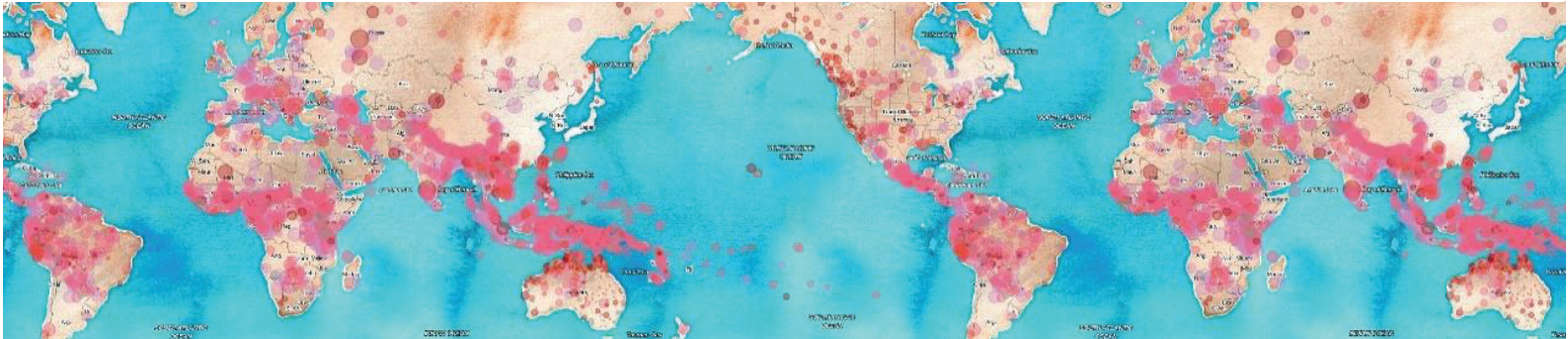


Mapping language and land with the Nunaliit Atlas Framework: Past, present and future

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Mapping language and land with the *Nunaliit Atlas Framework*: Past, present and future

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Abstract

The Nunaliit Atlas Framework is a collaborative mapping platform designed for creating interactive online atlases following the principles of cybercartography. This paper provides an overview of the application of Nunaliit to mapping language and land, showing the evolution of cybercartographic language atlases from mapping Indigenous place names on topographic maps to displaying abstract language relations using non-geographical visual forms. The languages mapped in these atlases include Gwich'in (an Athapaskan language), the language of Canadian Inuit, and the languages of Iran. We also discuss future Nunaliit language mapping initiatives, with a focus on an astronomical atlas by the Indigenous Pa Ipai and Koal people of Mexico. Consistent across all these atlases is a commitment to language documentation, the importance of presenting language in context, and the collaborative process of atlas creation.

Introduction

This paper provides an overview of how the Nunaliit Atlas Framework enables integrated mapping of language and land, and illustrates its diverse applications through an account of past, present, and future language atlas initiatives.

Nunaliit is a collaborative mapping platform that has been designed according to the principles of a recent, influential idea known as cybercartography. Cybercartography (Taylor 1997, 2005, 2014) is an approach to mapping which emphasizes the importance of land, culture and technology as parallel drivers of the mapping process. It incorporates both qualitative and quantitative resources in multi-modal and interactive data presentations, in an inherently collaborative research process that situates communities of map users at the centre of atlas production. It can be summed up in the plurality of all facets of knowledge: plurality of sources, contributors, perspectives, methods, scales, goals, and modes of communication and interaction (Eddy & Taylor 2003). While the emergence of cybercartography around 1997 predated and paved the way for other important collaborative movements such as geocybernetics (Reyes et al. 2014), NeoGeography (Goodchild 2009) and Participatory GIS (Dunn 2007), it lives on in its own right at the forefront of cartography's evolution as a wider field.

