THE UNIVERSITY OF BRITISH COLUMBIA

Evaluating Indigenous speech synthesis for education: A participatory design workshop on Ojibwe text-to-speech

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Indigenous Text-to-Speech (TTS)

Indigenous Language	Team
• Plains Cree (Central Algonquian) • Kanyen'kéha	• Harrigan et al., 2019 • Saunders, 2008
Kanien'kéha (also known as Mohawk; Iroquoian), Gitksan (Tsimshianic), and SENCO ´TEN (Coast Salish)	Pine et al., 2022, 2025
Anishinaabemowin (Ojibwe)	Hammerly et al., 2023
Cherokee	Conrad, 2020

About Ojibwe

Indigenous language in the Algonquian family, spoken in the US and Canada

High average age of L1 speakers
+
Parent generation unable to speak language with their children at home

Most instructors of Ojibwe identify as teacher-learners

https://www.tadtribalart.com/map-ojibwa-people

Anishinaabemodaa
Waking Up Ojibwe Language Learning Platform

App developed by:
CultureFoundry Studios,
Victoria, BC

TTS developed by

- **Department of Linguistics, UBC**, Vancouver, BC
- **SayItFirst**, Halifax, NS
- **CultureFoundry Studios**, Victoria BC

The Ojibwe TTS System

VITS Model: Parallel end-to-end model trained using the Coqui AI TTS Library

Data Training Set: Utterances recorded by heritage speaker collaborator, included edited audio file and associated transcription in double vowel orthography

(Hammerly et al., 2023)

A text-to-speech synthesis system for Border Lakes Ojibwe

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Abstract

This paper describes the development of a text-to-speech synthesis system for Border Lakes Ojibwe, which is being deployed within a web-based language learning platform. We discuss our approach to community engagement, recording and editing transcribed sets of utterances for model training, the technical implementation of the speech synthesis model itself, how the system is being used by teachers and learners within the web-based platform, strategies for future extensions of this type of work to other Indigenous voices, dialects and languages, and possibilities for applications in additional educational contexts and beyond.

1 Introduction

Ojibwe (known by speakers as Anishinaabemowin) is an Indigenous language of the Algonquian family consisting of a diverse set of mutually intelligible varieties spoken throughout large swaths of what is colonially known as Canada (through much of

