

# ScaleMaster.org

multi-scale mapping made easy

**Robert Roth** [reroth@psu.edu](mailto:reroth@psu.edu)

**Michael Stryker** [stryker@psu.edu](mailto:stryker@psu.edu)

**Carolyn Fish** [cfish11@psu.edu](mailto:cfish11@psu.edu)

**Douglas Schoch** [dbs5026@psu.edu](mailto:dbs5026@psu.edu)

**Cindy Brewer** [cbrewer@psu.edu](mailto:cbrewer@psu.edu)

## agenda

### *background/context:*

multi-scale mapping  
the ScaleMaster diagram

### *ScaleMaster.org:*

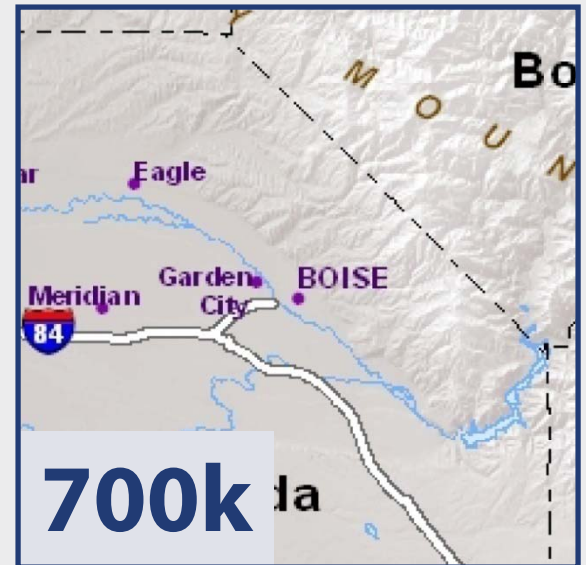
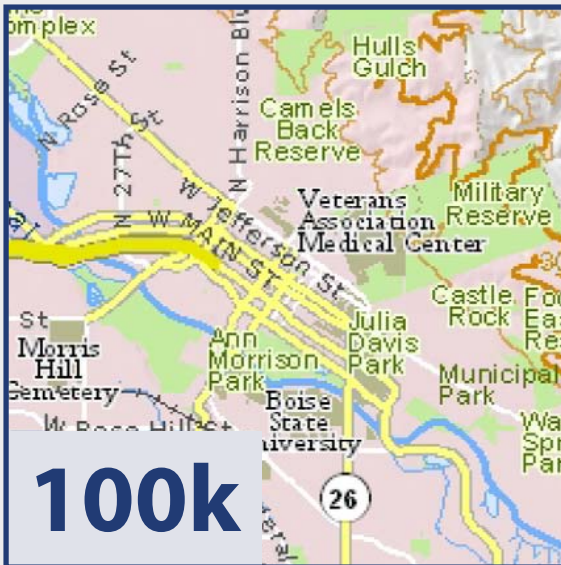
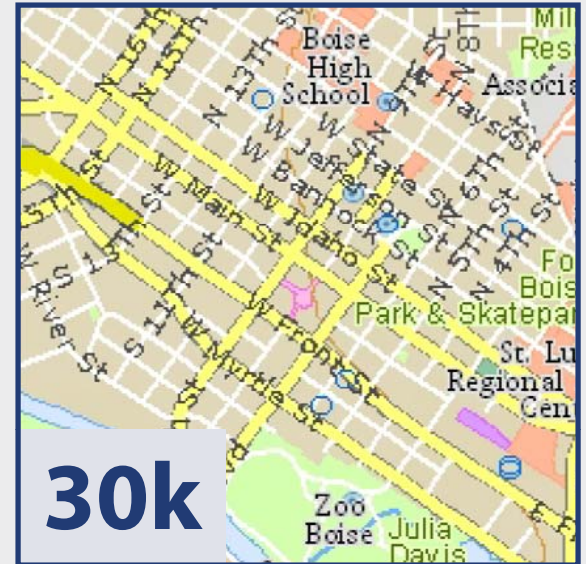
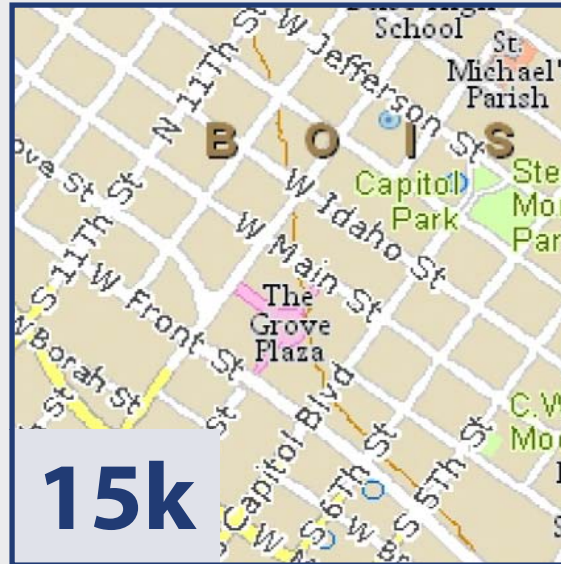
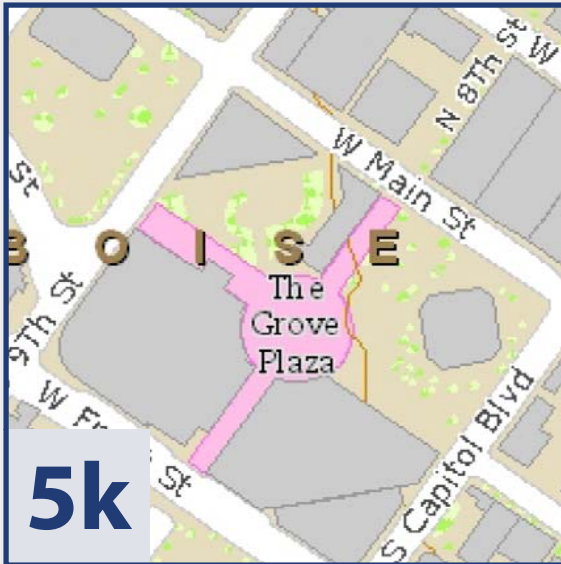
current development: the **Learn** component

