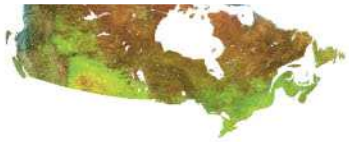
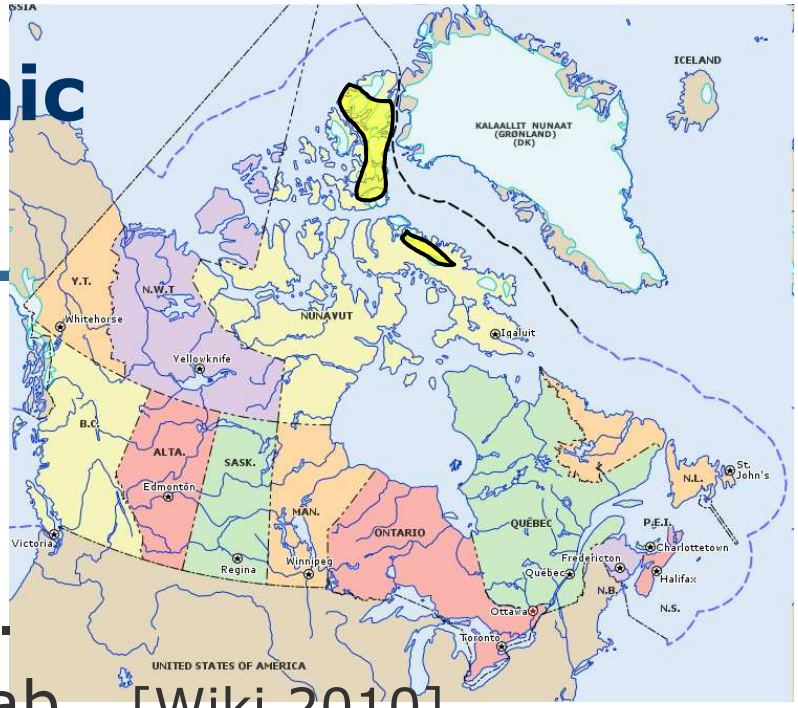


The Generalization of the Canadian Landmass: A Federal Perspective

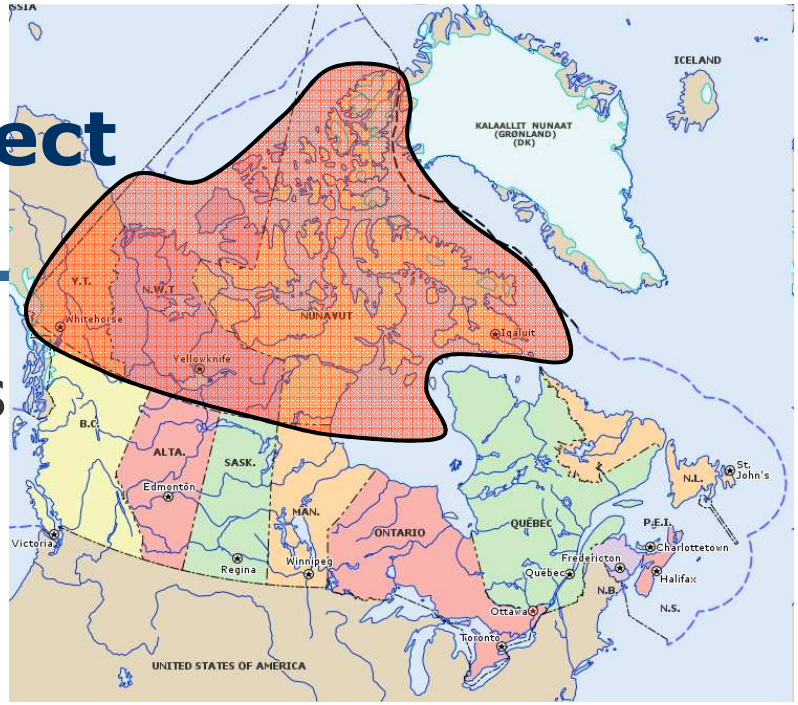
Daniel Pilon, Alexandre Beaulieu, Nouri Sabo

