Journal of Experimental Child Psychology 222 (2022) 105476

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Reading fiction and reading minds in early adolescence: A longitudinal study

Sanne W. van der Kleij [a,b,*], Ian Apperly [a], Laura R. Shapiro [b], Jessie Ricketts [c], Rory T. Devine [a]

[a] Centre for Developmental Science, School of Psychology, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
[b] School of Psychology, College of Health and Life Sciences, Aston University, Birmingham B4 7ET, UK
[c] Department of Psychology, Royal Holloway, University of London, Egham, Surrey TW20 0EX, UK

ARTICLE INFO

Article history:
Received 21 December 2021
Revised 4 April 2022
Available online 13 June 2022

Keywords:
Theory of mind
Reading experience
Adolescence
Fiction
Non-Fiction
Motivation

ABSTRACT

Reading fiction is argued to have benefits for our understanding of others' thoughts, feelings and desires, referred to as 'theory of mind'(ToM). We aimed to test this assumption by examining whether children's reading experience is longitudinally associated with later ToM. We examined reading experience and ToM in 236 children between the ages of 11–13 years. Participants were asked to report on their time spent reading both fiction and non-fiction at ages 11 and 13, ToM was measured at age 13. Verbal ability, reading comprehension, and reading motivation were included as control variables in all analyses. Results showed that children's self-reported fiction, but not their non-fiction reading was associated with ToM. Further, the association was concurrent but not longitudinal: fiction reading and ToM at age 13 were associated but fiction reading at age 11 did not predict ToM at age 13. Our findings motivate further research on what types of reading materials might be beneficial, and the level of exposure to fiction that is needed for measurable benefits for later ToM.

* Corresponding author at: Centre for Developmental Science, School of Psychology, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK.
E-mail address: s.w.vanderkleij@bham.ac.uk (S.W. van der Kleij).

https://doi.org/10.1016/j.jecp.2022.105476
0022-0965/

Introduction

Reading is essential for educational achievement and is a prerequisite for accessing most activities in everyday life (Duncan et al., 2007). Reading fiction is even argued to have broader benefits for our understanding of others' thoughts, feelings, and desires, referred to as "mindreading" or "theory of mind" (ToM) (Mar & Oatley, 2008). The high occurrence of social content in children's storybooks, referring to characters' motivations, social interactions, or false beliefs, may provide opportunities for practicing and refining emerging mindreading abilities (Dyer, Shatz, & Wellman, 2000). By 5 years of age, most typically developing children recognize that others possess beliefs, emotions, and desires that can differ from their own (e.g., Wellman & Liu, 2004). However, the ability to understand and reflect on others' intentions, thoughts, and emotions continues to develop throughout middle childhood and adolescence (e.g., Devine & Lecce, 2021) and individual differences persist into adulthood (e.g., Apperly, Samson, & Humphreys, 2009). Therefore, exposure to fiction could act as a training ground for further mindreading development and use. The goal of the current study was to examine the association between reading fiction and ToM between 11 and 13 years of age, when children are able to read independently.

A growing number of studies have sought to examine the overlap between ToM and reading texts in middle childhood and early adolescence (e.g., Ebert, 2020; Kim, 2020; Lecce, Ronchi, & Devine, 2022). The majority of previous studies have focused on how mindreading ability supports children's reading comprehension (Dore, Amendum, Golinkoff, & Hirsh-Pasek, 2018). These studies test the possibility that mindreading is necessary for "high-level" reading comprehension because it equips children with the ability to make inferences about authors' intentions and the minds of characters depicted in a text (e.g., Kim, 2017; Lecce et al., 2022). However, an alternative view is that narrative fiction activates and possibly enriches a reader's mindreading ability (Zunshine, 2006). Through reading fiction, we encounter mental states that are different from our own or experience situations that we otherwise would not encounter (Mar & Oatley, 2008; Zunshine, 2006). Mar, Oatley, Hirsh, Dela Paz, and Peterson (2006) speculated that reading fiction might be positively associated with ToM because frequent engagement with fiction provides readers with social knowledge and opportunities reflect on others' emotions, intentions, and beliefs. Correlations between ToM and reading fiction may also reflect the possibility that skilled mindreaders are more likely to read fiction because they seek out opportunities to think about others' thoughts, feelings, and desires (Mar et al., 2006).

Researchers have examined the relations between individual differences in fiction and nonfiction reading habits and ToM in adults. Reading habits are typically measured using self-report questionnaires about the frequency of reading or through performance on author recognition tests (where participants must distinguish between real authors and foils) (Stanovich & West, 1989). In the first study of its kind, Mar et al. (2006) reported moderate positive partial correlations between reading fiction and mindreading, measured using the Reading the Mind in the Eyes Task (r =.34), among 94 adults. In contrast, there were significant negative associations between nonfiction reading and ToM (r = −.26). A subsequent meta-analysis of six cross-sectional studies of adults indicated that there was a weak positive association between fiction reading and ToM (r =.17; Mumper & Gerrig, 2017).

Links between reading fiction and ToM have also been tested in several experimental studies with adults. For instance, in an experimental intervention, Kidd and Castano (2013) found that after a single session of reading literary fiction adults performed better on subsequent ToM measures than participants who read popular fiction or nonfiction. Attempts to replicate this study have generated mixed results (Black & Barnes, 2015; Fong, Mullin, & Mar, 2013; De Mulder, Hakemulder, van den Berghe, Klaassen, & van Berkum, 2017; Panero et al., 2016; Samur, Tops, & Koole, 2018; van Kuijk et al., 2018). However, a recent meta-analysis of 14 experimental studies indicated that there were small but significant positive effects (g =.15) of exposure to a single session of fiction on immediate ToM performance compared with exposure to nonfiction or no reading (Dodell-Feder & Tamir, 2018). Together, experimental and observational studies lend support to the view that reading fiction (rather than reading experience in general) is associated with ToM.

