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Research Note

A Drawing Task to Assess Emotion Inference in Language-Impaired Children

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Purpose: Studies investigating the ability of children with language impairment (LI) to infer emotions rely on verbal responses (which can be challenging for these children) and/or the selection of a card representing an emotion (which limits the response range). In contrast, a drawing task might allow a broad spectrum of responses without involving language. This study used a drawing task to compare the ability to make emotional inferences in children with and without LI.
Method: Twenty-two children with LI and 22 typically developing children ages 6 to 10 years were assessed in school during 3 sessions. They were asked to listen to audio stories. At specific moments, the experimenter stopped the recording and asked children to complete the drawing of a face to depict the emotion felt by the story's character. Three adult study-blind judges were subsequently asked to evaluate the expressiveness of the drawings.
Results: Children with LI had more difficulty than typically developing children making emotional inferences. Children with LI also made more errors of different valence than their typically developing peers.
Conclusion: Our findings confirm that children with LI show difficulty in producing emotional inferences, even when performing a drawing task—a relatively language-free response mode.

The ability to infer emotions in other people is an important skill for social adaptation. This ability requires one's capacity to attribute mental states to others (i.e., the theory of mind [ToM]) and to show empathy for them. The ToM has recently been defined as a multidimensional construct that includes both the cognitive ToM (i.e., inferences about others' knowledge and beliefs) and the affective ToM (i.e., inferences about others' emotions; Shamay-Tsoory, Harari, Aharon-Peretz, & Levkovitz, 2010; Vetter, Altgassen, Phillips, Mahy, & Kliegel, 2013). Thus, making emotional inferences differs from making inferences in general in that it requires knowing that others can feel different from oneself, as suggested by the affective ToM (for a review, see Westby & Robinson, 2014). Recent studies have focused on the ability of children with language impairment (LI) to make such emotional inferences. The results of these studies have consistently shown that children with LI are less efficient than their typically developing peers and make different kinds of errors. Across these studies, typically developing children consistently produce errors of same valence (e.g., sadness instead of anger), whereas children with LI vary in the type of errors they make, sometimes producing errors of same valence like their typically developing peers (Brinton, Spackman, Fujiki, & Ricks, 2007; Spackman, Fujiki, & Brinton, 2006; Spackman, Fujiki, Brinton, Nelson, & Allen, 2005), and sometimes producing errors of different valence (e.g., happiness instead of sadness; Ford & Milosky, 2003). Although this error type variation in children with LI could be due to age (i.e., 5 years in Ford & Milosky's [2003] study, 5 to 12 years in other studies), it is not found in typically developing children. The latter suggests that LI children are likely to exhibit greater error type variability.

To assess the ability of children to infer emotions, authors have traditionally used researcher-created stories (i.e., textoids), which narrate the adventures of fictional characters. For each given situation in the story, the character experiences a particular emotion, which the experimenters ask the participants to infer. Two answer methods have been used so far with children ages 5 to 12 years. In the first one, researchers ask children to verbally produce the label corresponding to the target emotion: Children are instructed to complete a sentence (e.g., Twinky feels …; Ford & Milosky, 2003) or answer a question (e.g., How does Chris feel?; Brinton et al., 2007). Although this method allows significant freedom of answer, children with LI may have difficulties producing verbal answers. The other examination methodology is based on response cards depicting either the facial expression of an emotion or a symbol

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representing an emotion (e.g., a sun for happiness or a ghost for fear). This process does not involve language use but requires children to pick from a selection of cards, thereby specifying and perhaps limiting the participants' emotional range. To facilitate the production of answers by children with LI, researchers usually use both methods. Children may answer by verbalizing an emotional label and/or by pointing to a response card (Brinton et al., 2007; Ford & Milosky, 2003; Fujiki, Spackman, Brinton, & Illig, 2008; Spackman et al., 2005, 2006; Trauner, Ballantyne, Chase, & Tallal, 1993). Although the combination of these two methods (i.e., free verbal answer combined with a forced-choice answer) does facilitate the task, it may also lead to the overestimation of children's ability to produce a correct answer. Indeed, several studies have shown that when children are given a restricted number of predetermined responses to choose from, they tend to perform better than when asked to respond freely (e.g., Markham & Adams, 1992).

