Bookworms versus nerds: Exposure to fiction versus non-fiction, divergent associations with social ability, and the simulation of fictional social worlds

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Abstract

While frequent readers are often stereotyped as socially awkward, this may only be true of non-fiction readers and not readers of fiction. Comprehending characters in a narrative fiction appears to parallel the comprehension of peers in the actual world, while the comprehension of expository non-fiction shares no such parallels. Frequent fiction readers may thus bolster or maintain their social abilities unlike frequent readers of non-fiction. Lifetime exposure to fiction and non-fiction texts was examined along with performance on empathy/social-acumen measures. In general, fiction print-exposure positively predicted measures of social ability, while non-fiction print-exposure was a negative predictor. The tendency to become absorbed in a story also predicted empathy scores. Participant age, experience with English, and intelligence (*g*) were statistically controlled.
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1. Introduction

> [M]an tends most towards representation and learns his first lessons through representation.

> — Aristotle, *Poetics* (trans., 1987)

We are all familiar with the stereotype of the bookworm. An image leaps automatically to mind: that of a nebbish and unfashionable individual, wearing spectacles, whose demeanour is largely characterized by the social awkwardness one might expect from someone who has chosen the company of print over peers. There are, however, good reasons to expect that this stereotype of social impairment may only pertain to non-fiction readers and furthermore, that the very opposite may be true of fiction readers. Non-fiction is typically expository in nature, whereas fiction most often takes the form of narrative. Although these two forms of text are highly similar—both are discourse-level text with local and global coherence—they are not identical in structure or content. This fact is evidenced by the observed differences between these two genres with respect to comprehension and recall (Graesser, Hauft-Smith, Cohen, & Pyles, 1980), and inference generation (Singer, Harkness, & Stewart, 1997). Stories contain depictions of the actual world replete with intentional agents pursuing goals to form a plot, whereas expository texts, in contrast, share no such parallels with the actual world. The processing of narratives, then, shares some similarities with the processing of our real social environment. Thus, frequent readers of narrative fiction, individuals who could be considered 'bookworms,' may bolster or maintain social-processing skills whilst reading stories, although they are removed from actual social contact during this activity. Conversely, frequent readers of non-fiction expository texts, individuals colloquially referred to as 'nerds,' could be headed toward an embodiment of the socially awkward stereotype by removing themselves from the actual social realm while not simulating experience in a fictional one. There exists both theoretical and empirical support for this hypothesis.

1.1. Theoretical parallels between processing narrative fiction and real-world events

Jerome Bruner (1986) was one of the first psychologists to propose that narrative was a distinctive mode of thought, specifically oriented around human agents, their intentions and their interactions. Richard Gerrig (1993) took this idea further, hypothesizing that real-world and narrative-processing are subserved by the same cognitive mechanisms. Gerrig (1993) also described a phenomenon sometimes referred to as narrative engagement—the manner in which stories draw in and capture their readers. He employed a metaphor of travel, describing how a good work of fiction can "transport" a reader to different times and places. Once transported, that reader experiences thoughts and emotions predicated on the fictional context. Such thoughts and experiences are not merely a form of entertainment, but have lasting real-world consequences. People speak of certain, favorite, books as "life-changing" for example, and it is common for feelings of sadness or elation to persist after closing the pages of a book.

The cognitive basis Gerrig (1993) proposed as common to both fictional and real-world processing may well entail the ability to infer what is in the minds of others. This ability has become known as theory-of-mind or mentalizing (Carruthers & Smith, 1996). While we are not privy to the thoughts and beliefs of others, their behaviour is motivated by these invisible internal states (Frith & Frith, 2001). In consequence, we must predict the actions and reactions of others by, in part, inferring what they are thinking, feeling, and intending. This ability to infer and monitor the mental-states of numerous autonomous agents also seems to underlie our capacity to understand drama and narrative. One need only attend a Shakespearean play to observe that understanding and keeping track of the motivations, intentions, and beliefs of characters is paramount for narrative comprehension. Narratives are fundamentally social in nature in that almost all stories concern relationships between people; understanding stories thus entails an understanding of people, and how their goals, beliefs and emotions interact with their behaviours.

Martha Nussbaum (1995) has taken the argument yet further. She has proposed that literature, most typically the novel, actively develops a form of imaginative thinking and feeling about others and their predicaments that is essential for social life, not just in personal relationships, but also in more public modes such as the administration of justice.

Formal models of discourse-processing in cognitive psychology have begun to take into account this important similarity between social- and story-processing. Although early theories focused on representing the text itself, current models have turned to understanding how the mind represents what the text describes, known as a mental model (Johnson-Laird, 1983) or situation model (van Dijk & Kintsch, 1983). Newer formulations based on this idea explicitly dictate that readers monitor many aspects of a mental model, including social aspects such as persons and their motivational states (Zwaan & Radvansky, 1998). A recent theory by Zwaan (2004) further incorporates the parallels between real-world and text-processing, proposing a framework based on theories of perceptual symbol systems (Barsalou, 1999). This Immersed Experiencer Framework (Zwaan, 2004) hypothesizes that words automatically activate neural events similar to those that occur during the actual experience of their referents. Thus, reading about complex social interactions such as those commonly described in narrative fiction, theoretically engages neural substrates similar to those used to navigate similar situations in the real-world. It should be noted that these ideas are fully congruent with an earlier proposal by Oatley (1999), who suggested that reading stories results in a cognitive and emotional simulation of experience, one that is specifically social in nature.

