Research Article

Requests for Communication Repair Produced by Typically Developing Preschool-Age Children

Hannah M. Julien,[a] Lizbeth H. Finestack,[a] and Joe Reichle[a]

Purpose: When breakdowns in communication occur, children may request a repair to increase understanding of the message. Unrepaired communication breakdowns may cause confusions, limit conversational exchanges, and restrict children's learning opportunities. Relatively little is known regarding the conditions under which children produce repair requests. Thus, this study examined the verbal communication repair requests produced by typically developing children and evaluated the relationship between children's repair requests and performance on a theory of mind task.
Method: Participants included 25 typically developing 4-year-old children who completed standardized, norm-referenced assessments of their expressive language, receptive language, and IQ; a theory of mind task; and a shared book reading task. In the shared book reading task,

the examiner elicited child repair requests using questions and statements that contained insufficient information.
Results: Participants produced a statistically significant greater number of repair requests when presented with questions with insufficient information compared to statements with insufficient information ($p < .001$). There were no differences in total repair requests between participants who passed or failed the theory of mind task ($p = .45$).
Conclusion: Among preschool-age children, the shared book reading task provided a naturalistic medium that facilitated the examination of children's repair requests. Results from this study provide baseline information to which the repair requests produced by other populations, such as children with autism spectrum disorder, can be compared.

A communication breakdown occurs when there is an interruption in the successful exchange of information between communication partners (i.e., speaker/listener). Breakdowns occur when a message is not understood and there is no response (see Wetherby, Alexander, & Prizant, 1998). Alternatively, a listener may understand a communicative partner's message but choose not to respond for a variety of reasons or may simply be distracted and attend to a competing activity that is of higher priority to the listener. When children experience communication breakdowns, it may restrict learning by limiting the control that a child can exert within their social environment (Halle, Brady, & Drasgow, 2004). Furthermore, as a social interaction progresses, the degree of misunderstanding may be compounded (Abbeduto et al., 2008). One way a child

may mitigate the negative consequences of communication breakdowns is to request a communication repair.

Communication repairs require early-emerging pragmatic skills that involve the identification that a breakdown has occurred and subsequent adjustment of the original communicative act. Repairs represent one type of communication function. Others include initiations (e.g., commenting, requests for information, requests for objects), responses (e.g., negating, confirming, answering questions), and verbal routines (Lahey, 1988). Studies examining the communication repairs of children have focused on either how children initiate (i.e., produce unprompted) repair requests or how they respond to their social partner's repair request, with more research focused on the latter (e.g., Flavell, Speer, Green, August, & Whitehurst, 1981; Morisseau, Davies, & Mathews, 2013; Revelle, Wellman, & Karabenick, 1985; Walters & Chapman, 2000; Webber, Fey, & Disher, 1984). Initiated repair requests serve as one measure of children's emerging social competence because the requests provide evidence that the child is attending to the speaker's communicative bids, is monitoring her own comprehension, has strategies for repairing communicative breakdowns,

[a]Department of Speech-Language-Hearing Sciences, University of Minnesota, Minneapolis

Correspondence to Lizbeth H. Finestack: finestack@umn.edu

and can successfully execute a repair request (Dollaghan, 1987). The efficient use of communication repair strategies increases the likelihood that social exchanges will extend across multiple conversational turns (Brinton, Fujiki, Loeb, & Winkler, 1986). Despite the value of children's repair requests, relatively little is known regarding the conditions under which children produce repair requests. Consequently, the purpose of the current study was to examine the spoken communication repair requests produced by children developing typically when asked a question or provided with a statement with insufficient information. A secondary study purpose was to characterize the relationship between repair requests and performance on a theory of mind (TofM) task.

Increased understanding of repair requests among typically developing children will allow researchers and interventionists to know the conditions under which children produce repair requests. These results can then be used as a point of comparison when examining the repair requests produced by children with weaknesses in social communication, such as children with autism spectrum disorder. Previous investigations have described limitations in repair requests produced by children with developmental disabilities that include children with intellectual disability, Down syndrome, Williams syndrome, and fragile X syndrome (e.g., Abbeduto, Davies, Solesby, & Furman, 1991; Abbeduto et al., 2008; Abbeduto, Short-Meyerson, Benson, & Dolish, 1997; John, Rowe, & Mervis, 2009; Skwerer, Ammerman, & Tager-Flusberg, 2013; Thurman, Kover, Brown, Harvey, & Abbeduto, 2017). However, results from these studies have been mixed potentially due to differences in study methods.

The terminology used in examining repair requests has varied across studies. Some researchers use the term *noncomprehension signals* (often to describe an array of different spoken repair behaviors; see Abbeduto et al., 2008). Other investigators use the term *clarification requests* to describe a specific type of repair. In the current study, we use the term *repair requests* to encompass signals of noncomprehension and clarification requests.

Children's Repair Requests

Effective use of repair requests requires that children engage in comprehension monitoring (Dollaghan, 1987). Comprehension monitoring is a multiphased activity with detection representing the first stage. In this stage, one detects lack of understanding. Detection alone does not guarantee that a child consciously recognizes what they did not understand in the message or realizes that the message was missing critical information. It is in the latter stages of evaluation and regulation of comprehension monitoring that a child recognizes deficiencies in a communicative partner's utterance. Consequently, in producing a repair request, a child must detect that a message was insufficient and subsequently evaluate the nature of the problem and consider the nature of the repair request. Then, the child must choose whether to produce a communicative repair

request. Doing so requires a discrimination between when a child understands and does not understand a social partner's communicative utterance (Dollaghan, 1987; Markman, 1979).

During a social exchange, it is comprehension monitoring that allows children to determine parts of the spoken and nonspoken communication act that they may not fully understand as a result of either their comprehension skills or inadequacies in the production skills of their communicative partner. Once a child realizes that he or she does not understand a communication message, the child can express this failure to the communicative partner (Dollaghan, 1987). Examining comprehension monitoring can be complicated given the potential for differential learner performance as a function of the type of materials used and/or the content that a child is being asked to understand (see Skarakis-Doyle, 2002).

Dollaghan (1987) suggested that, depending on the child's analysis of the nature of the comprehension problem, a typically or atypically developing child may choose from an array of different types of repair requests that include general requests for clarification (e.g., "What?"), specific requests for clarification (e.g., "Which green one?"), statements specifying insufficiency or correcting an error (e.g., "Not the dog, you mean the cat."), and general statements indicating lack of comprehension (e.g., "I don't understand."). In addition to a child's comprehension limitations, it is possible that a listener may understand the message but, instead, choose not to respond for a variety of reasons that include becoming distracted and/or not wishing to comply.

Typically developing children begin producing repair requests between ages 2 and 3 years (Aviezer, 2003; Pea, 1982; Revelle et al., 1985). This development continues throughout the early school years (Beal & Belgrad, 1990; Bonitatibus, 1988; Flavell et al., 1981; Morisseau et al., 2013; Patterson, O'Brien, Kister, Carter, & Kotsonis, 1981). However, some evidence suggests the lack of a developmental progression in children's productions of repair requests, with younger and older children performing similarly in elicited repair request tasks (Walters & Chapman, 2000). There are many unexplored variables that may further guide our understanding of children's use of repair requests. These include the pragmatic function of the adult's utterance preceding the repair request, the materials used, the child's motivation, the child's advanced perspective-taking skills (i.e., TofM development), the child's language abilities and IQ, and the history with a given communicative partner. Here, we review a few of the variables that likely impact children's use of repair requests.

Variables Affecting the Production of Repair Requests

Pragmatic Function of Partner's Utterance Preceding Breakdown

The majority of investigations related to repair requests produced by children with typical development (e.g., Flavell et al., 1981; Morisseau et al., 2013; Revelle et al., 1985; Walters & Chapman, 2000) and children with atypical

development (e.g., Abbeduto et al., 1997, 2008; Brinton & Fujiki, 1982; Dollaghan & Kaston, 1986; Ezell & Goldstein, 1991; John et al., 2009; Martin et al., 2017; Skwerer et al., 2013; Thurman et al., 2017) have used structured tasks to elicit repair requests. Typically, these elicitations provide children with insufficient information to complete an obligatory task. For example, participants might be asked to follow spoken directions in which the content is degraded (e.g., examiner states, "Put the (cough) in the cup.") or ambiguous (e.g., examiner states, "Bring me the cup," in the presence of multiple cups). Few studies (see Webber et al., 1984) have examined elicitations of nonobligatory responses (e.g., "I like the blue one," when there are multiple blue items in an array). Nonobligatory responses may take many forms. For example, a child may request a repair (i.e., "Which blue one?" or "This blue one?"), maintain the interaction by mirroring the examiner's utterance (i.e., "I like the blue one, too!"), change the topic without repairing (i.e., "I like the red truck!"), or attempt to infer the reference without repairing. The type of repair request produced by a child is likely to vary based on the social demands of the communication exchange.

