

## **BREAKING THE ICE: DESIGNING A PROTOTYPE FOR MULTILINGUAL ARCTIC TOPOGRAPHIC MAPS**

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### **ABSTRACT**

Multilingual maps for Canada's Arctic, are being developed at Earth Sciences Sector, Natural Resources Canada. The brief calls for maps which would open themselves up to the Inuit, the People of Canada's north, by including place names and other geographic information in their native languages. These new maps would be a common point of communication between the Inuit and other groups who go to the Arctic. They will also provide a means for Inuit elders to transfer their knowledge of the land to younger generations.

The new multilingual maps are based on the recent success of CanTopo: the newly designed Canadian topographic map series. CanTopo's art director was recruited to provide a certain amount of inertia to the work of designing the new maps.

The cartographic issues which emerged from our investigations deal specifically with hill shading and with representations and naming of topographic features as understood by the Inuit. The Inuit give names to features in their landscape in ways that are not easily absorbed by received notions of cartographic typography. We needed to formulate a strategy with enough flexibility to respond to this challenge.

In addition to the challenge of working with a new understanding of toponymy, the maps must be art directed to reflect the cultural distinctiveness of the Canadian Arctic. Design for the multilingual maps must also foster and support cross-cultural communication, as well as performing its duty of solving problems of activity-centered needs. Introducing new map content is part of achieving these goals. This may include hill shading, ice-flow edge, polynias, snow mobile trails, and other user-identified features.

The prototypes developed thus far have been workshopped in Nunavut. Feedback from these consultations form the basis from which to further develop the ideas that shape the surround, and determine the content of the map.

This paper uses details from prototypes to examine the theoretical means of problematizing the original design brief, and how findings from workshops in Nunavut informed the shape of this design proposal. It will also discuss how the shifts in scope of the project forced deeper design research and cartographic investigations.

The paper will include details and studies from these investigations to illustrate how our design process is able to respond to the new challenges. We hope the experiences described in this paper, and the maps we have designed, will be useful to other map designers when they are faced with their own large, complex design questions. The ideas represented here are not newly invented; we have only recognized new ways to apply them. In a similar fashion, we hope you might see ways to use them in your own work. And that we may then learn from you.

### **THE ORIGINAL DESIGN BRIEF**

The Multilingual Arctic Topographic Maps will make themselves relevant to the Inuit, the People of Canada's north, by including place names and other geographic information in their two native languages, Inuktitut and Inuinnaqtun. These new maps will serve as a common point of communication between the Inuit and other groups who go to the Arctic. Specifically, they would help those who travel to the arctic for scientific field work, economic development opportunities, search and rescue operations, and the Department of National Defence, when seeking advice from the Inuit. They will also serve the very important purpose of providing a means for Inuit youth to learn about the land from their elders.

Exceptional design is born from a deeper reading of the brief, placing nominal ideas within broader intersecting lines of creative inception [Francis and Desy, 2009]. It is here where the various forces meet to pull and push at the map, to shape it as it needs to be. The art director's duty is to be present to see how these movements sculpt the nominal ideas, respond to the gravity created, pick up the narrative threads which emerge, and deliver the graphic support onto which everything is secured.

These lines of force carry the requirements of each map audience group, those things they need to do with the map, the things they need the map to do for them, the realities of the production technology, and the requirements of the means of publishing and distribution.

## **POSITIONING OUR WORK**

While our deeper reading of the brief uncovered points of intersecting direction, our roles as art director and designer were necessarily framed by editorial choices. We asked the questions that were revealed during our critique, and responded as best we could to the editorial decisions which were made. Descriptions of this, as practiced, will be given later in the paper.

Activity-centered design extends its responsibilities beyond only reflecting user-identified content. It is a proactive approach which invites the designer to position himself as part of the user community engaged in a rigorous critique, demanding a high degree of functionality and organization from the product. As a design professional, he must now work to meet those expectations. The outcome is a product which is crafted to make its use easier and more natural.

Taking an activity-centered design approach makes clear the coincidences between map design and interface design. These coincidences open up possibilities for building devices and organizing information which will make accessing the information easier. This is apparent in the structure of the surround, as it mediates between user and information, affording avenues into the information, and suggesting ways of approach to the user.

Progressive disclosure is a theory borrowed from interface design [<http://www.interfacemafia.org/articles/200109/200109-ar0002.shtml> (accessed October 18, 2001)]. It describes how a single user interface may accommodate both general-interest users (such as the general public) and expert users (such as traffic engineers) by 'opening up' to reveal more options, more information, more detail or more analytical options, as the user might need. When this theory is applied to a paper map, it lets us problematize the organization of its information to imbed similar flexibilities.

The Multilingual Arctic Topographic Map project does not have the luxury of a pure research project where the *raison d'être* is discovery. We are designing a real world product, so it is important to have a clear understanding of what that product will come to be. However, there were migrations in the scope of the project. This necessarily meant we had to adopt an approach that 'over shot' any stated goals, projecting forward to anticipate content and need [Francis and Williams 2007].

Although this strategy demanded greater design output, the results can be edited to respond to a variety of anticipated needs. Additionally, the strategy forced deeper examinations of possibilities which constitute a valuable record of design research. It was important in this design research, to keep our efforts firmly attached to design's essential role of problem solver, rather than slipping into simply producing stylistic variation or decoration. Each design choice is rational and purposeful; it intends to solve a problem or remove a barrier to understanding.