To address these two limitations, we proposed a task in which children could freely produce the emotion inferred without having to use language. The drawing task seems to meet these two requirements. In recent times, numerous studies have focused on drawing and its relevance to investigating the development of emotional understanding (for a review, see Jolley, 2010). For instance, Brechet, Baldy, and Picard (2009) asked typically developing children ages 6 to 11 years to label and depict emotions in human face drawings. The children were asked to listen to textoids and then to freely label the emotion evoked (i.e., happiness, sadness, anger, fear, and disgust). Before proceeding to the drawing task, the experimenter gave feedback to the children who did not produce the correct label. To finish, the children were instructed to draw a character depicting the emotion. The results revealed that the abilities of children to label and to depict emotions in drawings develop concurrently and that a drawing task could be used to assess children's understanding of emotions. Using this method with children with LI, therefore, seemed relevant. Indeed, drawing affords children total freedom to determine the emotion inferred in a story via the act of creative graphic expression, which does not require the use of language.

Based on this assumption, the main purpose of this study was to examine whether children with LI and typically developing children perform differently when we evaluate their ability to infer emotions with a drawing task. Children with LI and typically developing children (ages 6 to 10 years) were asked to listen to a recorded story and then to complete the drawing of a character's face to depict the emotion that this character was supposed to have felt in the situation just described (i.e., happiness, sadness, or anger). To our knowledge, this study is the first to use a drawing task to assess the ability of children with LI to infer emotions. On the basis of the literature, we hypothesized that children with LI would have more difficulty inferring emotions than typically developing children. This would likely result in a higher proportion of either nonexpressive drawings or drawings depicting an emotion other than the one evoked in the story. In the latter case, we proposed to identify which emotion children depicted instead of the target one by comparing the kind of errors children with LI and typically developing children made (i.e., same or different valence).

Method

Participants

Forty-four children participated in this study: 22 children with LI and 22 children with typically developing language skills. Children with LI were 6 to 10 years old (M = 8;3 [years;months], range = 6;5–9;10, SD = 12 months). There were seven girls and 15 boys in this sample. Typically developing children were matched with children with LI in terms of age (M = 8;3, range = 6;5–9;10, SD = 12 months) and sex (i.e., seven girls and 15 boys).

Participants with LI

Children with LI were selected from a special institute for children with LI in Montpellier, France. This institute is a day hospital, where children attend specialized classes of about 10 students each and receive therapy (intensive speech therapy and sometimes psychotherapy). This institute educates and treats only children with LI; it does not treat autism spectrum disorders or other disorders (such as behavior or attention-deficit disorders). To qualify, students must first have failed to show improvement through standard speech therapy (i.e., three times per week with a speech pathologist in a normal schooling context). In addition, ear, nose, and throat (ENT) doctors and speech pathologists must have recommended that these children receive intensive speech therapy as the prescribed means for them to improve their language skills. Following the recommendations of Spackman et al. (2005), our LI participants were selected on the basis of several criteria, such as those contained in the admission tests performed by the institute's professionals 1 to 3 years prior to our study (i.e., IQ, language, psychomotor, and hearing tests). Their LI diagnosis had been made upon admission by the institute's speech pathologists, ENT doctors, and clinical psychologists. During the admission tests, all children had obtained a nonverbal IQ score above 80, ruling out intellectual disability as the basis for LI. The psychologists had used the Wechsler Intelligence Scale for Children–Fourth Edition (Wechsler, 2003) and the Wechsler Preschool and Primary Scale of Intelligence–Third Edition (Wechsler, 2002). The speech pathologists had used the New Tests for Language Assessment (Chevrie-Muller & Plaza, 2001) and/or the Oral Language Assessment (Khomsi, 2001) to evaluate the children's language capacities. All children had performed at least 1 SD below the mean on a formal measure on expressive language. Twelve children also performed at least 1 SD below the mean on a formal measure on receptive language. All the children with LI we selected presented with language delay of at least 18 months behind their chronological age. A pure-tone hearing screening administered by ENT doctors

from the institute had indicated normal hearing for all children selected. Because of the physical requirements of the drawing task, we added a criterion based on Brechet and Jolley (2014): Children with LI were seen by psychomotor specialists. No child presented with any psychomotor disorders. The characteristics of children with LI are presented in Table 1.

