

# ScaleMaster.org

## Illustrating and constructing the multi-scale mapping process

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# Outline

- Origins of the ScaleMaster.org project
- Background on the challenges of multi-scale mapping process
- The ScaleMaster diagram
- Typology of multi-scale operators
- Interactive website for learning about ScaleMaster tool
- Future work

# Beginnings

- Originally sketched in 2003 during ESRI planning meetings by Charlie Frye, the ScaleMaster concept since has been formalized in a pair of publications (Brewer and Buttenfield 2007; Brewer et al. 2007).
- Primary objective of ScaleMaster tool: reduce the map maker's workload in multi-scale design

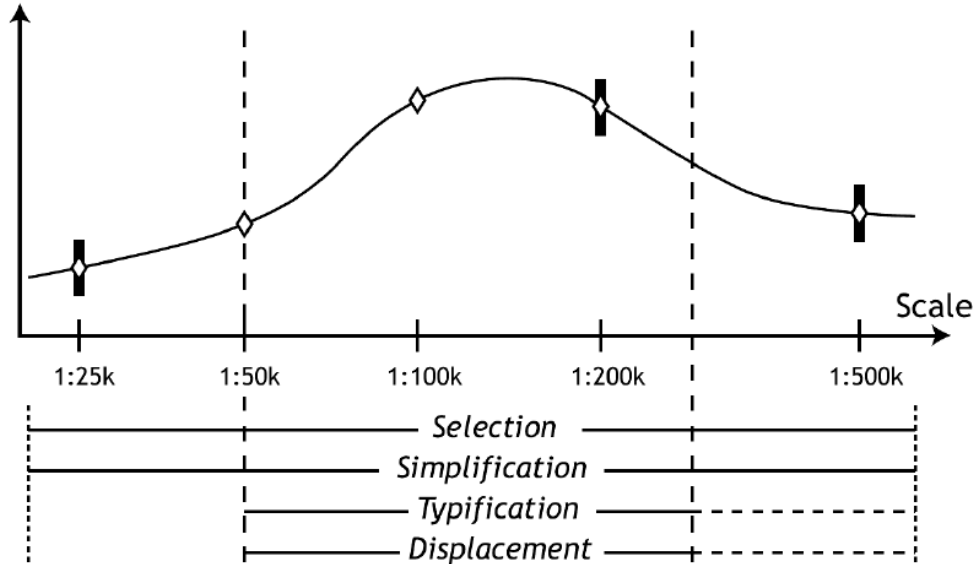
# Utility of ScaleMaster tool

- Multi-scale map design requires the application of generalization map content to maintain map legibility at smaller scales
- Decision-making process is contingent upon data resolution, desired display scales, and map purpose
- Map generalization still not an automated process
- Tracking these decision points provides a means for judging the workload amongst alternatives for achieving the desired map quality

# Workload in multi-scale map construction

## Road network

Generalization  
Complexity

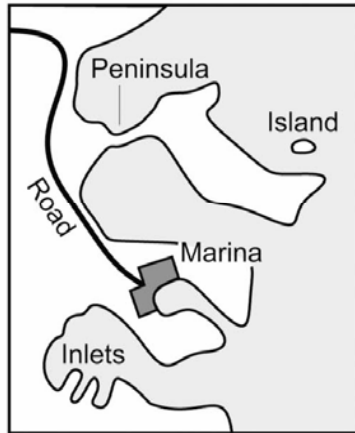


- ⋮ Limits of operator application
- ⋮ Map scale range
- ▬ Levels of detail (LoDs)
- ◇ Map scales

from **Cecconi et al. (2002)**

## Examining alternatives: geometric and symbology operators

a.  
Original compilation scale



Small map with features reduced to 20 percent of original size (final presentation size):



- b1.  
No modifications to display or geometry:  
- symbol widths retained (1 pt coast line and 2 pt road line),  
- feature details and locations retained



- c1.  
Modify display only:  
- thinner road and coast lines,  
- remove outline of marina area



- d1.  
Modify geometry:  
- displace road,  
- enlarge island and peninsula neck,  
- eliminate small islands,  
- collapse marina area to point symbol



- e1.  
Modify both display and geometry:  
- thinner road (less width change than c1) and coast,  
- displace road (less displacement than d1) and small inlets,  
enlarge island and peninsula neck (less enlargement than d1),  
- simplify marina area (retain general shape) and remove area outline

Screen images of small maps enlarged to 200 percent:



b2.



c2.