1.2. Empirical evidence for a parallel between narrative and real-world comprehension

The experimental work spurred by the theoretical proposals mentioned above have provided substantive support for these ideas. At the sub-discourse-level, Zwaan and his colleagues have demonstrated that language processing appears to involve perceptual simulations that correspond to real world experience (e.g., Zwaan, Madden, Yaxley, & Aveyard, 2004; Zwaan, Stanfield, & Yaxley, 2002). At the

discourse-level, readers often comprehend a story by assuming the perspective of a character (Özyürek & Trabasso, 1997; Rall & Harris, 2000), and mentally represent his or her emotions (Gernsbacher, Goldsmith, & Robertson, 1992). Moreover, these emotional experiences are equivalent in type and magnitude to those evoked by everyday events (László & Cupchik, 1995; Oatley, 1994, 1999). The cognitive and emotional forms of perspective-taking described above may underlie real-world mentalizing (Tager-Flusberg, 2001), and appear to mirror in some aspects the two major explanatory theories of this process, simulation-theory and theory-theory (Carruthers & Smith, 1996). Further, readers appear to create models of the characters they read about, and readily update these representations as new information becomes available (Rapp, Gerrig, & Prentice, 2001); a similar process likely occurs during encounters with individuals in the real-world (Read & Miller, 1993). Considering how closely related real-world and narrative-processing appear to be, it should not be surprising that engagement with fictional narratives can result in changes of belief and attitude, much like those produced by unmediated experiences in the real-world (Green & Brock, 2000; Prentice, Gerrig, & Bailis, 1997; Strange & Leung, 1999), although there is still some debate regarding the mechanism of this persuasion (Mar, Oatley, & Eng, 2003).

From developmental psychology, there is evidence that acquiring theory-of-mind abilities at around age four may aid the comprehension of stories, particularly those that involve belief (Astington, 1990). Futhermore, it appears that childhood imaginative abilities, similar to those hypothetically employed during adult narrative comprehension, are related to theory-of-mind skills. Seja and Russ (1999) have demonstrated, for example, that fantasy play ability appears importantly related to emotional understanding, over and above individual variation in verbal ability. Taylor and Carlson (1997) revealed, similarly, that children whose fantasy and pretend play abilities were more sophisticated do better on theory-of-mind tasks, independent of their verbal intelligence. Harris (2000), in his book which reviews a great deal of work in this area, argues that imaginative role-play during childhood may play a unique role in empathy, theory-of-mind, and importantly, later enable "children to understand and eventually produce connected discourse about non-current episodes" (p. 194). There is also some preliminary evidence that a causal relation exists between the fostering of narrative skills in children and the improvement of social abilities. Schellenberg (2004) randomly assigned 6 year-olds to 36 weeks of music lessons, drama lessons, or a waiting list. Only children who had received training in drama displayed an increase in adaptive social behaviour (medium effect-size; $d = 0.57$). Education in a narrative art for these children thus appears to have improved empathic or perspective-taking abilities to the extent that measurable changes in prosocial behaviour occurred.

Support for a parallel between social- and story-processing can also be found in the neuropsychological literature. To begin, Zwaan's (2004) basic proposal that words evoke neural events similar to those manifested during actual experience of the words' referent, has received some support. Reading particular action words (e.g., 'to kick' or 'to talk'), for example, results in activations in the motor cortex specific to those areas that represent the relevant part of the body typically used for that action (e.g., the leg or the face; Pulvermüller, Härle, & Hummel, 2001). Imagining an experience also

appears to engage neural substrates similar to those involved with actually perceiving that experience; this has been found to be the case with respect to perceiving objects (Kosslyn, Thompson, Kim, & Alpert, 1995; O'Craven & Kanwisher, 2000; cf. Mellet et al., 1996), motion (Goebel, Khorram-Sefat, Muckli, Hacker, & Singer, 1998; Kourtzi & Kanwisher, 2000), sound (Kraemer, Macrae, Green, & Kelley, 2005), and personal action (Gerardin et al., 2000). Perhaps most germane to the current discussion, a review of the neuroimaging and lesion literature found that the areas commonly implicated in narrative comprehension and production include a network of brain regions often associated with theory-of-mind processing (Mar, 2004).

1.3. The current study

The close relation between navigating social- and story-worlds has a number of implications, not the least interesting of which is the proposal that readers of predominantly narrative fiction may actually improve or maintain their social-inference abilities through reading. The same is unlikely to be true of non-fiction readers. Although in both cases individuals are removing themselves from true social interaction by virtue of the solitary nature of reading, non-fiction presumably does not sponsor the same simulation of the social world as narrative fiction. Frequent readers of non-fiction, then, by sacrificing human interaction and replacing it with no similar substitute, may actually impair their social skills. Individual differences in reading habits and preferences, then, may relate systematically to individual differences in social-processing ability. Exploring this question is made difficult, however, by the fact that many frequent readers of narrative fiction also likely read a great deal of non-fiction. A good portion of readers are simply readers per se, often happy to read whatever happens to be available at the moment regardless of genre. Fiction-reading is thus likely to be very highly correlated with non-fiction-reading. The question we would fundamentally like to ask is whether readers who read relatively more narrative fiction, controlling for the amount of expository non-fiction read, have greater social abilities. Stated in simpler terms, if two people read an equivalent amount of non-fiction, will the individual who reads more narrative fiction be better at social perception and understanding? In order to properly examine this question, partial correlations controlling for the variance shared between fiction and non-fiction reading must be employed.

