Contralateral masking effects in children and adults

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Background

❖ The "cocktail party effect" occurs when the brain must selectively attend to only one auditory signal while ignoring others. Children have greater difficulty with this task than adults.

❖ A two-talker masker consists of a continuous mixture of two people talking. This babble causes informational masking. Speech-shaped noise is noise within the spectrum of speech that causes energetic masking.

❖ Calandruccio et al. (2014) concluded that children performed worse in the two-talker masker as opposed to the speech-shaped noise masker, and this is important because Hillock-Dunn et al. (2015) showed that speech perception in a two-talker masker is more reflective of everyday experience than speech perception in speech-shaped noise.

❖ The cocktail party effect can be examined by using a contralateral masker where a target is presented in one ear and a masker is presented in the opposite ear. This contrasts with an ipsilateral masker where the target and masker are presented in the same ear.

❖ Wightman & Kistler (2005) showed that children are more susceptible to a contralateral masker than adults. This type of masking is not considered in clinical evaluation.

Objectives

The objectives of this research were to answer the following questions:

1. How does masked speech perception differ for children compared to adults when the masker is presented contralateral to the target?

2. Does contralateral masking differ for a two-talker vs. speech-shaped noise masker?

3. Does contralateral masking differ for 45 dB SPL and 75 dB SPL masker levels?

Participants

Listeners included 10 adults (19.3-35.2 years) and 10 children (5.9-10.7 years). All participants were screened for normal hearing and middle ear status. They were recruited through the University of North Carolina at Chapel Hill community.

Methods

Stimuli: Stimuli included 30 disyllabic, easily illustrated words within the vocabulary of a typical five-year-old. Maskers were either two-talker speech or speech-shaped noise. Stimuli and maskers were presented through insert earphones. The two-talker masker was composed of two female speakers reading selections of *Jack and the Beanstalk*. The speech-shaped noise was spectrally matched to the two-talker masker (Calandruccio et al., 2014).

Conditions: Target words were always presented to the left ear. Performance was measured in four contralateral masker conditions: two masker types (two-talker speech and speech-shaped noise) x two levels (45 and 75 dB SPL). In the control condition, target words were presented in quiet in the left ear.

Procedure

Listeners sat with an iPad in a sound-treated room and were instructed to select the picture corresponding with the target word they heard using the iPad touchscreen.

Participants chose from four pictures presented on the screen. An adaptive threshold procedure estimated the signal-to-noise ratio associated with 71% correct performance in each condition.
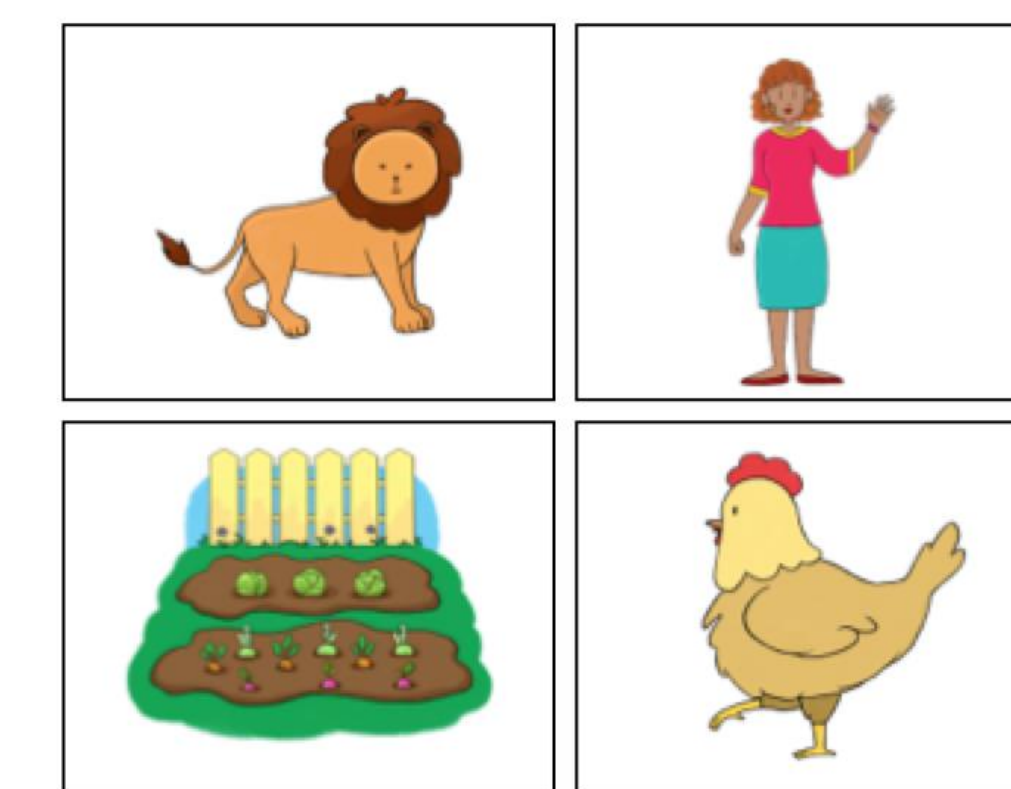
Results