Webber et al. (1984) examined responses produced by typically developing 3- to 9-year-old children when the examiner elicited both obligatory and nonobligatory responses using an ambiguous referent. In an unstructured play activity, the examiner presented 10 communication elicitations with ambiguities. Of these, seven were statements eliciting nonobligatory responses (e.g., "I have a *liki* at home."), and three were questions eliciting obligatory responses (e.g., "Do you know that story?"). Across all ages, children produced repair requests for at least 50% of total opportunities. This study provides evidence that, across a wide age range, children may produce repair requests when the communication partner produces a statement with insufficient information. Webber et al. did not report analyses related to differences based on participants' age and provided few specific methodological details and analyses. Thus, these results must be cautiously interpreted.

Children may be more likely to receive feedback when they fail to initiate a repair request following an elicitation of an obligatory response than of a nonobligatory response because there is a stronger social expectation to respond (Fey, War-Leeper, Webber, & Disher, 1988). Failure to follow a command or answer a question will inherently cause a breakdown, whereas failure to respond to a general statement or comment may create a socially acceptable but somewhat awkward communication exchange. Despite differences in the pragmatic functions of these communication elicitations, little research has focused on how the elicitation context may differentially influence children's production of repair requests.

Children's Perspective-Taking Abilities

As part of the repair request process, the person receiving the communication message must consciously or unconsciously acknowledge that the message they received —and did not fully understand—must not be what was intended by their communication partner. The listener's initiation of a repair request is based on the listener's assumption that the communication partner has more information to share to clarify the message. Thus, for children to successfully use repair requests, they must account for their social partner's perspective, which may differ from their own. Children's abilities to understand another person's perspective may be linked to TofM development (Feldman & Kalmar, 1996).

TofM is the ability to assign mental states to oneself and to others and to use knowledge of mental states to predict others' behavior (Premack & Woodruff, 1978). Among typically developing children, some evidence suggests a positive link between performance on TofM assessments and real-time social behavior (for a review, see Repacholi & Slaughter, 2003). In addition, Flavell (2004) broadly noted that, for some children, advanced TofM skills are closely associated with more successful social relationships. This, in turn, may influence a child's motivation to produce a communication repair. On the other hand, a number of researchers have suggested that TofM may be less related or not directly related to the initial emergence of perspective taking (see Happé & Loth, 2002; Nelson, Plesa, & Hensler, 1998; Skarakis-Doyle, Izaryk, Campbell, & Terry, 2014).

Feldman and Kalmar (1996; as cited by Bosco & Gabbatore, 2016) first described the link between TofM and engagement in communication repair. They noted that speakers might consider their conversation partner's knowledge and intentions and adjust their own accordingly. To date, a few studies have suggested that, for typically developing children, there is a direct relationship between good performance on TofM tasks and the recognition and repair of communication breakdowns (Bosco, Bucciarelli, & Bara, 2006; Bosco & Gabbatore, 2016; Sidera, Perpiña, Serrano, & Rostan, 2016). Although it is possible that TofM shares an association with perspective taking, some investigators have provided strong evidence that TofM, at least in the early stages of perspective taking, is not a requisite (Happé & Loth, 2002; Nelson et al., 1998; Skarakis-Doyle et al., 2014). As a result, a positive association between TofM and successful conversational exchanges remains somewhat controversial.

Nelson et al. (1998) provided an explanation of how children could demonstrate some level of perspective taking without being able to perform well on traditional TofM tests. She suggested that children learn to "read" others' communicative intentions as a result of practice obtained during regularly occurring social situations. By practicing in commonly occurring routines, children as young as 2 years old have been able to demonstrate perspective taking before they understand why they are doing so in a generalizable fashion. Supporting this explanation are results of experimental studies showing that 2-year-olds demonstrate sensitivity to the cooperative principle. They are beginning to correct false statements (Pea, 1982) and are beginning to consider how much information their conversational partners have and still require to successfully complete a task

(O'Neill, 1996). Furthermore, Bates (1976) demonstrated that children of this age are engaging in some rudiments of politeness.

These findings led Skarakis-Doyle et al. (2014) to examine elements of the cooperative principle that may emerge prior to children consciously engaging in inferencing understanding of false belief. Confirmation of their hypothesis was predicated on Nelson et al.'s (1998) work in this area. The subsequent work by Skarakis-Doyle et al. with 3- to 5-year-olds provided evidence supporting that children emitted behaviors indicative of some level of perspective taking prior to successful completion of TofM false belief task items. In a conversational setting (i.e., bath time and bedtime), the foundational knowledge for truth (Pea, 1982), relevance (Bloom & Lahey, 1978), and politeness (Bates, 1976) maxims was demonstrated in children's ability to identify some violations of cooperative communication. Skarakis-Doyle et al. concluded that it appears there are paths to aspects of perspective taking in addition to inferencing abilities that are the focus of TofM tasks. Thus, because there are investigations supporting both that TofM is and is not associated with the advanced perspective taking needed to engage in meaningful repair requests, further examination between TofM and the initiation of repair requests is warranted.

Language, IQ, and Demographic Variables

Much of available evidence suggests the absence of a significant link between the production of repair requests by typically developing children and receptive language abilities (e.g., Abbeduto et al., 1991, 1998; Walters & Chapman, 2000; cf. Abbeduto et al., 2008) and IQ (Abbeduto et al., 1998). There is little evidence related to the relationship between household income, maternal education level, and repair requests, despite empirically established positive relationships between socioeconomic status and language development (e.g., vocabulary knowledge; see seminal work by Hart & Risley, 1995; see also Inglebret et al., 2017). More broadly, socioeconomic status has been linked to multiple areas of children's development (for a review, see Bradley & Corwyn, 2002). Thus, it is important to further evaluate the associations between children's language, cognitive, and demographic profiles and use of repair requests.

Current Study

The purpose of the current investigation was to examine the repair requests produced by 4-year-old typically developing children during a shared book reading activity. By studying the repair requests of typically developing children, we intended to gain an understanding of expectations for typical development. Investigators can further use results of this study to evaluate the performance of children with developmental disabilities, including children with autism spectrum disorder who have limitations in social communication skills. In addition, focusing on 4-year-old children permitted the examination of early development of repair requests. Of particular interest in the current

study was a comparison of children's productions of repair requests under different conditions: (a) when elicited using insufficient information embedded in questions obligating a response and (b) when elicited using insufficient information embedded in statements not obligating a response. We also evaluated the relationship between the production of repair requests and performance on a TofM task given the different conclusions drawn from previous research related to the relationship between TofM and perspective taking. The specific research questions were the following:

1. Do 4-year-old typically developing children produce repair requests when provided insufficient information in questions that elicit obligatory responses and statements that elicit nonobligatory responses during a shared book reading activity?

2. Are there differences in the total number of repair requests that children who pass a TofM task produce compared to those who fail a TofM task?

3. What is the relationship between children's production of repair requests, their demographic characteristics (i.e., household income, maternal educational level), and their participant-level characteristics (i.e., age, IQ, communication abilities)?

We examined these research questions using an experimental shared book reading task, which have not been used previously, to examine repair requests. It was predicted that 4-year-old typically developing children would produce a greater number of repair requests following question elicitations with insufficient information of obligatory responses compared to statement elicitations with insufficient information of nonobligatory responses. Elicitations using questions intrinsically carry a stronger social expectation to respond in a particular way (i.e., requests for information carry the expectation that the responder will provide information). In contrast, elicitations using statements allow more variance regarding whether and how the child responds, which may reduce the likelihood of the child initiating a repair request.

With respect to the second question, it was predicted that children who pass a TofM task would be more likely to produce repair requests compared to children who do not pass the TofM task. Recent studies rooted in cognitive pragmatics suggest a positive relationship between children's development of TofM and their abilities to recognize and repair communication failures (see Bosco et al., 2006; Bosco & Gabbatore, 2016). Even if children displayed rudimentary conversational repair skills as a result of Nelson's explanation, we hypothesize that favorable performance on TofM task may result in superior repair request performance when compared to children who did not perform well on this task. We also predicted that children with stronger language and cognitive abilities and those from well-educated families would be more likely to produce repair requests because they would be better equipped to identify breakdowns in communication and have the necessary skills to initiate repair requests.

Method

A University of Minnesota Institutional Review Board approved all study procedures. Participants were recruited through a university-based child care center and three community-based preschools/day cares. Flyers and letters describing the study were distributed at each center. Any child whose parent responded to a flyer or letter and met inclusion/exclusion criteria was invited to participate in the study.

