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ORIGINAL ARTICLE

Household clutter and crowding constrain associations between maternal sensitivity and child theory of mind

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Abstract

Social interactions between parents and children are important for developing theory of mind, but these may be disrupted by aspects of the proximal home environment. The current study observed maternal sensitivity and its associations with child theory of mind and the housing environment (index by clutter and crowding) in a sample of mothers and their 3.5-year-old twins (N = 250 children). Maternal sensitivity and housing environment were measured from experimenter report and child theory of mind was measured through behavioural tasks. Results show that the association between maternal sensitivity and child theory of mind was moderated by the housing environment, where the positive associations between maternal sensitivity and child theory of mind were only observed at lower levels of clutter and crowding in the housing environment. Additional contextual variables and processes are discussed.

KEYWORDS

Housing environment, maternal sensitivity, theory of mind

BACKGROUND

Theory of mind (ToM) is defined as the ability to understand the beliefs, desires and knowledge of the self and others (Wellman, 1990). This mentalizing ability is critical for the development of healthy social cognition and develops rapidly between the ages of 3 and 5 years (Wellman et al., 2001), and is rooted in both cognitive and social influences. With regards to the latter, individual differences in ToM abilities

Statement of contribution

What is already known on this subject?

- Sensitive parenting is positively associated with concurrent and longitudinal ToM development
- Aspects of the physical home environment can disrupt the ongoing proximal processes within families

What the present study adds?

- The physical home environment moderates the link between maternal sensitivity and child ToM
- Associations between sensitivity and ToM were observed in the context of low crowding and clutter

have been linked to aspects of the home, family and broader cultural context (i.e. Cahill et al., 2007; Cutting & Dunn, 1999; see Devine & Hughes, 2018, for meta-analyses; Hughes et al., 2018; Shahaeian et al., 2014). There may further be factors of the daily household environment that can disrupt ongoing proximal processes between the child and their caregivers and other social partners (Bronfenbrenner & Evans, 2000), impacting ToM development. This disruption is typically investigated by examining the environment as a moderator of the link between parenting and child behaviour (Marsh et al., 2020). The current study will seek to examine the moderating role of the household environment on associations between parental sensitivity and ToM abilities.

Parental sensitivity

Early social interactions between parents and children serve as an important foundation for children to acquire ToM (Carpendale & Lewis, 2004; Hughes & Devine, 2015; Devine & Hughes, 2018). Parental sensitivity, reflecting warmth, availability and attentive and appropriate responses to the child during social interactions are particularly critical (Ainsworth et al., 1978; De Wolff & van IJzendoorn, 1997; Lamb & Easterbrooks, 1981). Parents who are sensitive and respond appropriately to their child's needs might facilitate early ToM development. Namely by providing predictable and appropriate responses, the behaviour of others may become more meaningful and may help the child become better at understanding mental states (Ensor & Hughes, 2008; Fonagy & Target, 1997; Licata et al., 2016). Additionally, insensitive, inconsistent or unpredictable interactions with caregivers may put an increased cognitive demand on developing emotion regulation systems, potentially leaving the child with limited resources to focus on mental state understanding (Fonagy & Target, 1997; Licata et al., 2016).

Several studies have shown that sensitive parenting (largely limited to maternal sensitivity) is associated with ToM development, and this has been observed both concurrently (Cahill et al., 2007; Hughes et al., 1999) and longitudinally (Ereky-Stevens, 2008; Licata et al., 2016; Symons & Clark, 2000). However, this association between maternal sensitivity and ToM has not always been observed. Meins and colleagues did not observe an association between maternal sensitivity in infancy (8 months) and ToM in preschool (51 months; Meins et al., 2013). Additional studies have found no link between warm, sensitive parental interaction styles and child ToM abilities (Ruffman et al., 2006; Vinden, 2001). Aspects of the surrounding home environment, especially those that might impact the predictability or quality of parent–child interactions, might account for some of the variability in this observed association.

Housing environment

Aspects of the larger environmental context can interfere with the proximal processes that occur between parents and children (Bronfenbrenner & Morris, 2006). One example of this context is 'chaos', a broad construct combining housing conditions (clutter, crowding and traffic), predictability and routines and noise levels. Research has shown that household chaos impacts socioemotional development (Bronfenbrenner & Evans, 2000; Coldwell et al., 2006; Evans & Wachs, 2009; Marsh et al., 2020) and is a chronic stressor that often (Evans et al., 2005) but not always (Valiente et al., 2007) accompanies poverty and low socioeconomic status.

