routines, and thus reflected more household chaos.

Noise

A decibel meter measured average dBA per second in the participant's living room during the pretest and again during the posttest. Data were used from the four days that the diary app was programmed. The mean dBA levels during the morning (7:00-8:30) and evening (17:30-19:00) were calculated. These means were averaged for the pretest and for the posttest, with higher scores indicating higher noise levels.

Sensitivity

Videos of the free play task and the naturalistic play task were coded for sensitivity. During the free play task parent and child played with toys brought by the researchers, whereas during the naturalistic play task parent and child played as they normally would in their home and could choose the play activity. It was expected that an effect of the home environment on parenting may be more visible in a naturalistic setting than in a structured task, while the structured task controlled for differences in play activity and therefore allowed for greater comparability. The Ainsworth Sensitivity Scales for sensitivity and non-intrusiveness were used (Ainsworth, Bell & Stayton, 1974). The scales ranged from 1) very insensitive or highly intrusive to 9) very sensitive or non-intrusive. Inter-coder reliability for sensitivity was good with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .82 (range .70 - .92, $N = 29$). Coding was discussed regularly to prevent coder drift. The scores for sensitivity and non-intrusiveness were averaged for the free play and naturalistic play separately (correlated at $p < .001$ with *r*s between .78 and .80), with higher scores indicating higher levels of sensitivity (including non-intrusiveness).

Discipline

Videos of the don't touch task were coded for harsh discipline using an adapted version of the discipline scales used by Joosen, Mesman, Bakermans-Kranenburg, and Van IJzendoorn (2012). Our version consisted of a physical discipline scale which evaluated frequency and intensity of physical attempts to make the child comply with the don't touch task, a laxness scale based on frequency of giving in, and an overreactivity scale based on frequency of verbal and non-verbal signs of anger or losing one's temper. All scales ranged from 1 to 5. Inter-coder reliability for all scales was good with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .79 (range .66 - .92, $N = 24$) and coding was discussed regularly to prevent coder drift. As very little laxness was observed, this scale was not used. The scores for physical discipline and overreactivity were summed (correlations within pre- and posttest with *r*s between .168-.347, *p*s between <.001 - .070), with higher scores reflecting more harsh discipline.

Child maltreatment

Child maltreatment was measured through a self-report questionnaire. The Conflict Tactic Scales – Parent Child (CTS-PC; Straus, Hamby, Finkelhor, Moore & Runyan, 1998) was used in combination with the emotional neglect scale of the Childhood Trauma Questionnaire (CTQ; Bernstein et al., 1994; see Pittner et al., 2019). The questionnaire consisted of 32 items which were scored on a five-point Likert scale from 1) Never to 5) (Almost) always. The subscales psychological aggression, corporal punishment, physical maltreatment, and neglect (total of 23 items) were averaged, with Cronbach's alphas of .54 for the pretest and .56 for the posttest. Scores ranged from 1.00 to 1.43 (M = 1.06, SD = 0.07) in the pretest and from 1.00 to 1.48 (M = 1.06, SD = 0.07) in the posttest, indicating there was hardly any incidence of child maltreatment in our sample. Thus, the CTS-PC could unfortunately not be used for analyses.

Perceived effectiveness and therapeutic alliance

We administered a questionnaire to both the intervention and control group during the posttest with 22 items on perceived effectiveness and therapeutic alliance. Items were answered on a 5-point Likert scale. Examples are "How fruitful was the intervention for your family as a whole?" with 1) Little, to 5) A lot, or "How did you experience the contact with the intervener?" with 1) Bad cooperation, to 5) Good cooperation. The pattern matrix from Principal Component Analyses (PCA) with oblique rotations indicated two correlated components (component correlation of .24), reflecting the perceived effectiveness (10 items) and therapeutic alliance (12 items). These items were averaged per scale to calculate a score for perceived effectiveness and for therapeutic alliance (Cronbach's alphas of .96 and .93, respectively). The distribution of therapeutic alliance score was skewed, as most participants were positive about the intervener (standardized skewness = -6.93). Transformed or categorized versions of this variable correlated highly with the skewed variable (*r*s > .98), which is why we decided to use the variable as is. Higher scores indicated more positive evaluations.

Analyses

Data were used from all participants who were randomized (N = 125). As 7 of the participants dropped out after randomization, we imputed these missing data and performed intent-to-treat analyses. Multiple imputation was used, with 100 conditional imputations using 5 iterations each, using functions from the mice function from the mice package (version 3.7.0). Results were pooled by using functions from mitml, miceadds, and merTools packages. All analyses were performed in SPSS version 25 and R version 3.6.1 with Rstudio version 3.4.4 with a fixed starting seed for reproducibility.

To test whether reduced household chaos mediated the effect of condition (i.e., the intervention or control group) on parenting, we conducted multiple regression analyses with 5% alpha level. We tested whether condition predicted posttest scores in household chaos. Next, we tested whether condition predicted posttest scores in parenting. These analyses were conducted separately for four measures of household chaos (self-reported household chaos, clutter, noise, and family routines) and three measures of parenting (harsh discipline, sensitivity in free play, and sensitivity in a naturalistic setting). Based on the outcomes of these analyses, we measured whether the mediator (i.e., a measure of household chaos) predicted parenting and evaluated the effect of condition on parenting after adding chaos as a predictor. All analyses were conducted in two steps: in the first step, we controlled for the per-test score of the outcome measure. In the second step, we added demographic variables, perceived effectiveness, and therapeutic alliance as covariates.

Results

Preliminary analyses

Descriptive statistics and Pearson's correlations are shown in Table 1 and Table 2, respectively. In the pretest, measures of household chaos were not significantly intercorrelated, with the exception of clutter and noise ($r = .27$, $p = .005$). There were no significant correlations among measures of household chaos in the posttest. For parenting, within the pretest sensitivity in free play and in the naturalistic setting were significantly correlated ($r = .54$, $p < .001$). Within the posttest sensitivity in both settings was again significantly correlated ($r = .64$, $p < .001$) and more harsh discipline was significantly correlated to less sensitivity in the naturalistic setting ($r = -.25$, $p = .006$). Most measures were stable over time, with significant correlations between pre- and posttest for household chaos measures (*r*s between .26 and .63, *p*s < .011) and for parenting measures (*r*s between .29 and .41, *p*s < .002). The pre- and posttest measure of discipline were not significantly correlated ($r = 10$, $p = .278$). Measures of household chaos were not related to parenting measures in the pretest, with the exception of a significant correlation between more pretest noise and higher pretest sensitivity during free play ($r = .28$, $p = .004$). In the posttest, measures of parenting and household chaos were uncorrelated.

Table 1

Descriptive statistics of measures of household chaos and parenting.

	Pretest						Posttest					
	Overall		Intervention		Control		Overall		Intervention		Control	
	M(*SD*)	Min-max	*M*(*SD*)	Min-max	*M*(*SD*)	Min-max	*M*(*SD*)	Min-max	*M*(*SD*)	Min-max	*M*(*SD*)	Min-max
Self-reported household chaos	2.29 (0.41)	1.21-3.27	2.30 (0.41)	1.47-3.27	2.28 (0.40)	1.21-3.14	2.22 (0.45)	1.27-3.21	2.20 (0.42)	1.40-3.07	2.24 (0.48)	1.27-3.21
Clutter*	0.00 (0.44)	-0.98-1.33	0.02 (0.46)	-0.81-1.06	-0.01 (0.41)	-0.98-1.33	0.00 (0.44)	-0.86-1.25	-0.02 (0.38)	-0.86-0.87	0.02 (0.50)	-0.81-1.25
Noise	43.71 (7.53)	22.38-60.20	43.63 (7.11)	28.88-59.21	43.80 (8.09)	22.38-60.20	43.06 (5.53)	25.84-58.36	42.56 (5.71)	25.84-55.81	43.59 (5.35)	29.46-58.36
Family routines*	-0.02 (0.62)	-1.08-2.66	0.00 (0.64)	-1.08-2.12	-0.04 (0.61)	-1.04-2.66	-0.03 (0.69)	-1.52-2.18	0.02 (0.69)	-1.17-2.18	-0.07 (0.70)	-1.52-1.65
Discipline	3.82 (1.13)	2.00-9.00	4.02 (1.23)	2.00-9.00	3.61 (0.98)	2.00-7.00	3.50 (1.03)	2.00-6.00	3.38 (1.01)	2.00-6.00	3.62 (1.04)	2.00-6.00
Sensitivity free play	6.57 (1.63)	2.50-9.00	6.63 (1.50)	2.00-9.00	6.51 (1.78)	2.50-9.00	5.75 (1.74)	1.50-9.00	5.88 (1.78)	1.50-9.00	5.63 (1.71)	2.00-8.50
Sensitivity naturalistic	7.15 (1.55)	2.00-9.00	6.97 (1.45)	3.00-9.00	7.35 (1.63)	2.00-9.00	6.64 (1.61)	3.00-9.00	6.61 (1.63)	3.00-9.00	6.67 (1.62)	3.00-9.00

Note. * = standardized scores. These descriptive statistics are based on observed cases.

Covariates were included if there was a significant correlation with pretest measures of household chaos or parenting. A younger age of the parent was significantly correlated to more harsh discipline (*r* = -.19, *p* = .036). A younger age of the child was also significantly related to more harsh discipline (*r* = -.19, *p* = .045) and to less sensitive parenting during free play (*r* =.23, *p* = .014). More children living in the household was related to higher noise levels (*r* = .32, *p* = .001) and to more self-reported household chaos (*r* = .31, *p* < .001). Lower parental education was significantly correlated with more harsh discipline (*r* = -.19, *p* = .039), and lower sensitivity during free play and the naturalistic setting (*r* = .23, *p* = .011 and *r* = .18, *p* = .049). Perceived effectiveness and therapeutic alliance were also entered as covariates and were significantly correlated (*r* = .36, *p* < .001). Higher perceived effectiveness was significantly correlated with more harsh discipline at posttest (*r* = .21, *p* = .029). Therapeutic alliance was significantly correlated with less self-reported household chaos at posttest (*r* = -.22, *p* = .028).

There were no significant differences in pretest levels of household chaos and sensitivity in both the naturalistic and structured setting between the intervention and control group. The intervention group showed more harsh discipline at pretest (*M* = 4.02, *SD* = 1.23) than the control group (*M* = 3.61, *SD* = 0.98; *t* (122) = -2.01, *p* = .046). The intervention group reported higher therapeutic alliance (*M* = 4.51, *SD* = 0.53) and higher perceived effectiveness (*M* = 3.30, *SD* = 0.93) than the control group (*M* = 4.26, *SD* = 0.73; *M* = 2.18, *SD* = 0.78; *t* (109) = -2.07, *p* = .041, and *t* (109) = -6.81, *p* < .001, respectively).

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Household chaos predicted by condition

Pooled results from the imputed data set are reported henceforth, with the exception of the adjusted R^2 and *F*-statistics (see Table 3). Condition was not a significant predictor of self-reported household chaos (first step: R^2 = .37, *F* (2; 107) = 33.04, β = -0.02, *p* = .791; second step: R^2 = .39, *F* (8; 88) = 8.72, β = 0.02, *p* = .819). This was the same for clutter (first step: R^2 = .39, *F* (2; 111) = 37.00, β = -0.07, *p* = .407; second step: R^2 = .40, *F* (8; 91) = 9.35, β = -0.13, *p* = .178), noise (first step: R^2 = .07, *F* (2; 70) = 3.67, β = 0.10, *p* = .589; second step: R^2 = .31, *F* (8; 57) = 4.72, β = -0.13, *p* = .254), and family routines (first step: R^2 = .01, *F* (2; 50) = 1.33, β = 0.01, *p* = .948; second step: R^2 = .08, *F* (8; 38) = 1.50, β = 0.08, *p* = .494). This meant that the intervention did not lead to lower levels of household chaos.

Table 2.
Correlations between pretest and posttest measures of household chaos and parenting.

	Self-reported household chaos	Clutter	Noise	Family routines	Harsh discipline	Sensitivity free play	Sensitivity naturalistic
Self-reported household chaos	.62***	.17	.15	.07	-.05	-.06	-.08
Clutter	.16	.63***	-.04	-.16	.07	.05	.07
Noise	.07	.27**	.30*	-.01	.15	-.06	-.03
Family routines	.04	-.11	.05	.26*	-.04	-.07	.04
Harsh discipline	.05	.03	.02	.06	.10	-.13	-.25**
Sensitivity free play	.01	.06	.28**	.08	-.17	.41***	.64***
Sensitivity naturalistic	-.00	.07	.20	.05	.02	.54***	.29**

Note. The grey diagonal reflects the correlation between pre- and posttest within a measure. Below the diagonal reflects pretest correlations. Above the diagonal reflects posttest correlations. *** $p < .001$. ** $p < .01$ * $p < .05$

Table 3

Posttest measures of household chaos explained by condition and covariates.

	Self-reported household chaos						Clutter						Noise						Family routines					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Step 1			107 (2)	33.04	<.001	0.37			111 (2)	37.00	<.001	.39			70 (2)	3.67	.030	.07			50 (2)	1.33	.273	.01
Intercept	0.82 (0.22)		101.87	3.65	<.001		0.09 (0.11)		110.19	0.82	.416		36.36 (3.62)		90.98	10.05	<.001		-0.01 (0.20)		90.83	-0.06	.951	
Condition	-0.02 (0.07)	-.02	106.20	-0.27	.791		-0.06 (0.07)	-.07	105.79	-0.83	.407		-0.58 (1.08)	-.05	91.34	-0.54	.589		0.01 (0.12)	.01	91.24	0.07	.948	
Pretest	0.63 (0.09)		103.55	7.38	<.001		0.58 (0.08)		112.02	7.60	<.001		0.17 (0.07)		87.16	2.41	.018		0.24 (0.11)		91.32	2.25	.027	
Step 2			88 (8)	8.72	<.001	0.39			91 (8)	9.35	<.001	.40			57 (8)	4.72	<.001	.31			38 (3)	1.50	.192	.08
Intercept	1.09 (0.61)		93.26	1.78	.079		0.70 (0.56)		94.35	1.27	.209		35.64 (9.28)		72.51	3.84	<.001		0.18 (1.05)		77.15	0.17	.867	
Condition	0.02 (0.08)	-.02	98.30	0.23	.819		-0.11 (0.08)	-.13	91.87	-1.36	.178		-1.44 (1.23)	-.13	82.64	-1.15	.254		0.10 (0.15)	.08	87.18	0.69	.494	
Pretest	0.55 (0.09)		96.94	6.11	<.001		0.57 (0.8)		102.17	7.30	<.001		0.14 (0.07)		84.70	1.95	.055		0.26 (0.11)		86.65	2.35	.021	
Age participant	-0.00 (0.01)		99.61	-0.24	.811		0.01 (0.01)		97.21	0.94	.350		-0.01 (0.13)		85.45	-0.08	.938		-0.01 (0.02)		90.94	-0.49	.627	
Age child	0.01 (0.02)		106.23	0.70	.485		-0.03 (0.02)		101.88	-1.88	.063		-0.34 (0.27)		87.92	-1.24	.217		-0.00 (0.03)		77.61	-0.03	.975	
Participant education	-0.02 (0.03)		90.74	-0.57	.571		0.01 (0.03)		94.71	0.23	.820		-0.05 (0.51)		82.10	-0.10	.921		0.00 (0.06)		96.52	0.08	.939	
Number of children	0.13 (0.05)		103.17	2.70	.008		0.00 (0.05)		94.05	0.02	.986		1.85 (.76)		76.32	2.43	.017		0.04 (0.08)		84.23	0.43	.665	
Perceived effectiveness	-0.02 (0.04)		91.45	-0.40	.689		0.08 (0.05)		76.30	1.75	.084		0.48 (0.69)		74.45	0.70	.488		-0.09 (0.08)		86.58	-1.19	.237	
Therapeutic alliance	-0.08 (0.06)		98.31	-1.36	.177		-0.11 (0.06)		76.73	-1.71	.090		1.41 (0.96)		62.96	1.46	.149		0.03 (0.11)		72.12	0.23	.817	

Note. All statistics are based on imputed data, with the exception of the model statistics. Condition was coded as 1 = control group, 2 = intervention.

Table 4
Posttest measures of parenting explained by condition and covariates.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t/F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t/F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t/F*	*p*	Adj. R^2
Step 1			114 (2)	1.63	.201	.01			113 (2)	11.38	<.001	.15			107 (2)	4.94	.009	.07
Intercept	3.56 (0.41)		111.11	8.67	<.001		2.71 (0.73)		118.02	3.71	<.001		4.42 (0.85)		115.56	5.19	<.001	
Condition	-0.28 (0.19)	-.14	113.15	-1.45	-.150		0.20 (0.29)	.06	114.65	0.67	.503		0.05 (0.29)	.02	113.79	0.18	.861	
Pretest	0.09 (0.09)		101.93	1.05	.295		0.42 (0.09)		115.93	4.89	<.001		0.30 (0.09)		114.05	3.18	.002	
Step 2			94 (8)	2.39	.022	.10			93 (8)	3.41	.002	.16			89 (8)	2.14	.040	.09
Intercept	4.92 (1.66)		103.52	2.97	.004		1.27 (2.43)		104.50	0.52	.603		0.35 (2.42)		104.39	0.14	.886	
Condition	-0.64 (0.23)	-.32	98.17	-2.78	.006		0.35 (0.36)	.10	103.24	0.97	.337		0.19 (0.34)	.06	102.77	0.56	.579	
Pretest	0.05 (0.10)		101.43	0.58	.562		0.37 (0.10)		110.33	3.87	<.001		0.27 (0.10)		106.40	2.77	.007	
Age participant	-0.02 (0.02)		101.41	-0.72	.471		0.01 (0.04)		105.84	0.29	.769		0.02 (0.04)		106.05	0.42	.672	
Age child	-0.02 (0.05)		106.73	-0.38	.708		0.03 (0.08)		107.89	0.40	.693		0.02 (0.07)		108.58	0.31	.757	

Table 4
Continued.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Participant education	0.00 (0.09)		106.88	0.05	.957		0.19 (0.15)		109.59	1.30	.196		0.31 (0.14)		105.56	2.19	.031	
Number of children	-0.09 (0.13)		100.31	-0.66	.510		0.07 (0.20)		106.88	0.36	.717		0.21 (0.20)		102.46	1.08	.281	
Perceived effectiveness	0.37 (013)		85.88	2.93	.004		-0.07 (0.20)		93.88	-0.33	.742		-0.14 (0.19)		94.11	-0.75	.454	
Therapeutic alliance	-0.13 (0.16)		89.11	-0.82	.416		-0.17 (0.25)		98.39	-0.69	.495		0.22 (0.24)		98.43	0.91	.365	

Note. All statistics are based on imputed data, with the exception of the model statistics. Condition was coded as 1 = control group, 2 = intervention.

Parenting predicted by condition

Results from these multiple regression analyses are shown in Table 4. Condition was a significant predictor of harsh discipline after the covariates were added (first step: $R^2 = .01$, $F(2 ; 114) = 1.63$, $\beta = -0.14$, $p = .150$; second step: $R^2 = .10$, $F(8 ; 94) = 2.39$, $\beta = -0.31$, $p = .006$), with a decrease of harsh discipline in the intervention group (see Figure 2). Condition did not predict sensitivity during free play (first step: $R^2 = .15$, $F(2; 113) = 11.38$, $\beta = 0.06$, $p = .503$; second step: $R^2 = .16$, $F(8; 93) = 3.41$, $\beta = 0.10$, $p = .337$), or sensitivity in the naturalistic setting (first step: $R^2 = .07$, $F(2; 107) = 4.94$, $\beta = 0.02$, $p = .861$; second step: $R^2 = .09$, $F(8; 89) = 2.14$, $\beta = 0.06$, $p = .579$). This means that the intervention did not lead to higher sensitivity levels.

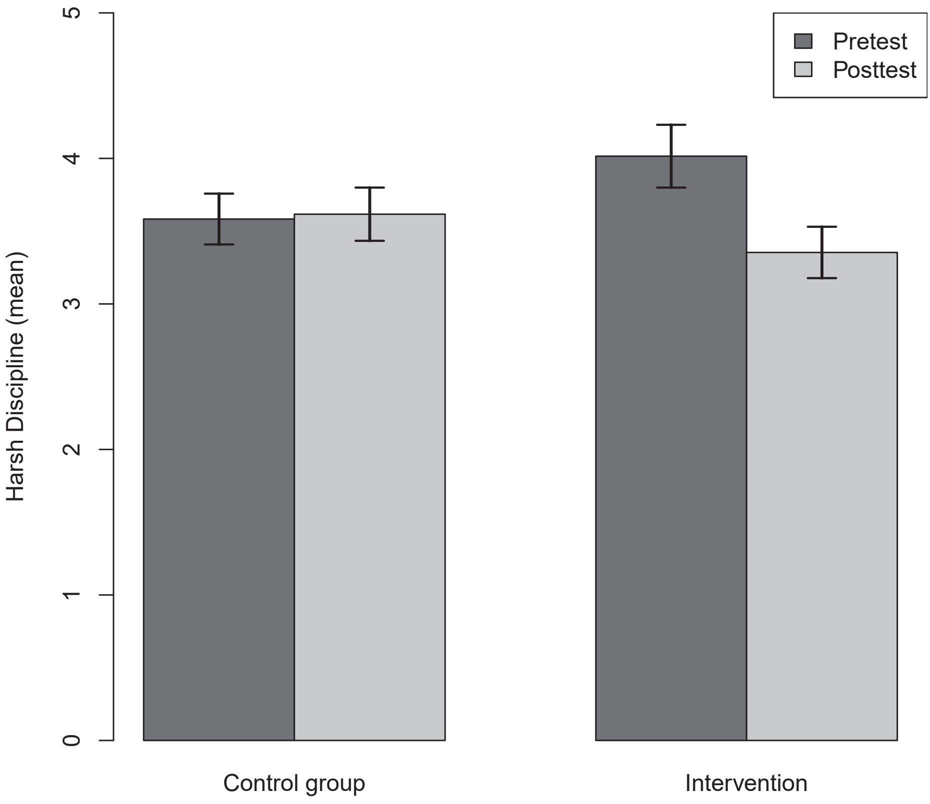

Figure 2. Mean harsh discipline on pre- and posttest for the intervention and control group.

