A cross-linguistic approach at investigating language learning in children who are hard-of hearing – preliminary results

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Fricative sounds /s/ and /z/ hold morpho-syntactic importance (e.g., signal plurality) in both English and French.

Fricative sounds are more difficult to perceive and produce for all children but especially for children who are hard of hearing (HOH) [1, 2].

Children who are HOH are known to show morpho-syntactic delays such as increased errors in noun and verb morphology [3, 4].

Are these observations language-specific or universal to all languages?

Goal: Is our cross-linguistic approach, testing both French and American children on the same tasks feasible?

Scientific Question: Does poor perception of fricatives relate to poor use of morphology for children with normal hearing (NH) and children with MMHL under noisy conditions?

Participants

> 11 American English-speaking children were tested online via the Gorilla platform (mean age = 5.9 y, range = 4.1-8.3y)

> 9 French-speaking children were tested in-laboratory (mean age = 5.4 y, range = 4.2-6.3y), 1 HOH (5.3 yr; Audiometric averaged thresholds on both ears = 46 dB HL).

> Standardized assessments of language were conducted in each language:

English: 1) Clinical Evaluation of Language Fundamentals – Preschool 2; Core Language Scale (Word Structure, Expressive Vocabulary, Sentence Structure); 2) Narrative Production - "Frog, where are you?"; 3) Reading assessment, locally developed

French: 1) French Peabody Receptive Vocabulary Test, 2) Kikou Sentence Comprehension

1. Fricative Identification in Noise

Stimuli: /asa/, /aza/, /usu/, /uzu/, /isi/, /izi/

- Natural tokens produced by 2 female & 1 male native American English and French speakers
- A steady speech-shaped noise (SSN) masker was constructed from female speech tokens for each language separately

Procedure: XAB method of constant stimuli [5]

- X = male in quiet, A & B = female in noise
- Measured % correct identification over 36 trials
- Signal-to-noise ratio (SNR) = +5, 0 dB (French), -5, 0 dB (English)

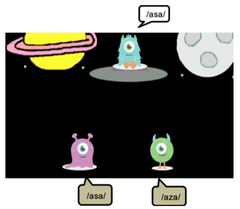

Fig. 1. XAB task visual display. Children were asked to select whether the purple monster (A) or the green monster (B) produced the same speech token as the blue monster on top (X).

2. Subject-Verb Agreement

Visual Stimuli: Two videos depicting the same action are shown on a screen; on one side the singular subject is presented and on the other side, the plural subject is presented.

Audio Stimuli: Sentence depicting the action, of the video - e.g., "Look, the boys open the object" or "Look, the boy opens the object". The sentences were embedded in a SSN at +5, 0 or -5 dB SNR. Three grammatical conditions were used [English: fricative is final; medial with adverbs; medial with a prepositional phrase. French: fricative is between the subject and verb; at the end of verb; or absent].

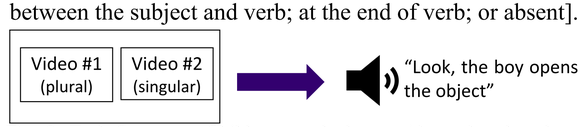

Fig. 2. Task Sequence. Children watched two videos, then heard a target sentence. They were then asked to point to the video (#1 or #2) that matched the sentence they heard.

English Results

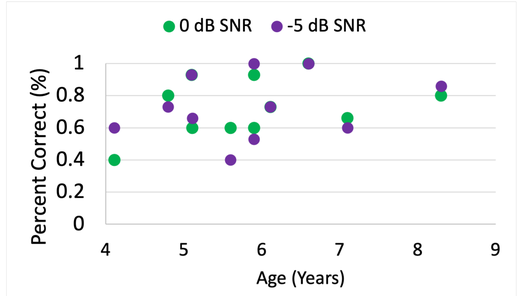

Fig. 3. Fricative in Noise task performance as a function of age of American English-speaking children.

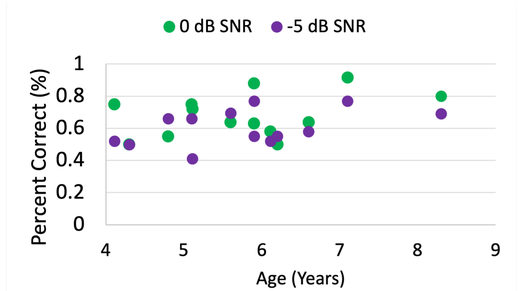

Fig. 4. Subject-Verb agreement task performance as a function of age of American English- speaking children.

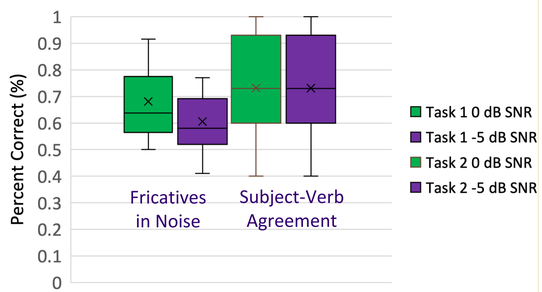

Fig. 5. American English speech children performance summary. Fricatives in noise at 0 dB SNR (green) and -5 dB SNR (purple) on the left. Subject-Verb agreement at 0 dB at – dB SNR (green) and -5dB SNR (purple) on the right

French Results

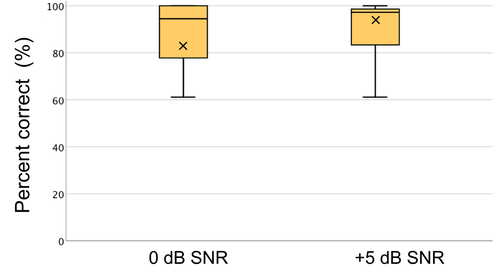

Fig. 6. Fricative in Noise task performance for French-speaking children in 2 SNR conditions (0 dB on the left, +5 dB on the right). The x indicates the performance of the child who was HOH.

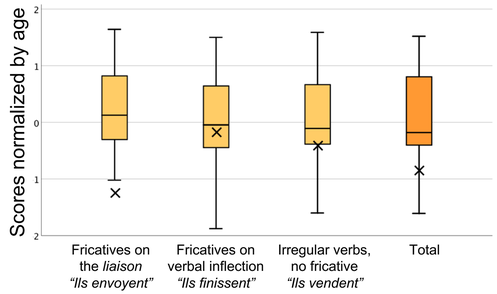

Fig. 7. Subject-Verb agreement task performance at +5 dB SNR normalized by age of the French speaking-children. The x indicates the performance of the child who was HOH.

Preliminary Observations

- Preliminary English data suggest a trend towards an effect of noise on the Fricative in Noise task (0 dB > -5 dB performance) and both English and French groups showed a trend towards an effect of age on the Subject-Verb agreement task (older kids performed better).
- Preliminary French data suggest that the child who was HOH showed poorer performance in the liaison condition of the Subject-Verb agreement task but not in the other tasks/condition.
- The two tasks are suitable for the targeted age range and feasible in both French and English. Data collection will be completed and levels of noise matched between the two language groups.

References

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