The Animals in Moral Tales:

Does Character Realism Influence Children's Prosocial Response to Stories?

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Abstract

Previous research has suggested that moral stories depicting realistic characters may better facilitate children's prosocial behavior than those containing anthropomorphized animal characters. The current study is a conceptual replication with a different sample and an extended age range. We examined the relationships between story character realism (anthropomorphized animal or human), theme (sharing or busyness), age and prosocial behavior (i.e., resource allocation). Four versions of an illustrated story book were created: An *Animal Sharing* book; an *Animal Busy* book; a *Human Sharing* book; and a *Human Busy* book. A total of 179 children, between 3 and 7 years old listened to one of the four versions of the story. Children's sticker donating behavior was measured prior to hearing the story and again following a story recall task. All groups donated more stickers post-story than pre-story. Younger children were more likely to increase their donation than older children and children who had made higher human internal state attributions in a previous experimental session donated more stickers post-story. In contrast to previous research, we found that a sharing-themed narrative depicting human characters was no more influential on sticker donation than the other stories.

The Animals in Moral Tales: Does Character Realism Influence Children's Prosocial Response to Stories?

The reading aloud of stories from picture books to young children is a regular activity in schools and preschools (Duursma et al., 2008; Jacobs et al., 2000; Lane & Wright, 2007). Read-aloud is practiced because there are established links between a child's exposure to shared reading and the emergence of language and literacy skills (Aram & Aviram, 2009; Kotaman, 2013; Lynch et al., 2008; Sénéchal et al., 2008). Moreover, stories are used in school-based personal, social and emotional learning (UK) or character education (USA and Canada), with the aim of conveying social, moral and emotional lessons to young children (Lee et al., 2014; Leming, 2000; Talwar et al., 2016; Walker & Lombrozo, 2017). Optimal educational resources must be underpinned by robust empirical evidence. In this context, it is important to determine the influence of key discrete properties of stories on children. With this in mind, the current study builds on existing research examining how fantasy and realism influence children's understanding and learning from picture books (e.g., Ganea, et al., 2014; Kotaman & Balcı, 2017a; Richert & Smith, 2011).

Moral Tales and Prosocial Behavior

Whilst infants may be innately predisposed towards prosocial behavior (e.g., Warneken & Tomasello, 2009), the expression of prosocial actions is cultivated and moderated by learning. With a focus on sharing, it is evident that rewards for altruism and punishments for selfishness occur across a wide variety of societies (Fehr & Fischbacher, 2004; Henrich et al., 2006), which indicates that the promotion of altruism is a widespread preoccupation. Furthermore, the ubiquitous presence of moral, folk and religious tales, suggests that these narratives provide important sources of relevant cultural information that shape children's behavior (Collette & Miller, 2018; Lee et al., 2014; Yao & Enright, 2020).

Key discrete features in moral tales appear to act as an immediate nudge for various forms of prosocial behavior. For example, narratives that portray a positive outcome for a

character who is honest significantly increase truth telling by children, when they are tested directly after hearing the story (Lee et al., 2014; Talwar et al., 2016). Intriguingly, in this research, children who were presented with moral stories that depicted negative outcomes for dishonest protagonists, subsequently told the truth no more frequently than those who heard a morally neutral story. Larsen et al. (2017) built on this finding and successfully used a story presenting positive outcomes for a generous protagonist to elicit sharing in Canadian children. For this reason, the current study used a narrative with a positive outcome for the prosocial protagonist. It should be noted however, that Chinese children have been found to respond to generosity stories by sharing more stickers than in a control condition, no matter the valence of outcome for the protagonist (Yao & Enright, 2020).

Altruistic Sharing in Children

Sharing is frequently used in research as a measure of prosocial behavior. An established measure of altruistic sharing, known in the literature as the 'dictator game', provides children with the opportunity to anonymously 'dictate' how a set of allocated resources (usually toys or stickers) are distributed between themselves and an absent third-party (Benenson et al., 2007; Cowell et al., 2017; Du & Hao, 2018). This procedure has been used successfully in children from 3 years old (Gummerum et al., 2010; Liu et al., 2016; Rochat et al., 2009). Children typically allocate only a small proportion of their resources to others, particularly if the sharing is anonymous and to an unspecified peer rather than a close friend (Flook et al., 2019; Moore, 2009; Stewart & McBride-Chang, 2000). Thus, this measure potentially provides sensitivity to increased sharing in response to experimental stimuli. However, individual differences in children's propensities to share are indicated by the large standard deviations reported in the literature (e.g. Benenson et al., 2007; Stewart & McBride-Chang, 2000). Therefore, it may be more appropriate to take a baseline measurement before any experimental manipulation and compare this with resource

allocation at a second point in time. We employed this technique and invited children to divide ten stickers between themselves and an unspecified same-age child both pre- and post-story, with the aim of examining the influences of specific aspects of stories on children's altruistic giving.

Predictable developmental trajectories are observed, with altruistic sharing more evident as children age (Benenson et al., 2007; Flook et al., 2019; Ongley et al., 2014; Posid et al., 2015). Whilst 3-year-olds appear to understand social expectations regarding fairness, the mean proportion of resources (stickers) shared in an anonymous task increases steadily between 3 and 8 years; 8-year-olds behave more in line with their egalitarian beliefs than 3-year-olds (Smith et al., 2013). Interestingly, whilst children's (baseline) propensity to share at least one sticker from a set increases incrementally from 3 years, when considering only those children who share, no age-related increases in donation are observed in under 7-year-olds (e.g., Blake & Rand, 2010; Posid et al., 2015).

Developmental pathways and the expression of prosocial actions are moderated by learning and culture (Henrich, 2015; House, 2018) and variations between cultures are observed (e.g. Cowell et al., 2017; Rochat et al., 2009; Samek et al., 2020). For example, it has been suggested that children in Eastern cultures exhibit greater peer-to-peer sharing than those in Western cultures (Stewart & McBride-Chang, 2000). Notably though, local socio-demographic characteristics can be at least as influential. For example, children living in urban contexts appear to be more self-interested than rural children (Rochat et al., 2009), but those from higher socioeconomic demographics altruistically share more resources than those from more impoverished environments (Benenson et al., 2007). We sought to further explore children's altruistic responses to stories in a 3-7-year-old sample of UK rural children.

Children's Responses to Anthropomorphism

A prevalent type of fantasy genre in children's literature uses anthropomorphism. Anthropomorphized characters are animals or objects portrayed as exhibiting human thoughts, feelings, goals and behaviors, which is a violation of reality (Epley et al., 2007; Severson & Lemm, 2016; Waytz et al., 2010). A small body of work has examined whether character realism affects the ease with which children understand these stories and apply the themes in fiction to themselves. For example, story comprehension is poorer if the book presents anthropomorphized illustrations rather than more realistic pictures, despite an otherwise identical narrative (Kotaman & Balcı, 2017b). The relationship between the transfer of solutions from stories to analogous real-world problems has also been observed to be less robust when fantasy protagonists, relative to human characters, are presented to young children (Ganea et al., 2008; Ganea et al., 2014; Richert et al., 2009; Richert & Smith, 2011).

Of direct relevance to the current study is research that has examined the influence of book character realism on 4 to 6-year-old children's prosocial behavior (Larsen et al., 2017). Larsen et al. found that children were more likely to share (stickers) if they had heard a story about human generosity compared with an anthropomorphized version of the same book. This finding supports the hypothesis that human characters are more effective than fantasy characters in facilitating prosocial behavior, such as sharing, in young children. However, Larsen et al. did not examine the influence of story character and narrative theme on prosocial response as separate factors. The current study sought to explore these potential influences on behavior and to examine the generalizability of the original finding with a different sample.