Participants

Participants included 25 typically developing children between the ages of 4;0 and 4;11 (years;months). Inclusion criteria were (a) absence of history of language disorder or developmental delay as reported by parents, (b) vision and hearing status within normal limits or corrected to within normal limits, (c) monolingual English language backgrounds, and (d) expressive and receptive communication and cognitive skills within a typical range (i.e., no greater than 1 SD below mean). The language and cognitive criteria were verified through the measures implemented in the study (detailed in a subsequent section). All but five parents reported their child's race as White. The remaining five reported that their child was from a multiracial background. Table 1 provides the participants' demographic information and details of their IQ, expressive and receptive communication, and adaptive behavior profiles.

Procedure

Participants completed the research protocol across two sessions requiring a total of 2–3 hr. All research sessions took place at the participants' homes ($n = 9$) or preschools ($n = 16$). During the first session, the participants completed standardized, norm-referenced, and criterion-referenced assessments. A certified speech-language pathologist administered the assessments. During the second session, the same individual administered the shared book reading task followed by any remaining assessment measures. The task was video-recorded and later coded by trained undergraduate research assistants according to a preestablished coding scheme.

Measures

Parent Report Measures

Participants' parents completed a short demographic and child history form. Information obtained included race, ethnicity, maternal education, household income, and child developmental history. In addition to the demographic and child history form, parents completed the Vineland Adaptive Behavior Scales–Second Edition Parent Report Form (Vineland-2; Sparrow, Cicchetti, & Balla, 2005). The Vineland-2 is a parent report measure of child development across four developmental domains: communication, daily living skills, socialization, and motor skills. Among the general population, the Vineland-2 has a mean standard

Table 1. Participant characteristics ($n = 25$).

Characteristic	Outcome
Female:male ratio	13:12
Maternal education	
High school	4%
College	32%
Graduate school	64%
Annual household income	
$0–$25,000	—
$25,000–$50,000	4%
$50,001–$100,000	16%
$100,001–$150,000	24%
$150,001+	56%
Child age (months)	
M	52.8
SD	3.48
Min–max	48–59
Theory of mind performance	
Pass:fail	17:8
IQ Standard Score[a]	
M	112.44
SD	7.87
Min–max	100–132
Expressive Communication SS[b]	
M	115.8
SD	13.72
Min–max	90–150
Receptive Communication SS[b]	
M	116.56
SD	12.88
Min–max	88–140
Vineland Adaptive Behavior[c]	
M	109.56
SD	10.78
Min–max	89–129

Note. These standardized, norm-referenced measures have $M = 100$ and $SD = 15$.

[a]Kaufman Brief Intelligence Test–Second Edition. [b]Preschool Language Scales–Fifth Edition Composite Standard Score (SS). [c]Vineland Adaptive Behavior Scales–Second Edition Composite Score.

score of 100 ($SD = 15$). Scores on the Vineland-2 were used descriptively to characterize participants in this study.

Child Measures

All participants completed two standardized norm-referenced assessments. The Preschool Language Scales–Fifth Edition (Zimmerman, Steiner, & Pond, 2011) is a measure of expressive and receptive communication skills for children ages 0;2–7;11 (Zimmerman et al., 2011). To be included in the study, participants had to score no lower than 1 SD (85) below the average standard score (100) on both Expressive Communication and Auditory Comprehension subscales. The Kaufman Brief Intelligence Test–Second Edition (Kaufman & Kaufman, 2004) is a measure of verbal and nonverbal intelligence for individuals between the ages of 4;0 and 90;11 (Kaufman & Kaufman, 2004). An additional inclusion criterion was that participants had to score no lower than 1 SD (85) below the average standard score (100).

In addition, participants completed two criterion-referenced assessments: a first-order false belief task (modeled after Hogrefe, Wimmer, & Perner, 1986; Tager-Flusberg & Sullivan, 2000) designed to measure TofM development (TofM task). During the TofM task, the researcher presented a familiar container filled with unexpected contents (i.e., a crayon box containing paper horses). The researcher asked the participants, "What do you think is inside?" (control question). After providing the expected answer (i.e., crayons), the researcher showed the participant that there were paper horses inside the box. Then, the researcher closed the box and asked three additional questions: (a) "What is really in the box?" (reality control question), (b) "If I show the crayon box to your <insert mom/dad>, will s/he know what is in here?" (ignorance question), and (c) "What will s/he think is in the box?" (false-belief question). The false-belief question was scored as either 0 or 1. Binary pass/fail scoring of TofM tasks has been implemented in other studies related to repair requests (e.g., John et al., 2009) and was utilized in this study. A pass score was assigned if participants answered the false-belief question correctly by indicating "crayons." The TofM task lasted approximately 3 min.

A hearing screening was administered to verify that hearing was within normal limits. The participants' hearing was screened in a quiet room with pure tones at 1000, 2000, and 4000 Hz at 20 dB in each ear. All participants (with one exception) passed the hearing screening at this presentation level in both ears. One participant required 30-dB presentation level at 1000 Hz in his left ear. His mother reported he had tubes placed during his second year of life and believed he had fluctuating hearing status prior to that. She reported he recently passed his well-child hearing screening.

Shared Book Reading Task

During the second research session, a researcher engaged the participants in a structured, shared book reading activity. The shared book reading activity provided a naturalistic context with elicitations for social interaction (Vogler-Elias, 2009). Shared book reading task materials included the children's book *The Bear Ate Your Sandwich* (Sarcone-Roach, 2015), a set of toy objects (i.e., four small plastic toy dogs and three small fish), and color pictures that related to the content of the book. The book was selected because it was focused toward a child audience, was of sufficient length to reasonably accommodate the experimental elicitations that were embedded throughout, and had been recently published. The final criterion was implemented to increase the likelihood that the participants were unfamiliar with the book. During the shared book reading task, the researcher and the child each sat on the round rugs that had been placed approximately 4 ft from the video recorder. All sessions were recorded using a Panasonic SDR-S50P/PC video recorder mounted on a tripod. This setup was standard across participants.

The shared book reading activity began with 1–2 min of unstructured conversation and/or play with familiar toys (i.e., toys from their home or something they liked to play with at their preschool). Then, the researcher introduced the book and activity. The researcher indicated that she and the participant were going to read a book together and that the child could help her answer some questions about the story and the toys and pictures related to the story. While giving the instructions, the researcher also provided a verbal prompt related to repairing by stating, "If you don't understand something I say, it's okay to tell me that you don't understand."

If during the activity, the participant initiated a repair request, the researcher acknowledged the request by providing an appropriate response (e.g., additional information, repetition of the original utterance). If the child became disengaged in the task and/or wandered away, the researcher provided spoken redirection, using the rug as a cue (i.e., "Please come sit on the yellow circle and we'll finish up the book."). The average time from the presentation of the title of the book to the examiner's closing was 9 min 26 s (range: 8 min 23 s to 12 min 33 s).

Experimental Communication Elicitations

During the shared book reading activity, the researcher provided 24 standardized short questions and comments (average mean length of utterance in morphemes = 5.5) that related to the characters, setting, and actions within the book and the standard set of toy objects and color pictures related to the content of the book. Such questions and comments have been used to assess young children's emerging comprehension skills (see Paris & Paris, 2003; Skarakis-Doyle & Demspey, 2008). Table 2 presents each of the structured questions and comments organized by condition and type. Each reflected one of two conditions dependent of the information provided: insufficient (IN) or sufficient (S). Twelve questions/comments associated with each condition were delivered in the context of book reading. Providing insufficient information resulted in an opportunity for the child to initiate a repair request. Elicitations were insufficient in one of two ways, either via a missing referent (e.g., "What is the cat doing?" in absence of a cat) or ambiguous referent ("What is that one doing?" in the presence of multiple agents). Sufficient elicitations provided a comparison to examine participants' overall engagement with the task. The sufficient elicitations were designed to be morphologically similar to the insufficient elicitations with mean length of utterance in morphemes of 5.67 and 5.17, respectively.

Within insufficient and sufficient information conditions, elicitations prompted obligatory (O) and nonobligatory (NO) responses. The obligatory response type was a request for information (i.e., a question) that the researcher initiated. The nonobligatory response type was a provision of information that the researcher provided (i.e., a statement; see examples in Table 2). Thus, there were four different response elicitations: insufficient information for an

Table 2. Structured communicative elicitations presented during shared book reading task.

	Condition	
Type	**Insufficient**	**Sufficient**
Obligatory	What is the cat doing? (MR)	What is the butterfly doing?
	Do you have the pencil? (MR)	Where is the bear climbing?
	Where is the car going? (MR)	Where is the bear going?
	What is that one doing? (AR)	What is the girl doing?
	Where is the green one? (AR)	What is the bear doing?
	What did the cat eat? (MR)	Who ate the sandwich?
Nonobligatory	I like this brown bear. (AR)	Peanut butter and jelly is my favorite.
	The bee is sleeping. (MR)	I like berries!
	The purple boat is my favorite! (MR)	The bear can hang upside down!
	This fish is very stinky. (AR)	The man has a silly bee costume!
	I like that one! (AR)	The bear is hiding!
	I love that one! (AR)	I love the black dog!