The open-source Nunaliit Atlas Framework (Pulsifer et al. 2010; Hayes et al. 2014; Hayes et al., in press; GCRC 2006–2018) was developed at the Geomatics and Cartographic Research Centre (GCRC) at Carleton University in Ottawa, Canada, to enable the application of cybercartography through digital mapping. Peter Pulsifer, an active contributor to Nunaliit, maintains that although Nunaliit is not the only platform that allows for the production of cybercartographic maps (other more recent tools that come to mind are ESRI Story Maps and some Google Maps mash-ups), through its intrinsically relation-oriented design and distributed architecture it is still the platform best suited for this (pers. comm. 2018). Since its inception in 2006, Nunaliit has been deployed in the production of online atlases on a range of issues spanning historical events, organizational structure, documentation and resolution of social and environmental issues, political and economic discourse, and Indigenous knowledge (GCRC 2018).

Language mapping, the focus of this article, is a recent application of the Nunaliit Framework. Traditionally, language mapping focuses on the spatial and social distribution of language varieties (language families, languages, dialects, and sociolects) (Upton 2010; Mang & Wollin 2010; Anonby & Sabethemmatatabadi, in press), but Nunaliit-built atlases demonstrate that the scope and implementation of language mapping can be much broader and richer than this. The earliest expressions of this new emphasis in Nunaliit revolved around the

connection between Indigenous language and land, and this theme has remained strong in all of the Nunaliit-constructed language atlases.

In this paper, we chronicle past, present, and future applications of the Nunaliit Framework to language atlases created in collaboration between Carleton’s GCRC and Indigenous and minority communities in various regions of the world. With attention to the language mapping research process over time, we show the development and enhancement of these atlases, progressing from mapping names of places and geographical features on topographic maps to displaying abstract language relations using non-geographical visual forms. What remains consistent across all the atlases is a commitment to language documentation, the importance of presenting language in context, and the collaborative process of atlas creation.

Past atlases: Nunaliit and language mapping

The earliest language-related atlases explored the naming and use of Indigenous space through the mapping of traditional place names in northern Canada. These are the *Arctic Bay Atlas* (Elliot, Willie et al. 2009–2018), the *Kitikmeot Place Name Atlas* (Keith et al. 2009–2017; Keith et al. 2014), and the *Gwich’in Atlas* (Kritsch, Andre et al. 2012–2018; Aporta et al. 2014). There are many purposes for mapping Indigenous place names, including reclaiming and defending ancestral lands and resources; strengthening Indigenous political organization, economic planning and natural resource management; and documenting and preserving Indigenous history and culture (Chapin et al. 2005). The primary goal of these early Nunaliit language atlases was to document Indigenous knowledge of the land, and to keep alive the culture, history, and values associated with the people and their land, before they would be lost to future generations (Elliot, Willie et al. 2009–2018; Keith et al. 2014; Aporta et al. 2014).

Each of these atlases contains an interactive topographic map containing the location, written name and pronunciation of traditional places, with additional information such as English translation, coordinates, boundaries, and geographical entity (see Figure 1 from the *Kitikmeot Place Name Atlas*). In addition to common

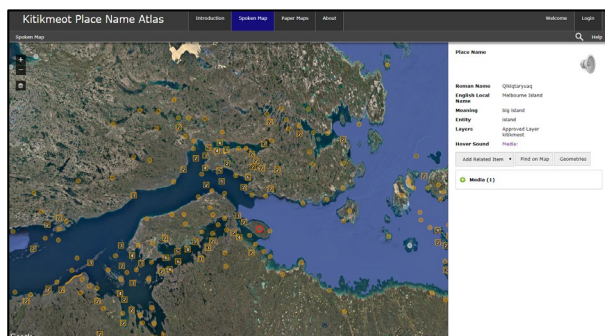


Figure 1. Kitikmeot Place Name Atlas

landmarks such as lakes, rivers, islands, points, sounds, hills, and cliffs, the maps contain geographical entities such as trails, traditional camp locations, graves, historic sites, harvesting locales, and sacred or legendary places.

With their rich oral traditions, it was important for Inuit and Gwich’in people to provide a context for the place names through video recordings of elders sharing stories about the cultural and historical significance of these places. The multimedia format of the Nunaliit platform easily accommodated the integration of text, photographs, and audio and video recordings.