At minimum, three separate arguments could be made for why a positive relation would exist between the reading of narrative and the possession of social abilities. Perhaps the simplest proposal is that frequent fiction readers expose themselves to concrete social knowledge embedded within stories, which is then applied to real-world interactions. It may also be that frequent readers of narrative hone their social-inference and monitoring skills, and that these improved skills are exercised in the real-world. A third possibility is that individuals who are very empathic, and skilled at making social inferences, simply enjoy reading fiction more and are more likely to engage in this activity. None of these individual hypotheses exclude the other possibilities, and in all likelihood some combination is at play. In any case, pursuing these more refined explanations must follow the basic demonstration that a positive

relation exists between the reading of fictional narratives and possessing social abilities or knowledge. The current study was intended to provide such a demonstration.

2. Method

2.1. Participants

A total of 94 participants (63 females) from the University of Toronto community ranging in age from 17 to 57 years ($M = 22.3$, $SD = 6.6$) participated in the study, for either course credit (46 Introductory Psychology students), or $15 (CDN) in remuneration. The latter were recruited using posters posted around the campus. On average, individuals had been fluent in English for 21.1 years, $SD = 7.4$, Min $= 8.0$. Most participants ($N = 70$) reported English as a first language, and English was generally learned at a young age, $M = 1.2$ years, $SD = 2.5$.

2.2. Materials

2.2.1. Author Recognition Test

The assessment of reading habits is made difficult by the issue of social-desirability, a problem intrinsic to a domain inextricably tied to ideas of intelligence and sophistication. Stanovich and West (1989) surmounted this problem by applying a signal-detection logic to their measure, resulting in the Author Recognition Test (ART). This measure asks respondents to check off from a list of names, those that they recognize as names of authors. Guessing is discouraged, however, as they are informed that some items are not author names (i.e., they are foils). Although not a direct measure of which authors participants read—in that a respondent need only recognize the names, not claim to have read the authors' books—it serves as an adequate measure of exposure to print. People tend to learn about authors they have not yet read by either shopping for books related to their interest, perusing books at the library, reading book reviews related to their genre of preference, discussing their interest and tastes in reading with others, or similar activities highly associated with reading itself. Extensive validation of this measure exists. ART scores are predicted by early reading ability (Cunningham & Stanovich, 1997), and predict real-world reading (West, Stanovich, & Mitchell, 1993), fine reading skills (Stanovich & West, 1989), and knowledge acquisition even after cognitive ability has been statistically controlled (Stanovich & Cunningham, 1993; West et al., 1993).

The ART was updated and revised for the current experiment, introducing a strict categorization of names into two mutually exclusive categories of Fiction and Non-fiction (50 names for each, and 40 foils; See Appendix A). Great care was taken to ensure that Fiction authors wrote only narrative works, and that Non-fiction authors worked exclusively in a non-narrative domain (e.g., not biography). To ensure breadth, both Fiction and Non-fiction were broken down into five separate genres, with 10 names included for each. This modification allowed for a score to be derived for both narrative fiction and expository non-fiction print-exposure. Other updated

versions of the ART have demonstrated convergent validity with respect to more conventional measures of reading exposure (Stanovich & Cunningham, 1993; West et al., 1993). Sénéchal and colleagues (Sénéchal, LeFevre, Thomas, & Daley, 1998, see Sénéchal & LeFevre, 2002; Sénéchal, LeFevre, Hudson, & Lawson, 1996), for example, modified the ART in order to examine exposure to storybooks in young children, creating checklists of children's authors and titles of storybooks for parents to complete. Although their versions of the ART correlated with parental self-reports of reading, the recognition checklist measures were a better predictor of the child's vocabulary, perhaps indicating a social-desirability bias in the self-reports that limited their validity. This same study also provided some evidence that a modified ART can be sensitive to preference and actual exposure; parents tended to score higher on an ART geared toward children's literature than non-parents.

Due to the noted heterogeneity of the empathy construct, evidenced by a common lack of intercorrelation between various measures (for a review see Ickes, 1997), diverse methods of assessment were employed (including self-report and performance-based measures), described below.