Two major facets of household chaos are cleanliness/clutter and crowding/'people traffic'. Across the globe, these aspects of the physical environment of the home are known to influence cognitive and socioemotional development (see Ferguson et al., 2013, for a comprehensive review). After controlling for correlated factors (e.g. socioeconomic status), the cleanliness and clutter of a child's home have been associated with greater child conduct problems (Deater-Deckard et al., 2009), lower child educational attainment (Dunifon et al., 2001) and higher rates of child internalizing behaviours (Eamon, 2000). Crowding in the home, often indexed as number of people per room, has also been associated with several negative outcomes. These include greater conduct problems (Deater-Deckard et al., 2009), increased levels of social withdrawal (Liddell & Kruger, 1989), greater problems at school (Evans et al., 2002) and poorer executive function skills (Vernon-Feagans et al., 2016). The link between crowding and executive functioning is particularly interesting, given the importance of executive function for the development of ToM (Benson et al., 2013; Devine & Hughes, 2014), and may suggest that crowding may have a similar detrimental impact on emerging ToM abilities. Crowding has also been found to contribute to psychological distress in adults (Ross et al., 2000) and to disrupt parent–child interactions (Evans, 2006; Wachs & Corapci, 2003).

Relatively few studies have investigated the role that clutter and crowding in the housing environment may play in the development of child ToM. However, one recent study involving a sample of father–preschooler dyads examined how household chaos moderated associations between the closely related construct of dyadic mutuality and child ToM and found that the positive associations between dyadic mutuality and child ToM were only observed at lower levels of household chaos (McCormick et al., 2021). These findings support the theory that an unclean, cluttered, and crowded housing environment may interfere with the proximal socialization processes that occur continuously between parents/caregivers and their children within their immediate environment throughout human development (Evans et al., 2005). More broadly, a chaotic home environment is less predictable and more stressful. In such contexts, lower levels of predictability and social exchanges with parents may negatively impact the link between parent behaviour and child ToM, limiting the child's ability to fully develop the skills necessary for understanding other's minds. Examining how physical aspects of the home environment can attenuate associations between parental sensitivity and ToM development is critical for informing potential intervention work.

Socioeconomic status

Socioeconomic status (SES) is a multifaceted construct that encompasses parent income, occupation and/or educational attainment (Bradley & Corwyn, 2002). While early ToM research often only included data from middle- to upper-class samples, reducing any observable influence of SES (Hughes, 2005), a recent meta-analysis of 50 studies demonstrates a significant positive association between SES and ToM development, specifically false belief understanding (Devine & Hughes, 2018). These findings suggest that children from higher SES families consistently perform better on false belief tasks. Another recent meta-analysis suggests that SES shows small-to-moderate positive associations with parental sensitivity (Booth et al., 2018). Furthermore, aspects of household chaos are thought to serve as an index of family functioning distinct from SES (Deater-Deckard et al., 2012; Dumas et al., 2005; Lecheile et al.,

2020; McCormick et al., 2021; Pike et al., 2006), and while correlated, one is not merely a stand-in for the other. Household chaos is still associated with child behavioural development in 'middle-class' samples as well as over and above SES when SES is controlled for in statistical models (Wachs & Evans, 2010). SES and aspects of chaos may moderate the associations between parental sensitivity and child ToM differently, and both need to be examined in tandem.

Current study

The current study will examine if physical aspects of chaos in the housing environment – operationalized as high levels of crowding and clutter – moderate the association between maternal sensitivity and child ToM. We expect to find that higher levels of maternal sensitivity are positively associated with stronger ToM abilities in early childhood. Additionally, we expect that associations between maternal sensitivity and ToM abilities will vary depending on the housing environment. Specifically, the association between maternal sensitivity and ToM is expected to be strongest in families with the least crowded and cluttered housing, and weakest in families with the highest levels of crowding and clutter, controlling for child sex and family SES. Furthermore, because of the well-established association between greater crowding and clutter in lower-SES households, and the known link between SES and ToM development, we also included SES as a moderator in addition to a covariate to test whether the hypothesized effects were specific to crowding/clutter. We expect to find that the association between maternal sensitivity and child theory of mind varies depending on family SES, specifically that it is stronger in higher-SES families, controlling for child sex and housing environment.