future directions: the **Create** component

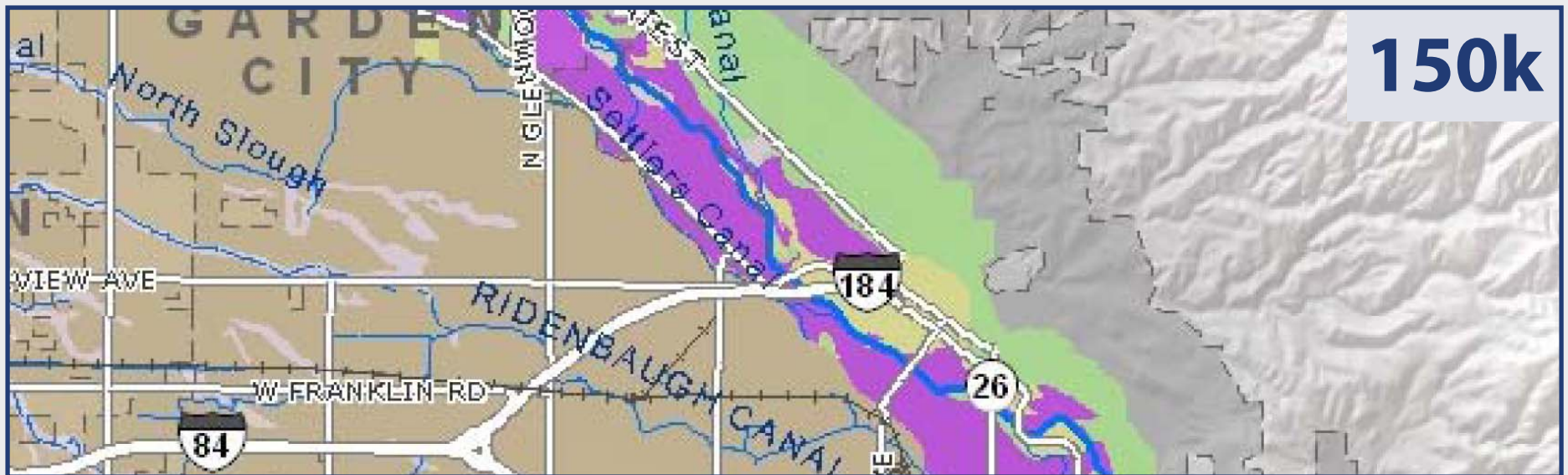
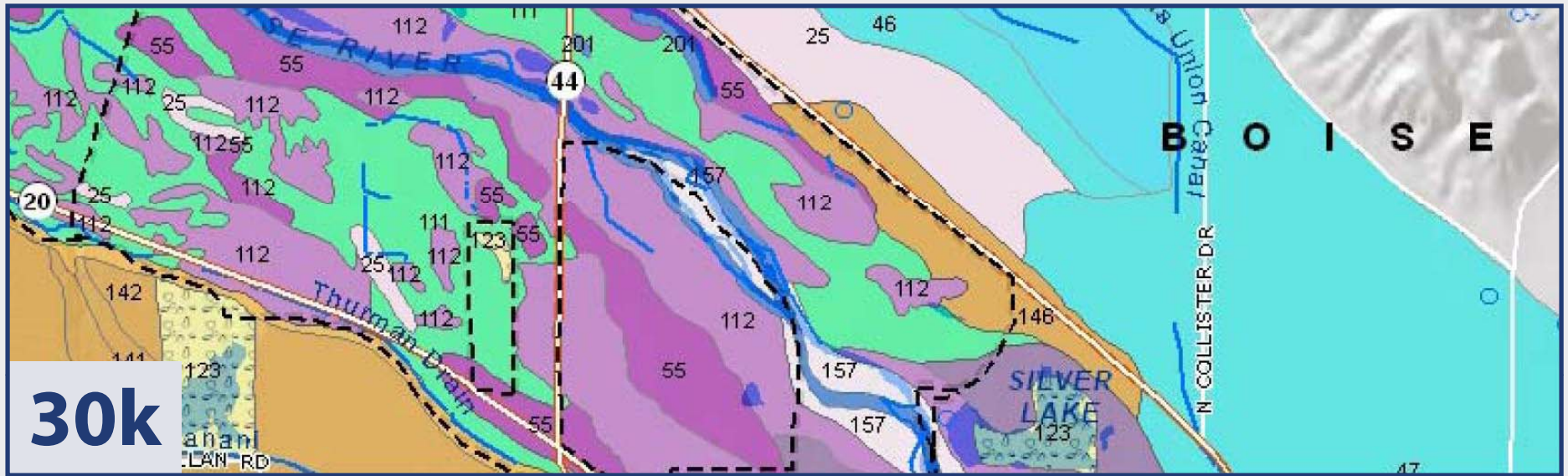
# multi-scale mapping is...

