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Article *in* Psychology of Aesthetics Creativity and the Arts · September 2021

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De Mulder, H. N. M., Hakemulder, F., Klaassen, F., Junge, C. M. M., Hoijtink, H., & van Berkum, J. J. A. (2021, September 30). Figuring Out What They Feel: Exposure to Eudaimonic Narrative Fiction Is Related to Mentalizing Ability. *Psychology of Aesthetics, Creativity, and the Arts*. Advance online publication. http://dx.doi.org/10.1037/aca0000428

Figuring out what they feel:

Exposure to eudaimonic narrative fiction is related to mentalising ability

Abstract

Being exposed to narrative fiction may provide us with practice in dealing with social interactions and thereby enhance our ability to engage in mentalising (understanding other people's mental states). The current study employs a confirmatory Bayesian approach to assess the relationship between mentalising and both the self-reported frequency of exposure to narrative fiction across media (books, films and TV-series) and the particular types of fiction that are consumed (eudaimonic vs. hedonic). This study focuses on this relationship in children and adolescents, as they are still developing their social abilities. Exposure to narrative fiction may thus be particularly important in providing input on how to interpret other people's mental states for this age group. In our study, we find no evidence for a simple relationship between overall frequency of narrative fiction exposure and mentalising ability in this age group. However, exposure to eudaimonic narrative fiction is consistently positively related to mentalising and, for some media types and aspects of mentalising, more strongly so than exposure to hedonic narrative fiction. No evidence was obtained to suggest that there are any differential effects related to the medium of the narrative fiction exposure (written vs. visual).

Keywords

Narrative fiction; mentalising; eudaimonic and hedonic experiences; written and visual media; Bayesian analyses

1. Introduction

"When I was younger, I scared my mother to death, the things I would blurt out about District 12, about the people who rule our country, Panem, from the far-off city called the Capitol. Eventually I understood this would only lead us to more trouble. So I learned to hold my tongue and to turn my features into an indifferent mask so that no one could ever read my thoughts. Do my work quietly in school. Make only polite small talk in the public market. Discuss little more than trades in the Hob, which is the black market where I make most of my money. Even at home, where I am less pleasant, I avoid discussing tricky topics." (p. 6; Collins, 2008)

Although in the paragraph above, Katniss Everdeen, feisty heroine of *The Hunger Games*, makes it explicit that she has learnt to keep her thoughts to herself and lets no one, not even her family, in on the workings of her mind, we, as readers, are in a privileged position. We do come to know what she is thinking and feeling, what moves her and what enrages her, who has her allegiance and who does not. The other characters in the fictional world of *The Hunger Games* may be left in the dark, but we are in on everything. As this book has proved to be immensely popular (according to Wikipedia[1] over 17,5 million copies have been sold in the United States alone), a huge number of children and teens, the book's intended audience, will have had this intimate experience with Katniss' mental life during her endeavour to fight to stay alive in a very hostile world. The question at the heart of the current study is whether this kind of vicarious experience of fictional others' mental states, be it by means of a book or other media such as films or TV-series, has beneficial effects in real life on children's ability to figure out others' mental states (i.e., 'mentalising', Frith & Frith, 2006).

[1] https://en.wikipedia.org/wiki/The_Hunger_Games_(novel)

1.1 Exposure to narrative fiction as 'mentalising training': Underlying mechanisms

Although on the face of it the suggestion that exposure to narrative fiction enhances mentalising may seem rather fanciful (these kinds of stories are surely 'just for fun'!), various researchers have theorised that being exposed to narrative fiction may well have profound effects on our (developing) social competence, primarily regarding the ability to understand others' mental states. The basis of this idea, which, as described below, is backed up by a considerable body of research, is that exposure to narrative fiction provides us with practice in dealing with social interactions. Both the 'narrative' and the 'fiction' component of 'narrative fiction' are assumed to be important in this discussion. A hallmark of narrative is that it is about autonomous intentional agents and their interactions (Mar & Oatley, 2008) and, as such, in order for us to be able to understand a narrative, we have to engage in the same kinds of social-cognitive processing that we employ when dealing with people in real life (Mar, Oatley & Peterson, 2009). By requiring us to simulate social interaction, narratives may thus hone our skills in this domain (Mar & Oatley, 2008; Oatley & Mar, 2005; Oatley, 1999a, 1999b; Sugiyama, 2001). Furthermore, narrative is special in that it can make explicit various aspects of people's mental lives that generally remain hidden from us in real life: we can gain explicit information on what is going on in another's mind and we may get information regarding other characters' perceptions of their fellow characters. This aspect of narrative may also help in coming to a deeper understanding of others' mental states.

In line with the suggestion that narrative exposure enhances mentalising ability by providing 'mentalising training', neuro-imaging studies have demonstrated that brain areas commonly associated with narrative processing overlap quite strongly with core areas of the mentalising network in the brain (Mar, 2011; Tamir, Bricker, Dodell-Feder & Mitchell, 2016). Furthermore, from the research on parasocial contact, we know that people have the tendency to process mass-media contacts similarly to interpersonal contact in real life

(Schiappa, Gregg, & Hewes, 2005), even demonstrating social facilitation in the 'presence' of favourite fictional characters (Gardner & Knowles, 2008).

Exposure to narrative, be it fictional or non-fictional, thus provides us with practice in processing social situations. However, given the characteristics of fictional narrative, exposure to this type of narrative is likely to be a particularly effective 'mentalising training'. Fictional and factual information can be processed differently (Altmann, Bohrn, Lubrich, Menninghaus & Jacobs, 2014). In processing non-fiction, readers are focused on updating their world-knowledge. Readers of fiction, on the other hand, are involved in an imaginative construction of the events that may follow, playing with various scenarios. For this to be possible, Altmann et al. (2014) suggest that readers also activate parts of the brain that are associated with mentalising. In this way, then, reading fiction may enable readers to become better equipped and more flexible in the interpretation of mental states.

Another characteristic of fiction that may be relevant in enhancing mentalising is that it is, by definition, not true (in the sense that it does not have to match external reality, Busselle & Bilandzic, 2008). This may allow consumers of narrative fiction to engage in social processing in a risk-free environment in which all kinds of thoughts and feelings can be entertained without fear of persecution or the moral obligation to come to the aid of agents in the narrative (Hakemulder, 2000; Zunshine, 2006). Whereas there might be real-world consequences associated with misinterpreting motives of real people, there are no repercussions for misreading fictional characters, so practicing in the fictional sphere is 'safe' in this sense. Furthermore, fiction readers may feel less inhibited when trying to understand behavioural motives of immoral characters (such as a paedophile in Nabokov's novel *Lolita*), than they would be in real-life (such as a defendant accused of paedophilia discussed in the media) which may also lead to mentalising gains. Furthermore, it is argued that the simulation experience provided by literary reading can be seen as a unique and

supplementary training of our social understanding, given that "fictional literature abstracts, summarizes and compresses human reality by selecting only the most relevant elements" (Mar & Oatley 2008, p. 177). Thus, it is assumed to help in making complex social information more comprehensible.

The risk-free social interaction training that narrative fiction can provide is thus assumed to be the key mechanism in explaining the relationship between mentalising ability and exposure to narrative fiction (Koopman & Hakemulder, 2015). Of course, this does not preclude the possibility that certain types of non-fictional narrative might also have this effect (e.g., a narrative biography about someone who is long deceased may well afford readers a similar 'risk-free social interaction training' along the lines of what we have sketched above for fictional narratives). Furthermore, none of this is to say that consuming narrative fiction is a better or more effective 'mentalising training' than engaging with real people in real life. However, the goal of this research is to investigate whether exposure to narrative fiction may provide an additional experience that could lead to an appreciable difference in children and adolescents' mental state understanding in real life.

1.2 Mentalising ability and narrative fiction exposure: Empirical evidence

Many studies have demonstrated that there is a positive, even causal, relationship between exposure to narrative fiction and mentalising ability (see Mumper and Gerrig, 2016, for a meta-analysis of correlational studies and Dodell-Feder and Tamir, 2018, for a meta-analysis of intervention studies). For instance, the self-reported tendency to engage in mentalising was found to be increased in participants who had read a short story as compared to those who read an essay of equivalent length and complexity (Djikic, Oatley & Moldoveanu, 2013). Furthermore, exposure to narrative fiction was found to have a direct positive effect on an objective measure of mentalising ability, whereas exposure to a non-fiction text was not

associated with enhanced mentalising (Kidd & Castano, 2013). Black and Barnes (2015a) further demonstrate that although reading narrative fiction was found to enhance social competence, it did not affect performance on a measure unrelated to social competence, thereby suggesting that there is a specific relation between narrative fiction consumption and mentalising ability. In addition to the effects reported for exposure to written narrative fiction in relation to mentalising, exposure to visual narrative fiction has also been found to directly enhance mentalising ability. Participants who viewed an award-winning TV-drama scored better on a test of mentalising than participants who watched a TV-documentary (Black & Barnes, 2015b).