Some studies have also examined the association between individual differences in reading experience and mindreading ability in children. In a study of 34 parent–child dyads, Adrian, Clemente,

Villanueva, and Rieffe (2005) showed that frequency of parent–child book reading was moderately associated (r =.36) with 4- and 5-year-old children's false belief understanding. Mar, Tackett, and Moore (2010) found that exposure to children's picture books, measured by parents' knowledge of children's authors and book titles, was moderately associated with ToM ability (r =.26) in 55 4- to 6-year-old children. Moving beyond early childhood, Boerma, Mol, and Jolles (2017) reported a moderate concurrent association (r =.30) between reading experience, measured using children's book cover recognition, and ToM, measured using the Strange Stories task (a vignette-based measure of ToM), in 8- to 11-year-old children. These studies provide support for the claim that fiction experience is associated with ToM. However, unlike studies with adults, existing studies with children tend not to distinguish between reading fiction and reading nonfiction, such that it is unclear whether fiction has a unique association with ToM.

The current work exploits an opportunity to collect data on mindreading in the context of a substantial ongoing longitudinal study of reading ability and behavior, where the cohort is currently in early adolescence (Cunningham, Burgess, Witton, Talcott, & Shapiro, 2020; van der Kleij, Burgess, Ricketts, & Shapiro, 2022). Early adolescence provides an interesting opportunity to investigate links between reading fiction and ToM. ToM is studied much less frequently in this age range than in younger children because of ceiling effects on many measures (e.g., Devine & Lecce, 2021). However, studies from the past decade consistently show that ToM continues to develop across middle childhood and adolescence (e.g., Weimer et al., 2021), and we adopted well-established methods to address this concern (Devine & Hughes, 2013). Early adolescence is also an interesting age range from the perspective of research on reading because as children become more proficient readers reading (fiction) becomes an important source for language learning (Nagy, Herman, & Anderson, 1985; Pfost et al., 2013), potentially including language that is relevant to ongoing improvements in ToM. Despite a decline in the self-reported amount of reading and enjoyment of reading in middle childhood and early adolescence, fiction is still reported to be read most often compared with other reading materials, with 54.6% of children in the United Kingdom reporting to read fiction at least once a month (Clark & Teravainen-Goff, 2020). They make independent choices about what they read and vary substantially in how much they read for pleasure (Nippold et al., 2005).

The association between reading experience and mindreading ability could potentially reflect more general abilities needed for both such as language ability and general intelligence. Studies consistently show that ToM performance is weakly to moderately associated with a wide range of language ability measures in early childhood (e.g., Milligan, Astington, & Dack, 2007) and in middle childhood and early adolescence (e.g., Devine & Hughes, 2016). Moreover, researchers have also documented links between children's ToM and the ability to make inferences about texts even when individual differences in verbal ability are taken into account (Lecce et al., 2022). These results raise the possibility that correlation between reading experience and ToM may reflect associations between both reading experience and ToM with language ability and/or reading comprehension. Supporting this view, studies indicate that there are moderate correlations between reading experience and verbal ability (e.g., Cunningham & Stanovich, 1997) and between reading experience and reading comprehension among 6- to 17-year-old children and adolescents (e.g., Mol & Bus, 2011). In addition, Hamilton, O'Halloran, and Cutting (2021) reported weak to moderate correlations between performance on an author recognition test and the Strange Stories task (r =.32) and between self-reported fiction reading and the Strange Stories task (r =.22) among 9- to 12-year-old children. However, neither correlation remained statistically significant (pr values =.16 and.12, p >.08) once individual differences in verbal ability were considered. Therefore, it is important to consider the potential confounding effects of language ability and reading comprehension when investigating links between reading experience and ToM.

Four key gaps remain in the current literature. First, current studies of children do not distinguish between the content of what children read (i.e., fiction vs. nonfiction), such that it is unclear whether reading exposure in general or fiction reading in particular is associated with ToM. Second, because current evidence is conflicting, it is unclear whether the association between reading experience and children's ToM reflects shared associations with verbal ability or reading comprehension. Third, motivational factors may confound apparent associations between reading experience and ToM. Numerous studies show that children exhibit individual differences in reading motivation (i.e., the degree to which they find reading enjoyable, valuable, and important) (e.g., Wigfield & Guthrie,

1997). Reading motivation is moderately associated with both reading frequency and reading comprehension in middle childhood and adolescence (e.g., Becker, McElvany, & Kortenbruck, 2010; McGeown, Duncan, Griffiths, & Stothard, 2015). Therefore, it might not be the amount of reading but rather the motivation and enjoyment for reading fiction that explains this specific association between fiction reading and ToM. Fourth, existing studies linking fiction reading and ToM are based on concurrent associations. Therefore, it is unclear whether reading fiction is developmentally associated with ToM. Concurrent associations, in the absence of longitudinal associations, would indicate that reading fiction overlaps with ToM but does not drive its ongoing development. Rather than being a training ground for ToM development, concurrent associations might reflect the possibility that skilled mindreaders may be more likely to read fiction than their less skilled peers.