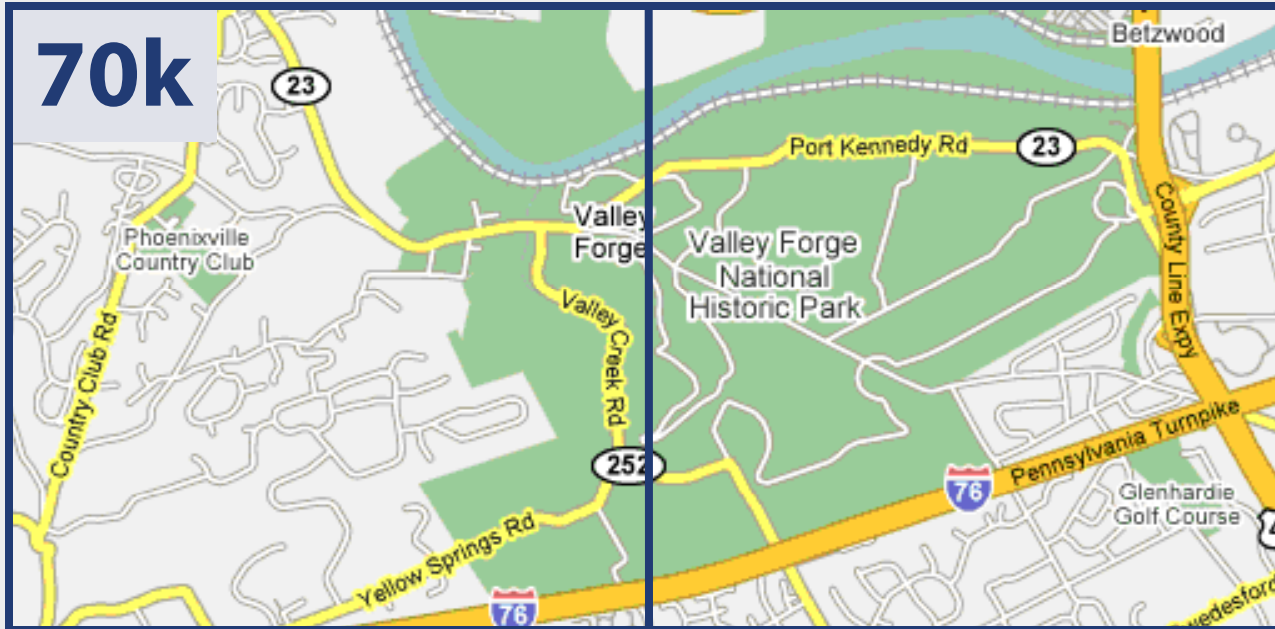
...the cartographic practice of providing ***integrated*** and ***legible*** map designs of the same geographic themes at all desired output scales