Some Canadian Geographic Characteristics

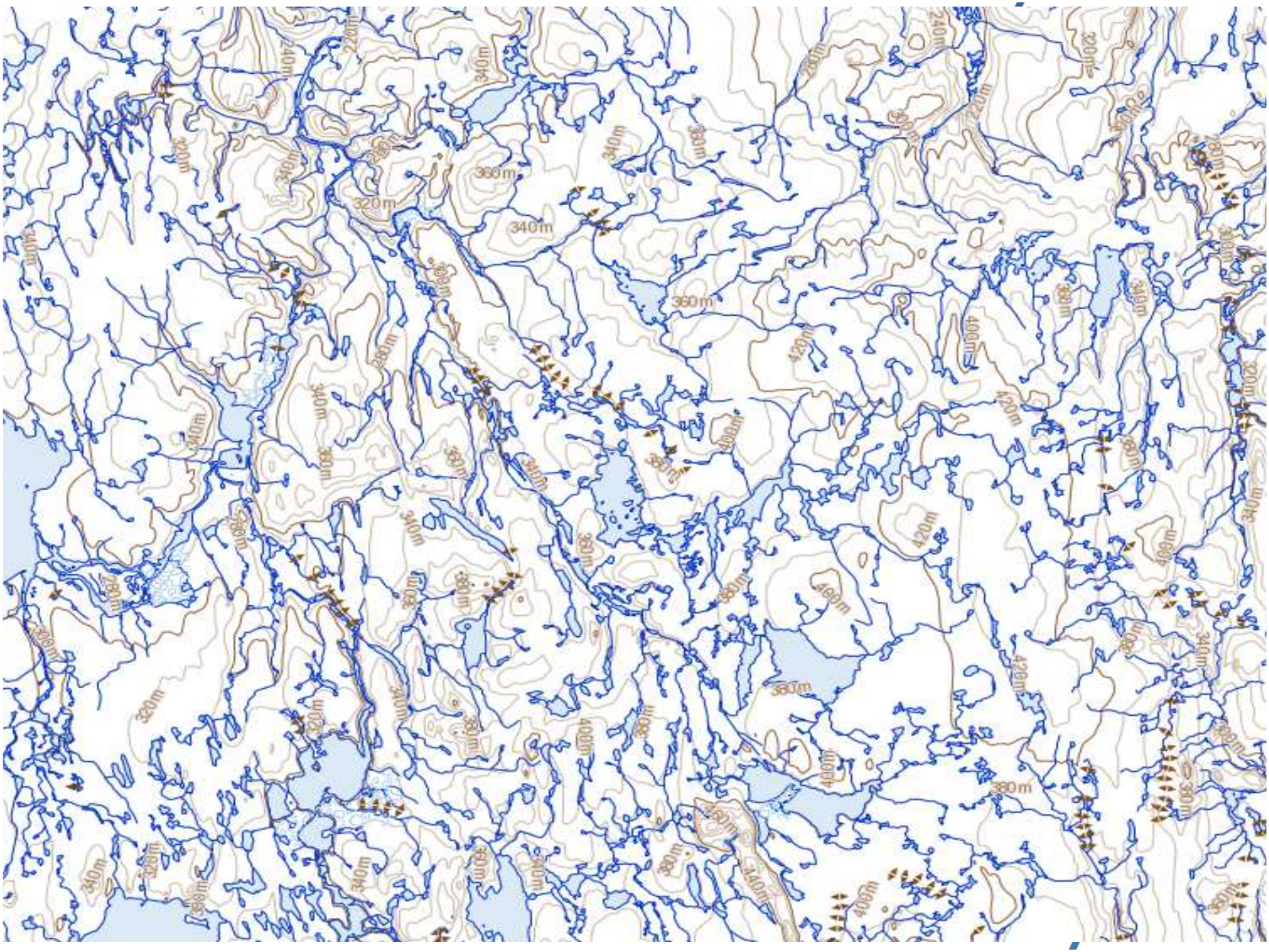


- Size and population
  - Canada: 9.9M km^2 37M hab.
  - Europe: 10.3M km^2 733M hab. [Wiki 2010]
- Base mapping:
  - 1:50 000
  - 13 200 tiles at 1:50 000 (not completed)
  - 915 tiles at 1:250 000 (completed)