The overarching aim of the current study was to examine the longitudinal and concurrent relations between reading fiction and ToM in middle childhood and early adolescence. To this end, we examined reading experience and mindreading in 236 children aged 11 to 13 years. We tested the unique association between reading fiction and ToM by asking children to distinguish between time spent reading fiction and time spent reading nonfiction both concurrently with measurement of ToM and longitudinally (prior to measurement of ToM). We also tested whether the link between reading fiction and ToM was unique by controlling for verbal ability, reading comprehension, reading motivation, and overall time spent reading outside of school. If reading fiction in particular is associated with ToM, then reading fiction (but not nonfiction) will be uniquely correlated with ToM over and above potential confounds. If reading fiction is developmentally associated with children's ToM, then earlier fiction reading will be associated with later ToM.

Method

Participants

Children were selected from an ongoing longitudinal study of children's literacy and vocabulary development (Cunningham et al., 2020; van der Kleij et al., 2022) based in Birmingham in the United Kingdom. All children with written consent from their parents or carers were eligible for participation in the study. Data were obtained from children at four time points spanning the end of primary school and the start of secondary school. Of the sample, 16% of the children were eligible for free school meals and 9% had English as an additional language. Participants were tested at the end of primary school at 11 years of age (M_{age} = 11.27 years, SD = 0.29; n = 299; 169 girls), hereafter referred to as Time 1. They were again tested half a year later (Time 2; M_{age} = 11.71 years, SD = 0.29; n = 266; 152 girls) and 1 year after that (Time 3; M_{age} = 12.75 years, SD = 0.28; n = 236; 133 girls).

A subsample of the cohort took part a year later at Time 4 (M_{age} = 14.33 years, SD = 0.29; n = 96; 58 girls). Due to school closures during the COVID 19 pandemic in 2020, we were not able to test the full sample; however, the subsample did not differ from the rest of the sample in children's verbal ability, t(183) = 0.44, p =.66, d =.07, 95% confidence interval (CI) [−.23,.37], reading comprehension, t(185) = − 0.98, p =.33, d =.15, 95% CI [−.45,.15], or socioeconomic status (SES), t(155) = 0.05, p =.96, d =.01, 95% CI [−.32,.34]. The Time 4 data were not included in the main analyses but were used as a robustness check of the final models for Time 1 to Time 3.

Measures

Reading experience and motivation

At Time 1, Time 3, and Time 4, children completed the student questionnaire from the Progress in International Reading Literacy Study (PIRLS; Martin, Mullis, & Kennedy, 2007). The PIRLS questionnaire includes items designed to capture information about reading habits outside of school and reading motivation (Mullis & Martin, 2015). Children reported on how often they read different types of materials (i.e., "stories or novels" and "books that explain things") outside of school and how often they read for fun or to find out about things outside of school on a 4-point rating scale ranging from *never* to *every day*. Children then reported on their reading motivation by indicating how much they

agreed with a set of statements about reading (i.e., "I enjoy reading," "I like talking about books with other people," "I like it when a book helps me imagine other worlds," "I would like more time for reading," "I think reading is boring," and "I only read if I have to") on a 4-point scale ranging from 1 (*disagree a lot*) to 4 (*agree a lot*).

We examined the latent factor structure of this questionnaire at Time 1 and Time 3 using a mean- and variance-adjusted weighted least squares estimator in Mplus 8 (Muthèn & Muthèn, 2017). A three-factor model consisting of a fiction reading latent factor, a separate correlated nonfiction reading latent factor, and a third correlated reading motivation latent factor fit the data well at Time 1, $\chi^2(32) = 71.767$, root mean square error of approximation (RMSEA) =.078, comparative fit index (CFI) =.983, Tucker–Lewis index (TLI) =.976, and at Time 3, $\chi^2(32) = 44.55$, RMSEA =.041, CFI =.997, TLI =.995. The three-factor model provided a better fit than a one-factor or two-factor solution (i.e., reading experience factor and reading motivation factor) at each time point. Therefore, we created mean scores for fiction reading, nonfiction reading, and reading motivation at Time 1 and Time 3.

Theory of mind

At Time 3 and Time 4, children completed the Silent Films task (Devine & Hughes, 2013, 2016). Children watched five short film clips from a classic silent comedy depicting instances of deception, misunderstanding, and false belief. Children responded to two questions about the first clip and to one question about the remaining clips, which required an explanation of a character's behavior with reference to the character's mental states. Children's open-ended responses were scored using a standard rating scheme aimed at capturing the degree to which participants mentalize in a way that is consistent with the context/situation. Answers were scored with 2 points for correct responses (i.e., referring directly or indirectly to a character's mind in a way that is consistent with the context), 1 point for partially correct responses (i.e., referring directly or indirectly to a character's mind but not considering context carefully), and 0 points for incorrect responses (e.g., failure to refer directly or indirectly to character's mental state or reference to mental states that are not relevant to the context). Two graduate-level research assistants were trained by the lead author and achieved excellent levels of inter-rater reliability ($.82 \leq \alpha \leq 1$). The Silent Films task shows excellent test–retest reliability among 8- to 13-year-old children and convergent validity with the Strange Stories task (a vignette-based measure of ToM) (Devine & Hughes, 2016). Items were summed together to create a total score with a possible range of 0 to 12.

Reading comprehension

At Time 1 children completed the York Assessment of Reading for Comprehension (YARC secondary edition; Stothard, Hulme, Clarke, Barnby, & Snowling, 2010). Participants read an age-appropriate fiction text and answered 13 open-ended questions, of which 5 measured literal comprehension (answer explicitly mentioned in the text) and 8 measured nonliteral comprehension (inferred from the text). Answers were scored by trained research assistants as either correct (1 point) or incorrect (0 points). Cronbach's alpha for this passage was.73, showing acceptable reliability.

