



“Goosebump man. That’s funny!”: Humor with siblings and friends from early to middle childhood

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ABSTRACT

We investigated change and continuity in children’s humor production from early to middle childhood with siblings and friends. Sixty-five children (M age = 56.4 months, $SD = 5.71$) were observed as they played with their older or younger sibling and with a friend in two separate play sessions. Children were observed again approximately three years later ($n = 46$, M age = 94.6 months; $SD = 6.6$). Spontaneous humor production was coded in the play sessions. Focal children’s humor production did not differ as a function of relationship or time. Children’s tendency to produce humor with their sibling at 4 years of age was associated with humor production with a friend, both concurrently and three years later. Our findings draw attention to childhood sibling relationships and friendships as rich contexts for humor and continuities across relationships and time.

Sharing humor integrates cognition, social knowledge, and emotional understanding (Loizou & Recchia, 2019; Polimanti & Reiss, 2006), and is associated with positive rapport in close relationships (Masten, 1986; Paine, Karajian, Hashmi, Persram, & Howe, 2021; Ransohoff, 1975) and positive adjustment and social competence in childhood (Fitts, Sebby, & Zlokovich, 2009; James & Fox, 2018). From infancy, children share laughter and silliness with their caregivers (Sroufe & Wunsch, 1972), and throughout childhood, demonstrate a widening repertoire of humorous acts that they share in their close relationships (Bergen, 2002, 2006). Social interactions with other children, such as play with siblings and friends, is a vital context within which children develop understanding of themselves and others (Howe, Petrakos, Rinaldi, & LeFebvre, 2005; Hughes, 2011; Leach, Howe, & DeHart, 2019a, 2019b). Although play in child-child interactions is a rich context for observing laughter and humor (Bergen, 2002; Dunn, 1988), surprisingly, this aspect of children’s play has received little research attention (Bergen, 2019; Martin, 2007). In the present study, we addressed this issue by examining humor production between siblings and friends from early to middle childhood.

Humor production in early and middle childhood

From the emergence of laughter at around the fourth month of life,

infants laugh with their caregivers in the context of incongruous events and repetitive games, such as peekaboo and coo-coo (Sroufe & Wunsch, 1972). In the first year of life, infants also produce humorous acts to elicit amusement in others, for example, by clowning (e.g., head wobbles) and teasing (e.g., pointing to an object and vocalising, then refusing it with a smile; Reddy, 2001; Reddy & Mireault, 2015; Sroufe & Wunsch, 1972). In toddlerhood, children produce various kinds of incongruities; in addition to motor play (e.g., looking upside down through their legs), they play with concepts and language, for example, by using objects in unexpected ways (e.g., placing a container on their head as a hat) and producing gibberish and exaggerated vocalizations (Loizou, 2005). From two to three years of age, children produce novel jokes in addition to those they copy from others (Hoicka & Akhtar, 2012) and recognize the distinction between mistakes and humorous intentions (Hoicka & Gattis, 2008). Early to middle childhood represents a period of rapid cognitive, linguistic, and social development, and, in parallel, children develop a widening repertoire of humorous acts (Pien & Rothbart, 1976). As well as the continuation of motor play and enjoyment of incongruous actions, older children also produce more sophisticated play with language (e.g., puns, riddles, comical stories and statements) and they delight in taboo, disgusting themes, and playfully ridiculing others (Bergen, 2002, 2006; Paine et al., 2021; Paine, Howe, Karajian, Hay, & DeHart, 2019; Varga, 2000).