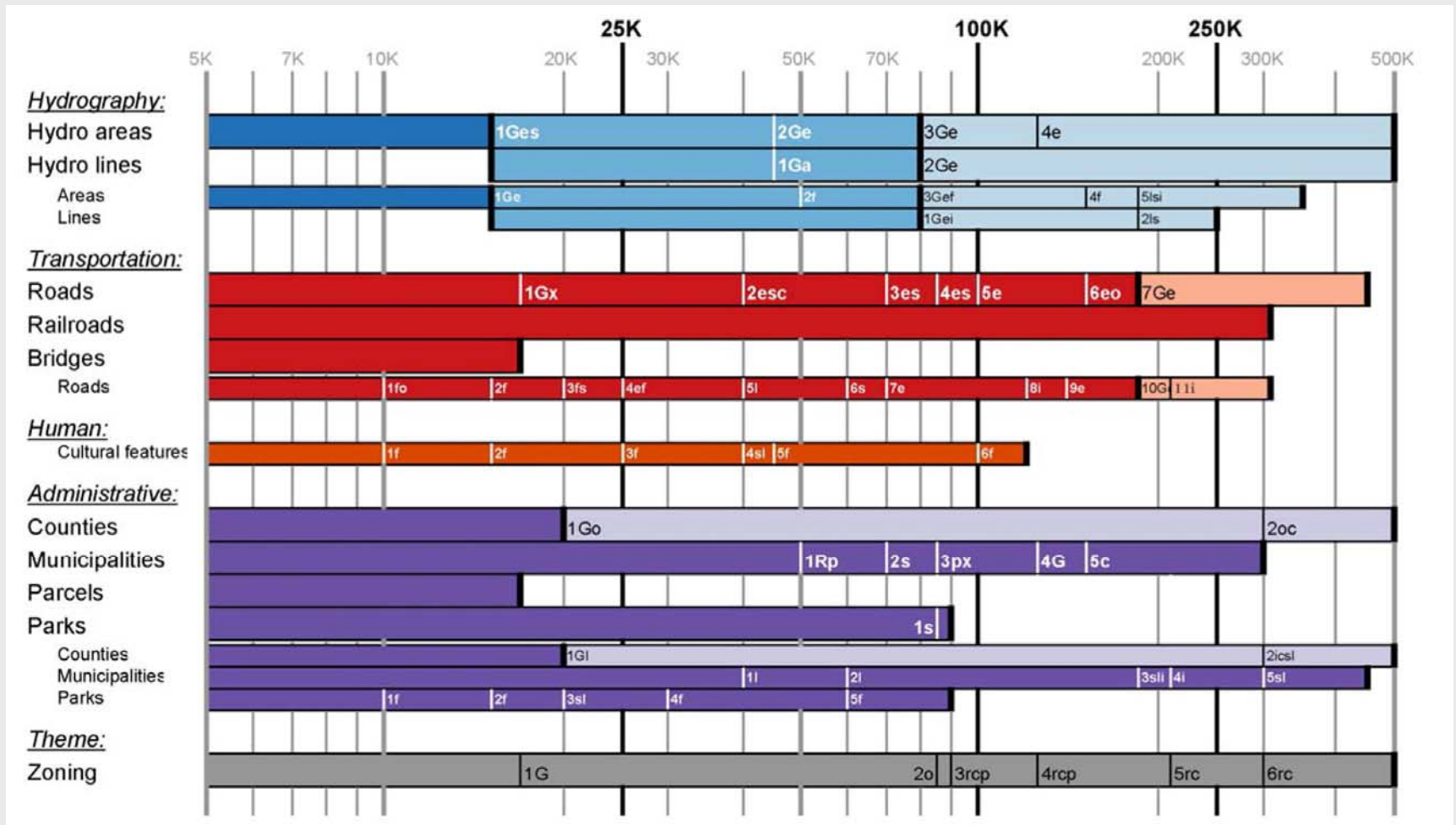


d2.