Verbal ability

At Time 1 and Time 2 children completed the British Picture Vocabulary Scale (BPVS-3; Dunn, Dunn, & National Foundation for Educational Research, 2009) as a measure of receptive vocabulary. Participants were asked to select the correct picture out of four options corresponding to the target word. The test consists of 14 sets of 12 items increasing in difficulty. The test was discontinued after 8 incorrect responses within a set. Scores on the BPVS were strongly correlated across time (r =.88) and were averaged to create a mean receptive vocabulary score.

Procedure

Measures were administered at four time points. At Time 1 (M_{age} = 11.26 years of age), participants completed the reading experience, motivation, verbal ability, and reading comprehension measures. At Time 2 (M_{age} = 11.71 years of age), they completed the verbal ability measure. Finally, at Time 3 (M_{age} = 12.75 years of age), participants completed the reading experience, motivation, and ToM

Table 1
Descriptive statistics: Reading and theory of mind measures.

	Time 1			Time 2			Time 3			Time 4		
	M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Theory of mind							6.68	2.20	194	7.08	2.14	96
Reading fiction	2.92	0.93	203				2.47	1.03	234	2.23	1.00	84
Reading nonfiction	2.49	0.84	203				2.12	0.82	234	2.10	0.81	86
Reading motivation	3.06	0.70	203				2.69	0.74	234	2.71	0.73	87
Reading comprehension	7.72	2.84	197									
Receptive vocabulary	133.42	13.61	203	136.54	12.85	204						

measures. At Time 1, Time 2, and Time 3, children were tested in a quiet room in school by trained research assistants. Each test session lasted about 45 minutes. Measures of reading were assessed individually; the remaining tasks were completed on a laptop. At Time 4 (M_{age} = 14.32 years of age), children completed the reading experience, motivation, and ToM measures independently on a PC in schools, supervised by a teacher.

Results

Analytic strategy

We used path analysis in Mplus (Version 8; Muthèn & Muthèn, 2017) to analyze the data. We applied a maximum likelihood estimator with robust standard errors (MLR) in each model to account for the non-normal distribution of our indicators. Table 1 shows the descriptive statistics for each key measure and the extent of missing data. We estimated model parameters and standard errors using all available data under the assumption that the data were missing at random so that all children who participated at Time 3 and at least one previous wave were included (n = 236).

Preliminary analyses

Performance on the Silent Films task (M = 6.68, SD = 2.20, range = 0–12) showed scores across the full range, with only 2 participants scoring at floor and 1 participant scoring at ceiling. There were significant declines in self-reported reading behaviors and attitudes over time. Self-reported fiction reading scores declined from Time 1 (M = 2.92, SD = 0.93) to Time 3 (M = 2.47, SD = 1.03), $t(201)$ = 6.43, p <.001, d =.45, 95% CI [.31,.60]. Self-reported nonfiction reading scores also decreased from Time 1 (M = 2.49, SD = 0.84) to Time 3 (M = 2.12, SD = 0.82), $t(201)$ = 5.44, p <.001, d =.38, 95% CI [.24,.53]. Finally, children's reading motivation declined from Time 1 (M = 3.06, SD = 0.70) to Time 3 (M = 2.69, SD = 0.74), $t(201)$ = 8.16, p <.001, d =.37, 95% CI [.28,.46].

Correlations between all measures are shown in Table 2. Correlations across time points showed that there was significant moderate rank-order stability in self-reported fiction reading and nonfiction reading. There was a weak positive correlation between self-reported fiction reading at Time 1 and ToM (Time 3), but this correlation was not statistically significant, $r(170)$ =.12, 95% CI [−.03,.26], p =.12. Nonfiction reading at Time 1 was not significantly correlated with ToM (Time 3), $r(170)$ =.02, 95% CI [−.13,.17], p =.81. These correlations did not differ significantly in strength from one another (z = 1.14, p =.128). At Time 3, there was a significant weak correlation between self-reported fiction reading and ToM, $r(190)$ =.17, 95% CI [.03,.30], p =.018, but no significant correlation between nonfiction reading and ToM, $r(190)$ = −.03, 95% CI [−.17,.11], p =.641. The strengths of these two correlations differed significantly from one another, z = 2.45, p =.007. There was a weak partial correlation between ToM and self-reported fiction reading at Time 1, $pr(169)$ =.12, p =.03 (one-tailed), and self-reported fiction reading at Time 3, $pr(189)$ =.20, p =.001 (one-tailed), when controlling for individual differences in self-reported nonfiction reading.

Table 2
Correlations between reading (Time 1 and Time 3), theory of mind measures (Time 3), and control variables.

		1	2	3	4	5	6	7	8	9	10	11
1	ToM T3											
2	Fiction T1	.12										
3	Nonfiction T1	.02	.34***									
4	Motivation T1	.15	.69***	.37***								
5	Fiction T3	.17*	.51***	.22**	.49***							
6	Nonfiction T3	−.03	.21**	.34***	.20**	.36***						
7	Motivation T3	.05	.52***	.19**	.61***	.73***	.34***					
8	Verbal ability	.23**	.37***	.05	.34***	.25***	−.06	.27***				
9	Comprehension	.25**	.35***	−.03	.40***	.22***	−.02	.23**	.62***			
10	Age	−.11	.01	−.03	.01	−.11	.02	−.06	.08	.02		
11	Gender	−.12	.02	.12	.02	.04	.13	.01	.07	.07	−.04	
12	Parent education	.17*	.13	.07	.09	.12	.05	.13	.12	.04	−.10	.13

Note. T1, Time 1; T3, Time 3; ToM, theory of mind. Age correlations use concurrent age.
* p <.05.
** p <.01.
*** p <.001.