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The repertoire of humorous acts displayed in childhood is thought to expand and develop in close connection with a child's ability to recognize incongruities and to understand the minds of others (Hoicka & Akhtar, 2012; Martucci, 2016; McGhee, 1979, 2002). Children communicate their humorous intentions through the *humor frame*, with playful and exaggerated facial expressions, gestures, and vocalizations (Bergen, 1998, 2002). By sharing playful incongruities, children demonstrate awareness of what their 'audience' may find amusing (Dunn, 1988; Leekam, 1991; Pien & Rothbart, 1976); indeed, children's production of humor is associated with a propensity to talk about mental states in the preschool years (Paine et al., 2021). Early to middle childhood also represents a period of social milestones; children transition to school, and relatedly, develop additional close relationships outside of the family (Kramer & Kowal, 2005). Although some studies have investigated the nature of humor produced by children in this age range cross-sectionally (e.g., Bergen, 2002; Paine et al., 2019, 2021), there is a lack of longitudinal studies examining the development of humor across this period of change (Masten, 1986; Paine et al., 2021). As such, we aimed to investigate change and continuity in children's humor production from early to middle childhood.

Humor production in child-child relationships

Children's understanding of the social world develops in the context of their close relationships (Carpendale & Lewis, 2015). Children's production of humor has largely been investigated in the context of the parent-child relationship (Hoicka & Akhtar, 2012; Mireault et al., 2012). However, beyond the toddler years, children spend a great deal of time playing with their sibling(s) and friends (Lehrer, Petrakos, & Venkatesh, 2014), who are important influences on a child's understanding of others (Hughes, 2011; Leach, Howe, & DeHart, 2017). Shared humor and laughter are central features of children's play with other children (Bergen, 2002; Dunn, 1988). Siblings produce a wide range of humorous acts; many of which are well-rehearsed, ritualistic, and indicative of unique shared meanings constructed in the context of their intimate relationship with one another (Paine et al., 2019, 2021). Comparatively, despite some early exceptions (e.g., Bergen, 2002; Groch, 1974; McGhee, 1976), there are few observational studies of the nature of friends' shared humor in childhood.

We investigated children's spontaneous production of humor during play with a sibling and with a friend and the association between the two contexts. Examining the degree of correspondence between children's humor shared with siblings and with friends has the potential to elucidate the nature of humor production as a within-child or context-specific characteristic of childhood interactions (Bergen, 1998). Studies suggest some degree of carryover between characteristics of a child's relationship with their sibling and with a friend. For example, friendly behaviour between siblings is associated with closeness of childhood friendships (Kramer & Kowal, 2005; Smorti & Ponti, 2018). These findings correspond with various theoretical positions; according to personality theory, enduring personality characteristics elicit similar responses from interactional partners (Caspi & Elder, 1988). Social learning frameworks suggest children learn behaviours in family relationships and generalize them to relationships outside of the family (Parke, MacDonald, Beitel, & Bhavnagri, 1988). According to attachment theory, internal working models of early relationships are said to influence children's relationships with siblings and other children (Bretherton, 1985; see Dunn & McGuire, 1992, for a review).

However, other examinations of sibling relationships and friendships show little evidence of carryover between the two relationships (e.g., Volling, Youngblade, & Belsky, 1997; White, Ensor, Marks, Jacobs, & Hughes, 2014); this is attributed to the numerous dimensions upon which sibling relationships and friendships differ. Siblings share a long, co-constructed, and intimate history of day-to-day family life; a familiarity that lends itself to uninhibited and emotionally intense interactions that can be positive and negative (Howe & Recchia, 2014).

Although sibling relationships can be reciprocal, they also feature complementary interactions (e.g., teaching, caregiving) due to age and developmental asymmetries (Hartup, 1989). Unlike sibling relationships, children's relationships with friends are voluntary (Rubin, Bukowski, & Bowker, 2015), and friends often share similarities, not only in terms of their age and, therefore, cognitive skill, but also in their interests (Hughes, 2011). Children's relationships with friends are often based on mutual attachment and liking, and are characterized by positive affect, reciprocity, and being "in tune" with one another (Howe & Recchia, 2014; Howe, Ross, & Recchia, 2014; Hughes, 2011). Indeed, children maintain more connected conversation and demonstrate more positive and prosocial strategies in play with their friend than their sibling (Dunn & Herrera, 1997; Leach et al., 2019a) and are more inclined to take the perspective of a friend than a sibling (Dunn, Slomkowski, Donelan, & Herrera, 1995).