Discussion

We used an RCT design to test whether there is a causal effect of household chaos on parenting. The intervention group received the SHINE intervention, which was designed for the purpose of this study to reduce household chaos (see Prevoo et al., 2020). We were not able to evaluate the effect of the intervention on child maltreatment as the incidence of reported child maltreatment was too low in the current sample. The intervention group showed a significant reduction in harsh discipline, while no intervention effects on sensitivity in free play or the naturalistic setting were found. We could not confirm the hypothesized mediating role of an intervention-induced reduction in household chaos in the effect on parenting.

We found that our intervention, aimed at reducing household chaos, was successful in decreasing harsh discipline. This is in line with previous correlational studies (e.g., Coldwell et al., 2006; Dumas et al., 2005) and points to a causal effect of household chaos on harsh parenting. While our intervention was successful in reducing harsh discipline, no differences in sensitivity during free play or in the naturalistic setting were found. As the task to measure harsh discipline (i.e., the don't touch task) was more demanding than the tasks to measure sensitivity, this may indicate that the effect of household chaos on parenting is most relevant in demanding situations. The effect of household chaos may be most relevant in an already demanding situation by making the situation even more demanding or stressful, resulting in more harsh discipline. This additive effect of household chaos on parenting in demanding situations was also proposed by Coldwell et al. (2006), who found that more child problem behavior, which can be considered demanding, cooccurred with more negative parenting especially in chaotic households. Household chaos may thus be causally related to parenting specifically in already demanding parenting situations.

Stress may be an underlying mechanism in the effect of household chaos on parenting. Previous research has shown that chaotic environments are more stressful (Nelson, O'Brien, Blankson, Calkins, & Keane, 2009; Selander et al., 2009) and stress has been related to more harsh parenting (Beckerman, Berkel, Mesman & Alink, 2017). Other mechanisms through which household chaos affects harsh discipline are reduced self-regulation and reduced parental self-efficacy. More household chaos has been related to lower self-regulation (Crandall, Deater-Deckard, & Riley, 2015), which in turn has been related to more harsh discipline (Deater-Deckard, Wang, Chen, & Bell, 2012; Valiente et al., 2007). In addition, parental self-efficacy was lower in more chaotic households (Corapci & Wachs, 2002) and parents with low parental self-efficacy showed less positive parenting and more harsh discipline (Albanese, Russo & Geller, 2019; Jones & Prinz, 2005).

The current absence of an effect of household chaos on sensitivity may be due to measuring sensitivity in a non-demanding parenting situation. Previous correlational studies have consistently found that sensitivity was lower in more chaotic households (e.g., Coldwell et al., 2006; Dumas et al., 2005) and Andeweg et al. (2020) found that sensitivity was lower after experimentally elevated levels of household chaos in a lab setting. In this lab study, participants took care of an infant simulator for 45 min while the simulator was programmed to cry inconsolably at certain times, which can be considered a demanding parenting situation. In Corapci and Wachs (2002), sensitivity was inferred from 45 min observations where the researcher followed the parent and child through the home. It is likely that more demanding parenting situations occurred in these 45 min observations than in the 5 min free play or naturalistic play observations used in the current study. Also, studies with puppet interviews with the child (e.g., Coldwell et al., 2006), or self-report questionnaires on parenting (e.g., Valiente, Lemery-Chalfant, & Reiser, 2007) found that positive parenting was lower in more chaotic households. Demanding parenting situations were an element of these instruments. Thus, it is likely that household chaos may only affect sensitivity in more demanding parenting situations, and that our measures of sensitivity were not demanding enough to elicit an effect of household chaos.

We expected to find that the intervention would affect parenting through decreased household chaos. We were not able to find this mediation effect. As the focus on household chaos was the main difference between the intervention and control condition, and because we controlled for generic intervention elements, we assume that the effect on harsh discipline is due to a reduction of household chaos, but that we were unable to measure this reduction. It is possible that our measures were not sufficiently sensitive. For instance, cleaning up toys before bedtime (one of the goals parents could work in in the intervention) would not be noticed with our measure of clutter, as clutter was coded from video-observations during the day, well before bedtime. Also, using a 5-point Likert scale may not be sufficiently sensitive to measure a small but informative significant reduction on the CHAOS questionnaire. Another possibility is that the effect of the intervention on harsh discipline is due to improved self-efficacy through the use of motivational interviewing in our intervention. As previously mentioned, the intervention may have affected harsh discipline through reducing household chaos and thereby improving parental self-efficacy. As motivational interviewing has been related to increased self-efficacy (Emmons & Rollnick, 2001; O'Halloran, Shields, Blackstock, Wintle, & Taylor, 2015) and higher self-efficacy is related to higher quality parenting (Jackson & Scheines, 2005), it is also possible that the intervention improved self-efficacy directly and not through reduced household chaos, and thereby affected harsh discipline.

Strengths and limitations

Strengths of the current study include the RCT design, basing our intervention on a previously studied intervention, using observations to assess parenting, controlling for demographic as well as generic intervention elements, and measuring multiple aspects of household chaos. Also, the drop-out rate was low (6%), which decreases potential drop-out bias. The first limitation is that our measures of household chaos may not have been sensitive enough to detect a significant reduction in household chaos. Second, we could not study an effect of household chaos on child maltreatment, as the incidence of child maltreatment was too low in the current sample. Our sample consisted of participants with relatively high levels of obtained education and income, limiting the generalizability of our results. This could also explain why our measures of household chaos and parenting measures were mostly uncorrelated in our sample, in contrast to previous studies which found more household chaos to be related to lower quality parenting (e.g. Coldwell et al., 2006; Corapci & Wachs, 2002; Dumas et al., 2005; Matheny et al., 1995). As low parental education and unemployment are known risk factors for child maltreatment (Van Berkel, Prevoo, Linting, Pannebakker, & Alink, 2020) and are related to more household chaos (e.g., Wang, Deater-Deckard, & Bell, 2013), evaluating the causality of household chaos on parenting quality in a low-SES sample is desirable.

Future research and implications

Future research should test whether stress, self-regulation or parental self-efficacy explain the effect of reduced household chaos on harsh parenting. The use of self-reported as well as observational measures, as done in this study, is recommended to ensure comparability across studies, although adaptations to make measures more sensitive may be necessary. For instance, the CHAOS questionnaire could be adapted to use a 10-point Likert scale instead of a 5-point Likert-scale, and longer or more naturalistic observations of parental sensitivity may be necessary. Other pathways of future research include conducting the current study design within a low SES sample, to test whether our findings are generalizable to low SES families. Focusing on more low SES and high-risk samples may be important, as these families could benefit most in terms of parenting from reducing household chaos. It should be noted that the SHINE intervention was designed for research purposes and not for clinical practice. After establishing that household chaos affects parenting quality in at-risk families, alterations to this intervention may be necessary before implementing it in clinical practice. Lastly, helping families to adequately manage household chaos may be effective to prevent harsh parenting. This could be done by, for instance, helping first-time parents in forming family routines or helping parents set boundaries for noise control.

Conclusion

In conclusion, our study is the first to investigate the causal effect of household chaos on parenting in families. Our intervention was successful in reducing harsh discipline, meaning household chaos affects parenting. The effect of household chaos may be most relevant in more challenging parenting situations, meaning it may make demanding parenting situations even more demanding, resulting in more harsh discipline. Possible underlying mechanisms are stress, self-regulation, and parental self-efficacy. Replicating the current study design in a low-SES sample is important as low-SES families generally have more chaotic homes and show lower quality parenting, and may thus benefit most from reducing household chaos. Lastly, helping parents to manage household chaos levels could be effective in preventing harsh parenting.

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Testing for whom household chaos affects parenting most: sensory-processing sensitivity and self-regulation as moderators.

Suzanne M. Andeweg, F. Fenne Bodrij, Mariëlle J. L. Prevoo, Ralph C. A. Rippe, Lenneke R. A. Alink

Education and Child Studies
Leiden University
The Netherlands

Submitted

Abstract

Previous studies have found evidence for a causal effect of household chaos on parenting, with lower parenting quality in more chaotic environments. Also, studies point to the possibility that this effect of household chaos may be stronger for parents with higher sensory-processing sensitivity (SPS) or lower self-regulation. The current study investigates whether primary caregivers of children around age 1.5-2 years show greater improvement in parenting after a decrease in household chaos if parents have higher SPS or lower self-regulation. The study employs an RCT design with an intervention aimed at reducing household chaos. Household chaos and parenting were measured through objective as well as self-report measures, including videotaped parent-child interactions and home observations. The effect of the intervention to reduce household chaos on parenting was not dependent on SPS or self-regulation. When studying the relation between change in measures of household chaos and posttest parenting, decreased self-reported household chaos was related to less harsh discipline in parents with higher self-regulation, and to more harsh discipline in parents with lower self-regulation. No moderation by SPS was found. Future research should study whether SPS and self-regulation are important for the effect of household chaos on parenting in highly chaotic households.

Keywords: RCT, household chaos, parenting, sensory-processing sensitivity, self-regulation

Introduction.

Previous studies have shown that more household chaos (i.e., high noise levels, clutter, crowding, and a lack of family and week routines; Evans & Wachs, 2010; Matheny, Wachs, Ludwig & Phillips, 1995) is related to lower parenting quality, such as more harsh or negative parenting and less positive parenting (e.g., Coldwell, Pike & Dunn, 2006; Deater-Deckard, Wang, Chen & Bell, 2012; Dumas et al., 2005). As these studies were mostly correlational, results could not be causally interpreted. Two recent experimental studies showed evidence of the causal effect of household chaos on parenting (Andeweg, Bodrij, Prevoo, Rippe, & Alink, 2020; Chapter 4). However, effects were small and were not found for all parenting outcomes that were tested. One explanation for these small and inconsistent effects is that some parents may be more susceptible to the effect of household chaos than others. Two likely factors that may influence this susceptibility are sensory-processing sensitivity (SPS) and self-regulation. There is evidence that higher SPS is related to a stronger decline in caregiving quality in a chaotic environment, and that higher self-regulation is related to more favorable behavioral responses to stressful or chaotic environments (Andeweg et al., 2020; Sprague, Verona, Kalkhoff & Kilmer, 2011). Therefore, in the current study we investigate whether reducing household chaos in families leads to a stronger improvement in parenting quality in parents with higher SPS or lower self-regulation.

Household chaos is one of the salient factors for parenting in young children and is defined as high noise levels, clutter, crowding, and a lack of family and week routines (Evans & Wachs, 2010; Matheny, Wachs, Ludwig & Phillips, 1995). Previous research has consistently found that more household chaos is related to more negative and harsh parenting and to less positive parenting, including measures of sensitivity and harsh discipline (e.g., Coldwell et al., 2006; Deater-Deckard et al., 2012; Dumas et al., 2005). Furthermore, parenting mediated the relation between more chaotic households and child development, with more conduct and language development problems in more chaotic households (Mills-Koonce et al., 2016; Vernon-Feagans, Garrett-Peters, Willoughby, Mills-Koonce & The Family Life Project Key Investigators, 2012). Two recent experimental studies found evidence for a causal effect of household chaos on parenting (Andeweg et al., 2020; Chapter 4). However, the effects were small and were not consistent for all parenting measures that were tested. In a lab setting, female young adults (non-parents) who took care of an infant simulator showed less sensitivity towards the infant simulator in a chaotic setting than in a neutral setting. An RCT using an intervention to reduce household chaos found a decline in harsh parenting, but no difference in sensitivity (Chapter 4). Therefore, further research is needed to unravel the effects of household chaos, and should consider whether some parents are more susceptible to the effect of household chaos on parenting than others.

One of the potential parent characteristics that makes parents more susceptible to the effect of household chaos is SPS. This reflects how easily a person notices stimuli and how aroused (in general or negatively) a person is by stimuli (Aron & Aron, 1997; Evans & Rothbart, 2008). Parents with high SPS are considered to notice the higher number and/or intensity of stimuli in more chaotic households more readily and/or to be more affected by these stimuli, which would translate into greater susceptibility to the effect of household chaos on parenting. Previous studies support this line of reasoning: Higher observed household chaos was experienced as more chaotic only by mothers with high SPS, whereas observed and self-reported household chaos were uncorrelated in mothers with low SPS (Wachs, 2013). Female young-adults with higher SPS showed a stronger decline in caregiver sensitivity in a chaotic environment compared to those with lower SPS (Andeweg et al., 2020). Thus, SPS could moderate the effect of household chaos on parenting: Parents with higher SPS may be more affected by household chaos, and could therefore benefit more from reducing household chaos than parents with lower SPS.

Another potential moderator of the effect of household chaos on parenting is self-regulation. Self-regulation consists of attentional and inhibitory control and is often also referred to as effortful control or executive functioning (e.g., Bridgett, Oddi, Laake, Murdock & Bachmann, 2013). Low self-regulation has been linked to lower quality parenting (e.g., Crandall, Deater-Deckard, & Riley, 2015). This is thought to be due to having lower inhibition and attention shifting skills, which would make it harder to refrain from harsh parenting and to maintain positive discipline strategies for parents with low self-regulation. Demanding situations, such as chaotic or stressful environments, may be harder for these parents. A recent study found that the relation between higher self-reported household chaos and more harsh parenting was diminished in mothers with higher self-regulation (Park & Johnston, 2020). Studies on stressful environments found similar results: In a low SES community sample, stress was related more strongly to aggressive behavior in adults with lower self-regulation compared to adults with higher self-regulation (Sprague et al., 2011). In contrast, Deater-Deckard et al. (2012) found that parents with high self-regulation only showed less harsh discipline in demanding parenting situations in non-chaotic households, meaning that higher self-regulation may not buffer the effect of household chaos on parenting. Also, the effect of household chaos on sensitivity in a lab setting with a neutral and chaotic living room was not dependent on self-regulation (Chapter 3). How self-regulation potentially moderates an effect of household chaos on parenting is thus not yet clear and needs further exploration.

Current study

The aim of the current study was to test whether a causal effect of household chaos on parenting is stronger in parents with higher SPS or lower self-regulation (see Prevoo, Bodrij, Andeweg, & Alink, 2020). Our study used an RCT design, in which we aimed to reduce household chaos in the intervention group while not discussing household chaos in the control group. No specific parenting advice was given in both groups. We expected that parents with higher SPS or lower self-regulation would show greater improvement in parenting quality after reducing household chaos (Chapter 4). Our previous findings suggested that only harsh discipline was significantly reduced in the intervention group, and we did not find evidence for significantly reduced levels of household chaos or improved sensitivity. It is possible that an effect of household chaos is stronger or perhaps only present in parents with certain characteristics. Therefore, we tested SPS and self-regulation as moderators of the effect of the intervention on parenting. As we were not able to detect a significant reduction in measures of household chaos (Chapter 4), we also tested whether the relation between change in household chaos measures and parenting was moderated by SPS or self-regulation.

Method

Participants

Parents who spent the most time with their child (i.e. the primary caregiver) of around the age of 1.5 years were recruited for the current study. Contact information of eligible parents was received from Dutch municipalities in the province of South Holland. An invitation letter to fill out a screening questionnaire was sent to these parents, in which demographic information was collected and the level of household chaos was self-reported by the primary caregiver. Exclusion criteria were mental and/or physical problems of the primary caregiver and/or participating child (e.g. depression, autism, chronic diseases affecting everyday life), and the presence of a child older than 12 years living in the same household. Twins or multiples were excluded. Inclusion criteria were that the child lived with the primary caregiver and that the primary caregiver was fluent in Dutch. Parents who rated one or more items of the Confusion, Hubbub And Order Scale (CHAOS; Matheny et al., 1995) questionnaire as true or completely true (i.e., a 4 or 5 on a 5-point Likert scale) were invited to participate. In total, 7,550 families were invited to fill out the screening questionnaire, of which 2,010 completed the questionnaire. Of these 2,010, 792 families met all inclusion criteria and were invited to participate. Of this group, 125 families entered the RCT. All primary caregivers were the biological parent (89% mothers) and all children lived with both parents. The primary caregiver was 34.32 years old on average (*SD* = 4.13). The children were 19.17 months old on average (*SD* = 1.90; 54% boys). Our sample had a relatively high socio-economic status, as 82% of the participants had a monthly income of above €3000, compared to the average gross monthly income of €2662 in 2018 in The Netherlands according to the Netherlands Bureau for Economic Policy Analysis (CPB, 2019). In addition, for 74% of primary caregivers their highest educational level was college or university.

Procedure

Pre and posttest

This study was approved by the ethics committee of the Institute of Child and Education Studies from Leiden University (number ECPW 2015-090) and was preregistered on Open Science Framework (OSF; Prevoo et al., 2020). Participation consisted of two home visits as pretest, randomization to the intervention or control group, and a posttest of two home visits. Informed consent was obtained during the first home visit. During the pre- and posttest, the parent and child carried out a structured play task (5 min), a don't touch task (2 min not allowed to play with a set of toys, 2 min play with the least interesting toy) and a naturalistic play task (5 min) in which parents and children played together in their house as they normally would. These observations were videotaped for later coding. Also, observations of the living room and child's bedroom were made to code clutter. In between the two visits within the pre- and posttest, a decibel meter was placed in the living room to measure noise levels and parents answered questions through a diary app. During all visits, questionnaires were filled out. Other aspects of participation included collecting saliva and hair samples to measure physiological stress. These data were not used in the current report. Participants received €75 as a reward and children received small gifts for participating in two home visits.

Intervention

After the pretest, participants were randomized to the intervention (n = 60) or control group (n = 65). An intervention to reduce household chaos was designed specifically for this study and consisted of four home visits and three follow-up phone calls, with one week in between. Parents formulated goals to decrease clutter and noise levels and to increase family routines and structure. Each week, one topic was discussed. The sequence of the topics was determined by the parent after completing a Q-sort in which the importance of the different aspects of household chaos for individual parents was assessed. During the home visits, parents chose a goal from a predetermined list and were allowed to choose an additional goal within a topic outside of the list. Gifts (such as a family planner), printed information and text messages were used to aid the parent in achieving their goal (Haines et al., 2013). In between home visits, phone calls were made to discuss all previous topics and two text messages were sent to remind the parent of their goal. During the entire intervention, the intervener used motivational interviewing to guide parents in formulating goals (Emmons & Rollnick, 2001). Interveners were trained extensively (including videotaped training sessions) and met regularly to prevent drifting from the techniques of motivational interviewing.

Control group

The control condition consisted of seven weekly phone calls about how the child was developing (e.g., playing, sleeping, eating). As in Van Zeijl et al. (2006), parents received a booklet with information about child development, which was revisited during the weekly phone calls. Parents received two text messages a week with reminders about the discussed information. Household chaos was not discussed and no specific parenting advise was given.

Measures

Sensitivity

Videos of the free play task and the naturalistic play task were used for sensitivity coding with the Ainsworth Sensitivity Scales for sensitivity and non-intrusiveness (Ainsworth, Bell & Stayton, 1974). This scale uses a 9-point scale, ranging from 1) very insensitive or intrusive to 9) very sensitive or non-intrusive. Good inter-coder reliability was reached, with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .82 (range .70 - .92, $N = 29$). To prevent coder drift, coding was discussed regularly. As sensitivity and non-intrusiveness scores were strongly correlated (ps <.001 with rs between .78 and .80), these scores were averaged, leading to one sensitivity score for the free play task and one for the naturalistic observation. Higher scores indicated more sensitivity.

Harsh discipline

Harsh discipline was coded from the videos of the don't touch task and was measured using three subscales. These subscales measured 1) frequency and intensity of physical discipline strategies, 2) laxness of the caregiver, and 3) verbal and non-verbal overreactivity (Chapter 4; Joosen, Mesman, Bakermans-Kranenburg, & IJzendoorn, 2012). All subscales were coded from 1 to 5, with higher scores reflecting more harsh discipline. Good inter-coder reliability for harsh discipline was reached with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .79 (range .66 - .92, $N = 24$). Again, coding was discussed regularly to prevent coder drift. As participants showed very little laxness, this subscale was not used. To create one score for harsh discipline, physical discipline and overreactivity scores were summed (correlations within pre- and posttest with rs between .17-.35 ps between <.001 - .070). A higher score reflected more harsh discipline.

Sensory-processing sensitivity

To measure sensory-processing sensitivity, two questionnaires were used. The Orienting Sensitivity subscale from the Adult Temperament Questionnaire Short form (ATQ-OS, Evans & Rothbart, 2007) was used to measure awareness of stimuli and how affected a person is by stimuli. We used a version with 22 items, in which some of the original 15 items were split to ease interpretation (see Andeweg et al., 2020), e.g., "I am often aware how the color and lighting of a room affects my mood" was split for an item about color and an item about lighting. Items were answered on a 5-point Likert scale, ranging from "never" to "always", with an additional option to indicate that one had never been in that situation (treated as missing). Item scores were averaged, with a higher score reflecting more sensory-processing sensitivity (Cronbach's alpha = .84). The second questionnaire was the Noise Sensitivity Scale (NSS; Weinstein, 1978). We used a version consisting of 24 items after splitting some of the original 21 items to ease interpretation (see Andeweg et al., 2020), e.g., "At movies, whispering and crinkling candy wrappers disturb me." was split into an item for whispering and an item for crinkling candy wrappers. A 6-point Likert scale was used, ranging from "totally disagree" to "totally agree", and an additional option to indicate that one had never been in that situation (treated as missing). Item scores were averaged (Cronbach's alpha = .88), with higher scores reflecting more noise sensitivity. The scores on the ATQ-OS and NSS were not significantly correlated ($r = .12$, $p = .201$). Thus, analyses were performed for the ATQ-OS and NSS separately, using standardized scores. Higher scores indicated more sensory-processing sensitivity.