❖ On average, children performed worse than adults in every condition.

❖ All participants had higher thresholds (poorer performance) in the two-talker masker compared to the speech-shaped noise masker.

❖ All participants had higher thresholds in the low intensity conditions (45 dB SPL) as opposed to the high intensity conditions (75 dB SPL).
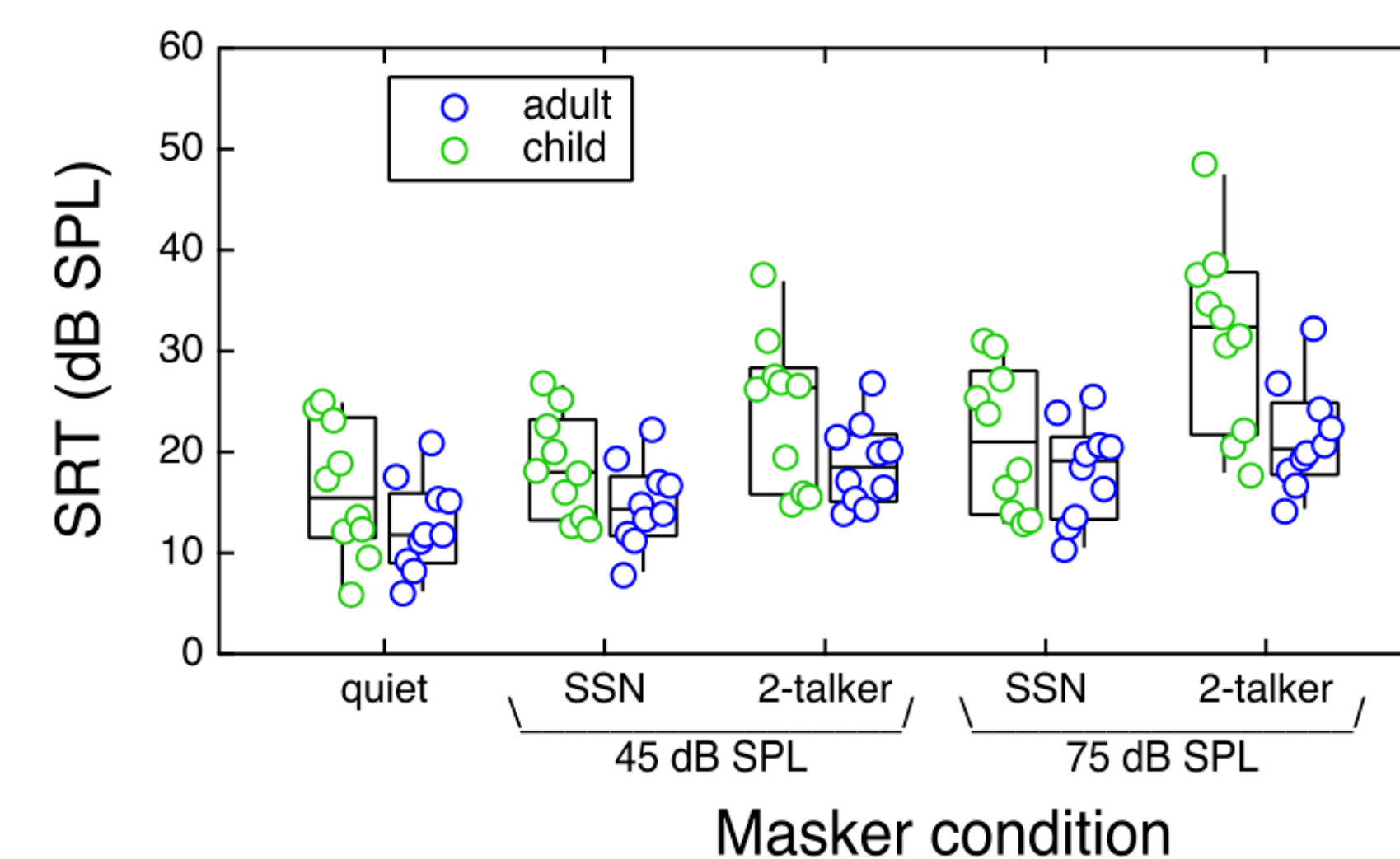