Note. MR = missing referent; AR = ambiguous referent.

obligatory response (IN-O; "What is the cat doing?"), insufficient information for a nonobligatory response (IN-NO; "I like this brown bear."), sufficient information for an obligatory response (S-O; "What is the butterfly doing?"), and sufficient information for a nonobligatory response (S-NO; "Peanut butter and jelly is my favorite.").

The presentation order was quasirandomized across the shared book reading task. This was necessary because the elicitations (questions/comments) were related to the story's narrative and thus could not be randomly presented across participants. Elicitations of the same type (e.g., IN-O) were never presented back-to-back. In addition, elicitations from the same condition (i.e., insufficient or sufficient information) were never presented more than twice in a row, and elicitations from the same response type (obligatory or nonobligatory response) were never presented more than twice in a row.

Coding and Dependent Variables

The participants' verbal and nonverbal behaviors following elicitations with either insufficient or sufficient information were coded by a trained undergraduate research assistant using a preestablished coding scheme. The research assistant was naïve to the purpose of the study and the participants' performance on the TofM task and language and cognitive assessment measures. After reading the coding manual, the assistant completed a 60-min training session during which the researcher provided direct instruction on each specific code, as well as direct instruction on the item-by-item fidelity and procedural fidelity checklists (outlined in a subsequent section). In addition to direct instruction, the researcher provided two to four examples of each coded behavior and utilized a participant video file as additional context for how each code may be applied.

After direct training, the research assistant independently coded one video file (i.e., one shared book reading task in its entirety) as well as a fidelity check for the same file. The researcher coded the training video file and calculated

interrater reliability between the research assistant and the researcher for the 12 individual codes (represented in Table 3), as well as each of the items on the procedural fidelity checklist (eight components) and each of the components of the item-by-item fidelity check. Reliability was computed by dividing the number of instances of agreement by the total number of opportunities and multiplying by 100. Reliability on the training file across individual codes ranged from 83.3% to 100%. The researcher and the research assistant met a second time to discuss instances of disagreement, consulting the coding manual as needed.

Table 3 provides the behaviors and definitions that were used to measure repair requests following elicitations of obligatory and nonobligatory responses with insufficient information and to capture participants' verbal and nonverbal behaviors following elicitations with sufficient information. Definitions were adapted from studies examining discourse management, comprehension monitoring, and communication repair (Brinton & Fujiki, 1984; John et al., 2009; Morisseau et al., 2013; Revelle et al., 1985). Participants' emission of repair requests was contingent on and temporally linked to each elicitation. The first behavior emitted within 5 s following the examiner's elicitation was coded. The 5-s window was selected based on previous relevant investigations that have used "online" tasks (i.e., children's comprehension monitoring skills and the expectancy violation detection task; Skarakis-Doyle & Dempsey, 2008).

Intercoder Reliability

A second trained undergraduate research assistant naïve to the purpose of the study coded 32% of the experimental sessions for reliability on the dependent variables. Reliability was calculated for each of the 12 individual codes represented in Table 3. Reliability was computed by dividing the number of instances of agreement by the total number of elicitations and multiplying by 100. Reliability across individual codes ranged from 90.6% to 100%.

Table 3. Definitions used to code behaviors following insufficient and sufficient elicitations.

Behavior and definition	Example
Types of repair requests	
General request: Child verbally requests general clarification or repetition.	"What?" or "Huh?"
Specific verbal request for clarification: Child requests clarification and provides specific information related to the nature or topic of the breakdown.	"Which one?" "Where is the cat?"
Statement specifying the insufficiency or correction of error: Child verbally indicates something that was insufficient about the examiner's communicative bid.	"I don't see a cat." "There's no car." "Not the bee, the bear."
General statement indicating lack of comprehension: Child verbally indicates that they do not understand the examiner's communicative bid.	"I don't know." "I don't understand."
Other verbal and nonverbal behaviors	
Provision of information that matches or mirrors examiner's bid: Child expresses idea that is similar to examiner's communicative bid and may share information about their preference for something. The child may change the demonstrative pronoun or the referent.	"I like that one, too!" Researcher: "I like the black dog." Child says: "I like the white dog."
Verbal provision of information, maintains, or shades topic: Topics are considered to be maintained if the child acknowledges the clinician's utterance (e.g., Mmhmm) and responds to a question directly or agrees with the clinician (e.g., "Okay."). Topics are considered to be shaded if some component of the previous utterance is maintained but slightly shifted the subject matter (see Brinton & Fujiki, 1984).	Researcher: "What's the butterfly doing?" Child: "Flying." Researcher: "The bear is sleeping." Child: "But I can see his butt."
Verbal provision of information, introduces new topic (e.g., child shifts to unrelated topic/subject): The "new topic" code should be used when the child introduces a completely new topic without any part of the clinician's previous utterance/topic in what the child is now talking about.	Researcher: "The bear is sleeping." Child: "I like animal crackers."
Verbal request for information: Child requests additional information following a sufficient opportunity.	Researcher: "What's the girl doing?" Child: "Where is the girl?"
Gaze check: Child shifts gaze from book toward examiner or from examiner toward book but does not hold gaze (up to 2 s).	Child's gaze moves back and forth between book and examiner or examiner and book.
Sustained gaze on examiner: Child shifts gaze from book toward examiner and sustains gaze for more than 2 s.	Child's gaze is on book, then shifts toward examine, and continues looking at examiner.
Sustained gaze on book or other task materials (i.e., pictures, toys): Child may be checking correspondence between communicative bid and the environment and/or attempting to make an inference.	Child's gaze is on book and continues looking at book without changing gaze or providing a verbal response.
Off-task behavior verbal or nonverbal: Child engages in off-task behavior that begins immediately following examiner's bid.	Child gets up from rug or makes nonspeech noises or lays head on floor.

Fidelity

Procedural fidelity was completed for 100% of experimental sessions by a trained undergraduate research assistant. For each elicitation, the research assistant coded whether the elicitation was delivered in the correct sequence, the child was attending to the examiner and/or book when the elicitation was implemented, and the elicitation was intelligible. Item-by-item fidelity was calculated by dividing the number of accurately implemented elicitations by the total number of elicitations (24) and multiplying by 100. Item-by-item fidelity was 99.8% for items presented in correct order, 100% for participant attending to the task, and 100% for intelligible elicitations.

General procedural fidelity was derived from a task analysis of eight broad components of shared book reading task: (a) Researcher talks or plays with the child during setup, (b) researcher provides spoken instructions related to task, (c) researcher reads title of the book, (d) researcher indicates book's author, (e) researcher asks the child a question to build interest in the story, (f) researcher provides verbal praise for child's attention to the task, (g) researcher follows the child's attentional focus during off-script conversational turns, and (h) researcher closes the book by asking a question relating the book to the child's life. The general procedural components were based on a dialogic book reading intervention task analysis reported by Rahn (2013). Procedural fidelity was calculated by dividing the number of accurately implemented task components by the total number (eight) for each participant and multiplying by 100. Procedural fidelity across participants was 100%. A second trained undergraduate research assistant coded procedural and general fidelity for 32% of the experimental sessions. Interrater reliability across the three item-by-item and eight general procedural fidelity codes ranged from 98.6% to 100%.

Design and Analyses

A within-subject experimental design was implemented to compare participants' productions of repair requests (dependent variable) following elicitations with sufficient and insufficient information of obligatory and nonobligatory responses (independent variables). Additional independent variables included participants' age, maternal education level, self-reported family income, total language score, and IQ. Participants' performance on the TofM task was also utilized as a dependent variable. Given the modest sample size, nonparametric statistical anlayses were utilized. A specific rationale for each statistical test is provided in the

subsequent sections. Analyses were completed in RStudio Version 1.0.153 (R Core Team, 2017).

Total Repair Requests

Wilcoxon signed-ranks tests were utilized to compare the number of repair requests participants produced following insufficient-obligatory and insufficient-nonobligatory elicitations. The Wilcoxon signed-ranks test is a nonparametric tool that allows for comparison of matched pairs/related samples by determining which member of any pair is greater (i.e., provides direction of the difference; Siegel & Castellan, 1988). Effect size estimates were calculated according to Rosenthal (1994) and interpreted according to Cohen's (1988) criteria for *r*-family estimates: 0.10 (small), 0.30 (medium), and 0.50 (large).

TofM Performance

Chi-square tests were implemented to examine differences in repair requests produced by participants who passed the TofM task compared to those who failed the TofM task. Participants were categorized as repairers or nonrepairers based on the total number of repair requests they produced following insufficient elicitations.