250K Generalization Project

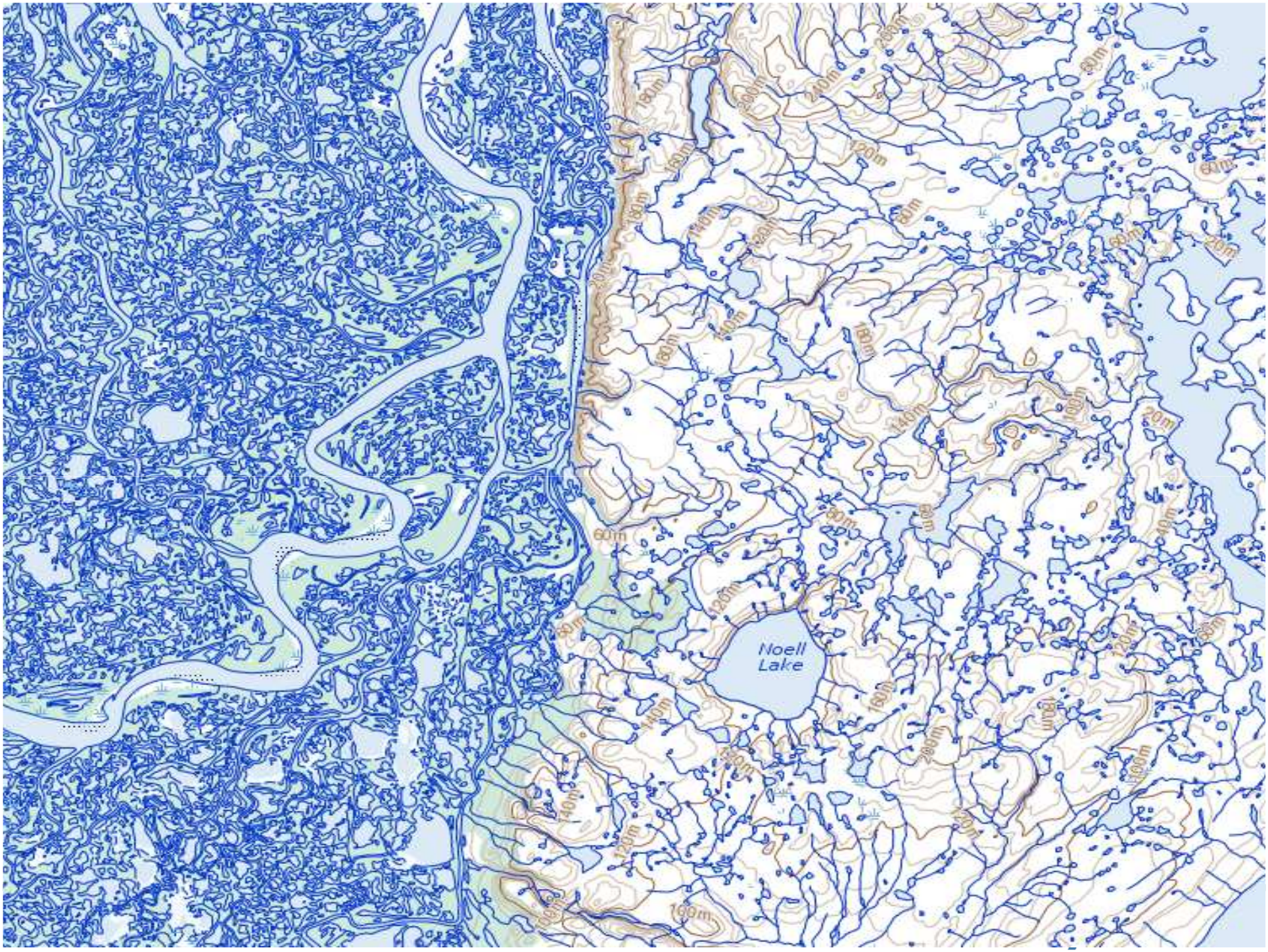


- Revamp the 250K map series
  - Create digital geographic model (step 1)
  - Create digital cartographic model (step 2)
- Maximize the generalization automation
- Modify cartographic specifications is an option
- Targeting the north in priority
  - 4 M km2 to map → 0.025 hab/km2
  - Almost just water and contours


220m
240m
260m
280m
300m
320m
340m
360m
380m
400m
420m

250K Generalization Project

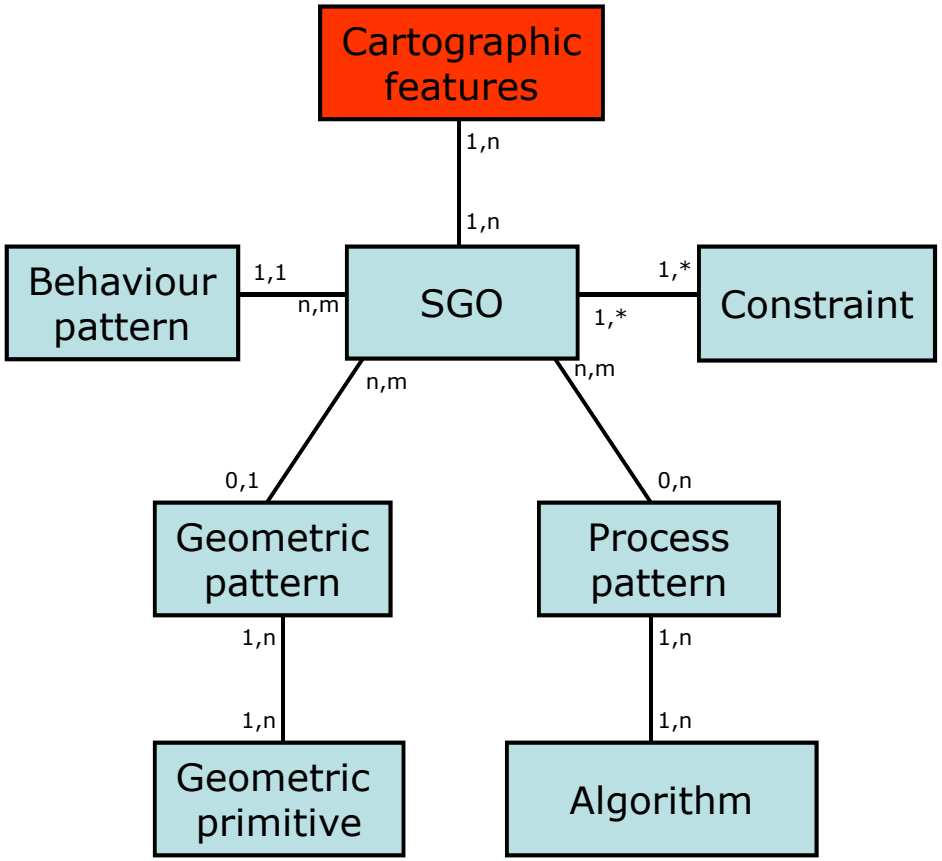
- The market is not offering good solutions for hydrography generalization…
- Use traditional GIS…
- Started a collaboration with Laval University
- «Thompson and Brooks» methodology for the generalization of the hydro network
- Production of a prototype Northern map
- In general, fair results **but:**
  - Line simplification was not satisfactory
  - The selected map was… « easy » …
  - Alternative solutions had to be investigated