## **CONSULTATION REPORTS**

In March, June and December of 2010, workshops were held in several communities in the Arctic. Participants included Inuit elders and Inuit school children, hunters, geologists, those who work at government agencies (culture/heritage, cartographers, toponymy, GIS, economic development), and academics. The reports from these consultations constitute the essential pool of information to mine for a design direction and to make editorial decisions for the new maps. However, there are opposing responses in these reports which need to be reconciled. For example, from the workshops in March, some respondents reported hill shading helps understand relief. Others reported hill shading would have little value because the sun's location in the sky is constantly moving, creating shadows which shift and change. Some participants said to include tidal zones. Others warned that the variability of this phenomenon means it is difficult to show on a map; plus the Inuit track tidal zone locations from experience [Fung, 2010].

Working through these issues often meant simply acknowledging the contradictions, while letting our experience and skills as professional practicing cartographers, geographers, and designers guide us toward workable editorial and design solutions. Exceptional care was needed to not impose our own will on the map, as this would compromise the integrity and purpose of the work. The new Multilingual Arctic Topographic Maps need to be a responsible, authentic and rational response to complex problems (the reported results from workshops in the Arctic; the requirements of our entire audience base) and intersections of the various forces that act upon it (design parameters and the possibilities of the production platform).

## **STARTING WITH CANTOPO**

The new multilingual maps are based on the recent success of CanTopo: the newly designed Canadian topographic map series [Francis and Desy, 2009]. It will be produced on the same software platform (MapGen), and will be made available through the same distribution network. CanTopo's art director was recruited to bring forward the lessons learned when that map series was being designed, and its production

platform was being developed. This knowledge provided much needed inertia to the work of designing the new multilingual map prototype. Throughout the design process we were in constant communication with the MapGen engineers, so our work would benefit their technical guidance.

## **CARTOGRAPHY**

### ***Hill shading***

The CanTopo design is based on very specific graphic signatures which give voice to all its feature categories. The balance of colour, shape, and texture are linked together by the sturdy theory of discursive categorial insertion. Each information type was collected and represented through a meaningful graphic form and an appropriate colour story [Francis and Desy, 2009]. Colour is the most potent and delicately balanced of those components. The greys of a hill shading layer compete directly with contours, spot heights, eskers, pingos, tundra polygons, tundra ponds, glaciers, roads and trails, sand in water, foreshore flats, dry river bed, single line streams, pipelines, mines, the UTM grid, built-up areas and typography. This compromises the communication potential of approximately 80% of the features which serve as the base for the new maps (figure 1).

The search for a remedy began with increasing the saturation and value of the colours which define hydrography (and other 'watery' features), the road symbol library, and the land category. These adjustments, it was hoped, would produce enough visual separation from the hill shading layer to let them advance. Next, the grey levels of the hill shading layer were manipulated to increase contrast and eliminate grey from zones where relief is flat. However, in October 2010 it was learned from conversation with Celine Gilbert (cartographer at the Geological Survey of Canada office in Iqaluit, Nunavut), the Inuit deem this to be too abstract. They insist both shadows and highlights be visible, not only implied, to comfortably glean information from hill shading (figure 2). The search for a solution began again with adjustments to the colour used for hill shading itself, as a way to relieve the conflicts with base map information. No satisfactory results have been achieved.

The benefits of hill shading are easy to understand. It offers the map user pictorial information about relief that is more digestible, and is accepted as less technical, than contour lines. But when this critique is continued from an activity-centered perspective, we encounter visual communication issues which must be acknowledged. In the documentary film, *Inuit Knowledge and Climate Change*, Inuit elder Joanaise Karpik of Pangnirtung speaks about the disappearance of the glaciers from the mountains that surround his village [Kunuk and Mauro, 2010]. Mr. Karpik would not be able to easily use the new map of Pangnirtung to talk about the disappearing glaciers with a youth, because hill shading would obscure this feature (figures 1&3).