Participants With Typically Developing Language Skills

The typically developing children were sampled from three regular elementary schools in the area of Montpellier, France. The demographic characteristics of the students were similar across the three schools. Fourteen classes of various grade levels participated in the study, for a total of 292 children. Following the drawing task experiment described later, we selected 22 typically developing children matching with children with LI (i.e., same gender and same chronological age within 1 month). For example, a boy with LI age 6;8 was matched to a boy without LI age 6;8. The typically developing children we selected were in their normal school year (i.e., they were not repeating or had not skipped a grade). Teachers were asked by the experimenter to identify the children who demonstrated developmental, academic, or physical difficulties (i.e., intellectual, behavioral, communicational, psychomotor, or language). To ensure that the teachers would have enough time to familiarize themselves with their students, their medical records, and their pediatrician visit routines, we carried out the drawing task experiment at the end of the school year. On the basis of the teacher's reports, the children we selected did not exhibit any of the problems discussed previously.

Materials

We selected three stories from a series of authentic natural stories written by Antoon Krings and titled *Drôles de Petites Bêtes* (i.e., *Funny Little Critters*; Krings, 2006). We chose to use natural stories instead of textoids for two reasons. First, natural stories have been shown to be a reliable tool to assess children's ability to make inferences (Lynch et al., 2008). Second, natural stories usually provide a more evocative emotional context from which the characters' emotion can be inferred (Blanc, 2010, 2014). These stories, available on audio CD, describe the daily life of several insects and animals commonly encountered in gardens. Each story lasts about 5 minutes and focuses on the adventures of a main character (e.g., a snail who wants to discover the world explores the other side of the garden). The three stories we selected are similar in terms of narrative structure. Indeed, (a) they include a similar number of critical events causally connected with the main character, and (b) they all strongly suggest an emotional state corresponding to the situation (see Blanc, 2014, for the validity of this material). The story typically describes the main character's sequential attempts to achieve his or her main goal by overcoming various obstacles. The text uses simple vocabulary (the original intended audience is children ages 3 to 7 years). These stories were, therefore, accessible to and appropriate for the children with LI of our sample, both in terms of age and level of understanding.

In each story, we selected two emotional passages that clearly evoked one of three basic emotions: happiness, sadness, and anger. For instance, after listening to the following passage, children were expected to infer that Luce feels happy:

> After a few rounds of legerdemain, Luce (the flea) appeared on the scene and performed her famous balancing act on a spider thread. She then proceeded to her big wheel act and after a series of acrobatic spins, she completed the triple somersault of the flea. It was a triumph, for thunderous applause ensued.

We chose these three emotions (i.e., happiness, sadness, and anger) because they are usually easily understood and depicted by young children. Happiness is usually understood by children around 3 years of age, sadness around 4 years, and anger around 5 years (Westby & Robinson, 2014; Widen & Russell, 2002). In parallel to emotional comprehension, children develop the ability to depict these emotions in drawings, and by the age of 6 years, they are usually able to depict happiness, sadness, and anger (Jolley, 2010). Each of these three emotions was evoked twice.[1] Note that no emotional labels were explicitly mentioned in the stories. As did Ford and Milosky (2003), we selected emotional passages on the basis of a pretest with 18 adults. We asked adults to identify the emotion elicited in the story each time the experimenter stopped the recording. Adults identified happiness correctly 97% of the time, sadness correctly 92% of the time, and anger correctly 100% of the time.

Each child received a booklet consisting of six drawing sheets (i.e., two per story). On each drawing sheet, the outline of a character from the story had been printed. The character's size and posture were always the same. The size of the face's outline was large enough for children to easily and freely complete the facial features of the character to depict its emotion. Six examples of a completed character's outline are presented in Figure 1, illustrating each emotion twice.

Procedure

Children were tested collectively in their classroom. There were about 10 children per LI class and 25 children per typically developing children class. Children were seated away from each other to ensure that they would not exchange ideas with one another and to prevent plagiarism. All children participated in three experiment sessions implemented weekly. In each session, children were asked to listen to the audio story and to perform the two drawing

[1]More precisely, happiness was suggested in the stories titled, "Margot, the Snail" and "Luce, the Flea"; sadness was evoked in the stories titled "Marie, the Ant" and "Margot, the Snail"; and anger was evoked in the stories titled "Marie, the Ant" and "Luce, the Flea."

Table 1. Individual characteristics of children with LI.

