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ARTICLE

Media exposure and preschoolers' social-cognitive development

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Abstract

Exposure to narratives may have beneficial effects on children's social-cognitive development because narratives provide information about the social world and often require social understanding for story comprehension. In the current study, we examined the influence of narratives presented via different media (books, audiobooks, TV/films) on theory-of-mind performance and mental verb comprehension in a sample of 114 three- to six-year-old preschool children. Parents' reports on the number of (children's) books at home, the overall duration of TV/film and audio media exposure, the frequency of shared book reading, watching children's TV/films and audiobook listening, and parent–child discussions about media content were collected. Children's theory-of-mind performance and mental verb comprehension were measured as dependent variables. When gender, age, language skills and parental education were controlled, only the number of children's books, shared book reading frequency, audio-media exposure and audiobook usage significantly predicted children's theory-of-mind scores. None of the media exposure or the parent–child discussion variables had significant incremental effects above the family and child characteristics on mental verb comprehension.

KEYWORDS

media exposure, mental verbs, reading, social cognition, theory of mind

Statement of contribution

What is already known on this subject?

- Theories assume a positive effect of narrative fiction on recipients' social-cognitive skills
- Reading narrative fiction correlates positively with adults' and adolescents' social-cognitive skills

What the present study adds?

- Exposure to children's books and audio media uniquely predicted children's theory-of-mind development
- However, they were not unique predictors of children's comprehension of mental state words

Narrative stories reflecting either real-life or fictional experiences are ubiquitous in human cultures and societies. Stories can be conveyed orally from person to person, in the form of books—read silently or aloud by others—in the form of audiobooks, or they can be viewed on TV. Thus, even before children enter school, they are exposed to large numbers of narratives through interpersonal interactions, predominantly with parents, grandparents and siblings but also through more passive audiovisual media exposure.

Theories proposed in literary arts (e.g. Zunshine, 2006) as well as in psychology (e.g. Mar, 2018) assume that narrative stories can foster children's, adolescents' and adults' social-cognitive competences and knowledge (i.e. theory of mind, empathy, knowledge of mental state terms). Recently, Mar (2018) proposed the Social Processes and Content Entrained by Narratives (SPaCEN) framework, which states that both social processes and social content knowledge can be improved through frequent exposure to narratives. Supporting this assumption, several studies have demonstrated correlations between book exposure and social-cognitive skills in adults (e.g. Mar et al., 2006, 2009; see also the meta-analysis published by Mumper & Gerrig, 2017) and adolescent samples (e.g. Lenhart et al., 2022; van Schooten et al., 2001).

However, the state of research on young children is less clear because only a few studies have targeted the relationship between exposure to narratives and children's social-cognitive development and those focused primarily on performance in theory-of-mind tasks and on TV/film exposure (e.g. Nathanson & Fries, 2014). In particular, the literature lacks studies on the effects of audiobooks, which are a prevalent form of media consumption in children (Medienpädagogischer Forschungsverbund Südwest, 2020). Few studies have also included measures of social-cognitive development other than theory of mind, and even fewer studies have addressed the potential moderating role of parent–child discussion.

Accordingly, the present study had three aims. The first aim was to extend previous research on the relationship between media and social-cognitive development by examining the effects of narratives presented via different forms of media (books, audiobooks and TV/films) and by including parent–child discussions about media content. All three forms of media are prevalent in children's daily lives (Medienpädagogischer Forschungsverbund Südwest, 2020). Second, we included important control variables (parental education, age, language skills, gender, overall amount of media exposure) to rule out the possibility that any relationship between media exposure and social-cognitive development might be an artefact of a third variable. Finally, we broadened the scope of social-cognitive competences by including children's knowledge of mental state language (e.g. *think*, *feel*, *believe*) as an additional measure of social-cognitive development. Mental state language is considered to be important for accomplishing theory-of-mind tasks, and it serves as an early foundation of later meta-representational ability (Bartsch & Wellman, 1995). In the following, we first provide an overview of theory of mind and mental verb

development in early childhood. Then we turn, in separate sections, to book exposure, audiobook exposure, TV/film exposure and their associations with children's social-cognitive development.

SOCIAL-COGNITIVE DEVELOPMENT IN EARLY CHILDHOOD

Social cognition or social-cognitive abilities are umbrella terms referring to 'the processing of stimuli relevant to understanding agents and their interactions' (Happé et al., 2017, p. 244). Among other competences, this processing includes the ability to recognize emotions, represent one's own and others' mental states, and adopt the affective states of others (Happé et al., 2017). Early indicators of these abilities are the use and comprehension of mental state language. Children's use of mental verbs begins typically in the second year of life, starting with terms that express desire (e.g., *want*). In the third year of life, desire terms are then followed increasingly by belief terms (e.g., *know, think*), with both categories of mental verbs increasing in frequency as children age (Bartsch & Wellman, 1995; Moore et al., 1994; Pascual et al., 2008; Tardif & Wellman, 2000). Although children use mental verbs very early, those verbs serve primarily conversational functions, and the usage of mental verbs does not necessarily indicate that children understand their reference to mental states. In the second half of the third year, some children begin to use some mental verbs as references to mental states, with the use and comprehension of mental verbs becoming more intertwined (Shatz et al., 1983).

Similarly, children show an age-dependent progression in standard theory-of-mind tasks. Typically, children raised in Western societies solve tasks addressing differences in desires (diverse desires) before tasks addressing differences in beliefs (diverse beliefs). After mastering these tasks, they solve tasks correctly that require understanding that something can be true, but that someone might have no access to that knowledge (knowledge access). The next step is that children understand that something can be true, but that someone might falsely believe something different (false belief). Finally, as a last step in many preschool tasks, children understand that someone can have an emotion but display a different one (hidden emotion; for overviews, see Kristen et al., 2006; Wellman, 2012; Wellman & Liu, 2004).

Children's understanding of mental state language and their theory-of-mind scores are highly correlated, probably boosting each other's development (Grazzani & Ornaghi, 2012; Lockl & Schneider, 2006). For example, mental state vocabulary has been shown to predict early theory-of-mind task performance (Lockl & Schneider, 2006; Olineck & Poulin-Dubois, 2007), and the comprehension of mental state language was among the strongest predictors of children's performance in false belief and emotion comprehension tasks (Grazzani & Ornaghi, 2012).

BOOK EXPOSURE AND CHILDREN'S SOCIAL-COGNITIVE DEVELOPMENT

Analyses of children's books suggest the assumption that exposure to narratives might augment children's social-cognitive development. Social-cognitive content is common in children's books, as indicated by linguistic expressions that refer to mental states (e.g. *think*, *feel*; Cassidy et al., 1998; Dyer et al., 2000; Dyer-Seymour et al., 2004; Farkas et al., 2020). For example, Cassidy et al. (1998) recorded the books that U.S. middle-class parents of 47 preschoolers had read to their children and analysed the mental state references as well as the presence and types of false beliefs in the plots. They found that 78% of the books contained at least one mental state reference and 34% of the books described false beliefs. In addition, Dyer et al. (2000) showed that mental state words occurred on average every three sentences in U.S. books marketed for children between 3 and 6 years and that every second mental state word represented a new type of mental state reference. Although the relative distribution of mental state categories seems to differ, the total frequency of mental state references in children's books appears to be similar across different cultures (Dyer-Seymour et al., 2004; Farkas et al., 2020).

