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"Where's your bum brain?" Humor, social understanding, and sibling relationship quality in early childhood

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Abstract

We investigated humor production in relation to social understanding and relationship quality in early childhood, by coding N = 72 5-year-olds' (M = 5.78, SD = .41) spontaneous humor production during play with an older (n = 34; M age = 7.84 years, SD = .84) or younger sibling (M age = 3.72 years, SD = .54). Children who demonstrated better understanding of minds also produced more humor (preposterous statements and humorous anecdotes, and sound play). Types of humor were differentially associated with siblings' ratings of positive rapport; associations were moderated by sibling constellation factors. Our findings highlight children's humor production as an important marker of their understanding of minds and of their warm, positive relationships.

KEYWORDS
humor, sibling relationships, social understanding

1 | INTRODUCTION

Shared humor is a central feature of children's close relationships and a universal, integral part of human experience that is characterized by playful incongruity or, a benign conflict between what is expected and experienced

in reality (McGhee, 1979; Pien & Rothbart, 1976; Schultz, 1976; Warren & McGraw, 2016). Humor is considered a complex cognitive attribute that draws on multiple domains of skill, such as the ability to manipulate social situations, language, and concepts creatively (Bergen & Rousta, 2019; Polimenti & Reiss, 2006; Semrud-Clikeman & Glass, 2010), which has been referred to as "cognitive playfulness" (Ziv, 1989) or "mental play" (Martin, 2007). The ability to conceive and express humor may be an important marker of a sophisticated appreciation and understanding of the mental states of others (Airenti, 2016; Hoicka & Akhtar, 2012; Martucci, 2016) and of warm, intimate relationships (Bergen, 2002). Children share humor in their close relationships in the first years of life (e.g., Hoicka & Akhtar, 2012; Loizou, 2005; Reddy, 2001), and demonstrate a widening repertoire of humorous incongruities across childhood (Airenti, 2016; Coates & Coates, 2019; Loizou & Recchia, 2019; McGhee, 1979; Paine et al., 2019). However, humor remains a feature of sibling relationships that is often overlooked (for exceptions see Dunn, 1988; Paine, et al., 2019). Therefore, in the present study we investigated associations between humor production, understanding of minds, and relationship quality within the context of children's play with an older or younger sibling in early childhood.

1.1 | Humor in childhood

Children are motivated to share humor with others from early childhood (Bergen, 2002). In infancy, children laugh at incongruities initiated by adults, play peekaboo, and display teasing and clowning behaviors (Hoicka & Akhtar, 2012; Mireault et al., 2011; Reddy, 2001). Throughout toddlerhood and early childhood, children produce humorous acts based on unexpected actions or language. They misuse, mislabel, and assign incongruous characteristics to objects (e.g., putting boxes on feet); exaggerate sounds (e.g., operatic singing); produce nonsensical adaptations of known words (e.g., "pajoodles"); and engage in playful, mischievous behavior, such as banter, taboo, and teasing (e.g., "Poo poo head" Bergen, 2002, 2006; Hoicka & Akhtar, 2012; Paine et al., 2019). In middle childhood, children increasingly play with language, producing for example, comedic hyperbole (e.g., "I can eat the whole universe!"), (pre)riddling patterns (e.g., "Why did the elephant take toilet paper to the party?" "Because he was a party pooper!"), gibberish (e.g., "Froop a doop!"), and word play with multiple meanings, (e.g., covering a dog with a blanket and saying, "Now he's a hot dog!"; Bergen, 2002, 2006; Paine et al., 2019; Varga, 2000). Children's repertoire of humorous acts is thought to expand and develop in close connection with their ability to recognize incongruities, as well as their emotional, communicative, linguistic, and metacommunicative competence (Bergen, 2002).

Shared humor may be one avenue by which children develop and demonstrate their understanding of the thoughts, feelings, and intentions of others, or, *theory of mind* (Dunn, 1994). Humor is closely related to play, sharing many of the properties of creating "make-believe" (Bergen, 2019; Loizou, 2005). Joint pretend play and humor both require play partners to be able to convey and understand that their behavior and language is playful and not literal (Bateson, 1955), but through silliness or nonsense, children create an alternative or distorted reality with the goal of triggering amusement (Bariaud, 1989). Some authors suggest that the ability to conceive and express humor may be the result of a sophisticated appreciation and understanding of the mental states of others (Hoicka & Akhtar, 2012; Martucci, 2016). Within a humorous act, the "performer" deliberately creates a playful incongruity with the expectation that the "audience" can understand and reconcile the performer's humorous act to find it amusing and respond with laughter and/or with humor in kind (Dunn, 1988; Leekam, 1991; Pien & Rothbart, 1976). Therefore, there is a strong theoretical case for a relationship between a child's understanding of minds and their ability to both produce humor and elicit amusement and humor in return from their play partner. This case is further supported by studies of neurodevelopmental disorders that suggest engagement in humor is an important aspect of socio-cognitive development (Reddy, 2002; Silva et al., 2017). However, more research is needed to determine the links between these domains of development (Bergen, 2019).

1.2 | Children's sibling relationships

In the early years, children often spend more time with siblings than with close others, such as friends (Dunn, 2007; McHale et al., 2012). Many siblings share in the absurdities and incongruities of day-to-day family life that form a rich context for humor (Dunn, 1988; Paine et al., 2019). In toddlerhood, siblings share forbidden, disgusting, and insulting topics of humor, for example calling one another "Mr. Piggyface!" (Dunn, 1988). In middle childhood, many instances of humor between siblings are dyadic and formed from their shared intimate history. They continue to share taboo themes of humor (e.g., "Fart? Does it fart?"), they banter and tease, (e.g., "Ya dummy!"), manipulate language, (e.g., "A, B, C, D, E, F, *R*!"), produce exaggerated sounds, physical movements (clowning), and perform incongruous actions (e.g., placing objects where they do not belong) (Paine et al., 2019). The quantity and type of humorous acts differ as a function of sibling constellation factors (i.e., gender and age of dyad, Paine et al., 2019). Gender differences in humor begin to appear as children reach middle childhood, where boys increasingly produce more attempts of humor than girls (McGhee, 1979; Paine et al., 2019). Younger dyads (7 year olds and a preschool-aged sibling) produce more sound play than older dyads (7 year olds and a sibling in late childhood, Paine et al., 2019), potentially using humor to explore and expand the boundaries of newly learned conventions and rules (Garvey, 1977; Loizou, 2005).

