

INTRODUCTION

- During the COVID-19 pandemic, traditional experimental data collection methods with human subjects were interrupted.
- An alternative method using voice-to-text, KEMAR, and remote microphone technology was developed in place of a human response. The transcription application “Otter” was used due to its accuracy to provide responses.
- Previous research has shown a significant improvement when using a remote microphone in noisy environments.^{1,2}
- To test the accuracy of the setup, an experiment was conducted examining the accuracy of Otter program to transcribe speech-in-noise when using remote microphone/hearing aid arrangement on KEMAR.

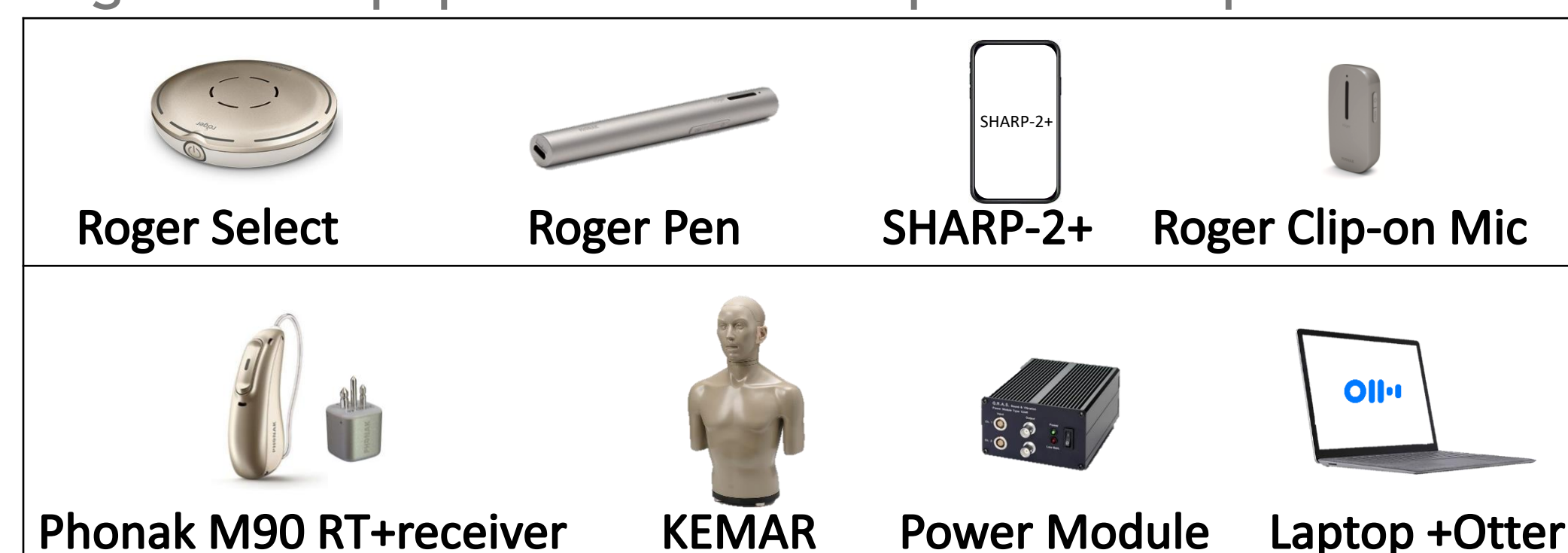
PURPOSE

- The purpose of this investigation was to:
1. Develop an alternative setup to testing technology in various controlled conditions without involving human subjects.
 2. Compare the scores obtained via the transcription application Otter in five signal-to-noise ratio (SNR) conditions and four remote microphone arrangements.

EQUIPMENT

Figure 1 shows the equipment used for the RMT microphone arrangement. RMT was connected to a Phonak Marvel M90 RT hearing aid (HA) programmed for a flat 60 dB HL loss. The smartphone app SHARP 2+ was developed in collaboration with UTD Engineering Department and connected to an iPhone 11.

Figure 1. Equipment for microphone comparisons.



METHODS

STIMULI:

Sentences– One list of ten HINT sentences (list #4) presented at 65 dB SPL three times for each test condition (0° azimuth)
ex. “The clown has a funny face.”