In line with the richness of mental themes and mental state language in children's books, Mar et al. (2010) found that parents' knowledge of titles and authors of children's books correlated with their children's theory-of-mind performance, even after controlling for children's age, gender, vocabulary, and parental income. In contrast, parents' recognition of book authors for adults showed no unique relation to children's theory-of-mind performance, indicating that not parents' own literacy but child-related (cumulative) literacy activities might matter. In addition to this indirect measure of (cumulative) exposure to children's books, Adrian et al. (2005) showed that the current frequency of parent–child book reading was significantly correlated with children's false belief understanding in 4- to 5-year-old preschoolers and that this relation remained significant when parental education and children's verbal mental age were controlled.

Apart from the specific content and wordings of the stories, story sessions offer parents rich opportunities to elaborate on mental topics included in the stories and to link them to children's lives (e.g. Nyhout & O'Neill, 2013). In support of this statement, positive correlations between mothers' use of mental state terms during shared book reading and diverse indicators of children's social-cognitive competences were found in cross-sectional and longitudinal analyses. Parents' mental state talk during book reading and storytelling was related to children's performance in theory-of-mind (Adrian et al., 2005, 2007; Symons et al., 2005) and emotion recognition tasks (Taumoepeau & Ruffman, 2006, 2008), children's empathy and prosocial behaviour (Schapira & Aram, 2020) and children's own use of mental state language (Taumoepeau & Ruffman, 2006, 2008).

Supporting the link between shared book reading and children's social-cognitive development, experimental studies have shown (1) that shared book reading with or without mental state themes improved children's theory-of-mind performance (e.g. Cates & Nicolopoulou, 2019); (2) that shared book reading that included conversations about mental state themes resulted in higher gains on theory-of-mind tasks and mental state knowledge than book reading without mental state themes (e.g., Grazzani et al., 2016; Tompkins, 2015a) and (3) that parents can be trained to focus on social-cognitive themes in books and thus use more mental state language during shared book reading (e.g. Aram et al., 2013).

AUDIOBOOK EXPOSURE AND CHILDREN'S SOCIAL-COGNITIVE DEVELOPMENT

The content of audiobooks and books is similar. However, audiobooks are often enriched by music and sound effects and contain multiple voices (Ritterfeld et al., 2005). To our knowledge, no studies have linked the use of audiobooks and social-cognitive development. However, research has demonstrated that children can learn words from overhearing conversations (Gampe et al., 2012), listening to audiotapes of stories (Lenhart, Lenhard, et al., 2020) and listening to audiobooks (Ritterfeld et al., 2006). However, audiobooks might stimulate parent–child discussion less than book reading because a personal narrator is not required, and they are technically less suited for parent–child interaction during story presentation. A recent survey of children's media consumption habits showed that children often listen to audiobooks alone, whereas book reading is frequently a shared activity between children and their parents (Medienpädagogischer Forschungsverbund Südwest, 2020). Consequently, audiobooks might have a less beneficial effect on young children's social-cognitive skills than shared book reading, assuming that parent–child discussions are crucial or at least very important for the effects to occur.

EXPOSURE TO TV/FILMS AND CHILDREN'S SOCIAL-COGNITIVE DEVELOPMENT

From a theoretical point of view, stories that display on the screen should contain the same amounts of mental state themes as their written counterparts (Mar, 2018). In addition, audiovisual narratives offer

multisensory input that might help to train the perception and interpretation of others' social non-verbal cues such as gestures and facial expressions (Mar & Oatley, 2008).

Partly supporting this assumption, Mar et al. (2010) found that parents' knowledge of children's films was significantly positively related to their children's theory-of-mind scores, even after controlling for children's age, gender, vocabulary and parental income. Parents' knowledge of TV series for children, in contrast, showed no statistically significant relation to children's theory-of-mind performance. Given that, from a theoretical perspective, films and TV series should have similar effects, Mar et al. (2010) speculated that these differences might be due to differences in format (e.g. length), which might influence learning from audiovisual input or provoke differences in parent–child conversations about content. Of course, another explanation might be that Mar et al.'s (2010) sample size of 55 children was too small to detect significant effects of TV series on children.

However, in contrast to these findings, most studies conducted with children reported negative relationships between various indicators of TV watching and performance on social-cognitive tasks (e.g. Conners-Burrow et al., 2011; Nathanson et al., 2013; Nathanson & Fries, 2014). An explanation for the negative correlations between TV watching and children's social-cognitive skills might be that the TV-watching content in these studies is typically not specified. The TV watching likely included appropriate and inappropriate content for preschool children. In particular, so-called background TV content might include many programs designed for adults that are not beneficial for children (e.g. Nathanson et al., 2013), which might also help explain the difference in Mar et al.'s (2010) results. Their checklists of films and TV series for children probably reflect the exposure to age-appropriate content. Consequently, narratives presented via TV/films might augment children's social-cognitive development, if they are appropriate for preschool children.

Another explanation for negative or low, non-significant correlations between TV exposure and children's social-cognitive development might be that preschool children's learning from media, such as books, films or TV series, is strongly supported by parental support during story presentation (e.g. Lenhart et al., 2019; Lenhart, Suggate, et al., 2020). Books offer parents-rich opportunities to engage with their children. However, in many instances, TV watching serves as a 'digital babysitter', with much viewing occurring without parental support (Kostyrka-Allchorne et al., 2017, p. 53). Research showed that the quality and quantity of parent language directed at children was considerably reduced during TV viewing compared to play or book reading sessions (Lavigne et al., 2015; Nathanson & Rasmussen, 2011) and that parents' sentences became shorter and less frequent when the TV was turned on (Tanimura et al., 2007). In addition, Nathanson et al. (2013) found that the negative correlation between TV-watching duration and children's theory-of-mind scores was counteracted by parent–child discussions of TV content.

In conclusion, the negative effects of watching TV/films might primarily occur when unsupported consumption of unsuitable content replaces other more beneficial learning opportunities. Additionally, influences of age-appropriate content are probably increased when children are not passively exposed to stories, but parents instead use these opportunities to actively engage their children in discussions about media content. Thus, child-appropriate content and parent–child discussion of that content might have beneficial effects on children's social-cognitive development.