The quality of relationships among siblings is highly variable (Dunn, 2002, 2015). Although high levels of intimacy, warmth, and emotional support may be common among some sibling pairs, other relationships may be predominantly characterized by conflict and rivalry (Brody, 1998; Dunn, 2002) or by an ambivalent combination of both positively and negatively valanced components (Pike et al., 2006). Although evidence is limited, shared humor may be a marker of high-quality sibling relationships. Children who are comfortable in one another's company and share harmonious interactions may also enjoy co-constructing shared humor and laughter more frequently (Bergen, 1998). Evidence suggests that playful young sibling dyads also have more affectionate and cooperative relationships (Cutting & Dunn, 2006; Dunn & Dale, 1984; Howe et al., 1998; Youngblade & Dunn, 1995). The ability to tell jokes and amuse others and to maintain a humorous outlook on life are associated with social competence, acceptance, support, and harmony within child-child relationships (James & Fox, 2018; Klein & Kuiper, 2006; Sletta et al., 1995). Indeed, humorous children are rated as more cheerful (Masten, 1986), and humor is considered a desirable characteristic by peers (Sprecher & Regan, 2002). Humor and laughter may have important social functions in defusing contentious situations and maintaining positive and cooperative interactions in the short and long term (Bergen, 2003; Masten, 1986; Scott et al., 2014).

It is well established that the sibling relationship is an important context for children's development of theory of mind (e.g., Devine & Hughes, 2018). A child's shared humor with their sibling may be one context within which children come to understand the minds of others (Dunn, 1994), as the positive influence of siblings on theory of mind may be due to positive aspects of sibling relationships (Cutting & Dunn, 2006; Hughes et al., 2006). A feature of children's sibling relationships associated with their developing understanding of minds is the use of internal state language in conversation (i.e., references to cognitions, desires, emotions, and intentions, e.g., Hughes et al., 2006; Leach et al., 2017). Children's internal state language is associated with other measures of social understanding in childhood, such as understanding false beliefs, emotions, and metacognitive language comprehension (Grazzani & Ornaghi, 2012; Lecce et al., 2009). Indeed, spontaneous references particularly, to *cognitions* (i.e., thoughts and knowledge) are considered a "real-life index" of children's ability to appreciate and reflect on the mental states of others (Howe & Recchia, 2014; Hughes et al., 2006; Paine et al., 2019). Such inner state language is frequently used among siblings during conflict negotiation and play, where both contexts provide children with opportunities to discuss their contrasting points of view and to negotiate their ideas and disputes (e.g., Hughes, 2011; Leach et al., 2017). However, children's propensity to refer to internal states during play has not yet been studied in the context of siblings' humorous interactions (Paine et al., 2019).

1.3 | The present study

Humor may be a "powerful lens" through which we can understand more about children's developing understanding of the world (Loizou & Recchia, 2019); however, the nature of children's humor in relation to their understanding of minds and of the warmth and intimacy of their close relationships is largely unexplored. Given that the sibling relationship is a rich context for children's shared humor and learning to navigate the social world, in the present study we investigated children's humor with an older or younger sibling and their play partners' responses to humor. Specifically, we investigated humor as it relates to children's ability to reflect on and understand the minds of others, and associations with ratings of positivity and conflict in the sibling relationship.

Our hypotheses were tested in the context of 5-year-old-children's naturalistic interactions with an older or younger sibling during play. We investigated the nature of humor children produced with their sibling and differences in humor according to structural features of the sibling relationship; including the gender composition of the dyad and birth order effects. Given that all sibling dyads included a 5-year-old focal child observed with their older or younger sibling, this enabled us to disentangle birth order effects for findings pertaining to the focal child without the confounding effect of age.

We hypothesized that 5-year-olds' production of humor during play with their older or younger sibling would positively relate to their ability to understand minds, as indexed by their spontaneous references to internal states. We examined focal children's humor production in relation to their total use of internal state language (i.e., references to cognitions, desires, and emotions) and also more specifically, their references to cognitive states (i.e., thoughts and knowledge) as a potentially more sensitive marker of children's understanding of mental states (Howe & Recchia, 2014; Hughes et al., 2006; Paine et al., 2019). We also hypothesized positive associations between children's humor production and sibling relationship quality. Humor resulting in positive responses from their partner may reflect a child's ability to better understand the minds of others and foster more positive relationships (Bergen, 2003; Masten, 1986; Scott et al., 2014). Therefore, we also hypothesized that siblings' positive *responses* to the 5-year-olds' humor would be positively associated with the focal child's internal state language and ratings of sibling relationship quality. Evidence suggests structural differences in the sibling relationship may affect humor production, mind-understanding, and relationship quality (Buhrmester & Furman, 1990; Paine et al., 2018; Ruffman et al., 1998). As such, in exploratory analyses we investigated whether the relationships between children's humor production, social understanding, and relationship quality differed as a function of the structure of the sibling relationship.

2 | METHOD

2.1 | Participants

Seventy-two sibling dyads from middle class, white, English-speaking families from a major bilingual (French/English) Canadian city took part in a study of reciprocal and complementary sibling interactions (see Howe et al., 1998, 2002, 2005). Ethical permission for the study was granted by the Research Ethics Committees for Concordia University (Department of Education) and Cardiff University (School of Psychology). Families were recruited through day care centers, schools, and by word of mouth. All sibling dyads included a kindergarten-aged focal child (M = 5.78, SD = .41, range = 4.83 to 6.79 years, 51.4% female) who was observed playing with their older (n = 34, 47.2%) or younger sibling. All older siblings were first-born children, and all younger siblings were second-born children. Older siblings were a M age of 7.84 years (SD = .84, range = 6.25 to 9.92 years; 55.9% female), and younger siblings were a M age of 3.72 years (SD = .54, range = 2.92 to 4.92 years; 55.3% female). In terms of gender composition, there were 15 (20.8%) male–male, 20 (27.8%) female–female, and 37 (51.4%) mixed gender dyads (20 were a female focal child with brother, 17 were a male focal child with sister).