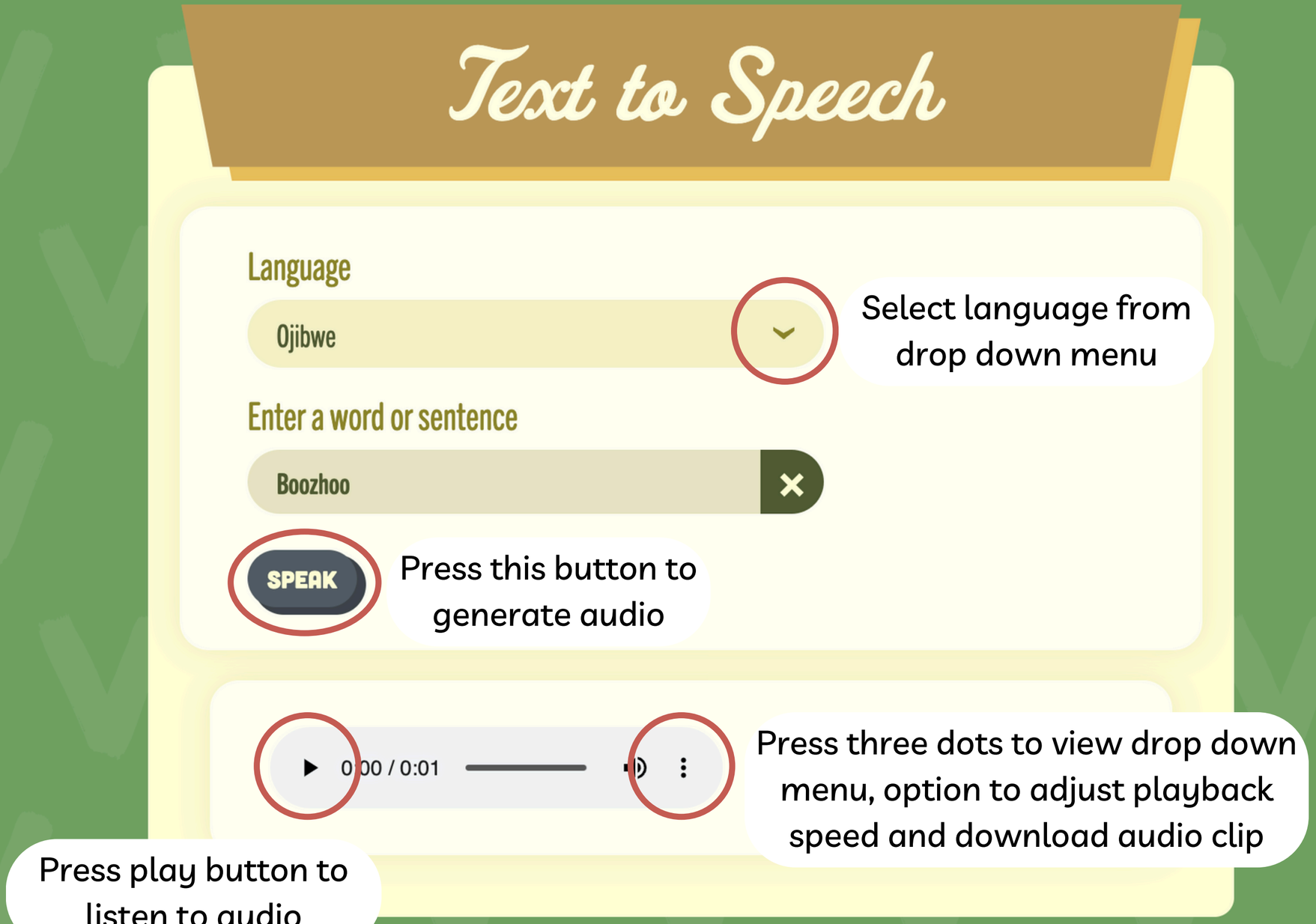
We describe an initial project that has built these tools for use by language instructors and learners in school and community settings within the Treaty #3 lands of Northwestern Ontario, where the Border Lakes variety of the Southwestern Ojibwe dialect group is spoken (Valentine, 1994). We especially focus on our process for creating training data for Indigenous speech synthesis systems.

2 Background

2.1 Positionality and community engagement

The project was initiated by the Seven Generations Education Institute in Fort Frances, Ontario as part of their *Anishinaabemodaa* "Waking up Ojibwe" language initiative, and has been conducted in collaboration with a team of researchers at the University of British Columbia, the Halifax-based language revitalization organization SayItFirst, and the Victoria-based educational start-up CultureFoundry. We include positionality statements from each member of the team who has worked directly

Text to Speech



Research Questions

1. What are the strengths and limitations of our existing Ojibwe TTS feature?

2. What are teachers' priorities when approaching new tools in educational technology like TTS?

How are you evaluating this tool?

Participatory Design Methods

Research participant
= Subject-matter expert in their community's needs

(Zelenko et al., 2021; Flaskerud & Anderson, 1999)

Indigenous PD methods

- Prioritize rapport-building
- Data: narratives and stories

(Woodward & Marrfurra McTaggart, 2016; Barcham, 2013)

+

Human computer interaction co-design methods

- Systematic and rigid
- Data: tangible design products, recommendations for improvement of technology

(Roschelle et al., 2006; Lin & Van Brummelen, 2021)