THE CURRENT STUDY

The current study is theoretically based on the SPaCEN framework (Mar, 2018), which assumes that exposure to narratives serves as a training ground for social cognition and improves real-life social-cognitive skills. In addition, the current study builds on previous work that underlines the beneficial effect of parent–child discussions with young children to profit from media exposure (e.g. Lenhart et al., 2019; Lenhart, Suggate, et al., 2020; Nathanson & Fries, 2014). Parent–child discussion is assumed to augment (in terms of a moderator effect) any potential beneficial effects of media exposure on children's social-cognitive development. Accordingly, the present study pursued three aims. First,

we extended previous research by examining the effects of narratives presented via different forms of media (books, audiobooks and TV/films) and by including parent–child discussions about media content across the different forms of media. In particular, given the evidence that media content matters (Mar et al., 2010; Nathanson et al., 2013), we included not only indicators of exposure to children's TV/films, books, and audiobooks but also measures of overall TV/film and audio-media exposure and general book possession.

Second, we included important control variables (parental education, age, language skills, gender) to rule out the possibility that any relationship between media exposure and social-cognitive development is an artefact caused by a third variable (for similar approaches, see Mar et al., 2010; Schapira & Aram, 2020; Symons et al., 2005; Taumoepeau & Ruffman, 2006). Finally, we broadened the scope of social-cognitive competences by including children's knowledge of mental state language (e.g., *think, feel, believe*) as an additional measure of social-cognitive development.

We expected a positive relationship between children's exposure to children's books and their theory-of-mind skills as well as their comprehension of mental verbs. In contrast to book exposure, to our knowledge, no empirical evidence has been reported in the literature that links audiobooks and children's social-cognitive development. From a theoretical point of view, the content of audiobooks and books should be similar. Additionally, children can learn from audio media (Lenhart, Lenhard, et al., 2020; Ritterfeld et al., 2006). Consequently, we assumed that audiobook exposure is positively related to children's theory of mind and mental verb performance. The research picture for TV/films is decidedly more complex. From a theoretical perspective, age-appropriate TV/films should have similar effects as books on social-cognitive skills (Mar, 2018; Mar & Oatley, 2008), but watching TV/films reduces the quantity and quality of parent–child interaction, which seems crucial for young children to benefit from stories. In addition, most evidence for children points in the opposite direction, indicating mainly negative correlations between TV-viewing duration and children's social-cognitive skills (e.g. Conners-Burrow et al., 2011; Nathanson & Fries, 2014). Thus, we expected a negative association between the overall amount of TV/films exposure and children's theory-of-mind performance and mental verb comprehension but a positive association for children's TV/films. Finally, we expected parent–child discussions about media content to be an important factor for young children to profit from media content (e.g. Lenhart et al., 2019; Lenhart, Suggate, et al., 2020; Nathanson & Fries, 2014). Accordingly, we assumed that parent–child discussions would augment beneficial media effects on children's theory of mind and mental verb knowledge (i.e. moderator effect).

MATERIALS AND METHODS

Participants

Participants were 114 preschoolers (62 female) recruited from seven preschools in Germany. The mean age of the children was 4 years and 8 months (SD = 11.65 months; range 36–75 months). Approximately 94% of the children, 76% of their mothers and 68% of their fathers were born in Germany, with 71% of the children speaking only German at home. Only one mother and four fathers left school without graduation, and approximately 70% of the fathers and 65% of the mothers received a university entrance certificate, which is somewhat higher than the distribution of maternal and paternal educational levels in the German population (reference group: 35–40-year-olds; Statistisches Bundesamt, 2020).

Design and procedure

We employed a cross-sectional correlational design. Parents received informed consent forms prior to the study. Parents and their children participated voluntarily and were included in the study only if parents had provided their written permission. Data were collected in the preschools in two sessions,

which took approximately 30–35 min each. Children received a small gift for their participation after completion of the study.

Measures

All questionnaires and test materials were presented in German. Indicators of children's media exposure and media-specific parent–child discussions were derived from a comprehensive questionnaire targeting the home-literacy environment (Lenhart & Lingel, 2023). The home-literacy questionnaire comprised also items on language and code-focused activities (such as teaching letters or rhyming), which were not relevant and thus not collected in the present study.

Demographics

Parents completed a questionnaire that required demographic information such as children's age, their child's and their country of birth, languages spoken at home, and their highest educational level. Highest educational level was assessed on a 5-point scale (1 = 9 years of schooling without graduation, 2 = 9 years of schooling with graduation, 3 = 10 years of schooling with graduation, 4 = 13 years of schooling/university entrance certificate, 5 = 17 years of schooling/university degree). Years of schooling (9, 10, 13 and 17) were used as a numeric approximation of educational level.

Book exposure

To assess exposure to children's books, parents indicated on a 5-point scale how often they read books to their children (1 = once per month or less, 2 = once per week, 3 = several times per week, 4 = once per day, 5 = several times per day). In addition, as a measure of cumulative exposure to children's books, parents indicated on a 6-point scale how many children's books they possess. The scale was derived from the PISA study (Hertel et al., 2014; 1 = 1–10 books; 2 = 11–25 books; 3 = 26–100 books; 4 = 101–200 books; 5 = 201–500 books; 6 = more than 500 books). As an additional outcome control, we also asked parents about their general book possession on the same 6-point scale.

Audio-media exposure

To assess exposure to children's audiobooks, parents indicated on a 5-point scale how frequently their children listened to children's audiobooks (1 = once per month or less, 2 = once per week, 3 = several times per week, 4 = once per day, 5 = several times per day). As an additional outcome control, we also asked parents to indicate on a 5-point scale how long their children generally listened to audio media (e.g. CDs, MP3, radio) per day (1 = not at all; 2 = up to 30 minutes; 3 = 30 to 60 minutes; 4 = 1 to 2 hours; 5 = more than 2 hours).

TV/film exposure

To assess exposure to children's TV/films, parents indicated on a 5-point scale how often their children watched children's TV/films (1 = once per month or less, 2 = once per week, 3 = several times per week, 4 = once per day, 5 = several times per day). As an additional outcome control, parents indicated on a 5-point scale how long their children were exposed to TV/film content per day (1 = not at all, 2 = up to 30 min, 3 = 30–60 min, 4 = 1–2 h, 5 = more than 2 h).

Parent–child discussions about media content

Parent–child discussions of media content were assessed with three items, separately for children's books, audiobooks and children's TV/films on a 5-point scale (1 = never, 2 = seldom, 3 = sometimes, 4 = frequently, 5 = always).

Theory of mind

Theory of mind was assessed using the German adaption (Hofer & Aschersleben, 2007) of the scale developed by Wellman and Liu (2004), which was based on their meta-analysis that summarized research on the sequence of children's theory-of-mind development. The English version (Wellman & Liu, 2004) and the German adaption (Hofer & Aschersleben, 2007) consist of five items (i.e. Diverse Desires, Diverse Beliefs, Knowledge Access, Contents False Belief, Hidden Emotion/Real-Apparent Emotion), which were used to calculate a theory-of-mind score (range 0–5 points). An additional sixth item, which is not included in the theory-of-mind score, measures explicit false belief (Explicit False Belief of Location). Following the test guidelines, the items were presented in order by increasing difficulty (Hofer & Aschersleben, 2007; Kristen et al., 2006). Performance in the theory-of-mind scale of both language versions increased with age, and item difficulties followed a systematic pattern, with Diverse Desires being most often solved, followed by Diverse Beliefs, followed by Knowledge Access, followed by Contents False Belief, followed by Real-Apparent Emotion (Kristen et al., 2006; Wellman & Liu, 2004). Furthermore, the items in both versions met the requirement of Guttman scaling (Kristen et al., 2006; Wellman & Liu, 2004). That is, children who solved an item correctly also solved typically all easier items. The scale correlated substantially with other tasks measuring theory of mind (e.g. the Sally-Anne false-belief task, Hiller et al., 2014).