Noell
Lake

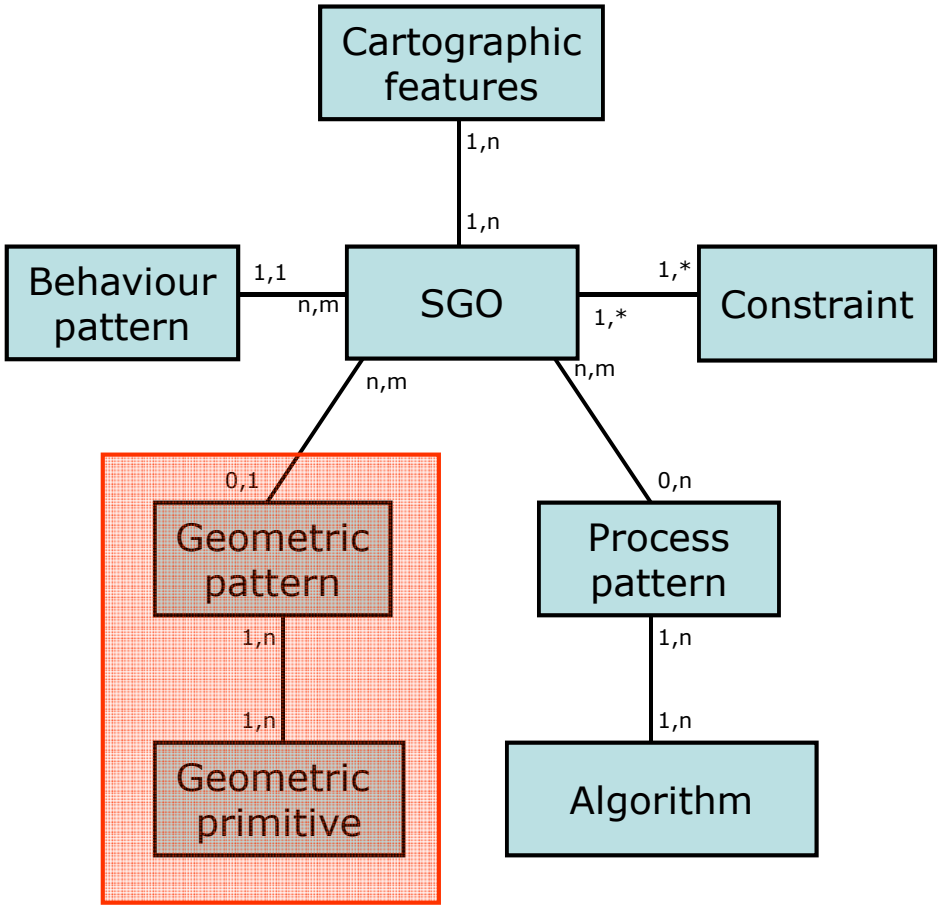
Self Generalizing Objects (SGO's): an Alternative?

- Dr. Sabo PhD thesis subject (Laval University)
- Developed for on-the-fly generalization
- Based on cartographic features enrichment
- Pros:
  - Gives very good and fast generalization results
- Cons:
  - Complex system to implement and maintain