Method Overview

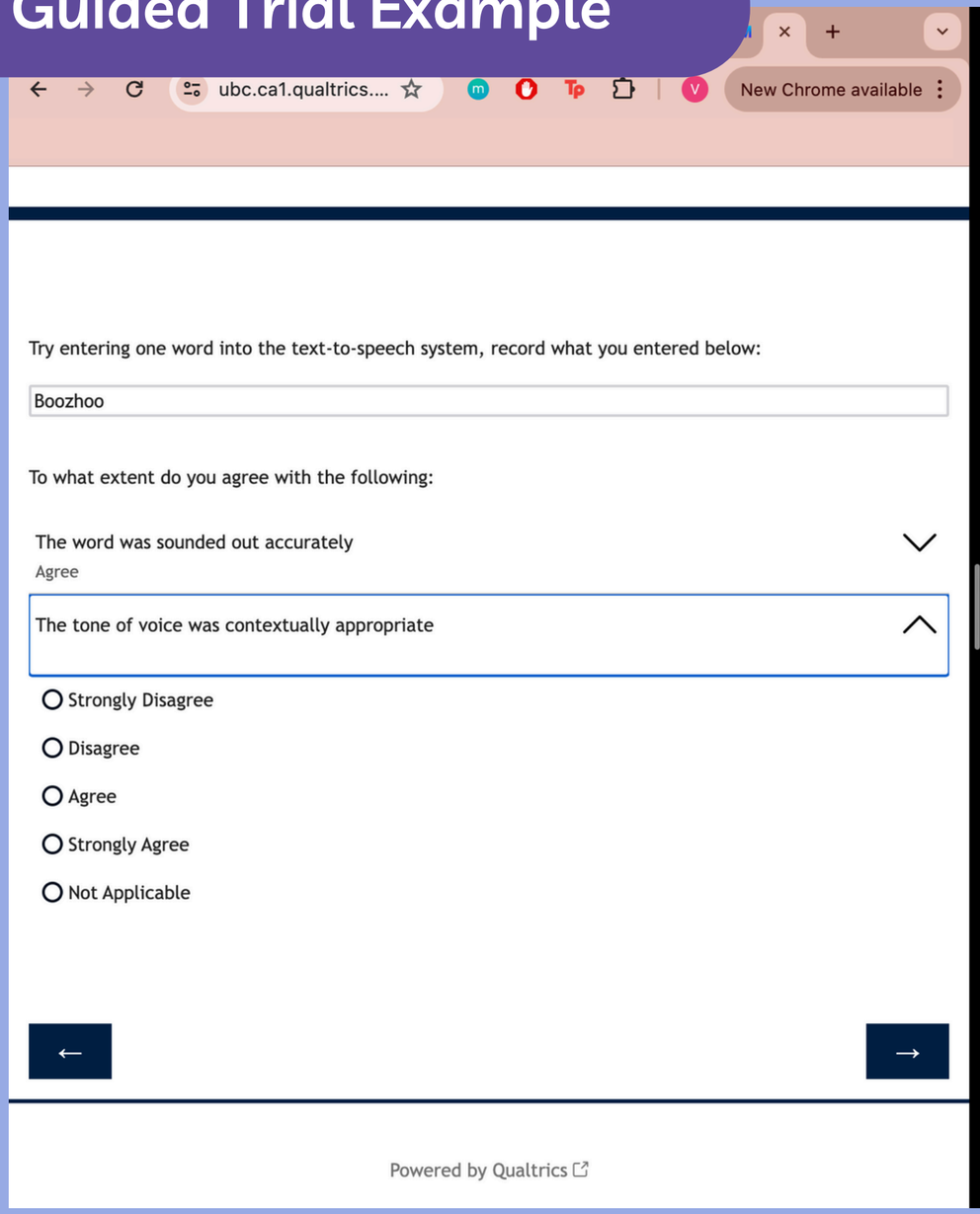
Pre-workshop Qualtrics questionnaire
~ 1 hour