Group	*n*	Chronological age in years;months (*SD* in months)	Verbal IQ		Nonverbal IQ	
			Mean score (*SD*)	Range	Mean score (*SD*)	Range
Children with LI	22	8;3 (12)	77 (20)	[48;110]	95 (8)	[81;116]

Note. Psychologists had used the Wechsler Intelligence Scale for Children–Fourth Edition or the Wechsler Preschool and Primary Scale of Intelligence–Third Edition to assess the verbal IQ and the nonverbal IQ.

tasks. No time limit was imposed for the drawing tasks. Each full session lasted about 20 min. Each child received a booklet from the experimenter in Session 1. The booklets were retrieved at the end of the session and issued again in the next two sessions.

The children were invited to carefully listen to a story played on an audio CD (i.e., "Marie, the Ant," "Margot, the Snail," or "Luce, the Flea"). They were informed that their understanding of the story would be assessed, but no further information regarding the nature of the task was given to them. We decided to present the story with an audio CD, rather than asking the teachers or the experimenter to read it. This was done so the children would not identify the emotion felt by the character of the story on the basis of the reader's facial expressions. The experimenter stopped the story twice for the drawing task to be performed. The drawing task consisted in asking children to complete the character's face in order to depict the emotion they thought the character was feeling at this particular moment in the story. The following instructions were given to the children: "In your opinion, what does the character feel at this particular moment? Complete the drawing of the character's face so I can see the emotion this character feels." The character's name was always mentioned in the instructions. After the children had completed their first drawing, the experimenter reminded them briefly of what had happened in the story up to that point and then resumed playing the story on the audio CD. The same procedure was repeated in Sessions 2 and 3 but with different stories.[2]

Scoring

On the basis of the scoring methods used by Brechet et al. (2009) and Cox (2005), the expressiveness of drawings was evaluated by three adult judges, who were asked to individually evaluate the 264 drawings (i.e., 44 participants times six drawings per participant). These judges were three female psychology students (22 years of age). The judges were not given any information about the study's objectives, the age of the children, or the groups studied (i.e., children with LI versus typically developing children). For each drawing, the judges had to determine which emotion was evoked by choosing from a list of five answer categories: happiness, sadness, anger, other, or neutral. When judges picked the category "other," they had to specify which emotion was depicted in the drawing.

The ratings were considered congruent, and the drawings were considered expressive of one specific emotion, if at least two of the three judges identified the same emotion. The ratings were considered noncongruent when no agreement was reached by judges on the emotion evoked by the drawing. When the ratings were congruent and the target emotion was correctly identified (i.e., corresponded to the emotion actually suggested in the story), the drawing was given a score of 1. If the ratings were congruent, but the target emotion was not identified, or if the judges selected the neutral answer, the drawing received a score of 0. When the ratings were noncongruent, the drawing was assigned a 0 score as well. The global interjudge agreement was 89%. The interjudge agreement for each emotion was 91% for happiness, 92% for sadness, and 84% for anger. The interjudge agreement for each group was 87% for children with LI and 91% for typically developing children.

Results

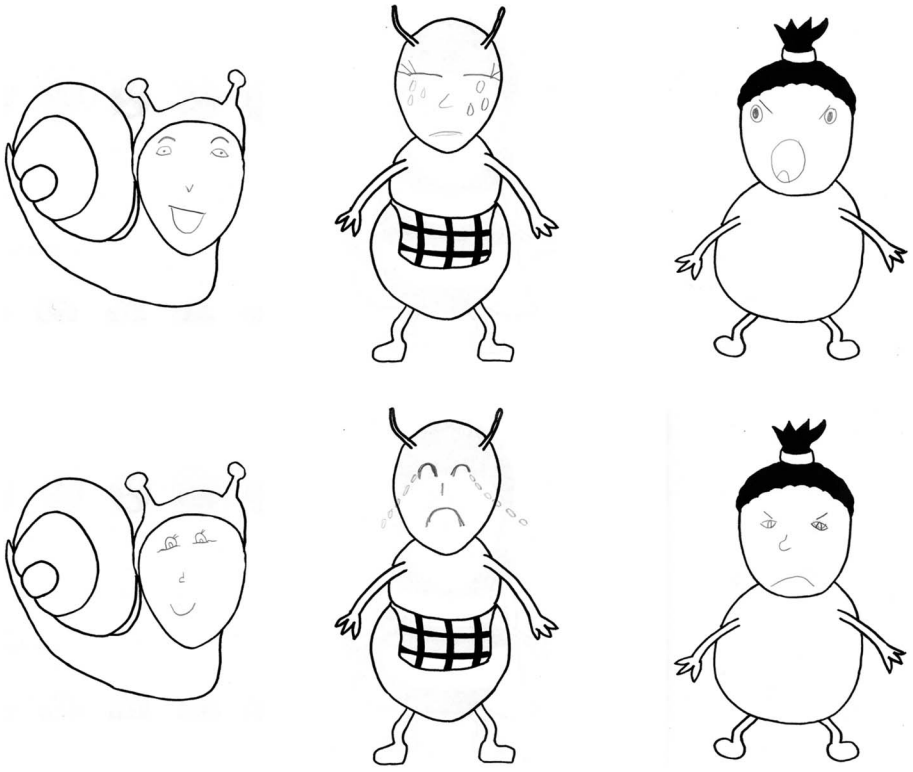
Proportion of Drawings Depicting the Target Emotion