METHOD

Participants

Participants included 250 children comprised of 125 same-sex twin pairs (59% female, 51% monozygotic, M_{age} =43 months, SD =0.82 months, range =42 months to 45 months). While young, we would still expect considerable variability in early ToM abilities in this age range (e.g. Cahill et al., 2007; Wellman & Liu, 2004). Families were recruited through hospital birth records and twin clubs in metropolitan London and other areas of southern and central England. The majority of families were White (93%), which reflects the greater population of England around the time of data collection (Office of Population Censuses & Surveys, 1991). Approximately half of the mothers and fathers had the equivalent of a high-school diploma or less (56.9% of mothers and 46.9% of fathers), about one third (33.3% of mothers and 38.9% of fathers) had college degrees and the remaining parents (9.8% of mothers and 14.2% of fathers) had postgraduate degrees. A small percentage of parents chose not to indicate educational levels (1.6% of mothers and 9.6% of fathers). Participating families had two residential parents, and the families lived in a variety of housing types, including council housing (8.8%), flats/shared houses (2.4%), terraced/semi-detached housing (46.4%), detached housing (25.6%) or another housing type (16.8%).

Participants were identical and fraternal twin pairs, but the current study did not employ the classic twin design in answering our research questions. We know from previous research that while ToM appears to be highly heritable in the preschool years, it also appears that non-shared environmental factors still play an important role (Hughes & Cutting, 1999; Hughes et al., 2005). The presence of twin pairs in the data set will result in non-independent observations (i.e. two children per family), and methods for dealing with this will be described in the data analysis section.

Procedure

Children and their primary caregiver (the mother in all but five families) visited the laboratory and participated in a home visit soon after (approximately 1 month). ToM measures were administered during the laboratory visit and parental warmth and responsiveness and household disorganization was measured immediately following the home visit. The home visit took approximately 90 minutes and involved two 10-minute structured play tasks between parents and each of their children, a free play task and an etch-a-sketch drawing task (Deater-Deckard & Petrill, 2004; Helm et al., 2020; Stevenson-Hinde & Shouldice, 1995). The two researchers on the home visit completed a modified version of the Post-Visit Inventory of parenting behaviour (Deater-Deckard, 2000; Dodge et al., 1986). The same two researchers completed the laboratory and home visit for a given family. Procedures were approved by the ethics board of [CONCEALED FOR REVIEW].

Measures

Theory of mind

ToM ability was assessed using a battery of eight false belief tasks and two deception tasks that have been shown to yield highly reliable individual difference scores representing overall mentalizing ability (Cahill et al., 2007; Hughes & Cutting, 1999; Hughes et al., 1999, 2000). Methods described here are identical to those presented by Hughes and Cutting (1999) and Cahill and colleagues (2007). Four of the false-belief tasks involved unexpected locations. In these tasks, either the anticipated contents of one container (e.g. cereal box) were shown to be in a different container, or a puppet moved an object while another puppet was not present to observe the action. For each of these, children had to state where the puppet would search for an object and explain why the puppet looked in the wrong location while referring to the puppet's false belief. Two additional false-belief tasks involved unexpected identity. Children were asked to attribute a false belief to a puppet as well as recall their own false belief. The remaining two false belief tasks showed a puppet receiving a good or bad surprise. These tasks required children to attribute a false belief to the puppet as well as to predict and explain how the puppet would have felt before the surprise.

All of the false belief questions were asked in a counterbalanced, forced choice format. To receive credit for a correct response, children first had to respond correctly to memory and reality control questions. Altogether, each child was presented with 14 test questions, and 1 point was awarded for each correctly answered question, with the possibility of 1 or 2 additional bonus points would be awarded for spontaneous false belief explanations in two of the tasks. Therefore, the maximum possible score for false belief tasks was 16.

The two deception tasks were a box and puppet game and a penny hiding game (Sodian & Frith, 1992). In the box and puppet game, there were four counterbalanced trials: non-verbal/verbal cooperation with a friendly puppet (i.e. by opening a locked box or by telling the puppet the box was open), and non-verbal/verbal competition with a nasty puppet (i.e. locking the box or falsely telling the puppet that the box was locked). Children scored 2 points for success on all four test trials, 1 point if they succeeded on the non-verbal trials only and no points for any other pattern of performance. In the penny hiding game, the researcher showed the child how to trick someone by showing a penny and then hiding it behind her back, then bringing the hands forward and asking the child to guess which hand held the penny. After three trials, the child was invited to play the game several times with the researcher, and received 1 point if successful on one trial, and 2 points if successful on at least two trials. Thus, the maximum score for the deception tasks was 4. The final maximum total score across the 10 combined false-belief and deception tasks was 20. The composite scores were internally consistent (α =.83).