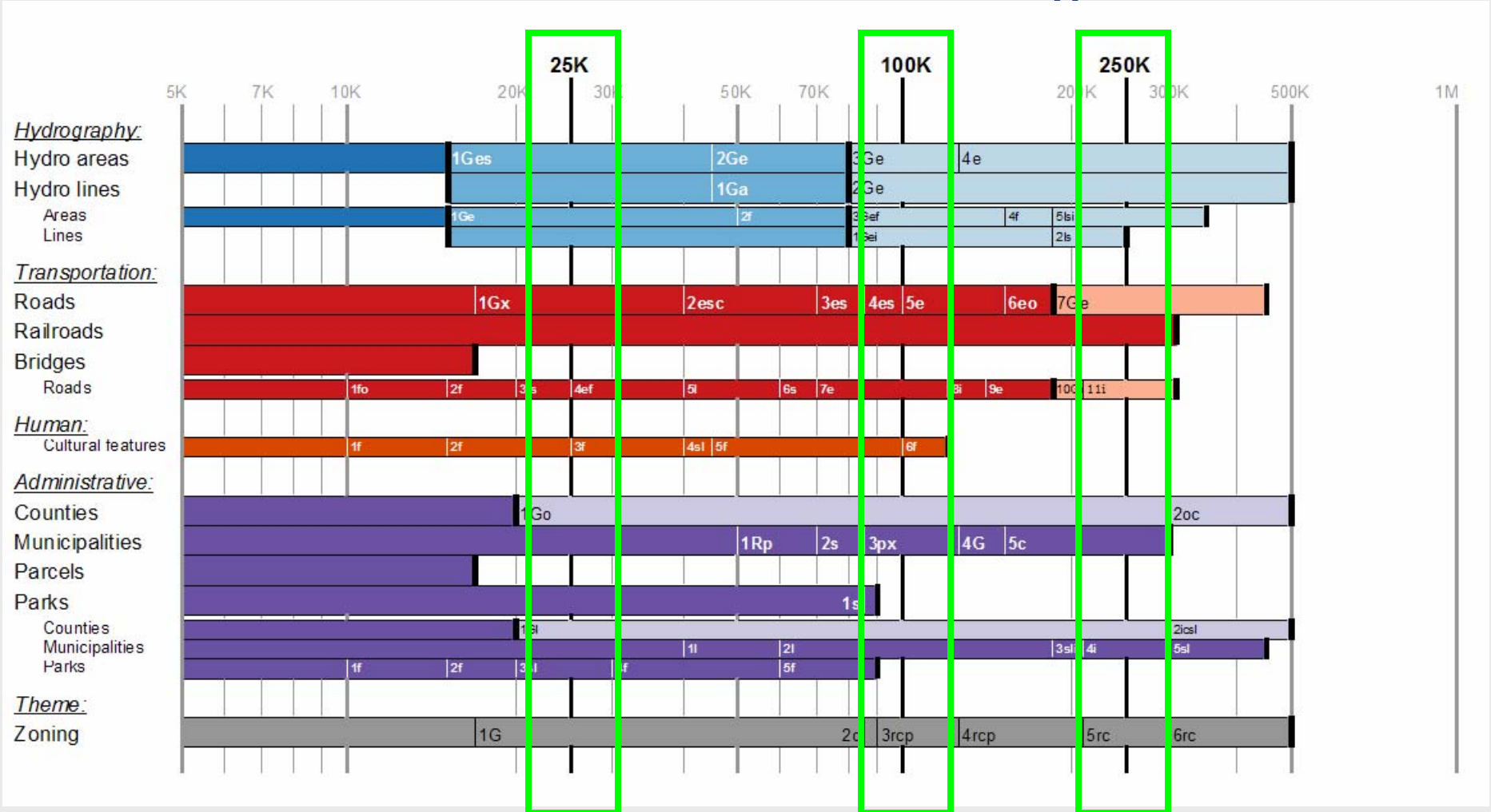


e2.

ScaleMaster diagram: a schematic for organizing scale-dependent design specifications for a multi-scale mapping project