The Interpersonal Reactivity Index. The Interpersonal Reactivity Index (IRI) is a 28 item self-report measure of multi-dimensional empathy containing four subscales: (1) Fantasy, (2) Perspective-taking, (3) Empathic Concern and (4) Personal Distress (Davis, 1980). Respondents indicate the degree to which statements are self-descriptive using a five-point Likert scale. Example items include: "I try to look at everybody's side of a disagreement before I make a decision" (Perspective-taking); "I am often quite touched by things that I see happen" (Empathic Concern); and "Being in a tense emotional situation scares me" (Personal Distress). Examination of the items that compose the Fantasy subscale of the IRI revealed that this measure is predominantly an index of narrative engagement. All of the items, except for item 1 ("I daydream and fantasize, with some regularity, about things that might happen to me."), refer to a tendency or ability to 'put oneself into a story' and identify strongly with its characters, be they part of a novel or a film. Items in this subscale include: "I really get involved with the feelings of the characters in a novel."; "Becoming extremely involved in a good book or movie is somewhat rare for me (negatively scored)."; and "After seeing a play or movie, I have felt as though I were one of the characters." This subscale was thus treated as a measure of narrative transportation. The dimensional structure of the IRI has been validated, and it correlates with other measures of empathy in a sensible fashion (Davis, 1983).

The "Reading the Mind in the Eyes" Test-revised. The "Reading the Mind in the Eyes" test-revised (MIE), an adult test of mentalizing, presents respondents with 36 still pictures of actors' eye-regions and asks which of four possible mental states the person currently possesses (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). All participants are presented with a list of terms used in the task, and are provided with the opportunity to read an explanation and example for each. This list of terms and definitions remains with each participant throughout testing for reference, controlling for any individual differences in vocabulary. Correct responses on the MIE indicate an ability to understand and pair mental-state terms with static non-verbal cues. High functioning individuals with Asperger's syndrome or autism perform

worse on this measure compared to age- and IQ-matched controls, indicating that the test is sensitive to rather subtle individual differences in social perception (Baron-Cohen et al., 2001). Scores on this test do not correlate with IQ, but appear to tap something separate and unique to the social realm (Baron-Cohen et al., 2001).

The Interpersonal Perception Task-15. The Interpersonal Perception Task-15 (IPT-15) is a video containing 15 unscripted interactions between two or more individuals (Costanzo & Archer, 1993). Following each vignette, a multiple-choice question is presented that has an objective and true answer (e.g., "Who is the child of the two adults?"). The answer to this question is never conveyed explicitly; respondents must closely attend to dynamic non-verbal cues (e.g., prosody, posture, gesture, etc.) in order to select the correct answer. Participant scores are reliable over a 5-week period and tend to be significantly above chance accuracy (Costanzo & Archer, 1993). Scores on this measure are also highly correlated with peer-ratings of interpersonal sensitivity and social skills (Costanzo & Archer, 1989).

Control variables. To stringently test the hypothesis that exposure to narrative fiction, controlling for expository non-fiction, may be positively related to social abilities, information on participants' age, years of English fluency, and intelligence was also collected. Each of these variables could be argued to mediate such a relation. Older individuals have more experience interacting with others and with reading; those with more years of English fluency may better comprehend the empathy tasks, and will likely recognize more English authors; and individuals with higher intelligence may simply read more, and are likely to be better at inference-making of many kinds. Data on age and years of English fluency were collected using self-report. Intelligence was assessed using the single best indicator of the general intelligence factor (g; Jensen, 1998), the Matrix-Reasoning subtest of the WAIS-IV.

2.3. Procedure

Participants were greeted by an experimenter who explained the general purpose and structure of the study. After signing a consent-form, individuals completed the Matrix-reasoning task and the IPT-15. The remaining measures were all administered using a computer, and the order of the questionnaires completely randomized for each participant. Following the completion of the experiment, participants were fully debriefed and compensated for their time.

3. Results

3.1. Scale reliabilities and scores

Scale reliability statistics along with validation data and norms for the majority of the tests used are available from source articles or the test authors. Cronbach's α for the MIE is not reported by Baron-Cohen and colleagues, and in this relatively small sample the measure had reasonable internal reliability, $\alpha = 0.60$. The revised ART had good internal reliability overall ($\alpha = 0.96$), and for the Fiction ($\alpha = 0.93$) and

Table 1
Means and standard deviations of measures

Measure	Mean	*SD*	Min.	Max.
ART-FC	12.5	9.5	0	39
ART-NF	7.8	6.8	0	33
MIE	27.8	3.8	15	35
IPT-15	9.9	1.7	6	13
IRI-FS	3.5	0.79	1.6	5.0
IRI-PT	3.5	0.66	2.0	4.9
IRI-EC	3.8	0.69	1.7	5.0
IRI-PD	2.7	0.72	1.0	4.7
Matrix	19.2	4.3	5	26

Notes. ART-FC = ART Fiction, ART-NF = ART Non-fiction, IRI-FS = IRI Fantasy, IRI-PT = IRI Perspective-taking, IRI-EC = IRI Empathic concern, IRI-PD = IRI Personal Distress, Matrix = WAIS-IV Matrix-reasoning.

Non-fiction subscales ($\alpha = 0.90$) individually. Split-half reliability for this revised measure was also very good, Fiction: Guttman coefficient = 0.94; Non-fiction: Guttman coefficient = 0.87.