Self-regulation

The Go/No-go task, a response inhibition computer task, was used to measure self-regulation (Braver, Barch, Gray, Molfese & Snyder, 2001). Participants were briefly shown the letter 'x' or 'k' (1000-3000 milliseconds) and were asked to only press the space bar after 'x' and not press any key after 'k'. Twenty of the 100 stimuli were 'k's. The number of correct rejections, i.e. the number of times the participant rightfully did not press the space bar, was used as an indicator of self-regulation (Braver et al., 2001). A higher score reflected better self-regulation. Scores were standardized.

Household chaos

Household chaos was measured in four ways during the pre- and posttest (Chapter 4). The CHAOS questionnaire was used to measure self-reported household chaos (Matheny et al., 1995). Participants indicated to what extent 15 items (e.g. "We almost always seem to be rushed") were true for their family on a 5-point Likert scale, ranging from 1) Completely not true, 2) Not true, 3) Sometimes true, sometimes not true, 4) True, 5) Completely true, and with a sixth option for not applicable (coded as system missing). The mean score was calculated, with a higher score indicating more self-reported household chaos (Cronbach's alpha = .80). Clutter was measured by coding observations of the living room and the child's bedroom using a coding scheme based on the Home Observation for Measurement of the Environment (HOME; Caldwell & Bradley, 1984) and the Purdue Home Stimulation Inventory (PHSI; Wachs, Francis & McQuiston, 1979), resulting in 14 items. Good inter-coder reliability was reached with a mean intra-class coefficient of all different pairs (single measure, absolute agreement) of .76 (range .61 - .97, *N* = 20) and coder drift was prevented by discussing coding regularly. The 14 items were standardized and averaged, with higher scores indicating more clutter (Cronbach's alpha = .68 at pre- and posttest). Family routines were measured using a diary app, through which parents answered questions on mealtime and bedtime on four days when they were at home with their child. Standard deviations were calculated for mealtime and bedtime events, which were then averaged. A higher score indicated less stability in family routines. Lastly, noise was measured with a decibel meter, which measured the dBA per second in the participant's living room during the four days that were also reported in the diary app. Mean dBA levels were calculated during the morning (7:00-8:30) and evening (17.30-19:00) and then averaged. Higher scores reflected more noise. Change scores were calculated for each measure by subtracting the pretest from the posttest.

General intervention elements

Perceived effectiveness and therapeutic alliance were measured to control for general intervention elements (Vîslă, Constantino, Newkirk, Ogrodniczuk & Söchting, 2016; Flückiger, Del Re, Wampold, Symonds & Horvath, 2012). All participants filled out a questionnaire about the intervention or control condition (Chapter 4). Perceived effectiveness was measured with 10 items, e.g., "How fruitful was the intervention for your family as a whole?" with 1) Little, to 5) A lot (Cronbach's alpha = .96). Therapeutic alliance was measured with 12 items, e.g., "How did you experience the contact with the intervener?" with 1) Bad cooperation, to 5) Good cooperation (Cronbach's alpha = .93). Higher scores indicated more positive evaluations of perceived effectiveness and therapeutic alliance.

Analyses

Seven participants dropped out after randomization. We imputed missing data to perform intention-to-treat analyses. Multiple imputation with 5 iterations and 100 imputations was used, with functions from the mice function from the mice package (version 3.7.0). Results were pooled by using functions from mitml, miceadds, and merTools packages. Analyses were performed in SPSS version 25 and R version 3.6.1 with Rstudio version 3.4.4, with a fixed starting seed for reproducibility.

To test whether the effect of the intervention on parenting was only visible in parents with high sensory-processing sensitivity or low self-regulation, we tested models first including condition (i.e., intervention or control group) and the moderator as main effects and then testing the interaction between condition and the moderator. We included the pretest parenting score as a covariate, as the intervention group showed more harsh discipline ($M = 4.02$, $SD = 1.23$) during pretest than the control group ($M = 3.61$, $SD = 0.98$; $t(122) = -2.01$, $p = .046$). Parent and child age, parental education, and number of children in the home were significantly related to parenting quality and/or household chaos, and thus included as covariates (see also Chapter 4). Perceived effectiveness and therapeutic alliance were also included as covariates for general intervention elements, as these are known to affect treatment outcome (Flückiger et al., 2012). As we did not find intervention effects on the household chaos variables that we measured (see also Chapter 4) but there were differences in the amount of change in the chaos measures from pre- to posttest, we tested the potential moderation of the relation between change scores in household chaos measures on parenting, by SPS and by self-regulation. When testing change scores of household chaos as a predictor, we included the pretest score as a covariate as measures of household chaos are relatively stable over time (Chapter 4). A significance level of 5% was used for all model and parameter evaluations.

Results

For descriptive statistics and correlations, see Tables 1 and 2. There were no significant correlations between the two measures of sensory-processing sensitivity, self-regulation and parenting measures or condition (Table 2). Results reported hereafter are based on imputed data, with the exception of *F*-statistics and adjusted R^2, as no multilevel combination rules exist for these measures (see Table 3). Conclusions based on analyses using observed data were equivalent, indicating robustness of our findings.

Sensory-processing sensitivity

ATQ-OS

We conducted multiple regression analyses for each parenting measure separately, with condition, ATQ-OS scores, pretest parenting score, and covariates as predictors in the first step. In the second step, we added the interaction between condition and ATQ-OS scores. For harsh discipline, a main effect of condition was found in the first step, with lower posttest harsh discipline in the intervention group (F(9; 93) = 2.11, β = -0.32, p = .007; R^2 = .09). No main effect of the ATQ-OS was found (β = 0.02, p = .916). In the second step we added the interaction between condition and the ATQ-OS. The interaction term was not significant (F(10; 92) = 2.22, β = -.10, p = .236, R^2 = .11). For sensitivity during free play, no main effects of condition or ATQ-OS were found in the first step, and no interaction between condition and ATQ-OS was found in the second step (F(10; 91) = 2.70, β = .09, p = .765, R^2 = .14). For sensitivity in the naturalistic setting also no main effects or interaction between condition or ATQ-OS were found (F(10; 87) = 1.71, β = .10, p = .706, R^2 = .07). Thus, effects of the chaos-intervention on the different parenting outcomes did not depend on parents' ATQ-OS levels.

Table 1
Descriptive statistics of measures of household chaos, parenting, measures of SPS, and self-regulation.

	Pretest						Posttest					
	Overall		Intervention		Control		Overall		Intervention		Control	
	M (*SD*)	Min-max	*M* (*SD*)	Min-max	*M* (*SD*)	Min-max	*M* (*SD*)	Min-max	*M* (*SD*)	Min-max	*M* (*SD*)	Min-max
Self-reported household chaos	2.29 (0.41)	1.21-3.27	2.30 (0.41)	1.47-3.27	2.28 (0.40)	1.21-3.14	2.22 (0.45)	1.27-3.21	2.20 (0.42)	1.40-3.07	2.24 (0.48)	1.27-3.21
Clutter*	0.00 (0.44)	-0.98-1.33	0.02 (0.46)	-0.81-1.06	-0.01 (0.41)	-0.98-1.33	0.00 (0.44)	-0.86-1.25	-0.02 (0.38)	-0.86-0.87	0.02 (0.50)	-0.81-1.25
Noise	43.71 (7.53)	22.38-60.20	43.63 (7.11)	28.88-59.21	43.80 (8.09)	22.38-60.20	43.06 (5.53)	25.84-58.36	42.56 (5.71)	25.84-55.81	43.59 (5.35)	29.46-58.36
Family routines*	-0.02 (0.62)	-1.08-2.66	0.00 (0.64)	-1.08-2.12	-0.04 (0.61)	-1.04-2.66	-0.03 (0.69)	-1.52-2.18	0.02 (0.69)	-1.17-2.18	-0.07 (0.70)	-1.52-1.65
Harsh discipline	3.82 (1.13)	2.00-9.00	4.02 (1.23)	2.00-9.00	3.61 (0.98)	2.00-7.00	3.50 (1.03)	2.00-6.00	3.38 (1.01)	2.00-6.00	3.62 (1.04)	2.00-6.00
Sensitivity free play	6.57 (1.63)	2.50-9.00	6.63 (1.50)	2.00-9.00	6.51 (1.78)	2.50-9.00	5.75 (1.74)	1.50-9.00	5.88 (1.78)	1.50-9.00	5.63 (1.71)	2.00-8.50
Sensitivity naturalistic	7.15 (1.55)	2.00-9.00	6.97 (1.45)	3.00-9.00	7.35 (1.63)	2.00-9.00	6.64 (1.61)	3.00-9.00	6.61 (1.63)	3.00-9.00	6.67 (1.62)	3.00-9.00
SPS: ATQ-OS*	0.00 (1.00)	-2.06-2.40	0.03 (1.04)	-2.06-2.40	-0.03 (0.96)	-1.92-2.20						
SPS: NSS*	0.00 (1.00)	-2.61-2.54	-.15 (0.96)	-2.10-2.54	-0.16 (1.02)	-2.61-2.14						
Self-regulation*	0.00 (1.00)	-4.06-1.14	0.05 (1.01)	-4.06-1.14	-0.06 (1.00)	-2.86-1.14						

Note. Descriptive statistics are based on observed cases. * = standardized scores.

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Table 2
Correlations between condition, SPS measures, self-regulation, and parenting measures.

	1	2	3	4	5	6	7	8	9	10	11
1. Condition	-				-.05	-.04	-.09	.07	-.12	.07	-.02
2. SPS: ATQ-OS*	.03	-			.06	.09	-.03	-.01	-.03	.03	.05
3. SPS: NSS*	.15	.12	-		.12	.03	.08	-.07	.05	.01	-.10
4. Self-regulation*	.06	.11	.04	-	-.13	-.01	-.06	-.12	-.00	.02	-.10
5. Self-reported household chaos	.02	.05	.15	-.12	.62**	.10	.07	-.01	-.03	.05	-.00
6. Clutter*	.04	.06	-.09	.08	.16	.63**	.08	-.06	-.00	-.06	-.07
7. Noise	-.01	.19	-.15	.01	.07	.27**	.30*	-.00	-.20	.19	.21*
8. Family routines	.03	.05	.02	.06	.04	-.11	.05	.26*	-.02	-.09	-.04
9. Harsh discipline	.18*	.06	.01	-.07	.05	.03	.02	.06	.10	-.21*	.02
10. Sensitivity free play	.04	.03	-.03	.04	.01	.06	.28**	.04	-.17	.41**	.39**
11. Sensitivity naturalistic	-.12	.09	-.02	.03	-.00	.07	.20	.05	.02	.54**	.29**

Note. Below the diagonal represents correlations with pretest measures, above the diagonal represents correlations with posttest measures. The diagonal represents correlations between pre- and posttest of the same measure. Condition is coded as 1 = dummy, 2 = intervention. * $p < .05$, ** $p < .01$, *** $p < .001$.

NSS

We also tested for moderation by SPS by analyzing the NSS as the moderator. Again, a main effect of condition on harsh discipline was found (F(9; 83) = 3.37, β = -.32, p = .006, R^2 = .19). In the second step, we found no interaction between condition and the NSS (F(10; 82) = 3.02, β = -.10, p = .424, R^2 = .18). For sensitivity during free play, we found no main effects and no interaction effect between condition and the NSS in the second step (F(10; 81) = 2.43, β = .10, p = .610, R^2 = .14). This was the same for sensitivity in the naturalistic setting (F(10; 77) = 1.35, β = .10, p = .894, R^2 = .04). This meant there was no moderation by the NSS.

Self-regulation

Again, we conducted multiple regression analyses for each parenting measure separately, with condition, self-regulation, pretest parenting score, and covariates as predictors in the first step. We added the interaction between condition and self-regulation in the next step. For harsh discipline, a main effect of condition was again found in the first step (F(9; 88) = 1.78, β = -0.31, p = .007, R^2 = .07). No main effect of self-regulation was found (β = -0.02, p = .825). In the second step we added the interaction between condition and self-regulation. The interaction term was not significant (F(10; 87) = 1.60, β = .06, p = .833, R^2 = .06). For sensitivity during free play, no main effects of condition or self-regulation were found in the first step, and no interaction between condition and self-regulation was found in the second step (F(10; 86) = 2.70, β = -.23, p = .472, R^2 = .15). For sensitivity in the naturalistic setting also no main effects were found, and in the second step no interaction between condition or self-regulation was found (F(10; 82) = 1.62, β = -.00, p = .988, R^2 = .063). Thus, effects of the chaos-intervention on the different parenting outcomes did not depend on parents' self-regulation.

Table 3
Multiple regression analyses to predict posttest parenting by condition, interaction with SPS: ATQ-OS, and covariates.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Step 1			93 (9)	2.11	.037	.09			92 (9)	3.01	.003	.15			88 (9)	1.93	.058	.08
Intercept	4.92 (1.66)		102.70	2.95	.004		1.27 (2.44)		103.65	0.52	.604		0.34 (2.42)		103.56	0.14	.888	
Condition	-0.64 (0.23)	-0.32	97.16	-2.75	.007		0.35 (0.37)	0.10	102.28	0.96	.338		0.18 (0.35)	0.07	101.64	0.52	.608	
SPS: ATQ-OS	-0.01 (0.10)	0.02	99.35	-0.11	.916		-0.00 (0.16)	0.03	103.54	-0.01	.992		0.07 (0.15)	-0.04	106.75	0.48	.631	
Pretest parenting	0.05 (0.09)		101.29	0.60	.553		0.37 (0.10)		109.40	3.86	<.001		0.26 (0.10)		105.68	2.72	.008	
Age participant	-0.02 (0.02)		100.42	-0.71	.480		0.01 (0.04)		104.79	0.29	.771		0.01 (0.04)		104.99	0.38	.706	
Age child	-0.02 (0.05)		105.76	-0.37	.714		0.03 (0.08)		107.14	0.39	.696		0.02 (0.07)		107.59	0.29	.774	
Participant education	0.00 (0.09)		106.22	0.05	.960		0.19 (0.15)		108.90	1.29	.199		0.31 (0.14)		105.01	2.22	.029	
Number of children	-0.09 (0.13)		99.55	-0.66	.512		0.07 (0.20)		105.90	0.36	.721		0.21 (0.20)		101.52	1.07	.288	
Perceived effectiveness	0.37 (0.13)		85.26	2.91	.005		-0.07 (0.20)		93.12	-0.33	.743		-0.14 (0.19)		93.13	-0.73	.469	
Therapeutic alliance	-0.14 (0.17)		87.61	-0.82	.416		-0.18 (0.26)		97.74	-0.68	.501		0.24 (0.25)		97.30	0.97	.334	
Step 2			92 (10)	2.22	.023	.11			91 (10)	2.70	.006	.14			87 (10)	1.71	.090	.07

Table 3
Continued.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Intercept	4.75 (1.67)		100.27	2.83	.006		1.40 (2.50)		102.37	0.56	.576		0.16 (2.48)		102.51	0.06	.949	
Condition	-0.62 (0.23)		95.77	-2.68	.009		0.35 (0.37)		101.46	0.95	.342		0.19 (0.35)		100.71	0.53	.596	
SPS: ATQ-OS	-0.40 (34)		102.23	-1.18	.239		0.15 (0.54)		101.28	0.28	.777		-0.11 (0.51)		100.69	-0.22	.823	
Condition*SPS: ATQ-OS	0.25 (0.21)	-0.10	99.96	1.19	.236		-0.10 (0.33)	0.09	100.94	-0.30	.765		0.12 (0.31)		101.58	0.38	.706	
Pretest parenting	0.03 (0.09)		100.32	0.35	.726		0.37 (0.10)		108.39	3.81	<.001		0.27 (0.10)		104.78	2.74	.007	
Age participant	-0.01 (0.03)		97.83	-0.41	.686		0.01 (0.04)		102.47	0.20	.843		0.02 (0.04)		103.00	0.47	.642	
Age child	-0.02 (0.05)		104.90	-0.42	.679		0.03 (0.08)		106.42	0.40	.691		0.02 (0.08)		106.76	0.28	.776	
Participant education	0.01 (0.09)		104.64	0.12	.903		0.19 (0.15)		107.94	1.26	.210		0.31 (0.14)		104.37	2.23	.028	
Number of children	-0.07 (0.13)		97.33	-0.55	.583		0.07 (0.21)		104.57	0.33	.745		0.22 (0.20)		100.42	1.10	.275	
Perceived effectiveness	0.38 (0.13)		83.43	2.92	.005		-0.07 (0.20)		92.51	-0.33	.740		-0.14 (0.19)		92.45	-0.73	.469	
Therapeutic alliance	-0.15 (0.17)		83.85	-0.88	.379		-0.17 (0.26)		97.37	-0.65	.518		0.23 (0.25)		96.99	0.94	.349	

Note. All statistics are based on imputed data, with the exception of the model statistics. Condition was coded as 1 = control group, 2 = intervention.

Table 4
Multiple regression analyses to predict posttest parenting by condition, interaction with SPS: NSS, and covariates.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Step 1			83 (9)	3.37	.001	.19			82 (9)	2.61	.010	.14			78 (9)	1.48	.169	.05
Intercept	5.06 (1.69)		101.06	2.99	.004		1.41 (2.47)		103.76	0.57	.569		0.03 (2.45)		103.99	0.01	.990	
Condition	-0.65 (0.23)	-0.32	96.84	-2.80	.006		0.34 (0.37)	0.10	101.94	0.91	.363		0.22 (0.35)	0.07	101.61	0.62	.535	
SPS: NSS	0.04 (0.19)	0.02	67.95	0.31	.756		0.07 (0.17)	0.03	86.83	0.40	.691		-0.11 (0.16)	-0.04	88.08	-0.71	.481	
Pretest parenting	0.05 (0.09)		100.84	0.57	.571		0.37 (0.10)		109.15	3.86	<.001		0.27 (0.10)		104.97	2.77	.007	
Age participant	-0.02 (0.03)		99.15	-0.77	.444		0.01 (0.04)		104.36	0.23	.819		0.02 (0.04)		104.70	0.53	.596	
Age child	-0.02 (0.05)		105.02	-0.41	.685		0.03 (0.08)		106.89	0.40	.691		0.02 (0.07)		107.94	0.33	.743	
Participant education	0.00 (0.09)		106.21	0.00	.997		0.18 (0.15)		108.46	1.25	.213		0.31 (0.14)		105.23	2.25	.027	
Number of children	-0.08 (0.13)		94.94	-0.56	.578		0.09 (0.21)		103.43	0.44	0.661		0.18 (0.20)		98.56	0.89	.373	
Perceived effectiveness	0.37 (0.13)		86.01	2.91	.005		-0.07 (0.20)		93.93	-0.37	.714		-0.13 (0.19)		93.28	-0.69	.491	
Therapeutic alliance	-0.14 (0.17)		87.64	-0.84	.401		-0.18 (0.26)		97.45	-0.70	.486		0.23 (0.24)		97.78	0.96	.341	
Step 2			82 (10)	3.02	.003	.18			81 (10)	2.43	.014	.14			77 (10)	1.35	.218	.04

Table 4
Continued.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Intercept	5.04 (1.70)		100.26	2.97	.004		1.38 (2.48)		103.13	0.56	.579		0.03 (2.46)		103.45	0.01	.991	
Condition	-0.67 (0.23)		96.05	-2.86	.005		0.34 (0.37)		100.90	0.93	.356		0.21 (0.35)		101.07	0.63	.532	
SPS: NSS	0.31 (0.36)		73.11	0.87	.385		-0.19 (0.52)		91.73	-0.35	.724		-0.18 (0.51)		88.87	-0.35	.726	
Condition*SPS: NSS	-0.18 (0.23)	-0.10	71.19	-0.80	.424		0.17 (0.33)	0.09	90.76	0.51	.610		0.04 (0.31)	0.10	91.39	0.13	.894	
Pretest parenting	0.06 (0.09)		99.62	0.67	.503		0.37 (0.10)		108.27	3.84	<.001		0.26 (0.10)		103.77	2.70	.008	
Age participant	-0.02 (0.03)		97.72	-0.81	.419		0.01 (0.04)		103.98	0.27	.791		0.02 (0.04)		103.66	0.54	.590	
Age child	-0.02 (0.05)		103.09	-0.42	.677		0.03 (0.08)		105.09	0.41	.680		0.03 (0.08)		106.86	0.34	.736	
Participant education	0.01 (0.09)		104.76	0.10	.922		0.18 (0.15)		106.81	1.19	.237		0.31 (0.14)		104.37	2.23	.028	
Number of children	-0.06 (0.14)		93.82	-0.44	.662		0.08 (0.21)		102.42	0.37	.711		0.18 (0.20)		97.90	0.87	.385	
Perceived effectiveness	0.38 (0.13)		85.00	2.96	.004		-0.08 (0.20)		92.87	-0.40	.691		-0.13 (0.19)		92.73	-0.70	.485	
Therapeutic alliance	-0.15 (0.17)		85.50	-0.88	.379		-0.17 (0.26)		96.83	-0.67	.502		0.23 (0.25)		96.95	0.95	.342	

Note. All statistics are based on imputed data, with the exception of the model statistics. Condition was coded as 1 = control group, 2 = intervention.