These findings from intervention studies are underscored by various correlational studies (e.g., Mar, Oatley, Hirsh, dela Paz and Peterson, 2006; Mar et al., 2009) and a meta-analysis of 30 correlational studies (Mumper & Gerrig, 2016) that also suggests that more exposure to narrative fiction over the lifetime is associated with superior mentalising skills. On the basis of these individual studies and the two meta-analyses on the topic (Mumper & Gerrig, 2016, and Dodell-Feder & Tamir, 2018), we think it is reasonable to state that the relationship between narrative fiction exposure and mentalising is robust, even if the effect sizes are small. Both meta-analyses argue that the research agenda in this domain should shift from attempts to replicate the presence of this relationship toward a more profound investigation of the underlying mechanisms. The purpose of the present study is to contribute to answering those calls.

1.3 Mentalising training: Does the type of narrative fiction matter?

An issue that requires further investigation is whether certain types of narrative fiction might provide better social interaction training, and thus mentalising enhancement, than others or whether all narrative fiction is equal in this respect. Fong, Mullin and Mar (2013) suggest that

literary genre is a relevant factor in this discussion, as their findings demonstrate that genres with a stronger focus on interpersonal interaction are positively associated with readers' interpersonal sensitivity levels. In a similar vein, Kidd and Castano (2013) demonstrate that reading literary fiction has a positive effect on mentalising performance whereas reading popular fiction does not. They explain this finding by suggesting that literary fiction requires more complex and profound psychological simulation than is the case for popular fiction (as the characters in literary fiction tend to be more complex and less predictable than is the case for characters in popular fiction, see Koopman and Hakemulder, 2015) and thus acts as a more efficient form of 'mentalising training'.

Various studies have provided empirical support for Kidd and Castano's (2013) main claim that literary fiction is more effective than popular fiction in terms of enhancing mentalising (e.g., Black & Barnes, 2015a; Kidd, Ongis, & Castano, 2016; Pino & Mazza, 2016; van Kuijk, Verkoeijen, Dijkstra, & Zwaan, 2018), although there are a number of studies that have not replicated their findings regarding the differential effects of exposure to literary vs. popular fiction (e.g., Camerer et al. 2018; Dijkstra et al., 2015; Panero et al., 2016; Samur, Tops & Koole, 2017). Thus, although the claim that exposure to narrative fiction enhances mentalising as compared to non-fiction reading and no reading is supported by the meta-analysis by Dodell-Feder and Tamir (2018), there is currently no empirical consensus regarding whether *literary* narrative fiction should be considered superior to *popular* narrative fiction in terms of mentalising enhancement. Furthermore, there are also theoretical issues associated with making a 'hard' distinction between what constitutes literary and popular narrative fiction. Although it may be possible to offer a definition of literariness (see, for example, Miall & Kuiken, 1999), the suggestion that there is some kind of objective 'fact of the matter' that can be applied to determine, for all readers, what constitutes literary fiction and what does not seems questionable. Some readers may read a novel, for instance Donna

Tartt's Secret History, and enjoy the thrilling plot; others may find meaning in intertextual references and come to some insight that they perceive as deep, relevant for their own life, or helpful for their understanding of others. While we thus recognise that there is considerable debate (see Van Peer, 2008) regarding the factors that should be taken into account when categorising a text as literature (e.g., whether conventional or social factors like the status of the publisher are taken into account or whether textual factors such as striking stylistic features are primary), we do not aim to solve that issue here. Instead, in our investigation of how different types of narrative fiction are related to mentalising, we use a conceptually related but different distinction and rely on a subjectivist approach of categorising narrative fiction (Oliver, Hartmann & Woolley, 2012).

In recent theorising on entertainment experience, the distinction between eudaimonic and hedonic gratifications has come to the fore (Oliver & Bartsch, 2010; Oliver & Raney, 2011; Slater, Oliver & Appel, 2016; Wirth, Hofer & Schramm, 2012). Consumers of entertainment may be primarily interested in enjoying and deriving pleasure from their entertainment choice: they seek *hedonic* gratification. However, readers/viewers may also have truth-seeking, or *eudaimonic*, motivations for seeking out particular types of entertainment. They wish to consume media that provide them with a sense of deeper meaning and a feeling of being moved by this experience (Oliver & Bartsch, 2010). Whereas hedonic media offerings[2] thus primarily give rise to positive affect, feelings of pleasure, excitement and enjoyment, the eudaimonic variety is more likely to lead to a sense of poignancy (mixed affect) and deeper understanding of the meaning of life and the human condition (Slater et al., 2016). Responses to the two types of media are distinct in affect, in

[2] Here and throughout the text, we use the term 'hedonic media (offerings)' only as shorthand for 'media (offerings) that engender hedonic experiences' and similarly for eudaimonic media (offerings).

bodily reactions, the type of value recognised in the stories, and the extent to which they motivate changes in behaviour (e.g., Oliver et al., 2012).

Eudaimonic experiences, we propose, may be the active component in literary reading. Obviously, not all eudaimonic experiences are literary (a popular television show might be experienced as revealing something about the human condition, Bálint, Hakemulder, Kuijpers, Doicaru, & Tan, 2016), just as not all literary experiences need to be eudaimonic (e.g., aesthetic appraisal of the imagery evoked by a poem). However, some studies on the nature of literary response suggest there is an important overlap, and it is in this overlap that we seek to locate one of the possible explanations for the effects found in the above mentioned meta-analyses (i.e., Mumper & Gerrig, 2016, and Dodell-Feder & Tamir, 2018). For instance, qualitative research suggests that foregrounding (i.e., deviating or disruptive text qualities, assumed to be characteristic of literary work), decreases fluency in processing, and simultaneously enhances reader reflectivity. Recipients may perceive such experiences as being meaningful rather than, say, suspenseful, the latter being, arguably, a plot-driven, hedonic pleasure (Miall & Kuiken, 1995; Kuiken, Miall, & Sikora, 2004; Bálint et al., 2016). Furthermore, previous research on this matter suggests that narratives that engender eudaimonic experiences are clearly associated with reflective thoughts regarding, for instance, character psychology and the social reality of others (Bartsch et al., 2014). Although media that engenders hedonic experiences is also likely to require its consumers to engage in mentalising, it does not seem to trigger the more profound contemplation that eudaimonic media does (Wirth et al., 2012). We thus posit that the deeper sense of reflectiveness on life's meaning and the vicissitudes of humanity that is characteristic of eudaimonic media will be associated with higher mentalising abilities than hedonic media. In this sense, then, our assumptions parallel those espoused by Kidd and Castano (2013), but we take the reader/viewer's experience to be crucial in determining what effect it will have on

mentalising ability[3]. We note, however, that this approach leaves open the question whether any effects we find might be mediated by underlying factors that are associated with the experience of eudaimonic and/or hedonic media exposure. For instance, it is possible that we find that there is a stronger positive correlation between exposure to eudaimonic media and mentalising ability than between exposure to hedonic media and mentalising, because media that engenders eudaimonic experiences contains more complex vocabulary, is more demanding in terms of working memory or describes social interactions in more detail (or some other characteristic that affects mentalising, but is not directly associated with the thought-provoking nature of eudaimonia that we assume to be the crucial 'active ingredient'). While we cannot rule out these kinds of third variable explanations in advance, we nonetheless assume that an investigation of how people's self-reported responses to the media they consume (in terms of eudaimonia and hedonia) relates to mentalising ability is a promising starting point in the exploration of mechanisms that underlie the relation between narrative exposure and mentalising (as called for by Mumper and Gerrig, 2016, and Dodell-Feder and Tamir, 2018).

1.4 Mentalising training: Does the medium of narrative fiction matter?

Aside from potential differential effects that exposure to eudaimonic vs. hedonic narrative fiction might have on mentalising, the current study also considers how the specific modality in which a media offering is consumed affects mentalising ability. Although by far the most of the studies that have investigated the relationship between narrative fiction exposure and mentalising have focused on written narrative fiction, there are studies that suggest that the

[3] There is thus no objective 'fact of the matter' whether a particular media offering can be considered to be eudaimonic or hedonic. A particular individual has been exposed to eudaimonic narrative fiction if it elicits eudaimonic experiences in this individual, regardless of genre or other people's experiences in response to it. Although certain media offerings may be much more likely to provide their consumers with hedonic or eudaimonic experiences, whether or not this is actually the case depends on the response of the individual consumer.

effect is not specific to the written modality. Black and Barnes (2015b), for instance, demonstrate that viewing an award-winning TV-drama also enhances mentalising ability (as compared to watching a TV-documentary). Mar, Tackett and Moore (2010) show that exposure to movies, as well as books, was positively related to mentalising ability in young children, although they did not find any positive effects of exposure to children's television.

There may thus be a positive relationship between mentalising and exposure to both written and visual narrative fiction, but more data is needed to be able to draw firm conclusions on this issue. This lack of available research also entails that it is not clear whether exposure to a particular media type (written or visual) is associated with greater gains in mentalising ability or whether the mentalising increase is the same regardless of the medium.

On the one hand, there are arguments to assume that written narrative fiction may be a more effective form of 'mentalising training' than visual narrative fiction. Written narrative fiction is more abstract than visual narrative fiction in that it portrays its characters in a purely symbolic and non-representational way and thus requires its consumers to play a more active role in constructing character information than is the case for visual narrative fiction (Mar & Oatley, 2008). Furthermore, written narrative fiction more easily allows the reader private access to characters' minds than visual narrative fiction, which may broaden readers' understanding of others' internal points of view.