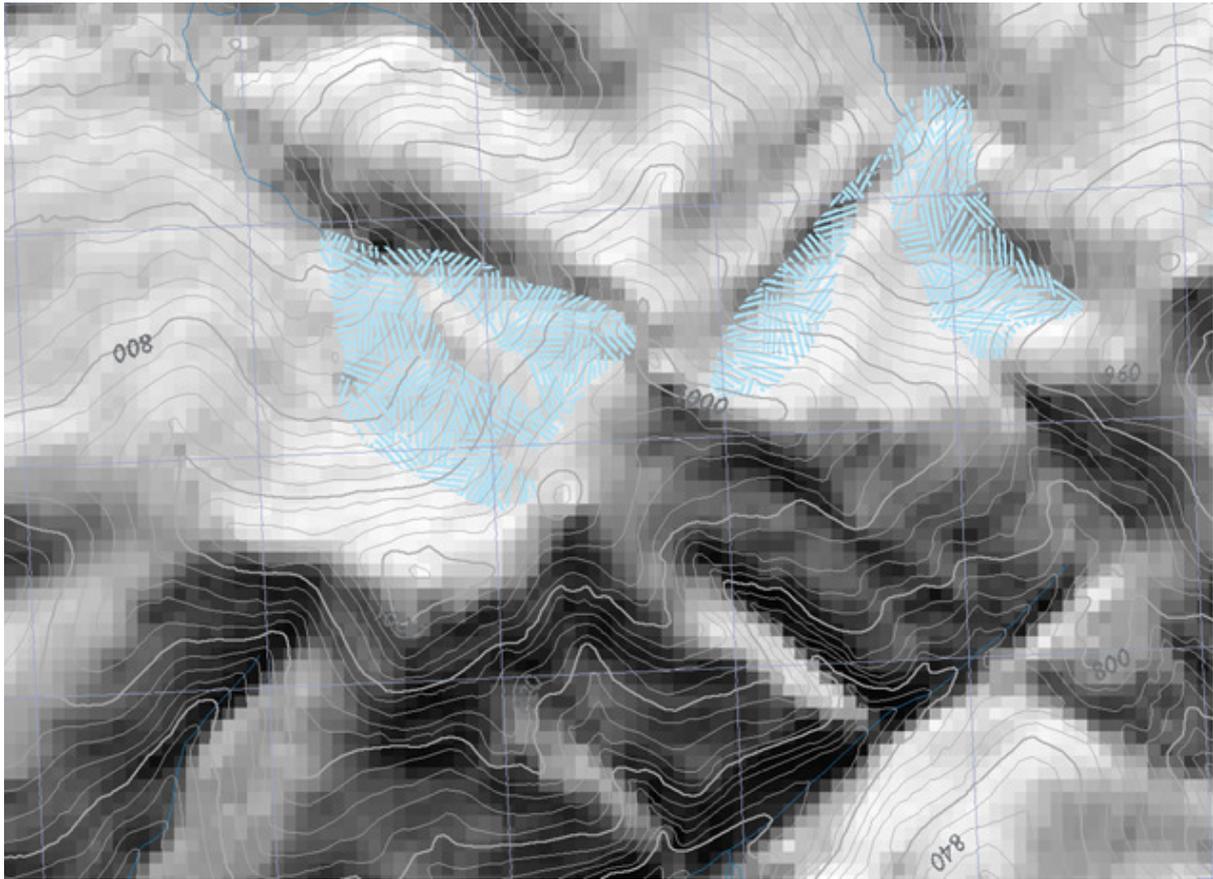


Figure 1. Detail of 26-1/4 Pagnirtung prototype with full hill shading.

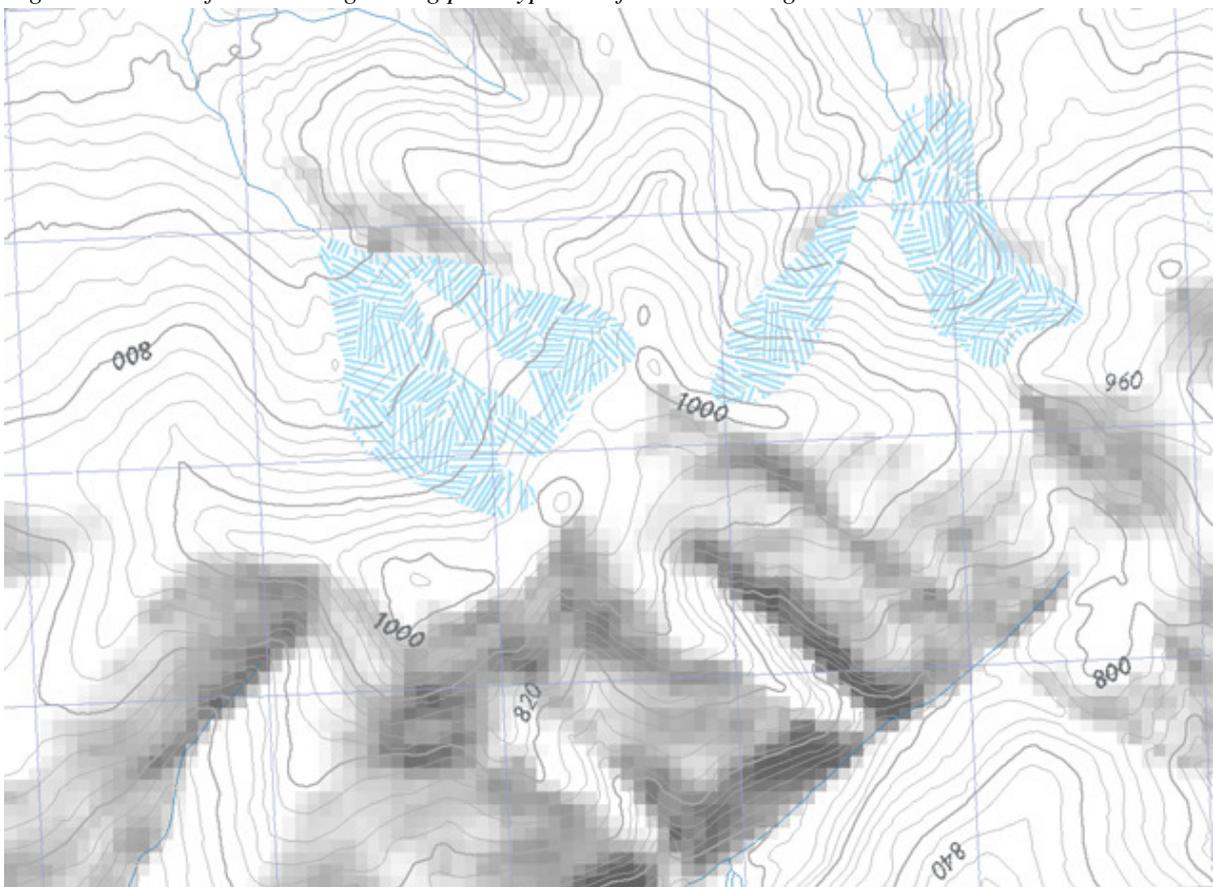


Figure 2. Detail of 26-1/4 Pagnirtung prototype with reduced hill shading.