# Elements of ScaleMaster Diagram

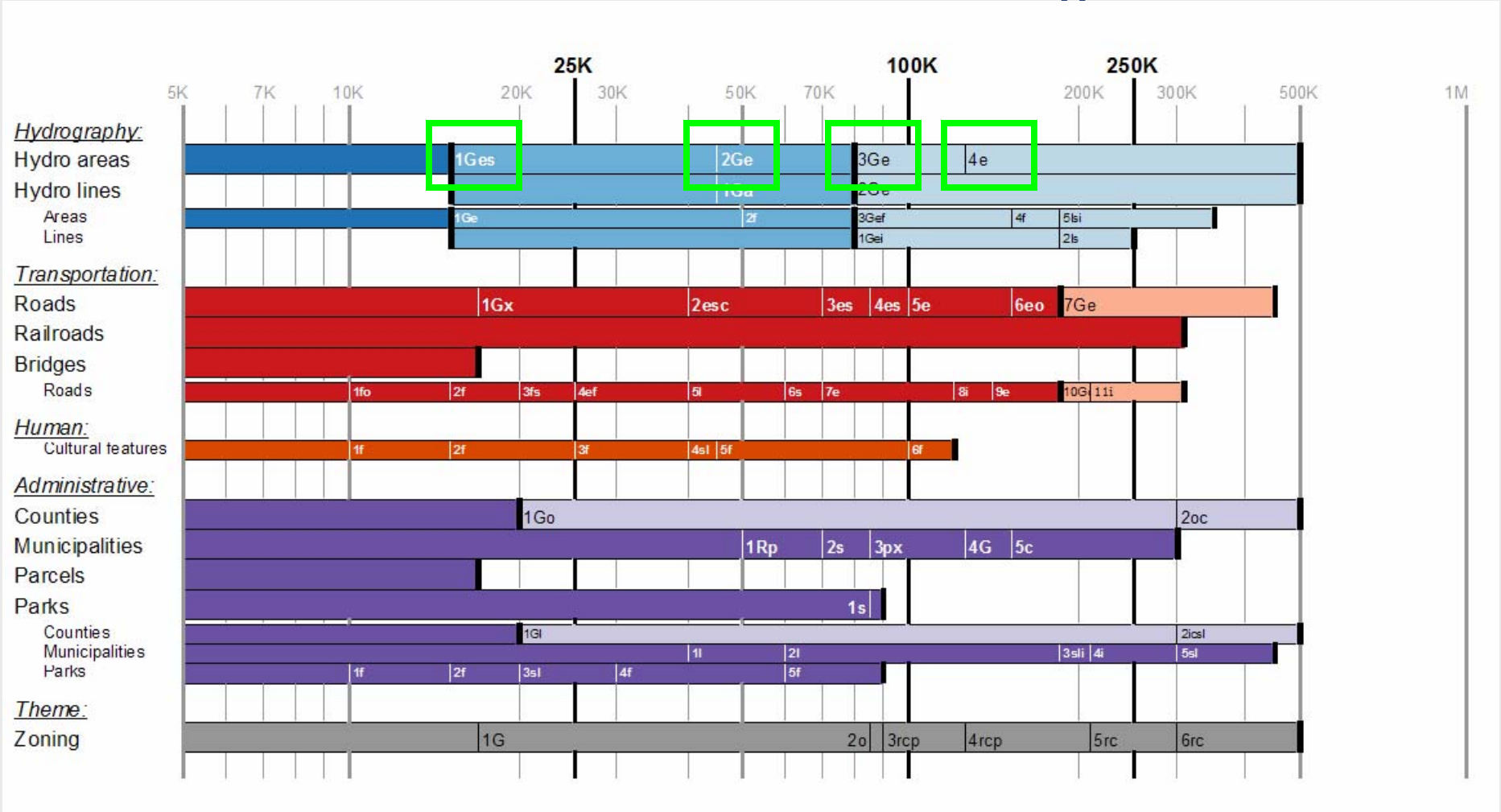


(courtesy of Jess Acosta)