Further impetus to explore the concepts with a different sample is provided by similar research conducted by Yao & Enright (2020). Their stories were anthropomorphized, but nevertheless prompted sharing in Chinese children; this is a challenge to the idea that only human characters be an effective nudge. Socioeconomic characteristics influence not only

altruism, but also responses to anthropomorphism. For example, rural children appear to employ less anthropocentric reasoning than urban children (Geerdts, 2016; Herrmann et al., 2010; Waxman & Medin, 2007), which may shape responses to animal characters. Given that the original recruited sample were children associated with a city university or science center (Larsen et al., 2017) and high SES, there is great value in examining the generalizability of responses to anthropomorphism in other geographic locations, with children from diverse backgrounds.

Anthropomorphized stories have been noted as providing the majority of fiction books available to children in educational settings (Kotaman & Balcı, 2017b; Larsen et al., 2017). However, children do not universally show a strong preference for this story type (Barnes et al., 2015; Mar et al., 2010; Mar & Oatley, 2008) and individual differences have been observed in terms of personal orientation to fantasy content (Plante et al., 2017; Richert & Smith, 2011; Sharon & Woolley, 2004). These individual differences may influence the effects of character realism on subsequent behavior and children with greater fantasy orientation might exhibit stronger responses to animal stories.

Indeed, Larsen et al. (2017) assessed orientation to fantasy content by measuring the strength of association between human behavior and anthropomorphic pictures in young children. They found that children who judged anthropomorphic characters to have human behaviors (such as eating with utensils) were more likely to show prosocial behaviors (measured by the number of stickers shared) following an anthropomorphized story with a prosocial theme. This measure was concerned with children's expectation of general behavior, (e.g., using utensils), but did not assess children's beliefs about an agent's relative consciousness, emotions, thoughts, or intentions. It is possible that a child's abilities to personally identify with a character's moral behavior might be more strongly related to those beliefs about mental states, rather than overt behaviors. In a separate line of research, these

beliefs have been assessed with a child oriented scale, the Individual Difference in Anthropomorphism Questionnaire-Child Form (IDAQ-CF; Severson & Lemm, 2016). This questionnaire has been adapted to assess children's mental and emotional state attributions to people and to various animal characters that might typically be found in storybooks (Russell & Cain, 2020). This was used in the current study to further our understanding of the development of anthropomorphic thinking in early childhood and its relationship with children's responses following a story with a prosocial theme, that either had human or anthropomorphized characters.

The current study

This study provides a conceptual replication and extension of Larsen et al.'s (2017) Canadian study, building on previous findings using a different set of methods to test the same idea. We extend the work in terms of the cultural context, by examining the responses of UK children. Additionally, we broaden the age range, to ensure a comprehensive sample of young children, to whom anthropomorphized literature is targeted. This enables an evaluation of the generalizability of previous findings, particularly since evidence suggests that cultural contexts can influence resource allocation (Callaghan & Corbit, 2018; Stewart & McBride-Chang, 2000), and is consistent with the current broad debate concerning reproducibility in psychology (Asendorpf et al., 2013; Munafò et al., 2017).

Our study extends the scope of the original Larsen et al. (2017) work in several respects. The previous study did not examine the influence of story character and narrative theme on prosocial responses as separate factors. To assess for potential separate influences of these two variables, we examined the relationships between character, theme and sharing behavior, using a factorial design. Children in each age group were randomly assigned to one of four story conditions: An *Animal Sharing* condition; an *Animal Busy* condition (both these stories were illustrated with identical anthropomorphic cartoon pictures); a *Human Sharing*

condition; *Human Busy* condition (both stories were illustrated with identical human cartoon pictures, adapted from the illustrations used in the anthropomorphic books). We predict that a sharing themed story will have a positive influence on post-story sticker donations and that human sharing stories will be associated with more donations than animal sharing stories. Gender was included in the first analysis, as differences in resource allocation have occasionally been noted previous studies; examples of higher generosity in girls (Gummerum et al., 2010; Ongley et al., 2014) and in boys (Posid et al., 2015) have been observed. We do not have a prior prediction concerning gender and sharing.

To extend our understanding of the development of these behaviors, we included 3- to 7-year-olds to explore the influence of age on sharing behavior. This age range includes that studied by Larsen et al. (2017) and is one of rapid development in social cognitive understanding (Wellman & Liu, 2004). From 3 years, children are sensitive to underlying causal structures in stories and become increasingly able to differentiate between human and fantasy characters (Walker et al., 2015). Additionally, a demonstrable grasp of the concept of fairness (Smith et al., 2013), capacities for moral decisions (Ball et al., 2017) and successful participation in dictator games (Benenson et al., 2007) emerges in 3-year-olds. This informed our decision to test a wider relevant age-range. In line with the previous literature, we predict that older children will donate more stickers than younger children when measured pre-test. Influence of age on donation responses to stories is exploratory.

We additionally examined the relationship between children's sharing and their responses to the adapted anthropomorphic scale (Russell & Cain, 2020), which sought to capture children's beliefs concerning potential protagonists' capacities for consciousness, emotions, and thoughts, in place of the behavioral categorization task employed in the original study. We predict that this measure would be more strongly related to change in sticker donation following the prosocial story.

Larsen et al. (2017) included only those children who could explicitly answer post-narrative comprehension questions in the reported analyses. This precluded the examination of how ability to remember the story was related to subsequent sharing. To address this, we assessed how children's engagement with the narrative theme (assessed by explicit mention in a retell) was related to their sharing behavior. We predict a positive relationship between prosocial theme recall and sticker donations.

Our purpose was to address the following research questions:

(1) Does story character (Human, Animal) or story theme (Sharing, Busy) influence sharing behavior.

(2) Are children's ratings for human or for anthropomorphized animal thoughts, feelings and self-awareness related to their sharing behavior?

(3) Is the ability to identify the story theme associated with the prosocial response following a prosocial story?

(4) Are there age-related influences on children's prosocial responses to stories?

Method

Participants

The participants were 179 typically developing children, attending 6 rural state primary schools in the North-West of England, mostly serving areas of lower socioeconomic status (SES), recruited as part of a larger study. The children were aged between 3 and 7 years (M = 66.34 months, SD = 14.18, range: 38 to 91 months, 104 boys) and all were native English speakers. Equal numbers of children from each year group were randomly assigned to one of the four picture book conditions. The data from seven additional children were excluded due to unwillingness to participate (N=4), being unavailable to complete the second session (N=1) or due to developmental concerns raised by school staff (N=2). We also

excluded participants with receptive vocabulary scores that were more than one standard deviation below the mean (N = 5)[1].

Materials

Book Stimuli

Book stimuli were created to explore the influences of character type and prosocial narrative content on children's subsequent altruistic behaviors. The illustrations were based on those in a published book called *Little Raccoon Learns to Share,* written by Mary Packard (2013). This story has a strong sharing theme and was used with this age range in previous work by Larsen et al. (2017).