On the other hand, visual narrative fiction may be more effective at giving its viewers the idea that they are physically present in the fictional world (i.e., the 'diegetic effect'; Tan, 1995). Additionally, visual narrative fiction provides direct representations of all kinds of, potentially ambiguous, complex facial expressions and emotions that can only be conveyed indirectly in written narrative fiction (Black & Barnes, 2015b). Visual narrative fiction may thus provide viewers with more 'lifelike', and thus, arguably, more effective, simulations of

social interactions. However, if the crucial mentalising-enhancing ingredient is the requirement to keep track of and analyse characters' mental states, perhaps the particular medium in which these characters are displayed does not matter for the effectiveness of the simulation. If this is the case, then written and visual narrative fiction would be equally good mentalising 'workouts'. There are thus theoretical arguments for all positions, but which of these positions will turn out to be most supported by the data is yet to be determined.

1.5 Exposure to narrative fiction: Enhancing mentalising development?

The current study investigates how the type and medium of narrative fiction exposure influences mentalising ability in children and adolescents. As the mentalising abilities of this age group are still developing (Blakemore & Choudhury, 2006; Van der Graaff et al. 2014), we consider it to be particularly relevant to assess the effects of narrative fiction exposure in this age range. Previous studies that have investigated effects of narrative fiction exposure in young children (most developmental studies in this domain investigate children between 3-6 years old) have found positive effects, both in intervention and correlational studies. For instance, false belief understanding (i.e., the ability to understand that others can entertain beliefs that are not in line with reality) was found to be enhanced following a literature-based intervention (Guajardo & Watson, 2002; Peskin & Astington, 2004). The relationship between exposure to narrative fiction and young children's developing mentalising ability as found in these intervention studies is backed up by findings from various correlational studies (e.g., Adrian, Clemente, Villanueva & Rieffe, 2005; Aram & Aviram, 2009; Gamannossi & Pinto, 2014; Ratner & Olver, 1998). Investigating a slightly older age-range (seven- to nine-year-olds), Kumschick et al. (2014) found that discussing a book in terms of the main characters' mental states similarly led to significant improvements in children's emotional competence. There is thus evidence to suggest that exposure to narrative fiction affects

mentalising ability in relatively young children, but less is known about how narrative fiction might affect mentalising ability in somewhat older children and adolescents. Previous research has similarly not investigated whether and to what extent the type and medium of the narrative fiction exposure affects mentalising ability, although Mar et al. (2010) suggest that both written and visual narrative fiction may affect Theory of Mind abilities in young children. As this information is potentially relevant in creating interventions that may help children and adolescents in their ability to further develop ways in which to competently engage in social interactions with others (which is important for their well-being, see Rosen et al., 2017), our study focuses on a somewhat older age group (8-16 year olds) than is usually considered in this type of research. Our interest was not to investigate how the younger and older children within this range would differ from each other. Instead, we focussed on assessing what the nature of the relationship between narrative fiction exposure and mentalising ability would be in this previously overlooked age group.

1.6 Aims and approach of the study

The present study aims to add to existing knowledge regarding the relationship between exposure to narrative fiction and mentalising ability in children and adolescents in various different ways. We aim to assess whether self-reported overall frequency of exposure to narrative fiction is related to self-reported and objective mentalising tasks in this age group. Furthermore, we investigate whether narrative fiction that engenders eudaimonic experiences is related more strongly to mentalising ability than narrative fiction that engenders hedonic experiences. Our investigation will also consider whether the relationship between narrative fiction exposure and mentalising differs depending on the media type. We will thus contrast exposure to written narrative fiction as consumed via books and visual narrative fiction as experienced in films and TV-series. In order to investigate these issues, we will employ a

confirmatory Bayesian approach. This approach, as well as specific predictions regarding the expected outcomes of these investigations, will be detailed in the data analysis section below (see also De Mulder, Hakemulder, van den Berghe, Klaassen and van Berkum, 2017, for an example of this approach in a related domain).

2. Method

2.1 Participants

The current study was part of a bigger project that was approved by the local ethics committee. 126 children between the ages of eight and sixteen (64 girls; M_{age}=12;4[4], see Table 1) participated, although not all tasks were completed by each child. Children were recruited via the municipality of Zeist and schools associated with the Utrecht University ChildResearchCenter [KinderKennisCentrum] in the Netherlands. In the Netherlands, children start primary school around the age of 4 (it is compulsory for children to attend school from 5 years on) with its grades ranging from 'Group 1' to 'Group 8' and they go on to secondary school around the age of 12 with its grades ranging from 'Class 1' to 'Class 4' (with one or two additional classes for the higher levels of education). The primary school children in our sample would thus be in group numbers ranging from 'Group 5' (the 8-year-olds) to 'Group 8' (the 11-year-olds); the secondary school children would be in class numbers ranging from 'Class 1' (the 12-year-olds) to 'Class 5' (the 16-year-olds). (This corresponds approximately to Grade 3 to Grade 11 in the American school system). Children and their parents received an information pack which included a response card. All children of 12 years and older and both of the parents had to have signed the informed consent form provided at the start of the testing session in order for participation to be possible. Most of the children that participated came from middle-class or upper middle-class families. None of the

[4] Ages are provided in the years;months format

participants had any officially diagnosed disorders regarding their socio-emotional development.

Table 1 Age and gender distribution of all children in the sample

Age group	Mean age in years; months (range)	Gender distribution: girls-boys	N
8	8;8 (8;3-8;11)	7-7	14
9	9;7 (9;1-9;11)	7-8	15
10	10;4 (10;0-10;10)	8-8	16
11	11;4 (11;0-11;11)	3-11	14
12	12;5 (12;1-12;11)	7-4	11
13	13;4 (13;0-13;9)	8-8	16
14	14;4 (14;0-14;11)	8-5	13
15	15;6 (15;1-15;11)	8-6	14
16	16;5 (16;0-16;11)	8-5	13
Overall	12;4 (8;3-16;11)	64-62	126

2.2 Measures

2.2.1 Exposure to narrative fiction Participants' exposure to narrative fiction was assessed using a novel questionnaire that consisted of two parts. Part one contained 23 questions regarding exposure to written narrative fiction (i.e., books); part two consisted of 38 questions regarding exposure to visual narrative fiction (i.e., films and TV-series). 33 of this total set of 61 questions were relevant to the hypotheses tested in this paper[5] (see the Supplementary Materials for questionnaire items analysed in this study).

Frequency of exposure to narrative fiction was assessed by asking participants to give a global estimate of how often they read books and watched films and TV-series in terms of the number of days per year, month or week in which they engaged in these activities[6]. Answers could be given on a ten-point scale ranging from *never* to *7 days a week*. In order to

[5] Other questions in the survey asked participants to list their favourite books, films and TV-series and how they would characterise them in terms of the eudaimonic and hedonic dimensions provided here and to what extent they experienced narrative transportation when they read books or viewed films or TV-series.

[6] Although participants were also asked to provide an estimate of how many hours they spent engaged in this activity, examination of data from pilot testing suggested that particularly the younger children in the sample often found it hard to give reliable answers to this question (e.g., answering that they spent 12 hours a day reading narrative fiction). In the current study, only the broader time frame estimate was thus analysed.

make sure that participants understood that the questionnaire was specifically related to their exposure to narrative fiction (and not to other types of media exposure), the questionnaire began with an introduction in which this distinction was explained (see Supplementary Materials).

Exposure to eudaimonic and hedonic narrative fiction was assessed by asking participants to give a relative estimate of their exposure to these types of narrative fiction. Answers could be given on a six-point scale ranging from *never* to *always*. As use of the terms hedonic and eudaimonic in the question ('how often do you read eudaimonic books?') would not have yielded reliable answers in this participant group, we used various different adjectives and phrases that are associated with these concepts and that would be comprehensible to the youngest participants in the study. For exposure to hedonic narrative fiction participants were asked to estimate how often the books that they read and the films and TV-series they viewed were *exciting*, *scary*, *funny*, *happy* and *romantic*. The choice of these terms is much the same as current in research on eudaimonic versus hedonic concerns (e.g., Oliver et al., 2012). We assumed that 'exciting' and 'scary' are understandable terms for the age groups that are under investigation, and that they are good proxies for genres that are typically associated with hedonic entertainment. Tension can be both a response to meaningful and pleasurable stories, but it is dominant for the latter (Oliver et al., 2012). For the age groups under investigation, it seemed that 'funny' is a good proxy for comedy, a genre that has been related to hedonic responses in several studies (McDonald et al., 2015). The gratification of feeling 'happy' is one of the most commonly acknowledged hedonic motivations (Oliver et al., 2012). 'Romantic' can be both serious and light, but for this age group it seemed appropriate to classify it as hedonic. Moreover, research reveals that it is dominantly associated with pleasurable movies rather than meaningful movies, and more with comedy than with tragedy (Oliver et al., 2012).