The children's drawing task scores were subjected to an analysis of variance with children's group (i.e., children with LI and typically developing children) as between-subjects factor and with emotion (i.e., happiness, sadness, and anger) as within-subject factor. Table 2 shows the proportion of drawings depicting the target emotion according to group and emotion. The analysis revealed two significant main effects. First, there was a main effect of the group factor, $F(1, 42) = 9.26$, $p < .001$, with a medium effect size, $n^2 = .18$.[3] The proportion of drawings depicting the target emotion was greater for typically developing children ($M = .70$) than for children with LI ($M = .49$). Second, there was a main effect of emotion, $F(2, 84) = 24.46$, $p < .001$,

[2]Note that this study was part of a larger project investigating understanding of emotions by children with LI. Thus, the children had to perform other tasks, which are not part of, or described in, this study. However, the drawing task presented here was always performed first, to avoid any carryover effect. The other tasks were performed after the story had been played in its entirety.

[3]The effect size for all analyses was based on eta-squared instead of partial eta-squared, because the latter measure can inflate the reported value (Tabachnick & Fidell, 1996).

Figure 1. Examples of story characters: "Margot, the snail" (i.e., happiness); "Marie, the ant" (i.e., sadness); and "Luce, the flea" (i.e., anger). *Note.* The characters' contours were printed without facial traits. In the task, children were asked to draw their faces based on the emotion suggested by the story narrative.



with a large effect size, $n^2 = .37$. Post hoc comparisons using Tukey's honestly significant difference test showed that happiness and sadness resulted in more drawings depicting the target emotion than anger (ps < .001), with no significant differences between happiness and sadness. The analysis did not reveal any interaction between group and emotion.

To assess whether the type of language difficulties (i.e., expressive only versus expressive or receptive language difficulties) and the time of task performance (i.e., first, second, or third session) had an impact on these results, we conducted two additional analyses. First, we performed chi-square tests to compare our three language groups. The chi-square tests indicate a significant difference between typically developing children and children with only expressive LI, $\chi^2(1) = 16.93$, $p < .001$, and a significant difference between typically developing children and children with expressive/receptive LI, $\chi^2(1) = 16.86$, $p < .001$. The difference between both groups of children with LI was not significant, $\chi^2(1) = 0.04$, $p = .85$. Second, we conducted a repeated measures analysis of variance with group (i.e., typically developing children versus children with LI) as between-subjects factor and with session (i.e., first, second, and third session) as within-subject factor. The analysis revealed a main effect of the group factor, $F(1, 40) = 6.27$, $p < .05$, with a medium effect size, $n^2 = .14$. The proportion of drawings depicting the target emotion was greater for typically developing children ($M = .70$) than for children with LI ($M = .49$). However, the analysis did not show any session effect nor any interaction between group and session, thus ruling out a practice effect.

Table 2. Proportion of drawings depicting the target emotion by group and emotion.

	Emotion		
Group	**Happiness**	**Sadness**	**Anger**
Language impaired	0.66	0.57	0.25
Typically developing	0.89	0.77	0.45

Error Analysis

To determine whether children had made errors of same valence (e.g., sadness instead of anger) or different valence (e.g., sadness instead of happiness), we analyzed the answers given by the judges (i.e., another emotion, neutrality, or noncongruent ratings) when the children did not depict the emotion suggested in the story. Remember that the judges could evaluate the expressiveness of each drawing by choosing one possible answer among happiness,

sadness, anger, neutrality, or "other." If they picked the other category, the judges had to specify the emotion they had identified. In those instances, we observed the prevalence of one emotion (i.e., surprise). Sometimes, each judge gave a different response. In those cases, the ratings were considered noncongruent. We compared the errors made by typically developing children and those made by children with LI by using Fisher exact probability tests. Table 3 provides an analysis of the errors for each group.

