



Talker discrimination in preschool children with and without specific language impairment



Natalie S. Dailey, Elena Plante*, Rebecca Vance

The University of Arizona, United States

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ABSTRACT

Variability inherently present between multiple talkers can prove beneficial in the context of learning. However, the performance during learning paradigms by children with specific language impairment (SLI) remains below typically developing peers, even when multiple talkers are used. Preschool children with typically developing language ($n = 17$) and SLI ($n = 17$) participated in a talker discrimination task. Five different pairings of talkers (same male, different males, same female, different females, male + female) were used to present 50 spoken words. Children with SLI were significantly poorer in discriminating same and different male speakers compared to their typical peers. The present findings demonstrate that preschool children with SLI can experience difficulty distinguishing between talkers. Poor sensitivity to variation in talkers may contribute to poor learning in SLI for contexts where multiple talker input should benefit the learner.

Learning outcomes: The reader will recognize that the presence of multiple talkers (voices) can assist or detract from performance on cognitive tasks. Children with specific language impairment are less proficient than their peers in distinguishing the same from different talkers.

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1. Introduction

As children learn languages, they typically receive language input from a variety of sources. The effect of this talker variability can be either positive or negative, depending on the cognitive task at hand. Previous research posits that talker variability comes at a cost to performance on some cognitive tasks, such as word recognition and item recall (Goldinger, Pisoni, & Logan, 1991; Mullennix, Pisoni, & Martin, 1988). Task performance can decrease when an additional cognitive load is placed on an individual, as with the introduction of multiple talkers, during an already demanding task. Ryalls and Pisoni (1997) investigated the effects of talker variability on word recognition in preschool children. Word lists were constructed using a single male talker or multiple talkers (5 males and 5 females). Children were instructed to point to a picture that corresponded to a spoken word. When the multiple talker word list was presented first, followed by the single talker list, children (ages 3 and 5) correctly identified more words during the single talker list compared to the multiple talker list. Conversely, when the single talker word list was presented prior to the multiple talker word list, no significant difference in word recognition was evident. This suggested that prior practice with the task overcame the disadvantage caused by multiple talkers.

* Corresponding author at: The University of Arizona, Department of Speech, Language, & Hearing Sciences, PO Box 210071, Tucson, AZ 85721-0071, United States. Tel.: +1 520 621 5080; fax: +1 520 621 9901.

E-mail address: eplante@email.arizona.edu (E. Plante).

Goldinger et al. (1991) also reported a single talker advantage during an item recall task. Ten word lists were presented either by a single male talker or multiple talkers (5 males and 5 females). In addition, the rate of word presentation for the entire list was manipulated with 250 ms to 4000 ms between each word. Higher word recall scores were observed in all but one condition when lists were presented by a single talker as opposed to multiple talkers. When items were presented at the slowest speed (4000 ms between words), individuals showed better recall when the list was presented by multiple talkers. One explanation regarding this finding might relate to processing demands. The slower stimulus presentation might have decreased in the cognitive load, resulting in a higher performance during the multiple talker condition.

In other contexts, talker variability can be facilitative. Multiple talkers facilitate learning of sound sequences in typically-developing infants and preschool children (Richtsmeier, Gerken, Goffman, & Hogan, 2009; Singh, 2008). Richtsmeier, Gerken, and Ohala (2010) reported that learning of nonwords was facilitated when multiple talkers presented the nonword tokens. Preschool children listened to novel words paired with novel pictures. Half of the nonwords were constructed to reflect high frequency English phonotactics and half had a low-frequency phonotactic composition. The former condition generally results in better word learning compared to the latter. In one experiment the children heard these words presented by a single talker and in a second experiment, the words presented by multiple talkers. The introduction of talker variability was facilitative even when the sound sequences of the nonword were low frequency relative to English words. Furthermore, increasing the number of times a word was presented within the experiment only benefitted learning when multiple talkers were used. The use of multiple talkers introduces perceptual variability, in that different speakers produce phones with different pitch, resonance characteristics, and speaking rates. Different speakers may also use different allophonic variants of a single phoneme thus introducing phonetic variants of a single phoneme. It is posited that such sources of talker variation are an important component in perceptual processing for children and infants (Richtsmeier et al., 2010; Singh, 2008). Exposure to multiple talkers may provide sufficient variability to facilitate this type of learning.

There is reason to believe that children with specific language impairment (SLI) may not benefit to the same degree as their typically developing peers from multi-talker input. Although no study has specifically contrasted single and multiple talkers in learning studies involving SLI, previous studies that have used multiple talkers to present stimuli have found that these children show poorer performance than typically developing (TD) peers (Plante, Bahl, & Gerken, 2010; Plante, Bahl, Vance, & Gerken, 2011). Poorer learning may be attributed to poorer attention, memory, or weaker phonological skills. It is also possible that these children fail to receive any benefit from multiple talkers because of a reduced ability to perceive differences in talker characteristics. This possibility has been suggested by a prior study in which children with SLI and their typical peers were asked to discriminate between single talker and talker pairs of German speakers presenting either German or English words (Levi & Schwartz, 2009). Although this study found no overall differences for a group of eight children ages 7–12, the authors suggested a subset of children with SLI showed a weak ability to differentiate between single and multiple talkers presenting word pairs. The current study aims to address whether preschool children with SLI have a reduced sensitivity to differences among talkers. In the present study, we expand upon the Levi and Schwartz study by using a task that explicitly contrasts native English talkers of different genders speaking English words.

2. Method

2.1. Participants

Thirty-four native English-speaking children participated, half were included in the SLI group and half in the typically developing (TD) group. Seventeen children (10 males and 7 females) were included in each group. Children were matched pair-wise by age and gender. A six-month range was allotted when matching participants, however the majority of participants differed by only 2 months. Ages ranged from 48 to 68 months (SLI, $M = 58.24$ months; TD, $M = 56.0$ months). All participants passed a pure-tone hearing screening of 500, 1000, 2000, and 4000 Hz at 25 dB HL bilaterally (American National Standards Institute, 1996). Children were recruited from local preschools in the Tucson area. Informed consent was obtained and all children provided assent prior to participating.

A battery of standardized tests was administered to assess both cognitive and language functioning. The nonverbal scales of the Kaufman Assessment Battery for Children Second Edition (KABC-II; Kaufman & Kaufman, 2004) were administered to rule out intellectual disability. Children were excluded from the study if their nonverbal standard score was below the cut-off score of 75 ($70 + 1SEM$). The Structured Photographic Expressive Language Test – Preschool Second Edition (SPELT-P2; Dawson, Stout, Eyer, Tattersal, Fonkalsrud, & Croley, 2005) was used to evaluate language status. The SPELT-P2 has been shown to have high accuracy in discriminating between children with SLI and those with typically developing language (Greenslade, Plante, & Vance, 2009). Children were included in the SLI group if their standard scores were below a cut-off score of 87, which was previously determined to maximally discriminate between children with SLI and their typically developing language peers (Greenslade et al., 2009).

A number of additional tests were administered to describe current language skills. To describe single-word receptive vocabulary knowledge, we administered the Peabody Picture Vocabulary Test-Fourth Edition (PPVT-IV; Dunn & Dunn, 1997). Likewise, to describe receptive grammar skills, we administered the Grammatical Understanding subtest of the Test of Language Development Primary – Third Edition (TOLD-P3; Newcomer & Hammill, 1997). Finally, we administered the Goldman-Fristoe Test of Articulation – Second Edition (GFTA-2; Goldman & Fristoe, 2000) to describe articulation skills.

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