Individual differences in humor production

Prior investigations have indicated sources of individual difference in children's production of humor in child-child relationships. Within sibling interactions, the quantity and type of humorous acts differ as a function of sibling constellation factors (i.e., sex and birth order; Paine et al., 2019). Five-year-old first-born children perform more incongruous actions with objects and banter more with their younger siblings (Paine et al., 2021), whereas in middle childhood, children produce more sound play with a younger than with an older sibling (Paine et al., 2019). Boys' and girls' humor appears to diverge with age (McGhee, 1979). Although studies show no sex differences in humorous acts in sibling and peer interactions in the preschool years (Bergen, 2002; Paine et al., 2021), in middle childhood, boys produce more sound play (e.g., silly rhyming), taboo themes (e.g., naughty words or antisocial themes), and incongruities than girls (Groch, 1974; McGhee, 1976; Paine et al., 2019). We examined the emergence of these individual differences from early to middle childhood by harnessing observational data from a longitudinal sample of children.

The present study

Play with siblings and friends is a vital context within which children develop understanding of themselves and others (Carpendale & Lewis, 2015; Howe et al., 2014; Hughes, 2011), and interactions with both siblings and friends are likely to be rich in shared humor (Bergen, 2002; Dunn, 1988; Paine et al., 2019). However, earlier studies have examined humor in sibling relationships or amongst peers and friends, and with preschoolers or school-aged children. Therefore, given the important developmental changes that occur from early to middle childhood, in the present study we aimed to bridge this gap in the literature by examining children's humor shared with a sibling and a friend in a longitudinal study.

We aimed to examine continuity and change in children's humor shared with a sibling and friend from early to middle childhood and the emergence of individual differences in children's humor production over this period as a function of child characteristics (birth order, sex). We expected, in line with cross-sectional work (Bergen, 2002, 2006; Paine et al., 2019, 2021; Varga, 2000), to observe more humor in middle childhood compared to early childhood. We also expected to document the emergence of sex differences, where boys would produce more humor than girls by middle childhood (Groch, 1974; McGhee, 1976; Paine et al., 2019, 2021). As evidence is mixed regarding associations between characteristics of children's interactions with siblings and friends, we made no hypotheses regarding correspondence or differences in humor across relationship contexts.

Method

Design

In total, 65 sibling and friend dyads took part in a longitudinal study of childhood relationships (see Leach et al., 2017, 2019a, 2019b; Leach, Howe, & DeHart, 2015; Paine et al., 2019). The participants were middle class families recruited from small towns and suburban and rural communities in western New York and were representative of the local communities. Children were observed in the home setting at a mean age of 4 years and followed up approximately 3 years later. Ethical permission for the study was obtained from the Ethics committee at SUNY Geneseo, and approval for secondary data analysis was obtained from Concordia University Human Research Ethics Committee and the Ethics Committee for the School of Psychology, Cardiff University.

Participants

Families were recruited from preschools, day cares, and schools or were referred by families enrolled in the study. Families were recruited based on the age of the focal child (approximately 4.5 years old) and whether they had either a younger or older sibling (1.5- to 2-year age difference). Focal children were observed at Time 1 (T1) when they were approximately 4 years of age ($n = 65$, M age = 56.4, $SD = 5.71$ months) with either an older sibling ($n = 28$, M age = 75.8, $SD = 11.2$ months) or a younger sibling ($n = 37$, M age = 34.9, $SD = 5.3$ months). Twenty-one focal children were first-born, 32 were second-born, and 12 were third or later born; therefore, focal children were labelled as either older or younger in relation to the sibling included in the study. Thirty-three dyads were same-sex pairs (17 brothers and 16 sisters) and 32 mixed-sex pairs (16 brother-sister and 16 sister-brother). Forty-six (70.8%) of T1 children participated in a follow-up wave of data collection approximately 3 years later (Time 2; T2). Family attrition was mostly due to family life changes (e.g., divorce, maternal employment, moved, or birth of another child), and there were no differences in family demographics (i.e., parental education, socio-economic status, and ethnicity) and focal child factors (i.e., age, sex, dyadic sex composition) between the families that participated at T2 and those that did not (Stauffacher & DeHart, 2006). At T2, the focal children (M age = 94.58, $SD = 6.59$ months) were observed with the same younger ($n = 21$; M age = 74.29, $SD = 5.66$ months) or older sibling ($n = 25$; M age = 114.00, $SD = 7.12$ months) as T1. At T2, 17 focal children were older, 21 were second-born, and 8 were third or later born. There were 27 same-sex sibling dyads (19 brothers and 13 sisters) and 19 mixed-sex sibling dyads (11 brother-sister and 8 sister-brother). At both T1 and T2, six mothers had completed education up to high school level, and the rest had completed a post-secondary degree.