Four versions of the book were constructed, one for each experimental condition. Two books had a prosocial theme about sharing. In the *Animal Sharing* book, the original book's anthropomorphized illustrations were used; in the *Human Sharing* book, the pictures were those created by Larsen et al. (2017) which had been altered to replace the animal characters with human protagonists. The prosocial stories were identical, other than for specific references to the character, for example, 'Little Rachel' in the human version was 'Little Racoon' in the animal story, as is typical in these narratives. The same animal and human illustrations were used to create two control versions of the books. Key words in the sharing story were changed to create a narrative about the theme of 'being busy', that fitted the pictures without providing a sharing theme. Again, the busy narratives were identical, other than for specific references to the character. This provided the *Animal Busy* and *Human Busy* books for the two control conditions. Table 1 provides examples of key matched sentences across the 4 conditions. The four books were printed to look identical. Additional wordless copies of the animal and human book were produced, for use in the recall task. These were printed and bound to match the experimental books.

[1] No significant differences in findings resulted from this exclusion.

Table 1

Examples of Matched Sentences from each Story Condition

Illustration type	Prosocial story (Sharing theme)	Control story (Busy theme)
Anthropomorphized: color drawings of a raccoon and animal friends	Little Raccoon was very selfish: her favorite word was 'mine'! …Then she went to pick some flowers. She didn't share!	Little Raccoon was very active: her favorite word was 'busy'! …Then she went to pick some flowers. She didn't stop!
Human: color drawings of a girl and human friends	Little Rachel was very selfish: her favorite word was 'mine'! …Then she went to pick some flowers. She didn't share!	Little Rachel was very active: her favorite word was 'busy'! …Then she went to pick some flowers. She didn't stop!

Sticker Task

To examine the influence of book type on children's sharing behavior, a sticker task was administered both before and after the story session. We used an established effective marker for altruism in children of this age, modelled on the dictator game task described by Benenson et al. (2007). Good quality color stickers were provided, which children could allocate to themselves and to others.

Anthropomorphic Picture Scale

An adaptation of the Individual Differences in Anthropomorphism Questionnaire-Children Form (IDAQ-CF; Severson & Lemm, 2016) was used (see Russell & Cain, 2020, for full details). The 16-item Anthropomorphic Picture Scale was administered on small, laminated picture cards and was randomized. The extent to which participants attributed feelings, thoughts, self-knowledge or agency to items within each category was assessed. For example, within the human subscale, a photograph of a person with a neutral expression was paired with the question, 'Does a person have feelings - like happy and sad?' For those items

which precipitated a positive response, children were asked to indicate ‘How much?’ on a 3-point visual scale, identical to one used by Severson and Lemm (2016).

Two scores, an anthropomorphic score and a human score, were computed by averaging child responses across the anthropomorphic items and human items respectively (see Severson & Woodard, 2018). Scores for both subscales ranged from 0 (no endorsement of internal state) to 3 (full endorsement of internal states). The intentionality items were excluded from the computed means as responses to these items loaded onto a separate factor and were clearly treated differently in the UK sample relative to that of the Canadian children in the original scale (see Russell & Cain, 2020, for a discussion of this finding).

Receptive Vocabulary Assessment

Receptive vocabulary was measured with the British Picture Vocabulary Scale: Third Edition (BPVS3; Dunn et al., 2009), which was administered and scored according to the manual guidelines. Four pictures on each plate were presented with a single word spoken aloud by the assessor and the child indicated which picture they considered matched with the word. The standardized scores were used to exclude participants with weak language skills (more than 1 SD below the mean; included range 85-125).

Home Literacy Environment

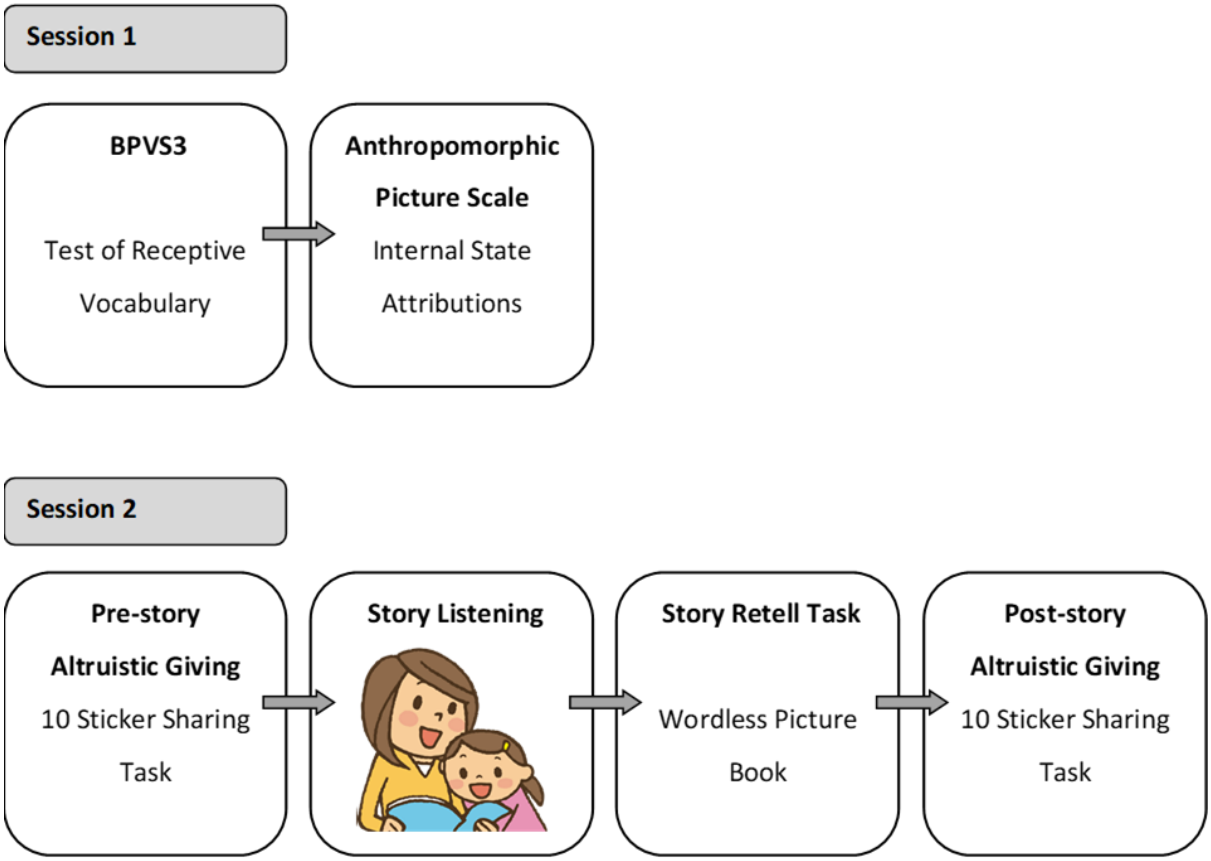
Parents completed a questionnaire about the home literacy environment (as part of a larger investigation concerning the influence of anthropomorphic characters on children’s understanding of stories). Only those questions designed to elicit information about children’s favorite book(s) and TV show(s) are relevant and reported here (see supplementary materials available on OSF). Parents were invited to name their child’s favorite book title(s) and TV show(s). Each listed item was carefully examined online and binary coded for the presence of anthropomorphic content by the researcher. This provided descriptive information concerning children’s orientation towards anthropomorphized media.

Procedure

Children were assessed individually in two separate sessions, each lasting no more than 20 minutes (see Figure 1).

Figure 1

Overview of the Procedure



Session 1

The BPVS3 was administered, followed by the Anthropomorphic Picture Scale. At the end of the first session, the researcher explained that the participant could choose a reward for their work at the start of session two.