SGO's in a Glimpse



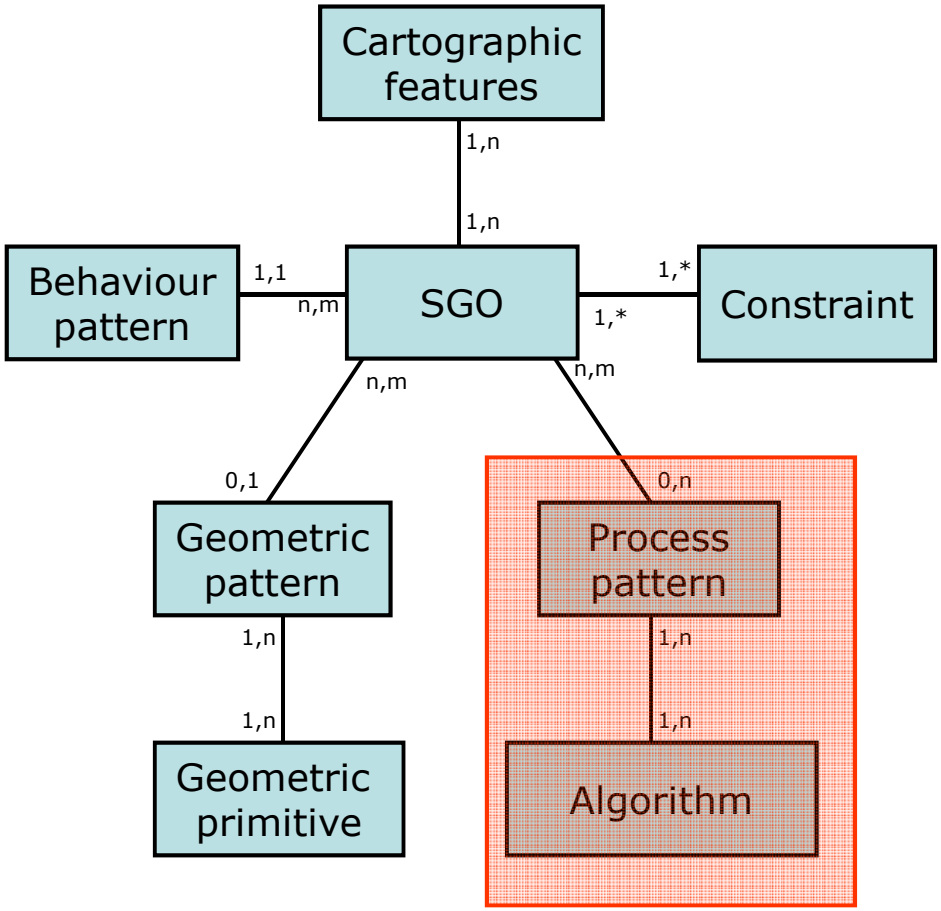
SGO's in a Glimpse



Geometric Patterns

Geometric objects having similar representation characteristics of many cartographic objects. During a scale reduction, instead of using generalization algorithms, the SGO selects/computes the most appropriate pattern for the desired scale.

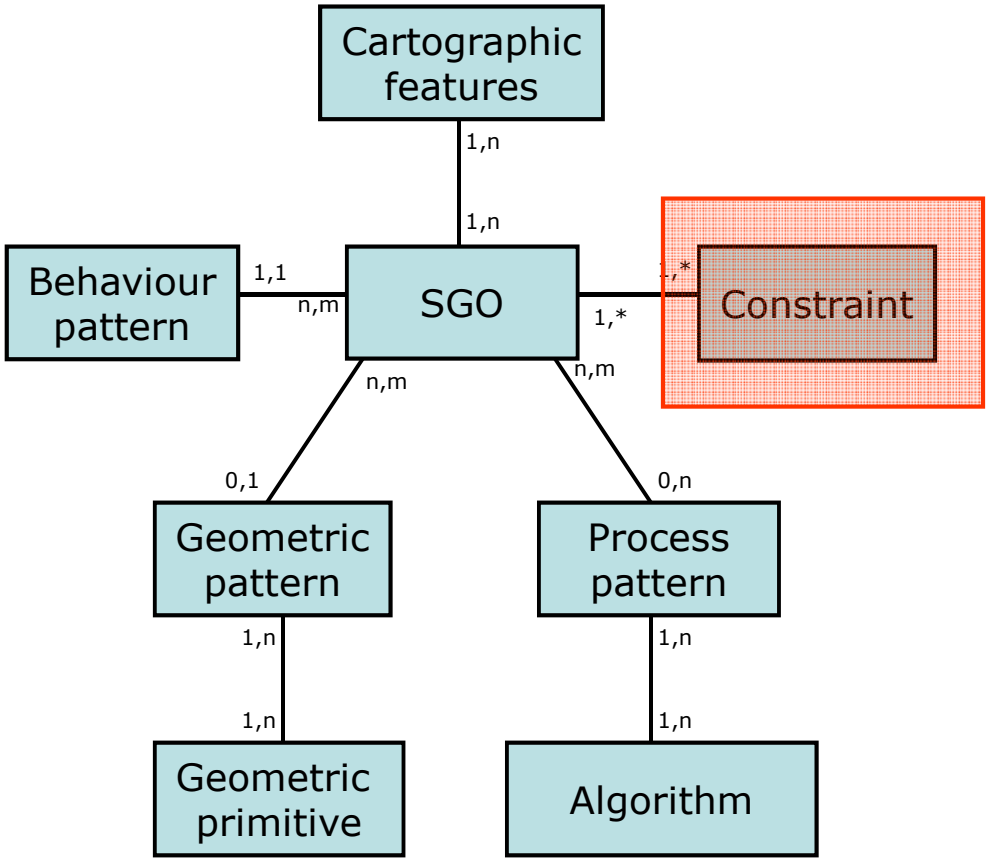
SGO's in a Glimpse



Process pattern

Defined a set of algorithms and a processing sequence that can be applied to map objects with similar characteristics (geometry, semantics, spatial context ...)