## Data Compilation Scales



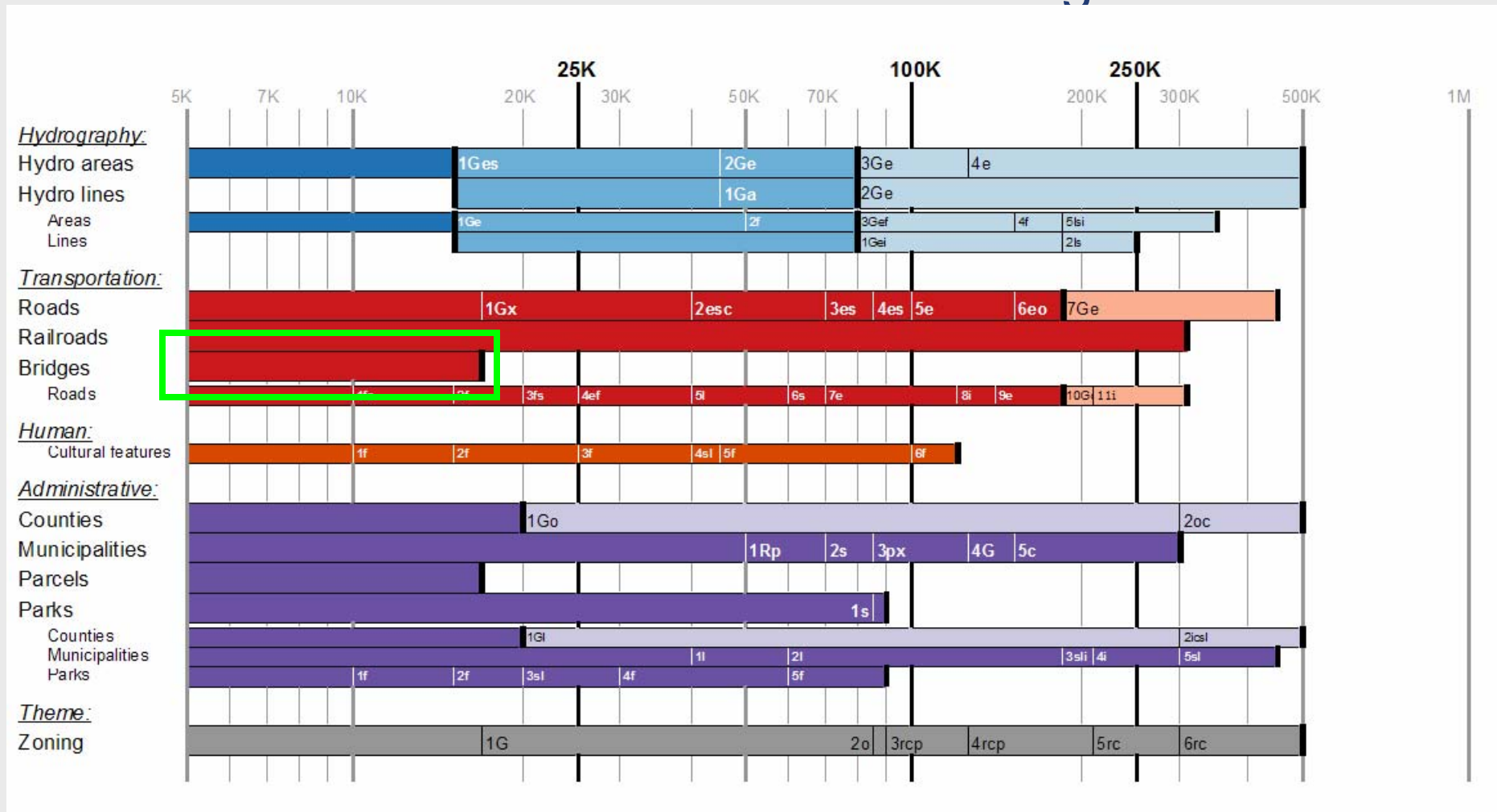
# Elements of ScaleMaster Diagram



(courtesy of Jess Acosta)