Mean scores and standard deviations for the measures used are presented in Table 1. Very few participants checked a false-name in the ART, with 88 participants (93.6% of the sample) falsely recognizing three or fewer foils, $M = 0.96$, $SD = 2.1$. As well, in this sample, the same number of participants reported that they were initially unfamiliar with 4 or fewer ($< 4.5\%$) of the mental-state terms used in the MIE, $M = 1.0$, $SD = 2.0$.

3.2. Gender differences

No statistically significant differences in scores for males and females were found for the ART, the MIE, the IPT-15, nor the Perspective-taking or Fantasy subscales of the IRI. Females reported slightly greater Empathic Concern and Personal Distress, Empathic Concern: $M_{females} = 3.9$, $M_{males} = 3.5$, $t(92) = 2.96$, $p < .05$; Personal Distress: $M_{females} = 2.8$, $M_{males} = 2.5$, $t(92) = 2.03$, $p < .05$.

3.3. Raw correlations

Correlations between measures of print exposure and social abilities are displayed in Table 2. Although Fiction and Non-fiction print-exposure were very closely related as predicted, they exhibited divergent correlations with respect to the social ability measures. Fiction was positively correlated with MIE scores whereas Non-fiction was unrelated, and this difference in association was statistically significant (Steiger, 1980), $t(91) = 3.38$, $p < .05$. Similarly, while both Fiction and Non-fiction were negatively related to IPT-15 performance, Fiction was much less related (a non-significant correlation); the difference in association for the two types of print-exposure was also statistically significant, $t(91) = 2.07$, $p < .05$. Since Fiction and Non-fiction were so highly related, it is possible that the negative association between

Table 2
Inter-scale correlations for measures of print-exposure and social ability

	Print exposure		Social ability tasks		Social ability questionnaires			
	ART-FC	ART-NF	MIE	IPT-15	IRI-FS	IRI-PT	IRI-EC	IRI-PD
ART-FC		.84*	.20 (.34*)	−.19 (.15)	.22*	.13	.09	−.16
ART-NF			.01 (−.26*)	−.30* (−.34*)	.08	.08	.02	−.14
MIE				.02	.18	.08	.15	−.07
IPT-15					.28*	.05	.12	.14
IRI-FS						.24*	.42*	.02
IRI-PT							.50*	−.03
IRI-EC								.16
IRI-PD								

Notes. ART-FC = ART Fiction, ART-NF = ART Non-fiction, IRI-FS = IRI Fantasy, IRI-PT = IRI Perspective-taking, IRI-EC = IRI Empathic concern, IRI-PD = IRI Personal Distress. Parenthetical correlations are partial correlations between print-exposure and performance-based measures of social ability ($df = 88$): Fiction controlling for Non-fiction, foil-checking, age and years of English fluency, and g; Non-fiction controlling for Fiction, foil-checking, age and years of English fluency, and g.

 * $p < .05$.

Fiction and this index of social ability is derived from what the two share, rather than the unique aspects of Fiction print-exposure. This question was addressed statistically, using partial correlations, as reported below. Scores on the IPT-15 and MIE were not correlated, replicating numerous previous reports illustrating the heterogeneity among common empathy measures (Ickes, 1997).

The tendency to become absorbed in a story, as measured by IRI Fantasy, was positively associated with Fiction but not Non-fiction print-exposure, confirming that the former is related to narrative while the latter is not; this difference in association was statistically significant, $t(91) = 2.42$, $p < .05$. Narrative engagement was also positively associated with performance on the videotape measure of social acumen (i.e., the IPT-15), the MIE ($p > .05$), and both self-reported perspective-taking and empathic-concern. The ability or tendency to place oneself within the fictional world of a story thus appears to be positively associated with both task-based and self-report measures of empathy or theory-of-mind.

3.4. Split-half reliability

Considering the fact that these associations contradict common perceptions regarding reading habits and social acumen, the reliability of the observed effect was tested using a split-half method. Half of the total participants were randomly selected and correlations were calculated for Fiction and Non-fiction print-exposure, and the performance-based measures of empathy. This procedure was repeated 10 times, resulting in 10 different random samples of the data, constituting a conceptual replication of the study (although with considerable loss of power due to the halved N). In every sample, Fiction print-exposure was more positively associated with the MIE test than Non-fiction print-exposure and this difference in correlation was statistically significantly different from zero, $M_{rdiff} = 0.19$, $SD_{rdiff} = 0.07$, $Min_{rdiff} =$

0.05, $Max_{rdiff} = 0.29$; $t(9) = 8.87$, $p < .05$. In the case of the IPT-15, Fiction print-exposure was more positively correlated (or less negatively-correlated) than Non-fiction print-exposure in all of the samples and this mean difference again was significantly different from zero, $M_{rdiff} = 0.12$, $SD_{rdiff} = 0.05$, $Min_{rdiff} = 0.06$, $Max_{rdiff} = 0.22$; $t(9) = 8.30$, $p < .05$.