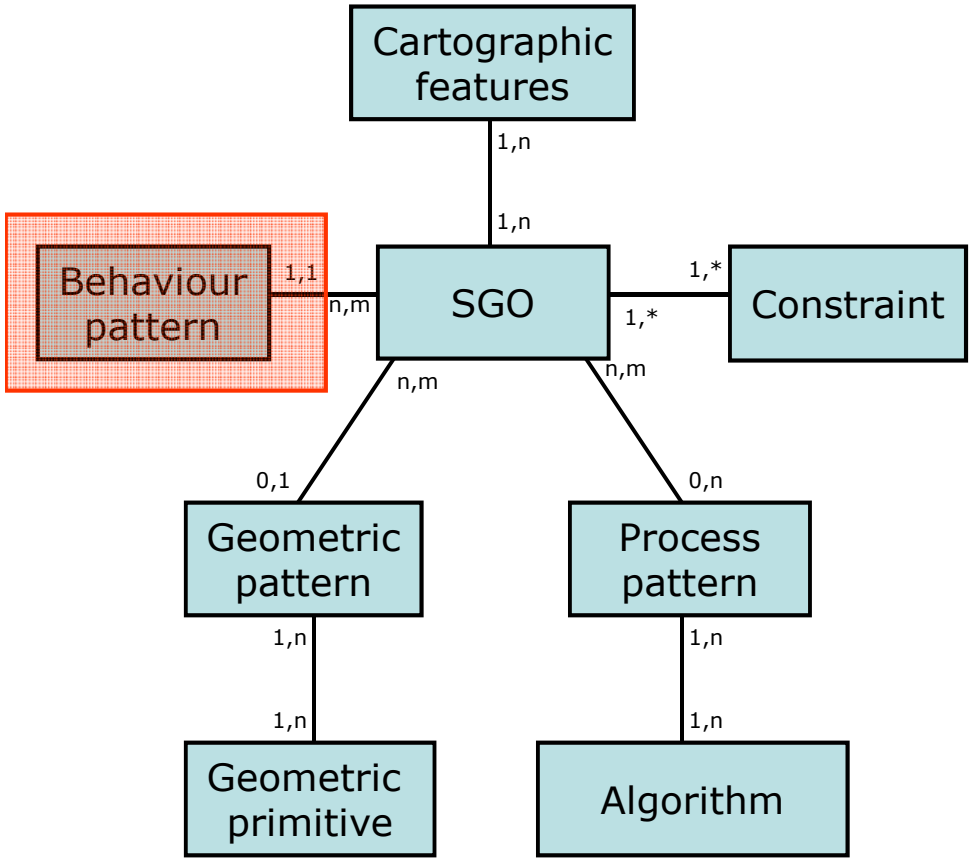
SGO's in a Glimpse



Constraint

Defined the relevant spatial relationships that must be met during a cartographic generalization