Model results

We examined the unique concurrent and longitudinal associations between reading behavior and ToM in two separate models. In our first model, we regressed ToM scores onto concurrent self-reported fiction and nonfiction reading at Time 3. In the second, longitudinal model, we regressed ToM scores (Time 3) onto self-reported fiction reading and nonfiction reading at Time 1. In both models, we attempted to isolate the unique association between fiction reading and ToM by controlling for reading motivation, verbal ability, child age (at Time 3), gender (i.e., 0 = girl, 1 = boy), and parental education (i.e., low, medium, or high). Predictor variables were permitted to correlate in the model. Models were saturated, meaning that the number of unknown model parameters equaled the number of known values in the input matrix (Brown, 2015). Model results are shown in Table 3 and Table 4.

The first (concurrent) model accounted for 13.7% of the variance in ToM. There was a significant unique concurrent association between fiction reading and ToM even when individual differences in verbal ability and reading motivation were considered (Table 3). In contrast, there was no significant unique association between ToM and nonfiction reading.

The second (longitudinal) model accounted for 11.8% of the variance in ToM. Self-reported fiction reading and nonfiction reading at Time 1 did not uniquely predict ToM at Time 3 (Table 4). Instead, individual differences in ToM were uniquely associated with receptive vocabulary, parental education, and gender.

Table 3
Model summary for the concurrent association between reading experience and theory of mind at Time 3.

	Theory of mind T3	
	β (*SE*)	95% CI
Reading fiction T3	.26 (.09)	[.11,.40]
Reading nonfiction T3	−.01 (.07)	[−.13,.11]
Reading motivation T3	−.22 (.10)	[−.39, −.06]
Verbal ability	.20 (.08)	[.07,.33]
Gender	−.17 (.07)	[−.28, −.06]
Socioeconomic status	.16 (.08)	[.04,.29]
Age	−.10 (.07)	[−.21,.01]

Note. T3, Time 3.

Table 4
Model summary for the longitudinal association between reading experience at Time 1 and theory of mind at Time 3.

	Theory of mind T3	
	β (*SE*)	95% CI
Reading fiction T1	−.06 (.09)	[−.23,.10]
Reading nonfiction T1	.03 (.08)	[−.03,.17]
Reading motivation T1	.10 (.09)	[−.10,.26]
Verbal ability	.21 (.08)	[.08,.34]
Gender	−.17 (.07)	[−.28, −.05]
Socioeconomic status	.17 (.08)	[.04,.29]
Age	−.11 (.07)	[−.22, −.07]

Note. T1, Time 1; T3, Time 3.

Follow-up analyses

We re-ran the two original models using reading comprehension as a covariate instead of verbal ability. Note that there was a strong correlation between reading comprehension and verbal ability, and so we did not enter these measures into the same model. As before, in the concurrent model, Time 3 fiction reading remained uniquely associated with Time 3 ToM (*Std. Est.* =.26, 95% CI [.08,.43], p =.005) even when reading comprehension was included in the model. In the longitudinal model, Time 1 fiction reading (*Std. Est.* = −.05, 95% CI [−.24,.15], p =.64) and nonfiction reading (*Std. Est.* =.05, 95% CI [−.11,.20], p =.55) were not uniquely associated with children's ToM at Time 3. In contrast, reading comprehension at Time 1 was uniquely associated with ToM at Time 3 (*Std. Est.* =.24, 95% CI [.09,.39], p =.002).

As a robustness check, we ran the same models again using data collected a year later (Time 4) with a subsample of the longitudinal cohort (n = 96; M_{age} = 14.32 years; 58 girls). Consistent with the reported results, we found concurrent associations between fiction reading and ToM measured using the Silent Films task (*Std. Est.* =.39, 95% CI [.10,.68], p =.009), but not between nonfiction reading and ToM (*Std. Est.* = −.11, 95% CI [−.32,.10], p =.30), and we found no longitudinal associations among Time 3 fiction (*Std. Est.* =.22, 95% CI [−.17,.61], p =.28), nonfiction reading (*Std. Est.* = −.12, 95% CI [−.34,.10], p =.30), and the ToM data collected at Time 4 a year later.

Discussion

In this study of 236 children, we examined the concurrent and longitudinal relations between reading fiction and ToM in middle childhood and early adolescence. Individual differences in self-reported fiction and nonfiction reading exhibited rank-order stability over time. Only concurrent self-reported fiction reading was associated with ToM when potentially confounding variables such as verbal ability and reading motivation were controlled statistically. This association was specific for fiction reading and ToM given that there was no unique association between nonfiction reading and children's ToM at any time point.

Consistent with previous research, we found a concurrent relation between children's reading experience and their mindreading ability. Children who reported reading more fiction in their own time performed better on the ToM task over and above other confounding variables such as verbal ability, reading comprehension, and parent education. However, such a concurrent relationship could also reflect a shared overlap with a third variable such as motivation or social interest. Reading motivation is a multifaceted construct, encompassing not just interest or perceived skill but also social motivations (e.g., sharing or talking about books) playing a role in choosing to read for pleasure (Guthrie & Wigfield, 2000; Wigfield, Guthrie, Tonks, & Perencevich, 2004). Children with greater social interest may potentially be more inclined to read fiction than nonfiction, especially fiction with social content (e.g., Mar et al., 2006). Busselle and Bilandzic (2009) found that higher emotional engagement with narratives positively correlated with enjoyment of the narratives. The extent to which children

feel engaged with a narrative also differs by their interest in specific genres (Jensen, Christy, Krakow, John, & Martins, 2016). Moreover, recent studies also indicate that individual differences in social motivation (i.e., willingness to build and maintain social relationships) are associated with individual differences in mindreading in middle childhood and early adolescence (Devine & Apperly, 2022). Therefore, it is plausible that individual differences in reading experience and ToM might reflect individual differences in social motivation and interest.