Mental verb comprehension

Mental verb comprehension was assessed with a German version (Lockl & Schneider, 2006) of a test developed by Astington (2000). The experimenter read each child a story, which consisted of 12 episodes, each illustrated by pictures. At the end of each episode, children were required to select one of two mental verbs to describe the character's state of mind. The following 12 mental verbs were included: *know*, *guess*, *remember*, *forget*, *wonder*, *figure out*, *explain*, *understand*, *learn*, *teach*, *predict* and *deny*. Each of the verbs appeared twice, once as the correct choice and once as the incorrect choice. The correct choice was the first verb in the pair for half of the questions and the second verb in the pair for the other half. To receive credit for a verb, children were required to answer both test questions that included the verb correctly. Two additional training items were given at the beginning of the test. The score for mental verb comprehension ranged from 0 to 12. Lockl and Schneider (2006) reported Cronbach's α of .64 to .70 for the German version. In addition, they demonstrated that mental verb comprehension increased with age and was substantially correlated with children's theory-of-mind performance, their meta-memory, and their general vocabulary. In the present study, Cronbach's α was .74 for mental verb comprehension.

Language skills

To assess children's language skills, we used the Sprachentwicklungstest für drei- bis fünfjährige Kinder (Language development test for 3- to 5-year-old children; SETK 3–5; Grimm et al., 2010), which represents a comprehensive, standardized and norm-referenced measure of children's language comprehension, language production and verbal memory in German. Language comprehension was measured by a sentence comprehension task, which required children to perform a specific act given verbal instruction

(Verstehen von Sätzen). Language production was measured by two tasks. The first task required children to use rules of pluralization for real and pseudowords (Morphologische Regelbildung), and the second required the description of elements that could be seen on a picture (Enkodierung semantischer Relationen). Verbal memory was measured by a task that required the repetition of pseudowords (Phonologisches Arbeitsgedächnis für Nichtwörter) and a task that required the repetition of sentences (Satzgedächtnis). The subtests showed sufficient to good reliability, with Cronbach's α ranging from .62 to .89 (Grimm et al., 2010). The performance in the test is positively correlated with age and with results of other tests of language skills (Grimm et al., 2010). Given that some of the tasks and items differed for 3-year-olds and older children, raw scores were not meaningfully interpretable across the different age groups. Thus, to obtain a general language score that is independent of age, we averaged the normed scores of the subtests of each version, which are scores referenced at the age-specific norming sample (normal distribution with $M = 50$, SD = 10). For the present study, the normed scores had the additional advantage of providing an estimate of language skills that was independent of age and thus reduced collinearity in the regression analyses in which age was included as a predictor. In the present study, Cronbach's α was .92 for the test version for 3-year-olds and .94 for the test version for 4-year-olds and older children.

RESULTS

Data preparation and analysis

Data and scripts are available on osf (https://osf.io/9rmjh/?view_only=b620b6403af44f2eb71e041ac602b1cd). Data preparation and analysis were conducted with IBM SPSS 29. Even though the amount of missing data was small and missing data were unsystematic (range = 0–7% per item; see Table 1), we used multiple imputations to avoid a reduction of cases and power (Enders, 2010). To minimize power loss, we conducted 100 imputations (Graham et al., 2007).

To test our hypotheses, we estimated separate multiple regression models with theory-of-mind performance and mental verb comprehension scores as outcome variables, controlling for family and child characteristics (Tables 3 and 4). Hierarchical (nested) models were estimated (see Cohen et al., 2003). In the first step, a baseline model that included the child and family control variables (gender, age, language skills, maternal and paternal levels of education) was estimated (baseline model). Then, each form of media exposure was added separately to the baseline model. In the next step, parent–child discussion about each type of media was added to examine its incremental value as a predictor above exposure to this kind of media. Finally, the interaction between each form of media exposure and parent–child discussion about each type of media was added. In the latter model, the predictors involved in the interaction were standardized (z scores) to avoid nonessential multicollinearity (see Cohen et al., 2003).

Given that the estimation of R^2, ΔR^2 and their significance tests for multiple regression analyses are currently not implemented in SPSS for imputed data sets, we used the R package miceadds (Robitzsch & Grund, 2023) to calculate pooled F-statistics for R^2, ΔR^2 and to obtain p values. Using these pooled F-statistics, we followed the procedure described in Smithson (2001) and used his SPSS script (Smithson, n.d.) to compute R^2, partial ΔR^2 and their confidence intervals. Then partial ΔR^2 values were multiplied by $(1 - R^2_{\text{baseline model}})$ to obtain semipartial ΔR^2, which represents the incremental variance of the total variance explained by adding the new set of predictors to the baseline model (see Smithson, 2001). Finally, we calculated f^2 (Selya et al., 2012) to assess the incremental local effect sizes of adding indicators of story exposure to the baseline model.

A sensitivity analysis with G*Power ($a = .05$, $1 - \beta = .80$, two-tailed tests, version 3.1.9.7; Faul et al., 2009) indicated that a sample size of 114 children was sufficient to detect single regression coefficients in multiple regression analysis with small effect sizes ($f^2 \geq .070$). All hypotheses were tested two-tailed with the significance level set at $p < .05$.

TABLE 1 Descriptive statistics of the sample.

Variables	*N*	Missing	*M*	SD	Min	Max	Skew	Kurtosis	M_{MI}
Gender (female)	114	0	54%						
Age (months)	114	0	55.82	11.65	36	75	0.04	−1.24	55.82
Maternal educational level (years)	112	2	13.97	3.38	9	17	−0.37	−1.69	13.92
Paternal education level (years)	106	8	14.50	3.25	9	17	−0.73	−1.21	14.30
Number of books	112	2	4.02	1.27	2	6	−0.09	−1.13	4.02
Number of children's books	113	1	3.33	1.00	1	6	0.32	0.18	3.33
Overall audio media exposure	108	6	2.28	1.15	1	5	0.82	0.01	2.27
Overall TV/film exposure	111	3	2.04	0.88	1	4	0.33	−0.85	2.04
Shared reading frequency	111	3	3.94	0.74	1	5	−0.71	1.59	3.93
Audiobook frequency	111	3	2.85	1.31	1	5	−0.03	−1.11	2.83
Children's TV/film frequency	112	2	3.13	0.89	1	5	−0.79	0.23	3.12
Parent–child discussion books	113	1	3.95	0.74	1	5	−0.98	2.99	3.94
Parent–child discussion audiobooks	111	3	2.90	1.20	1	5	−0.16	−0.93	2.91
Parent–child discussion TV/films	113	1	3.50	1.02	1	5	−0.48	0.17	3.50
Language skills (norm scores)	110	4	53.34	8.77	27.33	71.25	−0.40	0.05	53.03
Theory of mind	114	0	2.92	1.26	0	5	−0.12	−0.54	2.92
Mental verbs	114	0	5.18	2.78	1	12	0.63	−0.30	5.18

Note: Language skills are reported as normed scores ($M = 50$, SD = 10 in the norming sample), which are independent of age. MI = multiple imputation (100 imputations). Values near 0 for skew and kurtosis indicate normal distribution.

