


Developing a vario-scale IMGeo using the constrained tGAP structure

MSc thesis presentation Arjen Hofman



February 19th 2008




Introduction

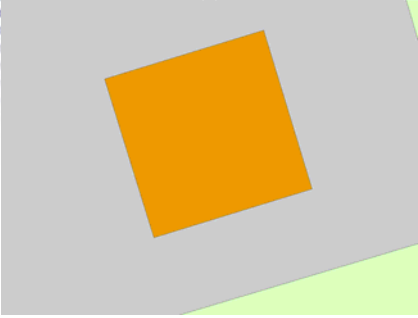


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Introduction





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Which of the two problems can be solved?

- Level of detail can not be increased without new surveying data
- To leave details out no new surveying is needed...
 - ...only smart computations are needed...
 - ...generalisation is needed...

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Presentation outline

- Assignment introduction
- Generalisation methods
- Pre-processing
- Results
- Conclusions

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Parties involved

- Gemeentewerken Rotterdam
- Delft, University of Technology
- Municipality of Almere
- Kadaster

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Problem definition

- Efficiency
 - 1:1,000
 - ~~1:10,000~~
 - ~~1:20,000~~
 - ~~1:50,000~~
- Authentic registrations
 - Collect once, multiple use
 - Topography doesn't fit
 - Core registrations should be connected

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Generalisation

- What is generalisation?

“Generalisation is the selection and simplified representation of detail appropriate to the scale and/or purpose of the map.” (ICA)
- Automatic generalisation: algorithms compute which details are ignored

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But... how to simplify?

Some examples:

- Aggregation
- Simplification
- Elimination

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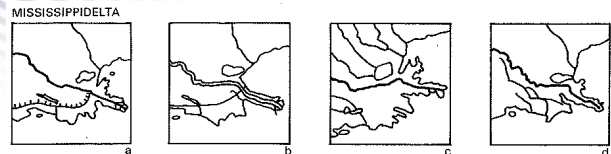


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Subjectivity in generalisation

Source: Ormeling and Kraak, 1993



Bosatlas

Alexander
Weltatlas

Andree's
Handatlas

Spectrum
Wereldatlas

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Research question

- *How can a vario-scale IMGeo be designed and developed by applying the constrained tGAP structure with Top10NL as initial constraint?*

■ Terms to be explained:

- IMGeo
- Top10NL
- Constrained tGAP

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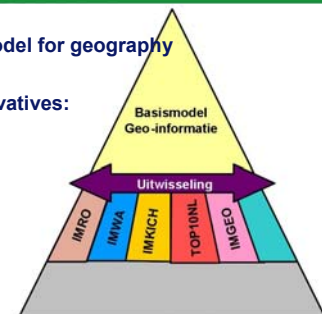
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Datasets

- NEN3610: Basic model for geography

■ Two important derivatives:

- IMGeo
- Top10NL



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Testdata municipality of Almere



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Testdata municipality of Almere



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IMGeo

- Large scale topographical model
 - 1:1,000
 - Object oriented
 - Derived from GBKN
 - Recently affirmed by GI Beraad
 - Pilot in Almere

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IMGeo



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Top10NL

- Medium Scale Map
 - 1:10,000
 - Produced by the Dutch Cadastre
 - Successor of Top10Vector
 - Authentic registration on topography

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Top10NL



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Generalisation method

- Constrained tGAP
- Merging objects in 1:1,000 map until the situation in the 1:10,000 map is reached
- IMGeo objects are placed in a Top10NL region

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Constrained tGAP

- tGAP = topological Generalised Area Partition
- topological: A simplified mathematical expression of geometry
- Generalised: Detail is left out appropriate to the scale of the map
- Area partition: the whole area is filled with objects with no objects overlapping

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Constrained tGAP

Step 0

Step 1

Step 2

Step 3

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Least important object

Least important face(x) = $\min_x(\text{area}(x) \cdot \text{classweight}(x))$

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Most compatible neighbour

Most compatible neighbour(y) =

$$\min_y(\text{cost}(\text{class}(x) - \text{class}(y)) \cdot \text{area}(y))$$

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Working of the tGAP

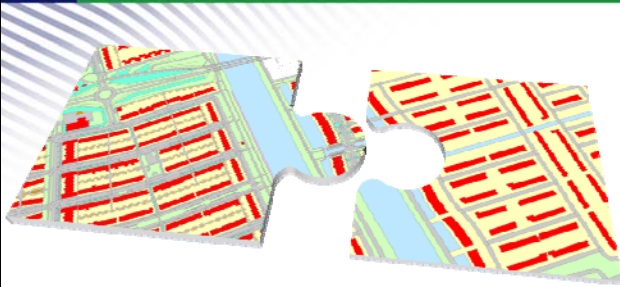
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How to combine the two datasets?