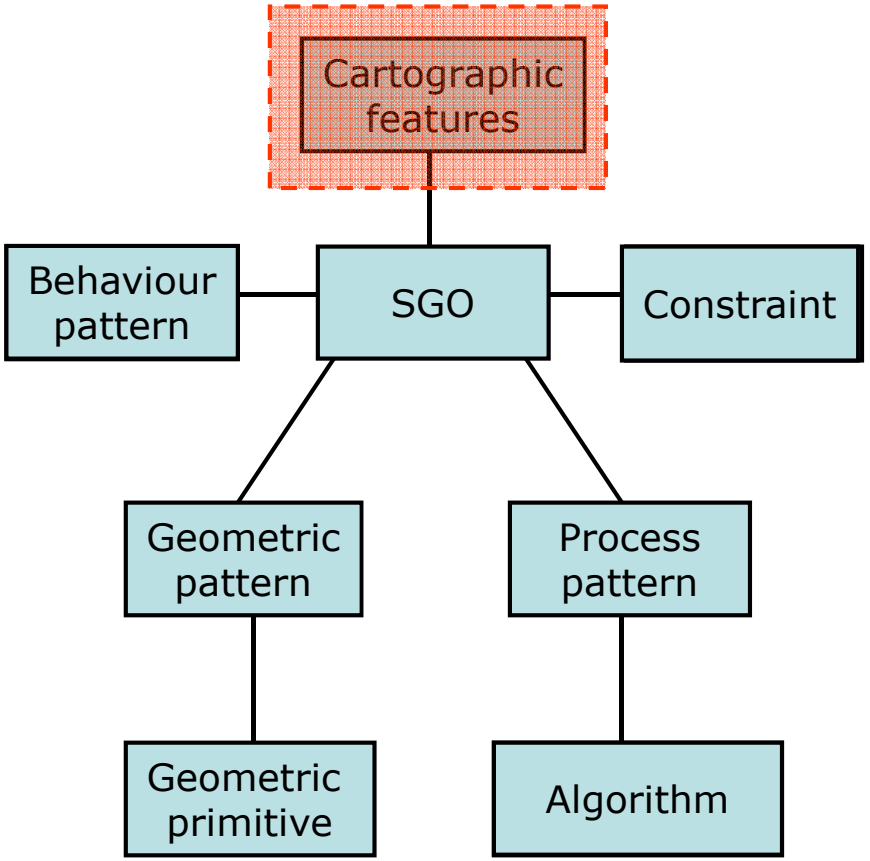
SGO's in a Glimpse

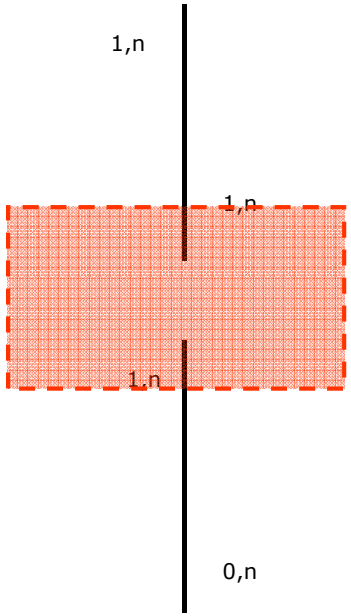


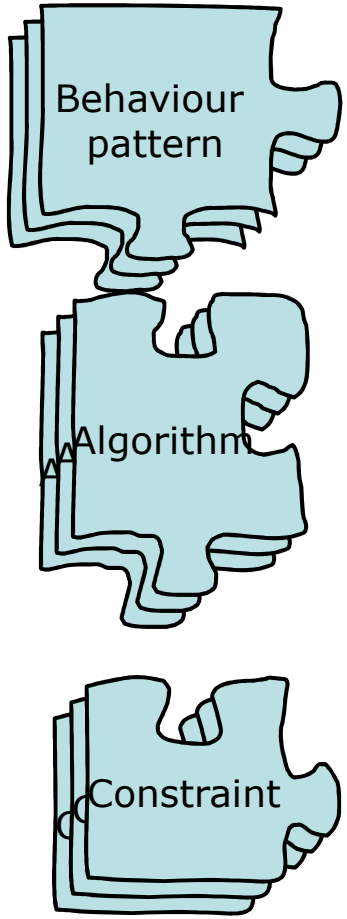
Behaviour Pattern

Coordinates the operations of generalization. Choose between geometric and process pattern. For process patterns determines the patterns or the most appropriate process patterns. Also controls the order in which constraints are checked. The behaviour patterns can be stored in a database.

From SGO's to Meta-Algorithm

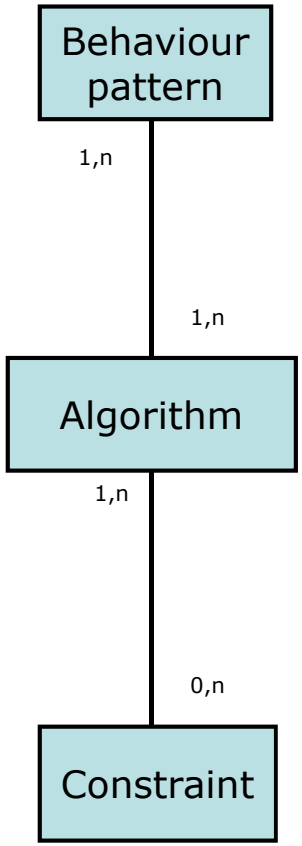






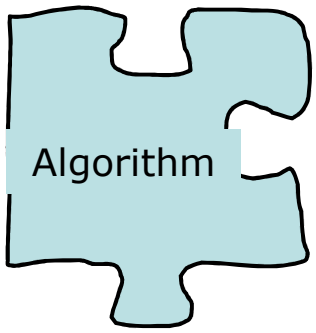
Cartographic feature enrichment Algorithm enrichment

Meta-Algorithm Benefits

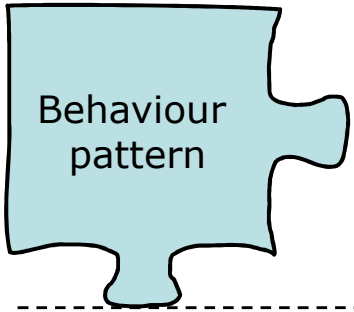


- Recycling existing algorithm
- Reuse components once developed
- Pluggable into traditional GIS
- Develop MA as needed…
- Medium/Low complexity to develop