Following a central tenet of the cybercartographic process, these atlases were developed by GCRC in partnership with Indigenous communities and organizations. For example, the *Arctic Bay Atlas* was a joint project with Nunavut Youth Consulting and Arctic College to engage Inuit youth and elders of the community in researching, documenting and representing their multi-faceted knowledge of the land. The *Kitikmeot Place Name Atlas* was created as an online platform for displaying place names that the Kitikmeot Heritage Society in Cambridge Bay, Nunavut had started collecting in 2000. The *Gwich’in Atlas* was part of a place name project started in 1992 by the Gwich’in Social and Cultural Institute as a cultural revitalization initiative and for documenting traditional land use.

Another early Nunaliit atlas documenting Indigenous knowledge is the *Siku Atlas* (Ljubicic, Taylor et al. 2008–2018). This atlas focuses on Inuit knowledge of sea ice (*siku*), including sea ice formation, timing of freeze-up and breakup, ice thickness, and changes in sea ice conditions (Laidler et al. 2010; Pulsifer et al. 2010, 2011; Ljubicic et al. 2014). Four Inuit communities on Baffin Island, Nunavut, are involved: Cape Dorset, Clyde River, Igloodik, and Pangnirtung. A topographic map was created for each community, where the location of sea ice features such as tidal cracks, ice ridges, and floe edges around the community are displayed in an interactive format that allows additional information on the features and localities to be exhibited. Figure 2 shows the locations of early ice melt around Cape Dorset.

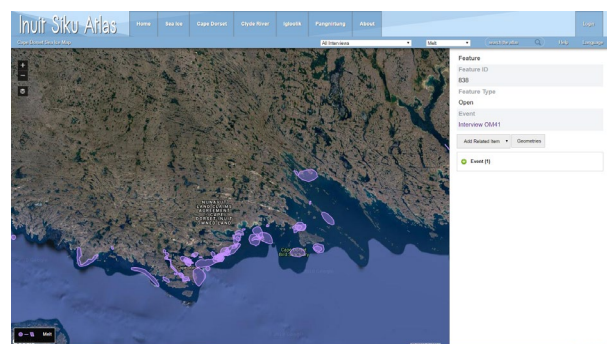


Figure 2. Early ice melt around Cape Dorset (*Siku Atlas*)

The atlas also contains a Sea Ice module that introduces commonly recognized sea ice features on a generic icescape (Ljubicic et al. 2014). Clicking on a feature brings up a panel with detailed information on the

feature, along with photographs and audio interviews with Inuit sea ice experts where available (Figure 3).

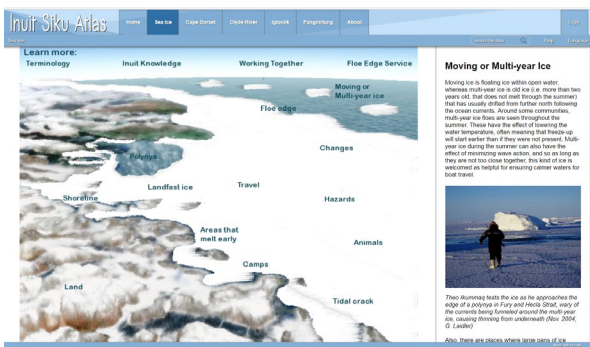


Figure 3. Generic sea ice map (*Siku Atlas*)

While the original objective of the *Siku Atlas* did not include exploring Inuit terminology for sea ice features, it became apparent that in order to understand Inuit sea ice knowledge it was necessary to learn the relevant terms in their language, Inuktitut (Ljubcic et al. 2014). Change is an important concept in sea ice terminology, found in the seasonal stages of freezing and thawing in the sea ice cycle (Ljubcic et al. 2014; Pulsifer et al. 2014). Shown in Figure 4 is a “map metaphor” that represents, through sea ice terminology, the relation between language and land, with the addition of a third dimension, time.