Preliminary analyses

Language skills

As shown in Table 1, our sample reached an average normed score of $M = 53.34$ (SD = 8.77), with a range of 27.33–71.25 points (imputed mean was very similar $M = 53.03$). Moreover, the separate inspection of the 3-year-olds ($n = 34$, $M = 51.62$, SD = 8.28, range = 34.25–66.75) and of the older children revealed similar results ($n = 76$, $M = 54.12$, SD = 8.92, range = 27.33–71.25), indicating that the language development in both age groups was neither meaningfully above nor below that of same-aged children (i.e. the norming sample). As expected, the normed scores were not significantly correlated with children's age (Table 2).

Theory of mind and mental verbs

On average half of the theory-of-mind items were solved correctly, spanning the whole range from 0 to 5 points (see Table 1). The theory-of-mind battery behaved much as described by Wellman and Liu (2004) and Kristen et al. (2006), with the tasks empirically increasing in difficulty from Diverse Desires to Real-Apparent Emotion (Diverse Desires: 87% passing, Diverse Beliefs: 70% passing, Knowledge Access: 70% passing, Explicit False Belief of Location: 53% passing, Contents False Belief: 34% passing, Real-Apparent Emotion: 31% passing). Concerning mental verbs, children solved on average 5.18 items of the 12 items correctly, ranging from 1 to 12 items (see Table 1).

As expected, theory-of-mind performance and mental verb comprehension were strongly correlated ($r = .52$), and both scores were strongly correlated with age, with older children showing higher theory-of-mind scores ($r = .51$) and better mental verb comprehension ($r = .51$; see Table 2). In addition, both theory-of-mind performance ($r = .31$) and mental verb scores ($r = .42$) were significantly and positively correlated to children's language skills, with age being controlled because of the normed scores.

Media exposure

As shown in Table 1, the number of books was considerably higher than the number of children's books at home. The number of books and children's books were highly correlated ($r = .62$; see Table 2 for all correlations). Children's book possession was also significantly but only moderately correlated with current shared reading frequency ($r = .20$), indicating that the variables tap into different aspects of children's book exposure. Overall exposure to TV/films and audio media was significantly correlated with children's exposure to children's TV/films ($r = .25$) and children's audiobook usage ($r = .55$), indicating that these variables reflect different facets of media exposure. Moreover, shared reading frequency and audiobook usage were positively correlated ($r = .33$), whereas both were not significantly correlated with exposure to children's TV/films (see Table 2). Finally, as indicated by positive correlations, parents who discussed media content with their children also tended to discuss across media types ($r = .36–.47$).

Bivariate correlations between media exposure and social-cognitive skills

As shown in Table 2, children's theory-of-mind scores were significantly, positively correlated with children's book possession, general book possession, shared reading frequency, general exposure to audio media and audiobook usage but not with general exposure to TV/films or with children's TV/films. Mental verb comprehension, in contrast, showed significant correlations only with (children's) book possession and audiobook usage. Interestingly, parent–child discussion was not correlated to any of the two indicators of social-cognitive development.

TABLE 2 Bivariate correlations.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Gender	1															
2 Age (months)	−.12	1														
3 Maternal educational level (years)	−.12	−.02	1													
4 Paternal education level (years)	−.08	.04	.67**	1												
5 Number of books	−.22*	.09	.61**	.53**	1											
6 Number of children's books	−.06	.13	.41**	.32**	.62**	1										
7 Overall audio media exposure	−.01	.12	.21*	.06	.18	.30**	1									
8 Overall TV/film exposure	.02	.2	−.06	−.04	.01	.11	.26**	1								
9 Shared reading frequency	.15	−.04	.23*	.15	.15	.20*	.23*	−.13	1							
10 Audiobook frequency	.01	.21*	.16	−.01	.12	.23**	.55**	.06	.33**	1						
11 Children's TV/film frequency	.05	.03	−.23*	−.22*	−.11	−.08	−.06	.25**	−.14	−.05	1					
12 Parent–child discussion books	.06	−.02	.03	.04	−.01	.06	.09	.00	.13	.23*	.02	1				
13 Parent–child discussion audiobooks	−.12	.12	.11	.05	.08	.19*	.21*	.09	.13	.52**	−.03	.47**	1			
14 Parent–child discussion TV/films	−.04	.12	−.08	−.08	−.11	.01	.07	.24*	−.07	.12	.40**	.41**	.36**	1		
15 Language skills (norm scores)	.01	.15	.46**	.31**	.29**	.27**	.34**	−.01	.26**	.39**	−.26**	−.04	.18	−.15	1	
16 Theory of mind	−.11	.51**	.30**	.20*	.31**	.35**	.31**	.09	.21*	.34**	.03	−.06	.17	−.05	.31**	1
17 Mental verbs	−.06	.51**	.30**	.24*	.29**	.24*	.18	−.02	.04	.24*	−.05	−.03	.14	−.03	.42**	.52**

Note: Gender was dummy-coded (female = 1; male = 0). Language skills are reported as normed scores ($M = 50$, SD = 10 in the norming sample), which are independent of age. Correlations were pooled based on 100 imputed data sets.

*$p < .05$. **$p < .01$ (two-tailed).

Regression analyses with theory of mind and mental verb comprehension as outcome variables

After controlling for children's gender, age, language skills and maternal and paternal education, the number of children's books, shared reading frequency, overall audio media frequency and audiobook usage significantly and positively predicted children's theory-of-mind scores (see Table 3). The incremental effects of the different forms of media exposure were small ($f^2 = .038–.046$). In contrast, the total number of books in the household and indicators of children's TV/film exposure were not statistically significant predictors of differences between children's theory-of-mind scores, with incremental effects being also considerably smaller ($f^2 = .000–.018$). Furthermore, parent–child discussions about media content and the interaction between media exposure and parent–child discussions for each media type were not statistically significant predictors of differences between children's theory-of-mind scores. Interestingly, exposure to children's TV/films became a significant positive predictor when parent–child discussions and the interaction between exposure and discussions were entered into the analysis. When parent–child discussions and the interaction term were included, incremental effects for exposure to children's TV/films ($f^2 = .050$) were similar to the effects for shared reading ($f^2 = .048$) and exposure to audiobooks ($f^2 = .053$).