2.2 | Procedure

The sibling dyads were visited in the home for the assessment session. Firstly, the sibling dyads were given a warm-up task (a game involving large magnets), which was followed by a video-recorded play session with a standardized wooden farm set (large and small barn, animals, figurines, fences, and trees). Each sibling dyad was given the farm set and asked to play freely for approximately 15 min. Following the play session, the children were individually interviewed in a counterbalanced order about their sibling relationship. The speech and behavior of both children during the play session was transcribed by a research assistant who was blind to the purpose of the present study. Each transcript was checked by two additional transcribers. The transcripts included all verbal content and a running account of all the children's behavior to provide a context for understanding the language.

2.3 | Coding

2.3.1 | Humor

Children's humor was coded from both the transcripts and video recordings (Paine et al., 2019). This scheme was based on types of humor noted by Bergen (2006) and Hoicka and Akhtar (2012) and revisions to the existing coding scheme were based on recent observational work (see Coates & Coates, 2019). The video recordings were coded by two coders, who first calibrated their coding by discussing the definitions of the categories and jointly coded 5/72 (7%) of the interactions. Inter-rater reliability was then established on an additional 20% of the interactions; Cohen's kappa are reported below. Disagreements were resolved via discussion and consensus.

2.3.2 | Humor production

Focal children's interaction with their sibling was coded for seven categories of humor (κ = .79): (1) *performing incongruities*, (2) *word play*; (3) *preposterous statements and humorous anecdotes*; (4) *sound play*; (5) *taboo*; (6) *banter*; and (7) *clowning* (see Table 1 for category descriptions and examples).

2.3.3 | Responses to humor

Siblings' responses to each instance of the focal child's humor were also coded (κ = .82) as either: (1) *no response* (i.e., no engagement, passive watching, walking away, or off-topic response); (2) *positive/neutral response* (i.e., smiling, laughing, reinforcement, or praise); (3) *negative response* (i.e., protest, disapproval, or reprimand); (4) *clarification* (i.e., questioning response); (5) *imitation* (i.e., exact repetition of focal child's humorous act); and/or (6) *extension* (e.g., production of modification of focal child's humorous act or introduction of new humorous act).

2.3.4 | References to internal states

Focal children's references to internal states were coded (for scheme, see Paine et al., 2020; Paine et al., 2019). The video recordings were coded by two coders, who first calibrated their coding by discussing the definitions of the categories before coding 5/72 (7%) of the interactions. Inter-rater reliability was then established on an additional 24% of the interactions.

TABLE 1 Humor categories in coding scheme

Humor category	Description	Example
Performing incongruities	Enacting a conflict between what is normal/expected and reality. For example, placing an object in a wrong location or making a toy perform a wrong action	OS pretends to eat the roof piece of the farm set YS "We need everything on the roof!" and places silo pieces on the barn roof
Word play	Nonsense words, rhyming words, riddles, jokes, label-based humor, calling something the wrong name. Making deliberate mistakes in language or changing words in well-known songs	OS "Barn dance, get it? Sharn dance" OS "Look at that bong bomb"
Preposterous statements and humorous anecdotes	Creating absurd or unusual stories, anecdotes, announcements, or nonsense sentences	OS "I'm the ghost of fiddles!" YS "It's a whole mystery of pigs"
Sound play	Humorous singing and chanting. Over exaggerated vocalizations or speech, exaggerated gasps, animal noises, using a very deep or gruff voice in a silly or unconventional way	YS (singing) "Bingo, bingo, bingo!" YS (singing) "Baseball, ba ba baseball"
Taboo	Disgusting noises, such as blowing raspberries, fart noises, and burp noises. Using taboo words or discussion and/or enacting taboo themes	YS "Honk, honk, burp, burp!" OS "I'll get violent with your pigs!"
Banter	Humorous aggression, derision, teasing, or mocking imitation. Include light-hearted insults. Rough and tumble play	OS "Pizza brain!" YS "That's a duck, you goose!"
Clowning	Silly or over exaggerated body movements, dancing, posing, or face contortions	OS wiggles his hips as he sings YS pulls silly face at OS

Note: Instances of humor could co-occur.
Abbreviations: OS, older sibling; YS, younger sibling.

Each utterance was coded according to references to: (1) *cognitions* (e.g., think, know, guess, pretend, and remember); (2) *desires* (e.g., want, need, wish, and hope); (3) *obligations* (e.g., got to, must, supposed to, and have to); (4) *intentions* (e.g., accident, going to, mean to, on purpose, and attempts); (5) *emotions* (e.g., happy, excited, sad, and angry); (6) *physiological states* (e.g., alive, hungry, sick, and sleeping); (7) *perceptions* (e.g., watching, looking, taste, and feel); and (8) *preferences* (e.g., like, love, hate, and do not care) (κ = .82).

2.3.5 | Conversational turns

We also determined the total number of conversational turns for each dyad as a proxy for the engagement with one another and with the play. A conversational turn was calculated as a reciprocal verbal exchange between the siblings (see Howe et al., 1998, 2005) (κ = .99).

2.4 | Measures

2.4.1 | Sibling relationship quality

A modification of the Sibling Behavior and Feelings Questionnaire (Mendelson et al., 1994) was used to assess children's behavior and feelings toward their sibling in six domains: positive feelings, closeness, conflict, identification, support, and companionship. Due to the young age of some of the children in the study, a shortened version of 20/53 items reflecting the six domains were selected on the basis of Mendelson and colleagues' factor analysis (Howe et al., 1998, 2005). Additionally, the 7-point scale of responses was reduced to 3 (1 = not very often, 2 = sometimes, and 3 = very often). Children could select their answer from three circles of graduated size that corresponded to these ratings. Two subscales were created (1) positive rapport (16 items, e.g., "How often do you play together with your sibling?") and (2) conflict (four items, e.g., "How often do you fight with your sibling?"). Children rated positive rapport and conflict out of a total possible score of 48 and 12, respectively, where higher scores indicated high positive rapport and higher conflict. Cronbach's alpha determined acceptable internal consistency of the items in each subscale: focal child positive rapport = .81, conflict = .64, and sibling positive rapport = .63, conflict .71. Data were available for 71/72 (98.6%) of sibling dyads, with one sibling dyad completing the observational portion of the assessment only.