Noise – Continuous speech-shaped noise presented from GSI-61 audiometer (180° azimuth)

SNR conditions: Quiet, +10, +5, 0, -5 dB

TRANSCRIPTION:

Otter- Version 2.3.116 ran on Dell laptop provided transcription for each list presented.

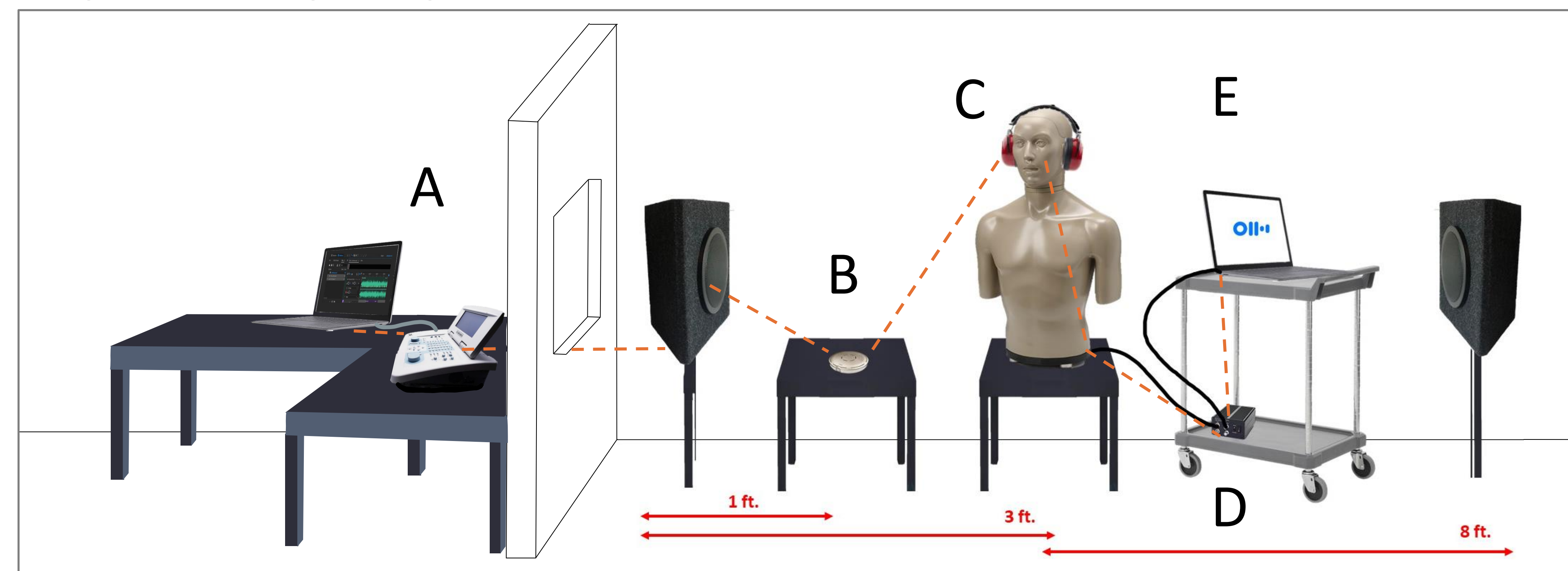
PROCEDURE:

The signal pathway is shown by the dotted line in Figure 2. KEMAR wore circumaural headphones over the hearing aid to prevent noise leakage into the hearing aid coupling.

SCORING:

Each word that was transcribed correctly by Otter was counted as one point. The total percent words correct was determined for each list, the mean for all three trials is shown in Figure 3.