A different pattern of results emerged for mental verbs (see Table 4). None of the media exposure and none of the parent–child discussion variables explained additional variance after controlling for family and child characteristics. Moreover, incremental effects of media and parent–child discussion variables were very small ($f^2 = .000–.021$).

DISCUSSION

The goal of the present study was to extend previous research on the association between story exposure and children's social-cognitive development. Although evidence is growing for such a correlation in adults (Mumper & Gerrig, 2017), only few studies have been published with child samples (e.g. Mar et al., 2010; Nathanson et al., 2013).

Summary and interpretation of the results

In the present study, we found evidence for positive bivariate correlations between book exposure variables, exposure to audio media, audiobook usage and theory-of-mind performance. In addition, controlling for children's age, language skills, gender and their mothers' and fathers' educational levels, the number of children's books, shared reading frequency, overall audio media duration and audiobook usage were statistically significant positive predictors of children's theory-of-mind performance, explaining around 2–3% incremental variance each. Given that the baseline models included a number of control variables that explained already around 37% of the variance in theory-of-mind performance, these effects are practically relevant and support the notion that stories might augment preschoolers' theory-of-mind development. These results are in line with Mar's (2018) SPaCEN framework and previous research (Mar et al., 2010), which used parents' knowledge of children's book titles and authors as an indicator. Lending further support to the role of story exposure in children's theory-of-mind development, no statistically significant relationship was found with parents' general book possession, after controlling for child and family variables. This finding corresponds also with Mar et al.'s (2010) study in which parents' knowledge of adult-literature authors did not predict children's theory-of-mind scores.

In contrast to positive correlations between exposure to books, audiobooks, and theory-of-mind performance, overall TV/film exposure or exposure to children's TV/films were unrelated to children's theory-of-mind scores and were not significant predictors. Only when parent–child discussions about children's TV/films and the interaction between media exposure and parent–child discussions were

TABLE 3 Hierarchical multiple regression analyses with theory of mind as outcome variable.

	B	95% CI	SE	*t*	*p*	R^2	ΔR^2 (90% *CI*)	f^2 (90% CI)
ToM Baseline model								
(Constant)	−2.15	[−3.66; −0.64]	0.77	−2.79	.005	.366** [.222; .443]		
Maternal educational level (years)	0.10	[0.02; 0.19]	0.04	2.38	.017			
Paternal educational level (years)	−0.02	[−0.10; 0.07]	0.04	−0.37	.714			
Gender	−0.07	[−0.45; 0.32]	0.20	−0.342	.732			
Age (months)	0.05	[0.04; 0.07]	0.01	6.24	<.001			
Language skills (norm scores)	0.02	[−0.01; 0.04]	0.01	1.34	.179			
ToM Model 1: ToM Baseline model +								
Number of books	0.13	[−0.08; 0.33]	0.10	1.23	.219	.375** [.224; .447]	.009 [.000; .045]	.014 [.000; .071]
ToM Model 2: ToM Baseline model +								
Number of children's books	0.23	[0.03; 0.44]	0.11	2.20	.028	.394** [.244; .465]	.027* [.002; .076]	.046 [.002; .126]
ToM Model 3: ToM Baseline model +								
Shared reading frequency	0.27	[0.00; 0.54]	0.14	1.97	.049	.389** [.239; .460]	.022* [.000; .068]	.038 [.000; .111]
ToM Model 4: ToM Baseline model +								
Shared reading frequency	0.29	[0.02; 0.56]	0.14	2.08	.037	.395** [.238; .461]	.027 [.000; .070]	.048 [.000; .115]
Parent–child discussion books	−0.13	[−0.38; 0.13]	0.13	−0.99	.323			
ToM Model 5: ToM Baseline model +								
Shared reading frequency (z scores)	0.21	[0.00; 0.42]	0.11	1.98	.048	.395** [.231; .456]	.028 [.000; .064]	.048 [.000; .105]
Parent–child discussion books (z scores)	−0.10	[−0.30; 0.10]	0.10	−0.99	.323			
Shared reading × Parent–child discussion	−0.02	[−0.19; 0.16]	0.09	−0.17	.869			
ToM Model 6: ToM Baseline model +								
Overall audio media exposure	0.20	[0.02; 0.37]	0.09	2.13	.033	.392** [.242; .463]	.026* [.001; .074]	.043 [.001; .121]
ToM Model 7: ToM Baseline model +								
Audiobook frequency	0.17	[0.01; 0.33]	0.08	2.02	.043	.391** [.241; .462]	.023* [<.001; .070]	.041 [<.001; .115]
ToM Model 8: ToM Baseline model +								
Audiobook frequency	0.18	[−0.01; 0.37]	0.10	1.88	.060	.392** [.235; .458]	.024 [.000; .064]	.043 [.000; .105]
Parent–child discussion audiobooks	−0.03	[−0.21; 0.16]	0.010	−0.26	.792			

(Continues)

TABLE 3 (Continued)

	B	95% CI	SE	*t*	*p*	R^2	ΔR^2 (90% *CI*)	f^2 (90% CI)
ToM Model 9: ToM Baseline model +								
Audiobook frequency (z scores)	0.23	[−0.01; 0.48]	0.13	1.85	.064	.398** [.234; .459]	.030 [.000; .066]	.053 [.000; .110]
Parent–child discussion audiobooks (z scores)	0.01	[−0.22; 0.25]	0.12	0.11	.909			
Audiobook × Parent–child discussion	0.11	[−0.10; 0.32]	0.11	1.05	.295			
ToM Model 10: ToM Baseline model +								
Overall TV/film exposure	0.02	[−0.21; 0.24]	0.11	0.15	.884	.366** [.215; .438]	.000 [.000; .006]	.000 [.000; .009]
ToM Model 11: ToM Baseline model +								
Children's TV/film frequency	0.16	[−0.07; 0.38]	0.11	1.39	.164	.377** [.226; .448]	.011 [.000; .050]	.018 [.000; .080]
ToM Model 12: ToM Baseline model +								
Children's TV/film frequency	0.23	[−0.01; 0.47]	0.12	1.92	.055	.392** [.235; .458]	.027 [.000; .069]	.043 [.000; .0113]
Parent–child discussion films/series	−0.17	[−0.37; 0.03]	0.10	−1.64	.100			
ToM Model 13: ToM Baseline model +								
Children's TV/film frequency (z scores)	0.24	[0.01; 0.46]	0.12	2.06	.040	.396** [.232; .457]	.030 [.000; .067]	.050 [.000; .111]
Parent–child discussion films/series (z scores)	−0.16	[−0.37; 0.05]	0.11	−1.49	.136			
Children's TV/films × Parent–child discussion	0.06	[−0.09; 0.21]	0.08	0.76	.450			

Note: Gender was dummy-coded (female = 1; male = 0). *p* values for single regression coefficients are reported for two-tailed tests; f^2 and ΔR^2 represent the incremental effect of adding variables (e.g. children's books) to the basic model that includes only the family and child control variables. ΔR^2 values differ slightly from the descriptive difference between the R^2 values because ΔR^2 values and R^2 values were derived directly from the corresponding pooled *F*-statistics. Values were pooled based on 100 imputed data sets.