2.5 | Data analysis

To address slight variability in video length, all coded variables were divided by number of minutes in each session and multiplied by 15 (the target interaction time). The summary measures in the present study included: (1) total focal child humor production and humor production by category; (2) sibling responses to focal child's humor: positive/neutral, negative, imitation, and extension (no response and clarifications were dropped from analyses for interpretability and low counts, respectively, but are presented descriptively); (3) focal children's total internal state language (the sum of all references to internal states). Children's references to cognitive internal states were also investigated separately; and (4) focal children's and siblings' ratings of relationship quality.

Analysis of covariance (ANCOVA)-based procedures tested differences in summary measures as a function of birth order and gender. For each significant omnibus effect, effect size is reported as partial eta-squared (η_p^2). Post hoc pairwise comparisons were investigated using the Bonferroni correction (with an alpha level of $p < .05$). Tests of associations among variables of interest were tested using partial correlations, and where $p < .05$, moderating effects of birth order and gender were investigated using a series of multiple regression analyses.

3 | RESULTS

3.1 | Young children's humor production

Descriptive statistics of focal children's production of humor are presented in Table 2. Humor was shared among the majority of sibling dyads (56/72, 77.8%), and most focal children (5 year olds) produced at least one instance of humor in their interaction (46/72, 63.9%). The focal children produced a mean of 4.43 (SD = 6.78) instances of humor during play with their sibling. The focal children's total production of humor was positively associated with the number of conversational turns in the play $r(72) = .34$, $p = .004$, and as such, the number of conversational turns was controlled in all subsequent analyses.

TABLE 2 Descriptive statistics for focal child humor and their siblings' responses to humor

Focal child humor production	*M*	*SD*	Range	Sibling responses to focal child humor production	*M*	*SD*	Range
Performing incongruities	1.09	1.82	0–8.57	No response	1.79	2.93	0–15.60
Word play	0.33	0.92	0–5.00	Positive/neutral response	0.66	1.65	0–11.19
Statements and anecdotes	0.76	1.58	0–7.41	Negative response	0.57	1.40	0–6.10
Sound play	1.20	2.67	0–14.40	Imitation	0.20	0.87	0–6.43
Taboo	0.29	1.30	0–9.52	Extension	0.72	1.86	0–10.00
Banter	0.59	1.64	0–8.28	Clarification	0.05	0.24	0–1.25
Clowning	0.18	0.64	0–3.75				
Total humor	**4.43**	**6.78**	**0–36.25**				

3.2 | Focal child humor and sibling structure

An ANCOVA investigated the effect of focal child birth older (first-born versus second-born) on total use of humor while controlling for conversational turns, but showed no birth order effects ($p = .31$). However, a one-way MANCOVA indicated a main effect of focal child birth order on categories of humor, Wilks' $\lambda = .79$, $F(7, 63) = 2.41$, $p = .03$, $\eta_p^2 = .21$. Pairwise comparisons showed first-born focal children performed more incongruities ($M = 1.52$, $SD = .29$) than second-born focal children ($M = .60$, $SD = .31$), $F(1, 69) = 4.81$, $p = .03$, $\eta_p^2 = .07$, and also engaged in more banter ($M = .94$, $SD = 2.12$) than second-born focal children ($M = .20$, $SD = .66$), $F(1, 69) = 3.74$, $p = .05$, $\eta_p^2 = .05$. There were no effects of focal child gender ($p = .61$) on total humor production and categories of humor use ($p = .83$). A one-way ANCOVA examining the effect of sibling dyad gender composition on the focal child's total humor did not reach statistical significance and a one-way MANCOVA showed no differences among categories of humor as a function of sibling dyad gender composition ($ps > .05$).

3.3 | Is young children's humor associated with understanding of minds?

Focal children's references to internal states during play with their sibling were common ($M = 19.84$, $SD = 14.89$, range = 0–73.33); 66/72 (91.7%). Children made at least one reference to an inner state. Children commonly referred to cognitions ($M = 5.01$, $SD = 4.37$, range = 0–20.40, 25% of total references to inner states). Children's total references to inner states were positively associated with conversational turns $r(72) = .42$, $p < .001$. There were no effects of focal child gender, sibling gender composition, or birth order (all $ps > .05$) on their total use of internal state language.

Partial correlations (with conversational turns controlled) were computed between children's production of humor (total use and seven categories) and their total internal state language and references to cognitive states (see Table 3). Children's *total* references to inner states were positively associated with children's preposterous statements and humorous anecdotes ($p < .05$). A series of multiple regressions assessed whether the associations between focal children's total references to internal states and preposterous statements and humorous anecdotes were moderated by birth order, focal child gender, or gender composition. Birth order significantly moderated the association between focal children's total internal state language and their production of preposterous statements and humorous anecdotes, R^2 change of interaction = .05, $F(1, 67) = 4.85$, $p = .03$. This interaction was graphed using simple slopes (see Figure 1). The positive association between total internal state language and preposterous

TABLE 3 Partial correlations between focal children's humor production, references to internal states, and ratings of relationship quality (conversational turns controlled)

	Total humor production	Performing incongruities	Word play	Statements and anecdotes	Sound play	Taboo	Banter	Clowning	Total internal state language	References to cognitions	Focal child positive rapport	Focal child conflict	Sibling rating of positive rapport	Sibling rating of conflict
1. Total humor production	–	.54**	.73**	.59**	.77**	.39**	.68**	.58**	.19	.28*	−.09	−.01	.06	−.02
2. Performing incongruities		–	.09	.38**	.12	.08	.22	.40**	.13	.11	−.04	−.02	−.31**	.12
3. Word play			–	.34**	.72**	.24*	.46**	.51**	.02	.09	−.07	.03	.24*	−.13
4. Statements and anecdotes				–	.27*	.06	.25*	.26*	.26*	.24*	−.08	.01	.00	.18
5. Sound play					–	.17	.43**	.27*	.12	.29*	−.14	.11	.23	−.14
6. Taboo						–	.12	.24*	.10	.04	−.04	−.03	−.08	−.03
7. Banter							–	.35**	.11	.21	.07	−.13	.14	−.07
8. Clowning								–	−.07	.06	−.01	−.16	.06	−.09

Note.: $df = 68$.