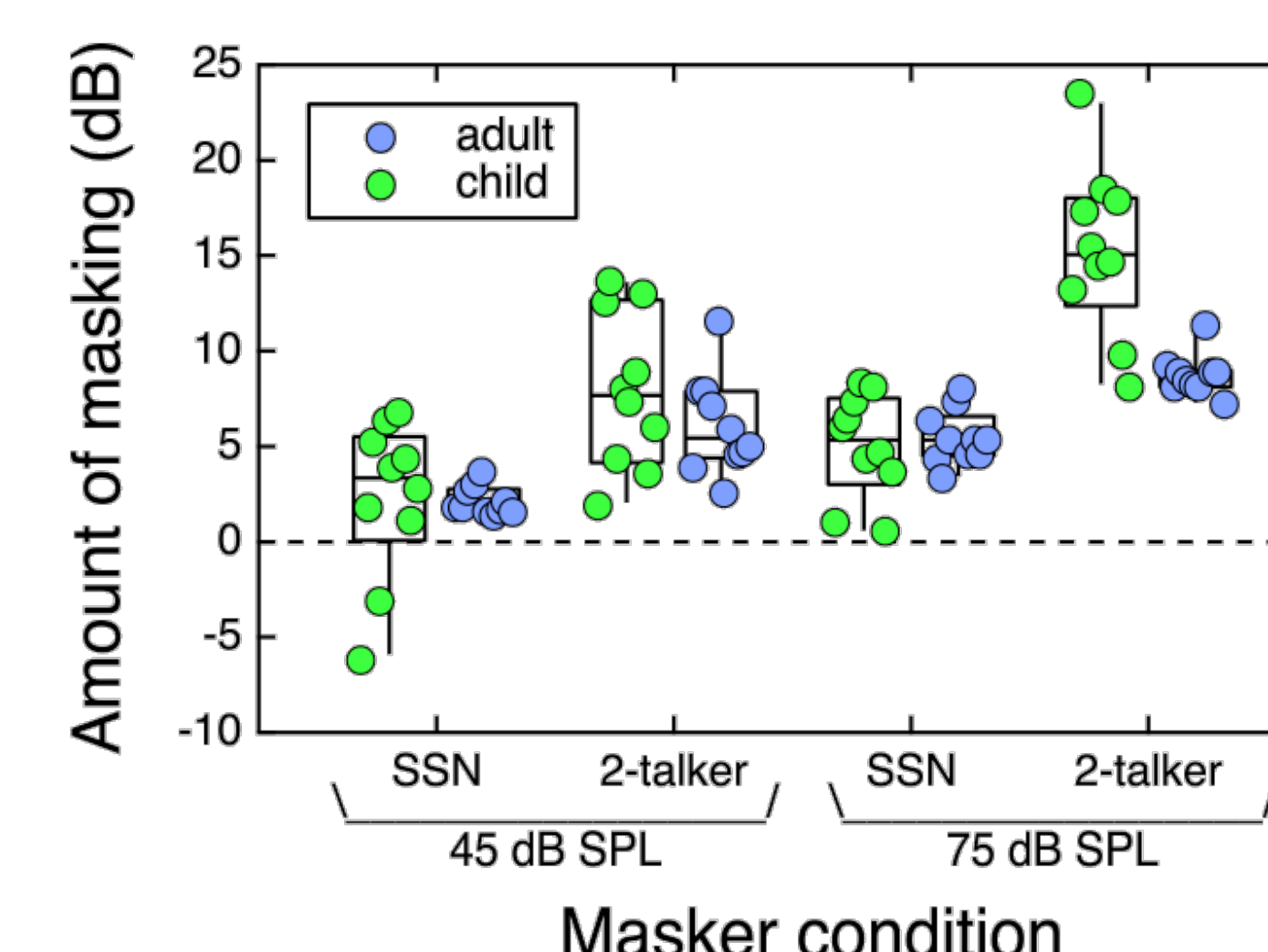Figure 1: Speech reception threshold (SRT) for adults and children.