*$p < .05$. **$p < .01$.

TABLE 4 Hierarchical multiple regression analyses with mental verb comprehension as outcome variables.

	B	95% CI	SE	*t*	*p*	R^2	ΔR^2 (90% CI)	f^2 (90% CI)
MV Baseline model								
(Constant)	−7.67	[−10.87; −4.47]	1.63	−4.70	<.001	.405** [.263; .480]		
Maternal educational level (years)	0.14	[−0.04; 0.33]	0.09	1.55	.122			
Paternal educational level (years)	0.02	[−0.16; 0.20]	0.09	0.24	.809			
Gender	0.11	[−0.71; 0.94]	0.42	0.27	.786			
Age (months)	0.11	[0.08; 0.15]	0.02	6.23	<.001			
Language skills (norm scores)	0.08	[0.03; 0.13]	0.03	2.96	.003			
MV Model 1: MV Baseline model +								
Number of books	0.21	[−0.22; 0.64]	0.22	0.98	.329	.411** [.262; .481]	.005 [.000; .035]	.010 [.000; .060]
MV Model 2: MV Baseline model +								
Number of children's books	0.10	[−0.35; 0.55]	0.23	0.42	.671	.406** [.257; .476]	.001 [.000; .021]	.002 [.000; .035]
MV Model 3: MV Baseline model +								
Shared reading frequency	−0.23	[−0.81; 0.35]	0.30	−0.79	.432	.408** [.259; .478]	.003 [.000; .030]	.005 [.000; .051]
MV Model 4: MV Baseline model +								
Shared reading frequency	−0.23	[−0.81; 0.36]	0.30	−0.75	.452	.408** [.252; .474]	.004 [.000; .021]	.005 [.000; .035]
Parent–child discussion books	−0.05	[−0.61; 0.50]	0.28	−0.19	.849			
MV Model 5: MV Baseline model +								
Shared reading frequency (z scores)	−0.24	[−0.69; 0.22]	0.23	−1.03	.304	.417** [.255; .477]	.014 [.000; .038]	.021 [.000; .065]
Parent–child discussion books (z scores)	−0.13	[−0.56; 0.30]	0.22	−0.59	.555			
Shared reading × Parent–child discussion	−0.26	[−0.63; 0.11]	0.19	−1.36	.172			
MV Model 6: MV Baseline model +								
Overall audio media exposure	−0.00	[−0.40; 0.39]	0.20	−0.02	.988	.405** [.256; .475]	.000 [.000; .008]	.000 [.000; .013]
MV Model 7: MV Baseline model +								
Audiobook frequency	0.02	[−0.33; 0.38]	0.18	0.13	.893	.405** [.256; .475]	.000 [.000; .007]	.000 [.000; .011]
MV Model 8: MV Baseline model +								
Audiobook frequency	0.00	[−0.41; 0.41]	0.21	0.01	.995	.406** [.250; .471]	.001 [.000; .009]	.002 [.000; .015]
Parent–child discussion audiobooks	0.05	[−0.36; 0.46]	0.21	0.22	.824			

(Continues)

TABLE 4 (Continued)

	B	95% CI	SE	*t*	*p*	R^2	ΔR^2 (90% CI)	f^2 (90% CI)
MV Model 9: MV Baseline model +								
Audiobook frequency (ʓ scores)	0.01	[−0.53; 0.54]	0.27	0.03	.980	.408** [.245; .468]	.003 [.000; .005]	.005 [.000; .008]
Parent–child discussion audiobooks (ʓ scores)	−0.00	[−0.52; 0.52]	0.27	−0.01	.996			
Audiobook × Parent–child discussion	−0.14	[−0.60; 0.31]	0.23	−0.61	.539			
MV Model 10: MV Baseline model +								
Overall TV/film exposure	−0.33	[−0.81; 0.15]	0.24	−1.34	.181	.415** [.266; .484]	.010 [.000; .045]	.017 [.000; .077]
MV Model 11: MV Baseline model +								
Children's TV/film frequency	0.17	[−0.31; 0.64]	0.24	0.68	.497	.407** [.258; .477]	.003 [.000; .028]	.003 [.000; .047]
MV Model 12: MV Baseline model +								
Children's TV/film frequency	0.24	[−0.28; 0.76]	0.26	0.91	.361	.411** [.255; .476]	.006 [.000; .028]	.010 [.000; .047]
Parent–child discussion films/series	−0.17	[−0.61; 0.27]	0.23	−0.75	.453			
MV Model 13: MV Baseline model +								
Children's TV/film frequency (ʓ scores)	0.23	[−0.26; 0.72]	0.25	0.90	.366	.411** [.248; .471]	.006 [.000; .019]	.010 [.000; .032]
Parent–child discussion films/series (ʓ scores)	−0.17	[−0.63; 0.29]	0.23	−0.72	.474			
Children's TV/films × Parent–child discussion	0.02	[−0.31; 0.35]	0.17	0.13	.900			

Note: Gender was dummy-coded (female = 1; male = 0). *p* values for single regression coefficients are reported for two-tailed tests; f^2 and ΔR^2 represent the incremental effect of adding variables (e.g. children's books) to the basic model that includes only the family and child control variables. ΔR^2 values differ slightly from the descriptive difference between the R^2 values because ΔR^2 values and R^2 values were derived directly from the corresponding pooled *F*-statistics. Values were pooled based on 100 imputed data sets.

*$p < .05$. **$p < .01$.

included in the model, exposure to children's TV/films became a significant predictor of theory-of-mind development. Although from a theoretical perspective, Mar's SPaCEN framework (Mar, 2018) suggests no differential effects of stories conveyed via different media, and audiovisual media might be particularly suited for learning non-verbal cues (Mar & Oatley, 2008), these assumptions might not necessarily generalize to child populations.

An explanation of the results might be that much TV content is simply not age-appropriate for children (see Nathanson et al., 2013). In addition, some types of children's programs might not be designed in an appropriate way for social learning or learning in general. For example, Goodrich et al. (2009) reported in their analysis of children's TV that it often focuses on visually intriguing elements and fast-paced action, neglecting reflective features. Children might be overwhelmed by the rapid pace and high amount of visual information, which in turn precludes any learning about mental themes contained in the stories (see Mar et al., 2010, for a similar line of argumentation). In addition, these kinds of TV programs have been shown to be related to poorer executive function in preschool children (e.g. Lillard & Peterson, 2011; Nathanson et al., 2014).