Maternal sensitivity

The two researchers on the home visit completed five globally rated items (5-point Likert-type scales) from the modified Post-Visit Inventory (Deater-Deckard, 2000) immediately following the home visit: maternal warmth (1 = cold, unfriendly, 5 = warm, affectionate), mother–child relationship (1 = hostile, negative, 5 = warm, positive), how well mother knows her own children (1 = not very well, 5 = very well) and enjoyment of parenting (1 = none at all, 5 = a lot). Inter-rater agreement was >.7. These first four items were substantially correlated ($r(114)$ =.72 to.84, $p's$ >.001) and were averaged into a general maternal warmth composite (α =.85). The fifth item assessed general maternal negativity by rating how often the mother shouted at the children (1 = not at all, 5 = a lot; α =.60). For the current study, a new composite score was created including the general maternal warmth composite and the general maternal negativity score, reverse coded. This score was then standardized to create a composite score for maternal sensitivity, where higher scores indicate higher levels of observed sensitivity.

Housing environment: clutter and crowding

The two researchers on the home visit rated several aspects of housing conditions using a modified version of the Post-Visit Inventory, or PVI (Deater-Deckard, 2000; Dodge et al., 1986), including crowding and clutter (Deater-Deckard et al., 2009). Inter-rater agreement was >.7. Crowding was computed as the number of residents per room (excluding bathrooms) in the home. Clutter was rated using a 5-point Likert-type scale for two items regarding the areas inside and outside the home: How clean was the inside of the home? (1 = very clean, no bugs, bad smells, clutter, etc.; 3 = somewhat clean, nothing unhealthy, but some clutter; 5 = very dirty, many bugs, bad smells, trash, clutter) and How clean was the area outside of the home? (1 = very clean, no bad smells, trash, etc.: 3 = somewhat clean, nothing unhealthy, but some trash; 5 = very dirty, lots of trash, bad smells). Indicators for crowding and clutter were standardized and averaged for all participants that had at least one indicator available to create a score for housing environment (α =.64). Higher scores indicate higher levels of clutter and crowding in the housing environment.

Socioeconomic status

Socioeconomic status (SES) was measured using mother's and father's education level and occupational class. Income information was not available for this sample. Three categories of parental occupational class (Office of Population Censuses & Surveys, 1991) were identified: (i) skilled/unskilled manual/non-manual (42.4% of fathers, 44.6% of mothers): (ii) managerial or technical (55.8% of fathers, 52.9% of mothers) and (iii) professional (1.8% of fathers, 2.5% of mothers). Education was also classified into three levels: (i) A-level (the British equivalent of a high school diploma) or lower (46.9% of fathers, 56.9% of mothers); (ii) undergraduate degrees (38.9% of fathers, 33.3% of mothers) and (iii) postgraduate degrees (14.2% of fathers, 9.8% of mothers). A principal components analysis of these four indicators yielded a single SES factor with factor loadings >.79 that explained 70% of the variance. These four indicators were standardized and averaged to yield a single SES composite, with higher scores corresponding to higher SES.

Covariate

Child sex was included as a covariate, with female coded as 0 and male as 1.

Data analysis plan

The current study includes non-independent observations (i.e. two children per family). We first tested the hypotheses using the full sample. Analyses were then internally replicated by analysing the data again after randomly assigning each twin to two different samples (so that each sample had only one child per family in it), an approach that has been used before (Cahill et al., 2007). Only families with complete data on all variables were used in analyses. Ten families were missing data on maternal sensitivity, nine were missing data for housing environment, two were missing data about SES and twelve children total were missing data on ToM tasks for a valid N of 222 families in the full sample and 111 families in each replication sample. Descriptive statistics and bivariate correlations were computed to understand patterns of variance in and covariance between the study variables and covariates (Table 1).

To test the hypothesized main effect of maternal sensitivity on child ToM, and potential moderating effects of crowding/clutter and SES on the association between maternal sensitivity and child ToM, we estimated a hierarchical multiple regression equation (Model 2 (Hayes, 2013); standardized (z) variables provided mean-centred statistical predictors) to explain variance in child ToM scores: Step

TABLE 1 Correlations and descriptive statistics for variable used in analysis.