Utilizing a categorical variable (repairer/nonrepairer) facilitated differentiation between participants who tended to produce repair requests and those who did not and allowed for between-participant comparisons based on this feature. Descriptive statistics of total repair requests suggested they were approximately normally distributed ($M_{\text{total repairs}}$ = 5.12, SD = 2.12). Given the distribution of total repair requests across participants, participants who produced more than six were categorized as *repairers.* Participants who produced six or fewer total repair requests were categorized as *nonrepairers.* This criterion yielded a group of participants who produced a total number of repair requests more than 1 SD above the mean. Moreover, this criterion was utilized because it represented the production of at least one repair request following both types of communicative elicitations (obligatory and nonobligatory) and the production of repair requests for more than 50% of the 12 total insufficient elicitations.

Relationship Between Demographic and Participant-Level Variables and Production of Repair Requests

Spearman's rank order correlation was used to examine the relationship between demographic and participant-level variables and production of repair requests. Spearman rank order correlation examines the direction and strength of relationship between variables, which may be ordinal in scale. Wilcoxon Mann–Whitney *U* tests were used to determine if there were differences in average IQ, average total language score, or average chronological age between participants categorized as *repairers* versus *nonrepairers.* Although Shapiro–Wilk tests confirmed that the distribution of scores for IQ and total language was approximately normal, the distribution of chronological ages of participants was positively skewed and violated the assumption of normality for independent-samples *t* test. Thus, the

Mann–Whitney *U* test provided a more conservative nonparametric approach to test whether two independent groups had been sampled from the same population (Siegel & Castellan, 1988).

Results

Given the relative novelty of a shared book reading task to examine repair requests, it was important to descriptively examine participants' overall engagement with the task and responsiveness to the sufficient elicitations. Participants verbally responded to 91.33% of six total sufficient elicitations for obligatory responses by providing information that maintained the topic. They verbally responded to 51.33% of six total sufficient elicitations for nonobligatory responses by providing information that maintained the topic. Other observed behaviors following sufficient elicitations for nonobligatory responses included sustained attention on the examiner, book or task materials (33.3% of responses), verbal request for information (8.67% of responses), and gaze checking between examiner and book (6% of responses).

Differences in Repair Requests Following Elicitations for Obligatory and Nonobligatory Responses

A Wilcoxon signed-ranks test was utilized to compare the number of repair requests participants produced following insufficient elicitations for obligatory and nonobligatory responses. Participants produced a significantly greater number of repair requests following elicitations for obligatory responses compared to nonobligatory responses, z = 3.55, p < .001, r = .50. Participants initiated repair requests for an average of 54% of insufficient elicitations for obligatory responses (M = 3.24, SD = 1.23, range: 0–6) and 31.3% of insufficient elicitations for nonobligatory responses (M = 1.88, SD = 1.33, range: 0–5).

A Wilcoxon signed-ranks test indicated there was not a statistically significant difference observed in the number of repair requests 4-year-old typically developing children produced following insufficient elicitations that contained an ambiguous referent (M = 2.28, SD = 1.57, range: 0–5) compared to insufficient elicitations that contained a missing referent (M = 2.84, SD = 1.21, range: 0–5), z = 1.39, p = .17, r = .20.

Table 4 displays the distribution of repair request types produced by participants following elicitations with insufficient information for obligatory and nonobligatory responses. Specific clarification requests (e.g., "Which one?") constituted 74.4% of total repair requests following elicitations for nonobligatory responses compared to 43.2% for obligatory responses. General statements indicating lack of comprehension (e.g., "I don't know") constituted 22.2% of total repair requests following obligatory request elicitations compared to 2.1% of total repair requests following nonobligatory request elicitations. There were smaller differences in productions of statements specifying information insufficiency (e.g., "I don't see a cat."), and general requests

Table 4. Number and percentage of total repairs for different forms of repair requests following insufficient elicitations for obligatory and nonobligatory responses.

Form of repair	Obligatory	Nonobligatory
General request for clarification	3/81 (3.7%)	3/47 (6.4%)
Specific request for clarification	35/81 (43.2%)	35/47 (74.5%)
Statement specifying insufficiency	25/81 (30.9%)	8/47 (17.0%)
Statement indicating general lack of comprehension	18/81 (22.2%)	1/47 (2.1%)

for clarification (e.g., "What?") were similar across obligatory and nonobligatory elicitations.

Performance on TofM Task and Production of Repair Requests

Of the 25 participants in the study, seven (28%) met the criterion of producing greater than six repair requests following insufficient elicitations and were considered repairers. Chi-square tests were completed to examine differences in the number of repairers who passed and failed the TofM task. Seventeen participants passed the TofM task. Six of these participants were categorized as repairers, and 11 were categorized as nonrepairers. Eight participants failed the TofM task. One of these participants was categorized as a repairer, and seven were categorized as nonrepairers. Participants who passed a TofM task were no more likely to be categorized as repairers compared to participants who failed the TofM task, $\chi^2(1) = 1.40$, $p = .23$.

Figure 1 displays participants' performance following insufficient elicitations. The group of participants on the left side of the figure are those who did not pass the TofM task; the group on the right passed the TofM task. Visual inspection of the figure indicates that there is a greater number of repairers who passed the TofM task ($n = 6$) than those who did not ($n = 1$). In addition, half of the repairers who passed the TofM task responded at a higher rate to the insufficient elicitations than the one repairer who failed the TofM task. Thus, there is a tendency for participants who passed the TofM task to repair insufficient elicitations more frequently than those who did not pass the TofM task. The figure also suggests that altering the criterion to classify participants as repairers or nonrepairers would not alter the results. For example a cutoff of greater than or equal to 50% would not yield a different outcome than the current criterion of greater than 50%.

Demographic and Participant-Level Variables' Relationship to Repair Requests

Spearman's rank order correlation was used to examine the relationship between demographic and participant-level variables and production of repair requests. Table 5 details the bivariate correlations between total repair requests and participants' age, maternal education level, self-reported family income, performance on the TofM task, total language score, and IQ, all of which were statistically nonsignificant. Overall, there were weak bivariate
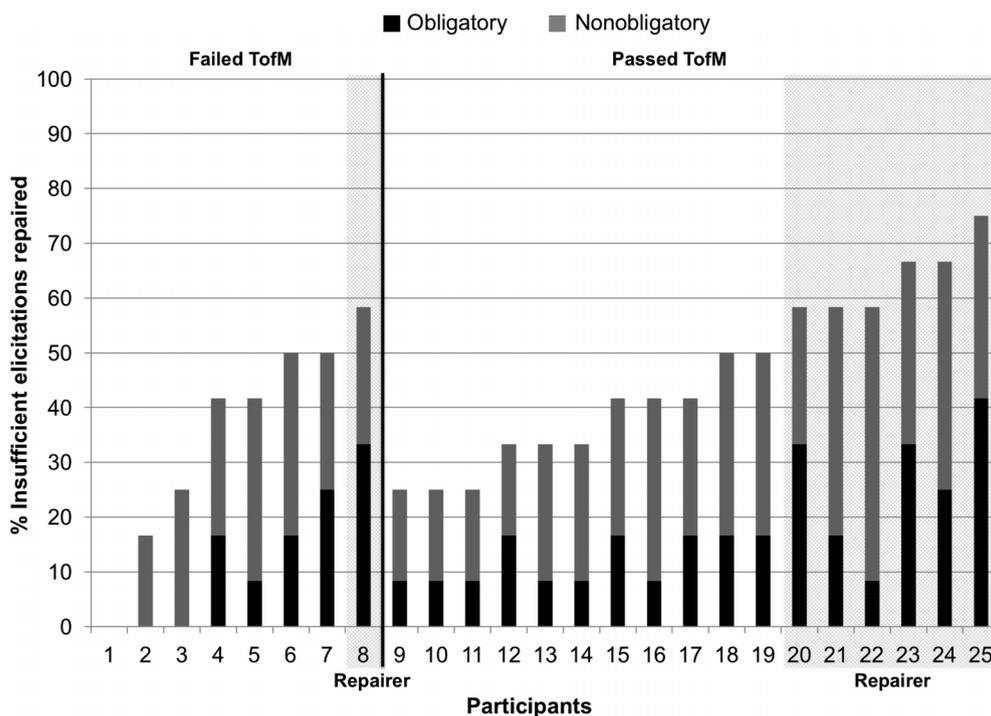
relationships between repair requests and age, performance on the TofM task, and total language score. Family income and IQ did not appear to have an association with total repair requests.