Exposure to eudaimonic narrative fiction was measured by asking participants about their exposure to *sad*, *moving* and *beautiful* books, films and TV-series and they were asked to determine *how often they learnt something important about other people* and *how often they learnt something important about themselves* when they read books or viewed films or TV-series (see Supplementary Materials for exact wording of questions). 'Sad' is a term that occurs frequently in the research and is related consistently with eudaimonic responses (e.g., Oliver et al., 2012). The feeling of being moved is less pervading, but convincingly related to appreciation (Oliver & Bartsch, 2011; Bartsch et al., 2014). In Dutch, the adjective 'mooi' (beautiful) is closely associated with appreciation, and is contrasted with labelling a story as 'leuk' (fun) which would be more indicative of hedonic pleasure (see also Oliver & Raney, 2011). Central to the notion of eudaimonia is that recipients seek meaningful portrayals of the human condition that inspire them to introspection and compassion. The experience that the narratives facilitate the deepening of self-knowledge, and help recipients learn about what it must be like to be someone else is also clearly linked to eudaimonia (Khoo, 2018; Oliver & Raney, 2011; Bracher et al., 2020; Knobloch-Westerwick et al., 2013). Our items assessing eudaimonic gratifications are based on previous research and were adapted for our age group where appropriate (e.g., 'This movie made me reflect on my own life and values' and 'This movie made me think about the purpose in my life', both used in Knobloch-Westerwick et al., 2013, became 'How often do you learn something important about yourself in the movies that you watch (for instance that you understand better why you think, feel or do certain things.)'. Note that each adjective/phrase was the topic of a different question and that each medium was dealt with separately. Exposure to hedonic narrative fiction was thus assessed using 15 different questions (3 media types x 5 questions), as was exposure to eudaimonic narrative fiction.

2.2.2 Mentalising ability Two objective measures of mentalising as well as a self-report measure were employed. The self-report measure of mentalising consisted of the perspective-taking scale of Davis's (1980) Interpersonal Reactivity Index (IRI-PT). The current study used a Dutch version of this measure that had been adapted for use with children and adolescents (Hawk et al., 2013). The IRI-PT consists of seven items that participants rate on a five-point scale ranging from *doesn't describe me well at all* to *describes me very well*. IRI-PT items assess respondents' inclinations to take other people's perspectives in their daily lives (e.g., 'When I'm upset at someone, I usually try to "put myself in his shoes" for a while'). The two objective mentalising measures each assessed a different aspect of mentalising ability. Basic emotion recognition was assessed using the Emotion Recognition (ER) subtest of the social cognition domain of the Computerized Neurocognitive Battery (Gur et al., 2012; Swagerman et al., 2016). Participants are shown a series of 40 faces and are asked to determine whether the face expresses happiness, sadness, anger, fear or no emotion. The Reading the Mind in the Eyes Task (RMET, Baron-Cohen, Wheelwright, Hill, Raste & Plumb, 2001) was employed as a more complex objective task of mentalising ability. The version used in the current study was translated to Dutch and adapted for use with children and adolescents (Overgaauw, van Duijvenvoorde, Moor & Crone, 2015). In this task, participants are shown the eye region of a series of 28 different faces and are required to choose from four possibilities (e.g. *unkind*, *cross*, *surprised* or *sad*) which option best conveys the mental state that is being signalled.

2.3 Procedure

The results reported in this paper were part of a bigger project that required children and one of their parents to come to the ChildResearchCenter for a day of testing. Only a subset of the data that was acquired is reported on in this paper. On the day of testing, the experimenter

first went through the informed consent form to make sure that everything was clear to both parent and child. After informed consent had been obtained, children were tested individually in special testing rooms in the centre; all tests pertinent to the current study were administered using Mac computers. All computer tasks were administered in a set order, as were all questionnaires, but children could choose to fill in questionnaires in between the various computer tasks if they wanted to. Furthermore, although certain times were reserved for breaks and lunch, children were free to take additional breaks throughout the day. The RMET (programmed in MATLAB) was the third computer task and ER (programmed within the Computerized Neurocognitive Battery; Gur et al., 2012) was the eighth. The IRI-PT questionnaire was the first in the list of questionnaires, the written narrative fiction questionnaire was the fifth and the visual narrative fiction questionnaire was the ninth. At the end of the day, children younger than 12 years old were given a gift and their parents received 30 euro's; children 12 years and over were given 10 euro's and their parents received 20 euro's. Travelling expenses were also reimbursed.

2.4 Data analysis

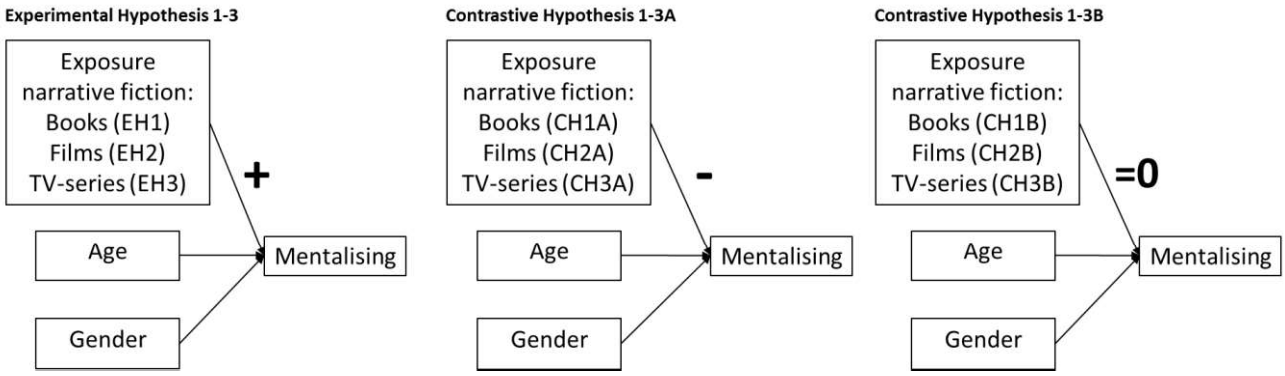
In order to test our hypotheses directly, the results of this study are analysed using informative hypotheses and Bayesian model selection (Hoijtink, 2012) with the software BIEMS (Mulder, Hoijtink, & de Leeuw, 2012) and BaIn (Gu, 2016). In this type of analysis, *prior to* observation of the data, background knowledge regarding the current state of theorising on the relationship between exposure to narrative fiction and mentalising ability is utilised to specify various competing hypotheses (Kluytmans, van de Schoot, Mulder, & Hoijtink, 2012; van de Schoot et al., 2011). These specific hypotheses can then be compared with each other, instead of each specific hypothesis being compared with the null hypothesis as is the case in classical frequentist hypothesis testing (Harlow, Mulaik & Steiger, 1997).

The Bayes Factor and the Posterior Model Probability that are associated with each hypothesis are then used as an indication of the amount of evidence that there is in the data for each particular hypothesis over other evaluated hypotheses (see Results section and the Supplementary Materials for more information on these concepts). This confirmative approach allows more precise testing of hypotheses, does not rely on arbitrary cut-off points and reduces the chance of obtaining false positives and false negatives, and, as such, is the approach of choice for this study (Hoijtink, 2012).

In these times of repeated and justified attention for open, transparent, and reproducible science (see, for example, Munafò et al., 2017), we want to provide a complete overview of all the analyses that we planned and executed when writing this paper. Our first set of analyses was executed without controlling for effects of age and gender in order to investigate whether, regardless of the influence of any other variables, there would be a relationship between exposure to narrative fiction and mentalising. As this indeed turned out to be the case, we then evaluated the exact same hypotheses, but now controlling for age and gender, to see whether the initial effects would remain. To limit the number of analyses presented in this paper, the interested reader is referred to the Supplementary Materials for the outcomes of these initial results. In this section, we present the data analysis plan for the analyses controlling for age and gender; the results section similarly only reports the analyses involving these variables.

The first set of hypotheses that were formulated regarded the nature of the relationship between the frequency of exposure to narrative fiction and mentalising, controlling for age and gender. As previous research suggests that there is a positive correlation between these two domains, our experimental hypotheses were to this effect (see Figure 1, Experimental Hypothesis 1-3).

Figure 1 Experimental and contrastive hypotheses regarding the frequency of exposure to narrative fiction and mentalising (controlling for age and gender)



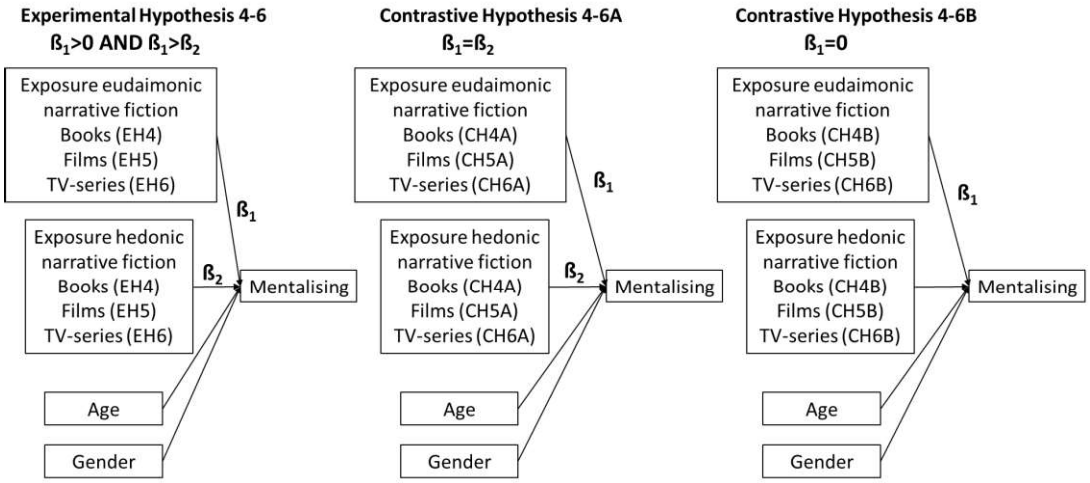
Note: EH: Experimental Hypothesis; CH: Contrastive Hypothesis; + denotes a positive correlation, - a negative correlation and 0 denotes a lack of correlation between the dependent and independent variables; each part of the figure represents nine different hypotheses (three narrative fiction media and three mentalising tasks)

As we are interested in how each media type affects mentalising independently, each media type (i.e., books, films and TV-series) was considered in a separate hypothesis (if all media types are considered as predictors of mentalising in one model, we would be looking at partial correlations between each media type and mentalising which was not our intention). The experimental hypotheses are compared to contrastive hypotheses that counter them: frequency of narrative fiction exposure is posited to be either negatively correlated with mentalising ability (Contrastive Hypothesis 1A-3A in Figure 1) or not correlated with mentalising ability at all (Contrastive Hypothesis 1B-3B).