Multiscale operators applied to hydro areas layer

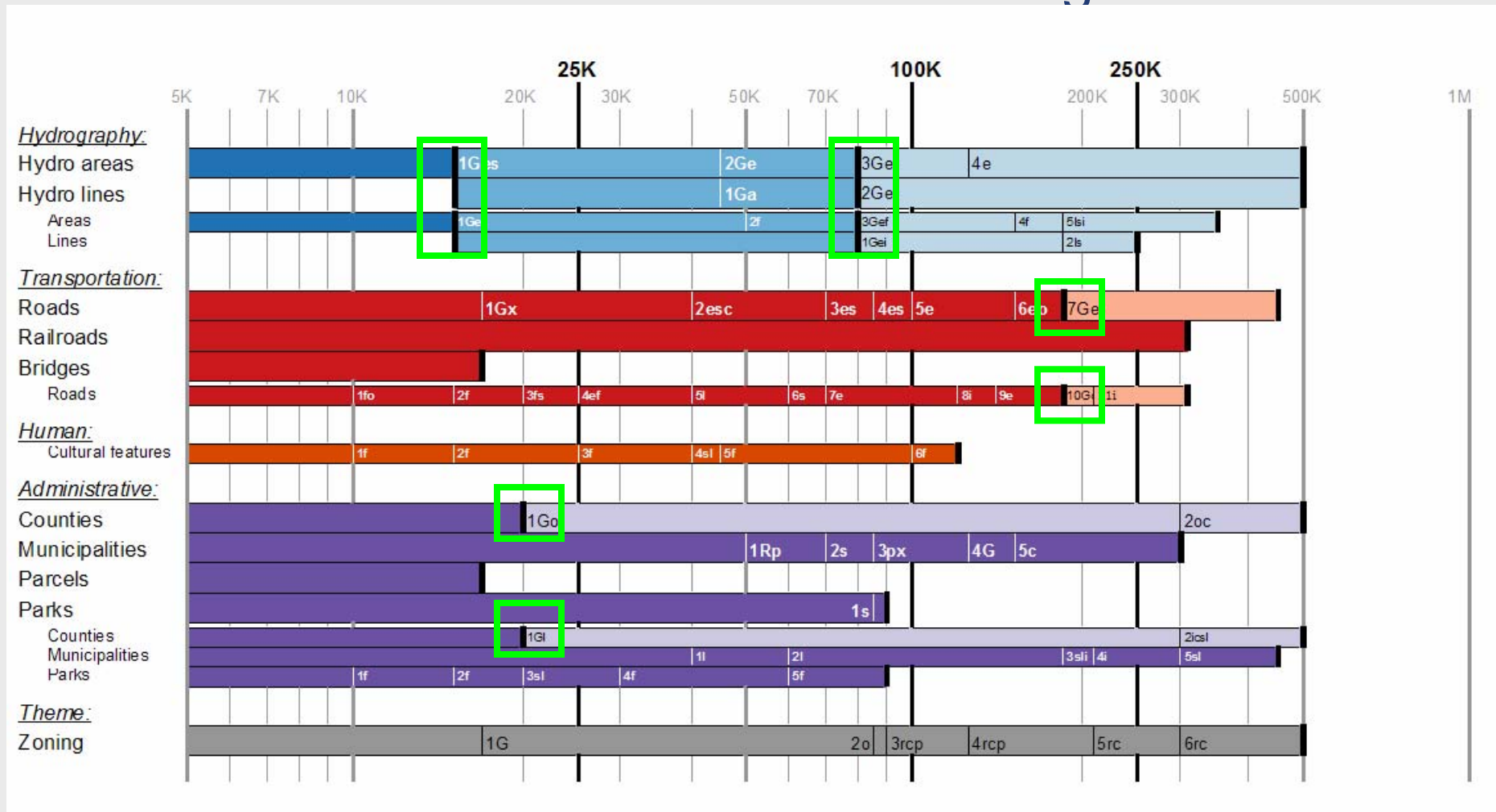
## Elements of ScaleMaster Diagram



Display range for bridges layer

(courtesy of Jess Acosta)

## Elements of ScaleMaster Diagram



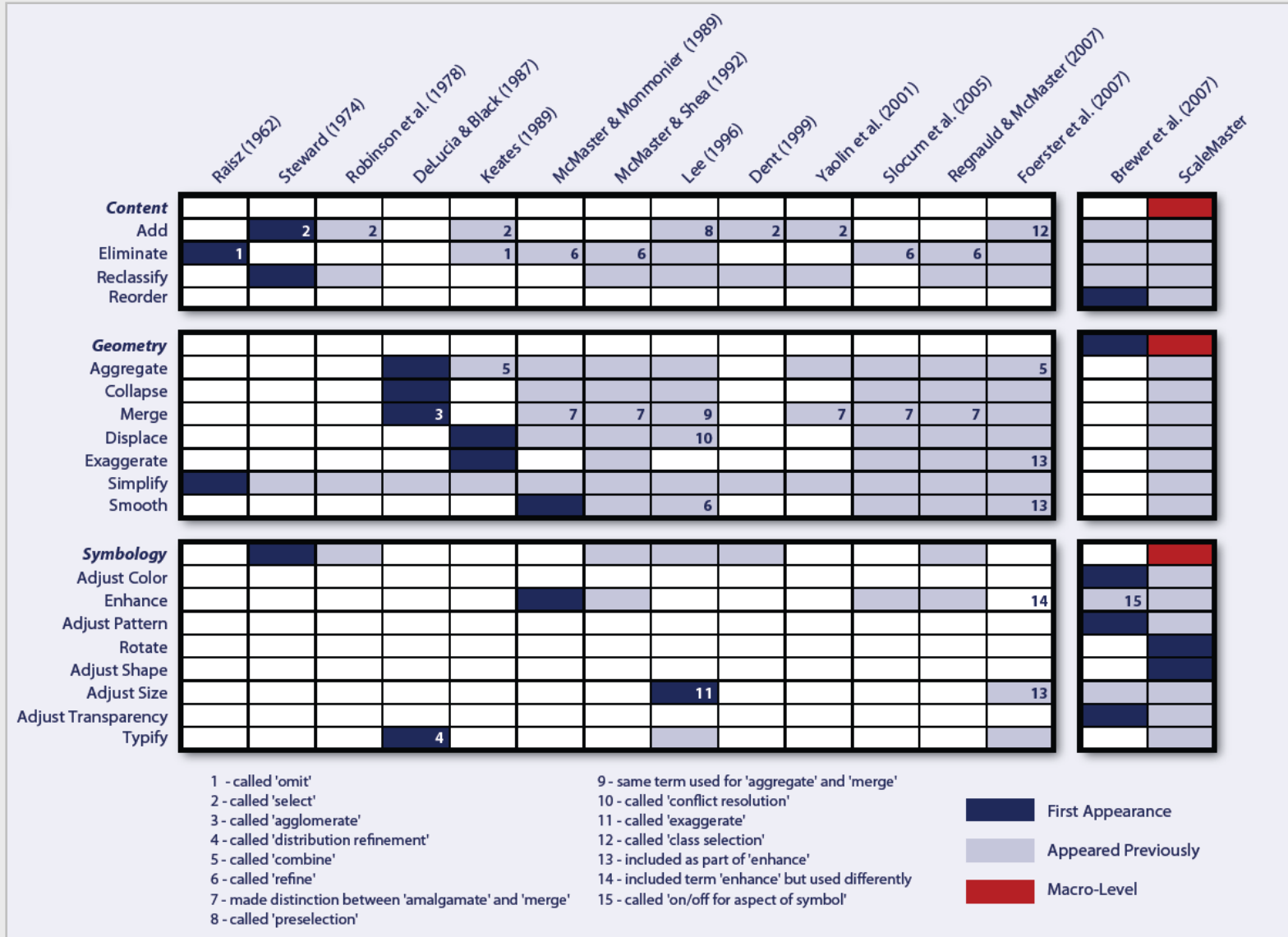
(courtesy of Jess Acosta)