	1	2	3	4	5
Full Sample (*N* = 222)					
1. Sensitivity (z)	1				
2. Household Environment (z)	−.213**	1			
3. SES (z)	.316**	−.269**	1		
4. Theory of Mind	.235**	−.186**	.219**	1	
5. Child Sex	−.165*	.015	−.107	.030	1
M	0.00	0.00	0.00	7.79	
SD	1.00	1.00	1.00	4.55	
Range	−3.07 to 1.31	−1.46 to 4.96	−2.53 to 1.68	0 to 19	
Random Subsample 1 (N =111)					
Sensitivity (z)	1				
Household Environment (z)	−.213*	1			
SES (z)	.316**	−.269**	1		
Theory of Mind	.153	−.132	.209*	1	
Child Sex	−.165	.015	−.107	.040	1
M	0.00	0.00	0.00	8.21	
SD	1.00	1.00	1.00	4.78	
Range	−3.07 to 1.31	−1.46 to 4.96	−2.53 to 1.68	0 to 19	
Random Subsample 2 (*N* = 111)					
Sensitivity (z)	1				
Household Environment (z)	−.213*	1			
SES (z)	.316**	−.269**	1		
Theory of Mind	.329**	−.249**	.231*	1	
Child Sex	−.165	.015	−.107	.018	1
M	0.00	0.00	0.00	7.37	
SD	1.00	1.00	1.00	4.28	
Range	−3.07 to 1.31	−1.46 to 4.96	−2.53 to 1.68	0 to 19	

Note: *indicates significance at the.05 level and **at the.01 level. For child sex, female is coded as 0 and male as 1.

TABLE 2 Hierarchical multiple regression predicting theory of mind from parental warmth and housing environment (Crowding/Clutter) – full sample.

	B	*SE*	*β*	*t*	*p*
Step 1:					
Maternal Sensitivity (z)	0.824	.314	.183	2.624	.009
Housing Environment (z)	−0.681	.355	−.131	−1.918	.056
SES (z)	0.520	.310	.117	1.676	.095
Child Sex	0.744	.594	.083	1.253	.212
Step 2:					
Maternal Sensitivity (z)	1.160	.328	.257	3.531	<.001
Housing Environment (z)	−0.754	.350	−.146	−2.156	.032
SES (z)	0.630	.307	.142	2.052	.041
Child Sex	0.659	.584	.073	1.129	.260
Sensitivity X Housing (z)	−0.683	.336	−.138	−2.036	.043
Sensitivity X SES (z)	0.651	.326	.147	1.999	.047

Note: For child sex, male is coded as 1 and female as 0.

1: child sex (Male =1, Female =0), SES (z), maternal sensitivity (z) and crowding/clutter in household environment (z); Step 2: maternal sensitivity X household environment (z), maternal sensitivity X SES (z) (Table 2). Significant two-way interactions will be probed using simple slopes (Schubert & Jacoby, 2004).

RESULTS

We first estimated the zero-order Pearson correlations between the study variables (see Table 1). For the total sample, maternal sensitivity was negatively correlated with the housing environment and positively correlated with SES and child ToM. The housing environment was also negatively correlated with SES and child ToM. SES was positively correlated with child ToM. Similar patterns were seen in the two random subsamples, although the p-values were larger because of the decrease in sample size.

Using hierarchical multiple regression (see Table 2), the first step of the equation explained 30.9% of the variance in child ToM, ($F(4,221) = 5.725$, $p < .001$). There was a significant main effect of maternal sensitivity, such that higher maternal sensitivity was associated with better child ToM performance, controlling for other variables. There was also a significant main effect of housing environment, where more highly crowded and cluttered housing environments were associated with lower child ToM scores. The final full equation for the full sample explained 37.5% of the variance in child ToM, $F(6, 221) = 5.880$, $p < .001$. There were significant interactions between both household environment and maternal sensitivity ($\beta = -.138$, $p = .043$) as well as SES and maternal sensitivity ($\beta = .147$, $p = .047$) in statistically predicting child ToM, controlling for other variables. This pattern of results for both the regression and simple slopes analyses held with internal replication, although the p-values increased due to the decrease in sample size (Table 3). In the first half sample, the interaction between household environment and maternal sensitivity was not observed to be significant ($\beta = -.067$, $p = .504$), but the interaction between SES and maternal sensitivity was marginally significant ($\beta = .205$, $p = .062$). In the second half sample, we saw a shift, where the interaction between household environment and maternal sensitivity was significant ($\beta = -.219$, $p = .019$), and the interaction between SES and maternal sensitivity was not observed to be significant ($\beta = .083$, $p = .409$). The pattern of results was similar in the half samples compared to the full sample findings, but significance values were decreased, likely due to lower power.