Families were asked to invite a friend of the focal child to participate (T1: M age = 57.8, $SD = 10.6$ months; T2 M age = 96.88, $SD = 11.01$ months). At T1 and T2, one family was unable to schedule a friend to attend the session, and additionally at T2, one family only participated for the friend interaction. There were three criteria for the selection of a friend: (1) a frequent playmate of the focal child; (2) similar age to the focal child; and (3) same sex as the focal child. When all three criteria could not be met, a friend was selected based on the first two requirements, therefore three focal children were observed with an opposite-sex friend at both time points. Approximately half of the families selected the same friend who participated at T1 to participate at T2 (20/46 = 43%). To ensure the children could be classified as close friends, the parents rated the closeness of the friendship on a 5-point scale (i.e., 1 = acquaintance, 3 = friend, 5 = best friend; $M = 3.96$, $SD = 0.81$, range 2–5 at T1, $M = 4.19$, $SD = 0.73$, range 2–5 at T2). At both time points, only one mother rated the child's friendship as a 2 (between an acquaintance and a friend).

Procedure

The procedure for the semi-structured play session was the same at both time points. Children were video-recorded as they played with their sibling and friend in two separate 15 min sessions in the focal child's home. The play sessions occurred approximately one week apart, and the order of sibling and friend observations was counterbalanced across families. At T1, dyads were given one of three developmentally appropriate counterbalanced wooden play sets (farm, village, or train) to facilitate cooperative play: farm set (32 siblings; 30 friend dyads), village set (31 siblings; 31 friend dyads), and train set (2 siblings; 3 friend dyads¹). At T2, dyads played with either a village set (19 siblings; 22 friend dyads) or a train set (27 siblings; 23 friend dyads). The research assistant instructed the children to play with the toys as they wished and then sat with the mother in another room to give the children privacy. Research assistants who were blind to the study's purposes, transcribed the children's language and behavior from the videotapes.

Coding

Humor. Children's humor was coded using both the video recordings and transcripts of children's speech (Paine et al., 2019, 2021). The video recordings were coded by two coders, who first calibrated their coding by discussing the definitions of the categories and jointly coded five play session interactions across T1 and T2. Interrater reliability was then established on an additional 49/221 (22.2%) humor interactions. Cohen's kappas are reported below. Disagreements were resolved via discussion and consensus. Children's interactions with siblings and friends at both time points were coded for seven categories of humor (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) ($\kappa = 0.78$).

Data analysis

To control for slight variability in video length in play sessions (due to bathroom breaks, interruptions, etc.), all coded variables were prorated, by dividing each variable by the length of the interaction and multiplying by 15 (the target interaction time). Coded humor variables were positively skewed, and as such a square root transformation was conducted for analysis to improve normality. Our analyses focused on the focal child observed in each play session. We first examined contrasts in children's humor production by social partner (sibling vs friend) and time (at 4 years of age [T1] vs 7 years of age [T2]). Next, we assessed the stability of humor production across social contexts (sibling vs friend) and across time (at 4 years of age [T1] versus 7 years of age [T2]). Finally, we examined individual differences in humor production according to sibling structural variables (sex and birth order) and the dyadic influence between children and their siblings and friends. Contrasts were tested using within-subjects ANOVA-based procedures and effect sizes are reported as partial eta-squared (η_p^2). Significant effects were followed up with univariate analyses (with an alpha level of $p < .05$). As recommended by Kenny, Kashy, and Cook (2006), we used Spearman's correlations to investigate associations where the data were non-independent more cautiously. Intraclass correlation analyses were used to examine evidence for dyadic influence (Kenny et al., 2006).