Importantly, we found no evidence for a longitudinal relation between reading fiction and children's mindreading ability. Although it is difficult to interpret the lack of an effect, there are several possible explanations for these results. First, it might be that our measures of reading experience failed to capture sufficient detail on what children are reading and how much they read. Although the questionnaire used in this study is an established measure of children's reading habits (Dowd & Pisani, 2013; Mullis & Martin, 2015), we may need more fine-grained measures that capture the different types of fiction children read. If reading fiction can enrich readers' mindreading ability, it is likely that a specific type of fiction that provides more opportunity to encounter mental states that differ from our own and to reflect on others' emotions, intentions, and beliefs (e.g., Mar et al., 2006; Zunshine, 2006) has potential developmental benefits for their mindreading ability and not fiction in general.

Second, it could be that a developmental relation does exist early in development, but not at this age. As shown by longitudinal studies in younger children, the amount of shared picture book reading predicts children's performance on false belief tasks (e.g., Adrian et al., 2005; Peskin & Astington, 2004). In these younger children, who are still developing basic concepts and principles for how others think and behave, reading may still provide learning opportunities for their mindreading ability, whereas this may be less so later in development. Among adolescents or even adults, these learning opportunities might still exist, but they may take longer to accumulate than the time frame studied here.

Third, there might be a developmental relation, but this might be in the opposite direction than the one studied here. Children with better mindreading ability might be more inclined to read fiction, which again suggests that motivational factors might potentially drive this relation. However, previous experimental work does seem to suggest that reading fiction, specifically literary fiction, in adults can at least "prime" better performance on ToM tasks (i.e., have immediate effects; Black & Barnes, 2015; Kidd & Castano, 2013), although this might not have implications for training or long-term benefits.

In sum, there is a need for more longitudinal research on this topic over a longer time frame to test the direction of the relation and to test for other factors such as social motivation (see Chevallier, Kohls, Troiani, Brodkin, & Schultz, 2012) that might drive the relation. We also need more research on what types of reading materials might be beneficial and how much and how long exposure should be in order to have developmental benefits for children's mindreading ability.

We also need to consider several limitations. First, because we had no measurement of prior mindreading ability, we were not able to tease apart the unique contribution of verbal ability and reading comprehension from children's prior mindreading ability, nor could we examine the predictive effect of ToM on later fiction reading. Second, we could not rule out whether it was verbal ability, reading comprehension, or both that are uniquely related to our ToM measure because we were not able to fit both constructs in the same model due to their strong correlation. Third, we used a single task—the Silent Films task (Devine & Hughes, 2013)—to assess ToM. Measuring ToM in adolescence and adulthood remains a significant challenge because of ceiling effects (e.g., Devine & Lecce, 2021), disagreement about what some tasks actually measure (e.g., Oakley, Brewer, Bird, & Catmur, 2016), and lack of convergent validity between different tasks (e.g., Qureshi, Monk, Samson, & Apperly, 2020; Warnell & Redcay, 2019). Among other things, this may account for the observation of inconsistent relationships between ToM and aspects of reading behavior in previous research (Dodell-Feder & Tamir, 2018). Given this uncertain picture, we believe that it is to the benefit of the current study that the Silent Films task does not suffer from ceiling effects in the current age range and in previous work shows good test–retest reliability, shows convergent validity with the Strange Stories task (Devine & Hughes, 2016), and predicts teacher-rated social ability (e.g., Devine & Apperly, 2022). Finally, as mentioned before, we need more fine-grained measures of children's reading behavior to test whether fiction that is rich in social content specifically contributes to children's mindreading development—for

instance, by asking children to keep reading diaries measuring what they read and how much time they spent reading over a longer period of time.

Notwithstanding these limitations, several strengths are worth acknowledging. We addressed important gaps in the literature by examining the relation between reading experience and mindreading ability in a longitudinal design in an age group where children are still developing their mindreading ability and read independently. Our reading experience measures showed rank-order stability over time, and our study was the first to isolate fiction versus nonfiction reading in relation to children's ToM. Future research is needed to specify the potential benefits of reading for mindreading by studying this association over a longer time frame and using more causally sensitive designs by intervening and controlling the exposure to specific types of fiction. Such research could also provide important practical insights into how to provide opportunities for children's mindreading development.

Conclusion

Our study is one of the first to examine the relation between children's fiction and nonfiction reading amount and their mindreading ability both concurrently and longitudinally in middle childhood. We showed that there is a unique concurrent association between fiction reading and mindreading but that there is no longitudinal association. Future studies should build on this evidence with more robust measures of reading experience and continuous measurement over time. The crucial next step is to uncover the underlying mechanism to answer why reading could benefit ToM. Specifically, we need to understand what types of reading materials might be beneficial and also the level of exposure to fiction that is needed for measurable benefits for later mindreading.

Acknowledgments

This study was supported by the Nuffield Foundation (EDO/43287; investigators L.R. Shapiro [principal investigator], J. Ricketts, and A.P. Burgess) and the Leverhulme Trust (ECF-2020-347).

References

Adrian, J. E., Clemente, R. A., Villanueva, L., & Rieffe, C. (2005). Parent–child picture-book reading, mothers' mental state language and children's theory of mind. *Journal of Child Language, 32*, 673–686.