Table 5
Multiple regression analyses to predict posttest parenting by condition, interaction with self-regulation, and covariates.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Step 1			88 (9)	1.78	.083	.07			87 (9)	3.00	.004	.16			83 (9)	1.81	.079	.07
Intercept	498 (1.69)		102.48	2.95	.004		1.24 (2.47)		103.83	0.50	.617		-0.19 (2.45)		102.01	-0.08	.937	
Condition	-0.65 (0.23)	-0.31	97.35	-2.78	.007		0.35 (0.37)	0.10	102.71	0.95	.342		0.22 (0.34)	0.07	102.01	0.64	.521	
Self-regulation	0.02 (0.10)	-0.02	107.33	0.22	.825		-0.01 (0.16)	0.01	96.29	-0.06	.949		-0.20 (0.15)	0.13	103.93	-1.38	.169	
Pretest	0.05 (0.09)		100.52	0.58	.565		0.37 (0.10)		109.36	3.85	<.001		0.27 (0.10)		105.20	2.78	.006	
Age participant	-0.02 (0.02)		100.50	-0.75	.458		0.01 (0.04)		105.43	0.30	.766		0.02 (0.04)		105.50	0.59	.557	
Age child	-0.02 (0.05)		105.64	-0.40	.692		0.03 (0.08)		106.87	0.40	.688		0.04 (0.08)		106.41	0.48	.632	
Participant education	0.00 (0.09)		105.86	0.03	.979		0.19 (0.15)		108.00	1.29	.201		0.33 (0.14)		104.49	2.35	.021	
Number of children	-0.08 (0.13)		100.51	-0.63	.532		0.07 (0.21)		105.72	0.35	.725		0.17 (0.20)		102.17	0.90	.373	
Perceived effectiveness	0.37 (0.13)		85.33	2.91	.005		-0.07 (0.20)		93.01	-0.32	.747		-0.13 (0.19)		94.20	-0.72	.472	
Therapeutic alliance	-0.13 (0.17)		88.73	-0.80	.426		-0.17 (0.26)		97.25	-0.68	.498		0.20 (0.24)		98.54	0.84	.405	
Step 2			87 (10)	1.60	.120	.06			86 (10)	2.70	.006	.15			82 (10)	1.62	.117	.06

Table 5
Continued.

	Harsh discipline						Sensitivity – free play						Sensitivity – naturalistic					
	B (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2	*B* (*sd*)	β	Df	*t*/*F*	*p*	Adj. R^2
Intercept	5.01 (1.70)		101.25	2.95	.004		1.06 (2.50)		102.03	0.43	.671		-0.21 (2.47)		101.22	-0.08	.933	
Condition	-0.65 (0.23)		96.24	-2.77	.007		0.37 (0.37)		101.65	0.99	.322		0.22 (0.35)		101.09	0.65	.520	
Self-regulation	0.08 (0.31)		102.80	0.27	.790		-0.38 (0.55)		81.61	-0.69	.490		-0.21 (0.47)		104.63	-0.45	.655	
Condition*Self-regulation	-0.04 (0.20)	0.06	102.71	-0.21	.833		0.25 (0.34)		85.41	0.72	.472		0.00 (0.30)	-0.00	102.11	0.01	.988	
Pretest	0.05 (0.09)		99.43	0.58	.565		0.37 (0.10)		107.76	3.78	<.001		0.27 (0.10)		104.22	2.76	.007	
Age participant	-0.02 (0.03)		97.61	-0.77	.445		0.02 (0.04)		100.79	0.44	.658		0.02 (0.04)		103.43	0.58	.566	
Age child	-0.02 (0.05)		104.91	-0.40	.689		0.04 (0.08)		105.83	0.43	.666		0.04 (0.08)		105.61	0.48	.630	
Participant education	0.00 (0.09)		105.24	0.04	.968		0.18 (0.15)		107.38	1.25	.215		0.33 (0.14)		103.73	2.34	.021	
Number of children	-0.08 (0.13)		99.43	-0.64	.526		0.09 (0.21)		104.62	0.42	.675		0.17 (0.20)		101.33	0.89	.378	
Perceived effectiveness	0.38 (0.13)		85.07	2.91	.005		-0.08 (0.20)		92.65	-0.39	.695		-0.14 (0.19)		93.56	-0.72	.471	
Therapeutic alliance	-0.13 (0.17)		88.51	-0.79	.434		-0.18 (0.26)		97.07	-0.71	.478		0.20 (0.24)		97.60	0.83	.406	

Note. All statistics are based on imputed data, with the exception of the model statistics. Condition was coded as 1 = control group, 2 = intervention.

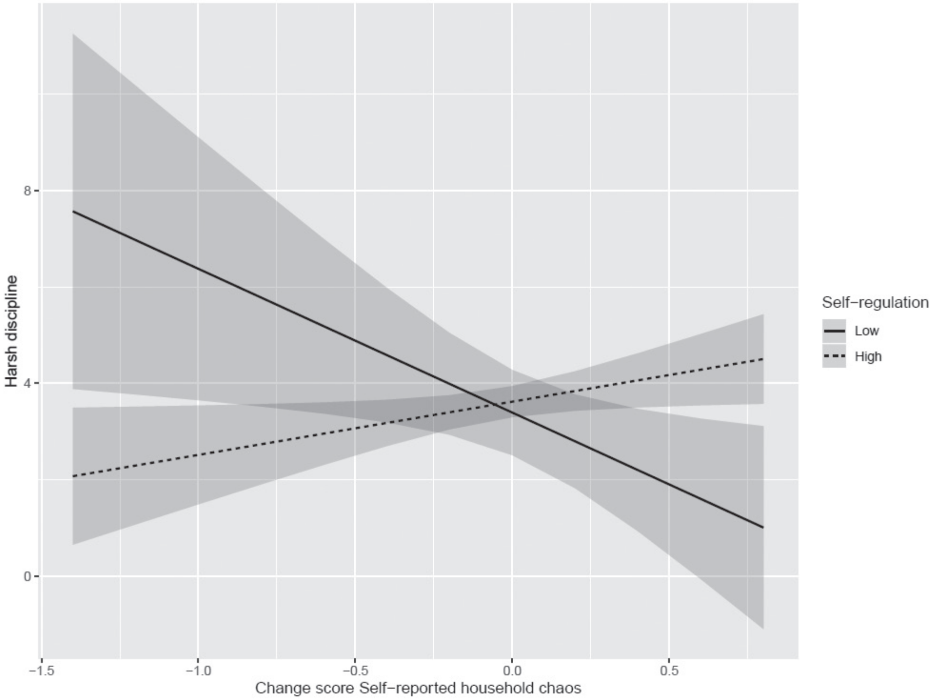

Figure 1. The relation between the change score of self-reported household chaos on harsh discipline at posttest, moderated by self-regulation.
Note. A negative change score on self-reported household chaos represents a decrease in self-reported household chaos. Highlighted areas reflect the range of 1 *SD* above or below average.

Change scores on household chaos

Multiple regression analyses were conducted separately for each of the parenting measures, household chaos measures, and moderators, resulting in 36 analyses. These were conducted in two steps. In step 1, the change score in household chaos, the pretest parenting score, pretest household chaos score, and covariates were added. In step 2, the interaction between the change score in household chaos and SPS or self-regulation was added. The results of these analyses can be found in Tables A1 through A12 in the Supplemental material Chapter 5. For self-regulation, we found one significant interaction, which was between change in self-reported household chaos and self-regulation on posttest harsh discipline (F (11; 80) = 1.34, β = -.25, p = .018, R^2 = .04; see Figure 1). Among parents with higher self-regulation, there was a positive association between change in household chaos and harsh discipline at posttest, while there was a negative association among parents with lower self-regulation. All other analyses with self-regulation did not indicate significant moderation. For SPS, we found no moderation by the

NSS. For the ATQ-OS, no significant moderation was found, although moderation of decreased self-reported household chaos by the ATQ-OS on posttest harsh discipline was in the expected direction (F(11; 84) = 1.35, β = -.09, p = .077, R^2 = .04). Overall, no significant moderation by SPS was found and most of the analyses with self-regulation indicated no moderation.

Discussion

The aim of the current report was to study whether experimentally reducing household chaos leads to a stronger improvement in parenting in parents with higher SPS or lower self-regulation. We found no evidence that effects of our chaos-intervention on parenting were dependent on SPS or self-regulation. Analyses on change scores of household chaos measures also indicated that an effect on parenting was not dependent on SPS. Self-regulation was only a significant moderator for the relation between change in self-reported household chaos and harsh parenting, but not for other household chaos or parenting measures.

For parents with higher self-regulation, a decrease in self-reported household chaos was significantly related to lower harsh discipline at posttest. As we did not find significant moderation by self-regulation for parental sensitivity during free play or the naturalistic setting, the effect of household chaos and self-regulation on parenting may be dependent on the parenting context. The task to measure harsh discipline, where the parent needs to keep their child from playing with attractive toys, can be considered as more demanding compared to the tasks measuring sensitivity, in which the parent plays with the child for 5 min. Especially in difficult parenting settings, self-regulation processes may be necessary to refrain from harsh parenting and to conduct positive parenting instead. We found that a decrease in household chaos was related to less harsh discipline in parents with higher self-regulation, while expecting to find this for parents with lower self-regulation. Instead, we found that for parents with lower self-regulation, a stronger decrease in household chaos was related to a higher score on harsh discipline at posttest. An explanation may lie in the cognitive processes required to establish a decrease in household chaos. To decrease household chaos, parents need to shift their attention and activate or inhibit behavior towards for instance tidying up or adhering to a routine. Thus, decreasing household chaos may be easier for parents with better attention shifting and inhibition skills and working memory, i.e. parents with higher self-regulation, and may be challenging for parents with lower self-regulation. Decreasing household chaos may be so taxing for parents with lower self-regulation that it may result in a lack of cognitive processes needed to refrain from harsh discipline. This may explain why in our study the benefit of decreasing household chaos on harsh discipline was only visible in parents with higher self-regulation. Parents with lower self-regulation may not be able to simultaneously decrease household chaos and inhibit harsh discipline. For these parents to benefit from decreasing household chaos, the new routines around household chaos may first need to be automated, thereby freeing up cognitive capacities needed to inhibit harsh discipline. This would imply that parents with lower self-regulation may benefit more from a gradual decrease in household chaos, thereby allowing enough room for their self-regulation skills to inhibit harsh discipline while establishing a new routine around household chaos. In parents with lower self-regulation, increased self-reported household chaos was related to lower harsh discipline at posttest. A stronger increase in chaos may be more overwhelming for these parents, who may respond by blocking out the environment, including the child's behavior, leading to less responses in general and thus to less harsh discipline.

Our results need to be interpreted with caution, as we only found significant moderation for self-reported household chaos and not for other measures of household chaos. This could indicate that individual elements of household chaos are less important and that it is the combination of these elements, as measured in the self-report questionnaire (Matheny et al., 1995), that is related to parenting. It could also indicate that the perception of household chaos is more important than the actual level of clutter, noise, or family and week routines, as the self-report questionnaire taps into the perception of household chaos whereas the separate measures of household chaos were more objective. As there is little research to date on whether self-regulation moderates the effect of household chaos on parenting, and as these studies do not consistently find significant moderation by self-regulation (e.g., Deater-Deckard et al., 2012; Chapter 3), more research on this topic is needed to determine whether special attention to parents with low self-regulation is necessary in the context of household chaos and parenting.

Our analyses based on intervention effects as well as on the change scores of household chaos indicated that the relation with parenting was not dependent on SPS. This contradicts previous findings, such as the experimental study by Andeweg et al. (2020), in which participants' caregiver sensitivity was more strongly affected by household chaos over time in participants with higher SPS than in participants with lower SPS. The difference in findings could be a result of not establishing a sufficiently large effect on household chaos in the current study (see also Chapter 4). We may not have been able to accomplish a difference in household chaos that is large enough so that parents with higher SPS are more affected than parents low in SPS. Perhaps only large shifts of household chaos have a stronger effect on parenting in parents with higher SPS than with lower SPS. As household chaos is fairly stable over time (Chapter 4), these larger shifts may only occur around larger changes in family life, for instance moving or the addition of a new family member. This would imply that SPS is not an important moderator for the effect of household chaos and parenting in everyday life. Another explanation is that only high levels of household chaos affect parenting more strongly in parents with higher SPS. In the current study, only 6% of the parents had a mean score of self-reported household chaos of 3 or higher, while the scale ranged from 1 to 5. This means that the level of household chaos was not very high in our sample, even though we invited the more chaotic families to participate in the study. In the study by Andeweg et al. (2020), the chaos condition was evaluated as very chaotic. Thus, the effect of household chaos on parenting may only by stronger for parents with higher SPS in highly chaotic environments. Lastly, in the study by Andeweg et al. (2020), household chaos was created by someone else, whereas the household chaos in the current study was created, at least to some extent, by the participant. SPS may only moderate the effect of chaotic environments on parenting in environments that are uncontrollable or that are new to parents.

Limitations and strengths

A limitation of the current study is that the intervention was not successful in producing a measurable decrease in household chaos (see also Chapter 4). We therefore also tested moderation by SPS or self-regulation in analyses with change scores of measures of household chaos. This ensured thorough investigation of these data for our research questions on the one hand, and led to a large amount of analyses on the other hand, meaning interpretations of the few significant results should be done with caution. Strengths include the use of multiple measures for parenting and household chaos, and the use of objective as well as self-report measures. Lastly, our sample was fairly low-risk, as parents reported relatively high education and income levels. This means our results are less generalizable to families with a lower socio-economic status. As families with low socio-economic status show more household chaos (e.g. Wang, Deater-Deckard, & Bell, 2013), these families may be more of interest for studying the current research question.

Future research and implications

Using an experimental study design, we found that the effect of self-reported household chaos on harsh discipline was moderated by self-regulation. As we did not find a moderation effect for other measures of household chaos or for sensitivity, and as previous studies are inconsistent in their findings, more research on this topic is needed to clarify whether self-regulation is indeed a moderator of the effect of household chaos on parenting before prevention and whether intervention efforts should be specifically targeted at parents with high or low self-regulation. Potentially, parents with lower self-regulation may benefit from a more gradual decrease in household chaos. As high-risk families generally have more chaotic households and lower parental self-regulation (Dumas et al., 2005; Deater-Deckard et al., 2012), it is worthwhile to further investigate this research question. Furthermore, we found no evidence that the effect of household chaos on parenting depended on SPS. More research is needed to establish whether SPS is only relevant in highly chaotic households or high-risk families. This could indicate that reducing household chaos could more effectively reduce negative parenting practices in parents with high SPS. Finally, as our results indicate that the effect of household chaos may only be present in more demanding situations, such as disciplinary situations, studying the role of child behavior may be important as well (Dumas et al., 2005).

Conclusion

In conclusion, we found some support for moderation by self-regulation and no support for moderation by SPS of the effect of household chaos on parenting. In our sample of low-risk families with normative to relatively high levels of household chaos, a decrease in self-reported household chaos was related to less harsh discipline for parents with higher self-regulation, and to more harsh discipline for parents with lower self-regulation. For parents with lower self-regulation, creating a new routine around household chaos may tax their cognitive capacities, thereby leaving no room to inhibit harsh discipline. Parents with lower self-regulation may thus benefit from more gradually introducing routines to decrease household chaos. In low-risk families, SPS may not be an important factor in how strongly household chaos affects parenting. Future studies should expand the current findings to more chaotic or at-risk families to test whether reducing household chaos may improve parenting, especially in parents with lower self-regulation or higher SPS.

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General discussion

The aim of the current dissertation was to test whether household chaos has a causal effect on parenting and whether this effect was stronger for parents with higher sensory-processing sensitivity (SPS), lower self-regulation, or more impulsivity. Using two experimental studies, we found evidence for a causal effect of household chaos on parenting (Chapters 2 and 4). Moderation by SPS or self-regulation was inconsistent, and we found no moderation for impulsivity (Chapters 3 and 5). These findings should be integrated with findings from previous studies and need to be considered within the currently used study designs to formulate directions for future research and practical implications.

Household chaos and parenting

The first question of this dissertation was whether more household chaos leads to lower quality parenting. In our lab study, increased chaos led to lower caregiver sensitivity, whereas no effect on harsh caregiving was found (Chapters 2 and 3). In our intervention study, the intervention – aimed at reducing chaos – resulted in less harsh discipline, but no effect on sensitivity was found (Chapter 4). A closer look at the methodologies used to measure sensitivity and harsh parenting is necessary to understand these seemingly inconsistent results. In the lab study, an infant simulator was set to not respond to caregiving behavior and therefore simulate an inconsolable infant. This is known to be stressful to parents (Zeifman & St James-Roberts, 2017). Harsh caregiving and caregiver sensitivity were measured from the same video-observations. In the intervention study, we measured harsh discipline in a don't touch task and sensitivity in a free play task. The free play task consisted of 5 min of playing with the child. In the don't touch task, the parent needs to make sure that the child refrains from playing with an attractive toy for 2 min. Thus, the task to measure harsh discipline was more difficult than the task to measure sensitivity. The finding that caregiver sensitivity was affected by household chaos in the lab study along with the finding that harsh discipline was affected in the intervention study, indicates that household chaos may specifically affect parenting in difficult parenting situations, such as soothing an inconsolable infant or disciplining a child. However, in the lab study, we measured harsh caregiving in response to a crying infant simulator and did not find an effect of household chaos. This task may not have been suitable to elicit harsh caregiving. Parents who show harsh caregiving in response to an inconsolable infant mostly develop these behaviors after three months (Reijneveld, Van der Wal, Brugman, Hira Sing, & Verloove-Vanhorick, 2004), which does not compare to caring for an inconsolable infant simulator for two observations of 45 min. Thus, our method may not have been sufficient to elicit harsh caregiving. An alternative option is to use virtual reality: within an experimental design, a virtual living room with two conditions can be created, one chaotic and one neutral condition, and participants can be asked to perform the don't touch task with a simulated 2-year old. The nunchucks used with virtual reality can simulate physical responses. Verbal and nonverbal harshness and laxness can still be coded in this paradigm.

Effect sizes

Overall, we conclude that parenting is affected by household chaos in already demanding parenting situations, and that both positive and negative parenting practices are negatively affected. This is in line with the findings from earlier correlational studies, such as finding more harsh parenting and less sensitive parenting in more chaotic households (e.g., Coldwell, Pike, & Dunn, 2006; Deater-Deckard, Wang, Chen, & Bell, 2012; Dumas et al., 2005). However, the effect sizes we found are smaller than previously found in correlational studies (e.g., Coldwell et al., 2006; Dumas et al., 2005). This may be due to several factors.

First, we used experimental designs. In social sciences, effect sizes in correlational studies are often stronger compared to those in experimental studies (Cheung & Slavin, 2016; Lipsey et al., 2012). This is mainly because many factors are related in social sciences, and whereas these factors may affect outcome measures in correlational studies, these are controlled for in experimental studies, resulting in smaller effect sizes. Regarding household chaos and parenting, our experimental study shows that household chaos only has a small direct effect on parenting (Chapter 2). In correlational studies household chaos may be related to stress or to parental self-efficacy, which are both also related to parenting (Nelson, O'Brien, Blankson, Calkins, & Keane, 2009; Selander et al., 2009; Corapci & Wachs, 2002; Beckerman, Berkel, Mesman & Alink, 2017; Albanese, Russo & Geller, 2019; Jones & Prinz, 2005). In experimental designs these relations are controlled for, whereas in correlational studies stress and parental self-efficacy would be able to be the third variable that influences both household chaos and parenting, and thereby lead to a larger effect size.

Second, it is possible that child effects play a role in how household chaos affects parenting, as previously suggested by Dumas et al. (2005). As child behavior is related to household chaos and parenting (e.g. Coldwell et al., 2006), a decrease in household chaos may lead to less difficult child behavior, which may in turn make parenting easier. This could explain why we found a small effect size in our lab study. In our lab study, the infant simulator followed the same crying schema in both lab visits, thereby deliberately excluding child effects. A larger effect size may be found if child effects are included: the chaotic environment would then affect sensitivity directly and indirectly through child behavior, as household chaos may lead to more child problem behavior, which in turn affects parenting. The effect we found in our RCT may be (partially) due to less difficult child behavior as a result of the chaos intervention (Chapter 4). To study this indirect effect, it would be necessary to compare the causal effect of household chaos on parenting with a child and with an infant simulator. In our RCT we studied parents with their child and with the infant simulator at pre and posttest, providing the data to investigate the role of child effects. These data were not used in the current dissertation.

In all, household chaos does affect parenting, but the causal effect is small. Thus, the evidence of strong correlations between household chaos and parenting cannot be interpreted as proof of a strong causal effect of household chaos on parenting. Other factors may be important, such as stress and parental self-efficacy, and their direct contribution to parenting in combination with household chaos should be studied. For instance, high stress levels or low parental self-efficacy may cause more parenting problems (Beckerman et al., 2017; Albanese et al., 2019; Jones & Prinz, 2005), but may also lead to more household chaos (Nelson et al., 2009; Selander et al., 2009; Corapci & Wachs, 2002), which in turn adds on to the parenting problems.

Underlying mechanisms

Why does household chaos only affect parenting in demanding parenting situations, and not in non-demanding parenting situations? And how exactly does household chaos affect parenting? To better understand how household chaos may affect parenting, and which other factors may be important in this model, it is necessary to study the underlying mechanisms through which household chaos affects parenting. These mechanisms could be increased stress, fatigue and negative emotions, lower self-regulation, or lower parental self-efficacy, as these are related to both more household chaos and lower quality parenting (Brown, Anderson, Garnett, & Hill, 2019; Nelson et al., 2009; Selander et al., 2009; Crandall, Deater-Deckard, & Riley, 2015; Corapci & Wachs, 2002). Non-demanding parenting situations, such as playing with a child, may not cause stress, fatigue, negative emotions, impede on self-regulation, or lead to lower parental self-efficacy. Demanding parenting situations on the other hand, such as situations in which it is difficult to make a child cooperate or in which a child is unsoothable, may have this effect. If household chaos indeed operates through these mechanisms, then a chaotic environment may exacerbate the already heightened levels of stress, fatigue, negative emotions or lowered levels of self-regulation and parental self-efficacy. Thus, household chaos would add on to these factors and thereby lead to more harsh and less sensitive parenting in demanding parenting situations. In non-demanding parenting situations, household chaos may also lead to more stress, lower self-regulation and lower self-efficacy, but not to such an extent that parenting is impacted. This reasoning is in line with studies that found that child maltreatment occurs most in families where there is a cumulation of risk factors and the number of risk factors exceeds a certain threshold (Patwardhan, Duppong Hurley, Thompson, Mason & Ringle, 2017; Doidge, Higgins, Delfabbro, & Segal, 2017). Knowing how household chaos affects parenting could inform prevention or intervention programs aiming to reduce parenting problems. For instance, interventions could reduce household chaos as well as improve stress coping mechanisms, or pay extra attention to boosting parental self-efficacy, to in turn reduce parenting problems.