Figure 2 illustrates the hypotheses regarding the effects of eudaimonic and hedonic narrative fiction exposure on mentalising ability, controlling for age and gender. Eudaimonic narrative fiction exposure was predicted to be positively related to mentalising ability (formalised as $ß_1>0$ in Experimental Hypothesis 4-6, with $ß_1$ denoting the standardised regression coefficient for eudaimonic narrative fiction exposure in relation to mentalising) and to be more strongly related to mentalising ability than exposure to hedonic narrative fiction (formalised as $ß_1>ß_2$, with $ß_2$ denoting the standardised regression coefficient for hedonic narrative fiction in relation to mentalising). These experimental hypotheses were

offset against contrastive hypotheses that countered them: eudaimonic narrative fiction exposure either does not have a special status as compared to hedonic narrative fiction ($ß_1 = ß_2$, Contrastive Hypotheses 4A-6A) or is wholly unrelated to mentalising ($ß_1 = 0$, Contrastive Hypotheses 4B-6B).

Figure 2 Experimental and contrastive hypotheses regarding exposure to eudaimonic and hedonic narrative fiction and mentalising (controlling for age and gender)

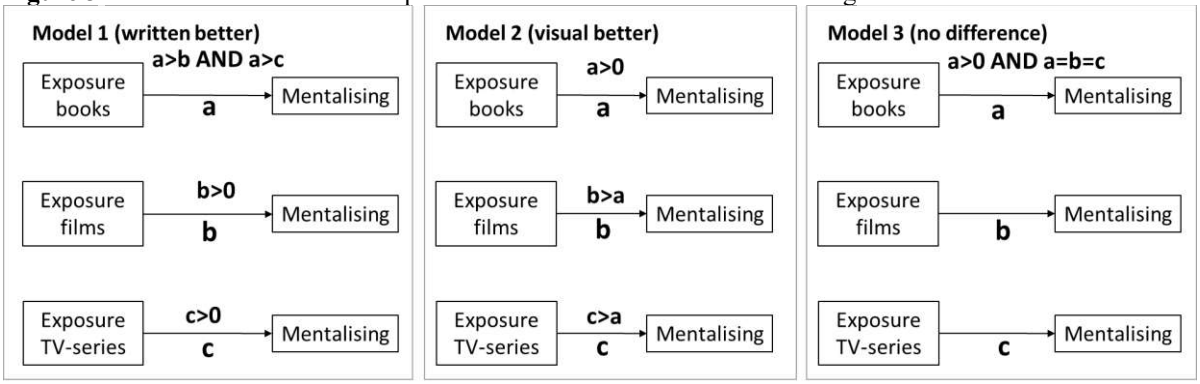


Note: EH: Experimental Hypothesis; CH: Contrastive Hypothesis; $ß_1$ and $ß_2$ are standardised regression coefficients; $ß_1$ denotes the relationship between exposure to eudaimonic books/films/TV-series and mentalising; $ß_2$ denotes the relationship between exposure to hedonic books/films/TV-series and mentalising; each hypothesis is shorthand for nine different hypotheses (three narrative fiction media and three mentalising tasks)

In addition to the specification of these six experimental hypotheses and their associated contrastive hypotheses, prior to data observation we also formalised three different models (that is, sets of internally related hypotheses) that dealt with potential strength differences in the effects that the two media types (written and visual narrative fiction) could have on mentalising ability. As there is no clear evidence to support the primacy of one type of media over the other or to assume that they have equal effects on mentalising, we formulated three different possible models (instead of designating specific experimental and contrastive hypotheses) and investigated which of these would be best supported by the data. Model 1 (consisting of a set of three interrelated hypotheses, see Figure 3) posited that exposure to

visual narrative fiction would be positively correlated with mentalising ability, but that exposure to written narrative fiction would be more strongly correlated with mentalising ability (the 'written better' model) . Conversely, Model 2 formalised the notion that although exposure to written narrative fiction would be positively correlated with mentalising, the correlation would be stronger for exposure to visual narrative fiction (the 'visual better' model). Finally, Model 3 stated that there would be a positive correlation between exposure to both types of narrative fiction and mentalising ability, but that these effects would not differ in strength (the 'no difference' model)[7].

Figure 3 Media effects models for exposure to narrative fiction and mentalising



Note: a denotes the correlation between exposure to books and mentalising ability; b denotes the correlation between exposure to films and mentalising ability; c denotes the correlation between exposure to TV-series and mentalising ability; as in Figure 1 and 2 separate hypotheses were tested for each of the three domains of mentalising, each model is thus shorthand for three different models

3. Results

Table 2 provides the descriptive statistics and sample sizes for each of the measures in the test battery (the dataset with the specific outcomes for each individual participant has been made available in the Supplementary Materials). Although the full sample consisted of 126 participants, due to technical glitches, experimenter error, and time constraints for

[7] The media effects models do not control for age and gender as our research question pertained to which medium would demonstrate the strongest effects across the board and not whether we would see the same pattern in every age and gender group. Furthermore, there is no specific theoretical motivation to assume that there would be medium specific differences between the age groups, so no analysis plans in this vein were specified prior to data analysis.

participants, data was not obtained from all participants on all measures (in the analyses list-wise deletion was applied based on the variables in the model). The column entitled N provides information on the number of participants that was included for each measure. Most of the missing data relates to responses for the questionnaire assessing exposure to visual narrative fiction, as this was the last questionnaire to be filled in. Time constraints thus entailed that 13 participants could not provide responses for this measure (this led to the exclusion of data from four 8-year olds, two 9-year-olds, five 10-year-olds, a 13- and a 15-year old). Furthermore, although normally the RMET is scored on a scale from 0 to 28, a technical error in the computer programme entailed that some answers (0.9% of the data) were not recorded properly. RMET scores thus consisted of a percentage score of the number of correct answers out of the number of valid trials. Note that frequency of exposure to narrative fiction in general and exposure to hedonic and eudaimonic narrative fiction were assessed on a different scale and in separate questions, so scores are not directly comparable. Percent of Maximum Possible, POMP, scores are provided in an additional column such that the values obtained for these measures can be compared (POMP scores express raw scores in terms of the maximum possible score and are determined by dividing the actual score by the highest possible score x 100, see Cohen et al., 1999).

Table 2 Descriptive statistics for all mentalising measures and the narrative fiction questionnaire

Task	Mean (SD)	Range	N	
Mentalising				
Perspective taking (IRI-PT)	14.7 (4.2)	5-25	125	
Emotion recognition (ER)	32.3 (4.0)	16-40	126	
Reading the Eyes in the Mind (RMET) [a]	64.3 (12.0)	32-86	125	
Narrative fiction exposure				**POMP score[b]**
Books-general frequency	4.9 (3.1)	0-9	121	54.4
Eudaimonic books	10.0 (5.0)	0-23	121	40.0
Hedonic books	11.9 (3.8)	0-23	121	47.6
Films-general frequency	3.0 (1.8)	0-9	115	33.3
Eudaimonic films	9.9 (4.1)	0-19	114	39.6
Hedonic films	13.5 (3.3)	0-22	114	54.0
TV-series-general frequency	5.3 (2.8)	0-9	113	58.9
Eudaimonic TV-series	8.1 (5.0)	0-25	113	32.4
Hedonic TV-series	12.0 (4.4)	0-25	113	48.0

Note: SD= Standard Deviation; [a] score denotes percentage correct; [b]: POMP= Percent of Maximum Possible (to enable comparison of frequency of narrative fiction exposure in general and eudaimonic and hedonic narrative fiction exposure on the same scale); maximum values: IRI-PT= 28; ER=40; RMET=100; Exposure books/films/TV-series= 9; Exposure eudaimonic/hedonic books/films/TV-series= 25

Table 3 gives an overview of all the correlation coefficients, as well as the associated Bayes Factors (BFs). The correlation coefficients provide a descriptive indication of the nature of the correlations; the BFs give an indication of the level of evidence that there exists in the data for these correlations. More information on the interpretation of BFs in a general sense can be found in the Supplementary Materials, but here the BF provides an indication of the amount of evidence that can be found in the data for the claim that there is a correlation between the two variables. More specifically, values larger than 1 entail that there is evidence for the presence of a correlation (e.g., if the BF is 5, there is five times more evidence for the claim that there is a correlation than for the claim that there is no correlation) and values smaller than 1 entail that there is evidence for the absence of a correlation (e.g., if the BF is 0.2, there is five times more evidence for the claim that there is no correlation than for the claim that there is a correlation (because 1/0.2=5))[8].