Among children who did not depict happiness in response to the emotion suggested in the story, no difference was found between children with LI and typically developing children. Among children who did not depict sadness in response to the emotion suggested in the story, more children with LI depicted happiness (19/19, 100%) than typically developing children did (2/10, 20%; $p < .01$) and more typically developing children depicted neutrality (8/10, 80%) than children with LI did (0/9, 0%; $p < .01$). Finally, among children who did not depict anger in response to the emotion suggested in the story, more children with LI depicted happiness (13/33, 39%) than typically developing children did (3/26, 12%; $p < .05$) and more typically developing children depicted neutrality or received noncongruent ratings (10/26, 38% and 4/26, 15%, respectively,) than children with LI did (4/33, 12%; and 0/33, 0%, respectively; ps $< .05$). To sum up, when children with LI did not depict sadness or anger, they depicted an emotion of different valence (i.e., happiness) more frequently than typically developing children did. In contrast, typically developing children depicted neutrality more often than children with LI did. We did not observe any significant differences between LI and typically developing children for happiness.

Discussion

The aim of this study was to assess the ability of children with LI to infer emotion through the use of a drawing task, as compared with that of typically developing children. Our method consisted in asking children aged 6 to 10 years to complete the drawing of a character's face to depict the emotion the character was supposed to have felt in a given situational narrative. Our results showed that children with LI have more difficulty inferring emotions than typically developing children. Indeed, children with LI produced fewer drawings depicting the emotion suggested in the story than their typically developing peers. Moreover, the error analysis showed that when they made mistakes, children with LI were more likely to infer happiness instead of sadness or anger (i.e., error of different valence) than their typically developing peers, who, instead, depicted neutrality. These findings confirm our hypothesis and support the validity of previous research on the ability of children with LI to make emotional inferences by showing that children's deficit is seen even in a task allowing a relatively language-free response mode. Moreover, we found that children with LI presenting with both expressive and receptive, or expressive only LI, had difficulties inferring emotions. These findings suggest that difficulties children with LI encounter in inferring emotions is not due to a comprehension issue but rather to a slower development of emotional knowledge in comparison to that of typically developing children. In particular, children with LI have difficulties correctly matching emotional information such as emotional context, facial expression, and emotional label (Brinton et al., 2007). The difficulties children with LI encounter when attempting to make emotional inferences and the errors of different valence they produce could partially explain why they are challenged when having to infer emotions within the context of social interaction, especially when interacting with typically developing children (Ford & Milosky, 2008; Fujiki, Spackman, Brinton, & Hall, 2004; Spackman et al., 2005, 2006).

Although our study provides additional knowledge about the ability of children with LI to infer emotion in a story, several limitations were identified. Though the number of participants was sufficient to show a group effect, our sample size was limited. It only led to a medium effect size, and it did not allow us to compare several age groups. A larger sample would allow investigators to extend this study to examine the development of children with LI's ability to produce emotional inferences with age. Furthermore,

Table 3. Number (and proportion) of errors by target emotion, group, and emotion depicted.

Target emotion	Group	Total errors	Emotion depicted					
			Happiness	Sadness	Anger	Other[a]	Neutrality	Noncongruent ratings
Happiness	Typically developing	5 (.12)	—	2 (.05)	1 (.02)	0 (.00)	0 (.00)	2 (.05)
	LI	15 (.22)	—	6 (.09)	2 (.03)	4 (.06)	1 (.01)	2 (.03)
Sadness	Typically developing	10 (.24)	2 (.05)	—	0 (.00)	0 (.00)	8 (.20)	0 (.00)
	LI	19 (.28)	19 (.28)	—	0 (.00)	0 (.00)	0 (.00)	0 (.00)
Anger	Typically developing	26 (.63)	3 (.07)	6 (.15)	—	3 (.07)	10 (.24)	4 (.10)
	LI	33 (.49)	13 (.19)	14 (.21)	—	2 (.03)	4 (.06)	0 (.00)
Total	Typically developing	41	5 (.14)	8 (.32)	1 (.02)	3 (.07)	18 (.44)	6 (.15)
	LI	67	32 (.48)	20 (.30)	2 (.03)	6 (.09)	5 (.07)	2 (.03)

Note. LI = language impaired.

