

## 21C Tools: 21st Century Tools for Indigenous Languages

Antti Arppe

University of Alberta

arppe@ualberta.ca

With computational technologies, one need not be restricted to creating only digital facsimiles of traditional physical resources such as dictionaries, text collections, grammars, and audio recordings, where the organization, access/search, and presentation of the data still mainly replicates the conventions developed for, and restricted by, the original physical artefacts. Rather, computational technologies allow us to reimagine how a learner (or speaker) of a language can access and find as well as organize the linguistic information that they need and are looking for as quickly and intuitively as possible. Furthermore, computational modeling, in particular rule-based approaches, of the word structure of a language with a rich and complex morphology, as is often the case for Indigenous languages, allows one to concisely describe extensive inflectional (and derivational) paradigms, without having to observe, or enumerate, all of these wordforms individually. Crucially, rule-based computational approaches, in contrast to the very latest machine-learning techniques, will generate and recognize precisely and only those word-forms that they are instructed to do (by a human). Moreover, recent developments in computational speech synthesis technology allow us to efficiently create surprisingly reliable spoken representations of all the linguistic materials, well beyond what would ever have been possible, or reasonable to expect, through recordings of fluent speakers. Nevertheless, great care should be taken to make clear to the user when linguistic data has been produced authentically by a native speaker, in contrast to a computational model's best approximation. We will showcase, using Plains Cree / nêhiyawêwin as an example case, a suite of interlinked digital tools that the Alberta Language Technology lab ([altlab.ualberta.ca](http://altlab.ualberta.ca)) and its partners in the project "21st Century Tools for Indigenous languages" ([21c.tools](http://21c.tools)) have developed, which process has also resulted in several open-source, language-independent software platforms, which together support the learning, teaching, and use of Indigenous languages in the 21st century.