Sensory-processing sensitivity

Another important question is whether household chaos affects parenting the same in all parents. We expected that household chaos would affect parenting more strongly in parents with higher sensory-processing sensitivity (SPS). First, as previous literature was inconclusive whether sensory-processing sensitivity (SPS) is a unidimensional, two dimensional, or three dimensional construct (Aron & Aron, 1997; Evans & Rothbart, 2008; Smolewska, McCabe, & Woody, 2006), we looked at dimensionality of SPS in our lab study (Chapter 2). We used a combination of self-report and observational measures to quantify SPS and found two components, which were similar to the components defined by Evans and Rothbart (2008): sensory sensitivity (how readily stimuli are perceived and if a person is generally affected by stimuli) and sensory discomfort (if a person is negatively aroused or overwhelmed by stimuli). This supports the notion that SPS is a two dimensional construct.

We expected that parents with more sensory-processing sensitivity (SPS) would show a stronger effect of household chaos on parenting. We hypothesized that due to a lower threshold for perceiving stimuli and stronger arousal to stimuli these parents would be more affected by the increased number and/or intensity of stimuli in chaotic households, thereby affecting their parenting practices more than in parents with low SPS. Our lab study showed partial support for this reasoning (Chapter 2). We found that participants with specifically more sensory sensitivity (i.e., a lower threshold for perceiving stimuli) showed a faster decrease in caregiver sensitivity in the chaotic compared to the neutral condition than participants with lower sensory sensitivity (i.e., a higher threshold for perceiving stimuli). We did not find this for SPS in general or specifically for sensory discomfort (i.e., increased arousal to stimuli). First, this means that when studying SPS it is important to distinguish between these components of SPS, as previously defined by Evans and Rothbart (2008). Second, this means that it is the heightened awareness rather than arousal by stimuli that makes people more susceptible to the effect of household chaos on parenting. Noticing the increased number and/or intensity of stimuli in highly chaotic environments may interfere with noticing and responding promptly and appropriately to infant stimuli. In our intervention study, we were not able to replicate these findings. Due to a smaller battery of measures for SPS in the intervention study than in the lab study, we could not distinguish between sensory sensitivity and sensory discomfort, which could explain why we did not find significant moderation (Chapter 5). Second, it is possible that SPS is not relevant to parents within their own home environment, as that these parents have adapted cognitive reactivity strategies to cope with the amount of household chaos in their homes (Wyller, Wyller, Crane, & Gjelsvik, 2017), or have partners who are not high in SPS and help them to regulate their heightened reactivity to stimuli (Greven et al., 2019). These coping mechanisms may not have been activated in the lab study, in which no partner was present and parents could not control the level of household chaos, thereby making parents with higher SPS more susceptible to the effect of household chaos. Another explanation is that our intervention study may not have created large enough differences between pre and posttest levels of household chaos for SPS to become relevant. Based on the measures of chaos we used, we could not confirm that our intervention was successful in decreasing household chaos, while the difference in levels of chaos between the neutral and chaos condition in the lab study was large. Therefore, the effect of household chaos on parenting may only be stronger for parents with higher SPS in case of extreme differences in household chaos, such as occur around major life events like the addition of a new family member or moving to a new home, but not in case of differences in daily hassles. This would mean that household chaos generally affects parenting regardless of SPS. Our results could also indicate that parents with higher SPS are only affected by household chaos when it passes a certain threshold, equal to the level of household chaos in our lab study's chaotic condition. To test this assumption, it would be necessary to study whether the effect of household chaos on parenting in demanding situations is stronger for parents with higher SPS in a sample of highly chaotic families.

Self-regulation

Our hypothesis was that household chaos affects parenting more strongly in parents with lower self-regulation. Their lower attention shifting and inhibition skills and less adept working memory could mean that coping with the higher amount of stimulation from a chaotic environment is more difficult for these parents than for parents with high self-regulation, resulting in a stronger effect of household chaos on parenting. In the lab study, we did not find moderation by self-regulation, assessed with a self-report questionnaire and a computer task for inhibition (Chapter 3). In the intervention study, we found that a decrease in self-reported household chaos correlated with lower post-test harsh discipline in participants with higher self-regulation, whereas more harsh parenting was related to a decrease in self-reported household chaos in parents with lower self-regulation (Chapter 5). This was opposite to our expectation. Overall, our studies show mixed results on whether self-regulation moderates the effect of household chaos on parenting. An explanation for not finding this in the lab study is that self-regulation may be more relevant for harsh caregiving than for caregiver sensitivity, as refraining from harsh caregiving requires inhibition skills (Crandall et al., 2015). As discussed previously, our observations to measure harsh caregiving may not have been successful in eliciting harsh caregiving, which also makes it difficult to find moderation by self-regulation. In our intervention study, lower harsh parenting in relation to a decrease in self-reported household chaos in parents with high self-regulation was expected, as less household chaos means less stimuli interfering with regulating parenting behavior. Parents low in self-regulation, on the other hand, showed more harsh discipline in relation to a decrease in chaos. This may be explained by the cognitive processes needed to establish the decrease in household chaos: the self-regulation capacity of parents with lower self-regulation may be insufficient to simultaneously maintain lower levels of household chaos and refrain from harsh discipline.

It is important to keep in mind that these results from analyses with change scores are correlational, meaning we cannot infer causality. As we used observational and computer task data for the parenting and self-regulation measures, it is not likely that our findings are due to subjective measurement types. Also, we again only found an effect on harsh discipline and not on sensitivity, indicating that self-regulation may indeed be more relevant for parenting in demanding situations than in non-demanding situations, and that good attention shifting and inhibition skills and working memory are needed to cope with a chaotic environment and a demanding parenting situation simultaneously. Another point to keep in mind is that our analyses only showed an interaction with self-reported household chaos, and not with other measures of household chaos. Therefore, the evidence for moderation by self-regulation in the intervention study was limited. Due to the limited evidence in the intervention study combined with not finding moderation by self-regulation in our lab study, our view is that it is too early to conclude that self-regulation moderates the effect of household chaos on parenting. Future studies should test whether experimentally reduced levels of household chaos indeed affect harsh parenting differently in parents with low vs high self-regulation abilities. Recruiting families with higher levels of household chaos may be helpful, as these families have more room for improvement.

Impulsivity

In our lab study, we exploratively studied whether more household chaos leads to lower parenting quality in parents who are more impulsive, reasoning that a chaotic environment combined with their higher urgency and faster approach behavior may make it difficult to refrain from harsh parenting and instead perform positive parenting strategies. We did not find that the effect of household chaos on caregiver sensitivity or harsh caregiving depended on impulsivity (Chapter 3). For harsh caregiving, this could be due to the task not being successful in eliciting harsh caregiving. For caregiver sensitivity, this means that more impulsive participants were not more affected by household chaos than less impulsive participants. The reasoning that more impulsive participants may have more trouble regulating their behavior in chaotic environments may still be true, but our results do not show that this leads to less caregiver sensitivity per se. It is possible that these participants switched more between different types of caregiving behavior (i.e., rocking, feeding, changing the diaper), or between the tasks in phase 2 and 3 and caregiving behavior, but this does not necessarily mean that these behaviors are harsher or less sensitive. Finally, it may be necessary to test the combination of heightened impulsivity and neuroticism, as more neurotic people are more easily aroused (e.g., Brown & Rosellini, 2008; Helmers et al., 1997), and parenting quality in demanding situations has been found to be especially lower for more neurotic and extraverted fathers. In conclusion, we did not find evidence that impulsivity exacerbates the effect of household chaos on parenting, but as this was the first study to research this question, more research is needed, and research should also look into impulsivity and neuroticism.

Strengths and limitations

The designs of the two studies have multiple strengths and limitations. The lab study was done in a highly controlled setting, in which an infant simulator was programmed to cry at certain times, and with female young adults who did not have children as participants. This design was chosen specifically to partial out potential confounders in the relation between household chaos and parenting, such as previous parenting knowledge and experience. Also, the use of the infant simulator enabled us to partial out the potential role of child behavior in how household chaos affects parenting (e.g., Dumas et al., 2005). The use of the lab allowed us to manipulate household chaos (except for the aspect of family routines) and keep all other factors stable. Thus, the strength of this design was that we were able to very accurately assess the effect of household chaos on parenting. This inherently means that generalizability of the results from this study to families is limited: in families, parents are able to control the amount of household chaos (to some extent), parents have experience with their own child, and the child reacts to the home environment and parenting. The goal of the second study, the intervention study, was therefore to replicate the findings from the lab study in real families. The use of the RCT design allowed us to answer the question of causality and the use of self-report as well as objective measures of household chaos ensured comparability with previous studies, in which mostly one type of measurement was used. As we studied household chaos and parenting in the home environment, the findings from the intervention study are more generalizable to families than the findings from the lab study. However, generalizability is still limited as our sample consisted of intact families and was characterized by relatively high educational attainment, high income, and Dutch ethnicity. Regarding ethnicity, studies on household chaos, child development and parenting show roughly the same patterns in Western and non-Western samples, such as India, Israel, and South-Africa (see Wachs & Corapci, 2003), but standards of what is chaotic differ across cultures. A systematic review can shed light on how important cultural differences are for the effect of household chaos on parenting. Also, cross-cultural research on this topic within countries may help understand parenting problems and child development problems.

In the intervention study we used a combination of objective and self-report measures for household chaos. As Wachs (2013) showed that self-reported levels of household chaos do not necessarily converge with observed levels of household chaos, the use of both types of measures of household chaos in our study is a strength. We do recommend some alterations to these measures for future research. For instance, our measure of family routines consisted of variability in the time the parent and child ate breakfast and dinner and the time the child was put to bed. Other aspects of family routines, such as whether the bedtime routine was performed in the same way each night, were not asked, and should be included in future measures of family routines. Also, there were some technical problems with the diary app, which resulted in quite some missing data. Furthermore, the goals in our intervention were not all measurable with our measures of household chaos. For instance, a goal to decrease clutter was to clean up all children's toys before bedtime, but observations of clutter were made during the day before the child's bedtime. Thus, future research with an intervention to reduce household chaos should make sure that measurements and goals of the intervention match more closely. Also, as crowding is not easily manipulated, we did not include this in our intervention and instead controlled for the number of children. Lastly, asking parents to fill out a screening questionnaire may have resulted in non-response from more chaotic families, as they may have a higher chance of losing the invitation to the screening questionnaire, or of simply forgetting it in the chaos of everyday life. Thus, this may not be the most effective way to recruit chaotic families or this requires more than one reminder to fill out the screening questionnaire.

Future research

While our study answers some research questions, it raises many more. To test whether some of our interpretations are correct, it is necessary that future experimental studies testing the effect of household chaos on parenting a) use self-report as well as objective measures of household chaos, b) measure positive and negative parenting practices in demanding and non-demanding parenting situations, and c) test for moderation by SPS and self-regulation in highly chaotic families. Regarding impulsivity, future studies should combine this with neuroticism to test moderation of the effect of household chaos on parenting. Furthermore, the mechanisms through which household chaos affects parenting, including stress, fatigue and negative emotions, self-regulation, and parental self-efficacy should be examined.

Another line of research is that on the role of child behavior. Besides knowing that parenting mediates the relation between household chaos and child development (Mills-Koonce et al., 2016; Vernon-Feagans, Garrett-Peters, Willoughby, Mills-Koonce, & The Family Life Project Key Investigators, 2012), it is necessary to test whether child behavior mediates the effect of household chaos on parenting. To this end, we studied parent-child interactions and parent-infant simulator observations in our intervention study (data not used in this dissertation). Furthermore, the effect of household chaos on parenting should also be studied in older children. Our study focussed on pre-school children, who generally spend much time at home. The effect of household chaos may be different for older children, who may be at home less but who also have an increasing role in the level of household chaos: for instance, the older children become, the more independent they are in grabbing toys from a basket, and the more parents can expect the child to help clean up. As previous correlational studies found relations between parenting and household chaos with school-aged children (e.g., Coldwell et al., 2006; Dumas et al., 2005), it can be expected that household chaos also affects parenting with older children.

Before we can formulate implications for practice, more research is necessary. Therefore, two important questions must be answered. The first question is whether our results are generalizable to families with low SES. In low SES families, other factors, such as financial stress or unemployment, are at play than in high SES families. Our samples consisted mostly of highly educated students or relatively high SES families. It is important to test whether and how strongly household chaos affects parenting in demanding situations in families with low SES. Second, it is important to study whether household chaos also affects parenting in families with a high risk of child maltreatment. If so, then this could be an opportunity for social workers to improve parenting. Helping families implement family routines or managing clutter and noise levels may be an effective way to reduce household chaos and thereby improve parenting and reduce child maltreatment. Knowledge on mechanisms underlying this effect should be used in this intervention. Also, future research should study whether aiding families in keeping household chaos at a low could be a preventive measure for parenting problems: if reducing household chaos leads to less harsh discipline, then making sure household chaos stays low may prevent harsh discipline. To better target these prevention and intervention efforts, information on whether SPS, self-regulation and impulsivity are moderators of the effect of household chaos on parenting could be used.

Implications

Our study sheds light on whether household chaos causally affects parenting and finds that it has a small effect in difficult parenting situations. The intervention study showed that harsh discipline decreased in the intervention group (Chapter

4). Still, we believe it is too early to implement this intervention in practice with families with clinical parenting problems. To this end, more research is needed in which the intervention is tested in families with extreme parenting problems. Also, understanding the mechanisms through which household chaos affects parenting would help to better shape the intervention. For instance, if household chaos affects parenting through stress, then implementing the chaos intervention next to a stress coping intervention, or adding a module on coping with stress to the intervention, is advisable. Also, our intervention may need modification for successful implementation in practice: is it feasible to add an intervention with 5 home visits to an already burdened family or should it be shortened? What goals from our standard list should be included, or should there not be a standard list to choose from? Studies with our intervention executed in a high-risk population should provide insight into which changes may be necessary before implementing the intervention in practice. Until these studies are executed, social workers should be advised to pay attention to the level of household chaos in families with young children, knowing that this may impact parenting.

Conclusion

In conclusion, household chaos affects both positive and negative parenting practices. This effect is only significant in demanding parenting situations, such as situations in which disciplinary actions towards the child are required or in which the child is inconsolable. The causal effect was small while correlational studies found larger effects, meaning that other factors may be important predictors of both household chaos and parenting. Therefore, more experimental studies in which the underlying mechanisms are investigated are important.

Support for moderation by SPS and self-regulation is inconsistent. Regarding SPS, this may exacerbate the effect of household chaos on parenting in case of extreme differences between or high levels of household chaos. Regarding self-regulation, parents with high self-regulation may benefit from reducing household chaos, while parents with low self-regulation may not have enough self-regulation capacities to simultaneously lower their level of household chaos and refrain from harsh discipline. The effect of household chaos on parenting was not dependent on impulsivity. Future studies should include self-report as well as objective measures of household chaos, and measures of positive and negative parenting practices in demanding and non-demanding situations. Also, it is necessary to test whether our findings can be replicated in older children, high risk families, and families with low SES and other ethnicities. Our results form a promising vantagepoint for further research, which could eventually lead to prevention and intervention programs to improve parenting by reducing household chaos.

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Supplementary Material

Supplemental Material Chapter 2

Figure A1.
Neutral condition.

Figure A2
Chaos condition.

Table B1
Principal component analysis with oblique rotation (pattern matrix): component loadings for components of sensory-processing sensitivity.

	Component 1	Component 2
ATQ-OS	**.82**	-.02
HSPS	**.82**	-.15
NSS	**.67**	-.22
Reactivity to noise	**.47**	-.69
NSS informant	.13	-**.79**
ATQ informant	.41	-**.49**

Note. ATQ-OS = Adult Temperament Questionnaire – Orienting Sensitivity. HSPS = Highly Sensitive Person Scale. NSS = Noise Sensitivity Scale.

Table B2
Principal component analysis with oblique rotation (pattern matrix): component loadings for components of sensory-processing sensitivity.

	Component 1 sensory sensitivity	Component 2 sensory discomfort	Component 3
ATQ: NPS	-**.89**	-.09	-.10
ATQ: APS	-**.86**	-.08	-.03
ATQ: AS	-**.75**	-.05	-.30
HSPS: AES	-**.52**	-.49	-.06
HSPS: EOE	-.14	-**.89**	-.20
HSPS: LST	-.09	-**.86**	-.04
NSS	-.05	-**.69**	-.12
Responsivity to noise	-.05	>.01	-**.96**

Note. ATQ:NPS = Adult Temperament Questionnaire : Neutral Perceptual Sensitivity. ATQ:APS = ATQ Affective Perceptual Sensitivity. ATQ:AS = ATQ Associate Sensitivity. HSPS:AES = Highly Sensitive Person Scale: Aesthetic Sensitivity. HSPS:EOE = HSPS Ease of Excitation. HSPS:LST = HSPS Low Sensory Threshold. NSS = Noise Sensitivity Scale.

Table B3
Overview models of caregiver sensitivity

1.	Unconditional means model.
2.	Unconditional growth model: phase as fixed effect.
3.	Unconditional growth model: phase as fixed and random effect.
4.	Phase and condition as fixed effects, phase as random effect, covariates added.
5.	Phase and interaction between condition and sensory-processing sensitivity as fixed effects, phase as random effect, covariates added.
6.	Interaction between condition, sensory-processing sensitivity and phase as fixed effects, phase as random effect, covariates added.
5a.	Phase and interaction between condition and sensory sensitivity as fixed effects, phase as random effect, covariates added.
6a.	Interaction between condition, sensory sensitivity and phase as fixed effects, phase as random effect, covariates added.
5b.	Phase and interaction between condition and sensory discomfort as fixed effects, phase as random effect, covariates added.
6b.	Interaction between condition, sensory discomfort and phase as fixed effects, phase as random effect, covariates added.

Supplemental Material Chapter 5

Table A1
Multiple regression analyses to predict posttest parenting by change in self-reported household chaos, interaction with SPS: ATQ-OS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.06							0.19							0.17
Intercept	4.84	1.90		101.07	2.55	.012		1.84	2.73		102.24	0.67	.502		1.64	2.68		103.97	0.61	.542	
Change self-reported household chaos*	-0.03	0.30	-0.01	96.15	-0.09	.928		-0.51	0.46	-0.11	98.66	-1.11	.271		-0.39	0.44	-0.09	95.61	-0.88	.379	
SPS: ATQ-OS	-0.03	0.10	-0.03	99.10	-0.28	.776		0.01	0.16	0.01	103.30	0.07	.941		0.08	0.14	0.05	105.78	0.55	.582	
Pretest parenting	0.03	0.09		102.11	0.31	.755		0.37	0.10		109.00	3.86	.000		0.24	0.10		103.61	2.49	.014	
Pretest self-reported household chaos	-0.11	0.29		104.21	-0.38	.708		-0.12	0.45		104.60	-0.26	.794		-0.38	0.42		103.92	-0.91	.367	
Age participant	-0.01	0.02		103.68	-0.32	.752		0.00	0.04		105.28	0.11	.911		0.01	0.04		105.30	0.24	.815	
Age child	-0.03	0.05		103.90	-0.57	.568		0.04	0.08		106.60	0.55	.585		0.02	0.08		106.40	0.31	.755	
Participant education	-0.01	0.10		105.46	-0.14	.891		0.18	0.15		107.68	1.25	.212		0.32	0.14		103.65	2.27	.025	

Table A1
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Number of children	-0.09	0.14		100.71	-0.60	.553		0.13	0.22		103.52	0.58	.565		0.30	0.21		100.41	1.39	.167	
Perceived effectiveness	0.21	0.11		88.96	1.82	.072		0.02	0.17		96.69	0.12	.905		-0.09	0.16		96.24	-0.56	.574	
Therapeutic alliance	-0.16	0.18		85.67	-0.87	.388		-0.20	0.27		94.70	-0.74	.464		0.19	0.25		97.62	0.74	.462	
Step 2							0.10							0.20							0.18
Intercept	5.11	1.88		100.05	2.72	.008		1.80	2.74		101.35	0.66	.514		1.57	2.69		102.84	0.58	.560	
Change self-reported household chaos*	0.00	0.30	0.00	93.93	-0.01	.992		-0.53	0.46	-0.12	97.74	-1.15	.253		-0.41	0.44	-0.10	94.35	-0.92	.358	
SPS: ATQ-OS	-0.01	0.10	-0.01	95.98	-0.06	.951		0.00	0.16	0.00	102.09	0.00	.999		0.07	0.15	0.04	104.63	0.46	.650	
Change self-reported household chaos*SPS: ATQ-OS	-0.61	0.34	0.00	90.31	-1.79	.077		0.36	0.53	0.00	95.10	0.69	.492		0.39	0.50	0.01	92.32	0.77	.442	
Pretest parenting	0.01	0.09		101.11	0.08	.935		0.36	0.10		107.96	3.77	.000		0.24	0.10		102.58	2.48	.015	

S

Table A1
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Pretest self-reported household chaos	-0.08	0.29		102.38	-0.29	.773		-0.13	0.45		103.27	-0.29	.769		-0.40	0.43		102.64	-0.94	.351	
Age participant	-0.02	0.02		103.49	-0.60	.552		0.01	0.04		104.42	0.20	.840		0.01	0.04		104.21	0.34	.738	
Age child	-0.02	0.05		103.53	-0.43	.670		0.04	0.08		105.66	0.49	.628		0.02	0.08		105.75	0.23	.818	
Participant education	-0.02	0.10		102.43	-0.24	.808		0.19	0.15		106.16	1.28	.204		0.32	0.14		101.79	2.28	.024	
Number of children	-0.11	0.14		99.05	-0.79	.432		0.14	0.22		102.19	0.64	.520		0.31	0.21		99.03	1.46	.149	
Perceived effectiveness	0.20	0.11		86.51	1.74	.086		0.03	0.17		95.58	0.16	.869		-0.08	0.16		95.42	-0.52	.608	
Therapeutic alliance	-0.16	0.18		83.03	-0.87	.385		-0.20	0.27		93.46	-0.73	.468		0.19	0.25		96.91	0.74	.458	

Note. A negative change in self-reported household chaos indicates that self-reported household chaos decreased from pretest to posttest.