Wilcoxon Mann–Whitney U tests were used to determine if there were differences in average IQ, average total language score, or average chronological age between participants categorized as repairers versus nonrepairers. There were no statistically significant differences in mean IQ between participants categorized as repairers ($M = 111$, $SD = 7.28$) versus nonrepairers ($M = 113$, $SD = 8.22$), $U = 70$, $p = .69$; mean Preschool Language Scales Total Language Score between participants categorized as repairers ($M = 115.71$, $SD = 10.47$) versus nonrepairers ($M = 117.5$, $SD = 14.59$), $U = 65$, $p = .93$; or mean chronological age between participants categorized as repairers ($M = 53.4$, $SD = 2.8$) versus nonrepairers ($M = 52.6$, $SD = 3.8$), $U = 48$, $p = .38$. In addition, a chi-square test indicated typically developing girls were no more likely to be categorized as repairers compared to typically developing boys, $\chi^2(1) < 0.001$, $p = 1.00$.

Discussion

The purpose of this study was to examine if 4-year-old typically developing children produce repair requests following insufficient elicitations for obligatory and nonobligatory responses within the context of a shared book reading activity and to examine the relationship between typically developing 4-year-old children's performance on a TofM task and their productions of repair requests. It is important to note that, overall, the children were highly responsive to the task. When provided with sufficient elicitations for obligatory responses (i.e., questions), participants responded verbally more than 90% of the time. Even when provided with elicitations for nonobligatory responses (i.e., comments), participants responded verbally more than half of the time. However, when given insufficient information, the children were much less likely to respond, particularly when a question was asked. Participants provided verbal responses 90% of the time when provided a sufficient elicitation for an obligatory response and only 51% of the time when provided an insufficient elicitation for an obligatory response. The difference in response rate between sufficient and insufficient elicitations for nonobligatory responses was less dramatic with rates of 51% and 31%, respectively. Most likely, this was due to the

Figure 1. Percentage of obligatory and nonobligatory insufficient elicitations repaired. TofM = theory of mind task.

Findings Related to Insufficient Elicitations for Obligatory Versus Nonobligatory Responses

Study results suggest the pragmatic function of the insufficient utterance (which creates the elicitation for repair) is an influential variable in our understanding of repair requests. It is likely that obligatory elicitations (e.g., questions, commands) have a stronger social expectation

Table 5. Correlation matrix for total number of repair requests produced by participants following insufficient elicitations.

Variable	1	2	3	4	5	6
Total repairs	.36	.19	.09	.23	.24	.09
1. Age	—	−.12	−.02	.53	.17	−.17
2. Maternal education		—	.28	−.28	.03	−.11
3. Income			—	−.35	.13	.05
4. Theory of mind task				—	.17	.23
5. Total language score[a]					—	.61
6. IQ[b]						—

Note. Bivariate correlation coefficients are presented, all of which are statistically nonsignificant.

[a]Total Language Standard Score from Preschool Language Scales–Fifth Edition. [b]Verbal and Nonverbal IQ Composite Standard Score from Kaufman Brief Intelligence Test–Second Edition.

overall reduced pragmatic demand to respond to a general statement.

to respond in a particular way (i.e., requests for information carry the expectation that the responder will provide information; Davis, Reichle, Southard, & Johnston, 1998). This is similar to an idea explored by Fey et al. (1988), who noted that nonobligatory elicitations (e.g., statements) do not carry the expectation that a child respond in a specific way. Consequently, in the current study, question elicitations may have been more likely to be repaired compared to the statement elicitations. A similar trend was observed following elicitations with sufficient information.

It is important to note that only 28% of the children met the specified criteria of producing greater than six repair requests to be considered a repairer. The relatively low percentage indicates that even for 4-year-old children who are developing typically have difficulty maintaining conversation when information is missing or ambiguous. One reason for the difficulty may have been the experimental naturalistic task than has been previously utilized for examining repair requests (see Martin et al., 2017). The shared book reading activity afforded the opportunity to examine repair requests in the context of a task with some degree of external validity. Previous studies with typically developing children have utilized elicitations for obligatory responses, typically implemented in referential communication tasks, direction-following tasks, or cooperative building tasks (e.g., Flavell et al., 1981; Morisseau et al., 2013; Revelle et al., 1985; Walters & Chapman, 2000). These tasks provide an opportunity to examine repair skills within an experimental environment with high internal validity and clearly defined

speaker and listener roles. That is, the researcher is providing instructions, and the child is listening to the instructions, with clear expectations to complete a specified task. Interactions during book reading are likely to vary across caregivers and their child. Some caregivers may routinely read story books straight through without pausing to discuss the book. Thus, the expectation for conversation while reading a book may be less clear to the child than if completing a structured task. The task used in the current study proved to be sensitive to capturing response differences in obligatory and nonobligatory responses, but it was also relatively ambiguous. Thus, to further increase ecological and external validity of evidence related to repair requests, there remains a need to continue to examine them within both structured and more dialogic, less structured tasks.

To examine how the form (i.e., questions vs. statements) of elicitations for communication impacts repair requests produced by children, we utilized two different types of insufficient elicitations (ambiguous referent vs. missing referent). We did not anticipate differences in total repair requests following each type. Previous studies have collapsed these two types into a broad category of inadequate content (Walters & Chapman, 2000). The two different types of insufficient elicitations (i.e., missing referent and ambiguous referent) allowed for variation in the task while mitigating the risk of threats to internal validity by confounding the ability to examine the relationship between obligatory versus nonobligatory elicitations.

The results were consistent with our hypothesis—there were no statistically significant differences in repair requests based on the type of insufficiency. This finding suggests that the children were able to frequently identify insufficient information in the communication exchange, and their responses were not sensitive to the type of communication violation. Our findings do differ from a set of previous studies that have demonstrated different types of insufficient information differentially influence repair requests (i.e., Beal & Belgrad, 1990; Markman, 1979; Walters & Chapman, 2000). For example, lengthy or distorted messages may be less likely to receive a repair request compared to messages that contain inadequate content (Walters & Chapman, 2000). Although this study did not reveal response differences when examining the repair requests of typically developing children, differences may emerge with clinical populations. For example, children with receptive vocabulary weaknesses may be more likely to fail to request repair when the referent is missing because they are unaware that the referent is missing. When designing interventions and establishing a criterion for responding, clinicians should consider the way in which a message is insufficient as a potentially influential variable.

It is important to note that there were differences in the repair request forms following insufficient elicitations for obligatory (i.e., questions) and nonobligatory (i.e., statements) responses, with a greater number of specific requests for clarification for nonobligatory responses. This suggests some sensitivity to the form of the repair elicitation. For both elicitation types, specific requests for clarification were among the most frequently used response, followed by statements specifying insufficiency, suggesting that the 4-year-old participants in this study were able to identify specific causes of communication insufficiency. It is unknown if younger children would respond more uniformly across the insufficiency types or how responses further develop throughout the preschool years.

Findings Related to TofM Task and Production of Repair Requests

A second aim of this study was to examine the relationship between performance on the TofM task and categorization as a repairer/nonrepairer. Seventeen participants passed, whereas eight did not pass the TofM task. There were no statistically significant differences between the performance of children who passed when compared with the performance of those who failed the TofM task with respect to the likelihood of being categorized as a repairer versus nonrepairer. Although there is some evidence that suggests a link between children's development of TofM and their abilities to recognize and repair communication failures (Bosco et al., 2006; Bosco & Gabbatore, 2016), evidence from this study did not support this relationship. One potential explanation for these findings could be the ceiling effect performance levels on the TofM task by this study's high-performing typically developing participants (approximately 70% of the participants passed). A TofM task that yielded greater differentiation among typically developing participants may have been a more sensitive measure to examine the relationship between perspective-taking abilities and repair requests. In addition, it is possible that using a TofM task with a higher degree of external validity, for example, the TofM inventory (Hutchins, Prelock, & Bonazinga, 2012), would have yielded greater performance differentiation. The TofM inventory is a parent report measure of TofM development that has emerging empirical evidence of reliability and strong construct validity for both typically developing children and children who experience differences in TofM development, such as children with autism spectrum disorder (Greenslade & Coggins, 2016). Alternatively, as Nelson (1998) posited, it may well be possible to acquire some perspective-taking skills in the absence of good performance on TofM elicited tasks if initial acquisition occurs in the routine of exposure to regularly occurring routines. Going forward, it will be important to further examine the relationship between TofM skills and repair behaviors in children who experience social communication weaknesses or language impairment to better understand the nature of these skills.

Demographic and Participant-Level Variables and Repair Requests

Results suggest that participant-level variables included in this study may not be highly influential variables in the production of repair requests among 4-year-old

typically developing children. Differences in age were not observed. Studies that have found differences in chronological age and repair requests have generally compared performance across children who differ in age by 1 or more years (e.g., Flavell et al., 1981; Morisseau et al., 2013; Revelle et al., 1985). The 12-month age range within this study represents a relatively short period of development in which we did not observe statistically significant differences in the production of repair requests between "young" and "old" 4-year-olds.