TABLE 3 Hierarchical multiple regression predicting theory of mind from parental warmth and housing environment (Crowding/Clutter) – internal replication samples.

	B	*SE*	*β*	*t*	*p*
Replication sample 1					
Step 1					
Maternal Sensitivity (z)	0.497	.486	.105	1.025	.308
Housing Environment (z)	−0.470	.549	−.086	−0.858	.393
SES (z)	0.599	.479	.128	1.249	.214
Child Sex	0.611	.918	.064	0.666	.507
Step 2:					
Maternal Sensitivity (z)	0.899	.511	.189	1.759	.082
Housing Environment (z)	−0.504	.544	−.092	−0.927	.356
SES (z)	0.744	.477	.159	1.559	.122
Child Sex	0.476	.908	.050	0.524	.602
Sensitivity X Housing (z)	−0.350	.522	−.067	−0.671	.504
Sensitivity X SES (z)	0.957	.507	.205	1.890	.062
Replication sample 2					
Step 1:					
Maternal Sensitivity (z)	1.151	.403	.273	2.855	.005
Housing Environment (z)	−0.891	.455	−.184	−1.956	.053
SES (z)	0.441	.398	.106	1.108	.270
Child Sex	0.877	.762	.104	1.151	.252
Step 2:					
Maternal Sensitivity (z)	1.421	.419	.337	3.394	<.001
Housing Environment (z)	−1.003	.445	−.207	−2.253	.026
SES (z)	0.515	.391	.124	1.318	.190
Child Sex	0.843	.744	.100	1.133	.260
Sensitivity X Housing (z)	−1.017	.428	−.219	−2.376	.019
Sensitivity X SES (z)	0.344	.415	.083	0.830	.409

Note: For child sex, male is coded as 1 and female as 0.

To interpret the two-way interaction term in the full and half samples for crowding/clutter in the household environment and maternal sensitivity, we conducted post-hoc probing using estimation of simple slopes at the mean and 1 and 2 *SD* above and below the sample mean of household environment as the moderator (see Table 4). As expected, the association between maternal sensitivity and child ToM was significant for slopes at the mean and levels below the mean of household environment. In contrast, the association between maternal sensitivity and child ToM was no longer significant at levels of household environment above the mean. Results indicated that the association between maternal sensitivity and child ToM was evident at average and lower levels of household clutter and crowding, controlling for child sex and family SES.

Additionally, to interpret the two-way interaction term for SES and maternal sensitivity, we conducted post-hoc probing using estimation of simple slopes at the mean and 1 and 2 *SD* above and below the sample mean of SES as the moderator (see Table 5). The association between maternal sensitivity and child ToM was significant for slopes at average and higher levels of SES. In contrast, the association between maternal sensitivity and child ToM was no longer significant at levels of SES below the mean. Results indicated that the association between maternal sensitivity and child ToM was evident at moderate-to-high levels of SES, controlling for child sex and housing environment.

TABLE 4 Simple slopes of maternal sensitivity predicting theory of mind at different levels of housing environment (Crowding/Clutter).

	Full Sample (*N* = 222)	
	β	***p***
Level of crowding/clutter		
+2 *SD*	−.055	.685
+1 *SD*	.092	.274
M	.238	.000
−1 *SD*	.385	.000
−2 *SD*	.532	.001
	Internal Replication Sample 1 (N=111)	
	B	***p***
Level of crowding/clutter		
+2 *SD*	−.032	.574
+1 *SD*	.062	.616
M	.155	.116
−1 *SD*	.249	.103
−2 *SD*	.342	.147
	Internal Replication Sample 2 (N=111)	
	β	***p***
Level of crowding/clutter		
+2 *SD*	−.082	.655
+1 *SD*	.127	.267
M	.335	.000
−1 *SD*	.543	.000
−2 *SD*	.752	.000

DISCUSSION

The home environment, and specifically the physical aspects of household chaos (e.g. crowding, clutter) have been implicated as risk factors in children's cognitive and emotional development (e.g. Coley et al., 2015; Deater-Deckard et al., 2009; Martin et al., 2012), but to date little work has examined how these external factors may impact the early development of social cognition and ToM acquisition. The current study was novel in its examination of how these physical facets of the home environment might impact the association between maternal sensitivity and ToM development in a large sample of preschool-age children. The association between maternal sensitivity and child ToM was evident in the context of low crowding and clutter (i.e. "chaos"), controlling for child sex and family SES. These findings suggest that crowding and clutter in the home environment may disrupt the effects of parental socialization processes in the home in ways that are impacting the development of ToM.