Session 2

Thirty assorted highly attractive stickers were presented at the start of the session. The child selected their ten favorites as their reward. Then, the child was invited to anonymously share their stickers with children in school who were not participating in the study; it was

made clear that they could keep all ten stickers if they wished to. Two envelopes were provided; one clearly marked with the child's name for stickers they wanted to take home, and an unmarked envelope for donated stickers. Participants were told that staff and other children would not know who had shared and that the researcher would not watch. After verifying that the child understood the task, the researcher turned away whilst the participant allocated stickers to envelopes. The child then posted the sharing envelope into a mailbox, which contained two discretely marked foil envelopes. The named envelope was put aside during the story, to reduce distraction.

Next, the child was presented with their allocated storybook. They were told to listen carefully, as they would have the opportunity to retell the story afterwards. The story was read straight through by the researcher. Any interruptions were answered neutrally, and attention redirected to the book. The child was then provided with a wordless version of the same book. Using similar directions to those used in the Test of Narrative Language (TNL; Gillam & Pearson, 2004), participants were invited to retell the story to the researcher and to include everything they could remember. If the child did not start within ten seconds, a probe of 'What happened at the beginning of the story?' was used; 'What happened next?' was used to as a neutral prompt during the task. After the task, the child was offered a further ten stickers from a new distinct assorted set of 30, ostensibly given in reward for story participation. The invitation to anonymously share, as outlined above, was repeated. The child's named envelope was returned to them to put away their additional stickers and a second plain sharing envelope, unobtrusively marked on the reverse to differentiate it from the first, was provided. The second sharing envelope was posted into the mailbox and the child's envelope was sealed. The participant was instructed to open them at home, to minimize sticker distribution in school during testing periods. Following the session, the numbers of stickers in each of the two envelopes were recorded. At the end of testing, the

children were debriefed in class by the researcher and donated stickers were given to class teachers for distribution.

Recall Coding and Reliability

The audio recordings were transcribed following the procedures outlined in the Expression, Reception and Recall of Narrative Instrument manual (ERRNI; Bishop, 2004) for use in a separate analysis. For the purpose of this current study, the transcripts were scored for explicit inclusion of the story theme (Westerveld & Gillon, 2010). Children were given credit for each mention of the key terms related to the story theme, in the prosocial story (selfish, sharing, taking turns etc.) and control story (busy, relaxing, stopping etc.). For reliability, twenty transcripts (just over 10%) were checked by a research assistant, blind to the experimental hypotheses. Reliability was excellent: transcription accuracy (98.83%); division into utterances (96.52%). Inter-coder reliability for theme estimated using Krippendorff's alpha test (Hayes & Krippendorff, 2007) was high ($\alpha = .97$). Any disagreement was resolved by discussion.

Analysis Strategy

Descriptive statistics were calculated using SPSS version 27 and used to characterize the sample. As the dependent variable provides count data (number of stickers) a number of suitable count distributions were fitted using the software package R (R Core Team, 2019). Initial analyses indicated a non-normal and over-dispersed distribution, with an inflated zero count (confirmed by a zero-inflation tolerance check). Therefore, we evaluated a typical linear regression against Poisson, negative binomial, zero-inflated Poisson and zero-inflated negative binomial distributions. Inspections of model fit to data informed our decision to use zero-inflated negative binomial models in the planned analyses (see Atkins & Gallop, 2007); see supplementary materials available on OSF [link to be inserted on acceptance of paper] for evaluative steps and related R packages.

For each analysis, two regression analyses are estimated in parallel. A zero-inflation component estimates the probability of not engaging with the sharing behavior post-story and a count component estimates whether the model predictors explain the sharing observed.

A priori power analysis indicated that a sample size of 160 would be sufficient to detect a significant medium effect in regression analyses with up to 8 predictor variables power of .95 and an alpha of .05.

Results

Descriptive Statistics

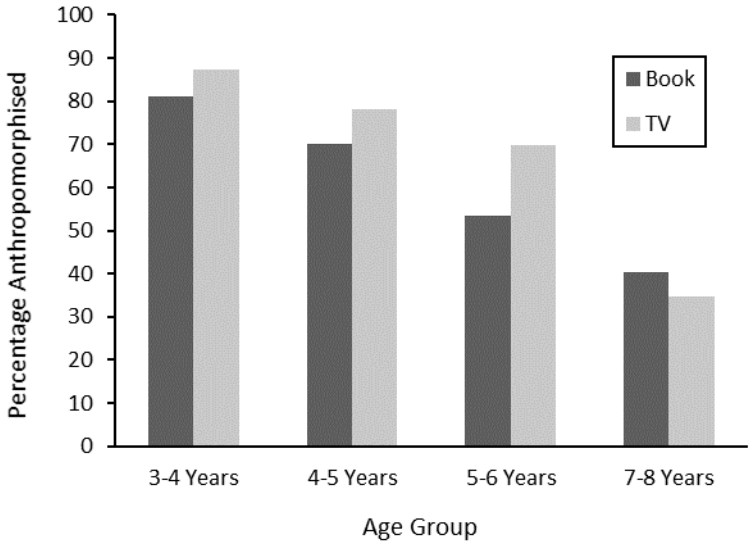
Children's Preferences for Anthropomorphic Content

Parents of 177 of the 179 participants returned a completed home literacy questionnaire. Parental responses indicated that 65.0% of children incorporated anthropomorphic content in their favorite film/TV viewing and 59.3% of children included anthropomorphic content in favorite books. Almost half the parents reported anthropomorphic content in both screen and book favorites (44.1%), whereas 19.8% of parents reported no anthropomorphized content either medium.

Chi-squared analysis revealed a significant effect of age on the likelihood that parents reported anthropomorphic content in their child's favorite TV program/film: χ^2 (3, N = 177) = 32.36, $p < .001$, and similarly for books: χ^2 (3, N = 177) = 17.07, $p = .001$. For both media, the reported preference for anthropomorphic content decreased with increasing age, as shown in Figure 2. Additional analyses revealed no effect of gender on the likelihood that favorite media contained anthropomorphic content: TV programs/films: χ^2 (1, N = 177) = .001, p = .98, and books χ^2 (1, N = 177) = .001, p = .98.

Figure 2

Percentage of Parents Reporting Anthropomorphized Content in Favorite Books and TV Programs for Each Age Group



Anthropomorphic Picture Scale

Children endorsed internal state for humans (M = 2.71, SD = 0.47) at a significantly higher rate than for animal characters (M = 1.24, SD = 0.89), $t(178) = 20.00$, $p < 0.001$, CI = 1.33, 1.62. The mean scores were explored in relation to children's story responses below.

Sticker Sharing Task

Preliminary analyses showed that sticker donation was not affected by the school location from which the data was collected, pre-story ($F(1,5) = 3.80$ $p = .57$, or post-story ($F(1,5) = 5.29$, $p = .61$. Therefore, we collapsed across this variable.

The means and standard deviations of the number of stickers shared by children in each story condition, pre- and post-story, are shown in Table 2. Pre- and post-story sticker sharing was moderately positively correlated ($r = .495$, $p < 0.001$). Children significantly increased their sharing after hearing a story, $t(178) = 2.71$, $p = .007$, 95% CI = .05, .35.