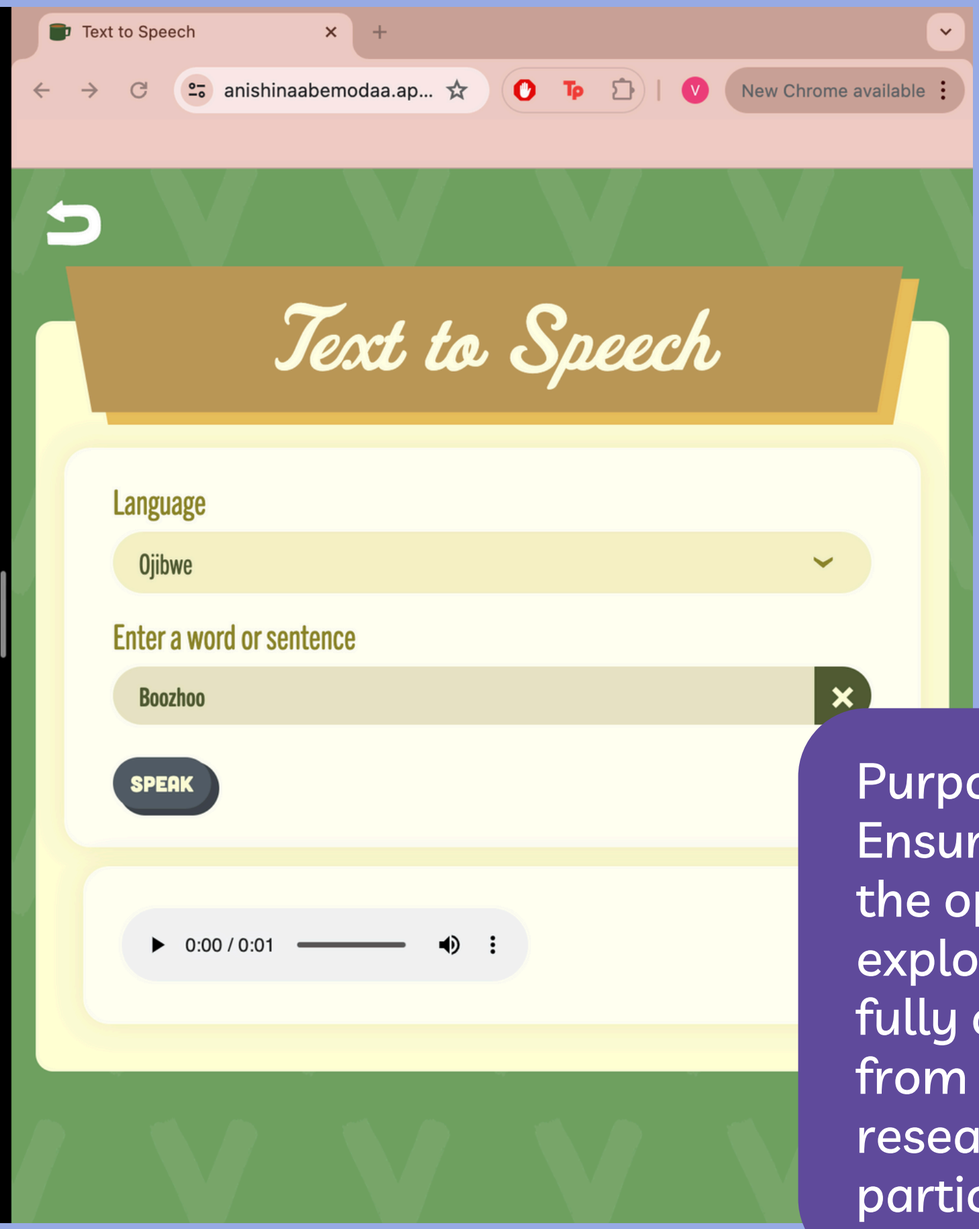
1. Demographic survey
2. Guided trial of TTS feature
3. User experience survey

Workshop on Zoom
~ 2 hours

Total time commitment: 3 hours

Guided Trial Example



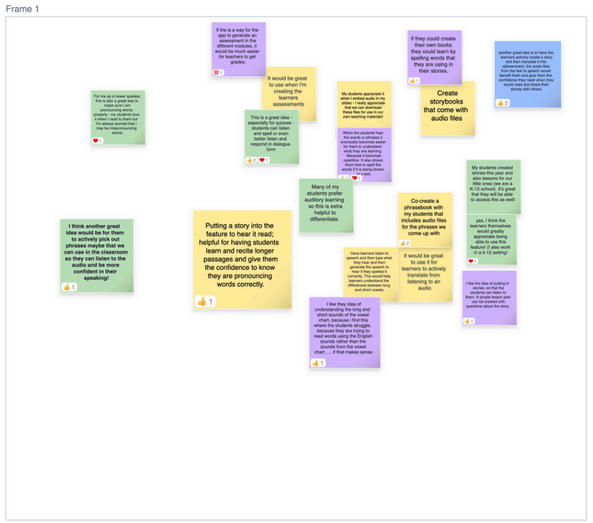


Purpose:
Ensure participants had the opportunity to explore the TTS feature fully on their own, free from influence from researchers and other participants

Workshop Zoom Whiteboard Set-up

1. Rapport-building
2. Brainstorming activity
3. Sorting activity
4. Choose one idea to develop
5. Develop lesson plan
6. Debriefing the activity
7. Personal reflection

Brainstorm Area



Sorting Area

Lesson Planning

Age group (Can be all ages):

Goal: to co-create a phrasebook as a class

Begin by teaching introductions, useful phrases, questions they ask frequently of each other, getting to know you phrases, teacher commands, numbers, classroom items, feelings emotions, family members

As we learn this vocabulary, we create the phrasebook so it is a living document of our learning.