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

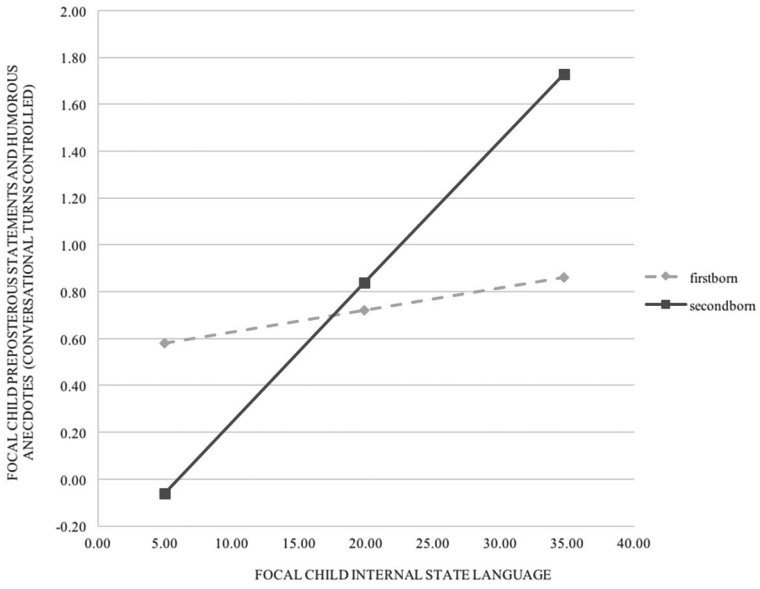

FIGURE 1 Association between focal child total internal state language and their production of preposterous stories and humorous anecdotes, moderated by focal child birth order. The solid line represents the significant simple slope and the dashed line the non-significant simple slope. Slopes were evaluated at −1 *SD*, *M*, +1 *SD* of focal child internal state language. Conversational turns were covaried

statements was apparent for second-born focal children (*B* = .06, *SE* = .02, *p* = .002) but not for first-born focal children (*B* = .01, *SE* = .02, *p* = .53). There was no moderating effect of focal child gender, or gender composition of the sibling dyad on this relationship (*p*s > .05).

Children's references to *cognitions* were associated with children's overall humor production, with sound play and preposterous statements and humorous anecdotes (all *p*s < .05, see Table 3). It is noteworthy that the association with banter approached significance (*p* = .07). Gender composition of the sibling dyad moderated the relationship between children's references to cognitive states and sound play, R^2 change = .19, *F*(3, 63) = 5.01, *p* = .001 and was graphed using simple slopes (see Figure 2). This relationship was only significant for male focal children with a sister (*B* = .58, *SE* = .12, *p* < .001); there were no statistically significant effects for female–female, female–male, or male–male dyads (all *p*s > .05). There were no moderating effects of focal child gender or birth order on this relationship. Neither birth order, focal child gender nor gender composition of sibling dyad moderated the relationship between children's references to cognitive states and their preposterous statements and humorous anecdotes (*p*s > .05).

3.4 | Is young children's humor associated with sibling relationship quality?

Both the focal children and their siblings reported on positive rapport and conflict in their sibling relationship (focal child rating of positive rapport *M* = 39.43, *SD* = 7.13, range = 31–47 and conflict *M* = 6.58, *SD* = 2.14, range = 4–12; sibling rating of positive rapport *M* = 39.00, *SD* = 6.37, range = 24–48 and conflict *M* = 7.95, *SD* = 2.11, range = 4–12). Second-born focal children reported more conflict in the sibling relationship than first-borns (*p* < .05);

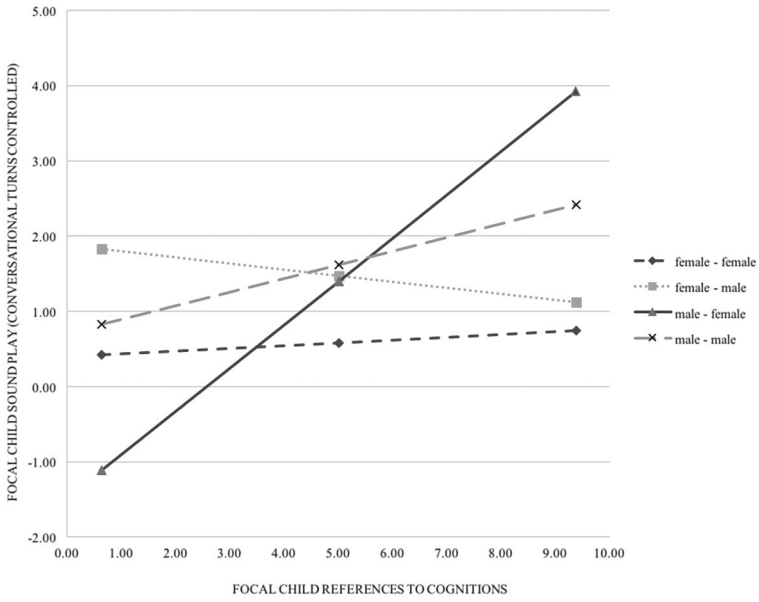

FIGURE 2 Association between focal child references to cognitions and their production of sound play, moderated by gender composition of sibling dyad. The solid line represents the significant simple slope and the dashed lines represent non-significant simple slopes. Slopes were evaluated at −1 *SD*, *M*, +1 *SD* of focal child references to cognitions. Conversational turns were covaried

however, neither focal children's ratings of positive rapport, nor siblings' ratings of conflict and positive rapport, differed according to birth order (*p*s > .05). Focal child and sibling ratings of relationship quality did not differ as a function of gender (all *p*s >.05). Focal children's ratings of positivity within the sibling relationship were associated with their siblings' ratings, ($p < .05$, see Table 3), yet their ratings of conflict were not significantly associated ($p > .05$). As such, focal children's and siblings' ratings of relationship quality were analyzed separately.