Table 2

Mean and Standard Deviation for Number of Stickers Shared Pre- and Post-Story for Each Story Condition

	Pre-story	Post-story	Difference

	M (SD)	M (SD)	M (SD)
Animal Busy	1.64 (1.87)	2.11 (2.44)	0.48 (1.85)
Animal Sharing	1.84 (2.09)	2.30 (2.71)	0.45 (2.57)
Human Busy	2.11 (2.20)	2.33 (2.84)	0.22 (2.44)
Human Sharing	2.41 (2.56)	3.39 (3.51)	0.98 (3.47)
All Conditions	2.01 (2.20)	2.54 (2.93)	0.54 (2.65)

1) Does Story Character (Human, Animal) or Story Theme (Sharing, Busy) Influence Sharing Behavior?

A zero-inflated negative binomial (ZINB) model for sticker sharing post-story was estimated with gender, age, sticker sharing pre-story, story character and story theme as independent variables. The model was fitted with an interaction between story character and theme, to fully explore the effects of these variables on post-story sharing. Variable means, standard deviations and correlations, are provided in Table 3 and the analysis results are reported in Table 4.

Seventy-two children (40%) did not share any stickers post-story. The zero-inflated portion of the model revealed that not sharing post-story was negatively predicted by sticker sharing pre-story (odds ratio = 0.30); that is, as pre-story sticker sharing scores increased, the odds for giving zero stickers post-story decreased. No other variable was predictive of non-sharing behavior following the story. The count portion of the model revealed that, on average, older children shared fewer stickers post-story than younger children (B = -0.02, $p <$ .001). Children's gender and pre-story sharing was not predictive of post-story generosity. Additionally, neither story character or story theme, nor an interaction between these variables, was observed to influence sticker sharing in this sample.

Table 3

Means, Standard Deviations and Correlations for Predictor Variables

Predictor Variables	*M*	*SD*	1	2	3	4	5	6
1. BPVS3 standardized score[a]	103.15	9.33						
2. Age in months	66.34	14.18	-0.08					
3. Stickers shared pre-story	2.01	2.20	0.13	0.10				
4. Stickers shared post-story	2.54	2.93	0.05	-0.17*	0.50**			
5. Thematic Utterances	3.72	3.15	0.01	0.02	-0.06	-0.21**		
6. Questionnaire score; Anthropomorphic	1.24	0.89	-0.06	0.04	0.01	-0.01	0.07	
7. Questionnaire score; Human	2.71	0.47	-0.08	0.40**	-0.03	0.03	-0.13	0.05

[a]BPVS3 has a mean of 100 and a standard deviation of 15.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4

Zero-Inflated Negative Binomial Regression Model Sticker Sharing Post-Story

Count model	B	*SE* B	*z* score	*p* >|*z*|	Estimate	95% CI
Predictor						
Intercept	1.27	0.13	9.83	<.001***	3.55	[2.76, 4.57]
Gender[a]	-0.02	0.12	-0.20	.839	0.98	[0.77, 1.23]
Age[b]	-0.02	0.00	-5.08	<.001***	0.98	[0.97, 0.99]
Stickers shared (pre-story)	0.04	0.02	1.49	.138	1.04	[0.99, 1.09]
Story character[c]	-0.07	0.06	-1.13	.257	0.94	[0.83, 1.05]
Story theme[d]	-0.07	0.06	-1.20	.232	0.93	[0.83, 1.05]
Story character * Story theme	0.08	0.06	1.45	.148	1.09	[0.97, 1.22]
Zero-inflation model						
Predictor						
Intercept	0.96	0.41	2.37	.018*	2.62	[1.18, 5.80]
Gender[a]	-0.01	0.48	-0.01	.989	0.99	[0.39, 2.53]
Age[b]	-0.00	0.02	-0.08	.935	1.00	[0.97, 1.03]
Stickers shared (pre-story)	-1.21	0.32	-3.72	<.001***	0.30	[0.16, 0.56]
Story character[c]	-0.03	0.23	-0.12	.903	0.97	[0.61, 1.54]
Story theme[d]	0.12	0.23	0.51	.610	1.13	[0.71, 1.79]
Story character * Story theme	0.06	0.23	0.25	.806	1.06	[0.67, 1.67]

Note. The model was estimated against a null model with the regressors removed. The Likelihood Ratio Test (LRT) statistic indicated that the model was a good fit to the data, $\chi 2(12) = 115.23$, p = <.001.

B = unstandardized estimate.

Estimates = incident risk ratio (IRR) are presented for the negative binomial (count) model and odds ratio (OR) presented for the logistic (zero-inflation) model.

[a]Female = 0, male = 1.

[b]Variable centered on the mean.

[c]Contrast coded, animal = -1, human = +1.

[d]Contrast coded, busy = -1, sharing = +1.

*p < .05, **p < .01, ***p < .001.

2) Are Children's Ratings for Human or for Anthropomorphized Animal Thoughts, Feelings and Self-awareness Related to Their Sharing Behavior?

Children completed different storybook conditions. Two one-way ANOVAs (collapsed over age, with storybook condition as a between-subjects factor) revealed no significant differences between experimental groups' ratings on the anthropomorphic picture scale: human, $F(3,175) = 1.54$, $p = .21$), anthropomorphic, $F(3, 175) = 0.46$, $p = .71$.

As above, a ZINB model for sticker sharing post-story was estimated with child (age, pre-story sticker sharing) and condition (story character, story theme) variables. In addition, mean scores for human and anthropomorphic characters' internal states from the anthropomorphic scale were included. Interactions between the mean scale scores and story theme were fitted to test whether post-story sticker sharing was predicted by attributed character self-awareness within prosocial (sharing themed) stories. A preliminary analysis showed no significant effect of gender on the mean scores for internal states (human, $t(177) = 1.71$, $p = .09$; anthropomorphic, $t(177) = -1.43$, $p = .15$), so the data were collapsed across this variable. The results of the ZINB regression are presented in Table 5, with post-story sticker sharing as the outcome variable.

As previously seen, the zero-inflated component of the model showed that, as sticker sharing scores pre-story increased, the odds for having a zero score post-story (rather than a non-zero score) decreased (odds ratio = 0.21). The count portion of the model showed the age-related effect, with older children, on average, sharing fewer stickers post-story than younger children ($B = -0.03$, $p < .001$). In addition, however, a significant relationship between the human internal state score and sticker sharing post-story was observed ($B = 0.29$, $p = .03$); on average, children who conferred higher internal states scores for humans gave more stickers post-story. Animal character internal state scores did not predict post-story

sticker sharing. There were no interactions between the human score and story theme, or between the anthropomorphic score and story theme, on donation responses.