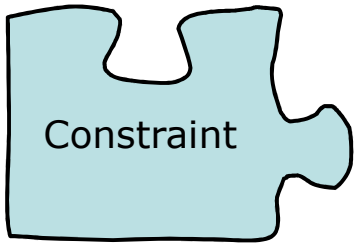
Meta-Algorithm a first try: Sherbend (line simplification)



- Recycle the original [Wang 1998] line simplification algorithm, plus:
  - Per feature tolerance
  - Similar consecutive bends simplification

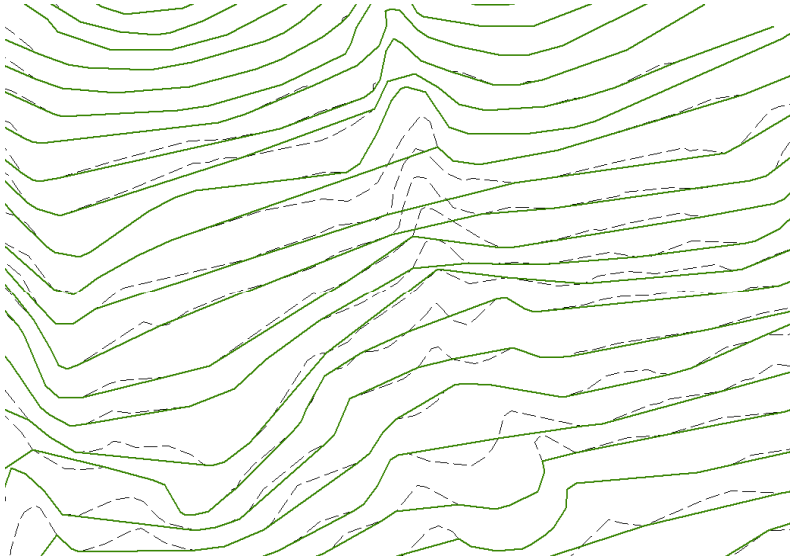


- Capacity to handle/resolve conflicts
- On-the-fly parameterization of the algorithm



- Self intersection
- Crossing between lines
- Sidedness (relative position)

Sherbend Example



- Very good results:
  - Natural features
  - Dense areas
- Sherbend implementation:
  - Python 2.6
  - Shapely 1.2

Conclusion

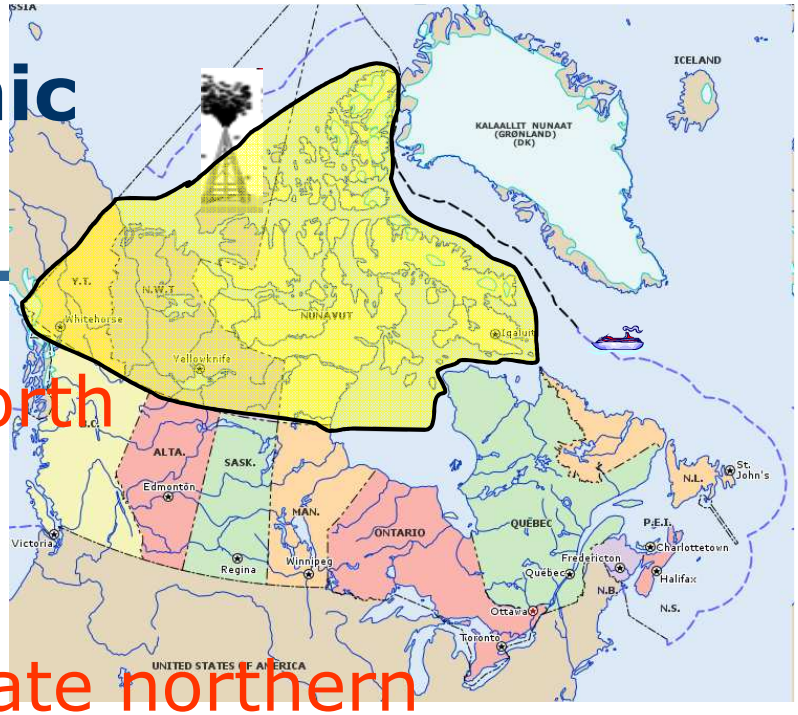
- Meta Algorithms show a lot of potential in generalization:
  - Recycle and customize existing algorithms
  - Solve specific generalization problems
  - Easily integrate into traditional GIS

- 250K Northern generalization is moving ahead

Perspective

- MA is a work in progress…
- Refactoring Sherbend to decouple some MA concepts
- Develop other MA as needed
- Release it with an open source licence
- Include Geometric Patterns concepts in MA (from SGO's)

Some Canadian geographic characteristics



- Increasing interest in the north
  - Global warning
  - Oil exploration
- Effort to update and terminate northern mapping
- Awareness of the state/status of the 250K
  - Actual 250K (old and imprecise)
  - Northern people work with 250K