Decision points

# ScaleMaster.org site objectives

- Provide an interactive site for education on multi-scale mapping through three dynamically linked panels:
  - (1) a library of multi-scale mapping operators,
  - (2) a ScaleMaster diagram example for a multi-scale mapping project using all of these operators, and
  - (3) a pair of maps illustrating before-and-after designs for a user-selected decision point on the ScaleMaster diagram.
- Provide an interface for constructing ScaleMaster diagrams – capturing the design *decision points* for scale dependent map specifications to
  - (1) Formalize cartographer's decisions about changing map scales
  - (2) Maintain consistency across multi-scale map products
  - (3) Guide organizations without on-site cartographic expertise
  - (4) Assist efforts in the design of Multi-Representational Databases (MRDB)

## Typology of Multi-Scale Mapping Operators



# Typology of Multi-Scale Mapping Operators

## Geometry

- 1) aggregate
- 2) collapse
- 3) merge
- 4) displace
- 5) exaggerate
- 6) simplify
- 7) smooth

## Symbology

- 1) enhance
- 2) typify
- 3) adjust color
- 4) rotate
- 5) adjust pattern
- 6) adjust shape
- 7) adjust size
- 8) adjust  
transparency

## Content

- 1) reorder
- 2) reclassify
- 3) add
- 4) eliminate

# ScaleMaster.org Learn module

ScaleMaster.org

Example Multi-Scale Mapping Project



Previous Display Scale: 10000



Current Display Scale: 15000

Illustration | Explanation



original map scale



reduced

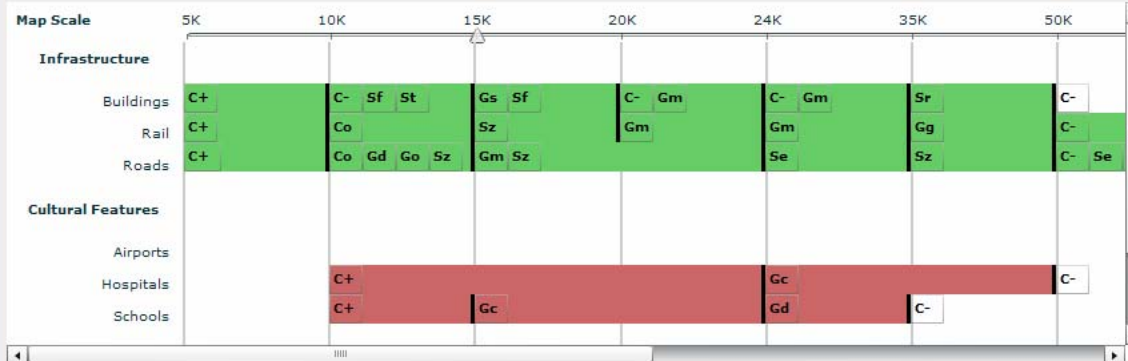


adjusted

Content | Geometry | Symbolization

- Gg aggregate** replacement of many related features with a representative feature of increased dimensionality
- Gc collapse** replacement of a feature with a representative feature of lower dimensionality
- Gd displace** adjustment to the location of a feature to avoid coalescence with adjacent features
- Gx exaggerate** amplification to a portion of a feature to emphasize a characteristic aspect of it
- Gm merge** replacement of a feature with a representative