Focal children's ratings of positive rapport and conflict and siblings' ratings of conflict within the sibling relationship were not associated with their total humor production (see Table 3, all *p*s > .05). However, siblings' ratings of positive rapport were positively associated with focal children's play with words ($p < .05$) and sound play approached significance ($p = .06$). Interestingly, the focal children's performance of incongruities was negatively associated with siblings' ratings of positive rapport. It is also worthy of note that siblings' ratings of positive rapport were associated with the focal child's tendency to talk about internal states and more strongly, their references to cognitive states (all *p*s < .05).

We investigated the moderating effects of birth order, focal child gender, and gender composition of the sibling dyad on associations between humor production and siblings' ratings of positive rapport with multiple regressions. Although we detected no moderating effects of focal child gender or gender composition of sibling dyad, birth order significantly moderated the negative relationship between focal children's performing of incongruities and positive rapport, R^2 change of interaction = .09, $F(1, 66) = 7.11$, $p = .01$. This interaction was plotted with simple slopes (Figure 3), which showed that second-born focal children's performance of incongruities were associated with lower sibling-rated positive rapport (i.e., by their older sibling), $B = -3.32$, $SE = .88$, $p < .001$, but not for first-borns, $B = -.61$, $SE = .51$, $p = .24$. A series of multiple regressions found no moderating effect of birth order or focal child/sibling gender, or gender composition on the positive relationship between focal children's word play and their siblings' ratings of positive rapport (*p*s > .05).

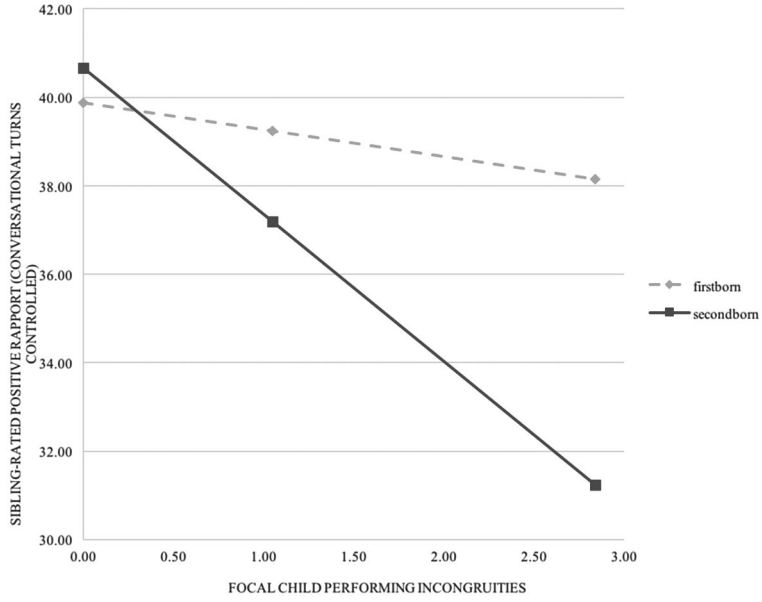

FIGURE 3 Association between focal child production of performing incongruities and sibling-rated positive rapport, moderated by focal child birth order. The solid line represents the significant simple slope and the dashed line the non-significant simple slope. Slopes were evaluated at −1 *SD*, *M*, +1 *SD* of focal child performing incongruities. Conversational turns were covaried

3.5 | Siblings' responses to young children's humor

Siblings' responses to the focal children's humor are presented descriptively in Table 2. A one-way MANCOVA (controlling for conversational turns) indicated that there were no statistical differences in siblings' responses according to whether they were first- or second-born ($p > .05$). Although there was also no effect of the sibling's gender alone ($p > .05$), we found a main effect of gender composition on siblings' responses to humor, Wilks' $\lambda = .59$, $F(15, 174.32) = 2.46$, $p = .003$, $\eta_p^2 = .16$, where male siblings were more likely to extend the humor produced by their brothers ($M = 2.17$, $SD = 3.45$), than all other gender compositions (female siblings with sister $M = .55$, $SD = 1.01$; female siblings with brother $M = .18$, $SD = .47$, and male siblings with sister $M = .27$, $SD = .94$).

3.6 | Are children's understanding of minds and relationship quality associated with their siblings' responses to humor?

Partial correlations were computed between siblings' responses to the focal child's humor and the focal child's total internal state language, references to cognitive states, and both focal child and sibling ratings of relationship quality (see Table 4). Focal children's references to cognitive states were associated with siblings' imitation of their humor ($ps < .05$). This relationship was moderated by birth order, R^2 change of interaction = .05, $F(1, 67) = 3.84$, $p = .05$. Simple slopes are graphed in Figure 4, showing that first-born focal children's references to cognitions were associated with sibling imitation of humor (i.e., imitation by their young siblings), $B = .11$, $SE = .03$, $p < .001$, but not for second-born focal children, $B = .01$, $SE = .04$, $p = .70$. The association between focal child references to cognitions and sibling imitation of humor was also moderated by gender composition of the sibling dyad, R^2 change = .12, $F(3, 63) = 3.38$, = .02, (see simple slopes graphed in Figure 4) where this relationship was only significant among brothers, $B = .21$, $SE = .05$, $p < .001$; no statistically significant effects were observed for female–female,

TABLE 4 Partial correlations between sibling responses to focal child humor production, references to internal states, and ratings of relationship quality (conversational turns controlled)

	Positive response	Negative response	Imitation	Extension	Total internal state language	References to cognitions	Focal child positive rapport	Focal child conflict	Sibling rating of positive rapport	Sibling rating of conflict
1. Positive response	–	.45**	.22	.49**	.03	.10	−.07	−.05	−.13	.06
2. Negative response		–	.01	.16	.06	−.10	−.05	−.05	−.43**	.22
3. Imitation			–	.42**	.06	.33**	.02	−.17	−.01	−.23
4. Extension				–	.06	.15	−.05	.01	.06	−.03

Note: df = 68.