[8] The BFs for Table 3 and Table 4 were added in response to a request by a reviewer. No informative hypotheses were thus tested in these cases (this would have to have been specified in advance in the data analysis section); this value only gives insight into the level of evidence that there is for the presence of a correlation. Note that our decision to report specific BFs only for values between 0.1 and 10 does not reflect any 'official' cut-off point. This decision was made in light of reader-friendliness (given that values can be very small and very large) and the notion that a hypothesis that receives ten times more evidence than another hypothesis could reasonably be considered a strongly supported hypothesis on any account.

Table 3 Correlations between exposure to (eudaimonic/hedonic) narrative fiction, mentalising, age and gender, Bayes Factor in brackets after correlation

	Perspective taking (IRI-PT)	Emotion Recognition (ER)	Reading the Mind in the Eyes (RMET)	Age	Gender[a]
Books-general frequency	.15 (0.4)	-.27 (>10)	-.16 (0.4)	-.55 (>10)	-.10 (0.2)
Eudaimonic books	.42 (>10)	.33 (>10)	.38 (>10)	.23 (3.6)	-.37 (>10)
Hedonic books	.29 (>10)	.20 (1.2)	.22 (2.5)	.01 (<0.1)	-.27 (>10)
Films-general frequency	.08 (0.1)	.07 (0.1)	.01 (<0.1)	.12 (0.2)	.02 (<0.1)
Eudaimonic films	.34 (>10)	.24 (3.8)	.35 (>10)	.23 (2.5)	-.42 (>10)
Hedonic films	.20 (1.1)	.12 (0.2)	.14 (0.3)	.15 (0.4)	-.25 (6.2)
TV- series-general frequency	-.06 (0.1)	-.05 (0.1)	-.06 (0.1)	-.24 (4.2)	-.11 (0.2)
Eudaimonic TV-series	.26 (7.3)	.25 (4.7)	.25 (4.8)	.27 (>10)	-.41 (>10)
Hedonic TV-series	.18 (0.6)	.03 (0.1)	.05 (0.1)	.10 (0.2)	-.32 (>10)
IRI-PT		.15 (0.4)	.25 (7.2)	.17 (0.6)	-.26 (9.7)
ER			.36 (>10)	.53 (>10)	-.16 (0.5)
RMET				.43 (>10)	-.11 (0.2)

Note: [a] negative correlations entail lower values for boys than girls

Table 4 displays the correlations between each of the components of the eudaimonic and hedonic narrative fiction measures and the various mentalising tasks as well as the associated BFs (as in Table 3 these can be used to assess to what extent the presence of a correlation is supported by the data). No specific separate analyses were planned to investigate these individual components, but this descriptive information is potentially relevant for future research that seeks to further investigate relationships between eudaimonic and hedonic media in relation to mentalising. One thing to note is that the correlations for the hedonic media tend to be small to non-existent in size, whereas there are more moderate sized correlations for the eudaimonic media. However, for the eudaimonic components, the component assessed with the term 'beautiful' seems to be less consistently correlated with the mentalising tasks than the other components. Furthermore, the component assessed with the term 'romantic' seems to fit more with the correlations seen for the eudaimonic components than for the hedonic components.

Table 4 Correlations between exposure to specific eudaimonic and hedonic dimensions in relation to mentalising, Bayes Factor in brackets after correlation

	Perspective taking (IRI-PT)	Emotion Recognition (ER)	Reading the Mind in the Eyes (RMET)
Eudaimonic dimensions			
Books			
Sad	.32 (>10)	.28 (>10)	.39 (>10)
Moving	.29 (>10)	.15 (0.4)	.35 (>10)
Beautiful	.21 (1.5)	.13 (0.3)	.09 (0.2)
Learn about others	.37 (>10)	.43 (>10)	.29 (>10)
Learn about self	.39 (>10)	.22 (2.4)	.34 (>10)
Films			
Sad	.17 (0.5)	.19 (0.9)	.15 (0.4)
Moving	.30 (>10)	.24 (4.4)	.40 (>10)
Beautiful	.14 (0.3)	-.03 (<0.1)	.06 (0.1)
Learn about others	.29 (>10)	.28 (>10)	.36 (>10)
Learn about self	.28 (>10)	.13 (0.3)	.22 (1.7)
TV series			
Sad	.10 (0.2)	.21 (1.3)	.24 (3.2)
Moving	.17 (0.6)	.20 (1.1)	.20 (1.1)
Beautiful	.02 (<0.1)	.08 (0.1)	.04 (0.1)
Learn about others	.32 (>10)	.26 (7.4)	.26 (8.9)
Learn about self	.34 (>10)	.17 (0.5)	.19 (0.8)
Hedonic dimensions			
Books			
Exciting	.23 (2.6)	.23 (3.1)	.15 (0.4)
Scary	.19 (1.0)	.21 (1.7)	.22 (2.5)
Happy	.03 (<0.1)	-.15 (0.3)	-.04 (0.1)
Romantic	.33 (>10)	.35 (>10)	.33 (>10)
Funny	.00 (<0.1)	-.13 (0.2)	-.08 (0.1)
Films			
Exciting	.25 (4.5)	.10 (0.2)	.03 (0.1)
Scary	.03 (<0.1)	.02 (<0.1)	.10 (0.2)
Happy	-.05 (0.1)	-.20 (1.1)	-.14 (0.3)
Romantic	.27 (>10)	.38 (>10)	.34 (>10)
Funny	-.01 (<0.1)	-.07 (0.1)	-.03 (<0.1)
TV series			
Exciting	.11 (0.2)	.10 (0.2)	.05 (0.1)
Scary	.17 (0.5)	.02 (<0.1)	.09 (0.2)
Happy	.05 (0.1)	-.15 (0.4)	-.15 (0.4)
Romantic	.30 (>10)	.31 (>10)	.27 (>10)
Funny	-.10 (0.2)	-.24 (4.2)	-.16 (0.4)

3.1 Frequency of exposure to narrative fiction

In the interpretation of the results in this section the Posterior Model Probability (PMP) will be employed to determine which of the tested hypotheses is most supported[9]. The PMP gives the probability that a particular hypothesis is the most supported by the data given all the specific hypotheses that are evaluated, taking into account the complexity and the fit of the hypothesis. If a particular experimental hypothesis thus has a PMP of, for example, 0.64, this entails that the probability is 64% that preferring this hypothesis over other evaluated hypotheses is the right choice. Importantly, there should be no rules regarding what constitutes a sufficient value[10]; instead, the results are summarised and reported and their interpretation is reflected upon in the discussion section.

The first analyses assessed the correlation between the frequency of exposure to narrative fiction across media types and the various mentalising tasks. Table 5 provides PMPs for Experimental Hypothesis 1-3 in relation to the three mentalising tasks. Shaded cells indicate that a hypothesis has the highest PMP and is thus the most supported by the data. (All Bayes Factors, PMPs associated with these analyses and an explanation of the relevance of the PMP values of the unconstrained hypotheses can be found in the Supplementary Materials, see also footnote 9).

[9] For the purposes of this study, the information provided by the PMPs is sufficient to determine the amount of support in the data for the various hypotheses. However, all the Bayes Factors associated with the analyses presented here and a short description of how this information should be interpreted can be found in the Supplementary Materials.

[10] The .05 rule to decide whether a p-value is significant or not was eloquently criticised by Rosnow and Rosenthal (1989): "surely, God loves the .06 nearly as much as the .05". Any rule for the interpretation of the size of PMPs is subject to the same criticism.

Table 5 Results hypotheses for relationship between frequency of exposure to books, films and TV-series and mentalising controlling for age and gender

	PMP EH 1-3 + relationship	**PMP CH 1-3A** - relationship	**PMP CH 1-3B** no relationship	PMP Unconstrained
IRI-PT				
Books	0.63	0.00	0.05	0.32
Films	0.21	0.06	0.59	0.14
TV-series	0.07	0.21	0.58	0.14
ER				
Books	0.13	0.12	0.63	0.12
Films	0.12	0.11	0.66	0.11
TV-series	0.25	0.06	0.54	0.15
RMET				
Books	0.24	0.06	0.55	0.15
Films	0.08	0.15	0.65	0.12
TV-series	0.16	0.09	0.63	0.12

Note: PMP=Posterior Model Probability; EH=Experimental Hypothesis; CH= Contrastive Hypothesis; shaded cells represent the hypothesis that is most supported by the data

Table 5 demonstrates that our experimental hypotheses (according to which there would be a positive relationship between frequency of narrative fiction exposure and mentalising) do not receive unambiguous support from the data. There is support for the idea that the frequency of exposure to books is positively correlated with IRI-PT, but the general finding is that there is no correlation between the child's exposure to books, films or TV-series and her mentalising ability. The data do clearly demonstrate though that there is no support for the notion that there is a negative correlation between exposure to books, films or TV-series and mentalising ability.