Apperly, I. A., Samson, D., & Humphreys, G. W. (2009). Studies of adults can inform accounts of theory of mind development. *Developmental Psychology, 45*, 190–201.

Becker, M., McElvany, N., & Kortenbruck, M. (2010). Intrinsic and extrinsic reading motivation as predictors of reading literacy: A longitudinal study. *Journal of Educational Psychology, 102*, 773–785.

Black, J. E., & Barnes, J. L. (2015). The effects of reading material on social and non-social cognition. *Poetics, 52*, 32–43.

Boerma, I. E., Mol, S. E., & Jolles, J. (2017). The role of home literacy environment, mentalizing, expressive verbal ability, and print exposure in third and fourth graders' reading comprehension. *Scientific Studies of Reading, 21*, 179–193.

Busselle, R., & Bilandzic, H. (2009). Measuring narrative engagement. *Media Psychology, 12*, 321–347.

Chevallier, C., Kohls, G., Troiani, V., Brodkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences, 16*, 231–239.

Clark, C., & Teravainen-Goff, A. (2020). *Children and young people's reading in 2019: Findings from our annual literacy survey.* National Literacy Trust Research Report, ERIC No. ED607777.

Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33*, 934–945.

Cunningham, A. J., Burgess, A. P., Witton, C., Talcott, J. B., Shapiro, L. R. (2020). Dynamic relationships between phonological memory and reading: a five year longitudinal study from age 4 to 9. Developmental Science, e12986. https://doi.org/10.1111/desc.12986.

De Mulder, H. N., Hakemulder, F., van den Berghe, R., Klaassen, F., & van Berkum, J. J. (2017). Effects of exposure to literary narrative fiction: From book smart to street smart? *Scientific Study of Literature, 7*, 129–169.

Devine, R. T., & Apperly, I. A. (2022). Willing and able? Theory of mind, social motivation, and social competence in middle childhood and early adolescence. *Developmental Science, 25*, e13137.

Devine, R. T., & Hughes, C. (2013). Silent Films and Strange Stories: Theory of mind, gender, and social experiences in middle childhood. *Child Development, 84*, 989–1003.

Devine, R. T., & Hughes, C. (2016). Measuring theory of mind across middle childhood: Reliability and validity of the Silent Films and Strange Stories tasks. *Journal of Experimental Child Psychology, 149*, 23–40.

Devine, R. T., & Lecce, S. (Eds.). (2021). *Theory of mind in middle childhood and adolescence: Integrating multiple perspectives*. New York: Routledge.

Dodell-Feder, D., & Tamir, D. I. (2018). Fiction reading has a small positive impact on social cognition: A meta-analysis. *Journal of Experimental Psychology: General, 147*, 1713–1727.