Table 5

Zero-Inflated Negative Binomial Regression Model Sticker Sharing Post-Story

Count model	B	*SE* B	*z* score	*p* >|*z*|	Estimate	95% CI
Predictor						
Intercept	1.19	0.11	11.05	<.001***	3.28	[2.66, 4.05]
Age[a]	-0.03	0.00	-5.60	<.001***	0.98	[0.97, 0.98]
Stickers shared (pre-story)	0.04	0.03	1.67	.096	1.04	[0.99, 1.10]
Story character[b]	-0.07	0.06	-1.12	.264	0.94	[0.84, 1.05]
Story theme[c]	-0.04	0.06	-0.62	.534	0.96	[0.86 .1.08]
Human score[a]	0.29	0.13	2.18	.029*	1.34	[1.03, 1.74]
Anthropomorphic score[a]	-0.02	0.06	-0.33	.743	0.98	[0.87, 1.11]
Story theme * Human score	-0.21	0.12	-1.70	.089	0.81	[0.64, 1.03]
Story theme * Anthropomorphic score	0.05	0.06	0.81	.418	1.05	[0.93, 1.19]
Zero-inflation model						
Predictor						
Intercept	1.03	0.28	3.72	<.001***	2.81	[1.63, 4.85]
Age[a]	0.00	0.02	0.24	.813	1.00	[0.97, 1.04]
Stickers shared (pre-story)	-1.57	0.51	-3.08	.002**	0.21	[0.08, 0.57]
Story character[b]	0.03	0.28	0.11	.916	1.03	[0.59, 1.79]
Story theme[c]	0.19	0.25	0.78	.437	1.21	[0.74, 1.98]
Human score[a]	-0.55	0.61	-0.90	.369	0.58	[0.18, 1.91]
Anthropomorphic score[a]	0.16	0.30	0.54	.590	1.17	[0.66, 2.09]
Story theme * Human score	-0.22	0.64	-0.34	.732	0.80	[0.23, 2.81]
Story theme * Anthropomorphic mean	-0.05	0.30	-0.19	.853	0.94	[0.53, 1.69]

Note. The model was estimated against a null model with the regressors removed. The Likelihood Ratio Test (LRT) statistic indicated that the model was a good fit to the data, $\chi 2(1) = 122.72$, $p < .001$.

B = unstandardized estimate.

Estimates = incident risk ratio (IRR) are presented for the negative binomial model and odds ratio (OR) presented for the logistic (zero inflation) model.

[a]Variable centered on the mean.

[b]Contrast coded, Animal = -1, Human = +1.

[c]Contrast coded, Busy = -1, Sharing = +1

*$p < .05$, **$p < .01$, ***$p < .001$.

3) Is the Ability to Identify the Story Theme Associated with the Prosocial Response Following a Prosocial Story?

Of the 179 participants, eight children were excluded from this analysis as no data relating to thematic inclusion was available, due to participant unwillingness to retell the story (*N*=1), poor recording quality which precluded an accurate deciphering of participant narrative (*N*=5), or audio-recording equipment failure (*N*=2).

A ZINB model for sticker sharing post-story was estimated for the remaining participants (*N*=171). One hundred and forty-nine children (87%) made at least one explicit reference to the story theme (Sharing, Busy) during recall. The number of explicit references to the theme (range 0 to 22) was included as an independent variable in the model, and interactions between thematic references and story character, and thematic references and story theme, were fitted. The variables of age, sticker sharing pre-story, story character and story theme were retained as independent variables from the previous model. As preliminary analysis showed no significant effect of gender on the number of thematic utterances, $t(169) = -0.56$, $p = .58$, we collapsed the data across this variable. The results from the ZINB regression are presented in Table 6, with post-story sticker sharing as the outcome variable.

Sixty-nine children (40%) shared no stickers post-story. The zero-inflated portion of the model showed that the only variable associated with not sharing after the story was pre-story sharing, with lower sticker sharing pre-story associated with higher odds of not sharing post-story (odds ratio = 0.29).

The count portion of the model continued to show the influence of age on sticker sharing after a story, with older children donating fewer than younger children on average (B = -0.02, $p < .001$). Children's thematic utterances were not related to their sticker sharing, and there was no interaction between story theme and theme mentions in predicting subsequent sticker sharing. However, this model suggests a significant effect of story theme

(B = -0.18, p = .046) on post-story sharing, with more stickers donated following sharing themed stories (M = 2.86, SD = 3.17), than after busy stories (M = 2.22, SD = 2.64). No effect of story character was observed.

Table 6

Zero-Inflated Negative Binomial Regression Model Sticker Sharing Post-Story

Count model	B	*SE* B	*z* score	$p > \|z\|$	Estimate	95% CI
Predictor						
Intercept	1.27	0.13	10.05	<.001***	3.55	[2.77, 4.54]
Age[a]	-0.02	0.00	-3.82	<.001***	0.98	[0.97, 0.99]
Stickers shared (pre-story)	0.05	0.03	1.74	.081	1.05	[0.99, 1.11]
Thematic utterances	-0.02	0.02	-1.03	.302	0.98	[0.94 .1.02]
Story character[b]	0.01	0.09	0.12	.915	1.01	[0.84, 1.21]
Story theme[c]	-0.18	0.09	-2.00	.046*	0.83	[0.70, 1.00]
Thematic utterances * Story character	-0.03	0.02	-1.41	.157	0.97	[0.9531.01]
Thematic utterances * Story theme	0.02	0.02	0.93	.352	1.02	[0.98, 1.06]
Zero-inflation model						
Predictor						
Intercept	0.31	0.42	0.74	.459	1.36	[0.60, 3.06]
Age[a]	-0.02	0.02	-1.18	.239	0.98	[0.94, 1.02]
Stickers Shared (pre-story)	-1.24	0.32	-3.86	<.001***	0.29	[0.15, 0.54]
Thematic utterances	0.19	0.10	1.85	.065	1.21	[0.99, 1.47]
Story character[b]	0.03	0.35	0.08	.934	1.03	[0.52, 2.06]
Story theme[c]	0.42	0.36	1.18	.240	1.53	[0.75, 3.10]
Thematic utterances * Story character	-0.01	0.08	-0.12	.903	0.99	[0.84, 1.16]
Thematic utterances * Story theme	-0.02	0.09	-0.24	.814	0.98	[0.83, 1.16]

Note. The model was estimated against a null model with the regressors removed. The Likelihood Ratio Test (LRT) statistic indicated that the model was a good fit to the data, $\chi 2(14) = 103.32$, $p = 1.1 \times 10^{-15}$.

B = unstandardized estimate.

Estimates = incident risk ratio (IRR) are presented for the negative binomial (count) model and odds ratio (OR) presented for the logistic (zero-inflation) model.

[a]Variable centered on the mean.

[b]Contrast coded, animal = -1, human = +1.

[c]Contrast coded, busy = -1, sharing = +1.

*p < .05, **p < .01, ***p < .001.

4) Are there age-related influences on children's prosocial responses to stories?

The means and standard deviations of the number of stickers shared by children, pre- and post-story, for each age group are shown in Table 7.

Table 7

Means and Standard Deviations for Number of Stickers shared Pre- and Post-Story in Each Age Group

	Pre-story	Post-story	Difference
	M (SD)	M (SD)	M (SD)
3-4 years	1.82 (2.65)	3.67 (3.81)	1.85 (3.51)
4-5 years	1.88 (2.27)	2.60 (3.26)	0.72 (3.02)
5-6 years	1.82 (1.94)	2.23 (2.29)	0.41 (1.40)
6-7 years	2.40 (2.02)	2.04 (2.22)	-0.37 (2.10)

A one-way ANOVA[2] explored the change in sticker donations made by children in each year group. Younger children were more likely than older children to increase the number of stickers donated post-story compared with pre-story, $F(3,175) = 5.15$, $p = .002$, $\eta p2 = .08$. A Tukey post hoc test revealed that the youngest children (Nursery, age 3-4 years) were significantly more likely to increase their sticker donation post-story compared with the oldest children (Year 2, age 6-7 years). There were no significant differences between the intermediate age ranges.