Another explanation might be differences in the ways that the different types of media are used. As reported by Kostyrka-Allchorne et al. (2017, p. 53) in their review on TV exposure and children's cognition and behaviour, TV is often used as a 'digital babysitter', making children passive consumers in the absence of parental interaction. Even if co-viewing occurs, language quantity and quality are typically lower during TV (co-)viewing than during other activities (Nathanson & Rasmussen, 2011; Tanimura et al., 2007). Consequently, an environment that is marked by prolonged sessions of TV exposure probably reduces the time for other more beneficial activities such as shared reading or conversations. Thus, the negative influence of TV exposure (for a review, see Kostyrka-Allchorne et al., 2017) might be explained by a reduction in activities that benefit social development, such as conversations with older siblings (Lewis et al., 1996; Ruffman et al., 1998), family talk about mental states (Moore et al., 1994; Ruffman et al., 2002), and parental use of mental state words during book reading and storytelling (Adrian et al., 2005, 2007; Symons et al., 2005). Stories conveyed via TV/films might offer similar beneficial effects for children but only if they are child-appropriate and are used in a similarly interactive way as their written counterparts. This interpretation might also explain why Mar et al. (2010) found a positive correlation between parents' knowledge of children's film titles and children's theory-of-mind performance. If parents deliberately select films for their children, they might be more likely to choose child-appropriate content and less likely to employ films as a mere babysitter. In addition, they might also use the films as real learning opportunities by involving their children in meaningful discussions about the content. We included no measure of exposure to children's films and TV series separately. Thus, this hypothesis could not be examined in the present study.

Our results also showed that parents who discussed media content with their children, tended to discuss across media types. However, to our surprise, parent–child discussions about media content were not significantly related to children's social-cognitive development, and it did not moderate the relationship between media exposure and theory-of-mind performance. This finding was unexpected, given that previous research indicated that children, in contrast with adults, might not profit so much from the story content but predominantly from the dyadic interaction with their parents and parents' elaborations on the story (Tompkins, 2015a, 2015b). An explanation might be that our three items, which were part of a more comprehensive home-literacy questionnaire (Lenhart & Lingel, 2023), asked only about parent–child discussions about children's books, audiobooks and TV/films in general but not specifically about mental states.

Finally, we found that the bivariate correlational pattern for children's mental verb comprehension was descriptively similar to the pattern for theory-of-mind performance. However, only children's book possession, general book possession and audiobook frequency were related to children's mental verb knowledge. After controlling for children's age, language skills, gender and their mothers' and fathers' educational levels, none of the media exposure variables or the parent–child discussion variables had a significant incremental value in explaining individual differences in mental verb comprehension. Analogous to our expectations for children's theory-of-mind skills, we had expected a positive relation

to child-appropriate story exposure presented via different types of media. Given that children's understanding of mental state language increased with age and was related to their theory-of-mind scores, their parents' educational levels and their language skills, which corresponds to previous research (e.g. Grazzani & Ornaghi, 2012; Lockl & Schneider, 2006), we believe that no methodological aspect of the mental verb task can explain the difference in the theory-of-mind performance outcome. A tentative explanation might be that child-appropriate stories (e.g. presented via children's books) represent opportunities for young preschool children to put themselves into characters' shoes, which augments their performance in typical theory-of-mind tasks. However, the children might concurrently learn not so much about nuanced differences between mental state words. Instead, for the acquisition of a nuanced understanding of mental state words, other situations and contexts might perhaps be more beneficial. For example, real-life situations—when the difference really matters—might be more beneficial for children to understand the difference between *knowing* and *believing*.

Limitations

The present study has some limitations that need to be addressed. A clear limitation is the correlational and cross-sectional design of the study. Therefore, the relationships between indicators of media exposure and children's social-cognitive skills provide no causal evidence. For example, the positive correlation between possession of children's books and children's theory-of-mind development might indicate that cumulative exposure to children's books fosters children's skills, or it might indicate that better theory-of-mind skills lead to more enjoyment of narratives and thus more book buying and reading. From a theoretical perspective, a bidirectional relationship between media exposure and skill development makes sense (Mar, 2018; Zunshine, 2006). Second, we used the number of children's books in the household as an operationalization of children's cumulative storybook exposure. This measure is by nature confounded with parents' socioeconomic status. However, we believe that it is an appropriate means to capture the cumulative aspect of storybook exposure (for a discussion of different operationalizations of print exposure, see Mol & Bus, 2011). Moreover, in the multiple regression analyses, we controlled for mothers' and fathers' educational backgrounds as indicators of parental socioeconomic status and still found the relationship for children's books. In addition, no such unique relationship existed with the total number of books in the household. A third limitation is that we measured the number of children's books and the other types of media exposure in fixed categories, thereby likely sacrificing some differential power compared to an open-ended assessment. However, this kind of assessment is used in many studies including large-scale analyses such as PISA (e.g., Hertel et al., 2014), and parents' ability to accurately indicate the number of books possessed or the minutes the TV is turned on is doubtful. A fourth limitation is that the consumption of children's TV series and films was not assessed separately, given that Mar et al. (2010) found a significant effect for children's films but not for TV series. Although we assume no differences from a theoretical point of view (e.g. Mar, 2018), and Mar et al.'s (2010) findings could have also stemmed from a small sample size, we nevertheless should have empirically examined the different media separately in the present study. Another limitation is that the different types of narrative media content and the content of parent–child discussions about the media were not differentiated in our study. Given that the research findings on the effects of TV exposure show that content matters (Kostyrka-Allchorne et al., 2017), this aspect is an important avenue for future research on the effects of media on children's social-cognitive development. A sixth limitation is that several key constructs (i.e., the different types of media exposure and parent–child discussions of each media type) were measured with only a single item. This increases the likelihood of measurement error and may have attenuated some of the estimates for associations. A seventh limitation is the broad age range in the present study. Different types of media and parent–child discussions might have different effects when looking at different age points. Although we included age as a control variable in the regression analyses, future studies could profit from restricting their age ranges and from examining media effects in specific age groups. A final limitation is that we used parent-report questionnaires for children's media exposure and parent–child discussions. These might partly reflect social desirability and probably introduce measurement error, which

might reduce the validity and reliability of these data. Although observational data would be preferable, they suffer from other shortcomings (e.g. reactivity due to knowledge about the observation, only limited intervals can be observed) and self-report data remain the standard for assessing the home learning environment (e.g. Lenhart & Lingel, 2023).

CONCLUSION

In sum, the present study adds to a growing body of research on how media influences children's social-cognitive development. Combined with previous research (e.g. Mar et al., 2010; Nathanson et al., 2013; Nathanson & Fries, 2014), the current findings indicate that stories might augment children's theory of mind development and that these stories might be presented via different types of media. Moreover, given the results for mental verb comprehension, the present study also underscores the point that previous findings for theory of mind cannot simply be conferred to other indicators of children's social-cognitive development. Accordingly, future studies should include a broader range of social-cognitive measures, assess the content of narratives to which children are exposed and parent–child discussions about mental themes that are stimulated by these narratives.

AUTHOR CONTRIBUTIONS

Jan Lenhart: Conceptualization; methodology; investigation; formal analysis; writing – original draft; writing – review and editing. **Tobias Richter:** Writing – review and editing; investigation.

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CONFLICT OF INTEREST STATEMENT

We have no known conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

Data and scripts are available on osf: https://osf.io/9rmjh/?view_only=b620b6403af44f2eb71e041ac602b1cd.

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