Dore, R. A., Amendum, S. J., Golinkoff, R. M., & Hirsh-Pasek, K. (2018). Theory of mind: A hidden factor in reading comprehension? *Educational Psychology Review, 30*, 1067–1089.
Dowd, A. J., & Pisani, L. (2013). Two wheels are better than one: The importance of capturing the home literacy environment in large-scale assessments of reading. *Research in Comparative and International Education, 8*, 359–372.
Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., ... Japel, C. (2007). School readiness and later achievement. *Developmental Psychology, 43*, 1428–1446.
Dunn, L. M., Dunn, D. M., & National Foundation for Educational Research. (2009). *British Picture Vocabulary Scale* (3rd ed.). London: GL Assessment.
Dyer, J. R., Shatz, M., & Wellman, H. M. (2000). Young children's storybooks as a source of mental state information. *Cognitive Development, 15*, 17–37.
Ebert, S. (2020). Theory of mind, language, and reading: Developmental relations from early childhood to early adolescence. *Journal of Experimental Child Psychology, 191*, 104739.
Fong, K., Mullin, J. B., & Mar, R. A. (2013). What you read matters: The role of fiction genre in predicting interpersonal sensitivity. *Psychology of Aesthetics, Creativity, and the Arts, 7*, 370–376.
Guthrie, J. T., & Wigfield, A. (2000). Engagement and motivation in reading. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.). *Reading research handbook* (Vol. 3, pp. 403–424). Mahwah, NJ: Lawrence Erlbaum.
Hamilton, L. G., O'Halloran, I., & Cutting, N. (2021). Individual differences in narrative production in late childhood: Associations with age and fiction reading experience. *First Language, 41*, 179–199.
Jensen, J. D., Christy, K., Krakow, M., John, K., & Martins, N. (2016). Narrative transportability, leisure reading, and genre preference in children 9–13 years old. *Journal of Educational Research, 109*, 666–674.
Kidd, D. C., & Castano, E. (2013). Reading literary fiction improves theory of mind. *Science, 342*, 377–380.
Kim, Y. S. G. (2017). Why the simple view of reading is not simplistic: Unpacking component skills of reading using a direct and indirect effect model of reading (DIER). *Scientific Studies of Reading, 21*, 310–333.
Kim, Y. S. G. (2020). Theory of mind mediates the relations of language and domain-general cognitions to discourse comprehension. *Journal of Experimental Child Psychology, 194*, 104813.
Lecce, S., Ronchi, L., & Devine, R. T. (2022). Mind what teacher says: Teachers' propensity for mental-state language and children's theory of mind in middle childhood. *Social Development, 31*, 303–318.
Mar, R. A., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science, 3*, 173–192.
Mar, R. A., Oatley, K., Hirsh, J., Dela Paz, J., & Peterson, J. B. (2006). Bookworms versus nerds: Exposure to fiction versus non-fiction, divergent associations with social ability, and the simulation of fictional social worlds. *Journal of Research in Personality, 40*, 694–712.
Mar, R. A., Tackett, J. L., & Moore, C. (2010). Exposure to media and theory-of-mind development in preschoolers. *Cognitive Development, 25*, 69–78.
Martin, M. O., Mullis, I. V. S., & Kennedy, A. M. (2007). *PIRLS 2006 technical report*. Chestnut Hill, MA: TIMSS and PIRLS International Study Center, Boston College.
McGeown, S. P., Duncan, L. G., Griffiths, Y. M., & Stothard, S. E. (2015). Exploring the relationship between adolescents' reading skills, reading motivation and reading habits. *Reading and Writing, 28*, 545–569.
Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: Meta-analysis of the relation between language ability and false-belief understanding. *Child Development, 78*, 622–646.
Mol, S. E., & Bus, A. G. (2011). To read or not to read: A meta-analysis of print exposure from infancy to early adulthood. *Psychological Bulletin, 137*, 267–296.
Mullis, I. V. S., & Martin, M. O. (Eds.) (2015). *PIRLS 2016 assessment framework* (2nd ed.). Chestnut Hill, MA: TIMSS and PIRLS International Study Center, Boston College.
Mumper, M. L., & Gerrig, R. J. (2017). Leisure reading and social cognition: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts, 11*, 109–120.
Muthèn, L. K., & Muthèn, B. (2017). *Mplus: Statistical analysis with latent variables: User's guide* (8th ed.). Los Angeles: Muthèn & Muthèn.
Nagy, W. E., Herman, P. A., & Anderson, R. C. (1985). Learning words from context. *Reading Research Quarterly, 20*, 233–253.
Oakley, B. F., Brewer, R., Bird, G., & Catmur, C. (2016). Theory of mind is not theory of emotion: A cautionary note on the Reading the Mind in the Eyes Test. *Journal of Abnormal Psychology, 125*, 818–823.
Panero, M. E., Weisberg, D. S., Black, J., Goldstein, T. R., Barnes, J. L., Brownell, H., & Winner, E. (2016). Does reading a single passage of literary fiction really improve theory of mind? An attempt at replication. *Journal of Personality and Social Psychology, 111*, e46–e54.
Peskin, J., & Astington, J. W. (2004). The effects of adding metacognitive language to story texts. *Cognitive Development, 19*, 253–273.
Qureshi, A. W., Monk, R. L., Samson, D., & Apperly, I. A. (2020). Does interference between self and other perspectives in theory of mind tasks reflect a common underlying process? Evidence from individual differences in theory of mind and inhibitory control. *Psychonomic Bulletin & Review, 27*, 178–190.
Samur, D., Tops, M., & Koole, S. L. (2018). Does a single session of reading literary fiction prime enhanced mentalising performance? Four replication experiments of Kidd and Castano (2013). *Cognition and Emotion, 32*, 130–144.
Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. *Reading Research Quarterly, 24*, 402–433.
Stothard, S., Hulme, C., Clarke, P. J., Barnby, P., & Snowling, M. (2010). *The York Assessment of Reading for Comprehension (YARC): Passage Reading Secondary*. London: GL Assessment.
Van der Kleij, S. W., Burgess, A. P., Ricketts, J., & Shapiro, L. R. (2022). From bibliophile to sesquipedalian: Modelling the role of reading experience in vocabulary and reading comprehension. *Scientific Studies of Reading*, 1–13. https://doi.org/10.1080/10888438.2022.2068418.
van Kuijk, I., Verkoeijen, P., Dijkstra, K., Zwaan, R. A., Vazire, S., & Vul, E. (2018). The effect of reading a short passage of literary fiction on theory of mind: A replication of Kidd and Castano (2013). *Collabra: Psychology, 4*(1), 7. https://doi.org/10.1525/collabra.117.

Warnell, K. R., & Redcay, E. (2019). Minimal coherence among varied theory of mind measures in childhood and adulthood. *Cognition, 191*, 103997.
Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development, 75*, 523–541.
Wigfield, A., & Guthrie, J. T. (1997). Relations of children's motivation for reading to the amount and breadth or their reading. *Journal of Educational Psychology, 89*, 420–432.
Wigfield, A., Guthrie, J. T., Tonks, S., & Perencevich, K. C. (2004). Children's motivation for reading: Domain specificity and instructional influences. *Journal of Educational Research, 97*, 299–310.
Zunshine, L. (2006). *Why we read fiction: Theory of mind and the novel*. Columbus: Ohio State University Press.
Weimer, A. A., Warnell, K. R., Ettekal, I., Cartwright, K. B., Guajardo, N. R., & Liew, J. (2021). Correlates and antecedents of theory of mind development during middle childhood and adolescence: An integrated model. *Developmental Review, 59*. https://doi.org/10.1016/j.dr.2020.100945 100945.
Pfost, M., Dörfler, T., & Artelt, C. (2013). Students extracurricular reading behavior and the development of vocabulary and reading comprehension. *Learning and Individual Differences, 26*, 89–102. https://doi.org/10.1016/j.lindif.2013.04.008.
Nippold, M. A., Duthie, J. K., & Larsen, J. (2005). Literacy as a leisure activity. *Language, Speech, and Hearing Services in Schools, 36*, 93–102. https://doi.org/10.1044/0161-1461(2005/009).
Brown, T. A. (2015). *Confirmatory Factor Analysis for Applied Research* (2nd ed.). London: The Guilford Press.