¹ The five dyads who received the train set were recruited late in the first wave of the data collection and were accidentally given the train set for the play session, which was meant to be used for the T2 data collection only.

Table 1
Humor categories in coding scheme.

Humor category	Description	Sibling examples	Friend examples
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.	Picks up pieces of playset and puts them on their sibling's head. "These trees are for eating, yum!" and pretends to eat a tree. "Goosebump man. That's funny!"	"Here's a house in the water, aha hee!" and places house in the lake. Child picks up train track and holds it in both hands over their head. "Thanks for the teeter totter, the weeter wotter."
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.	"Horkin-torkin peekaboo." "Maybe they're going to kiss a moose!" "They [the animals] don't want to be mushed chocolate!"	"Where are my stickers, boo bickers?" "It's a very romantic place in the trees." "It's a tootsie roll house!"
Preposterous statements and humorous anecdotes	Creating absurd or unusual stories, anecdotes, announcements, or nonsense sentences.	"It's a slide, a slidey slide [singing to the theme of Sesame Street]." "Chimney here, chimney here, chimney here..."	"Look at the cow's [very deep voice] udders." "The people on the bus go WAH WAH WAH!"
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.	"Look at my nose!" and shows a large bubble of snot to sibling. "Dropping in a big lump of poop!"	"You know what he did? He hit his privates on the tree! Oooh! Right on the branch!" "The toots has a rear end on it!"
Taboo	Disgusting noises, such as blowing raspberries, fart noises, burp noises. Using taboo words or discussion and/or enacting taboo themes.	"You are the biggest and loudest and the despicablest!" "Ahh get off me, you big galoop!"	"I got the person, haa-haa-ha-ha-haa!" "That's not a boat! Brat!"
Banter	Humorous aggression, derision, teasing or mocking imitation. Include light-hearted insults. Rough and tumble play.	Child puts foot on their sibling's head. Child rolls onto their back with legs in the air and stays there for 10 s.	Child leaps from one side of the room to the other. Child jumps around, flops dramatically on the floor, then holds foot in the air.
Clowning	Silly or over exaggerated body movements, dancing, posing or face contortions.		

Note. Categories of humor could co-occur.

Results

Descriptive statistics

Descriptive statistics for humor produced by focal children in each relationship context and time point are presented in Table 2. At T1, 54/65 (83.1%) children produced humor at least once with their sibling, and 59/64 (92.2%) produced humor with their friend. At T2, 38/46 (82.6%) produced at least one instance of humor with their sibling and 39/46 (84.8%) produced humor with their friend. Sound play was the most commonly produced category of humor at all time points, followed by performing incongruities and banter with siblings at T1 and banter and

taboo with friends at T1. At T2, children also most commonly performed incongruities and shared preposterous statements and humorous anecdotes with their sibling and bantered and played with words with their friend.

Examination of associations between children's categories of humor used in each play session showed that the majority of humor categories were positively and moderately to highly correlated (see Supplementary Materials for associations among humor categories in each play session), and the internal consistency of children's humor categories in each session ranged from $\alpha = 0.62$ to 0.79 . Therefore, in all subsequent analyses, we collapsed children's humor categories into total humor focal children produced within each play session (see Table 2 for Ms and SDs of total humor produced with a sibling and friend at T1 and T2).

Table 2
Descriptive statistics for focal children's humor produced with a sibling and friend in early and middle childhood.