To the best of our knowledge, this is the first study to examine the moderating role of clutter and crowding on the association between parenting behaviour and child theory of mind. But, previous research has examined the moderating role of chaos and the home environment on links between aspects of parenting behaviour and parental social cognition, both of which have been shown to be important for the development of ToM in children (Hughes et al., 2018; Kirk et al., 2015; Laranjo et al., 2010). In one study, researchers found that chaos within the home environment can disrupt the link between

TABLE 5 Simple Slopes of Maternal Sensitivity Predicting Theory of Mind at Different Levels of SES.

	Full Sample (*N* = 222)	
	β	***p***
Level of SES		
+2 *SD*	.596	.000
+1 *SD*	.430	.000
M	.264	.000
−1 *SD*	.097	.198
−2 *SD*	−.069	.553
	Internal replication sample 1 (*N* = 111)	
	β	***p***
Level of SES		
+2 *SD*	.584	.014
+1 *SD*	.389	.016
M	.194	.067
−1 *SD*	.001	.989
−2 *SD*	−.197	.243
	Internal Replication Sample 2 (N=111)	
	β	***p***
Level of SES		
+2 *SD*	.617	.007
+1 *SD*	.481	.002
M	.346	.000
−1 *SD*	.210	.048
−2 *SD*	.075	.645

parental attributions of child behaviour and parental behaviours, such that parents in high chaos homes are more likely to interpret child misbehaviour as intentional compared to parents in non-chaotic households (Wang et al., 2013). Findings from another study further suggest a deleterious effect of chaos, combined with the stressor of premature birth, on links between maternal mentalization and maternal sensitivity. Specifically, the well-established link between mentalization and sensitivity in mothers was evident in low- but not high-stress contexts (Yatziv et al., 2018). Building on these prior findings, our study results suggest that the home environment context plays a crucial part in supporting sensitive and responsive caregiving, which has a critical role in the healthy development of preschoolers' ToM. More research is needed to better understand the mechanisms underlying these associations.

Consistent with literature examining other parenting constructs and other child outcomes, the findings of the current study suggest that aspects of the home environment can disrupt the proximal social processes between parents and children that support ToM development (Coldwell et al., 2006; Evans et al., 2005; McCormick et al., 2021). Homes that have higher levels of clutter and crowding may simply constrain opportunities for parent–child interactions, or higher levels of clutter and crowding may affect the nature of these interactions. This could result in either less-sensitive or fewer sensitive interactions overall between parents and children, potentially negatively impacting theory of mind development. Future longitudinal studies and intervention experiments with larger samples will better allow for causal

inferences to be made regarding the particular influence of the housing environment on associations between parental sensitivity and child ToM.

Interestingly, there was also a statistical interaction between SES and maternal sensitivity as predictors of child ToM abilities. A sizeable body of literature demonstrates that SES has an impact on broader cognitive development, including language and executive function (Hackman & Farah, 2009; Hoff, 2006; Noble et al., 2005), and a recent meta-analysis also shows that SES has small-to-moderate positive associations with parental sensitivity (Booth et al., 2018). While early ToM research often only included data from middle- to high-class samples, reducing any observable influence of SES (Hughes, 2005), more recent work suggests that there is also a significant positive association between growing up in a higher SES home and showing better ToM performance (Devine & Hughes, 2018). Recent evidence complicates this finding by demonstrating that children experimentally assigned to be of a disadvantaged social status display better ToM (Rizzo & Killen, 2018), demonstrating that mental state understanding is not always a stable skill and may be influenced by experience with structurally based inequalities. More research is also needed on the specific and interactional processes involving SES and other familial and environmental factors.

SES and housing environments are known to covary (Evans et al., 2005; Wang et al., 2013), but the current study suggests that they do not completely overlap and may have a differential impact on ToM development. This finding is reflected in the extant literature as well, with regard to a broader set of developmental outcomes (Deater-Deckard et al., 2012; Hart et al., 2007; Holmes et al., 2019; Micalizzi et al., 2019; Seidler & Ritchie, 2018). In particular, it may be that the household environment operates interactively, not additively, with the effects of socioeconomic status. Aspects of the housing environment might serve as a signal of something distinct such as parent and household functioning or time to engage in activities besides work and childcare. Further research is needed to more thoroughly disentangle the specific influence of these environmental moderators.