ScaleMaster.org: multi-scale mapping made easy

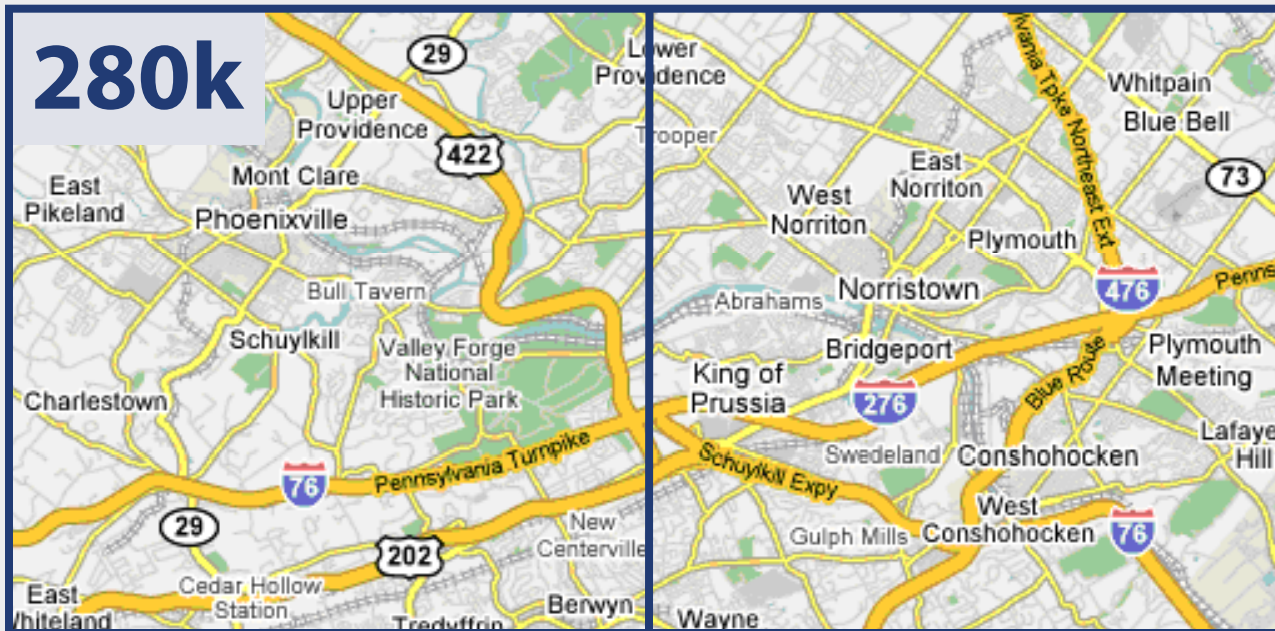








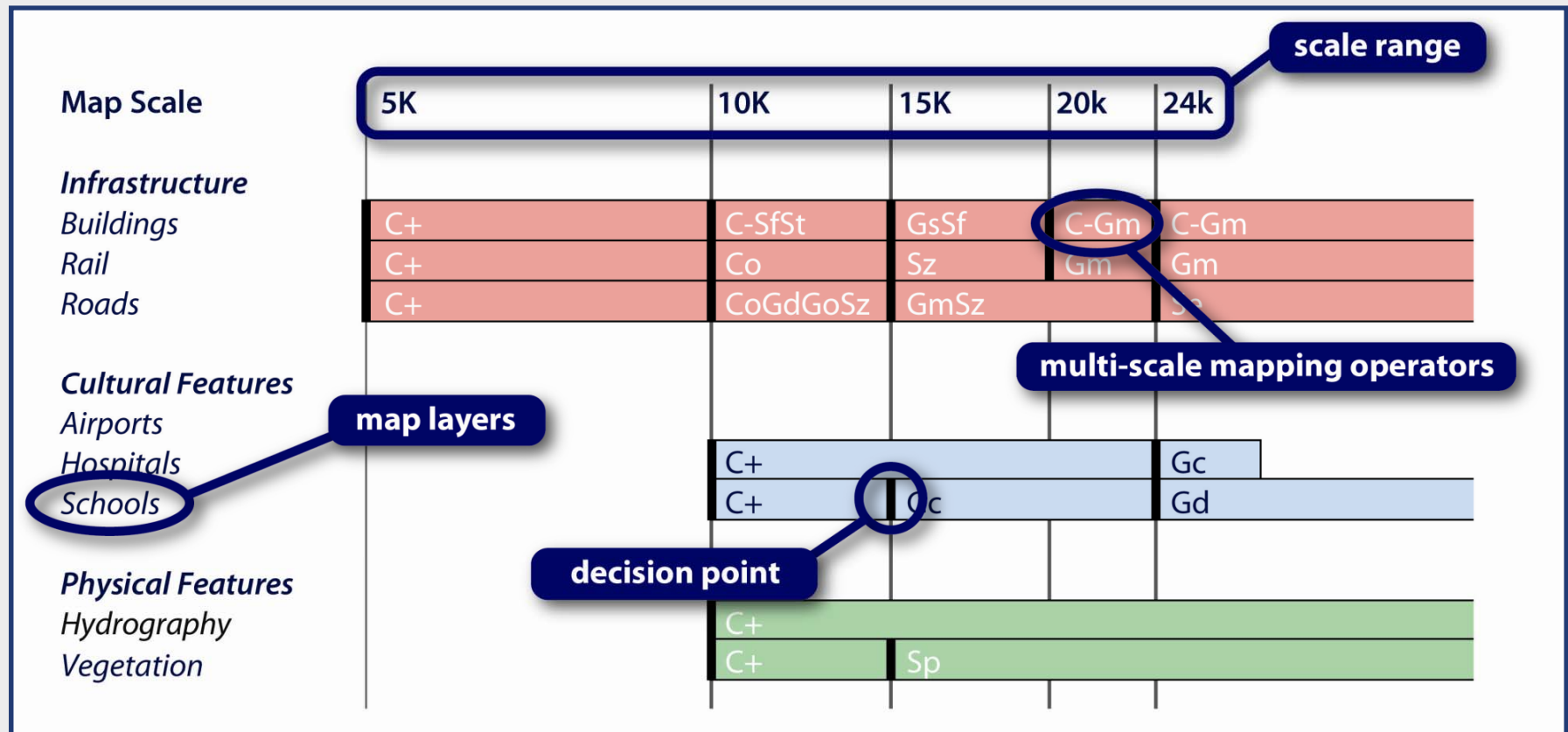
GoogleMaps  
scale step #6



GoogleMaps  
scale step #8



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



# ScaleMaster.org

**ScaleMaster.org:** An online tool for the education of map generalization and the creation of scale-dependent generalization specifications


> switch to **LEARN**