	Sibling		Friend	
	Time 1 M (SD)	Time 2 M (SD)	Time 1 M (SD)	Time 2 M (SD)
Performing incongruities	1.09 (2.18)	1.08 (1.83)	1.86 (2.96)	1.16 (1.86)
Sound play	2.57 (3.82)	2.14 (3.05)	2.50 (3.41)	3.48 (6.23)
Word play	0.82 (1.39)	0.83 (1.30)	1.04 (1.72)	1.26 (3.10)
Preposterous statements and humorous anecdotes	0.57 (1.12)	0.97 (1.71)	1.20 (1.39)	1.10 (1.86)
Banter	0.99 (2.37)	1.33 (2.26)	0.59 (1.53)	1.87 (4.47)
Taboo	0.44 (0.93)	1.09 (2.36)	0.95 (1.86)	0.97 (2.17)
Clowning	0.59 (1.33)	0.63 (1.81)	0.52 (1.17)	1.03 (2.78)
Total humor	7.07 (9.22)	8.08 (9.62)	8.67 (9.04)	10.87 (13.66)

Note. Time 1 sibling N = 65, Time 1 friend N = 64, Time 2 sibling and friend N = 46.

Contrasts in humor by relationship and time

We conducted a 2 x 2 repeated measures ANOVA to examine the effects of partner (sibling vs. friend) and time (T1; 4 years of age vs. T2; 7 years of age) on children's total production of humor. This analysis showed no significant differences in children's humor production as a function of partner, Wilk's $\lambda = 0.99$, $F(43) = 0.51$, $p = .48$, or of time, Wilk's $\lambda = 0.99$, $F(43) = 0.43$, $p = .52$. Similarly, we did not detect a significant interaction between partner and time, Wilk's $\lambda = 0.99$, $F(43) = 0.64$, $p = .43$.

Continuity in humor across relationships and time

Table 3 shows associations between focal children's total humor production in each play session. We detected significant positive associations between children's humor with their sibling and with their friend at T1, $r_s(64) = 0.32$, $p = .01$. We also detected significant positive associations between children's humor with their sibling at T1 and humor with their friend at T2, $r_s(46) = 0.30$, $p = .04$. It is also worthy of note that the association between humor at T1 and T2 with a sibling neared significance, and the effect size was not negligible, $r_s(46) = 0.27$, $p = .07$. We did not detect any significant associations in children's production of humor across relationship contexts at T2 ($p = .37$).

Table 3
Spearman correlations between children's humor produced in each play session.

	1.	2.	3.	4.
1. T1 humor with sibling	–			
2. T1 humor with friend	0.32* (64)	–		
3. T2 humor with sibling	0.27+ (46)	0.13 (45)	–	
4. T2 humor with friend	0.30* (46)	0.02 (45)	0.14 (45)	–

Note. + $p < .10$, * $p < .05$. N is reported underneath coefficients in brackets.

Correlates of humor and dyadic influence

A series of independent samples t -tests showed that children's total production of humor did not differ as a function of the child's sex in any of the play sessions (t s ranged from 0.02 to 1.52, all n s), and a one-way ANOVA showed that children's humor production did not differ as a function of the sex composition of the sibling relationship (i.e., sister-sister, brother-brother, mixed sex). Children's total humor production with their sibling differed as a function of birth order at T1, where second-born children produced more humor with their older sibling ($M = 9.97$, $SD = 11.14$), than firstborn children with their younger sibling ($M = 3.25$, $SD = 3.07$), $t(58.54) = 3.10$, $p = .003$.

Intraclass correlation analyses were used to examine evidence for dyadic influence between the focal children in the study and their sibling and friend at each play session. We detected dyadic influence in all play sessions in humor production, $ICC = 0.55$ at T1 in the sibling play session, $ICC = 0.79$ at T1 in the friend play session, $ICC = 0.76$ in the T2 sibling play session, and $ICC = 0.78$ in the T2 friend play session, (all p s < 0.001).