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

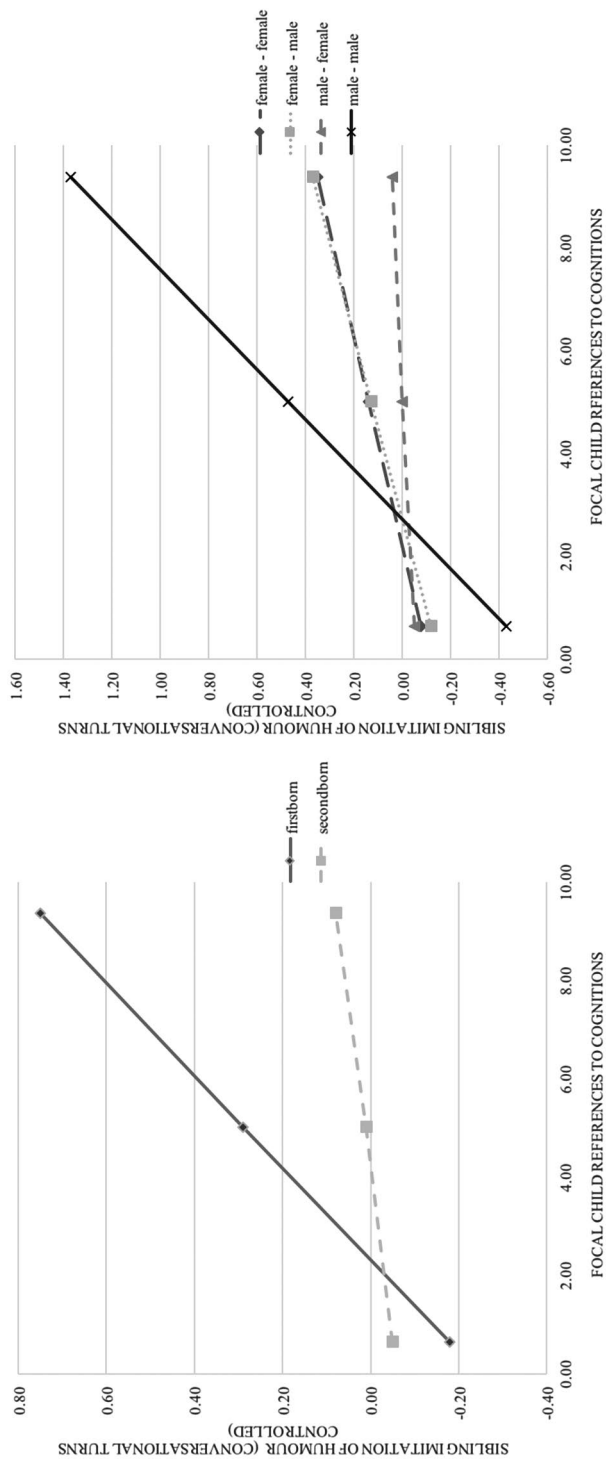

FIGURE 4 Association between focal child references to cognitions and sibling imitation of focal child humor moderated by focal child birth order (left) and by composition of the sibling dyad (right). The solid lines represent significant simple slopes and dashed lines represent non-significant simple slopes. Slopes were evaluated at –1 *SD*, *M*, +1 *SD* of focal child references to cognitions. Conversational turns were covaried

female–male, or male–female dyads (all *p*s > .05). Siblings' negative responses to the focal child's humor were negatively associated with their own rating of positive rapport in the relationship (Table 4). This relationship was not moderated by gender of the focal child, sibling, by the gender composition of the dyad or by birth order.

4 | DISCUSSION

We investigated humor production in early childhood by coding 5-year-olds' shared humor during play with their older or younger sibling. We identified relationships between children's humor, social understanding—indexed by their references to inner states—and sibling relationship quality. We found that 5-year-old focal children's references to internal states was positively associated with their production of humor during play with their sibling. Focal children's humor was also associated with their sibling's ratings of positive rapport in the relationship; some types of humor were associated with greater positive rapport, and others with lower rapport. Focal children's propensity to refer to mental inner states was associated with sibling imitation of humor, and sibling negative responses to focal child humor was associated with lower sibling ratings of positive rapport. In exploratory analyses, we identified sibling structural variables (gender and birth order) that moderated some of these relationships. There is a strong theoretical base for relationships between humor production and progress in other areas of development, such as social-emotional and cognitive development (Bergen, 2019; Hoicka & Akhtar, 2012; Leekam, 1991; Martucci, 2016). However, to the best of our knowledge, this study is the first to demonstrate evidence of relationships between young children's production of humor, their ability to understand and reflect on the minds of others, and positive rapport in the sibling relationship.

Five year olds most often performed incongruities, (e.g., making a man dive off the top of the silo, shouting, "Cowabunga!"), played with sound (e.g., loud, operatic, "My tree-ee!"), produced humorous anecdotes and nonsense statements (e.g., "The pig was so excited he ran backwards!"), and bantered (e.g., "What's so funny about that, buster?"); often combined with taboo themes (e.g., "Where's your bum brain?"). With the exception of performing incongruities, the most common types of children's humor were largely consistent with those observed from 7-year-olds' play with their siblings in another sample (see Paine et al., 2019). Together, these observations align with assertions that 4 to 5 year olds are more likely to notice and produce conceptual incongruities, and, by the age of seven, children's ability to restructure sequences of events enables them to play with multiple meanings (McGhee, 1984). As such, by middle childhood, children increasingly produce play with words (e.g., riddles and puns) (Paine et al., 2019; Schultz, 1974). We detected differences in children's humor according to sibling structure; with first-born focal children producing more banter and performing more incongruities than second-born focal children. In contrast to observations of older sibling dyads (Paine et al., 2019), we detected no significant effects of focal child gender or gender composition on children's humor production at the age of five, although male siblings were more likely to extend humor produced by their brothers. This corroborates claims that boys' and girls' humor production starts to diverge as children reach middle childhood (McGhee, 1979), with boys becoming more frequent jokers in later childhood (Paine, et al., 2019).