"Phrase of the day" - students record the phrase with the audio file in a document they get to keep as an ongoing resource.

Materials needed: online template for the phrasebook

First introduction teacher would model how to write/spell the word and then how to generate the audio file and embed it in the template

How can the project benefit community efforts at language maintenance and revitalization?

Inclusive Education

Encouraging Language Use

How can the project benefit community efforts at language maintenance and revitalization?

Inclusive Education

- Help implement accommodations
- Support students who struggle with reading and writing
- Create multimodal learning materials
- Offer alternative assessment options

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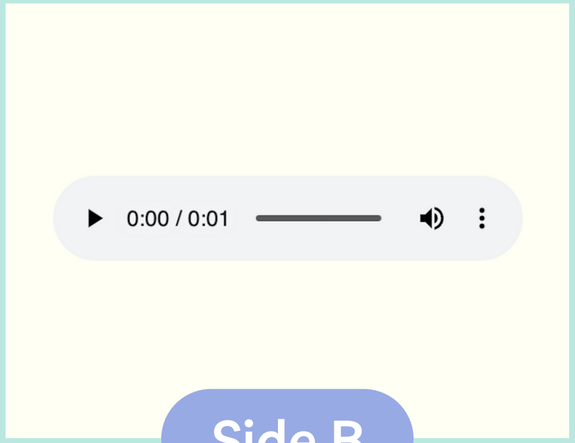
Workshop 2 Activity

(1) Practice Phase

- Input terms from vocabulary list into TTS feature
- Listen to audio, practice pronunciation

(2) Create Flashcards

- Record self reading vocabulary word
- Use flashcard software or PowerPoint to put word on one slide/ side then audio clip on the next



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Workshop 1 Activity 16

Make-Your-Own Phrasebook

1. Download audio clip of phrase from TTS feature
2. Add audio clip next to text of phrase
3. Periodically update phrasebook

Sample

My Phrasebook

agongosens 0:00 / 0:01

mashkode-bizhiki 0:00 / 0:01

waabooz 0:00 / 0:01

How can the project benefit community efforts at language maintenance and revitalization?

Encouraging Langauge Use

- Encourage students to practice speaking and listening at home
- Increase exposure to language outside of the classroom
- Support community effort to educate students

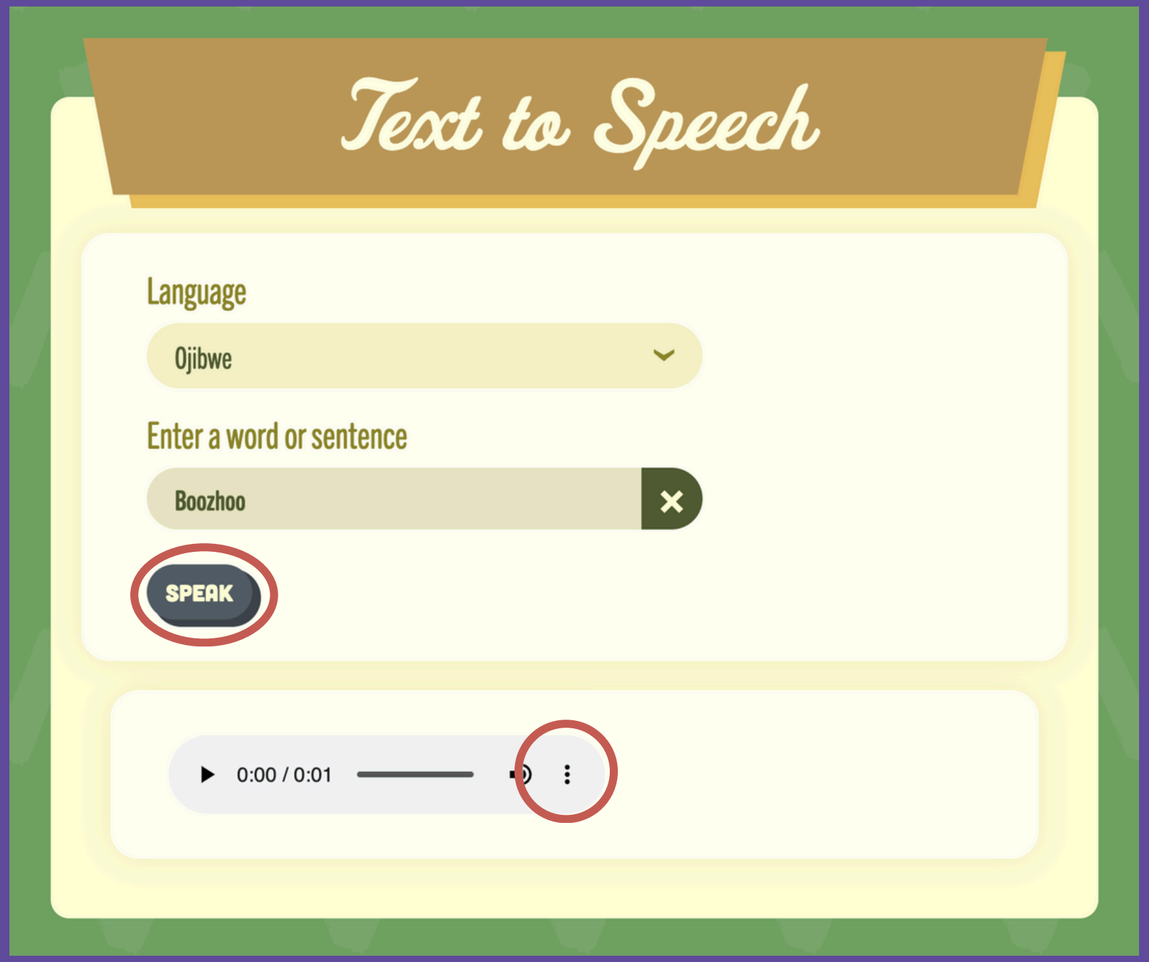
What are some challenges you encountered and how did you address them?