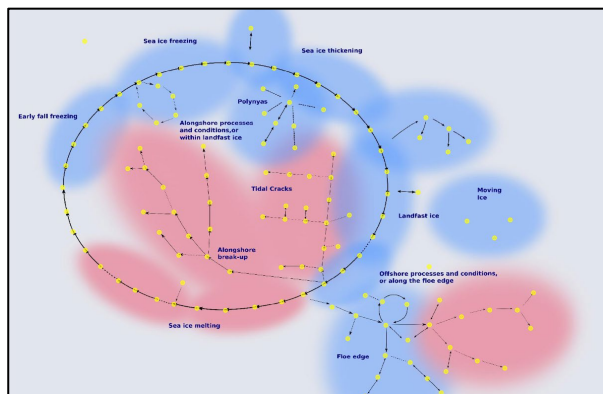


Figure 4. Sea ice terminology and seasons (*Siku Atlas*)

In Figure 4, the blue background shading represents freezing stages, and the red background shading, melting stages. The circle represents both time and space. Starting with the “Early fall freezing” stage in the leftmost blue section and moving clockwise, the circle represents the progression of general freeze/thaw stages such as “Sea ice freezing,” “Sea ice thickening,” and “Landfast ice.” The red section at the bottom of the circle represents the “Sea ice melting” stage. Each yellow node on the circle represents an Inuktitut term for an ice condition or process found during a particular freezing or melting stage. The circle is also an abstract representation of the land: terms shown on or inside the circle are conditions relating to the shoreline or land; those on the outside occur along the floe edge, or offshore. Each node links to

the pronunciation of the term, a full description, photograph, and other related materials (Pulsifer et al. 2010; Ljubcic et al. 2014).

Similar to the earlier place name atlases, the *Inuit Siku Atlas* documents the close relation between language and land in Indigenous culture. The importance of context is also evident, in the links to photographs of sea ice features and video interviews with Inuit elders. The atlas was developed in close collaboration with Inuit through interviews, participatory mapping sessions, and focus groups (Ljubcic et al. 2014).

This atlas differs from previous ones, though, in the introduction of abstract representations in the visualization of information. Whereas the earlier atlases displayed the location and names of places on a topographic map that realistically represented their actual location, in the *Siku Atlas* we see a generic sea ice map (Figure 3), and in Figure 4, a “map metaphor” that only abstractly represents the land with a circle. Furthermore, while the maps in the place name atlases displayed the relation between two elements, language and the land, the diagram in Figure 4 represents language, land, and a third dimension, time (seasons). The two current atlases discussed in the next section, the *Atlas of the Languages of Iran* and the *Atlas of the Inuit Language in Canada*, exhibit further abstractions in both form and relations, while retaining the key properties of language documentation, the importance of showing language in context, and a collaborative and user-centred process in creating the atlas.

Present initiatives in language mapping with Nunaliit

The Atlas of the Languages of Iran (ALI)

The first Nunaliit atlas with a primary focus on language is the *Atlas of the Languages of Iran* (ALI) (Anonby, Taheri-Ardali et al. 2015–18). The overall goal of the ALI research programme is to enable work toward a systematic understanding of the language situation in Iran. Like its language-related predecessors, local perceptions of language and its place in people’s connection to the land remain as basic organizing principles, but the systematic treatment of large linguistic data sets and exploration of how people perceive, organize and apply language relationships are new emphases. Initiated in 2009, today ALI is an online, open-access resource (iranatlas.net) that is being developed by an international team of seven institutional partners and more than sixty scholars¹ in collaboration with Iran’s diverse language communities. The atlas is simultaneously published in Persian, English and French.

The structure and content of the atlas as a whole has been crafted to incorporate and enable the representation of complementary perspectives. The identification of atlas

1 A list of institutional partners and team members is found at: iranatlas.net/module/atlasteam.

user groups, along with analysis of existing language maps and classifications of Iran's languages, are instrumental in understanding how different groups view the language situation. Major user groups include Iranian and western scholars, policy makers in Iran, speakers of the national language Persian, and speakers from each of the country's many other language communities; and within each of these groups, there is also a plurality of perspectives represented (Anonby and Sabethemmatabadi, in press).