Table A2
Multiple regression analyses to predict posttest parenting by change in self-reported household chaos, interaction with SPS: NSS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.2							0.17
Intercept	4.98	1.98		97.70	2.52	.013		2.21	2.82		101.79	0.78	.435		1.27	2.76		104.48	0.46	.646	
Change self-reported household chaos*	-0.03	0.30	-0.01	95.57	-0.12	.909		-0.53	0.46	-0.12	97.05	-1.15	.254		-0.36	0.45	-0.09	93.75	-0.80	.425	
SPS: NSS	0.02	0.12	0.02	71.78	0.17	.865		0.10	0.18	0.06	85.25	0.55	.587		-0.08	0.17	-0.05	87.31	-0.47	.638	
Pretest parenting	0.02	0.09		101.74	0.27	.786		0.37	0.10		108.69	3.85	.000		0.25	0.10		102.97	2.54	.013	
Pretest self-reported household chaos	-0.12	0.30		100.70	-0.41	.682		-0.18	0.46		101.75	-0.39	.698		-0.32	0.44		102.65	-0.73	.466	
Age participant	-0.01	0.03		102.40	-0.37	.714		0.00	0.04		104.84	0.03	.974		0.01	0.04		105.42	0.36	.723	
Age child	-0.03	0.05		103.14	-0.62	.535		0.04	0.08		106.20	0.54	.590		0.03	0.08		106.85	0.37	.713	
Participant education	-0.02	0.10		105.81	-0.16	.877		0.18	0.15		107.25	1.20	.232		0.32	0.14		104.03	2.27	.025	

S

Table A2
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Number of children	-0.08	0.16		94.42	-0.50	.615		0.17	0.24		99.06	0.71	.481		0.27	0.22		95.91	1.18	.240	
Perceived effectiveness	0.20	0.11		89.21	1.79	.076		0.00	0.17		96.61	0.03	.976		-0.08	0.16		96.33	-0.50	.621	
Therapeutic alliance	-0.15	0.18		85.28	-0.86	.393		-0.22	0.27		94.06	-0.81	.422		0.18	0.25		97.64	0.72	.472	
Step 2							0.07							0.2							0.18
Intercept	5.09	1.99		97.31	2.56	.012		2.05	2.84		101.53	0.72	.471		1.24	2.79		103.95	0.44	.658	
Change self-reported household chaos*	-0.05	0.30	-0.02	94.61	-0.16	.869		-0.52	0.47	-0.12	96.09	-1.10	.273		-0.34	0.45	-0.08	94.13	-0.75	.456	
SPS: NSS	0.02	0.12	0.02	70.43	0.15	.878		0.10	0.18	0.06	85.19	0.56	.577		-0.08	0.17	-0.05	85.94	-0.48	.632	
Change self-reported household chaos*SPS: NSS	-0.12	0.33	0.01	59.12	-0.34	.732		0.18	0.47	0.02	73.55	0.37	.713		0.00	0.46	-0.02	69.80	0.01	.993	

Table A2
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Pretest parenting	0.02	0.09		100.08	0.26	.793		0.37	0.10		108.03	3.85	.000		0.25	0.10		102.78	2.53	.013	
Pretest self-reported household chaos	-0.15	0.31		98.91	-0.48	.632		-0.14	0.47		99.83	-0.31	.761		-0.31	0.45		101.28	-0.70	.485	
Age participant	-0.01	0.03		101.58	-0.36	.717		0.00	0.04		104.16	0.04	.970		0.01	0.04		104.85	0.35	.727	
Age child	-0.04	0.05		100.92	-0.67	.506		0.05	0.08		105.29	0.58	.561		0.03	0.08		105.82	0.38	.707	
Participant education	-0.02	0.10		104.90	-0.17	.867		0.18	0.15		106.57	1.20	.233		0.32	0.14		103.08	2.26	.026	
Number of children	-0.07	0.16		93.33	-0.47	.640		0.16	0.24		97.67	0.68	.499		0.27	0.23		95.01	1.17	.244	
Perceived effectiveness	0.21	0.11		88.57	1.81	.073		0.00	0.17		95.81	0.02	.986		-0.08	0.16		95.64	-0.51	.609	
Therapeutic alliance	-0.16	0.18		85.28	-0.87	.387		-0.21	0.27		93.05	-0.79	.431		0.19	0.25		96.99	0.74	.463	

Note. A negative change in self-reported household chaos indicates that self-reported household chaos decreased from pretest to posttest.

Table A3
Multiple regression analyses to predict posttest parenting by change in self-reported household chaos, interaction with self-regulation, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.06							0.19							0.18
Intercept	4.85	1.90		101.21	2.55	.012		1.82	2.74		102.44	0.66	.509		1.28	2.68		102.92	0.48	.635	
Change self-reported household chaos*	-0.03	0.30	-0.01	96.06	-0.10	.923		-0.50	0.46	-0.11	98.51	-1.10	.276		-0.41	0.44	-0.10	94.13	-0.94	.351	
Self-regulation	0.00	0.10	0.00	106.03	0.00	.997		0.00	0.16	0.00	94.34	-0.03	.977		-0.21	0.15	-0.13	102.84	-1.45	.151	
Pretest parenting	0.03	0.09		101.45	0.28	.784		0.37	0.10		108.91	3.85	.000		0.25	0.10		103.21	2.53	.013	
Pretest self-reported household chaos	-0.11	0.29		104.00	-0.38	.708		-0.11	0.45		104.13	-0.25	.800		-0.44	0.42		103.20	-1.03	.304	
Age participant	-0.01	0.02		103.83	-0.35	.730		0.00	0.04		105.68	0.12	.902		0.02	0.04		105.53	0.43	.666	
Age child	-0.03	0.05		103.86	-0.59	.557		0.05	0.08		106.28	0.56	.579		0.04	0.08		105.21	0.51	.610	
Participant education	-0.01	0.10		104.93	-0.12	.902		0.18	0.15		106.58	1.23	.220		0.34	0.14		103.18	2.42	.017	
Number of children	-0.09	0.14		101.17	-0.60	.552		0.13	0.22		103.56	0.58	.566		0.27	0.21		100.74	1.29	.201	

Table A3
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Perceived effectiveness	0.21	0.11		88.93	1.82	.073		0.02	0.17		96.11	0.12	.907		-0.08	0.16		96.95	-0.47	.639	
Therapeutic alliance	-0.15	0.18		86.62	-0.83	.409		-0.20	0.27		94.03	-0.75	.456		0.14	0.25		98.91	0.56	.577	
Step 2							0.12							0.20							0.19
Intercept	3.84	1.92		97.98	2.00	.048		1.74	2.80		100.28	0.62	.536		1.59	2.71		101.82	0.58	.560	
Change self-reported household chaos*	0.05	0.30	0.02	91.70	0.18	.857		-0.50	0.47	-0.11	96.33	-1.06	.291		-0.45	0.45	-0.11	92.19	-1.00	.318	
Self-regulation	0.00	0.10	0.00	100.27	-0.01	.994		0.00	0.16	0.00	93.99	-0.03	.976		-0.21	0.15	-0.13	103.23	-1.45	.149	
Change self-reported household chaos*Self-regulation	0.72	0.30	0.00	87.12	2.42	.018		0.08	0.46	0.00	92.01	0.16	.872		-0.34	0.42	-0.05	98.04	-0.80	.424	
Pretest parenting	0.06	0.09		99.07	0.68	.498		0.37	0.10		107.98	3.83	.000		0.25	0.10		101.91	2.57	.012	
Pretest self-reported household chaos	-0.05	0.28		101.48	-0.18	.861		-0.11	0.46		102.25	-0.24	.814		-0.47	0.43		102.26	-1.10	.273	

Table A3

Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Age participant	0.00	0.02		101.13	-0.03	.973		0.01	0.04		104.54	0.14	.887		0.01	0.04		103.69	0.35	.725	
Age child	-0.03	0.05		102.44	-0.50	.622		0.05	0.08		105.38	0.56	.576		0.04	0.08		104.26	0.50	.621	
Participant education	0.00	0.09		102.65	-0.06	.955		0.18	0.15		105.79	1.23	.222		0.34	0.14		102.13	2.41	.018	
Number of children	-0.05	0.14		99.02	-0.38	.703		0.13	0.22		102.89	0.59	.559		0.26	0.21		99.46	1.22	.227	
Perceived effectiveness	0.19	0.11		88.35	1.68	.096		0.02	0.17		95.46	0.11	.914		-0.07	0.16		95.62	-0.42	.677	
Therapeutic alliance	-0.08	0.18		82.83	-0.42	.676		-0.19	0.27		92.14	-0.71	.482		0.10	0.25		97.62	0.42	.677	

Note. A negative change in self-reported household chaos indicates that self-reported household chaos decreased from pretest to posttest.

Table A4
Multiple regression analyses to predict posttest parenting by change in clutter, interaction with SPS: ATQ-OS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.2							0.2
Intercept	4.35	1.76		101.15	2.47	.015		0.95	2.46		101.45	0.38	.701		-0.21	2.43		98.43	-0.09	.930	
Change in clutter	0.23	0.30	0.09	94.85	0.76	.448		0.56	0.44	0.13	102.52	1.26	.211		0.68	0.42	0.17	96.99	1.61	.110	
SPS: ATQ-OS	-0.03	0.10	-0.03	99.42	-0.31	.755		0.01	0.16	0.01	101.58	0.08	.937		0.08	0.14	0.05	103.92	0.54	.592	
Pretest parenting	0.03	0.09		101.80	0.37	.714		0.38	0.10		109.32	4.02	.000		0.26	0.10		103.51	2.70	.008	
Pretest clutter	0.08	0.26		106.06	0.33	.745		-0.16	0.39		108.51	-0.40	.687		-0.14	0.37		106.03	-0.38	.706	
Age participant	-0.01	0.03		103.21	-0.37	.715		0.00	0.04		104.42	0.09	.925		0.01	0.04		103.89	0.24	.813	
Age child	-0.02	0.05		103.36	-0.36	.718		0.06	0.08		106.00	0.70	.485		0.05	0.08		104.88	0.69	.493	
Participant education	-0.02	0.09		105.87	-0.16	.869		0.20	0.15		107.65	1.38	.172		0.32	0.14		102.17	2.32	.023	
Number of children	-0.10	0.14		99.66	-0.76	.448		0.11	0.20		103.89	0.53	.597		0.24	0.20		98.55	1.25	.215	
Perceived effectiveness	0.19	0.11		89.27	1.67	.098		0.01	0.17		95.33	0.08	.933		-0.11	0.16		94.86	-0.70	.487	
Therapeutic alliance	-0.12	0.18		87.66	-0.69	.494		-0.13	0.26		95.95	-0.48	.631		0.30	0.25		94.55	1.19	.238	
Step 2							0.07							0.2							0.2
Intercept	4.42	1.77		100.79	2.50	.014		0.95	2.48		100.83	0.38	.703		-0.44	2.48		97.85	-0.18	.861	

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Table A4
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Change in clutter	0.19	0.30	0.07	94.23	0.61	.544		0.56	0.46	0.13	100.60	1.22	.226		0.74	0.44	0.18	95.78	1.68	.096	
SPS: ATQ-OS	-0.04	0.10	-0.04	99.21	-0.36	.716		0.01	0.16	0.01	99.96	0.08	.940		0.08	0.15	0.05	102.18	0.56	.574	
Change in clutter*SPS: ATQ-OS	0.15	0.25	-0.02	102.48	0.60	.551		0.01	0.39	0.00	98.55	0.02	.980		-0.18	0.39	0.02	92.14	-0.46	.643	
Pretest parenting	0.04	0.09		100.56	0.40	.686		0.38	0.10		108.10	3.98	.000		0.27	0.10		102.54	2.72	.008	
Pretest clutter	0.07	0.26		105.34	0.27	.789		-0.16	0.40		107.24	-0.40	.687		-0.13	0.37		105.05	-0.34	.736	
Age participant	-0.01	0.03		102.17	-0.34	.734		0.00	0.04		103.42	0.09	.925		0.01	0.04		103.05	0.23	.817	
Age child	-0.02	0.05		103.00	-0.45	.656		0.06	0.08		104.79	0.69	.492		0.06	0.08		103.31	0.76	.452	
Participant education	-0.02	0.09		105.14	-0.18	.855		0.20	0.15		106.83	1.37	.175		0.32	0.14		100.92	2.30	.023	
Number of children	-0.11	0.14		98.68	-0.79	.434		0.11	0.21		103.04	0.53	.599		0.25	0.20		97.55	1.27	.206	
Perceived effectiveness	0.19	0.11		89.35	1.68	.096		0.02	0.17		94.57	0.09	.931		-0.11	0.16		94.15	-0.69	.491	
Therapeutic alliance	-0.12	0.18		88.40	-0.69	.493		-0.13	0.27		95.27	-0.48	.632		0.30	0.25		94.16	1.20	.234	

Note. A negative change in clutter indicates that clutter decreased from pretest to posttest.

Table A5
Multiple regression analyses to predict posttest parenting by change in clutter, interaction with SPS: NSS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.21							0.2
Intercept	4.41	1.80		99.47	2.45	.016		1.05	2.49		101.48	0.42	.673		-0.59	2.46		98.23	-0.24	.810	
Change in clutter	0.22	0.30	0.09	94.32	0.74	.460		0.55	0.44	0.13	102.75	1.23	.221		0.72	0.42	0.18	96.14	1.69	.094	
SPS: NSS	0.00	0.12	0.00	74.10	0.03	.977		0.05	0.17	0.03	84.64	0.30	.767		-0.14	0.16	-0.09	86.01	-0.90	.373	
Pretest parenting	0.03	0.09		101.24	0.32	.747		0.38	0.10		109.15	4.01	.000		0.26	0.10		101.98	2.75	.007	
Pretest clutter	0.08	0.26		106.36	0.32	.752		-0.15	0.39		108.36	-0.39	.696		-0.15	0.37		105.49	-0.40	.693	
Age participant	-0.01	0.03		102.39	-0.39	.696		0.00	0.04		104.17	0.06	.952		0.02	0.04		103.70	0.40	.687	
Age child	-0.02	0.05		102.92	-0.41	.684		0.06	0.08		105.74	0.70	.483		0.06	0.08		105.37	0.76	.447	
Participant education	-0.02	0.09		106.01	-0.17	.869		0.20	0.15		107.25	1.34	.185		0.33	0.14		102.65	2.38	.019	
Number of children	-0.10	0.14		96.57	-0.74	.463		0.12	0.21		101.80	0.58	.562		0.21	0.20		95.54	1.05	.298	

Table A5
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Perceived effectiveness	0.19	0.12		89.20	1.67	.099		0.00	0.17		95.55	0.03	.976		-0.09	0.16		94.93	-0.56	.574	
Therapeutic alliance	-0.12	0.18		87.17	-0.66	.513		-0.14	0.26		95.84	-0.52	.606		0.29	0.25		94.02	1.19	.239	
Step 2							0.08							0.21							0.2
Intercept	4.35	1.80		98.89	2.43	.017		1.10	2.51		99.34	0.44	.663		-0.61	2.48		97.01	-0.24	.807	
Change in clutter	0.27	0.30	0.11	93.71	0.90	.369		0.50	0.45	0.12	100.97	1.11	.269		0.72	0.43	0.18	95.24	1.68	.097	
SPS: NSS	0.02	0.12	0.02	74.64	0.18	.859		0.03	0.18	0.02	85.60	0.18	.855		-0.14	0.16	-0.09	88.81	-0.88	.383	
Change in clutter*SPS: NSS	0.34	0.29	0.01	87.14	1.17	.246		-0.34	0.46	0.01	82.78	-0.74	.463		0.05	0.43	-0.03	82.14	0.11	.909	
Pretest parenting	0.03	0.09		99.79	0.31	.757		0.38	0.10		108.06	3.97	.000		0.26	0.10		101.08	2.73	.007	
Pretest clutter	0.07	0.26		104.91	0.29	.773		-0.15	0.39		107.24	-0.37	.711		-0.15	0.37		104.74	-0.39	.695	

Table A5
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Age participant	-0.01	0.03		100.53	-0.43	.667		0.00	0.04		103.33	0.10	.923		0.01	0.04		102.36	0.40	.694	
Age child	-0.02	0.05		102.21	-0.34	.738		0.05	0.08		104.04	0.66	.511		0.06	0.08		104.35	0.76	.447	
Participant education	-0.02	0.09		105.19	-0.17	.869		0.20	0.15		106.52	1.34	.182		0.33	0.14		101.78	2.37	.020	
Number of children	-0.09	0.14		96.52	-0.62	.535		0.11	0.21		101.76	0.50	.615		0.22	0.20		95.49	1.06	.291	
Perceived effectiveness	0.19	0.12		88.69	1.67	.098		0.00	0.17		94.57	0.02	.980		-0.09	0.16		94.29	-0.57	.568	
Therapeutic alliance	-0.12	0.18		87.02	-0.69	.492		-0.13	0.26		96.01	-0.49	.624		0.30	0.25		92.73	1.19	.238	

Note. A negative change in clutter indicates that clutter decreased from pretest to posttest.

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Table A6
Multiple regression analyses to predict posttest parenting by change in clutter, interaction with self-regulation, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.20							0.20
Intercept	4.38	1.77		101.42	2.47	.015		1.00	2.48		101.78	0.40	.686		-0.59	2.45		97.62	-0.24	.812	
Change in clutter	0.22	0.30	0.09	94.50	0.76	.451		0.56	0.44	0.13	102.14	1.26	.210		0.66	0.42	0.16	96.56	1.55	.124	
Self-regulation	0.01	0.10	0.01	105.47	0.09	.925		0.02	0.16	0.01	93.51	0.14	.888		-0.17	0.14	-0.11	103.05	-1.18	.240	
Pretest parenting	0.03	0.09		101.20	0.33	.742		0.38	0.10		109.28	4.02	.000		0.26	0.10		102.85	2.75	.007	
Pretest clutter	0.08	0.26		106.07	0.31	.758		-0.16	0.39		108.26	-0.40	.690		-0.12	0.37		105.87	-0.32	.747	
Age participant	-0.01	0.03		103.31	-0.40	.687		0.00	0.04		104.96	0.08	.933		0.02	0.04		104.30	0.40	.687	
Age child	-0.02	0.05		103.58	-0.39	.695		0.06	0.08		105.78	0.69	.494		0.06	0.08		104.46	0.84	.401	
Participant education	-0.02	0.10		105.39	-0.16	.874		0.20	0.15		106.62	1.33	.186		0.34	0.14		101.86	2.42	.017	
Number of children	-0.10	0.14		100.29	-0.75	.456		0.11	0.21		103.48	0.55	.581		0.22	0.20		99.16	1.10	.275	
Perceived effectiveness	0.19	0.11		89.24	1.66	.100		0.01	0.17		94.97	0.07	.947		-0.10	0.16		95.37	-0.62	.533	
Therapeutic alliance	-0.11	0.18		88.12	-0.64	.526		-0.13	0.26		95.30	-0.48	.629		0.26	0.24		96.08	1.06	.293	
Step 2							0.07							0.21							0.22
Intercept	4.38	1.78		100.61	2.46	.016		1.00	2.49		100.79	0.40	.690		-0.67	2.44		96.66	-0.27	.785	

Table A6

Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Change in clutter	0.22	0.30	0.09	94.02	0.75	.455		0.56	0.44	0.13	101.41	1.26	.211		0.67	0.42	0.17	95.46	1.58	.117	
Self-regulation	0.00	0.10	0.00	104.85	0.04	.971		0.03	0.17	0.02	87.82	0.19	.850		-0.11	0.15	-0.07	103.60	-0.76	.448	
Change in clutter*Self-regulation	0.06	0.27	0.00	104.84	0.21	.837		-0.11	0.44	0.01	90.37	-0.26	.795		-0.57	0.38	-0.03	105.58	-1.50	.136	
Pretest parenting	0.03	0.09		100.41	0.33	.740		0.38	0.10		108.38	4.01	.000		0.28	0.10		102.14	2.93	.004	
Pretest clutter	0.08	0.26		105.10	0.29	.773		-0.15	0.40		107.31	-0.37	.711		-0.08	0.37		105.05	-0.23	.820	
Age participant	-0.01	0.03		102.16	-0.42	.673		0.00	0.04		104.15	0.12	.909		0.02	0.04		102.78	0.58	.565	
Age child	-0.02	0.05		102.69	-0.40	.688		0.06	0.08		104.61	0.70	.483		0.07	0.08		102.36	0.88	.381	
Participant education	-0.01	0.10		104.29	-0.13	.894		0.19	0.15		104.55	1.28	.204		0.31	0.14		100.90	2.23	.028	
Number of children	-0.10	0.14		99.41	-0.73	.467		0.11	0.21		102.74	0.53	.595		0.20	0.20		98.39	1.04	.300	
Perceived effectiveness	0.19	0.12		88.29	1.66	.100		0.01	0.17		93.87	0.05	.960		-0.11	0.16		94.20	-0.69	.494	
Therapeutic alliance	-0.11	0.18		87.73	-0.62	.540		-0.13	0.26		94.99	-0.50	.619		0.24	0.24		96.34	0.97	.335	

Note. A negative change in clutter indicates that clutter decreased from pretest to posttest.