3.5. Partial correlations

In order to properly explore the observed differences between Fiction and Non-fiction print-exposure, analyses were undertaken to parse out shared variance between the two variables. By doing so, the characteristics shared by both forms of print-exposure (e.g., a tendency to read in general, regardless of genre) were taken into account, revealing associations unique to a specific preference for narrative and its attendant representation of the social world. To begin, age and years of English fluency were averaged to form a composite variable, in order to reduce the collinearity problem posed by their high intercorrelation, $r = .94$, $p < .05$; $M_{composite} = 21.7$, $SD_{composite} = 6.9$. Partial correlations between Fiction print-exposure and the two task-based social ability measures (i.e., the MIE and IPT-15) were calculated controlling for Non-fiction print-exposure, averaged age and fluency, and g. The checking of foils was also entered as a control, in order to account for patterns of responding (e.g., low-threshold for recognition). The results of this analysis appear in parentheses, in Table 2; both the MIE and IPT-15 were positively associated with Fiction print-exposure, although the latter association was not statistically significant. A similar analysis was conducted examining the relation between Non-fiction print-exposure and social ability, controlling for Fiction print-exposure, foil-checking, age and English fluency, and g. The parenthetical correlations in Table 2 illustrate that Non-fiction print-exposure was negatively related to both performance-based empathy tasks. The convergence of these two measures of empathy with regard to both analyses lends additional support to our hypotheses, but was unexpected, as the two tasks were not related in either the zero-order (see Table 2) or partial correlations, Fiction (Non-fiction controlled): $pr = .04$, $p > .05$; Non-fiction (Fiction controlled): $pr = .07$, $p > .05$. While the high correlation between Fiction and Non-fiction print-exposure raises the possibility of multicollinearity issues, collinearity diagnostics provided by a conceptually identical regression analysis indicated no such problems.[1]

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[1] A simultaneous linear regression ($R^2 = .13$) with Fiction, Non-fiction, age and fluency, g, and foil-checking predicting scores on the MIE replicated the results of the partial correlations; Fiction positively predicted MIE scores and Non-fiction served as a negative predictor. More importantly, the highest value of the Variance Inflation Factor (VIF, the inverse of Tolerance) was below 5, and the Condition Index (CI) was less than 18. Common guidelines recommend that regressions with VIF values greater than 10, or CI values greater than or equal to 30, be interpreted cautiously due to multicollinearity problems (Belsley, 1991; Neter, Kutner, Nachtsheim, & Wasserman, 1996). A similar regression ($R^2 = .15$) with IPT-15 scores regressed on the same predictors again largely replicated the results of the partial correlations; collinearity diagnostics once more indicated no problems of multicollinearity, VIF < 5, CI < 18.

4. Discussion

The results from this study demonstrate that fiction and non-fiction print-exposure appear to exhibit a double-dissociation with regard to various measures of empathy and social ability. In raw correlation, exposure to fiction was more positively (or less negatively) related to the performance-based measures of social ability than exposure to non-fiction. These divergences are unlikely to occur by chance and may be attenuated, considering the high intercorrelation between fiction and non-fiction print-exposure. Furthermore, the self-reported tendency to become highly engaged in stories was positively correlated with fiction print-exposure, and predicted performance on the two social ability tasks (albeit statistically non-significantly in one case) as well as two measures of self-reported empathy. The reliability of the primary associations was demonstrated using a split-half approach. In order to properly examine the question at hand, however, it was necessary to take into account the variance shared between fiction and non-fiction print-exposure. Using partial correlations, the unique variance in Fiction was found to be positively associated with both task-based empathy measures (although statistically non-significantly in one case) whereas the parallel analysis indicated that Non-fiction (controlling for Fiction) was negatively related to these same tasks. This analysis also established that the effect could not be attributed to age, experience with English, or general intelligence. The relations between exposure to fiction and the social ability tasks were much more positive here than what was observed in the raw correlations, perhaps indicating that non-fiction print-exposure was responsible for an attenuating influence on these latter associations.

The negative correlation observed between exposure to non-fiction texts and empathic skill indicates that the socially awkward stereotype attributed to bookworms may be more appropriate for so-called 'nerds,' or those who prefer expository material over narrative texts. Bookworms, by reading a great deal of narrative fiction, may buffer themselves from the effects of reduced direct interpersonal contact by simulating the social experiences depicted in stories. Nerds, in contrast, by consuming predominantly non-narrative non-fiction, fail to simulate such experiences and may accrue a deficit in social skills as a result of removing themselves from the actual social world. Notably, one limitation of this study is that causal direction cannot be inferred and remains a question for future research; influence may well travel in both directions. Other limitations of this work include the characteristics of the sample. The population employed in this study may be somewhat restricted in range with respect to literary preferences and reading behaviours. It is quite possible that individuals to be found in and around a University campus are more likely to read than those in the wider population. This may mean that the effects observed here are actually underestimates of the population-level effect. Whether this finding generalizes to a more diverse population, however, remains to be seen. The sample employed is also relatively small, and the study suffers from diminished power as a result.