As in traditional language atlases, language distribution maps and linguistic structure maps are central fixtures in ALI. Figure 5 is a static map showing the distribution of the word for 'man' in the province of Chahar Mahal va Bakhtiari in Iran. Figure 6 shows the distribution of language varieties in the same province.

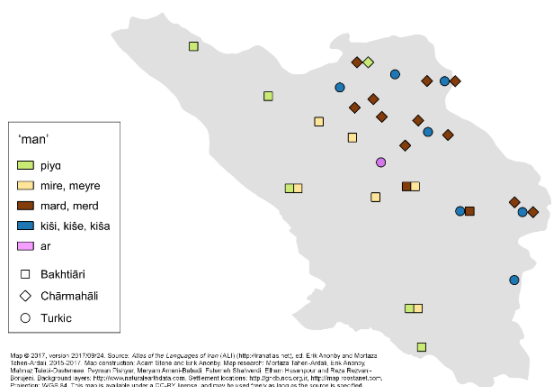


Figure 5. Traditional representation of a linguistic feature in one province of Iran (ALI)

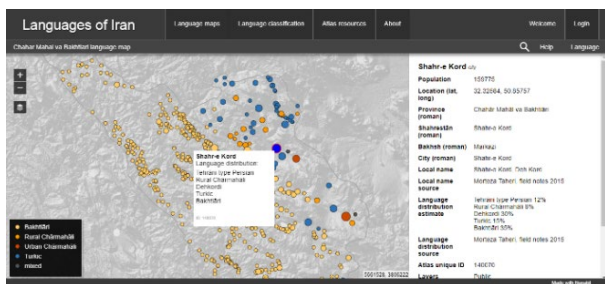


Figure 6. Screenshot of an interactive map of language distribution in one province of Iran (ALI)

Figure 6 is an innovative, interactive point-based map that contributes much more significantly than static maps to the objectives of the atlas as a living document grounded in the experience of its users. It embodies the audience-centred, relational and multimodal ethos of cybercartography in the following ways: each of the province's several hundred cities and villages is represented; the local name (which often differs from the official name) is provided, and accompanied by a sound file when possible; locally-researched language distribution information is specified; and the researcher who collected this information is cited. From this map, users may navigate to any other piece of information in the atlas that is related to the map, such as a fuller description of each of the language varieties spoken in any

settlement, bibliographic references that are relevant to it, or words that have been collected there (and, once the programming is in place, they will be able to navigate to interactive maps that show these words). Further, any user who is logged in can make suggestions for changes or additions to the information in the map, subject to a moderation process. (For further features of the maps, and the research process that is used to generate them, see Anonby (2015) and Anonby, Mohammadirad & Sheyholislami (in press).)

Even the content and display of the language maps is receptive to differences in the perspectives that individual users, or people from the major user groups mentioned above, bring to the atlas. This is achieved through the application of an interactive three-dimensional language relation web (Figure 7), discussed in detail elsewhere (Anonby 2017; Anonby et al., forthcoming), which documents and applies differences in the inventory of language varieties that users wish to include in a given map; the labels they specify for these language varieties; and the way that they group the language varieties together on the map.

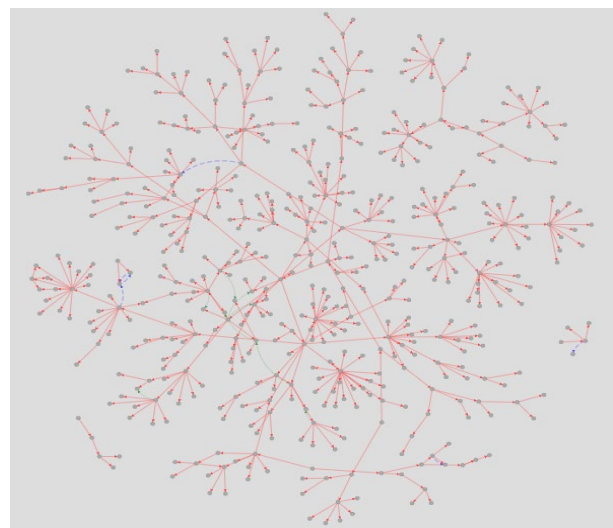


Figure 7. Screenshot of ALI's interactive, user-defined 3D language relation web (under development, from: iranatlas.net/module/taxonomy.selectMap)

In this way, greatly differing maps are produced within the atlas by people exhibiting fundamental differences in presuppositions about language identity and distribution. Critically for the purposes of the atlas, users can then compare their own maps with those of others (see Anonby & Sabethemmatabadi, in press, for examples) and, ultimately, the many linguistic data maps in the atlas, in order to arrive at a refined and well-informed picture of the language situation.