Figure 2: Amount of masking for adults and children.

Discussion

❖ On average, it is more difficult for children than adults to segregate multiple simultaneous streams of speech and focus on one stream of information. This is true even when the masker is contralateral to the target.

❖ When using a contralateral masker, children and adults perform poorer in a two-talker masker than speech-shaped noise masker. Children are particularly susceptible to informational masking when the two-talker masker is presented at a high intensity.

❖ This closed-set test of speech perception may be useful in clinical settings to provide a more accurate reflection of an individual's abilities to hear in complex environments and in everyday life.

❖ This experiment relates to a phenomenon in the sound field called the "head-shadow effect" which occurs when auditory input from one side of the listener is lower in level at one ear than the other. As a result, the SNR can differ across the ears. In these conditions a listener should attend to sound in just one ear.
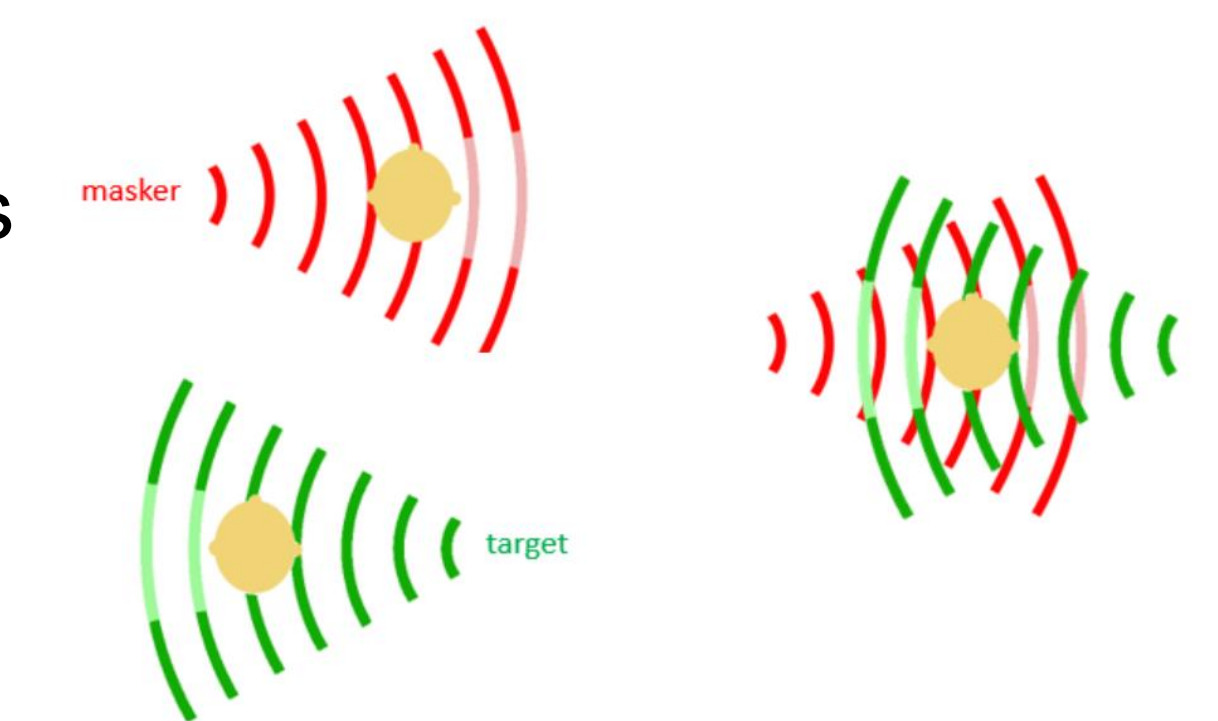
Key References

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