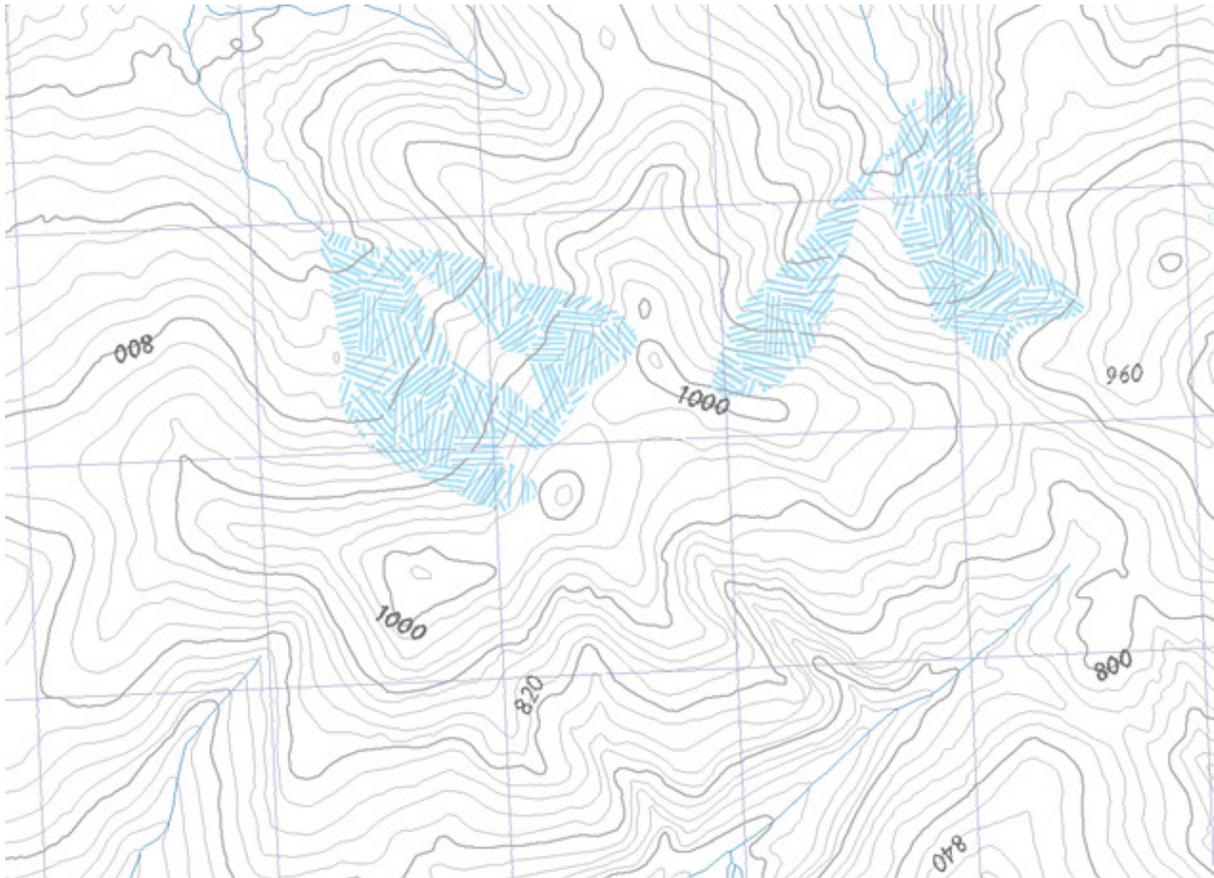


Figure 3. Detail of 26-1/4 Pangnirtung prototype.

It is intended that the multilingual maps position themselves within an extended cartographic practice, as a vehicle for user participation. This is an invitation for map users to make notes in the margins, draw on the map and add new content. It is a way for users to formally (solicitation of content from an official mapping agency), or informally (annotation for one's own use), become part of the map making process. However, this a troublesome invitation to extend and to accept, when hill shading competes with pencil or pen marks of user generated content or notes (figure 1).

### **Typography**

Execution of typography for these maps asked us to think beyond ordinary cartographic techniques. Typesetting was of no real consequence; colour, however, offered a surprise. Ms Gilbert offered the advice that the Inuit are not confined to the convention that connections blue type and water features. This offered some freedom, as we could then comfortably transgress the convention of executing type for hydrography in blue.

There was also the nature of topographic complexes to consider. Portions of a river or shoreline may have a unique name, a single feature may have multiple names according to season or multiple activities performed there, and a topographic complex (a bay, plus section of shoreline, plus a cliff, for example) may be known by a single name. If a single named feature includes both land and water, following cartographic convention (naming water features with blue and land features with black) would be partially misleading. Instead, delineated features were given a neutral colour. We moved toward a dark, saturated colour with enough strength to stand beside the blue and black in play on the CanTopo base, but be distinct enough to stand apart from them. The art director sourced an eggplant purple to serve this purpose (figure 4).