3.2 Exposure to eudaimonic and hedonic narrative fiction

Aside from assessing the overall frequency of narrative fiction exposure, the questionnaire also provided information on the type of narrative fiction that the participants were exposed to. Table 6 shows the results of the analyses concerning the relationship between exposure to eudaimonic and hedonic narrative fiction and mentalising ability.

Table 6 Results hypotheses for relationship between exposure to eudaimonic/hedonic books, films and TV-series and mentalising controlling for age and gender

	PMP EH 4-6 eud>0 AND eud>hed	**PMP CH 4-6A** eud=hed	**PMP CH 4-6B** eud=0	PMP Unconstrained
IRI-PT				
Books	0.41	0.40	0.02	0.17
Films	0.35	0.39	0.11	0.15
TV-series	0.22	0.35	0.31	0.12
ER				
Books	0.20	0.50	0.17	0.12
Films	0.26	0.35	0.26	0.12
TV-series	0.45	0.16	0.21	0.18
RMET				
Books	0.39	0.41	0.04	0.17
Films	0.61	0.13	0.02	0.23
TV-series	0.45	0.18	0.20	0.18

Note: EH= Experimental Hypothesis; CH= Contrastive Hypothesis; shaded cells represent the hypothesis that is most supported by the data

These results clearly demonstrate that Contrastive Hypotheses 4-6B (exposure to eudaimonic narrative fiction is not related to mentalising) are not supported by the data, as the hypothesis that exposure to eudaimonic narrative fiction is not related to mentalising ability is never the most supported hypothesis. However, the data is split on the question whether exposure to eudaimonic narrative fiction is positively related to mentalising and more strongly so than hedonic narrative fiction exposure or whether there is no difference between hedonic and eudaimonic narrative fiction exposure in its relation to mentalising. For the self-reported mentalising task (IRI-PT), the differences between these two hypotheses are very limited (PMPs are very similar for all media that were assessed). It is clear that exposure to eudaimonic narrative fiction is positively related to self-reported mentalising, but there is no conclusive evidence to suggest that it has a special status over exposure to hedonic narrative fiction. For the basic objective mentalising task (ER), exposure to eudaimonic TV-series is clearly more strongly related to mentalising than exposure to hedonic TV-series, but this does not hold for books or films. For the complex objective mentalising task (RMET), the differences are most pronounced: exposure to eudaimonic films and TV-series is clearly more

strongly related to complex mentalising than their hedonic counterparts, although there is no pronounced difference for eudaimonic vs. hedonic books in this respect. It should be noted though, that for all measures the relationship between eudaimonic narrative fiction exposure and mentalising is clearly positive (see also Table 3).

3.3 Media effects

The media effects analysis investigated whether there were strength differences in the media types in their relation to mentalising. All specified models (see also Figure 3) stated that the correlations between the frequency of exposure measure would be positive. In addition to that parameter, Model 1-'written better' specified that the correlation between exposure to written media (books) and mentalising would be more strongly positive than the correlation between exposure to visual media (films and TV-series) and mentalising. Model 2-'visual better' specified the opposite: higher positive correlations for visual media and mentalising. Finally, Model 3-'no difference' stated that the positive correlations between exposure to the various media types and mentalising would be equal. The outcome of this analysis can be found in Table 7.

Table 7 Media effects: Frequency of exposure to written and visual media types in relation to mentalising

	PMP Model 1 written>visual AND visual>0	**PMP Model 2** visual>written AND written>0	**PMP Model 3** written=visual AND written>0	PMP Unconstrained
IRI-PT	0.21	0.01	0.69	0.09
ER	0.00	0.01	0.06	0.93
RMET	0.01	0.02	0.82	0.15

Note: PMP= Posterior Model Probability; written=frequency of exposure to written narrative fiction (books); visual= frequency of exposure to visual narrative fiction (films and TV-series)

This analysis demonstrates that there are no differences between the written and visual media types in their relation to mentalising (the PMPs of Model 1-'written better' and Model 2-'visual better' are never the highest values in any of the rows). For one of the three mentalising measures, ER, we see that all of the models that have been specified fit the data very poorly. The correlations between the frequency of exposure to all of the media types and ER are either negative or very close to zero, so none of the specified models fit properly and the unconstrained model receives the highest PMP (the unconstrained model represents a model with no formulated constraints, high PMP values for the unconstrained model thus entail that the specified models are not well-chosen, see also Supplementary Materials). For the RMET and the IRI-PT mentalising measures, Model 3-'no difference' receives the most support. Although this may seem unexpected, given that some of the correlations are also negative in these cases, the negative correlations are quite small and the confidence interval for these values also comprises positive values. This means that the model parameter that specifies that the correlations are positive is close enough to what is found in the data for it not to completely rule out all of the specified models (as it did for the ER measure). Given that there is no evidence for differences between the values of the correlations for the various media types (as Model 1 and 2 specify), that entails that Model 3-'no difference' is the most supported in this case. This model also receives high PMP values because it is the more specific of the three models (the Model 3 claim that two variables are equal is more specific than the Model 1 and 2 claim that one correlation will be higher than another) and specificity of a model is also taken into account in Bayesian model selection (Hoijtink, 2012). For the IRI-PT and RMET measures in relation to media exposure, there is thus the most support for the notion that there is no difference in effects based on the medium of the exposure[11].

[11] For completeness' sake, we note that we also conducted an analysis in which we investigated potential media effects for different eudaimonic media types. This was guided by the fact that whereas the correlations between general frequency of exposure and the mentalising measures were generally very small or even negative (in contrast to what the model parameters specified), the correlations were clearly positive for exposure to

3.4 Result summary

The results of the analyses regarding children and adolescents' exposure to narrative fiction suggest that in this wide age range there is no correlation between the self-reported *frequency* of exposure to narrative fiction in general and mentalising, except that exposure to books is clearly positively correlated with self-reported mentalising. This was also reflected in the media type analysis: either none of the models were supported (for the relationship between frequency of exposure and ER) or there was no difference in terms of the relationship between the various media types and the scores on the mentalising measures (for RMET and IRI-PT). However, there does seem to be a relation between mentalising ability and the *type* of narrative fiction that participants are exposed to. The results suggest that exposure to eudaimonic narrative fiction is positively related to mentalising and that exposure to this type of fiction has a special status for TV-series in relation to basic objective mentalising and for films and TV-series in relation to more complex objective mentalising. For the other domains that were investigated, either the data did not clearly differentiate between the hypotheses that eudaimonic exposure has a special status or that it is comparable to hedonic exposure (there were only small differences between the PMPs of these hypotheses) or the most support was found for the idea that exposure to eudaimonic and hedonic narrative fiction is equal in its relationship to mentalising. The hypothesis that exposure to eudaimonic narrative fiction was not related to mentalising was never the most supported by the data.

4. Discussion and Conclusion

4.1 Frequency of exposure to narrative fiction and mentalising

eudaimonic media and mentalising ability. However, with hindsight we came to the conclusion that this does not fit well with the Bayesian requirement to only conduct analyses specified prior to viewing the data.

The findings of the current study demonstrate that the frequency of exposure to books is positively correlated with self-reported mentalising. That is, children who report spending more time reading books also report being more inclined to take other people's perspectives in their daily lives, even if age and gender are controlled for. However, frequency of exposure to books was not correlated with objective measures of mentalising and exposure to films and TV-series was not correlated with any aspect of the child's mentalising capacity as assessed here. Whilst the result regarding books and self-reported mentalising was as expected given our hypotheses, the other results give rise to two questions: 1) why did we not find a positive correlation between the frequency of exposure to visual narrative fiction and mentalising? and 2) why did we not find a positive correlation between the frequency of exposure to books and the objective mentalising tasks? To start off with the first question: perhaps the relationship between the frequency of exposure to visual narrative fiction and mentalising is just not particularly robust. Indeed, as noted in the introduction, by far the most of previous research has considered the relationship between exposure to written narrative fiction and mentalising, far fewer studies have looked at exposure to visual narrative fiction in this respect. Although there are studies that have found evidence for this relationship (Black & Barnes, 2015b, and Mar et al., 2010), these studies did not consider the same age range as the current study (focussing either on adults or younger children respectively). Perhaps the results from these studies just do not generalise to the age group investigated in the current study and/or are hard to replicate in general.

The relationship between the frequency of narrative fiction exposure and mentalising might thus be specific to written narrative fiction, but this still leaves us with the question why we did not find a positive correlation between the frequency of exposure to books in general and the objective mentalising tasks. A possible answer may lie in the fact that compulsory reading is a much greater part of exposure to books for this age group than for

the younger children and adults that have been assessed in other studies. The frequency measure that we employed does not make a distinction between reading for pleasure and compulsory reading at school (or as explicitly 'forced onto' children by parents), whereas this may well affect the way in which the material is processed. Indeed, various studies suggest that reading for pleasure and positive attitudes towards reading are positively related to achievement in reading (e.g., Brozo et al., 2011; Stutz et al., 2016). Perhaps then, the sheer amount of reading a child or adolescent engages in is of subsidiary importance to the way in which they engage with the material. That this notion might be on the right track, is supported by the findings of the current study with respect to exposure to eudaimonic and hedonic narrative fiction, discussed in the next section.