The focus on complementary perspectives among individuals and groups in ALI contrasts with the particular emphasis on the perspective of Indigenous elders that was at the core of earlier language-related Nunaliit atlases. The flexible, user-centred Nunaliit platform can accommodate both approaches, making it a versatile tool for fulfilling different user needs. Another

unique property of ALI is the emphasis on perceptions of language relationships, in particular the inventory, naming and grouping of language varieties, rather than being limited to the direct relation between language and the land that was central to the earlier place name and terminology atlases. This theme of mapping language relationships is further developed in the second Nunaliit atlas focusing specifically on language, the *Atlas of the Inuit Language in Canada*.

Atlas of the Inuit Language in Canada

A primary objective of the *Atlas of the Inuit Language in Canada* is to help protect and strengthen the vitality of Inuit dialects through the documentation of their words (Murasugi et al. 2016–2018; Murasugi & Ittusardjuat 2018; Murasugi, in press). The central component of this atlas is a multidialectal database of written and spoken words in twelve Inuit dialects. Each entry in the lexical database consists of the Inuit word, English equivalent, grammatical category (noun, verb, etc.), semantic category (e.g. body parts, seasons), definition, pronunciation, source, associated dialect and community, and links to photographs and videos, where available.

The *Atlas of the Inuit Language in Canada* contains a typical language distribution map displaying language varieties associated with Inuit communities on a topographic map (Figure 8).

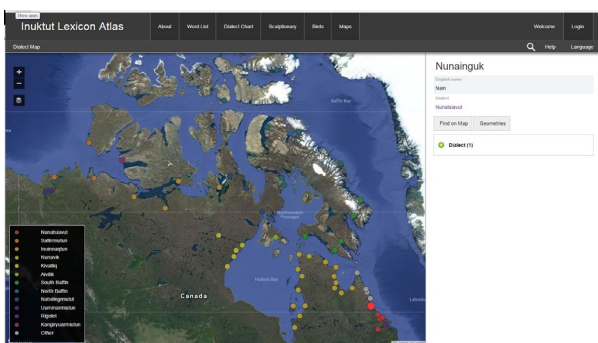


Figure 8. Language distribution map (Inuit Atlas)

However, the variety of information in the database, and the Nunaliit platform structure itself, which enables flexible representation of relationships between data elements (Ljubic et al. 2014), encourages the mapping of relationships beyond language (word forms and dialects) and the land (communities). In fact, the central focus of the atlas is on the relation between word forms and dialects, without the mediation of land. The land, though, is inherently present because of the geographical basis of Inuit communities and their dialects.

This relation between word form and dialect is represented visually in different ways for different purposes and users. Two examples are the Dialect Chart (Figure 9) and the Sculptionary (Figure 10). Because location is not a salient feature, the visualizations are not bound to geographically-based topographic maps.

In the Dialect Chart (Figure 9), each row displays the Inuit word belonging to a particular semantic category

(e.g., Body Parts, Birds, Animals, Kinship Terms, Weather), with a column for each dialect. Hovering on a word brings up an audio recording of its pronunciation. Clicking on it brings up a side panel consisting of all the information in the database associated with that word. This presentation of words in different dialects is particularly suited to the analysis of dialectal similarities and differences, and is useful for translators, teachers, and linguists.