Notably, few studies have specifically examined the relationship between repair requests and receptive and expressive communication abilities or IQ level. Abbeduto et al. (2008) found a link between receptive language abilities and repairs among typically developing children. However, results from this study mirror the majority of available evidence, which has suggested the absence of a significant link between receptive language abilities and repair requests (e.g., Abbeduto et al., 1991, 1998; Walters & Chapman, 2000) and IQ and repair requests (Abbeduto et al., 1998).

We speculate that there may be other participant-level variables influencing repair requests, including a child's attention, a child's interest in a particular topic, a child's experience with instructional opportunities related to repairing communication breakdowns, partner responsivity, and familiarity between social partners. Children may be more likely to produce repair requests following insufficient utterances related to a highly motivating topic compared to utterances based on more neutral topics. Dollaghan (1987) noted a child's motivation to uncover an ambiguity or contradiction may influence the likelihood of repair.

The overall responsivity of a social partner during an interaction may also influence repair requests. High levels of responsivity may increase the likelihood that a child would initiate a repair. Moreover, the adequacy of the social partner's repair (following the child's repair request) may influence the likelihood of future repair requests. If a child receives inadequate information following their repair request, they may be less likely to produce future repair requests.

In addition to social partner responsivity, repair requests may also be a function of the familiarity between social partners and their communicative competence. Social partner familiarity remains a relatively unexplored variable within the repair request literature. If a child's social partner is a familiar person (i.e., sibling or caregiver), the child may feel more comfortable requesting a repair compared to a less familiar social partner. Conversely, if a child's social partner is unfamiliar, the child may be more reticent to request repair and may leave the communication breakdown unrepaired. A future research direction may be to examine the likelihood of repair requests when insufficient elicitations are provided by a familiar person (e.g., a primary caregiver) compared to an unfamiliar person (e.g., a researcher). Evidence related to the influence of familiarity between social partners on repair requests may potentially inform how interventionists design intervention that targets communication repair strategies. If children are more likely

to request repair when insufficient elicitations are implemented by a familiar adult, interventionists may partner with caregivers to initially create opportunities for repair requests and then progress to unfamiliar social partners.

Critically, a more nuanced understanding of some of the aforementioned variables that may affect repair requests could ultimately inform assessment and intervention. Empirical evidence related to the percentage of elicitations and under what conditions typically developing children request repair serves interventionists as they consider "typical" performance criterion and establish ecologically valid goals. This is an important pursuit given the limited number of intervention studies related to teaching repair requests (see Dollaghan & Katson, 1986; Ezell & Goldstein, 1991).

Limitations

This study relied on a relatively modest-sized, homogeneous sample of participants. The small sample size limits the statistical analyses that are appropriate to implement when examining the data. A larger sample size would allow for more complex modeling of the relationship between repair requests and participant-level variables such as TofM development and language skills. The participants in this sample represented a homogenous group with respect to self-reported race, household income, and maternal education. Thus, the study results represent a highly specified sample of participants who were predominantly White and upper middle class. The small sample size and homogeneity of participants limit the external validity and generalizability of the findings.

Another limitation is that this study did not sample a broad range of "typical" expressive and receptive communication skills demonstrated by 4-year-old typically developing children. The participants' average expressive and receptive communication skills fell 1 SD above the mean. It would be inappropriate to extend the results of this study to a broader population of 4-year-old typically developing children as the sample in this study demonstrated above average communication abilities rather than a broad range of average communication abilities. Children with low IQ and/or language abilities may perform differently. Moreover, we may observe associations between participant-level variables and repair requests among children with a broader range of IQ and/or language abilities. Although the study sample was homogeneous based on both demographic variables and language and cognitive abilities, results from this study lay a foundation for researchers for further study of repair requests produced by children developing typically and those with language weaknesses.

The experimental task used to elicit repair request in this study was based on a single story book. The impact of the particular story of children's repair requests remains unknown as this was the first time this task was used. To more fully understand the repair request skills of children, it will be important to consider other tasks, which may have to be modified based on the child's developmental level.

Similarly, the TofM task utilized in this study provides only one static method to measure the development of perspective-taking abilities, and this measure relied on the response to a single question to determine whether a participant passed the task. A different measure or, more ideally, a set of measures of TofM development or social communication may yield different results with respect to the link between advanced perspective-taking abilities and children's productions of repair requests.

Future Directions

There remains a need to better understand communication repair requests among typically developing children. A first step in future research would be to replicate the findings of this study with a larger and more diverse sample with respect to race, household income, and maternal education, as well as a broader range of cognitive and language abilities. A larger, more heterogeneous sample would increase the external validity of findings and facilitate better understanding of the relationship between participant-level variables (i.e., expressive and receptive communication or language abilities, IQ, TofM development) and the production of repair requests. Studies should also explore the influence of variables previously discussed, including the child's interest in a particular topic, attention, motivation, familiarity between social partners, responsivity of social partner, and language environment. Beyond the influence of these factors, future investigations should examine how repair requests emerge within children's development (i.e., conduct longitudinal analyses of repair requests) and within more naturalistic, less structured interactions (e.g., conversation). Relatedly, future studies may examine the link between communication repair skills elicited during structured, experimental tasks and communication repair behaviors produced in unstructured real-time interactions.

Further research is needed to more fully understand preschool-age children's productions of repair requests. Critically, there remains a need to examine repair requests among children who experience social communication challenges and who may be at risk for experiencing breakdowns in communication, for example, children with autism spectrum disorder. Very few studies have examined repair requests among children with autism spectrum disorder (see Martin et al., 2017). If, indeed, the production of repair requests is a particular area of weakness for children with autism spectrum disorder, researchers and interventionists may work to understand how to effectively target this skill and monitor over time both the proximal and distal effects of intervention. It would also be beneficial to know if children's use of repair requests changes with different levels of support and prompting from the communication partner. This information could be used to develop intervention programs for children.

The current study serves as an initial step toward better understanding the verbal repair requests produced by typically developing 4-year-old children. Results suggest that the use of children's repair requests is heavily influenced by the function of the conversational partner's communication. Results also suggest that not all 4-year-old children have mastered the repair request use when evaluated in a naturalistic shared book reading task. There is a need to investigate repair requests produced by typically developing children and children with language impairment. Additional evidence will ultimately serve interventionists as they assess the pragmatic skills of children and implement interventions targeting communication repair requests for individuals who demonstrate difficulties with communication repair.

Acknowledgments

References

Abbeduto, L., Davies, B., Solesby, S., & Furman, L. (1991). Identifying the referents of spoken messages: Use of context and clarification requests by children with and without mental retardation. *American Journal of Mental Retardation, 95*(5), 551–562.

Abbeduto, L., Murphy, M. M., Kover, S. T., Giles, N. D., Karadottir, S., Amman, A., . . . Nollin, K. A. (2008). Signaling noncomprehension of language: A comparison of fragile X syndrome and Down syndrome. *American Journal of Mental Retardation, 113*(3), 214–230.

Abbeduto, L., Short-Meyerson, K., Benson, G., & Dolish, J. (1997). Signaling of noncomprehension by children and adolescents with mental retardation effects of problem type and speaker identity. *Journal of Speech, Language, and Hearing Research, 40*(1), 20–32.

Abbeduto, L., Short-Meyerson, K., Benson, G., Dolish, J., & Weissman, M. (1998). Understanding referential expressions in context: Use of common ground by children and adolescents with mental retardation. *Journal of Speech, Language, and Hearing Research, 41*(6), 1348–1362.

Aviezer, O. (2003). Bedtime talk of three-year-olds: Collaborative repair of miscommunication. *First Language, 23*(1), 117–139.

Bates, E. (1976). *Language and context: The acquisition of pragmatics.* New York, NY: Academic Press.

Beal, C. R., & Belgrad, S. L. (1990). The development of message evaluation skills in young children. *Child Development, 61*(3), 705–712.

Bloom, L., & Lahey, M. (1978). *Language development and language disorders.* New York, NY: MacMillan.

Bonitatibus, G. (1988). Comprehension monitoring and the apprehension of literal meaning. *Child Development, 59*(1), 60–70.

Bosco, F. M., Bucciarelli, M., & Bara, B. G. (2006). Recognition and repair of communicative failures: A developmental perspective. *Journal of Pragmatics, 38*(9), 1398–1429.

Bosco, F. M., & Gabbatore, I. (2016). Theory of mind in recognizing and recovering communicative failures. *Applied Psycholinguistics, 38*(1), 57–88.

Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual Review of Psychology, 53*(1), 371–399.

Brinton, B., & Fujiki, M. (1982). A comparison of request–response sequences in the discourse of normal and language-disordered children. *Journal of Speech and Hearing Disorders, 47*(1), 57–62.

Brinton, B., & Fujiki, M. (1984). Development of topic manipulation skills in discourse. *Journal of Speech and Hearing Disorders, 27*(3), 350–358.

Brinton, B., Fujiki, M., Loeb, D. F., & Winkler, E. (1986). Development of conversational repair strategies in response to requests for clarification. *Journal of Speech and Hearing Disorders, 29*(1), 75–81.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Earlbaum.

