

**Critical Review:**  
**Do children with Specific Language Impairment have difficulty interpreting auditory emotion cues, as compared to children with typical language development?**

Sarah Gillespie  
M.Cl.Sc (SLP) Candidate  
University of Western Ontario: School of Communication Sciences and Disorders

This critical review examines the literature regarding differences between children with specific language impairment (SLI) and children with typically developing language (TLD) in their ability to interpret auditory emotion cues. Six studies, congruent with the search criteria were found. Four were cohort studies and the remaining two were case-control studies. All of these were Level 2b evidence. The literature suggests that children with SLI are impaired in their ability to interpret auditory emotion cues, as compared to children with TLD. The literature also suggests this ability is correlated with age. Clinical implications and recommendations for speech language pathologists as well as for further research are discussed.

***Introduction***

Social cognition is a broad and complex term, which encompasses many skills including: emotion perception, social problem solving, self cognition, and the ability to take another's perspective (Marton, Abramoff, & Rosenzweig, 2005; Timler, 2003). All of these skills help a person navigate social interactions successfully. Studies have found children with specific language impairment (SLI) have difficulties with many aspects of social cognition. Specifically, these children have difficulty initiating social interactions, accessing on-going interactions, maintaining interactions with others, negotiating, and resolving conflicts (Marton et al.). The exact cause of these difficulties is unknown; however, it is generally accepted that the impaired language of children with SLI is a contributing but insufficient factor to account for these deficits in social cognition (Marton et al.).

Crick and Dodge proposed a social processing model which attempts to explain how children integrate the necessary multiple skills during a social interaction (as cited in Timler, 2003). The first level in this model involves encoding social cues; it is this initial step with which this review is concerned. This level of processing is emotion understanding, or the ability to interpret the emotions of others through their facial expression, tone of voice or other contextual cues in the environment. This emotion understanding is one factor that likely contributes to a person's social cognition (Brinton & Fujiki, 2005).

Prosody, one aspect of emotion understanding, can be defined as "the use of variations in vocal tone or pitch, stress, and timing in speech" (Van der Meulen, Janssen, & Den Os, 1997, p. 155). Prosody has two main functions: grammatical and emotional/affective.

Evidence in the literature demonstrates an intertwining of prosody and language development in children with typical language development (TLD), thus it is important to understand this critical relationship in children with SLI (Van der Meulen et al.).

In one of the first studies to investigate the ability of children with SLI to interpret auditory cues of emotion, Berk, Doehring, and Bryans (1983) found a highly significant difference between their group with TLD and their SLI group (mean chronological age (CA) 8;7). In fact, the TLD group achieved almost perfect scores. This differed from another early study by Courtright and Courtright (1983) which included younger children, aged 3-7 years old. Although a significant difference was found between the performances of the children with SLI and the children with TLD, both groups made several errors. In addition, Berk et al. found a significant correlation between age and accuracy in the SLI group. Likewise, Dimitrovsky (1964) found the same correlation in children between 5 and 12 years old (as cited in Van der Meulen et al., 1997). Thus, it is possible that impairments in ability to interpret auditory emotion cues in children with SLI may only become evident as they become older and their peers with TLD become more competent with the skill (Creusere, Alt, & Plante, 2004).

***Objectives***

The primary objective of this paper is to critically evaluate the existing literature on the ability of children with SLI to interpret auditory emotion cues. Clinical implications and recommendations are also discussed.

***Methods***

### Search Strategy

Computerized databases, including PubMed and PsycINFO, were searched with the following search strategy: (language impairment) AND ((emotion comprehension) OR (emotion understanding)). The reference lists of articles found in the databases were also searched for relevant literature.

### Selection Criteria

Studies included in this review were written in English, with no limits on the publication date. Limits were set to include only children (preschool to age 18) with SLI and no concomitant cognitive impairments. Studies involving children with autism spectrum disorder (ASD) were also excluded. A hallmark feature of ASD is impaired social skills. Numerous studies have been conducted to examine the source of these impairments. The objective of this review was to investigate research on children whose impaired social skills are less overt than those of children with ASD. Studies were limited to those which examined the comprehension of auditory emotion cues. Studies which only looked at the grammatical function of prosody were excluded. Studies which only examined the expression of emotion cues were also excluded, as this review sought to examine the comprehension literature. Finally, there are many studies which examined the comprehension of visual emotion, i.e. facial expression, but these were also excluded as this was beyond the scope of the current review.

### Data Collection

The literature search yielded six papers congruent with the search criteria. All of them were Level 2b evidence, per the *Experimental Design-Decision Tree* (2009). Two studies (Boucher, Lewis, & Collis, 2000; Trauner, Ballantyne, Chase, & Tallal, 1993) were case-control studies; the remaining four were cohort studies.