Discussion

In this longitudinal home-based observational study, we investigated children's humor production from early to middle childhood with siblings and friends. We did not find evidence of differences in children's total humor production as a function of their play partner, nor did we detect change over time from Time 1 (4 years of age) to Time 2 (7 years of age). However, we did find some evidence of continuity in children's humor production across relationship contexts and time; 4-year-old children's humor with their sibling was associated with their humor with a friend at the same time point, and children's humor with their sibling at 4 years of age was associated with humor with a friend three years later.

Humor production in child-child relationships over time

The present study addresses a paucity of research that has examined children's production of humor longitudinally (Masten, 1986; Paine et al., 2021). We did not detect significant differences in children's tendency to use humor in each relationship context. Instead, sibling relationships and friendships were both rich contexts for humor production. Descriptively, there were some qualitative differences in the types of humor used. Children bantered with their sibling more often in early childhood, while more linguistically complex types of humor, such as word play, were observed more often in the context of children's friendships. The familiarity and intimacy of the sibling relationship may result in more uninhibited interactions, in terms of sharing more 'juvenile' sound manipulations (i.e., singing, chanting, over exaggerated voices, "Let's be really LOUD!"), and incongruities with objects ("Wanna see something funny? I put the people up here [on top of a house] and I take this kind of block and go, BOOM!" [Knocking them down]), but additionally, the involuntary and enduring nature of the sibling relationship may enable children to test the boundaries of banter and playful teasing ("Goofhead!") without jeopardising the relationship.

Although the difference was not significant, descriptively, we

observed that children produced humor with their friend more frequently in middle childhood. Given siblings' asymmetries in age and cognitive development, quite possibly, siblings' sources of amusement may become less aligned later in development. Quite possibly, as children's friendships become more central to children's social lives as they transition to primary school, they become a richer context for humor. Humor may be an increasingly important tool in childhood friendships that fosters and maintains intimacy, by boosting positive emotions, maintaining harmony, and diffusing contentious interactions (Martin, 2007; Scott, Lavan, Chen, & McGettigan, 2014). For example, in middle childhood, following a disagreement between two friends as they negotiated construction of the train track (focal child: "NO! No, no, no!") the conflict ceased following a sudden exchange of the friend saying, "I'm abducting your brain," and focal child responding, "I'm a ducky-mo-bob." Friendships become an increasingly important context for improving social skills and developing understanding of mental states (Bagwell & Schmidt, 2011; Hughes, 2011), and as such, humor may become more common as children develop a better understanding of what their friends may find amusing. Indeed, this aligns with earlier research showing that friends share more positive and connected sequences of interaction than siblings (Leach et al., 2019a; Rubin et al., 2015; Volling et al., 1997). Friends generally share a motivation to maintain a positive relationship with one another as well as relying on their common interests and cognitive abilities (Howe et al., 2014; Hughes, 2011). Although siblings share a long history together, friends' sources of amusement may be more compatible with one another and could lead to more sustained and successful humorous exchanges; this possibility, however, warrants closer investigation.

Although the limitations of our sample size and low frequencies of some individual categories of humor production precluded us from investigating developmental changes in children's categories of humor during play, we note that children's play with sound ("Look at the cow's [very deep voice] udders") remained the most common form of humor in early and middle childhood. We also observed that banter ("ner-ner-ner-ner-ner!"), word play ("Goosebump man!"), and preposterous statements and humorous anecdotes ("It's a very romantic place in the trees.") were among the most common forms of humor used in middle childhood with siblings and friends. This aligns with McGhee's (2002) proposed developmental stages of humor where, in middle childhood, children increasingly recognise and produce conceptual incongruities and word play with multiple meanings. Alongside more sophisticated verbal and conceptual incongruities, however, we observed that sound play often co-occurred with other categories of humor, indicating children's humorous intentions within the humor frame (see Bergen, 1998, 2002). For example, in a squeaky voice, a focal child was observed saying to their friend, "My art [his train] is not for playing with! Mommy, he ruined my art!" and then pushed his friend's train off the track as they both laughed.