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Table A7

Multiple regression analyses to predict posttest parenting by change in noise, interaction with SPS: ATQ-OS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.11							0.19							0.17
Intercept	3.60	1.87		102.28	1.93	.057		1.33	2.77		101.59	0.48	.634		0.51	2.73		99.78	0.19	.852	
Change in noise	0.04	0.02	0.30	84.41	1.80	.076		-0.01	0.03	-0.03	81.14	-0.16	.871		-0.02	0.03	-0.08	86.25	-0.52	.601	
SPS: ATQ-OS	-0.01	0.10	-0.01	95.60	-0.11	.911		-0.01	0.16	0.00	102.53	-0.04	.966		0.05	0.15	0.03	104.91	0.34	.734	
Pretest parenting	0.04	0.09		98.68	0.48	.632		0.37	0.10		107.50	3.75	.000		0.24	0.10		103.90	2.50	.014	
Pretest noise	0.02	0.02		92.25	0.82	.417		0.01	0.04		89.53	0.24	.814		0.01	0.03		88.86	0.17	.862	
Age participant	-0.01	0.02		102.27	-0.32	.752		0.01	0.04		105.12	0.15	.883		0.01	0.04		104.44	0.32	.752	
Age child	-0.01	0.05		103.59	-0.18	.861		0.03	0.08		105.36	0.36	.717		0.01	0.08		106.45	0.17	.865	
Participant education	-0.01	0.09		104.19	-0.11	.915		0.20	0.15		107.91	1.35	.179		0.32	0.14		104.00	2.28	.025	
Number of children	-0.13	0.14		93.92	-0.93	.356		0.06	0.22		99.12	0.25	.806		0.19	0.21		96.48	0.87	.386	
Perceived effectiveness	0.18	0.11		86.22	1.62	.108		0.04	0.17		96.20	0.26	.797		-0.07	0.16		95.01	-0.44	.665	
Therapeutic alliance	-0.19	0.18		83.86	-1.05	.297		-0.18	0.27		95.13	-0.65	.516		0.24	0.25		95.35	0.96	.339	
Step 2							0.11							0.20							0.18
Intercept	3.59	1.88		101.29	1.91	.059		1.38	2.77		100.74	0.50	.619		0.57	2.75		98.69	0.21	.836	
Change in noise	0.04	0.02	0.30	83.77	1.80	.075		0.00	0.04	-0.02	78.60	-0.12	.901		-0.02	0.03	-0.08	84.46	-0.51	.609	

Table A7
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
SPS: ATQ-OS	-0.01	0.10	-0.01	94.28	-0.12	.907		0.00	0.16	0.00	101.17	-0.02	.984		0.05	0.15	0.03	103.60	0.36	.722	
Change in noise*SPS: ATQ-OS	0.00	0.01	-0.10	81.38	0.39	.697		0.02	0.02	-0.02	96.78	1.06	.292		0.01	0.02	0.29	90.28	0.39	.697	
Pretest parenting	0.05	0.09		97.52	0.51	.610		0.38	0.10		105.94	3.80	.000		0.24	0.10		102.47	2.42	.017	
Pretest noise	0.02	0.02		91.45	0.79	.431		0.01	0.04		87.73	0.18	.859		0.00	0.03		87.56	0.15	.881	
Age participant	-0.01	0.02		100.63	-0.29	.774		0.01	0.04		104.35	0.21	.837		0.01	0.04		103.23	0.34	.736	
Age child	-0.01	0.05		102.84	-0.15	.881		0.03	0.08		104.80	0.39	.695		0.01	0.08		105.63	0.18	.855	
Participant education	-0.01	0.09		103.22	-0.13	.898		0.19	0.15		106.56	1.26	.211		0.32	0.14		103.38	2.25	.027	
Number of children	-0.13	0.15		92.51	-0.89	.375		0.07	0.23		96.53	0.31	.754		0.19	0.22		95.51	0.89	.375	
Perceived effectiveness	0.18	0.11		85.07	1.59	.115		0.04	0.17		94.93	0.21	.837		-0.07	0.16		94.14	-0.46	.649	
Therapeutic alliance	-0.19	0.18		82.69	-1.05	.298		-0.18	0.27		93.98	-0.66	.510		0.24	0.25		94.93	0.95	.346	

Note. A negative change in noise indicates that noise decreased from pretest to posttest.

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Table A8

Multiple regression analyses to predict posttest parenting by change in noise, interaction with SPS: NSS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.11							0.19							0.18
Intercept	3.65	1.90		100.86	1.92	.058		1.53	2.80		101.88	0.55	.586		0.19	2.76		99.73	0.07	.945	
Change in noise	0.04	0.02	0.30	83.56	1.78	.078		-0.01	0.03	-0.03	81.13	-0.19	.848		-0.02	0.03	-0.08	86.28	-0.48	.630	
SPS: NSS	0.00	0.12	0.00	72.79	0.00	.998		0.08	0.17	0.05	86.76	0.49	.625		-0.10	0.16	-0.06	88.80	-0.62	.534	
Pretest parenting	0.04	0.09		98.14	0.46	.648		0.37	0.10		107.19	3.75	.000		0.25	0.10		103.27	2.53	.013	
Pretest noise	0.02	0.02		91.81	0.81	.420		0.01	0.04		89.69	0.20	.838		0.01	0.03		89.66	0.24	.811	
Age participant	-0.01	0.02		101.21	-0.32	.748		0.00	0.04		104.83	0.08	.938		0.02	0.04		104.46	0.43	.667	
Age child	-0.01	0.05		103.12	-0.21	.836		0.03	0.08		105.13	0.36	.719		0.02	0.08		106.50	0.21	.835	
Participant education	-0.01	0.09		104.45	-0.12	.907		0.19	0.15		107.44	1.30	.196		0.32	0.14		104.38	2.32	.022	
Number of children	-0.13	0.15		89.70	-0.88	.379		0.08	0.23		97.13	0.35	.727		0.16	0.22		94.22	0.71	.479	
Perceived effectiveness	0.18	0.11		86.40	1.61	.110		0.03	0.17		96.52	0.17	.865		-0.05	0.16		94.88	-0.33	.740	
Therapeutic alliance	-0.18	0.17		84.13	-1.06	.293		-0.18	0.26		95.03	-0.67	.504		0.24	0.25		96.12	0.95	.342	
Step 2							0.11							0.19							0.18

Table A8
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Intercept	3.64	1.91		100.06	1.91	.059		1.54	2.82		100.97	0.55	.586		0.30	2.78		98.03	0.11	.915	
Change in noise	0.04	0.02	0.30	82.19	1.78	.079		-0.01	0.03	-0.03	81.63	-0.18	.854		-0.01	0.03	-0.07	87.35	-0.44	.657	
SPS: NSS	0.00	0.12	0.00	72.95	0.01	.993		0.09	0.17	0.05	86.91	0.50	.619		-0.09	0.16	-0.06	86.82	-0.54	.589	
Change in noise*SPS: NSS	0.00	0.01	0.01	71.75	0.06	.948		0.00	0.02	0.42	83.62	0.08	.933		0.01	0.02	-0.46	69.49	0.52	.606	
Pretest parenting	0.04	0.09		96.42	0.47	.640		0.37	0.10		106.34	3.66	.000		0.24	0.10		101.60	2.41	.018	
Pretest noise	0.02	0.02		90.51	0.81	.422		0.01	0.04		88.44	0.20	.841		0.01	0.03		88.70	0.20	.839	
Age participant	-0.01	0.02		99.96	-0.32	.750		0.00	0.04		103.78	0.06	.949		0.01	0.04		103.39	0.36	.722	
Age child	-0.01	0.05		101.60	-0.20	.841		0.03	0.08		103.67	0.36	.717		0.02	0.08		105.24	0.25	.802	
Participant education	-0.01	0.09		103.28	-0.12	.906		0.19	0.15		106.37	1.30	.198		0.32	0.14		103.06	2.29	.024	
Number of children	-0.13	0.15		88.30	-0.86	.391		0.08	0.24		94.41	0.35	.727		0.18	0.23		91.64	0.78	.440	
Perceived effectiveness	0.18	0.12		85.62	1.61	.111		0.03	0.17		95.68	0.17	.863		-0.06	0.16		93.52	-0.34	.738	
Therapeutic alliance	-0.18	0.18		83.80	-1.06	.294		-0.18	0.27		93.70	-0.66	.512		0.24	0.25		94.67	0.96	.337	

Note. A negative change in noise indicates that noise decreased from pretest to posttest.

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Table A9
Multiple regression analyses to predict posttest parenting by change in noise, interaction with self-regulation, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.10							0.19							0.19
Intercept	3.66	1.88		102.38	1.94	.055		1.30	2.80		101.36	0.46	.643		-0.02	2.73		99.17	-0.01	.995	
Change in noise	0.04	0.02	0.30	84.22	1.80	.076		-0.01	0.03	-0.03	81.53	-0.16	.870		-0.02	0.03	-0.09	84.48	-0.58	.565	
Self-regulation	0.02	0.10	0.02	104.85	0.17	.865		-0.01	0.16	0.00	92.68	-0.04	.969		-0.21	0.15	-0.13	102.60	-1.43	.157	
Pretest parenting	0.04	0.09		97.85	0.46	.646		0.37	0.10		107.39	3.74	.000		0.24	0.10		103.51	2.52	.013	
Pretest noise	0.02	0.02		92.42	0.81	.420		0.01	0.04		89.54	0.23	.815		0.01	0.03		86.86	0.20	.838	
Age participant	-0.01	0.02		102.59	-0.35	.729		0.01	0.04		105.62	0.15	.881		0.02	0.04		104.62	0.50	.617	
Age child	-0.01	0.05		103.38	-0.20	.840		0.03	0.08		105.16	0.37	.712		0.03	0.08		105.39	0.35	.726	
Participant education	-0.01	0.09		103.67	-0.12	.903		0.20	0.15		106.76	1.34	.183		0.34	0.14		103.45	2.44	.016	
Number of children	-0.13	0.15		94.56	-0.90	.373		0.06	0.23		98.88	0.24	.807		0.15	0.21		96.71	0.69	.491	
Perceived effectiveness	0.18	0.11		86.27	1.60	.113		0.04	0.17		95.50	0.26	.800		-0.05	0.16		95.48	-0.33	.741	
Therapeutic alliance	-0.18	0.17		84.70	-1.04	.302		-0.17	0.26		94.53	-0.65	.518		0.21	0.25		96.58	0.85	.396	
Step 2							0.12							0.19							0.21
Intercept	2.94	1.98		98.30	1.49	.140		1.04	2.92		97.16	0.36	.721		0.68	2.77		97.65	0.25	.806	
Change in noise	0.04	0.02	0.32	82.53	1.93	.057		0.00	0.03	-0.02	81.09	-0.14	.893		-0.02	0.03	-0.11	82.98	-0.69	.491	

Table A9
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Self-regulation	-0.01	0.10	-0.01	101.79	-0.13	.898		-0.02	0.18	-0.01	84.46	-0.14	.891		-0.16	0.15	-0.10	101.15	-1.06	.291	
Change in noise*Self-regulation	0.02	0.01	-0.12	88.57	1.26	.212		0.01	0.02	-0.13	75.86	0.37	.715		-0.02	0.02	-0.93	97.69	-1.43	.156	
Pretest parenting	0.07	0.10		95.29	0.73	.467		0.37	0.10		106.57	3.76	.000		0.26	0.10		101.60	2.67	.009	
Pretest noise	0.02	0.02		90.75	1.03	.305		0.01	0.04		87.31	0.29	.770		0.00	0.04		85.34	-0.05	.961	
Age participant	0.00	0.03		99.65	0.02	.980		0.01	0.04		101.05	0.24	.814		0.01	0.04		101.22	0.15	.880	
Age child	-0.01	0.05		102.04	-0.15	.884		0.03	0.08		104.39	0.37	.714		0.03	0.08		104.43	0.35	.727	
Participant education	0.01	0.10		100.88	0.08	.936		0.21	0.15		104.81	1.37	.175		0.31	0.14		101.56	2.22	.029	
Number of children	-0.15	0.15		93.17	-1.03	.307		0.05	0.23		97.32	0.21	.836		0.18	0.22		95.24	0.86	.392	
Perceived effectiveness	0.18	0.11		84.54	1.59	.115		0.05	0.17		94.69	0.27	.789		-0.06	0.16		93.94	-0.35	.724	
Therapeutic alliance	-0.20	0.18		81.79	-1.13	.262		-0.18	0.27		93.25	-0.67	.506		0.24	0.25		94.01	0.97	.334	

Note. A negative change in noise indicates that noise decreased from pretest to posttest.

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Table A10

Multiple regression analyses to predict posttest parenting by change in family routines, interaction with SPS: ATQ-OS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.19							0.17
Intercept	4.57	1.72		102.53	2.65	.009		1.68	2.44		101.91	0.69	.494		0.55	2.42		101.64	0.23	.819	
Change in family routines	0.00	0.18	0.00	86.36	-0.01	.990		-0.06	0.27	-0.03	91.77	-0.24	.814		-0.09	0.26	-0.04	85.93	-0.34	.737	
SPS: ATQ-OS	-0.03	0.10	-0.03	98.81	-0.27	.790		0.02	0.16	0.01	102.81	0.13	.895		0.08	0.15	0.05	105.65	0.58	.566	
Pretest parenting	0.03	0.10		99.78	0.33	.740		0.38	0.10		108.14	3.90	.000		0.26	0.10		103.65	2.72	.008	
Pretest family routines	-0.10	0.23		88.16	-0.46	.646		-0.33	0.34		95.47	-0.96	.339		-0.24	0.33		92.20	-0.74	.462	
Age participant	-0.01	0.02		103.24	-0.28	.784		0.01	0.04		104.71	0.15	.882		0.01	0.04		104.97	0.30	.763	
Age child	-0.03	0.05		105.21	-0.56	.580		0.03	0.08		105.88	0.41	.685		0.02	0.08		106.88	0.30	.764	
Participant education	-0.02	0.09		105.65	-0.21	.834		0.18	0.15		107.07	1.24	.218		0.31	0.14		103.45	2.18	.032	
Number of children	-0.10	0.13		100.16	-0.78	.434		0.08	0.20		104.13	0.40	.690		0.22	0.20		100.18	1.09	.276	
Perceived effectiveness	0.21	0.11		89.27	1.82	.071		0.04	0.17		96.99	0.23	.820		-0.09	0.16		95.72	-0.54	.590	
Therapeutic alliance	-0.15	0.18		87.31	-0.84	.401		-0.18	0.26		96.67	-0.68	.496		0.24	0.25		95.23	0.96	.338	
Step 2							0.08							0.19							0.17

Table A10
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Intercept	4.54	1.72		101.63	2.64	.010		1.67	2.46		101.05	0.68	.499		0.55	2.43		100.84	0.23	.821	
Change in family routines	0.01	0.18	0.00	85.33	0.04	.969		-0.06	0.27	-0.03	91.08	-0.23	.817		-0.09	0.26	-0.04	84.69	-0.34	.733	
SPS: ATQ-OS	-0.02	0.10	-0.02	97.87	-0.19	.852		0.02	0.16	0.01	101.97	0.13	.895		0.08	0.15	0.05	104.38	0.56	.575	
Change in family routines*SPS: ATQ-OS	0.12	0.14	-0.02	84.50	0.91	.367		0.00	0.20	0.01	96.05	-0.02	.986		-0.03	0.20	0.04	92.53	-0.15	.880	
Pretest parenting	0.04	0.10		98.90	0.41	.683		0.38	0.10		107.10	3.88	.000		0.26	0.10		102.89	2.69	.008	
Pretest family routines	-0.09	0.23		86.48	-0.37	.711		-0.33	0.34		94.73	-0.96	.342		-0.25	0.33		90.68	-0.75	.458	
Age participant	-0.01	0.02		102.27	-0.35	.726		0.01	0.04		103.74	0.15	.882		0.01	0.04		103.87	0.32	.752	
Age child	-0.03	0.05		103.15	-0.54	.591		0.03	0.08		104.91	0.41	.685		0.02	0.08		105.86	0.30	.766	
Participant education	-0.01	0.09		104.70	-0.14	.886		0.18	0.15		106.16	1.23	.221		0.31	0.14		102.51	2.16	.033	
Number of children	-0.09	0.13		99.39	-0.70	.487		0.08	0.21		102.98	0.39	.697		0.21	0.20		99.19	1.07	.288	
Perceived effectiveness	0.21	0.11		87.82	1.85	.067		0.04	0.17		96.08	0.23	.820		-0.09	0.16		95.13	-0.55	.586	
Therapeutic alliance	-0.15	0.18		85.76	-0.88	.383		-0.18	0.26		95.97	-0.67	.502		0.24	0.25		94.16	0.97	.336	

Note. A negative change in family routines indicates that family routines decreased from pretest to posttest.

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Table A11
Multiple regression analyses to predict posttest parenting by change in family routines, interaction with SPS: NSS, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.20							0.17
Intercept	4.64	1.75		101.22	2.65	.009		1.85	2.47		102.07	0.75	.456		0.30	2.44		102.38	0.12	.901	
Change in family routines	0.00	0.18	0.00	85.96	-0.02	.987		-0.06	0.27	-0.02	92.14	-0.21	.837		-0.09	0.26	-0.04	86.59	-0.34	.738	
SPS: NSS	0.01	0.12	0.01	74.16	0.10	.919		0.08	0.17	0.05	86.37	0.48	.633		-0.11	0.16	-0.07	87.21	-0.66	.508	
Pretest parenting	0.03	0.09		99.34	0.29	.769		0.38	0.10		107.90	3.91	.000		0.27	0.10		103.00	2.76	.007	
Pretest family routines	-0.11	0.23		88.06	-0.47	.641		-0.32	0.34		95.79	-0.95	.346		-0.23	0.33		92.32	-0.71	.477	
Age participant	-0.01	0.03		102.56	-0.31	.757		0.00	0.04		104.45	0.10	.924		0.02	0.04		105.08	0.44	.660	
Age child	-0.03	0.05		104.84	-0.60	.550		0.03	0.08		105.53	0.41	.681		0.03	0.08		107.15	0.35	.727	
Participant education	-0.02	0.10		105.69	-0.22	.824		0.17	0.15		106.48	1.17	.243		0.31	0.14		103.73	2.20	.030	
Number of children	-0.10	0.14		96.58	-0.74	.463		0.10	0.21		101.85	0.50	.619		0.19	0.20		97.36	0.94	.349	
Perceived effectiveness	0.21	0.11		89.32	1.80	.075		0.02	0.17		97.03	0.14	.887		-0.07	0.16		95.52	-0.44	.661	
Therapeutic alliance	-0.14	0.17		87.16	-0.83	.411		-0.19	0.26		96.39	-0.74	.464		0.23	0.25		96.12	0.93	.353	
Step 2							0.08							0.20							0.18

Table A11
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t*/*F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t*/*F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t*/*F*	*p*	Adj. R^2
Intercept	4.68	1.78		98.19	2.63	.010		1.86	2.48		101.38	0.75	.454		0.20	2.45		101.02	0.08	.936	
Change in family routines	-0.01	0.18	-0.01	82.66	-0.05	.957		-0.05	0.27	-0.02	92.03	-0.18	.858		-0.12	0.26	-0.06	84.80	-0.45	.657	
SPS: NSS	0.01	0.12	0.01	72.89	0.10	.923		0.08	0.17	0.05	85.60	0.49	.628		-0.10	0.16	-0.06	87.42	-0.65	.520	
Change in family routines*SPS: NSS	-0.02	0.18	0.01	51.70	-0.09	.928		0.03	0.23	0.04	80.54	0.13	.895		-0.16	0.23	-0.05	70.02	-0.70	.489	
Pretest parenting	0.02	0.10		99.00	0.26	.792		0.38	0.10		107.16	3.89	.000		0.27	0.10		101.64	2.79	.006	
Pretest family routines	-0.09	0.23		85.01	-0.40	.690		-0.31	0.35		92.30	-0.90	.373		-0.25	0.33		89.14	-0.74	.459	
Age participant	-0.01	0.03		101.89	-0.29	.771		0.00	0.04		103.51	0.09	.925		0.02	0.04		103.88	0.47	.636	
Age child	-0.03	0.05		102.41	-0.61	.541		0.03	0.08		104.93	0.40	.690		0.03	0.08		105.85	0.38	.705	
Participant education	-0.02	0.10		104.40	-0.23	.818		0.18	0.15		105.61	1.18	.241		0.30	0.14		102.83	2.16	.033	
Number of children	-0.10	0.14		93.02	-0.71	.478		0.10	0.21		99.94	0.47	.640		0.21	0.20		95.86	1.00	.317	
Perceived effectiveness	0.21	0.12		86.17	1.81	.073		0.02	0.17		95.25	0.12	.901		-0.05	0.17		93.22	-0.33	.744	
Therapeutic alliance	-0.15	0.18		84.23	-0.86	.394		-0.19	0.26		95.27	-0.72	.470		0.22	0.25		95.68	0.89	.378	

Note. A negative change in family routines indicates that family routines decreased from pretest to posttest.