Numerous complications plague the measurement of both reading habits and social abilities, and these issues have been highlighted by the current study. With respect to reading, social-desirability biases are a clearly documented problem (for a

discussion see West et al., 1993), motivating the approach taken in this study. However, by employing only a single assessment of reading (i.e., print-exposure), this study cannot provide a direct comparison between more conventional self-report approaches (or other methods of assessment) and the recognition-test format adopted; although, other studies have demonstrated that the latter holds greater predictive validity (Allen, Cipielewski, & Stanovich, 1992; Sénéchal et al., 1996). In order to get an accurate measurement of actual reading behaviours, an experience-sampling method (e.g., daily diaries or occasional promptings by a digital recorder) would probably be ideal for future research. These methods, however, are quite time- and resource-intensive, relying upon the long-term participation of motivated individuals. Since recognition tests like the ART appear to have the same degree of predictive validity as daily activity diaries (Allen et al., 1992), and require significantly less commitment and fewer resources, they may provide a useful alternative for researchers. Measuring social ability, or empathic accuracy, has its own set of problems including, but not limited to, the issue of socially desirable responding on self-report questionnaires. Different assessments of this construct frequently fail to correlate with one another as would be expected, even when they share similar methods (Ickes, 1997; Lawrence, Shaw, Baker, Baron-Cohen, & David, 2004). The lack of correlation between the two different social-ability tasks used in this study, then, is not unusual but still demands explication. Both the MIE and IPT-15 have a great deal of face-validity; they both explicitly require respondents to engage in different forms of social decoding. Moreover, the construct validity of each of these measures has been independently supported (Baron-Cohen et al., 2001; Costanzo & Archer, 1989, 1993). Why then, do they appear unrelated? To begin, the construct of empathic accuracy appears to be heterogenous, with many noting that both an emotional, embodied, dynamic, and non-verbal component appears present along with a more cognitive, language-oriented and explicit component (e.g., Tager-Flusberg, 2001). A post hoc task-analysis indicates that the two social ability tasks used in this study may be differentially weighted toward one or another of these two aspects of social-processing. Correct answers on the MIE rely upon the ascription of verbal labels to static representations of mental-state expression, and achievement on this measure thus may be more a function of a cognitive form of empathy. In contrast, success on the IPT-15 relies on decoding dynamic portrayals of non-verbal cues (e.g., prosody, posture, gesture) and thus may preferentially tap an embodied sort of social-decoding. If this is provisionally taken to be the case, then the partial correlations in Table 2 indicate that Fiction print-exposure is more positively related to cognitive empathy than embodied social-processing. In contrast, Non-fiction print-exposure appears to be more negatively related to emotional social-cognition than propositional social-reasoning. That said, more research is clearly needed to explore these possibilities further.

By demonstrating the existence of an arguably counterintuitive positive relation between fiction-exposure and social abilities, this study has raised a number of interesting questions and appears to have broad implications for a variety of sub-disciplines in psychology. To begin, does this effect generalize beyond a laboratory setting? That is, do readers of fiction tend to show real-world empathic advantages

over their non-fiction preferring counterparts, or only in a lab setting? The results of this study that concern the IPT-15, a test with considerable ecological validity, implies that real-world outcomes are likely. Second, would this effect still manifest if measured in reverse? That is, do differences in social-ability account for any of the variance in traditional measures of story-comprehension? Are people who are more empathic better at comprehending narratives? Finally—and most critically—how might the relation between fiction-exposure and social ability be explained?

Two of the hypotheses introduced to possibly explain the observed relation have been lightly addressed in this study. The tendency to become deeply absorbed in a story appears to be related to both exposure to narrative fiction and measures of social ability, providing corroborative evidence for the links between imagination, theory-of-mind, and narrative-processing proposed by Harris (2000). That empathic processes are related to story-reading is congruent with both the idea that reading stories hones social-inferencing processes, and the idea that more empathic people have a greater tendency to enjoy and engage in reading. It remains to be uncovered, however, whether empathy precedes fiction-exposure or proceeds from it, and both may well occur. If naturally empathic people tend toward reading, this should be observable from a developmental perspective. Harris (2000) found that children who spontaneously engage in imaginative play tend to be rated as more empathic by others. It would be interesting to see, in the course of a longitudinal study, whether these same children also enjoy and engage in reading more often at an early age. This theory, however, is not without weaknesses. It would be slightly surprising if individuals who are naturally empathic and skilled socially were to prefer a solitary pursuit such as reading over their unhindered and easy interactions with peers in the real-world. The schema of a bookworm present in North American culture (and other cultures, such as in Japan), describes a child withdrawing from his or her social world (often due to rejection) into a world of fantasy wrought by narratives. It seems unlikely that this conception would have absolutely no basis in reality.

Whether the reading of stories hones theory-of-mind processes could be examined by staging an intervention, whereby a group of participants are assigned a diet of fiction over a number of months, similar to the study conducted by Schellenberg (2004). (Although, one would also have to consider the likely possibility that some novels and stories are more effective in prompting the imaginative activities of theory-of-mind than others.) As a control, a matched group would read a similar set of non-fiction materials. Measures of social ability, pre- and post-exposure, could then be compared. This theory, however, begs elaboration as well. What specific theory-of-mind processes could be fostered through mere reading? The monitoring of goals for multiple autonomous agents, and the interpretation of behaviour based upon knowledge of these goals is one distinct possibility. Stories are often populated with many characters, whose goals almost always differ and even shift as the narrative progresses. The ability to keep track of this information prevents deception and other undesirable outcomes in the real-world, and in the cinema prevents us from confusedly whispering "I thought he was on *their* side!" to our

neighbour during a plot-twisting spy film. Inferring mental and emotional states from behaviour also seems essential for both social-processing and story comprehension. If a story describes how "Wendy's hand trembled slightly as she pulled open the drawer to retrieve the letter, eliciting a faint wooden rattle," it is important for the reader to be able to conclude that there is something about the letter that holds emotional importance for Wendy. Repeated exposure to narratives reveal such things to us, much the way that readers learn to infer the meanings of new words based upon their context.