English	Nunatsiavut	Sallirmiutun	Inuinnaqtun	Nunavik	Kivalliq
forehead	kauk	qauq	kiinaq	qauq	qauq
groin	lutak		imlqutak	imlqutaaq	
gum	akkik	iki	itkiq	itkiq	
hair	nujak	nuyaq	nuyaq	nuyaq	nujak
hand	aggak	adgak	algak		aggak
head	niakuk	niaquq	niaquq	niaquq	niaquq
heart	ommatik	uumman	uummat	uummat	uummat
heel	kimmik	kimmik	kingmitquq		kumaak
hip	kotsinák	ukpatik	hilviaq	sivviaq	
jaw, lower	alliguk	agliguk	agliguk	alliruk	alliruk
kidney	talluk	taqtuq	taqtu	taqtu	
knee	sekkuk	sittuq	hittuq	sittuq	
larynx (voice box)	tukkuják		nivyaarvik	nipiqauvik	turquajaq
leg	niuk	niuk	atiraq	niuk	
lip, lower	qaquk	qaquk	qaqnuq	qarsuq	
lip, upper	kakkiviak	kakkiviaq	umilruq		kakaiviaq
liver	tinguk	tinguk	tinguk	tinguk	tinguk
lower lip					qaklu
lung	puvak	puvak	puvak	puvak	
mouth	kanik	qaniq	qaniq	qaniq	qaniq

Figure 9. Dialect Chart (Inuit Atlas)

The Sculptionary (Figure 10) presents words belonging to the semantic category of Body Parts in an interactive visual format. The sculpture in Figure 10 consists of body part “hotspots” that are connected to words in the database. After selecting a dialect from a menu, the user can hover over a body part to hear the word pronounced, or click on it to see all the information associated with that word in a side panel. Figure 10 shows the result of selecting the Inuinnaqtun dialect and clicking on the sculpture’s foot. If “All dialects” is selected, then the forms from all dialects appear in the side panel, with links to the individual entries in the database. The Sculptionary is a useful tool for teaching language in an engaging and interactive way.

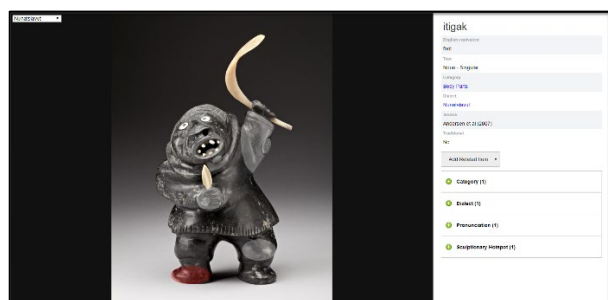


Figure 10. Sculptionary module (Inuit Atlas). The sculpture is the work of Gjoa Haven artist Nelson Takkiruk (1930–1999).

Figures 9 and 10 present the same information in the database but from different perspectives. Regardless of the visual format, they both reinforce the uniqueness and importance of the dialects, and raise awareness of the similarities and differences among them by facilitating cross-dialectal comparisons of word forms.

This atlas exhibits the fundamental properties shared by all the language-related Nunaliit atlases discussed so far: documentation as a main purpose, context, interactivity,

and user-centred approach. Consistent with the user-centred ethos of cybercartography, Inuit are the main participants in the creation of this atlas. Fluent speakers contribute to the database by providing new words or confirming ones from published sources (e.g., dictionaries and glossaries). Those who are not fluent in the language are also valuable contributors. Mostly young, they have technical skills that are indispensable in the creation of an online atlas. At the same time, they have the opportunity to learn about their language by working with fluent speakers. With an approved user account, anyone can add and edit lexical entries from any location that has Internet access. There is also the option to work offline where Internet access is limited or unreliable, or when contributors are not comfortable using digital technology. All aspects of the content and design of the atlas are planned in consultation with Inuit partners, from the semantic categories included in the database, to the communities featured in the maps.