Accessibility

Issues with Literacy

Lack of Representation

What are some challenges you encountered and how did you address them?

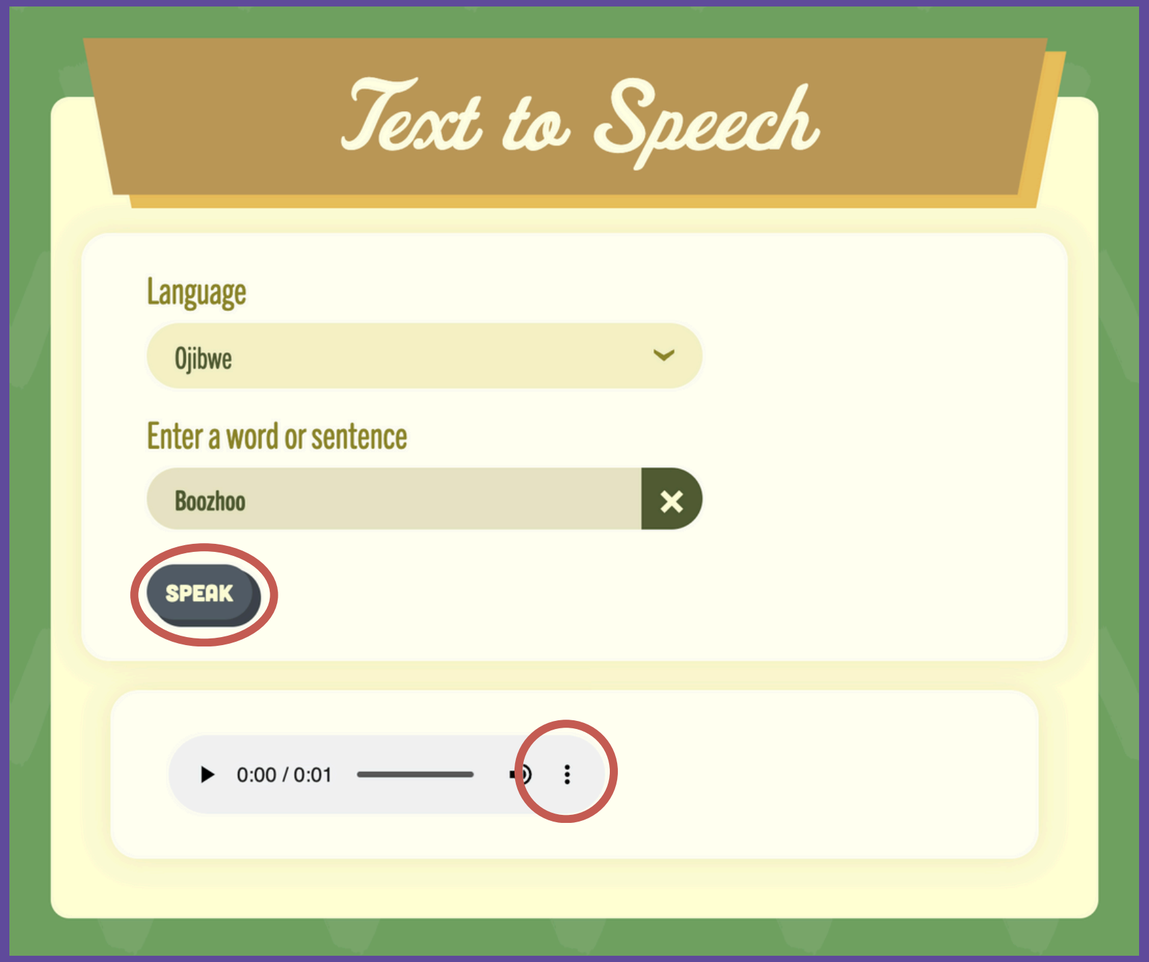


Accessibility

Using TTS not an intuitive experience:

- “Speak” instruction unclear
- Function of three dots unclear

What are some challenges you encountered and how did you address them?



Accessibility

Using TTS not an intuitive experience:

- “Speak” instruction unclear
- Function of three dots unclear

How to address

- Change language used to be a balance between technical and user-friendly
- Add more instructions to interface

What are some challenges you encountered and how did you address them?

Literacy

- Correct spelling in standard orthography needed to generate accurate synthetic speech output
- Spelling is challenging for some
- Dialect differences

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Literacy

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How to address

- New multilingual model allows for more flexibility in writing system (Wang et al., 2025)
- Spell-check mechanism (Hammerly et al., 2025)