ScaleMaster Diagram





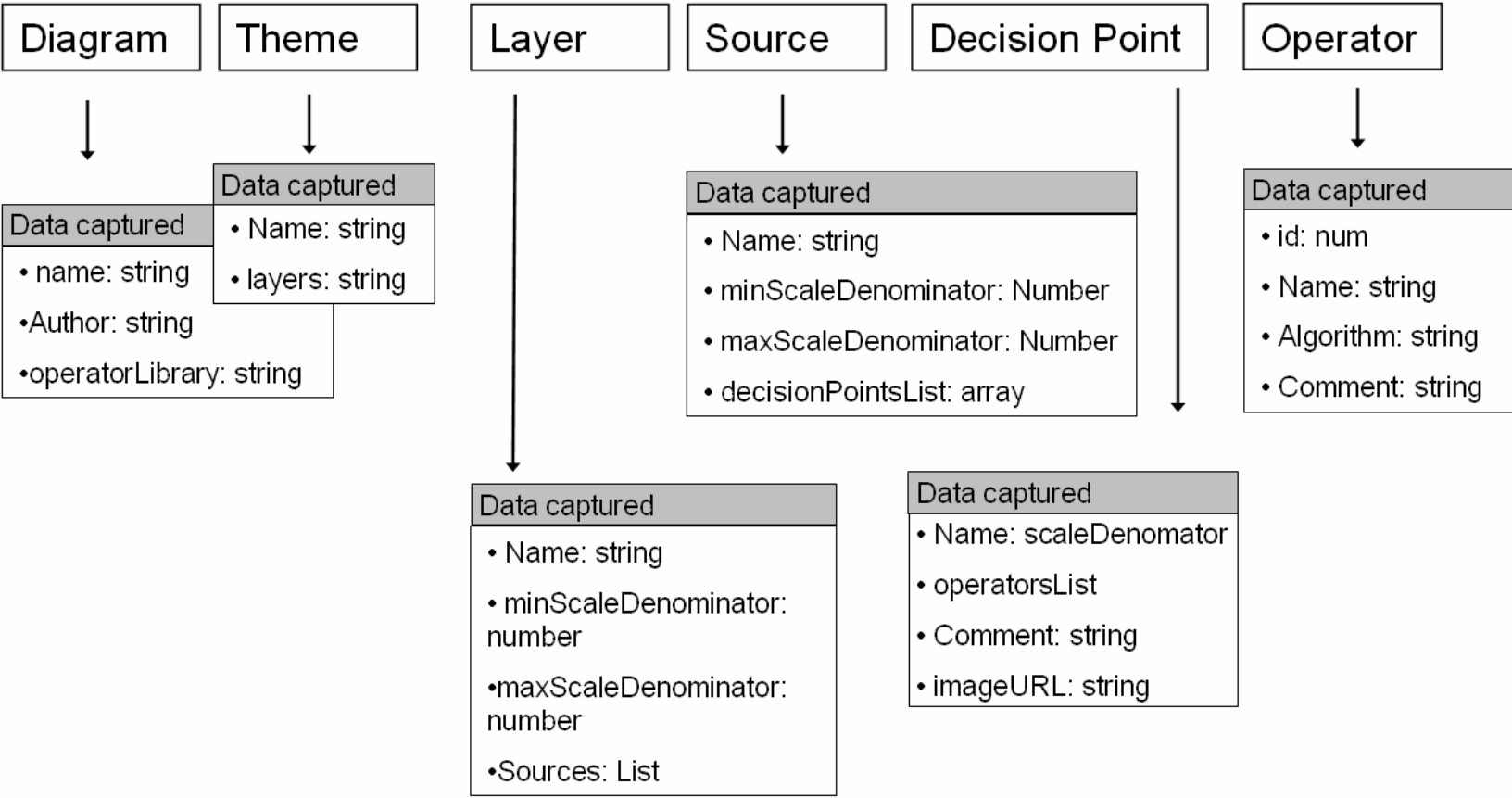


# Exporting design specifications

## ScaleMaster Abstraction Hierarchy

(general)

(elemental)



# Acknowledgements

- The generous support of the ORN Labs travel scholarship to allow us to present this work at GIScience 2008
- Carolyn Fish and Douglas Schoch for the multi-scale map designs of Portland
- Jess Acosta for ScaleMaster diagrams generated from her designs of Ada County

Thank you for your  
attention

For more information on the ScaleMaster.org project visit  
<http://scalemaster.org/>