### **Results**

The articles reviewed used different terms to identify the children with language impairment and the control groups. For simplicity, in this review, all groups of children with language impairment are referred to as 'SLI' and all control groups as 'typical language development' (TLD). One study identified children for the SLI group through standardized testing (Trauner et al., 1993), while the remaining studies used diagnoses from speech language pathologists or other qualified professionals and/or children who were receiving speech and language services. Additionally, all children with SLI had scores within 1-2 standard deviations of the mean on

various IQ tests and/or had no history of other behavioral, emotional, or other mental impairments. Two studies (Spackman, Fujiki, Brinton, Nelson, & Allen, 2005; and Trauner et al.) included monolingual or native English speaking participants. One study (Van der Meulen, et al., 1997) included Dutch-speaking participants. The remaining three articles (Creusere et al., 2004; Fujiki, Spackman, Brinton, and Illig, 2008; and Boucher et al., 2000) did not specifically report native language characteristics of their participants.

### Preschool-age Subjects

Van der Meulen et al. (1997) sought to replicate Courtright and Courtright's (1983) earlier study on the ability of children with SLI to interpret vocal affect (*happy, sad, angry, or afraid*) from a sentence. Participants in the study included 30 Dutch-speaking preschool children with SLI (range of CA 4;4 to 6;11) and a TLD control group. Participants in both groups were divided into 3 groups of 10: 4, 5, and 6 year olds.

The authors reported that although the children with SLI performed more poorly than the children with TLD did, the difference was not statistically significant per an analysis of variance (ANOVA) with repeated measures. Age was found to have a significant main effect. Furthermore, both groups of 4-year-olds scored at a less-than-chance level. This suggests that children's ability to identify vocal affect improves as they develop.

Strengths of Van der Meulen et al.'s (1997) study included reliable and valid methods. The authors included data on inter-rater reliability, the only study in the review to do so. Appropriate statistical analyses were performed. Despite the relatively high level of evidence, due to the lack of a significant difference between the SLI and TLD groups, this study offered only suggestive evidence that children with SLI were impaired in their ability to identify vocal affect cues. However, the presence of a main effect of age and the less-than-chance performance of both groups of younger participants, Van der Meulen et al.'s study offered compelling evidence for a correlation between accurate affect identification and age.

One hypothesis concerning children with SLI's impaired ability to interpret auditory emotion cues is that the linguistic structure is the source of difficulty, not the prosody itself. Therefore, Creusere et al. (2004) investigated this source of difficulty by controlling for linguistic content. The authors also examined how children performed when facial and vocal emotion cues (of *happy, mad, sad, and*

*surprised*) were presented simultaneously. The study included one group of 26 preschool children with SLI (mean CA 5;1) and one group of children with TLD. Creusere et al. investigated performance on four blocks of stimulus cues (three relevant to this review): (1) an auditory presentation of an utterance with all linguistic content removed leaving only prosodic information, so that the utterance sounded muffled (2) presentation same as (1) with a video of facial expression and (3) the control block—auditory presentation of an utterance with a video of facial expression.

A subset of items was analyzed by conducting a mixed ANOVA, with group as the between-subjects factor and cue as the within-subjects factor. Main effects for both language group and cue were found. Total scores for the SLI group were lower than for the TLD group. Looking at specific blocks of cues, children with SLI performed significantly poorer than did children with TLD on control block 3. Pearson correlation coefficients indicated that both the SLI and TLD groups' performances on block 2 (prosodic information and facial expression) correlated to their chronological age. This was the only significant age correlation for the SLI group, while the TLD group's total affect score was also correlated to age. In both groups the younger participants (CA 4;0-4;2) had more difficulty with the prosodic information only (block 1), although both groups as a whole performed above chance level.

Strengths of the study included valid test measures and appropriate statistical analysis. Limitations of the study included the omission of a second stimulus control block of an auditory utterance only. Secondly, subjects responded with a forced-choice question, thus increasing the chances of guessing correctly. This differed from the other studies which all used a variation of a picture-pointing response. Finally, there was no mention of a training period for the participants, only instructions for the task.

Although Creusere et al.'s (2004) results do not definitively identify the source of difficulty for children with SLI when comprehending auditory emotion cues, the authors presented compelling evidence to indicate that children with SLI are impaired in their ability to interpret vocal affect cues. Due to the younger children having more difficulty with identification and the significant age correlations, Creusere et al.'s results also offered compelling evidence that these differences between children with SLI and TLD may only become apparent as children become older.