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Table A12

Multiple regression analyses to predict posttest parenting by change in family routines, interaction with self-regulation, and covariates.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Step 1							0.07							0.19							0.18
Intercept	4.60	1.74		102.72	2.64	.010		1.69	2.47		102.10	0.68	.495		0.08	2.45		100.00	0.03	.976	
Change in family routines	0.00	0.18	0.00	86.26	-0.01	.991		-0.06	0.27	-0.03	91.72	-0.22	.822		-0.12	0.26	-0.05	85.92	-0.45	.655	
Self-regulation	0.01	0.10	0.01	105.80	0.09	.927		0.01	0.17	0.00	92.18	0.04	.967		-0.20	0.15	-0.12	101.58	-1.34	.184	
Pretest parenting	0.03	0.10		99.10	0.30	.765		0.38	0.10		108.01	3.90	.000		0.27	0.10		103.10	2.76	.007	
Pretest family routines	-0.11	0.23		88.53	-0.48	.636		-0.32	0.34		95.83	-0.95	.342		-0.23	0.32		91.95	-0.71	.479	
Age participant	-0.01	0.02		103.47	-0.31	.758		0.01	0.04		105.37	0.16	.876		0.02	0.04		105.44	0.49	.628	
Age child	-0.03	0.05		105.16	-0.58	.562		0.03	0.08		105.51	0.41	.683		0.04	0.08		105.49	0.50	.616	
Participant education	-0.02	0.10		105.10	-0.21	.836		0.18	0.15		105.69	1.20	.232		0.33	0.14		102.83	2.31	.023	
Number of children	-0.10	0.14		100.86	-0.77	.441		0.08	0.21		104.04	0.41	.681		0.18	0.20		100.81	0.94	.348	
Perceived effectiveness	0.21	0.11		89.23	1.82	.072		0.04	0.17		96.71	0.22	.827		-0.08	0.16		96.46	-0.48	.632	
Therapeutic alliance	-0.14	0.17		88.01	-0.80	.423		-0.18	0.26		96.17	-0.70	.483		0.20	0.24		96.66	0.83	.410	
Step 2							0.07							0.20							0.19
Intercept	4.56	1.79		99.53	2.55	.012		1.37	2.53		99.53	0.54	.589		-0.23	2.51		96.31	-0.09	.927	

Table A12
Continued.

	Harsh discipline							Sensitivity – free play							Sensitivity – naturalistic						
	B	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2	*B*	*SD*	β	Df	*t/F*	*p*	Adj. R^2
Change in family routines	0.00	0.18	0.00	82.82	-0.01	.991		-0.04	0.28	-0.02	88.19	-0.13	.895		-0.09	0.26	-0.04	86.28	-0.35	.728	
Self-regulation	0.01	0.10	0.01	103.40	0.10	.924		0.02	0.17	0.01	88.29	0.11	.914		-0.18	0.15	-0.11	102.64	-1.20	.233	
Change in family routines*Self-regulation	-0.01	0.18	0.01	66.81	-0.06	.952		-0.18	0.29	0.01	65.12	-0.61	.544		-0.18	0.25	-0.08	80.00	-0.74	.463	
Pretest parenting	0.03	0.10		97.89	0.30	.763		0.38	0.10		106.34	3.89	.000		0.26	0.10		102.52	2.74	.007	
Pretest family routines	-0.11	0.23		88.90	-0.48	.629		-0.33	0.34		94.22	-0.96	.338		-0.23	0.32		90.92	-0.72	.475	
Age participant	-0.01	0.03		99.94	-0.28	.780		0.01	0.04		102.98	0.27	.790		0.02	0.04		102.86	0.60	.551	
Age child	-0.03	0.05		103.85	-0.58	.562		0.04	0.08		104.37	0.46	.647		0.04	0.08		103.67	0.56	.577	
Participant education	-0.02	0.10		104.02	-0.20	.846		0.18	0.15		104.75	1.20	.232		0.33	0.14		101.88	2.32	.022	
Number of children	-0.10	0.14		100.39	-0.76	.447		0.08	0.21		102.83	0.41	.685		0.18	0.20		99.73	0.92	.361	
Perceived effectiveness	0.21	0.11		88.64	1.80	.075		0.03	0.17		95.10	0.16	.870		-0.09	0.16		95.52	-0.55	.587	
Therapeutic alliance	-0.14	0.17		87.70	-0.79	.434		-0.16	0.26		93.79	-0.61	.541		0.22	0.25		94.15	0.90	.372	

Note. A negative change in family routines indicates that family routines decreased from pretest to posttest.

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Appendices

Nederlandse samenvatting (Summary in Dutch)

In bijna elk gezin komen weleens situaties voor zoals het niet kunnen vinden van sleutels, moeten haasten voor een afspraak, of proberen op te ruimen terwijl de kinderen alweer de volgende bak speelgoed opentrekken. Dit zijn voorbeelden van wat we verstaan onder chaos in de thuisomgeving. Meer in het algemeen wordt chaos in de thuisomgeving gedefinieerd als een gebrek aan gezins- en weekroutines, en een hoge mate van rommel, geluid en drukte. Al sinds de jaren '80 is er interesse in de vraag of chaos samenhangt met de ontwikkeling van het kind en met opvoeden. Wat telkens in onderzoek wordt aangetoond is dat chaos in de thuisomgeving samenhangt met een minder gunstige kindontwikkeling. Kinderen die opgroeien in een meer chaotische thuisomgeving ervaren gemiddeld een lager welzijn, hebben gemiddeld een lager IQ, lopen meer achter in de taalontwikkeling, en laten meer gedragsproblemen zien (zoals agressief gedrag). Een mogelijke verklaring hiervoor ligt in de opvoeding van deze kinderen: chaos hangt namelijk samen met een lagere kwaliteit opvoeden. Ouders in meer chaotische huishoudens laten meer hardhandigheid (zoals een tik geven of een arm hard beetpakken) en verbale en non-verbale overreactiviteit zien (bijvoorbeeld schreeuwen). Ten slotte vertonen zij ook minder warmte en blijdschap in reactie op het kind en minder sensitiviteit (het signaleren en juist interpreteren van een signaal van het kind en er vervolgens tijdig en adequaat op reageren).

Nog onbekend is of er een oorzakelijk verband is tussen chaos in de en minder positief en meer negatief opvoeden, omdat de hiervoor genoemde onderzoeken geen experimentele studies zijn. Het is bijvoorbeeld ook mogelijk dat ouders die een lagere kwaliteit opvoeden laten zien tegelijkertijd ook minder goed in staat zijn om hun huishouden op orde te houden, en dat er een derde factor is die zowel chaos als opvoeden beïnvloedt. Om de opvoeding te kunnen te verbeteren en een minder gunstige kindontwikkeling te voorkomen, is het noodzakelijk om te weten of er een oorzakelijk verband is tussen chaos in de thuisomgeving en opvoeden. Dit proefschrift beoogt deze vraag te beantwoorden.

Naast de vraag of chaos daadwerkelijk leidt tot minder goed opvoeden, is het de vraag of dit effect voor iedereen gelijk is. Een aantal persoonlijkheidskenmerken versterkt mogelijk het effect van chaos op opvoeden. In dit proefschrift werd onderzocht of het effect van chaos op opvoeden sterker is voor mensen die meer gevoelig zijn voor stimuli (prikkels uit de omgeving, zoals licht of geluid). Omdat een meer chaotische omgeving gepaard gaat met meer en/of intensere stimuli, laten de mensen die hier meer gevoelig voor zijn mogelijk een sterker effect van chaos op opvoeden zien. We onderzochten dit ook voor mensen die een minder sterke zelfregulatie hebben. Zelfregulatie wordt gezien als de cognitieve functies die horen bij het reguleren van aandacht en gedrag. Voor mensen met een minder sterke zelfregulatie kan het lastiger zijn om hun gedrag te activeren of inhiberen als hun omgeving zeer afleidend is, zoals het geval kan zijn in een meer chaotische omgeving. Deze omgeving vergt meer van hun zelfregulatie, waardoor hun opvoedgedrag minder gereguleerd kan worden. Ten slotte onderzochten we of het effect van chaos op opvoeden sterker is voor ouders met een hogere mate van impulsiviteit. Impulsiviteit, een onderdeel van temperament, is gerelateerd aan zelfregulatie. Voor ouders met een hogere mate van impulsiviteit kan het lastiger zijn om hun neiging om snel te reageren te onderdrukken, en daarmee lastiger om hun opvoedgedrag te reguleren, in een afleidende omgeving.

In Hoofdstuk 2, 3 en 4 werd onderzocht of chaos in de thuisomgeving daadwerkelijk een causaal effect heeft op opvoeden. In Hoofdstuk 2 werd dit onderzocht middels een experimentele labstudie, waarbij een chaotische en een neutrale labconditie ("huiskamers") werden gecreëerd en MBO- en HBO-studenten voor een vooraf ingestelde babypop zorgden. Dit onderzoek liet zien dat in de chaotische conditie na verloop van tijd het zorgen voor de pop minder sensitief was in de chaotische labconditie dan in de neutrale labconditie. Daarmee werd bewijs gevonden voor een causaal effect van chaos op opvoeden. In Hoofdstuk 3 werd geen bewijs gevonden voor een verschil in hoe hardhandig en overreactief er werd omgegaan met de babypop tussen de condities. Mogelijk kwam dit doordat de procedure minder geschikt was voor het ontlokken van hardhandig en overreactief gedrag. In Hoofdstuk 4 werd middels een *randomized controlled trial* (RCT) onderzocht of ouders die een interventie kregen om chaos te verlagen een verbetering in opvoeden lieten zien in vergelijking met ouders die een controle-interventie kregen. Voor en na de (controle-)interventie werden chaos in de thuisomgeving en opvoeden gemeten met vragenlijsten en observaties van ouder en kind. Al werd er geen effect van de interventie gevonden op de gemeten chaos, de interventiegroep liet wel een afname in hardhandig disciplineren zien. In sensitiviteit werd geen verschil gevonden. Mogelijk waren de instrumenten waarmee chaos werd gemeten niet goed genoeg in het meten van kleine verschillen. Het vinden van een effect op hardhandig disciplineren en niet op sensitiviteit doet vermoeden dat chaos in de thuisomgeving met name effect heeft op opvoeden in situaties die voor ouders lastig zijn: tijdens de observatie van hardhandig disciplineren moesten ouders zorgen dat hun kind niet speelde met heel aantrekkelijk speelgoed, terwijl de observatie van sensitiviteit bestond uit spelen. Ook in de labstudie was sprake van een situatie die lastig was: de babypop was zodanig ingesteld dat deze niet stopte met huilen, wat de respondent ook deed. Op basis van deze onderzoeken concluderen wij daarom dat chaos in de thuisomgeving een causaal effect heeft op opvoeden in opvoedsituaties die al lastig zijn. Het effect van chaos op opvoeden was klein, terwijl in correlationele studies een sterker verband werd gevonden. Dit kan betekenen dat naast chaos in de thuisomgeving andere factoren ook een causaal effect hebben op opvoeden. Een volgende stap in onderzoek naar chaos en opvoeden is onderzoeken welk mechanisme dit effect verklaart. Mogelijk zorgt chaos voor een toename in stress of negatieve emoties, of een afname in zelfregulatie of vertrouwen in het eigen kunnen als ouder, waardoor ouders lagere kwaliteit opvoedgedrag laten zien.

In Hoofdstuk 2 en 5 werd onderzocht of het effect van chaos op opvoeden sterker is voor mensen die meer gevoelig zijn voor prikkels. In Hoofdstuk 2 werd gevonden dat mensen die gevoeliger waren voor prikkels na verloop van tijd in de chaotische labconditie een sterkere afname van sensitiviteit voor de babypop lieten zien dan mensen die minder gevoelig waren voor prikkels. Dit werd gevonden voor een specifieke vorm van gevoeligheid voor prikkels, namelijk hoe snel iemand prikkels opmerkt. Mensen die hier gevoeliger voor zijn nemen de grotere hoeveelheid prikkels in de chaotische labconditie mogelijk meer waar, waardoor chaos een groter effect had op hun opvoeden dan op het opvoeden van mensen die minder snel prikkels opmerken. Er werd geen verschil gevonden voor hoeveel last iemand heeft van prikkels. In Hoofdstuk 5 werd geen verschil gevonden in het effect van de chaosinterventie op opvoeden voor gevoeligheid voor prikkels. Dit komt mogelijk doordat in dit onderzoek niet specifiek werd gekeken naar hoe snel iemand prikkels opmerkt, maar naar gevoeligheid voor prikkels in zijn geheel. Een andere verklaring is dat het verschil in chaos te klein was voor gevoeligheid voor prikkels om een verschil te maken. Gevoeligheid voor prikkels is wellicht wel relevant bij grotere veranderingen in chaos in de thuisomgeving, zoals bij verhuizingen of een nieuw gezinslid, of bij hogere niveaus van chaos dan in dit onderzoek aanwezig waren in gezinnen. Er is op basis van Hoofdstuk 2 en 5 geen eenduidig antwoord te geven op de vraag of het effect van chaos op opvoeden sterker is voor mensen die meer gevoelig zijn voor prikkels. Een mogelijkheid voor toekomstig onderzoek is onderzoeken of het effect van chaos op opvoeden sterker is voor ouders met meer gevoeligheid voor prikkels in gezinnen waar meer chaos is.

In Hoofdstuk 3 en 5 werd onderzocht of chaos een sterker effect had op opvoeden voor ouders met minder sterke zelfregulatie of een hogere mate van impulsiviteit. In Hoofdstuk 3 werd dit niet gevonden voor zowel zelfregulatie als impulsiviteit. Een verklaring voor het niet vinden van moderatie door impulsiviteit is dat impulsiviteit met name van belang kan zijn voor omgang met anderen (zoals opvoeden) maar niet voor omgang met de omgeving (zoals een chaotische thuisomgeving). Eerder onderzoek dat moderatie door impulsiviteit vond, keek bijvoorbeeld naar moeilijke omgangssituaties met anderen terwijl ons onderzoek keek naar een moeilijke omgeving. Daarnaast is het mogelijk dat impulsiviteit pas een moderator is voor chaos in de thuisomgeving in een moeilijkere opvoedsituatie dan in dit onderzoek werd gecreëerd. Ten slotte is impulsiviteit wellicht alleen bij bepaalde ouders een moderator voor het effect van chaos op opvoeden: in eerder onderzoek werd extravertheid en neuroticisme gecombineerd. Mogelijk heeft chaos een sterker effect op opvoeden bij mensen die zowel meer impulsief als meer neurotisch zijn.

Moderatie door zelfregulatie wordt mogelijk pas zichtbaar bij langere blootstelling aan een chaotische omgeving, zoals in onderzoeken waar wel moderatie door zelfregulatie werd gevonden. Daarnaast is er ook onderzoek dat laat zien dat chaos een effect heeft op opvoeden via zelfregulatie. Beide rollen voor zelfregulatie moeten onderzocht worden, zodat duidelijk wordt of chaos een sterker effect heeft op opvoeden via zelfregulatie of bij mensen met minder sterke zelfregulatie. Een andere mogelijkheid is dat zelfregulatie met name van belang is voor hoe men reageert op signalen van een kind, en niet voor hoe men omgaat met de omgeving: voor sensitiviteit met de babypop werd geen moderatie door zelfregulatie gevonden (Hoofdstuk 3), terwijl dit wel werd gevonden voor hardhandig disciplineren van het kind (Hoofdstuk 5). In Hoofdstuk 5 zagen we dat wanneer werd gekeken naar het verschil in zelf gerapporteerde chaos tussen de voor- en nameting, een afname in chaos gerelateerd was aan minder hardhandigheid bij ouders met meer zelfregulatie, en juist aan meer hardhandigheid bij ouders met minder zelfregulatie. Een belangrijke limitatie is dat we bij deze verkenningen geen onderscheid hebben gemaakt tussen de interventie- en controlegroep en bovendien vonden we dit alleen bij één van de vijf meetinstrumenten van chaos. Ouders met minder zelfregulatie hebben wellicht langer nodig om te wennen aan gewoonten die horen bij het verlagen van chaos in de thuisomgeving (zoals vaker opruimen of de avond van tevoren alvast het ontbijt klaarzetten voor de dag erna), wat hun zelfregulatie belast. Die belasting van zelfregulatie laat mogelijk weinig ruimte over om ook hun opvoedgedrag te reguleren, waardoor deze ouders juist een toename in hardhandigheid lieten zien. Voor de praktijk betekent dit dat ouders met lage zelfregulatie mogelijk gebaat zijn bij het meer geleidelijk aanbieden van interventies om te voorkomen dat opvoedgedrag verslechtert. Een eenduidig antwoord is niet te geven op de vraag of het negatieve effect van chaos op opvoeden sterker is bij ouders met minder zelfregulatie. Onze onderzoeken laten deels geen moderatie zien en deels laten de resultaten zien dat een afname in chaos in deze groep juist gerelateerd is aan minder goed opvoeden.

Op basis van dit proefschrift zijn meerdere aanbevelingen te formuleren. Toekomstige studies zouden moeten onderzoeken of chaos inderdaad met name in lastige opvoedsituaties leidt tot minder positief en meer negatief opvoeden. Daarnaast is het ook belangrijk om deze interpretatie te toetsen in een steekproef waar meer opvoedproblemen aanwezig zijn of waar meer chaos is dan in de huidige steekproef van Hoofdstuk 4 en 5. Dit zou inzicht bieden in de noodzaak om chaos te voorkomen via preventie of om chaos te verlagen via interventies om ernstige opvoedproblemen zoals kindermishandeling te voorkomen. Zo zouden gezinnen waar meer chaos voorkomt geholpen kunnen worden om dit te beperken, om mogelijke opvoedproblemen te voorkomen. Verder kan onderzocht worden of in gezinnen met meer opvoedproblemen of chaos de ouders met meer gevoeligheid voor prikkels een sterker effect van chaos op opvoeden ondervinden. Ook zou toekomstig onderzoek moeten kijken of zelfregulatie passender is als moderator of mediator in het model van chaos en opvoeden. Daarnaast zou de combinatie van impulsiviteit en neuroticisme onderzocht kunnen worden als versterkende factor in het effect van chaos op opvoeden. Als laatste is het belangrijk dat experimenteel onderzoek wordt gedaan naar welke mechanismen het effect van chaos op opvoeden verklaren. Het is essentieel om deze mechanismen te begrijpen om goede preventie en interventies te ontwikkelen die chaos kunnen verlagen en daarmee mogelijk ernstige opvoedproblemen kunnen voorkomen.

Concluderend kan op basis van dit proefschrift gesteld worden dat chaos in de thuisomgeving een effect heeft op opvoeden. Chaos heeft een effect op zowel positief opvoeden, zoals sensitiviteit, als op negatief opvoeden, zoals hardhandig disciplineren, maar lijkt alleen een effect op opvoeden te hebben in lastige opvoedsituaties. Het gevonden causale effect was kleiner dan het effect in eerdere correlationele studies, wat betekent dat de relatie tussen chaos en opvoeden ook afhankelijk is van (een complex samenspel van) andere factoren. Er zijn aanwijzingen dat chaos met name een effect heeft op opvoeden bij mensen die gevoeliger zijn voor prikkels. Voor het effectief vormgeven van preventie en interventies is het noodzakelijk om ook het mechanisme te begrijpen waardoor chaos een effect heeft op opvoeden.

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Curriculum Vitae

Suzanne Marijke Andeweg werd geboren op 7 september 1993 te Bodegraven. Als jong kind verhuisde ze naar Polen. Na vijf mooie jaren keerde ze met haar familie weer terug in Nederland. In 2010 behaalde ze haar Gymnasiumdiploma met genoegen aan het Sint Maartens College te Voorburg. In 2011 begon ze haar studie Pedagogische Wetenschappen aan de Universiteit Leiden. Ondertussen werkte ze onder andere als zorgverlener voor een jonge vrouw met zware meervoudige beperkingen. Haar bachelor behaalde ze in 2014 en aansluitend startte zij haar master Forensische Gezinspedagogiek. Als onderdeel van haar master deed zij een onderzoeksstage bij Jeugdbescherming Rotterdam-Rijnmond en ondertussen werkte ze verder als onderzoeksmedewerker binnen experimenteel onderzoek over negatieve attributies als voorspeller van kindermishandeling. Haar master rondde ze begin 2016 cum laude af. Hierop keerde zij terug als onderwijs- en onderzoeksmedewerker bij het instituut Pedagogische Wetenschappen van de Universiteit Leiden. Ze verzorgde onder andere werkgroepen en scriptiebegeleiding en werkte mee aan het project Changing Chaos. In augustus 2017 kon zij binnen dit project haar promotietraject starten. Daarnaast bleef zij nog tot medio 2019 docent. Naast haar werkzaamheden als promovendus en docent startte zij een project over chaos in gezinnen in de residentiële hulpverlening en richtte zij een evenementencommissie op voor het instituut. In 2020 rondde zij haar promotietraject af. De resultaten hiervan zijn beschreven in dit proefschrift. Sinds mei 2020 werkt zij als onderzoeker bij het Verwey-Jonker Instituut, binnen de onderzoeksgroep Jeugd, opvoeding en onderwijs. Hier is zij hoofdzakelijk betrokken bij projecten over huiselijk geweld en kindermishandeling.

Publicaties

Andeweg, S. M., Bodrij, F. F., Prevoo, M. J. L., Rippe, R. C. A., & Alink, L. R. A. (2020). DoesSensory-Processing Sensitivity Moderate the Effect of Household Chaos on CaregiverSensitivity? An Experimental Design. *Journal of Family Psychology*, Advance onlinepublication. https://doi.org/10.1037/fam0000766

Andeweg, S. M., Bodrij, F. F., Prevoo, M. J. L., Rippe, R. C. A., & Alink, L. R. A. (2020).Household chaos, caregiver sensitivity and the role of sensory sensitivity: an experimentaldesign. Biennial meeting of the Society for Research in Child Development, Baltimore.

Andeweg, S. M., Bodrij, F. F., Prevoo, M. J. L., Rippe, R. C. A., & Alink, L. R. A. Self-regulation andimpulsivity: Moderators of the effect of household chaos on parenting?*Submitted*

Andeweg, S. M., Bodrij, F. F., Prevoo, M. J. L., Rippe, R. C. A., & Alink, L. R. A. Reducinghousehold chaos to improve parenting quality? An RCT using the SHINE intervention.*Submitted*

Andeweg, S. M., Bodrij, F. F., Prevoo, M. J. L., Rippe, R. C. A., & Alink, L. R. A. Testing forwhomhousehold chaos affects parenting most: sensory-processing sensitivity and self-regulation as moderators. *Submitted*

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