What are some challenges you encountered and how did you address them?

Lack of Representation

- Only one voice option of a middle-aged male on the TTS feature
- Ethical concerns regarding use of likeness

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How to address

- Use of Multilingual TTS instead of VITS → Faster generation of synthetic speech, fewer samples needed to train
- New adult female voice trained
- Modulation of voices

(Wang et al., 2025)

What lessons have you learned that might benefit similar collaborations?

Lessons Learned

1

Building trust and rapport is as much a priority as meeting the aims of the study.

Understand challenge of being open with strangers

Plan ample time for rapport building

Accommodate different styles of communication

Setting expectations:
“All ideas are good ideas”
“This is a safe space”

Lessons Learned

2

A role-reversal in the researcher-participant dynamic is beneficial to community collaborations.

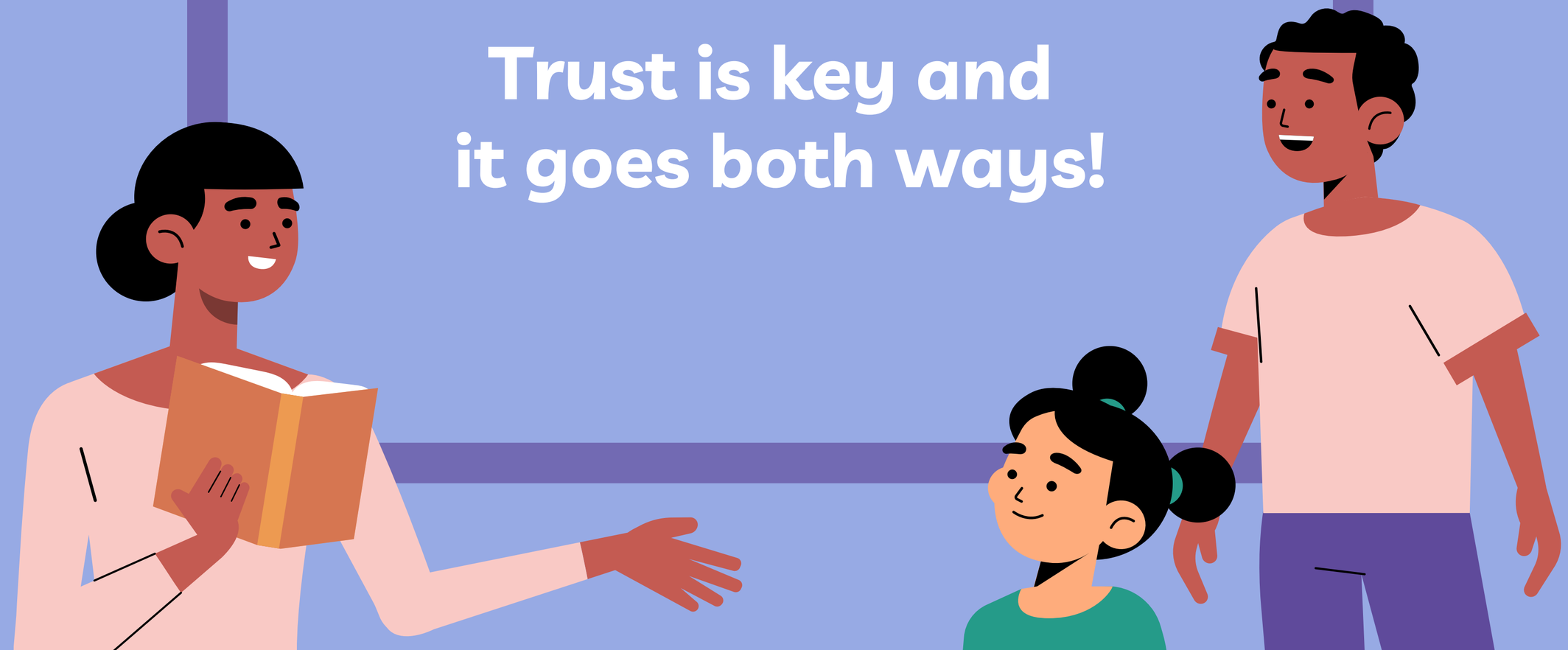
Researcher seeking to learn from participant (subject-matter expert)