Partner effects on children's humor production

Children who produced humor during play with their sibling when they were 4 years of age were also more likely to produce humor with their friend at the same time point and 3 years later. These findings suggest some degree of carryover between characteristics of children's interactions within the sibling relationship and friendships, and align with other studies demonstrating that having warm, friendly, and intimate sibling relationships is associated with positive interactions in other child-child relationships (Smorti & Ponti, 2018; White et al., 2014). Humor production with siblings in childhood is associated with positive rapport and markers of children's ability to understand others' minds (Paine et al., 2021). Although causality cannot be determined in the present study, it is thought that sibling relationships provide a context (or, 'natural laboratory') for learning about the social and cognitive world and practising social skills that foster the development of positive friendships (Howe et al., 2014; Smorti & Ponti, 2018).

We did not, however, find that focal children's humor with their sibling was associated with humor with a friend in middle childhood. Although this may be due to the different playsets used in each play context, it quite possibly indicates change in the nature of children's sibling relationships and friendships over time (White et al., 2014) and might suggest that humor becomes more context-specific in later childhood. This aligns with earlier work demonstrating contrasts rather than carryover effects between children's sibling relationships and friendships (Leach et al., 2015; Leach et al., 2019b; White et al., 2014). Our finding that focal children's humor in each interaction was strongly associated with their play partner's humor confirms similar findings that humor is highly dyadic (Paine et al., 2019, 2021). Therefore, together with the partner effects shown in this study, this supports the notion that children may come to use humor in different ways within different relationships. Beyond our focus on change and continuity of humor produced by the focal child, an interesting and valuable direction for future research would be to conduct a more comprehensive and enriched analysis of actor and partner effects to elucidate dyadic patterns of how humor is shared in child-child interactions (Kenny et al., 2006).

Individual differences in children's humor production

We also investigated differences in children's humor production as a function of birth order at both time points. Given that same-aged focal children (i.e., 4 years of age at T1, and to investigate birth order differences whilst 7 years of age at T2) were observed with either an older or a younger sibling, this enabled us to remove the confounding effect of age. In early childhood, second-born children produced humor more frequently than first-born children. Given that it is well-documented that presence of an older sibling confers an advantage in children's developing understanding of minds (e.g., Leach et al., 2017; Ruffman, Perner, Naito, Parkin, & Clements, 1998), older siblings may scaffold humor production in their younger siblings (Vygotsky, 1978). It is also possible that younger siblings' enhanced mind-understanding better equips them for sharing humor (Paine et al., 2021). Mechanisms by which older siblings may influence their younger siblings' humor production would be an interesting direction for future research.

It is well established that there are sex differences in the production, appreciation, and processing of humor in adulthood (see Hofmann, Platt, Lau, & Torres-Marín, 2020); it has been proposed that sex differences in humor start to emerge in middle childhood (McGhee, 1979). In line with earlier work (Paine et al., 2021), we did not detect any sex differences in focal children's humor production in early childhood. However, in contrast to other behavioral studies in childhood (Groch, 1974; McGhee, 1976; Paine et al., 2019) and contrary to our expectations, we also did not detect sex differences in humor production in middle childhood. It is quite possible that effects were not detected due to the small sample size at the middle childhood observation. Our results should therefore be taken as preliminary; further longitudinal investigation of children's humor within child-child relationships in larger, and additionally, more socioeconomically diverse samples, would address limitations in our study.

Conclusion

Notwithstanding these limitations, this study draws attention to children's humor as an important feature of their social lives. To the best of our knowledge, this study is the first to investigate humor production in different child-child relationships longitudinally, by harnessing observational data of children's play in their naturalistic home environments. This study underscores the importance of sibling relationships and friendships as rich contexts for sharing incongruities and absurdities that mark understanding of, and closeness with, others in childhood.

Data availability statement

Data are available from the corresponding author under reasonable request.

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appdev.2021.101321>.

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