Discussion

The present study examined the influences of story character realism and prosocial message on children's subsequent sharing behavior. We tested a concept originally developed in a novel study conducted in Canada (Larsen et al., 2017), which had recruited children from an urban and relatively high SES demographic. Our sample provided a different cultural context, testing UK children recruited from rural areas with a lower SES profile. We found

[2] See also non-parametric test in supplementary materials

no significant influence of story character on children's sharing behavior. Furthermore, the evidence for an influence of a sharing story theme on children's post-story giving was not robust. As such, this study does not find evidence to suggest the generalizability of a significant influence of sharing-themed narratives depicting human characters benefitting generosity. Our paradigm was sensitive to detect differences in relation to pre- and post-story sharing behavior and age. We also found that children's internal state attributions for humans related to their sharing behavior, but that internal state attributions for anthropomorphic characters did not. Furthermore, internal state ratings did not interact with a sharing story theme to influence generosity. Finally, children's recall of the story theme was not related to their subsequent generosity. These findings and an examination of key patterns we observed in our data are considered in relation to the wider literature and potential contextual confounds. The challenges in generalization and the need for more robust empirical evidence in support of educational resources using anthropomorphized content are discussed.

First, we consider the influence of story character and story theme on children's post-story sharing. Our stories for each theme (Sharing, Busy) were identical, other than the carefully manipulated book illustrations and any specific references to the protagonists, either human (e.g., Little Rachel) or anthropomorphized animal (e.g., Little Racoon). We found no evidence that children responded differently to stories about humans compared with stories that conveyed the same content but with anthropomorphized characters. Moreover, there was not a robust influence of story theme; in two of our three models, the sharing theme did not predict our measure of prosocial behavior (subsequent sticker donation). There was no interaction between story theme and story character, so our children did not behave significantly differently towards human sharing stories, compared with other story variants.

These findings prompted an evaluation of a key difference between our study and Larsen's et al. (2017). First, we might consider the differences in sample. Larsen et al.'s

participants were urban Canadian children, with a higher SES than our rural UK sample. Whilst relative wealth is associated with higher levels of altruism (Rochat et al., 2009), rural living (and associated exposure to real animals) is associated with less anthropocentric thinking (Waxman & Medin, 2007). Although sticker donations may be slightly fewer from children with lower socioeconomic demographics, the difference in responses to animal and human stories could plausibly be expected to be larger in rural children (who tend to view animals as less similar to humans); we did not observe this difference in our data, which prompted an evaluation of experimental methods.

We included a post-story retell task prior to sticker sharing. This may have interrupted the immediate influences of character and prosocial concepts on children's subsequent actions. Indeed, a contemporaneous experiment that involved similar resource sharing after the retelling of a human-charactered generosity story also found no effect of prosocial theme on stickers donated (Kruse et al., 2020). Research suggests that pre-adolescent children focus primarily on concrete representations of stories, rather than accurately abstracting the intended meaning of a narrative (Mares & Acosta, 2008; Narvaez, 2002; Narvaez et al., 1999; Walker & Lombrozo, 2017). Therefore, an explicit instruction for children to listen and remember the story for later recall potentially further focuses children upon memorizing concrete events, rather than reinforcing the underlying story theme.

Second, we explored the influences of children's internal state attributions for humans and for anthropomorphized animals on sticker sharing. Children rated the internal states at significantly different levels for humans compared with animal characters demonstrating validity in our task to assess internal state attributions. However, there was no interaction between either score and the story theme on sticker donation. This suggests that no matter children's propensity to take perspective (assessed with our internal state attribution task) there was no further influence of prosocial story on their donations. However, an association

between children's human internal state attributions and post-story sharing was found. Children who were more aware of the thoughts and feelings of people were more likely to share than children with lower awareness, across all conditions. This supports previous evidence that finds a relationship between children's perspective taking and various prosocial behaviors, including sharing (Cigala et al., 2015; Cowell et al., 2015; Eggum et al., 2011; Paulus & Moore, 2017; Wu & Su, 2014; Yu et al., 2016). Plausibly, those children with higher human perspective taking scores may be more able to imagine the thoughts and feelings of unseen recipients of their generosity, which may encourage their donation.

Third, we sought to understand whether children's explicit recall of the story theme might be related to their subsequent generosity. We found no relationship between thematic recall and donation; children who included more of the theme at recall did not then share differently to those who included fewer references to the theme. There was no significant interaction between story character and thematic recall on generosity. More surprisingly, there was also no significant interaction between the number of thematic references and the story theme (Sharing, Busy) on subsequent sticker sharing. That is, those children who heard a sharing story, who explicitly recounted more of this prosocial theme, were no more generous post-story than children who heard a neutral story (busy) and recalled more of the busy theme. This finding may relate to the knowledge-behavior gap previously observed in children of this age; an awareness of fairness, does not tend to correspond with actions in accordance with this knowledge, at least not in the absence of multiple specific examples of generosity (Blake, 2018; Blake et al., 2014; Du & Hao, 2018; Gummerum et al., 2008). Our single presentation of a moral tale, without further reinforcement of the meaning, may not have been likely to have had an enduring effect upon young children's subsequent decision making.

With further regard for the necessity of reinforcement, previous research has demonstrated that prompts focused on the prosocial meaning of a narrative can facilitate children's generalization and application of moral learning, when offered after a story (e.g. Rottman et al., 2020; Walker & Lombrozo, 2017), or prior to a moral narrative (Cingel et al., 2020). In line with this, several studies that report an effect of stories on subsequent prosocial behavior include a task to encourage attention on the meaning of the story. Examples include children being asked to articulate a moral evaluation of the story (Talwar et al., 2016), or direction to behave according to the prosocial message presented in the narrative (Lee et al., 2014). Whilst a few studies have found an immediate influence of prosocial story on behavior without such a prompt (Larsen et al., 2017; Yao & Enright, 2020), others have not (Kruse et al., 2020). Our recall task not only separated the story from the immediacy of donation but did not explicitly direct children's attention to the meaning of the story; we subsequently found no robust effect of a sharing theme. Together this suggests that the length of gap between story and task, along with the presence or absence of a retell activity (not specifically focused on the meaning of the tale) may be influential on observed prosocial outcomes. Future intervention studies should address these factors, and establish reinforcement tasks with the pedagogical power to enable children in classrooms to connect moral lessons from stories to their own actions.

In each model we found that age was a significant negative predictor of post-story sharing. On average, children in every experimental condition were more generous after the story than before (which we discuss further below). However, the effect was greatest for the youngest children (3- to 4-year-olds) and absent in the oldest age group (6- to 7-year-olds). This pattern may reflect the greater appropriateness and enjoyment of picture stories for younger children. An age effect was not seen in the previous study which examined 4- to 6-year-olds (Larsen et al., 2017). However, we considered a wider age range to include 3- to 7-

year-olds. The extant literature suggests that altruistic giving increases with age (e.g., Blake, 2018), a pattern we did not observe in pre-story sharing. However, detectable differences in sharing resources are frequently not observed until children over 7 years are compared with younger age groups (Benenson et al., 2007; Fehr et al., 2008; Yu et al., 2016). Future work that includes older children, measures engagement with (or enjoyment of) experimental materials and explores children's appreciation of the value of the resources (stickers) used might identify additional factors and age-related changes which shape behavior following prosocial stories.