#### Preschool and School-age Subjects

Like Creusere et al. (2004), Spackman et al. (2005) investigated the skill by removing the linguistic structure from the test stimuli. The authors examined how children with SLI identified auditory emotion cues (*happy, sad, fear, and anger*) while listening to a musical excerpt. No previous study had looked at the ability of children with SLI to identify emotions in music; as such, the authors considered this a preliminary study. Participants consisted of 43 children with SLI and 43 children with TLD. These two groups were then divided by age into a younger group (mean CA of 6;6-7;6) and an older group (mean CA of 10;4-10;9). Spackman et al. predicted a high variability of responses due to the exploratory nature of the study. Therefore, they chose to use a consensus scoring system, using the TLD group as the comparison group.

A four-way mixed ANOVA was conducted. Age, group, and emotion had significant main effects. Overall, the TLD group had higher consensus with the comparison group than did the SLI group. Additionally, both older groups of participants had higher agreement than did either of the younger groups. Missing from the analysis was a comparison of the SLI group versus the TLD group by age.

Due to the preliminary nature of this study and the large variability in responses across all groups, including during an adult validation study, the results were only suggestive that children with SLI do differ from children with TLD in their ability to interpret auditory affect cues. Results were also only suggestive that as children become older they get better at interpreting auditory vocal cues.

#### School-age Subjects

In the next study, Trauner et al. (1993) investigated how school-age children with SLI interpreted vocal affect (*happy, angry, and sad*) from a short phrase. The study consisted of eight children with SLI (mean CA 10;7) matched for IQ with eight children with TLD. This subject matching made this a case-control study.

The authors found the children with SLI were significantly impaired compared to the TLD group in their ability to identify vocal affect. Some limitations of this study included not reporting a validity test for the material, unlike most of the other studies, and only a partial reporting of results. The authors stated that analyses were performed with ANOVA and *t*-tests; however only data for the *t*-tests were reported.

Due to the methodological limitations of this study, along with the incomplete reporting of results, this study provided only suggestive evidence that school-

age children with SLI have impairments in interpreting auditory affect cues.

Fujiki et al. (2008) also examined this ability in school-age children with SLI. The authors investigated the skill in a more naturalistic situation than the other studies by using a short narrative in place of a single utterance. Fujiki et al. also studied the identification accuracy of specific emotions (*happy, angry, sad, and fear*). The study included two groups, one group of 19 children with SLI (mean CA 9;1) and one TLD control group. The authors attempted to control for linguistic structure by constructing the narrative to be within the language skills of the SLI group and providing a familiar school context.

A 3-way mixed analysis of covariance (ANCOVA) was performed, with nonverbal IQ as the covariate. Main effects for language group and emotion were found. As a group, the children with SLI performed more poorly than the TLD group did. Descriptive statistics also demonstrated the poorer performance by children with SLI. The authors performed correlations to determine if age or general language abilities of the participants were related to their ability to identify each of the four emotions. Once Bonferroni adjustments were made, no correlations were significant. This differed from Van der Meulen et al. (1997), Creusere et al. (2004), and Spackman et al. (2005) who found correlations between identification accuracy and age.

The authors concluded that their results did not indicate that children with SLI had an overall impairment in their ability identify vocal affect, but rather they had difficulty identifying certain emotions (i.e. *fear* and *sad*). However, due to sound methodological procedures and appropriate statistical analyses their results offered compelling evidence that children with SLI are impaired in their ability to identify vocal affect, as compared to children with TLD. No significant correlations for age were found, so results are equivocal regarding the increase in ability to identify vocal affect with age.

The last study, by Boucher et al. (2000) assessed the possibility of a cross-modal impairment as an explanation, or contributing factor, in impaired ability to match vocal-to-facial affect (*happy, sad, disgust, fear, anger, and surprise*) in children with autism. The experiment included two control groups, one comprised of 19 school-age children with SLI (mean CA of 9;7), and the other of 19 children with TLD (mean CA 6;4). The SLI participants were matched for language and nonverbal reasoning abilities to the children with autism. The TLD participants were matched for group mean language

scores to the other two groups. This matching made this a case-control study. The authors predicted they would confirm previous preliminary findings that children with autism were impaired relative to both control groups in their ability to identify vocal affect. Boucher et al.'s results were surprising in that the SLI group performed significantly worse than the other two groups, according to a two-way ANOVA and a Bonferroni-corrected *t*-test.