There were the technical issues to consider, as well. Inuktitut syllabics require a different font for character representation whereas Inuinnaqtun is written in the Roman alphabet. Toponyms in syllabics require Unicode fonts be supported by the cartographic and geographical names databases which store the delineations and toponyms used for map generation. Additionally, multiple languages for features require a reconfiguration of the encoded rules for text placement.

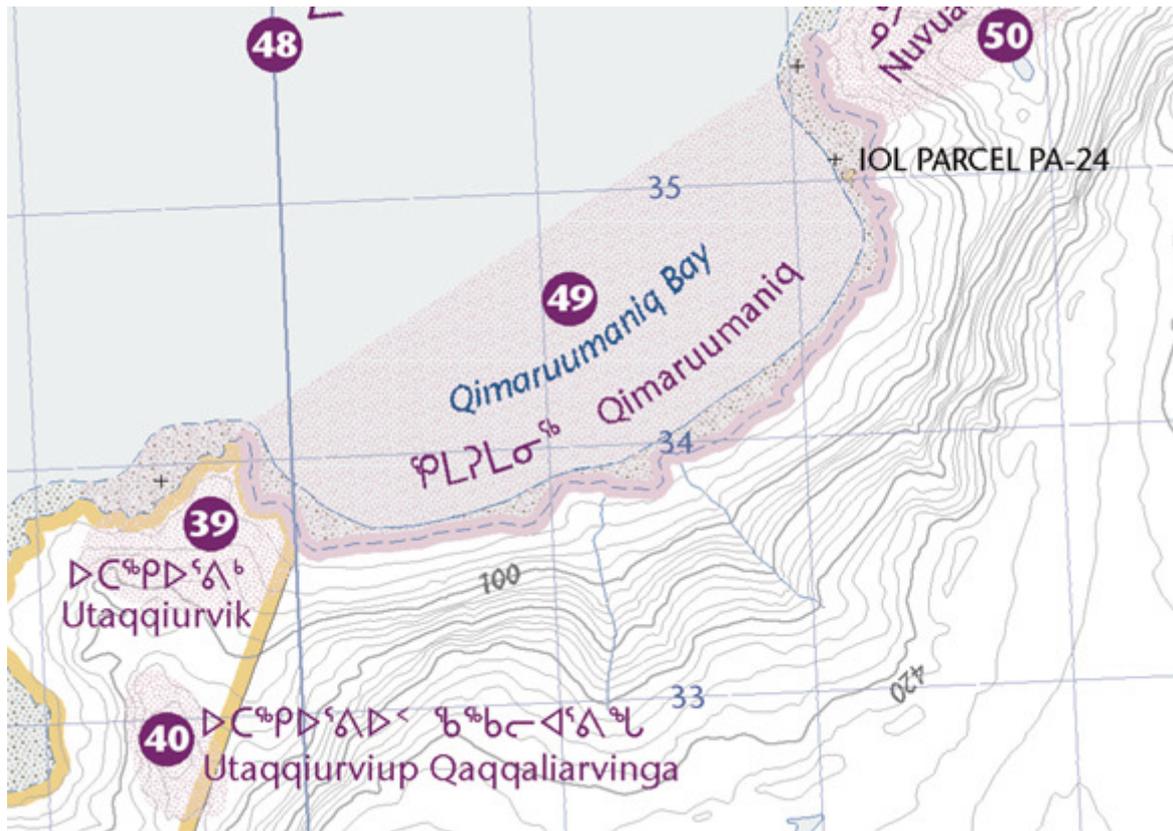


Figure 4. Detail of 26-1/4 Pangirtung prototype.

#### **Delineations**

Readers of Inuktitut and Inuinnaqtun, particularly those from the local area, would certainly have no difficulty knowing what features are being named. Others would certainly need the reassurance of carefully executed feature delineation.

Feature delineations were created in the process of interviewing Inuit elders to obtain the Inuit names and significance of each local geographic feature. Digital delineations of geographic features are necessary for automatic text placement which is part of the MapGen process.

The search for a strategy to delineate topographic feature complexes began at a substantive starting point: basic cartographic theory of how to treat areas, lines (and points). Fattened lines sit beneath shorelines and rivers, marking the lengths which are named. Areas are treated with textured fills. The texture is composed of small open circles. It has a coverage density around 35%, which allows the base map layers to be easily read through it. This produces a simple strategy for delineation which is basic enough to respond to the context of its geographic specifics, and nimble enough to take up an appropriate voice to respond to added layers (figure 4).