We noted some interesting patterns in our data which warrant discussion. Our children donated more stickers post-story than pre-story, in every story condition. This pattern contrasts with that found in the original study (Larsen et al., 2017) which reported a reduction in generosity after a neutral story or anthropomorphized sharing story, unless influenced by specific (human) prosocial stimuli. However, the wider literature does not suggest a general shift in baseline sharing with increasing numbers of trials (Ben-Ner et al., 2017; List & Samak, 2013) and, indeed, most assume baseline sharing to be stable (e.g. Flook et al., 2019; Lu & Chang, 2016). A contextual explanation for the increase in generosity in the present study might be considered. A small body of work suggests a relationship between positive emotional states and subsequent prosocial action in both adults and children (Aknin et al., 2018; Eisenberg et al., 2016; Sabato & Kogut, 2019; Wang et al., 2014). As the sticker donation tasks were carried out in the second session, the children were already familiar with the experimenter. The session started with the 'reward' of stickers for work in the previous session. This was followed by a one-to-one story, a retelling task for which they were praised, and a further allocation of stickers. The perception of this individual attention as a positive and unquestionably profitable interaction within an otherwise ordinary school day, may have

influenced mood and subsequently increased children's generosity, irrespective of story theme.

Additionally, comment upon the large number of children who did not share, and the high levels variance amongst those who did, is justified. Approximately one third of our children did not donate any stickers at either invitation. The zero-inflated model showed that children who did not share pre-story were unlikely to share post-story; this suggests a stable predisposition towards not sharing in some young children. This finding is not unexpected; other similar studies find that a sizeable minority of children keep all their resources, for example, the modal level of sharing for 3 and 4-year-olds given ten stickers in Samek et al,'s study (2020) was zero. As such, the use of a zero-inflated model is supported, to separately consider the factors that predict not sharing and the factors that influence the level of sharing when it does occur.

Accordingly, the count portion of the model indicated no relationship between pre- and post-story generosity in children who did share and the variance in our data (as demonstrated by large standard deviations) was large relative to the mean. Such large variances in child dictator game tasks are not uncommon (e.g., Benenson et al., 2007; Stewart & McBride-Chang, 2000). This indicates that the variability between individual children's propensities to give was greater than any difference resulting from a response to a story. Whilst our raw scores suggested that children responded to the human sharing story with the greatest increase in generosity from baseline, a significant effect was not detected, despite conducting a well powered experiment.

Overall, our study raises important questions about the conditions under which children's prosocial behavior is influenced. Further work to identify the mechanisms that govern the development and expression of children's prosocial behavior is key. The disparity in findings may reflect not only experimental methods, but additionally have been influenced

by cultural variation, including socioeconomic and demographic factors that bear on children's prosocial development (Benenson et al., 2007; Callaghan & Corbit, 2018; Stewart & McBride-Chang, 2000). Furthermore, anthropomorphism is not always associated with negative prosocial outcomes, as demonstrated in a study with Chinese children (Yao & Enright, 2020). This indicates a need for additional conceptual replications across cultures.

In conclusion, there is to date limited evidence concerning the role of character realism in children's moral development in response to stories. We suggest that further empirical work, across diverse populations is required before decisions can be made as to what constitutes optimal characters to portray in educational resources.

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Supplementary Materials

Parental Questionnaire Items

These were used to indicate whether children's favourite TV/film and books (as reported by parents) contained anthropomorphic content. This allowed a description of age-related trends in children's orientation to the genre.

> Please answer the following questions about your child's preferences.
> There are no right or wrong answers, children vary in their enjoyment of these activities at this age.
>
> **My Child's favourite TV program(s) or film(s) are:**
> _____
> _____
> _____
> (If none watched, please leave blank)
>
> **My Child's current favourite book(s) are:**
> _____
> _____
> _____
> (If none enjoyed, please leave blank)

Regression Model Evaluation

We evaluated a typical linear regression against Poisson, negative binomial, zero-inflated Poisson and zero-inflated negative binomial distributions, using R (R Core Team, 2019). Figure S1 shows the actual count and model predicted values.

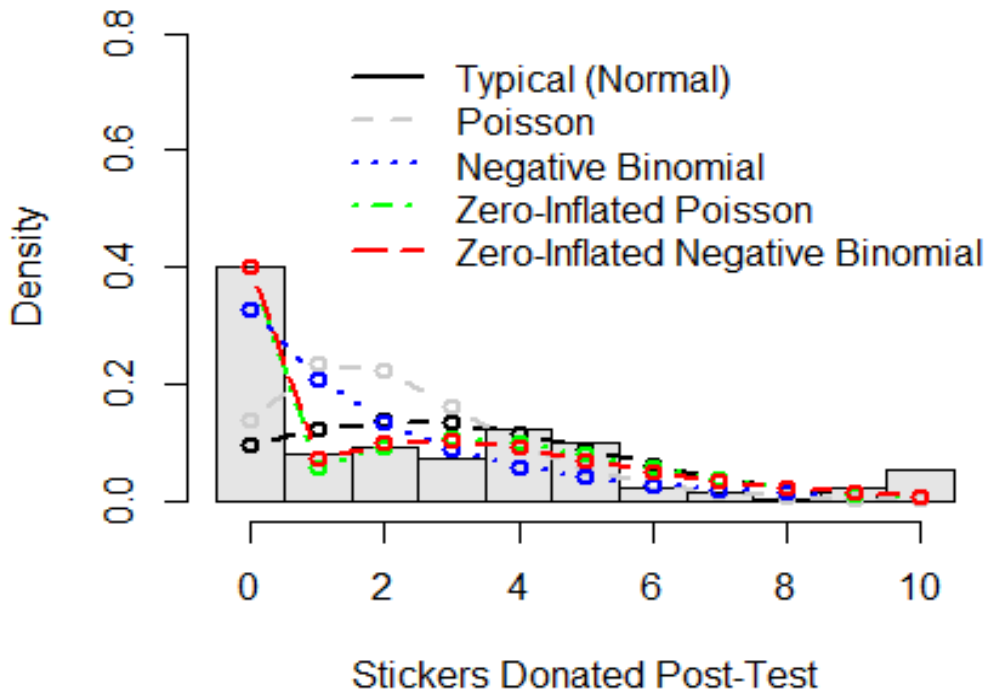
We inspected AIC, BIC and model-predicted and observed counts for each model. Both zero-inflated models provided a superior fit for the data, compared with models that did not offer an additional probability weight for zero counts. A zero-inflated tolerance check* (using a Poisson distribution) further confirmed that observed zeros (72) were larger than model predicted zeros (25), indicating that the model was underfitting zeros.

The AIC and BIC values and model-predicted counts were very similar for zero-inflated Poisson and zero-inflated negative binomial models, and there was no statistically significant difference a comparison of the two zero-inflated models using the Likelihood

Ratio Test (LRT). The dispersion statistic suggested that the zero-inflated negative binomial model was closer in value to 1. This informed our decision to use this model in the planned analyses (see Atkins & Gallop, 2007).

Figure S1

Sticker Donation Response Density and Predicted Values by Model



Note: Color should be used for this figure

*https://rdrr.io/cran/performance/man/check_zeroinflation.html

Non-Parametric Supplementary Analysis of Age-Related Influences on Children's Prosocial Responses to Stories

A Krustal-Wallis H test was used to explore the change in sticker donations made by children in each year group. Younger children were more likely than older children to

increase the number of stickers donated post-story compared with pre-story, $H(3) = 15.19$, $p = .002$. Dunn's pairwise post hoc test revealed that the youngest children (Nursery, age 3-4 years) were significantly more likely to increase their sticker donation post-story compared with the oldest children (Year 2, age 6-7 years), $p = .001$ (adjusted using the Bonferroni correction). There were no significant differences between the intermediate age ranges.