Some methodological limitations of this study included a possible learning effect for the children with autism. Some of the children with autism were involved in therapy which included learning to name basic emotions at the time of the experiment. This could have partially explained their better-than-expected performance during the naming task. Nonetheless, this does not negate the significantly impaired performance of the SLI group as compared to the TLD group. Finally, although the authors mention a training period for the children, there is no mention of validation of the testing stimuli, unlike most of the other studies in this review.

Despite these limitations, considering the 2b case-control level of evidence and the appropriate statistical analyses, the results of the study offered compelling evidence that children with SLI, when compared to children with TLD, were impaired in their ability to identify vocal affect. No analysis was done regarding correlations of age with the ability to identify vocal affect.

### ***Discussion***

As the studies were all similar in design, some statements about limitations can be made generally. First, no study reported effect sizes, which would have made comparisons across studies easier. Second, the studies used varying emotions and varying response modes, which also made direct comparisons more difficult. With the exception of Van der Meulen et al. (1997) no study mentioned inter-rater reliability for scoring or blinding of the examiners to the participants.

It is generally accepted that children with SLI have difficulties with many aspects of social cognition and that the impaired language of children with SLI is a contributing, but insufficient factor to account for these deficits (Marton et al., 2005). In order to understand why children with SLI have social cognition impairments, it is necessary to examine the underlying skills. The ability to accurately identify auditory emotion cues is likely one aspect of emotion understanding that contributes to a child's social cognition (Brinton & Fujiki, 2005).

A review of six articles revealed that in all studies, except Van der Meulen et al. (1997), children with SLI performed significantly more poorly on auditory emotion identification tasks than did children with TLD. This poor performance was observed in children from 4 to 12 years old. This poor performance also occurred across a range of test stimuli. Three studies used single utterances, one used a short narrative, one used musical excerpts, and one used utterances and prosodic information. This decreased ability was observed even in studies which attempted to control for the language impairments in children with SLI by controlling the linguistic structure of the stimuli. This poor performance across age ranges and test stimuli provides evidence that children with SLI are impaired in their ability to accurately identify auditory affect cues, a skill that likely contributes to their overall social cognition.

All of the studies reviewed provided a relatively high level of evidence, Level 2b, which is close to the *gold standard* experimental level. Thus, these studies taken together offer compelling evidence that children with SLI do have an impairment in their ability to accurately identify auditory emotion cues as compared to children with TLD.

Furthermore, Van der Meulen et al. (1997), Creusere et al. (2004), and Spackman et al. (2005) found that all younger participants, both SLI and TLD, had more difficulty accurately identifying auditory affect cues than did their older counterparts. Creusere et al. also found a significant correlation between age and the ability to accurately identify auditory emotion cues. This evidence suggests that identifying auditory affect is a skill which develops as children grow older. Therefore, impairments in accuracy may not be evident until children are older and the skill is more developed in their peers with TLD.

### ***Clinical Implications***

Misunderstanding the affective content of another's utterance can have serious social implications for a child. Fujiki et al. (2008) give the following example to demonstrate how misinterpreting vocal affect can hinder social acceptance:

Two children [are] approaching a roller coaster. Child 1 says, in a fearful voice, 'Oh, a roller coaster'. Child 2 interprets the prosodic cues as conveying sadness and offers a ticket for the roller coaster to cheer child 1 up. Such an exchange is not likely to promote the mutual understanding that is important to friendship formation. (p. 342)

Moreover, this impairment can contribute to an overall impairment in social cognition, which in turn

can lead to decreased self-esteem and decreased peer relationships. These put the child at risk for juvenile delinquency, school drop-out, and other social adjustment problems (Marton et al., 2005). Recognizing that children with SLI are at risk for social impairments, and specifically impairments in identifying auditory emotion cues, would allow speech language pathologists (SLP) to consider these as possible intervention goals.

Many treatments and interventions to increase emotion identification have been developed for children with ASD (Timler, 2003). The evidence presented in this review suggests that it is important for SLPs to consider similar interventions for children with SLI, even though their social impairments are not as overt as those in children with ASD. It is clear that they do have underlying impairments that can significantly impinge on their social functioning.

The evidence of an age correlation with emotion identification suggests that an impairment may not become obvious until school age. It is possible for an SLP to see a preschool child with SLI who does not appear to have difficulty in interpreting auditory emotion cues. However, based on the evidence presented here, treatment targeting emotion identification may be warranted.

### ***Recommendations***

- Conduct more research on emotion identification, specifically exploring age correlations with identification accuracy
- Conduct more research specifically investigating auditory and visual emotion cues in combination
- Conduct efficacy research on social cognition targets in intervention with children with SLI
- Increase speech language pathologists' awareness of social cognition deficits in children with SLI
- Integrate more social cognition targets during interventions with children with SLI

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