#### **Polynias**

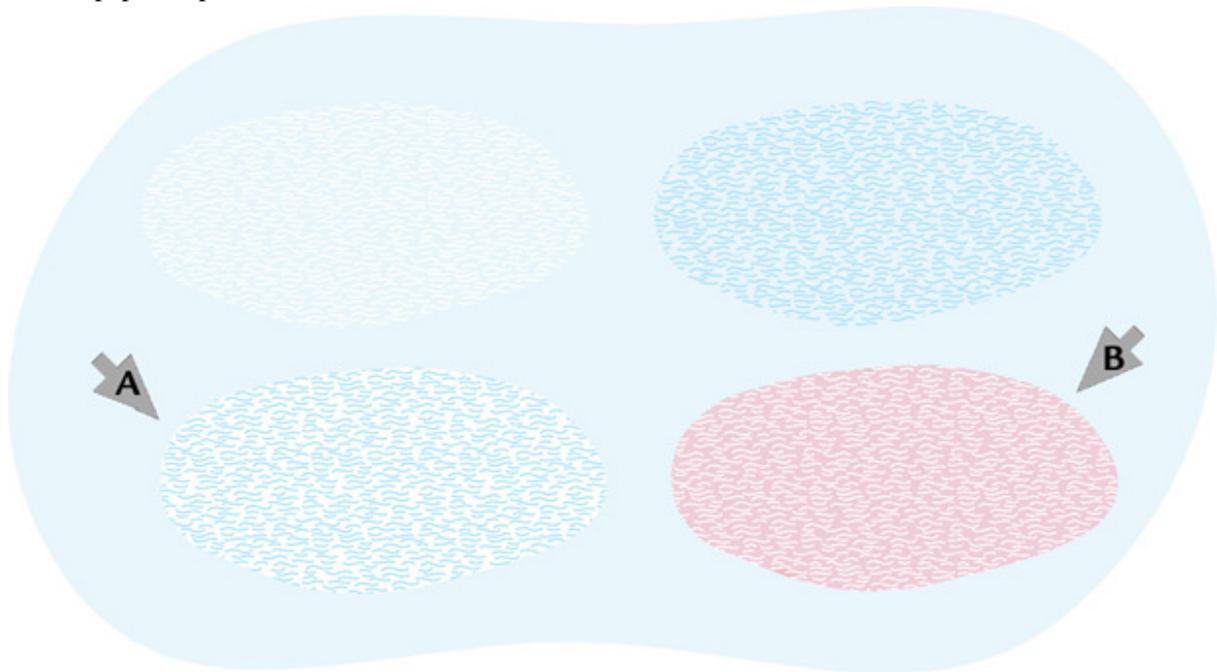
Polynias are areas of water that remain free of ice all year. These are sometimes very large and significant enough to the Inuit to be given names. They are not part of the CanTopo base map, so a new representation was needed to show them on the new maps. Our challenge was to represent open water. However, the blue fill of the CanTopo base map already represents open water. We knew we could not layer an element on top of open water, since this contradicts the physicality of the feature. We needed to look at the representation as a continuing narrative.

As the starting point was open water, we needed to "open up" the surface by removing the blue fill. Next, the art director drew a texture composed of irregular broken wavy lines. When rendered in the same blue reserved to act as an adjective for water features in CanTopo, the new symbol works very well to articulate the idea of polynia (figure 5A). For those polynias which are named and need to be delineated, the broken wavy texture would be rendered in white and reversed out of the colour built for that purpose (figure 5B).

#### **Ice floe edge**

Similar to polynias, ice floe edge is the meeting of open water and ice. It was identified as being of interest to some consultation participants. However, this particular phenomena is highly dynamic; frequently, large

pieces of floe edge fracture and splinter off. For this reason, ice floe edge was decided to be unsuitable for a static paper map.



*Figure 5. Studies for new polynia symbol.*

#### **THE SURROUND**

GPS is a very popular and widely used tool among Inuit hunters [Fung, 2010]. To facilitate use of GPS with the Multilingual Arctic Topographic Maps, the maps now feature a diagram which collects the geographic co-ordinates for the four corners of the map. It is a simple device that makes the task of using a GPS device with these new maps a bit easier (figure 6A).

Out on the land, when the weather turns bad, getting to a cabin for shelter can save lives. Both hunters and Search and Rescue operations need this information on maps. Working from an activity-centered design strategy helped us streamline the activity of locating a cabin. Each cabin on a map sheet is given a number, and each number is listed in the surround with its geographic co-ordinate. When used along with a GPS, this would speed up the activity of finding a cabin and, perhaps, save a life (figure 6B).

These maps would be a common point of communication for the Inuit and those who travel there. Working from an activity-centered design strategy helped us imagine how a group consisting of both Inuit and non-Inuit would engage with the map. It became clear that exchanges and understanding would be facilitated by everyone referring to one legend where all languages are integrated. Without this, the Inuit and the non-Inuit would be forced to focus on different parts of the map, while they are trying to engage with the same information (figure 6C).

Careful delineation of features named in Inuktitut and Inuinnaqtun, as well as a glossary of those names accompanied by their generic feature codes in English and French would be essential to accommodate the non-Inuit reading portion of our audience. Names on a map are sequentially numbered to make using the glossary a rational activity. The map's essential role as a common point of communication for Inuit and non-Inuit could only be realized if delineations are provided (figure 6E).