Findings from the current study should be interpreted in the context of study limitations. The current study was limited in its sole use of observer reports of housing conditions. Many studies examining the influence of the home environment or household chaos utilize parent-report measures of these constructs. It may be that parental perceptions of the home environment are critical to accurately measuring the saliency of these environmental constructs. Future research should consider using more rigorous assessments, including parent-report questionnaires, interviews and direct observations of the physical environment of the home and neighbourhood that would strengthen the measurement of the home context (Deater-Deckard et al., 2009; Whitesell et al., 2015). Similarly, we did not conduct analyses examining clutter and crowding effects separately. It would be very interesting to examine these constructs independently to see if one drives these associations in particular. Future research examining associations between aspects of household chaos and ToM should explore this possibility. Certain aspects of chaos such as crowding might indicate potential extra social interactions within the home. This may also be especially important to consider given the increase in multigenerational homes (Pearce et al., 2018), or other family structures that offer children increased opportunities to interact with more people on a daily basis. Clutter might indicate different problems than crowding (e.g. lack of time to clean vs. lack of income needed to get an adequate living space). The various components of the housing environment will likely require different intervention to address, so examining the distinct variance that each component contributes will be an important future direction for research to consider. Finally, chaotic households are not often intentional, but rather are the result of systemic stressors and demands that pile up and disproportionately impact lower-income families. Programmes and policies to reduce the additional systemic burdens that chaotic homes may face will be critical in addition to any future parenting intervention work (Emond, 2020).

Furthermore, participants included in the current study were all twin pairs, which may have resulted in unequal distribution of variance in the data. We accounted for this nested data structure by validating findings in random subsamples, but results should be replicated in a sample of unrelated participants. Additionally, the statistical significance values of the interaction terms of interest were large in the current study. This suggests that the study might be significantly underpowered to detect small effects.

While the results of the full analyses are in line with extant research suggesting that chaos disrupts proximal processes in the home (Marsh et al., 2020; McCormick et al., 2021), future research should also seek to replicate these findings in larger samples. Furthermore, while the twin design was a strength in that all families had a minimum of two children, it may also be that families with multiple children in the current study have different levels of clutter than families with a single child. Additionally, families with two children who are the same age may have 'two of everything', resulting in excess clutter. Furthermore, maternal sensitivity may be more clutter dependent in the context of having to be responsive to two children of the same age. Future research should consider this and examine unrelated participants from small and large families.

Finally, children in this study were young and the analyses were cross-sectional. While there is considerable variability in ToM abilities in the preschool years, a larger age range would have provided more variability in ToM scores. Longitudinal data are needed as well, and these results from the current study are exploratory and not causal or predictive. As mentioned above, longitudinal research may better allow for inferences to be made about *how* clutter and crowding are impacting parent–child interactions, perhaps through limiting the number of interactions overall or by constraining them in some way. This would also be particularly informative for examining the stability of clutter and crowding in the context of home visits, where this may vary more from day to day. The limited research that exists on the stability of chaos suggests that it is stable longitudinally, but used self-report measures of chaos (Lecheile et al., 2020). Future research should examine these questions with a larger age range and in longitudinal samples.

Despite these limitations, the current study adds to our understanding of factors that impact links between parenting and ToM abilities by highlighting the potential importance of physical aspects of the home context. Given that ToM is critical for developing a healthy social cognition (Hughes & Devine, 2019), it is especially important to understand the mechanisms underlying its development and identify potential areas for intervention in cases where ToM may develop atypically. Future research should attempt to further examine constructs within the proximal environment that may impact ToM development, including physical housing conditions that may be readily amenable to change with adequate supports in place for families.

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CONFLICT OF INTEREST

All authors declare no conflict of interest.

AUTHOR CONTRIBUTION

Sarah McCormick: Conceptualization (equal); Formal analysis (equal); Writing – original draft (equal); Writing – review & editing (equal). **Kirby Deater-Deckard:** Data curation (equal); Funding acquisition (equal); Methodology (equal); Project administration (equal); Writing – review & editing (equal). **Claire Hughes:** Data curation (equal); Methodology (equal); Project administration (equal); Writing – review & editing (equal).

DATA AVAILABILITY STATEMENT

Data from the study are available upon reasonable request.

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