The third hypothesis proposed (that concrete social-knowledge is transferred to readers), has not been addressed in the current study, but also remains an interesting topic for future research. If it is the case that social information is explicitly transmitted through narratives, frequent readers of fiction should be able to consciously volunteer, or at least recognize, more of such knowledge than others. Concrete knowledge in the form of social lessons, particularly about complicated situations such as love, are often the crux of stories both classic and modern. With respect to all these theories, however, it must be stressed that some combination or interaction of these possible explanations (and potential others not imagined) is most likely responsible for the observed effect, rather than any single mechanism.

The major findings of the current study—a positive association between exposure to narrative fiction and social abilities, and the opposite pattern for expository non-fiction—describe a systematic linear relation between individual differences in literary preference and individual differences in social processing ability. The former has been somewhat understudied, and the revised ART created for this study is a promising tool for future research. While a causal direction has yet to be established for the observed relations, the possibility that social skills may be improved as a result of exposure to social narratives remains a compelling one. Should future work determine that fiction-reading interventions yield improvements in empathy, stories could prove a powerful tool for educating both children and adults about understanding others, an important skill currently under-stressed in most educational settings. If it proves to be the case that the causality of this relation is reversed—that being more empathic predisposes people toward reading fiction—we will still have learned something interesting about fiction, and about the empathic personality.

Acknowledgments

Appendix A

ART items

Fiction

Romance	Sci-Fi/Fantasy	Suspense/Thrillers	Domestic fiction	Foreign (in translation)
Sidney Sheldon	Robert Jordan	Dean Koontz	John Updike	José Saramago
Danielle Steele	Douglas Adams	John LeCarré	W. O. Mitchell	Yukio Mishima
Jackie Collins	Anne McCaffrey	Robert Ludlum	Alice Munro	Gabriel Garcia Marquez
Judith Krantz	William Gibson	Clive Cussler	Maeve Binchy	Albert Camus
Nora Roberts	Terry Brooks	Sue Grafton	Carol Shields	Umberto Eco
Iris Johansen	Terry Goodkind	Ian Rankin	John Irving	Milan Kundera
Diana Palmer	Piers Anthony	P. D. James	Toni Morrison	Paulo Coelho
Catherine Anderson	Arthur C. Clarke	John Saul	Amy Tan	W. G. Sebald
Joy Fielding	Ray Bradbury	Patricia Cornwell	Rohinton Mistry	Italo Calvino
Nicholas Sparks	Ursula K. Le Guin	Ken Follett	Sinclair Ross	Thomas Mann

Non-fiction

Science	Philosophy/Psychology	Political/Social-commentary	Self-help	Business
Stephen Hawking	Roland Barthes	Noam Chomsky	Jack Canfield	Faith Popcorn
Stephen J. Gould	John Searle	Norman Mailer	Philip C. McGraw	Jim Collins
Richard Dawkins	Jean Baudrillard	Michael Moore	M. Scott Peck	Napoleon Hill
Thomas Kuhn	Michel Foucault	Eric Schlosser	Robert Fulghum	Robert T. Kiyosaki
Ernst Mayr	Bertrand Russell	Bob Woodward	Erma Bombeck	Stephen C. Lundin
Douglas Rushkoff	Antonio Damasio	Pierre Berton	Jean Vanier	Peter S. Pande
Amir D. Aczel	Daniel Goleman	Naomi Klein	Stephen R. Covey	Kenneth H. Blanchard

Appendix A (*continued*)

Non-fiction				
Science	Philosophy/ Psychology	Political/Social- commentary	Self-help	Business
Matt Ridley	Jeffrey Gray	Naomi Wolf	Melody Beattie	Peter F. Drucker
John Maynard Smith	Joseph LeDoux	Robert D. Kaplan	Deepak Chopra	Barry Z. Posner
Diane Ackerman	Oliver Sacks	Susan Sontag	Marianne Williamson	M. D. Johnson Spencer
Foils				
Lauren Adamson	John Condry	Martin Ford	James Morgan	
Eric Amsel	Edward Cornell	Harold Gardin	Scott Paris	
Margaritia Azmitia	Carl Corter	Frank Gresham	Richard Passman	
Oscar Barbarin	Diane Cuneo	Robert Inness	David Perry	
Reuben Baron	Denise Daniels	Frank Keil	Miriam Sexton	
Gary Beauchamp	Geraldine Dawson	Reed Larson	K Warner Schaie	
Thomas Bever	Aimee Dorr	Lynn Liben	Robert Siegler	
Elliot Blass	W Patrick Dickson	Hugh Lytton	Mark Strauss	
Dale Blyth	Robert Emery	Franklin Manis	Alister Younger	
Hilda Borko	Frances Fincham	Morton Mendelson	Steve Yussen	

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