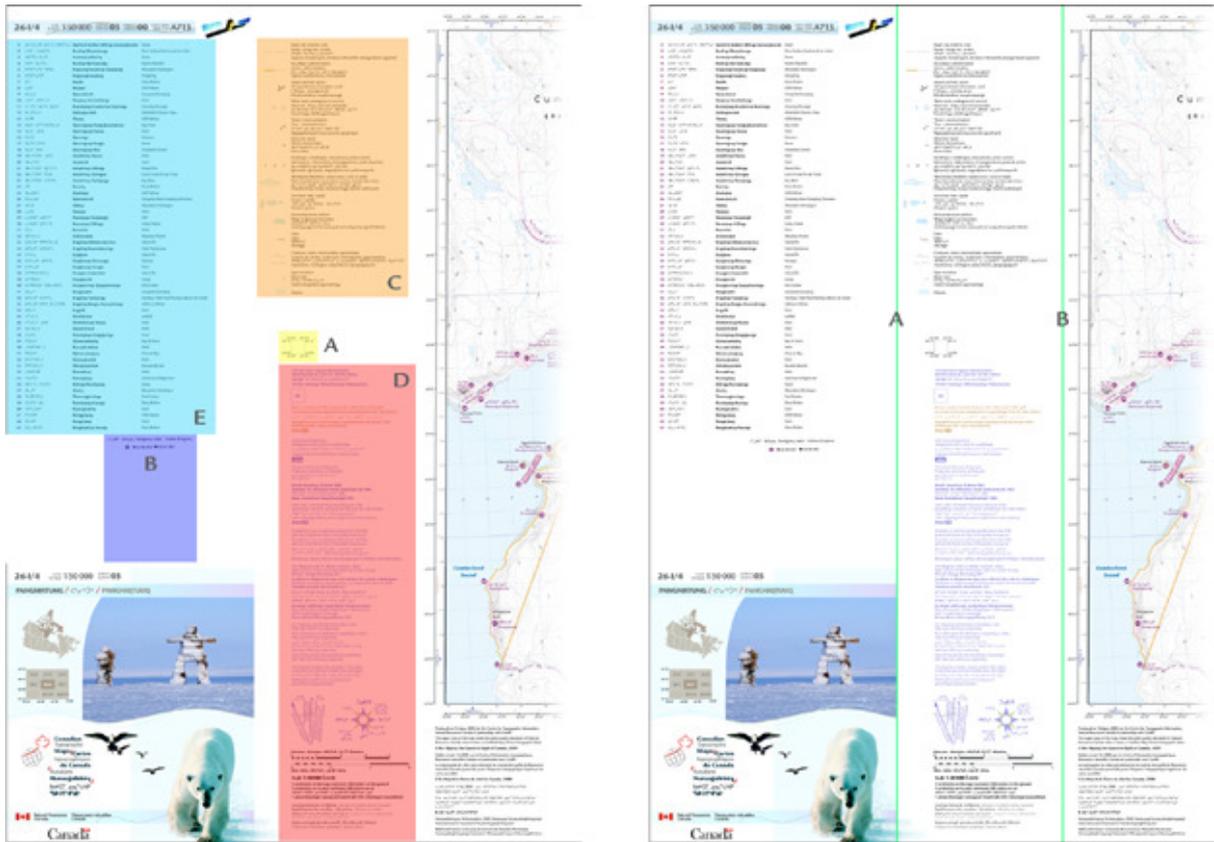
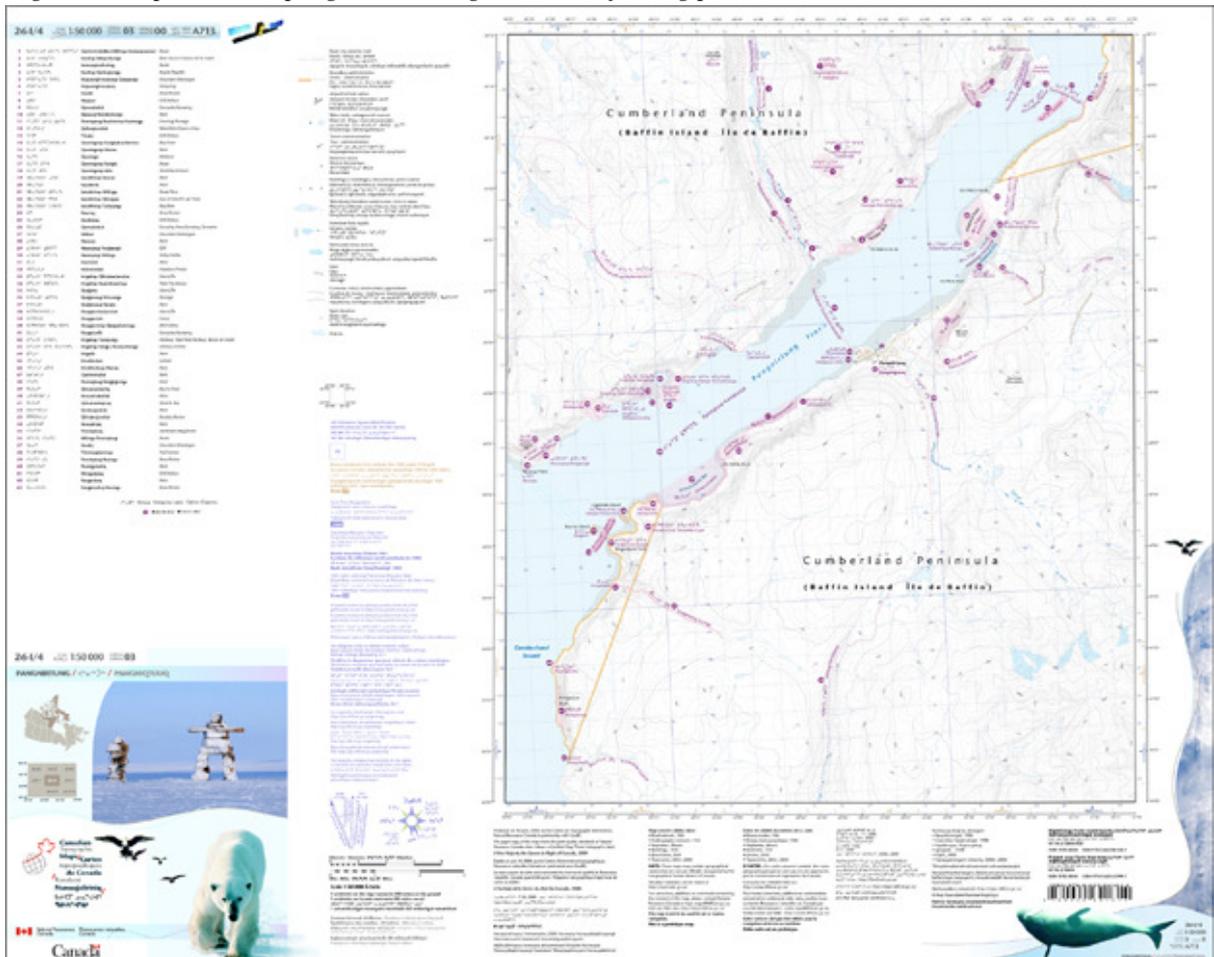