We investigated children's production of humor in relation to their spontaneous references to internal states, which mark their developing ability to reflect on and understand the minds of others (Paine et al., 2019; Ruffman et al., 2002). In accordance with our hypothesis, children's references to cognitions, particularly, were associated with humor production. Although the cross-sectional nature of this study precludes us from making conclusions about directionality of this relationship, it is suggested that engagement in humorous interactions emerges in the first years of life; prior to the emergence of a full-fledged theory of mind (Airenti, 2016; Mireault et al., 2011; Reddy, 2001). Humor is thought to emerge as children develop understanding of reality and mastery of concepts, which enables them to produce distortions and violations of what is expected (Garvey, 1977). Yet, shared humor is likely a context within which siblings develop a more sophisticated understanding of others (Dunn, 1988). Humor between siblings is often shared within mutual and returned exchanges; we observed humorous exchanges that

were clearly well-rehearsed and ritualistic, for example: older sibling, "Where do you live?" both together, "Down the lane!" Older sibling, "What's your number?" both together, "Cucumber!" Children's references to cognitions were also associated with imitation of humor by younger siblings and among brothers. Possibly, children who are most proficient at understanding minds are most likely to produce humor that they know is appealing to their playmate and likely to be reciprocated. Such reciprocal interactions have been labeled the "building blocks" of relationships (Dunn, 1983; Howe & Recchia, 2014) in that they afford children opportunities to develop understanding of the perspectives of others.

In line with assertions that a child's shared humor may facilitate positive social relationships (Ransohoff, 1975), we found that 5-year-olds production of word play (e.g., "Chocolatina, chocolatina!") was positively associated with their siblings' ratings of positive rapport in their relationship. Production of nonsense and rhyming words, label-based humor, and deliberate mistakes in language appears, therefore, to be a marker of more friendly, warm, and cooperative sibling relationships, which corroborates earlier work suggesting that the expression of humor is associated with social competence and acceptance within child-child relationships (Carson et al., 1986; James & Fox, 2018; Klein & Kuiper, 2006; Sletta et al., 1995). Given that friendly sibling relationships in early childhood are associated with adaptive social functioning later in development and outside of family relationships (Stormshak et al., 1996), future work would do well to determine mechanisms by which some types of humor production are associated with positive relationships. Friendly sibling relationships are generally characterized by warmth as well as conflict that is addressed through negotiation and compromise (Howe & Recchia, 2014). Potentially, shared humor may be one way in which situations of tension and conflict are more effectively diffused, and may provide a platform by which challenging ideas and events can be explored (Martin, 2007).

Contrary to expectations, 5-year-olds' performances of incongruities were associated with lower ratings of positive rapport by their sibling, but this was only the case for second-born siblings (i.e., rapport rated by their older sibling). Possibly, this finding represents lack of mutual amusement, as different types of humor are understood and enjoyed by children at different ages (Bergen, 2006). Bariaud (1989) also emphasized the importance of humor occurring within a frame of mutual playful intent; in the absence of appropriate cues or mutual complicity or sharing of such playful intent, incongruous actions may be disgruntling, confusing, and perhaps even threatening (Semrud-Clikeman & Glass, 2010). Indeed, we observed children's incongruous actions that were met with rebuke from their older sibling: focal child (younger sibling) "… the tree could go on here!" (laughing, puts a tree on top of the silo) and the older sibling replies, "No, no, put it on here!" and puts the tree back on the table. Humor that misaligns with a play partner's intentions can, therefore, potentially prompt disapproval and a break down in play. Indeed, studies of adults have demonstrated that failed attempts at humor can be costly (e.g., McGraw et al., 2014; Smeltzer & Leap, 1988). Our findings also suggest that failed attempts at humor may not be appreciated by older siblings and perhaps may have implications for their ongoing relationship quality.

4.1 | Limitations and future directions

Some limitations are worthy of note. Although our investigation of humor shared between sibling dyads, which all included a 5-year-old focal child with an older or younger sibling, enabled investigation of birth order effects on the focal child's humor without the confounding effect of age, results pertaining to siblings' humor responses and reports of relationship quality may reflect a confound between age and birth order. Our examination of humor production and internal state language within an unconstrained, naturalistic setting is a strength; future studies would do well to corroborate these findings using independent and robust measures of theory of mind (i.e., false belief tasks; i.e., Baron-Cohen et al., 1985). However, children's spontaneous references to inner states are associated with perspective-taking skills (Howe, 1991) and other measures of social understanding in the preschool years (Ruffman et al., 2002) and in middle childhood (Paine et al., 2019). Within the cross-sectional design of this study, we are unable to make any claims about directionality of the associations between humor production,

social understanding, and relationship quality. Further study of childhood humor longitudinally would elucidate continuity and change in how humor is produced over time and mechanisms by which different types of humor may promote positive outcomes in childhood. Finally, we acknowledge that more studies are needed to examine humor within socioeconomically and culturally diverse families and within other family configurations. Future research is needed that considers interactions that involve other family members beyond the sibling dyad (e.g., Persram et al., 2019); this would also illuminate more about the development, role, and function of humor shared in the family.

4.2 | Conclusion

Siblings share a long, intimate history and are the primary source of companionship in early life. As such, children's interactions with their sibling provide an important context for developing understanding of minds, although children's production of humor with siblings has often been overlooked. This study highlights the sibling relationship as a rich context for the study of productive humor as a marker of the quality of children's close relationships and their developing social understanding. Our findings suggest that investigation of the role and function of humor in child development, and processes by which humor may forge positive relationships, would be a worthy and fruitful avenue for future research.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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