Davis, C. A., Reichle, J., Southard, K., & Johnston, S. (1998). Teaching children with severe disabilities to utilize nonobligatory conversational opportunities: An application of high-probability requests. *Journal of the Association for Persons With Severe Handicaps, 23*(1), 57–68.

Dollaghan, C. A. (1987). Comprehension monitoring in normal and language-impaired children. *Topics in Language Disorders, 7*(2), 45–60.

Dollaghan, C. A., & Kaston, N. (1986). A comprehension monitoring program for language-impaired children. *Journal of Speech and Hearing Disorders, 51*(3), 264–271.

Ezell, H. K., & Goldstein, H. (1991). Observational learning of comprehension monitoring skills in children who exhibit mental retardation. *Journal of Speech and Hearing Disorders, 34*(1), 141–154.

Feldman, C. F., & Kalmar, D. (1996). You can't step in the same river twice: Repair and repetition in dialogue. In C. Bazzanella (Ed.), *Repetition in dialogue* (pp. 78–89). Tübingen, Germany: Niemeyer.

Fey, M. E., Warr-Leeper, G., Webber, S. A., & Disher, L. M. (1988). Repairing children's repairs: Evaluation and facilitation of children's clarification requests and responses. *Topics in Language Disorders, 8*(2), 63–84.

Flavell, J. H. (2004). Theory-of-mind development: Retrospect and prospect. *Merrill-Palmer Quarterly, 50*(3), 274–290.

Flavell, J. H., Speer, J. R., Green, F. L., August, D. L., & Whitehurst, G. J. (1981). The development of comprehension monitoring and knowledge about communication. *Monographs of the Society for Research in Child Development, 46*(5), 1–65.

Greenslade, K. J., & Coggins, T. E. (2016). Brief report: An independent replication and extension of psychometric evidence supporting the theory of mind inventory. *Journal of Autism and Developmental Disorders, 46*(8), 2785–2790.

Halle, J., Brady, N. C., & Drasgow, E. (2004). Enhancing socially adaptive communicative repairs of beginning communicators with disabilities. *American Journal of Speech-Language Pathology, 13*(1), 43–54.

Happé, F., & Loth, E. (2002). 'Theory of mind' and tracking speakers' intentions. *Mind & Language, 17*(1–2), 24–36.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Brookes.

Hogrefe, G. J., Wimmer, H., & Perner, J. (1986). Ignorance versus false belief: A developmental lag in attribution of epistemic states. *Child Development, 57,* 567–582.

Hutchins, T. L., Prelock, P. A., & Bonazinga, L. (2012). Psychometric evaluation of the theory of mind inventory (ToMI): A study of typically developing children and children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 42*(3), 327–341.

Inglebret, E., Bailey, S., Clothiaux, J. A., Skinder-Meredith, A., Monson, K., & Cleveland, L. (2017). Reporting of socioeconomic status in pediatric language research. *American Journal of Speech-Language Pathology, 26*(3), 1042–1052.

John, A. E., Rowe, M. L., & Mervis, C. B. (2009). Referential communication skills of children with Williams syndrome: Understanding when messages are not adequate. *American Journal on Intellectual and Developmental Disabilities, 114*(2), 85–99.

Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman Brief Intelligence Test–Second Edition (KBIT-2)*. Bloomington, MN: Pearson.

Lahey, M. (1988). *Language development and language disorders*. New York, NY: MacMillan.

Markman, E. M. (1979). Realizing that you don't understand: Elementary school children's awareness of inconsistencies. *Child Development, 50,* 643–655.

Martin, G. E., Barstein, J., Hornickel, J., Matherly, S., Durante, G., & Losh, M. (2017). Signaling of noncomprehension in communication breakdowns in fragile X syndrome, Down syndrome, and autism spectrum disorder. *Journal of Communication Disorders, 65,* 22–34.

Morisseau, T., Davies, C., & Matthews, D. (2013). How do 3- and 5-year-olds respond to under- and over-informative utterances? *Journal of Pragmatics, 59,* 26–39.

Nelson, K. (1998). *Language in cognitive development: The emergence of the mediated mind*. Cambridge, United Kingdom: Cambridge University Press.

Nelson, K., Plesa, D., & Hensler, S. (1998). Children's theory of mind: An experimental interpretation. *Human Development, 41,* 7–29.

O'Neill, D. K. (1996). Two-year-old children's sensitivity to a parent's knowledge state when making requests. *Child development, 67*(2), 659–677.

Paris, A. H., & Paris, S. G. (2003). Assessing narrative comprehension in young children. *Reading Research Quarterly, 38*(1), 36–76.

Patterson, C. J., O'Brien, C., Kister, M. C., Carter, D. B., & Kotsonis, M. E. (1981). Development of comprehension monitoring as a function of context. *Developmental Psychology, 17*(4), 379–389.

Pea, R. D. (1982). Origins of verbal logic: Spontaneous denials by two- and three-year olds. *Journal of Child Language, 9*(3), 597–626.

Premack, D., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences, 1*(4), 515–526.

Rahn, N. L. (2013). *A comparison of word-learning in 3-year-old children at risk for language and literacy difficulties in two conditions: Dialogic reading and activity based intervention* (Unpublished doctoral dissertation). University of Minnesota, Minneapolis, MN.

R Core Team. (2017). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from http://www.R-project.org/

Repacholi, B. M., & Slaughter, V. (Eds.). (2003). *Individual differences in the theory of mind*. New York, NY: Psychology Press.

Revelle, G. L., Wellman, H. M., & Karabenick, J. D. (1985). Comprehension monitoring in preschool children. *Child Development, 3*(56), 654–663.

Rosenthal, R. (1994). Parametric measures of effect size. In L. V. Hedges & H. Cooper (Eds.), *Handbook of research synthesis* (pp. 231–244). New York, NY: Russell Sage Foundation.

Sarcone-Roach, J. (2015). *The bear ate your sandwich*. New York, NY: Knopf Books for Young Readers.

Sidera, F., Perpiñà, G., Serrano, J., & Rostan, C. (2016). Why is theory of mind important for referential communication? *Current Psychology, 37*(1), 82–97.

Siegel, S., & Castellan, N. J., Jr. (1988). *Nonparametric statistics for the behavioral sciences*. New York, NY: McGraw-Hill.

Skarakis-Doyle, E. (2002). Young children's detection of violations in familiar stories and emerging comprehension monitoring. *Discourse Processes, 33*(2), 175–197.

Skarakis-Doyle, E., & Dempsey, L. (2008). The detection and monitoring of comprehension errors by preschool children with and without language impairment. *Journal of Speech, Language, and Hearing Research, 51*(5), 1227–1243.

Skarakis-Doyle, E., Izaryk, K., Campbell, W., & Terry, A. (2014). Preschoolers' sensitivity to the maxims of the cooperative principle: Scaffolds and developmental trends. *Discourse Processes, 51*(4), 333–356.

Skwerer, D. P., Ammerman, E., & Tager-Flusberg, H. (2013). Do you have a question for me? How children with Williams syndrome respond to ambiguous referential communication during a joint activity. *Journal of Child Language, 40*(1), 266–289.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales–Second Edition (Vineland-II) [Manual]*. Circle Pines, MN: AGS.

Tager-Flusberg, H., & Sullivan, K. (2000). A componential view of theory of mind: Evidence from Williams syndrome. *Cognition, 76*, 59–89.

Thurman, A. J., Kover, S. T., Ted Brown, W., Harvey, D. J., & Abbeduto, L. (2017). Noncomprehension signaling in males and females with fragile X syndrome. *Journal of Speech, Language, and Hearing Research, 60*, 1606–1621.

Vogler-Elias, D. (2009). *A parent-implemented shared storybook reading intervention for preschoolers with autism spectrum disorders* (Doctoral dissertation). Available from ProQuest LLC.

Walters, D. B. S., & Chapman, R. S. (2000). Comprehension monitoring: A developmental effect? *American Journal of Speech-Language Pathology, 9*(1), 48–54.

Webber, S. A., Fey, M. E., & Disher, L. M. (1984, November). *What's a grizic? Clinical sampling of children's contingent query behavior*. Paper presented at the American Speech-Language-Hearing Association Convention, San Francisco, CA.

Wetherby, A. M., Alexander, D. G., & Prizant, B. M. (1998). The ontogeny and role of repair strategies. In A. M. Wetherby, S. F. Warren, & J. Reichle (Eds.), *Transitions in prelinguistic communication* (pp. 135–159). Baltimore, MD: Brookes.

Zimmerman, I. L., Steiner, V. G., & Pond, R. V. (2011). *Preschool Language Scales–Fifth Edition (PLS-5) [Manual]*. San Antonio, TX: The Psychological Corporation.