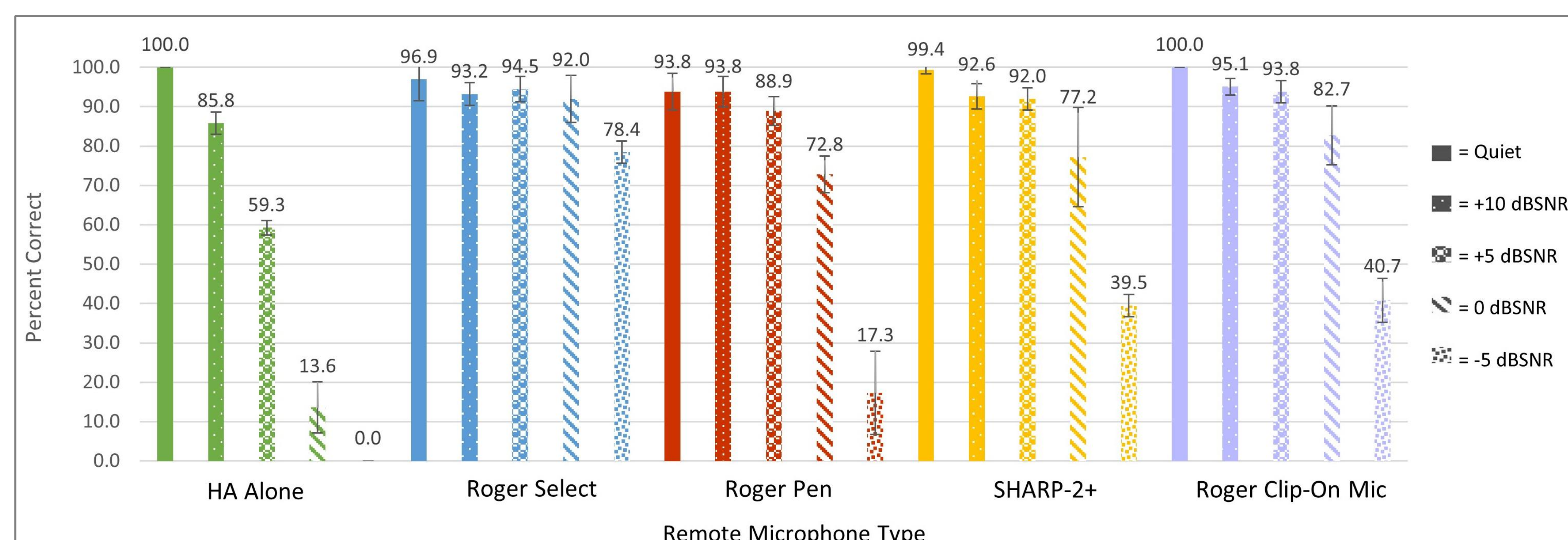
Figure 2. Testing arrangement



Note: A: Laptop and audiometer present stimuli to soundfield speakers. B: Remote microphone receives signal and transmits to HA+receiver. C: Signal from HA sent through Zwislocki coupler in KEMAR. D: The power module receives the signal and transmits to laptop. E: Otter speech-to-text program transcribes sentence.

RESULTS

Figure 3. Speech Recognition with Remote Microphone Technology Using KEMAR and Voice-to-Text Testing



Note: Standard error bars represent +/- one standard deviation.

CONCLUSIONS

- Figure 3 shows as SNR decreased, performance declined similarly across the four microphones types.
- In quiet, all microphones yielded similar performance to the HA alone ranging from 96.9 to 100%.
- Higher percent correct scores were seen in all SNR conditions compared to HA alone.
- At the most difficult SNR (-5 dB), Roger Select microphone yielded the highest performance with 78.4% accuracy.

LIMITATIONS

- Requires extensive setup.
- Costly initial investment if the researcher does not have all the necessary equipment.
- May not accurately reflect human cognitive processing of contextual cues.

REFERENCES

- 1 Tittle, S., Thibodeau, L. M., Panahi, I., Tokgoz, S., Shankar, N., Bhat, G. S., & Patel, K. (2020). Behavioral validation of the smartphone for remote microphone technology. *Seminars in hearing, 41*(4), 291-301. <https://doi.org/10.1055/s-0040-1718714>
- 2 Thibodeau L. (2014). Comparison of speech recognition with adaptive digital and FM remote microphone hearing assistance technology by listeners who use hearing aids. *American journal of audiology, 23*(2), 201- 210. https://doi.org/10.1044/2014_AJA-13-0065

ACCESS TO SUPPORTIVE WORK

UTD’s Hearing Health Lab (HHL) Website:
www.utdallas.edu/hhlab

ACKNOWLEDGMENTS & CONTACT

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For more information, please contact
emma.freeman@utdallas.edu