Annotate ScaleMaster: Overall Document | Selected Breakpoint > Open Saved Project

Layer:  Type of Change:  Upload Image:

Scale:  Change in Source Data?:

Description:

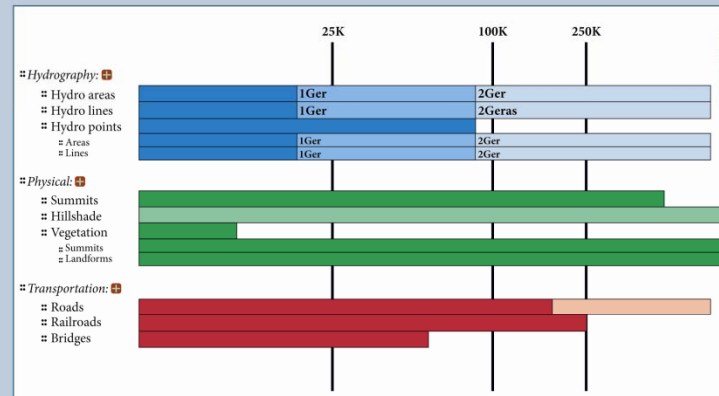


Generalization Techniques

Explanation | Illustration



ScaleMaster Specification: + Add new Category + Add new source data scale # Print ScaleMaster