The future of language mapping with Nunaliit

Moving forward from past and present language mapping initiatives, several further Nunaliit-driven language atlases are taking shape: an *Atlas of Language on the Canadian Prairies* (see Rosen, in press), an *Atlas of Haudenosaunee Place Names* (Ingram et al., in press), and the *Pa Ipai Astronomical Atlas* (Parás Fernández et al., in press). As is already evident from their titles, these atlases are diverse in scope and nature. Rosen's atlas is currently focused on sociolinguistic variation and change among English speakers on the Canadian prairies. Relationships between language and variables other than, or in conjunction with, land, such as temporal and social variables, are explored. Like the past and present atlases discussed above, Ingram et al.'s project is firmly rooted in Indigenous knowledge, culture, and territory, but returns new insights regarding all of these elements through incorporation of rigorous morphological analysis, comparison, and mapping of place name roots. The *Pa Ipai Astronomical Atlas*, for its part, shows that the scope of language mapping is bound not only to geographical territory, but can also span representations ranging from outer space to the structure of meanings embedded within Indigenous knowledge itself. Here, we explore the development and trajectory of this third atlas in detail.

The *Pa Ipai Astronomical Atlas* maps the geographical and astronomical knowledge of the Pa Ipai and Koal people living in the municipality of Ensenada in Baja California, Mexico near the border with the United States. In pre-Hispanic times these people were semi-nomadic hunter-gatherers, but now, with their palmilla-based economy, they have settled in the towns of Santa Catarina (known also by its original Indigenous name of Xac Tojol) and Héroes de la Independencia, where the data for the atlas were collected. The Pa Ipai and Koal languages, part of the Yuman Cochimí language family, are severely endangered; through fieldwork, fewer than

10 Pa Ipai and 4 Koal speakers have been identified as fluent in their language. Pa Ipai and Koal families live in poverty, suffering from severe unemployment.

The Atlas contains two modules: the geographical and the astronomical. The geographical module consists of an interactive map of Santa Catarina and Héroes de la Independencia. On this map, Pa Ipai families have located and named specific elements of the landscape in their language. Furthermore, they have included short stories and songs related to those places. Some examples of locations are: Llano Colorado (The Red Plain), el Paso Coyote (Coyote's Pass), and el Cerro de la Palmilla (The Palm Hill).

The astronomical module, called the Sky Story Map, consists of a drawing by Martín Domínguez illustrating the Pa Ipai sky based on Pa Ipai and Koal oral traditions (Figure 11). The image is divided into three levels. The first level depicts the constellations and the Milky Way; the second displays the sun, the moon, Venus, comets, and other celestial bodies; and the third level shows earth-based elements such as the two coasts of Baja California, mountains, Santa Catarina and Héroes de la Independencia.

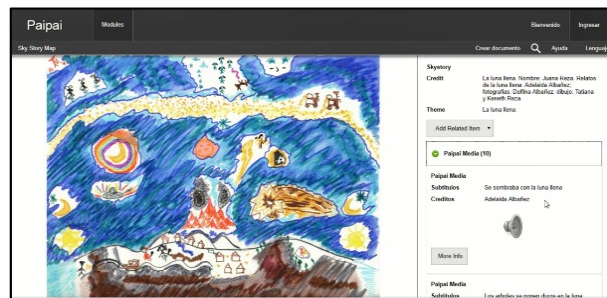


Figure 11. Sky Story Map module in the *Pa Ipai Atlas*

There are other important future directions for the *Pa Ipai Astronomical Atlas*. The Pa Ipai and Koal people are interested in defining the borders of their communities and territories, labelling significant features in the terrain, and identifying culturally and symbolically meaningful archaeological and historical sites. For the Pa Ipai and Koal people, maps are important not just for memories and symbolism, but also in the struggle for rights to their land. A further, related goal is to develop similar atlases for other endangered Yuman languages.

Conclusion

Nunaliit language-based atlases have evolved from a focus on Indigenous languages in the Canadian north, to Indigenous languages in Mexico, minority and majority languages in Iran, and even varieties of Canadian English. They can focus on the perspective of Indigenous elders, or display the multiple perspectives of different groups of atlas users. Since the earliest mapping of language and the land through place names, Nunaliit atlases have expanded their applications to include visualizations of all types of language relations. The development of these recent atlases underscores the versatility of the Nunaliit Atlas Framework, which both strengthens

and situates existing initiatives in language mapping, and opens new horizons for the very conceptualization of what a language atlas can be.

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