Partipants dictate flow of unstructured discussion

Less stress on quality of data collected or standardization of procedures

Immerse self in the consultative process, less researcher anxiety

Trust is key and
it goes both ways!



Q&A

Key References

TTS for Indigenous Language Education:
Pine, A., Cooper, E., Guzmán, D., Joanis, E., Kazantseva, A., Krekoski, R., Kuhn, R., Larkin, S., Littell, P., Lothian, D., Martin, A., Richmond, K., Tessier, M., Valentini-Botinhao, C., Wells, D., & Yamagishi, J. (2025). Speech generation for indigenous language education. Computer Speech and Language, 90, Article 101723. Advance online publication. https://doi.org/10.1016/j.csl.2024.101723

Ojibwe TTS Model ComputEL-6 Paper:
Hammerly, C., Fougère, S., Sierra, G., Parkhill, S., Porteous, H., & Quinn, C. (2023, March). A text-to-speech synthesis system for Border Lakes Ojibwe. In Proceedings of the Sixth Workshop on the Use of Computational Methods in the Study of Endangered Languages (pp. 60-65).

PD Methods:
- Barcham, M. (2023). Towards a radically inclusive design–indigenous story-telling as codesign methodology. CoDesign, 19(1), 1-13.
- Flaskerud, J. H., & Anderson, N. (1999). Disseminating the results of participant-focused research. Journal of Transcultural Nursing, 10(4), 340-349.
- Lin, P., & Van Brummelen, J. (2021, May). Engaging teachers to co-design integrated AI curriculum for K-12 classrooms. In Proceedings of the 2021 CHI conference on human factors in computing systems (pp. 1-12).
- Roschelle, J., Penuel, W., & Shechtman, N. (2006). Co-design of innovations with teachers: Definition and dynamics.
- Woodward, E., & Marrfurra McTaggart, P. (2016). Transforming cross-cultural water research through trust, participation and place. Geographical Research, 54(2), 129-142. ISO 690
- Zelenko, O., Gomez, R., & Kelly, N. (2021). Research co-design: meaningful collaboration in research. In How to Be a design academic (pp. 227-244). CRC Press. ISO 690

New Multilingual Ojibwe TTS Model/ FST:
- Hammerly, C., Livesay, N., Arppe, A., & Stacey, A., Silfverberg, M. (2025) OjibweMorph: An approachable finite-state transducer for Ojibwe (and beyond). Manuscript submitted for review to Language Resources and Evaluation.
- Wang, S., Yang, C., Parkhill, M., Quinn, C., Hammerly, C., & Zhu, J. (2025). Developing multilingual speech synthesis system for Ojibwe, Mi'kmaq, and Maliseet. arXiv preprint arXiv:2502.02703.