[a]When judges evaluated the emotion depicted as "other," they indicated only one emotion (i.e., surprise).

the children in our study were asked to react to stories based on an auditory modality only. Future research should aim to prevent any potential comprehension difficulties due to the presentation mode of the story. Ideally, researchers would implement a procedure that would allow them to assess the children' understanding of the story before the drawing task is performed. Finally, although we selected and proposed basic emotions (which even young children are usually able to identify and depict graphically), it would have been useful to check the emotions identified by the children to ensure that the emotions evaluated by the judges corresponded to those the children intended and attempted to depict in their drawings.

To conclude, our findings offer new clinical and research application prospects to evaluate the ability of children with LI to produce emotional inferences. Indeed, the drawing task appears to be an original and pleasant method to assess children's ability to infer emotions and could be used as an alternative method in clinical settings that aim to evaluate this competence. Moreover, the drawing task might also be used as a tool to improve children's ability to infer emotions: Future research should explore whether the use of this task, for instance in group therapy, could help children with LI improve their ability to make emotional inferences, and perhaps modify their social behaviors in given situations.

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Research Article

How Age, Linguistic Status, and the Nature of the Auditory Scene Alter the Manner in Which Listening Comprehension Is Achieved in Multitalker Conversations

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Purpose: We investigated how age and linguistic status affected listeners' ability to follow and comprehend 3-talker conversations, and the extent to which individual differences in language proficiency predict speech comprehension under difficult listening conditions.
Method: Younger and older L1s as well as young L2s listened to 3-talker conversations, with or without spatial separation between talkers, in either quiet or against moderate or high 12-talker babble background, and were asked to answer questions regarding their contents.
Results: After compensating for individual differences in speech recognition, no significant differences in conversation comprehension were found among the groups. As expected, conversation comprehension decreased as babble level increased. Individual differences in reading comprehension skill contributed positively to performance in younger EL1s and in young EL2s to a lesser degree but not in older EL1s. Vocabulary knowledge was significantly and positively related to performance only at the intermediate babble level.
Conclusion: The results indicate that the manner in which spoken language comprehension is achieved is modulated by the listeners' age and linguistic status.

Spoken language comprehension appears to be virtually effortless when there are no competing sound sources and one is listening to clearly articulated speech in one's native language. Nevertheless, because comprehension requires the processing of the speech signal at many different levels (e.g., phonological analysis, lexical identification, syntactic and semantic resolution of the speech stream), it is one of the most complex of human activities (for a review, see Wingfield & Tun, 2007). The relative ease with which comprehension is achieved tends to disappear when competing sound sources are introduced into listening situations, with the disruption of processing at both perceptual and cognitive levels greater for older adults and for those operating in their second language. In older listeners, age-related declines in either lower-level sensory and perceptual processes and/or age-related changes in higher-level cognitive processes, such as language comprehension, memory, attention, and processing speed, may be responsible for their speech comprehension difficulties in noise (e.g., Ben-David, Tse, & Schneider, 2012; Frisina et al., 2001; Heinrich & Schneider, 2006; Humes et al., 2012; Pichora-Fuller, Schneider, MacDonald, Pass, & Brown, 2007; Schneider & Pichora-Fuller, 2001; Wang, Wu, Li, & Schneider, 2011). The increased difficulties experienced by young nonnative listeners may be attributed to a reduced ability to discriminate fine phonemic information as well as a reduced ability to make use of linguistic cues, and possible cross-language interference due to the activation of semantic and linguistic processes in more than a single language (e.g., Bradlow & Pisoni, 1999; Kroll & Steward, 1994; Mayo, Florentine, & Buus, 1997; Meador, Flege, & Mackay, 2000; Weber & Cutler, 2004). Age-related auditory declines could sabotage the smooth and rapid operation of early (sensory) processes and lead to delayed and/or incorrect phoneme and word recognition. Alternatively, an inadequate command of the target language could produce the same result. In either case, these early errors may have a "cascading" effect and compromise the operation of one or more of the higher, more central cognitive processes required for speech comprehension.

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