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Differences IMGeo – Top10NL

- **General**
 - Small differences in the modelling
 - Models have a different background
 - No tuning when making the models
- **Testdata**
 - Buildings
 - Roads
 - Semantics

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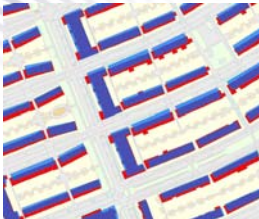
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Geometry

Buildings



Roads



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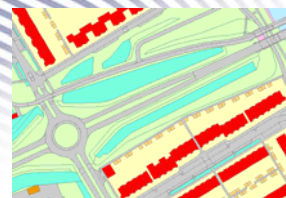


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Semantics



IMGeo: plants



Top10NL: wood?

Hierarchy?

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Data pre-processing

- How to assign an IMGeo object to a Top10NL region?
 - Intersect and split all IMGeo objects in case of a Top10NL border
 - Assign the IMGeo object to the Top10NL object that overlaps the IMGeo object most
 - Split the IMGeo object in case of a 50-50 situation

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IMGeo normal



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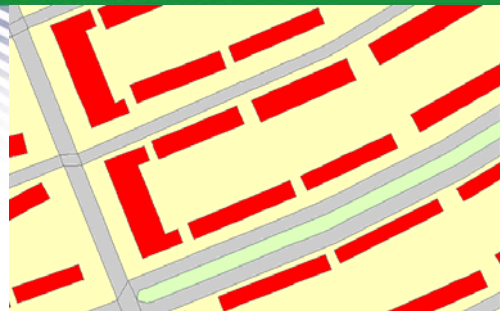
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Top10NL normal



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Simple intersection



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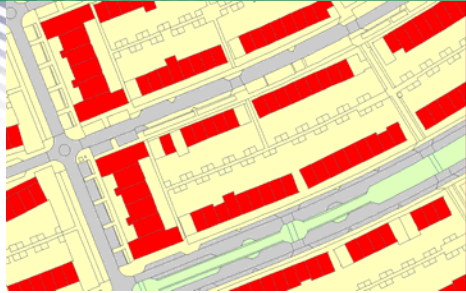
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IMGeo with 'maximum area method'



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IMGeo with 'split method'



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Solution: first classify buildings



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Applying the constrained tGAP structure

- Conversion Shape → Oracle in FME
- tGAP code in PL/SQL

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Results using the constrained tGAP



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New weights

Class	Code	Weight
Residence object / Building	1001	13
Other Building	5003	1
Road	2001	1,2
Water	3001	1,3
Lot	4001	9
Fallow land	4002	1
Plants	4003	0,9
Terrain (to be determined)	4004	0,1
Grass / Grassland	4005	1
Bin	5001	0,1

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Result using new weights



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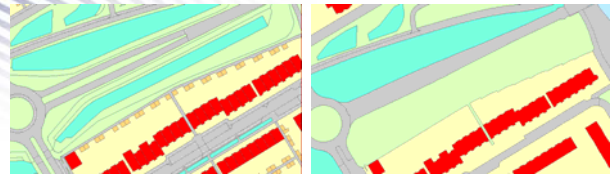


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Remarkable



Before

After

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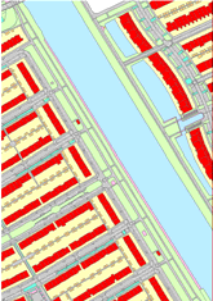



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Remarkable





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tGAP without constraint

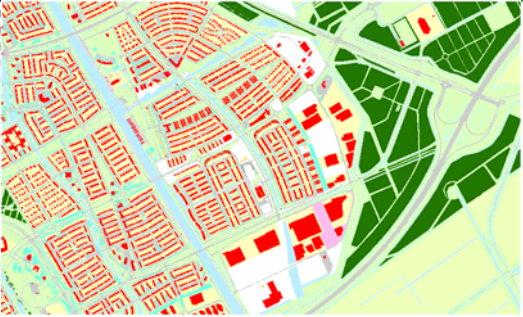


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Larger dataset



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Conclusions

- Constrained tGAP is a good addition to the tGAP structure
- No short term implementation of tGAP at municipal level foreseen
- 'Building first' method as constrained tGAP classification method works best

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Recommendations

Municipalities:

- Cut road objects into better pieces
- Passive participation in research possible
- Cooperate with Kadaster when updating IMGeo

Kadaster:

- Make Top10NL an area partition
- Cooperate with IMGeo study group

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Future research

- Add line simplification to the constrained tGAP algorithm
- Look at 3D (constrained) tGAP
- Convince governments of the necessity of a topological structure for topographical models

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Biertje?

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