4.2 Exposure to eudaimonic vs. hedonic narrative fiction and mentalising

Self-reported *frequency* of exposure to narrative fiction in general may thus not be intimately tied to mentalising ability in this age range, but the particular *type* of narrative fiction that the child is exposed to was found to be related to mentalising in interesting ways. Eudaimonic narrative fiction exposure is positively correlated with mentalising and these correlations are consistently higher than those between hedonic narrative fiction exposure and mentalising. The findings demonstrate that exposure to eudaimonic narrative fiction has a special status, an edge over hedonic narrative fiction exposure, in the visual domain, particularly in relation to the more complex objective mentalising task. This finding is in line with the results reported in Black and Barnes (2015b) demonstrating that exposure to an award-winning, and thus, arguably, eudaimonic, TV-series[12] enhanced performance on an objective mentalising task. However, given that Kidd and Castano (2013) and Black and Barnes (2015a) found

[12] Of course, the fact that a particular TV-series has won an award does not automatically entail that it engenders eudaimonic experiences in its viewers, but given that all stimuli had received awards as outstanding drama series (and not as comedy series), arguably, these stimuli were more prominently associated with mixed affect and contemplation than with positive affect and excitement.

exposure to literary texts to be more strongly associated with mentalising than exposure to popular fiction texts, we also expected to find a distinction between eudaimonic and hedonic books in this respect. After all, the more profound contemplation of the human condition, assumed to be a crucial mentalising-enhancing ingredient, is more associated with both literary texts and eudaimonic experiences than with popular fiction texts and hedonic experiences. However, what we found was that both exposure to eudaimonic and hedonic books was positively related to mentalising and that the difference between the two was not big enough for exposure to eudaimonic books to receive a special status in its relation to mentalising.

So, exposure to both hedonic *and* eudaimonic books is positively related to mentalising, but it is in the visual domain (films and tv-series) with respect to the more complex mentalising task (RMET) that exposure to eudaimonic media most clearly has a special status. Perhaps then, we can tentatively conclude that this is subtle evidence in favour of a more profound relationship between exposure to written narrative fiction and mentalising than between visual narrative fiction and mentalising. After all, whereas for the visual media the relationship between mentalising and narrative fiction exposure is only clearly stronger for media offerings that engender deep contemplation (i.e., eudaimonic films and TV-series), potentially the more active meaning construction that is required for the processing of written media is related to mentalising ability for material that requires less profound contemplation as well (i.e., hedonic books). We thus suggest that both hedonic and eudaimonic narrative fiction can train mentalising ability, but a good 'mentalising workout' requires passing an active meaning-construction threshold which, we assume, is reached sooner when the consumer is exposed to eudaimonic narrative fiction.

This conclusion may sound as if it contradicts the finding that there is no clear positive relationship between exposure to books (written media) in a general sense and

mentalising and the outcome of the media effects analysis (which found no evidence to suggest that there was a difference in terms of the frequency of exposure to the media types in relation to mentalising), but two points need to be considered here. The first point is that the overall frequency of exposure and the type of exposure are separate concepts measured using different scales. It is possible to have only very limited exposure to narrative fiction (and thus a low frequency of exposure score), but all of this exposure could engender eudaimonic experiences (which would entail high scores on the eudaimonic fiction exposure scale); or one could have a high frequency of exposure, but no eudaimonic experiences (with resulting low scores on the scale). Secondly, not all media exposure necessarily has to lead to hedonic or eudaimonic experiences. For instance, compulsory reading might primarily engender boredom, or a film or TV series might be on in the background whilst the viewer simultaneously engages in other activities. This kind of exposure would be counted in the frequency measure, but it would not be represented in the media type measure. If the type of narrative fiction exposure is more relevant than the frequency of exposure, it is thus possible to find evidence for positive relationships between eudaimonic and/or hedonic narrative fiction exposure and mentalising ability even if there is no evidence for a relationship between exposure to narrative fiction in general and mentalising ability. In this sense, then, we consider it to be possible that both eudaimonic and hedonic media exposure is related to mentalising ability (with a 'special status' for eudaimonic media exposure), even if the frequency of exposure is not (and the media effects analysis that was based on the frequency of exposure measure does not provide evidence to suggest that there are differences on this front).

Taken together, the findings suggest that although the frequency of self-reported exposure to narrative fiction in general is often not correlated with mentalising in this age range, the type of narrative fiction (i.e., the kind of experience it gives rise to) that the child is

exposed to is related to mentalising ability. Exposure to eudaimonic narrative fiction is consistently positively related to mentalising; this is most pronounced in the visual domain with regards to the more complex mentalising task. However, less intensive simulations of human social interaction and more pleasure-based involvement in characters' lives as provided by exposure to hedonic narrative fiction also have a role to play in allowing the child to practice understanding others' mental states.

4.4 Limitations of the current study

In the current study, the measure of narrative fiction exposure that we used (both in general and as regards eudaimonic and hedonic narrative fiction exposure) was self-reported. This may have led to over- or underreporting of the amount of exposure that each individual had had. Although we acknowledge that there are other measures that may suffer less from this potential drawback (e.g., media diaries, direct observation or checklists for Author, Title or Character Recognition; Stanovich & Cunningham, 1993; Vandewater & Lee, 2009), practical constraints regarding the amount of testing time available dictated that a relatively simple measure that could be held constant for children of different ages had to be preferred over alternative methods. We are thus assessing our participants' impressions of their exposure to (eudaimonic and hedonic) narrative fiction, rather than the rate of exposure in any absolute sense. It should be noted that this is only potentially problematic for the frequency of narrative fiction exposure measure and not for the measure of eudaimonic and hedonic narrative fiction exposure. Although there is a 'fact of the matter' regarding the child's frequency of exposure to narrative fiction in a general sense (children who answer that they read five days a week, but in reality read one day a week have indeed given a 'wrong' answer), by definition, the amount of exposure to eudaimonic and hedonic narrative fiction depends on the child's response to the narrative fiction she is exposed to. The 'fact of the

matter' regarding this type of fiction exposure thus crucially lies in the child's subjective assessment and as such can only be self-reported. Nonetheless, especially given the fact that our results regarding the relationship between the frequency of exposure to narrative fiction and mentalising were in contrast to predictions, it would be worthwhile to investigate whether more objective assessments of the frequency of narrative fiction exposure would yield similar results to those obtained in the current study.

An additional limitation of the narrative fiction exposure measure we used is that it did not distinguish between reading for pleasure and compulsory reading. We speculated that we did not find a positive relation between the frequency of exposure to narrative fiction and mentalising, but we did when the type of exposure was taken into account, because mentalising effects only occur when a reader engages with the narrative in a certain way and this engagement is less likely to occur when exposure is compulsory. We thus suggest that future research investigating different types of fiction exposure also takes into account the nature of the fiction exposure (compulsory or for pleasure), especially when investigating age groups for which compulsory reading (and potentially also other media exposure) is likely to be a major component of exposure.

Another limitation of the current study is that it is correlational and can thus not provide insight into the nature of the causal relationship between narrative fiction exposure and mentalising. Although the findings are in line with the idea that exposure to narrative fiction affects mentalising ability, it is also possible that children who are less good at mentalising just simply expose themselves less to (certain types of) narrative fiction than those who are better at mentalising. Indeed, it seems likely that both directions of causality are in effect. Intervention studies that demonstrate that exposure to narrative fiction leads to direct effects on mentalising ability (e.g., Kidd & Castano, 2013; Kumschick et al, 2014; Peskin & Astington, 2004) suggest a causal effect from narrative fiction exposure to

mentalising. However, research that demonstrates that children with mentalising problems (e.g., children with autism) do not generally display much interest in narrative fiction (Barnes, 2012) suggests that poorer mentalising ability may also affect media exposure choices. Longitudinal studies are required in order to tackle this issue further.

Future studies may also want to reassess our operationalisation of the various dimensions associated with eudaimonia and hedonia. While we based our selection of terms on previous research on this topic, the term 'beautiful' may not evoke the concept of 'appreciation' that we strived to assess (or at least not in the age group we assessed), as the correlations with mentalising that we found for this dimension of the eudaimonic experience did not match well with the correlations for the other eudaimonic dimensions. Furthermore, it may have been incorrect to classify the term 'romantic' as hedonic instead of eudaimonic. Although we assumed that books, films and TV-series that this age group would classify as romantic would be likely to engender pleasure-based experiences, the results suggest that, as regards the nature of its correlation with the mentalising tasks, the term fits better with the eudaimonic concepts. Perhaps then, books, films and TV-series that are categorised as 'romantic' by this age group do lead their consumers to profound contemplation of other people's mental states. Indeed, work by Fong et al. (2013) also suggests that exposure to romance novels is correlated with mentalising ability in adults. Future work could thus investigate what kind of experiences are engendered by exposure to media that this age group considers 'romantic' and thereby flesh out the concept of eudaimonic and hedonic experiences more fully than was possible in the current research.

These limitations notwithstanding, on the basis of our findings, we would encourage educators and parents alike to go with the hypes and allow their children the opportunity to be eudaimonically gratified by Katniss Everdeen's trials and tribulations. Of course, this might

not provide them with more than a good bed-time read, but it might also aid them in their understanding of others, not just in Panem, but in the real world too.

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