Figure 6. Map surround programmes. Figure 7. New folding pattern.



*Figure 8. Full map surround design.*

Some users cut the margin notes and legend from a topographic map, affix these elements to the back, and laminate the maps to make them more durable when taking them out on the land. Both activity-centered design and progressive disclosure were valuable when problematizing this new fact. The legend was aligned with the north neat line and sits just to the west of the map. The margin notes (UTM notes, magnetic declination notes, and scale information) were re-organized, and along with a new GPS diagram, are positioned to occupy a vertical space below the legend. The relationships within the margin notes were maintained when this re-organization was executed. This column is sandwiched between the map cover and the west neat line. The glossary of names and the cabin co-ordinates list were placed in the column above the map cover and to the left of the legend and margin notes. These two vertical spaces afford a folding pattern that allows the glossary to be folded away, leaving the legend and margin notes with the map. The map may be folded at the western neat line to place all this essential map information at the back of the map (figure 7A). This new arrangement eliminates the two cuts, plus taping or gluing, that is now needed to prepare the map for laminating (figure 7B).

MapGen, the new map's production platform, requires precise and permanent space allotments for each element in the surround. Each space allotment must be reserved for its programme alone. Working subtractively allows the design to recognize how each small design choice is set within the larger context. This approach anticipates needs and prepares a setting for potential future uses. It allowed us to work toward solving the maximum space needs for all the surround's programmes. By answering the biggest, most complex questions, the smaller questions are automatically solved. In this way, the arrangements produced will always work without conflict (figure 8).

#### **ART DIRECTION**

The map cover retains all of the graphic devices that have proven successful in the CanTopo series. They have been reinterpreted for the context of the multilingual maps. The area specific to the northern maps is emphasized on the thumbnail map of Canada. The logotype now includes both Inuktitut and Inuinnaqtun. The 4"x9" map cover spills out to double its size with the addition of a pictorial field. This expanded arrangement includes illustrations reported to be highly favoured during workshops in Nunavut in March 2010. The longer map title is accommodated in this expanded cover plate.

These maps were art directed to reflect the cultural distinctiveness of Canada's Arctic. We took careful notice of the maps which make up the bulk of our source material. They are created in the Arctic, by northerners, with specific Arctic content (place names in Inuktitut and Inuinnaqtun), for a primarily Inuit audience. It is instructive that none of these maps are decorated [Mirnguiqsirviit, Nunavut Parks, Government of Nunavut; Kitikmeot Atlas Map, Kitikmeot Heritage Society; GSC Open File Map Series]. We let this fact guide us when we decided to take a measured approach when including illustrations on the Canadian Arctic Topographic map series.

We wished to produce a single cover design to serve all the maps. Like southern Canada, the Arctic is not culturally homologous. It was decided to not focus tightly on the historical figurative, as clothing styles and personal decorative techniques are regionally specific. Plus, the Inuit are a contemporary People, living in a modern world; to historicize them would be to misrepresent them. A search for ways to art direct the cover lead to the option of including recent pictures of Inuit involved in daily activities on the land. It also lead to non-figurative options: pastiche and wildlife/landscape. We chose pictures of an inunnquag and inuksuit, and wildlife (caribou, polar bear, terns, musk-ox, walrus and beluga whale) as decorations for the cover and the east panel which anchors a truncated librarian's block. With its decorative nature, this arrangement provides the map with a modern cartouche (figure 8).

An undulating horizon line moves across the pictorial field both in the map cover in the west, and in the secondary block in the east. These lines move past the edge of the pictorial space carrying the eye in toward the map.

In anticipation of different space requirements, alternative cover designs were explored. A horizontal orientation for the map cover which opens up more vertical page real estate is ready to respond to different scenarios of the surround's final programme composition (figure 9). A new legend arrangement was designed, as well. In anticipation of alternative space requirements, it is vertically more compact. Also, it separates Inuktitut and Inuinnaqtun from English and French (which was suggested may be preferred by the Inuit), while maintaining a single focus for the entire readership (figure 10).



We were constantly aware of the map's full audience and the need for cross-cultural communication. This design affords avenues of approach and understanding for its full readership, and so may serve as a tool for the sharing of information between Inuit and southerners.

The next challenge will come when focus is resolved and there is greater certainty in the scope and intent of the new Multilingual Arctic Topographic Maps. Designing to loosely defined goals is a much greater challenge than having a crisply articulated vision of the final product. But we took this as an opportunity to flex our design muscle and generate more connectivities and more possibilities in our design output. Indeed, it allowed us to produce a prototype which is ready to do the work which is required of it now, and a bank of robust design ideas which are ready to respond to what might come next.

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