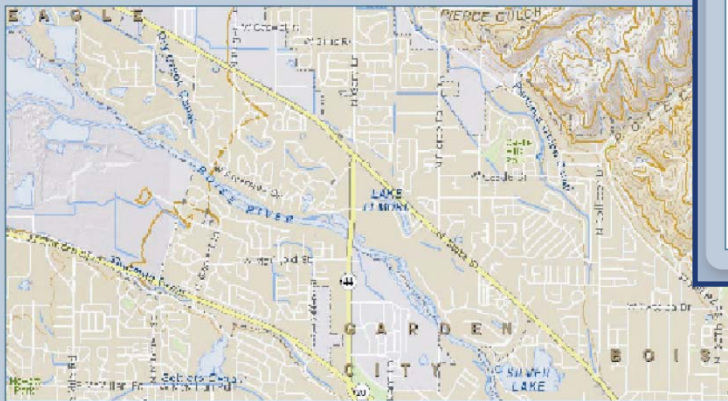
Search Techniques

By Geometry | Alphabetical

Code	Name

**ScaleMaster.org:** An online tool for the education of map generalization and the creation of scale-dependent generalization specifications

Prototype Map:  Topographic  Zoning  Soils  Population



ScaleMaster Specification:



Search Techniques

By Geometry | Alphabetical

Code	Name

(2) Create

(1) Learn



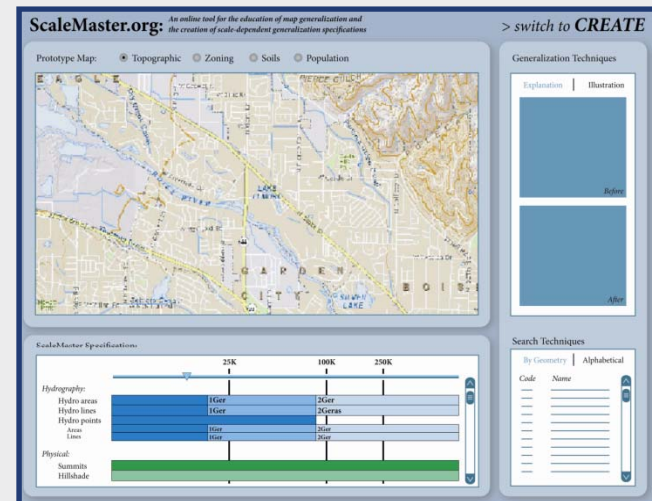
# Learn Component

(1) determining a typology of multi-scale mapping operators

	Buck (1962)	Soward (1974)	Robinson et al. (1978)	DeLuis & Beck (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1994)	Dent (1999)	Yodanis et al. (2001)	Socum et al. (2002)	Reynolds & McMaster (2007)	Foerster et al. (2007)	Breuer et al. (2007)	ScaleMaster
<b>Content</b>															
Add	2	2	2			2		8	2	2					12
Eliminate	1					1	6	6				6	6		
Reclassify															
Recoder															
<b>Geometry</b>															
Aggregate						5									5
Collapse															
Merge					3		7	7	9		7	7	7		
Displace									10						
Exaggerate															13
Simplify															13
Smooth								6							
<b>Symbolology</b>															
Adjust Color															
Enhance														14	15
Adjust Pattern															
Rotate															
Adjust Shape															
Adjust Size								11						13	
Adjust Transparency															
Typify					4										



(2) designing an example multi-scale mapping project



(3) developing an interface for exploration of this material

# (1) determining a typology of multi-scale mapping operators

	Raisz (1962)	Steward (1974)	Robinson et al. (1978)	DeLucia & Black (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1996)	Dent (1999)	Yaolin et al. (2001)	Slocum et al. (2005)	Regnault & McMaster (2007)	Foerster et al. (2007)
Aggregate				First Appearance		Appeared Previously		6					
Amalgamate				3									
Classify		First Appearance	Appeared Previously										11
Collapse				First Appearance		Appeared Previously							
Combine	1				5								12
Displace					First Appearance	Appeared Previously		7					
Enhance						First Appearance	Appeared Previously						13
Eliminate								First Appearance					
Exaggerate					First Appearance	Appeared Previously		8					
Induction		First Appearance	Appeared Previously										
Merge						First Appearance	Appeared Previously			Appeared Previously			
Omit	First Appearance				Appeared Previously								
Refine				4		Appeared Previously		9					
Select		First Appearance	2		Appeared Previously			10	Appeared Previously				14
Simplify	First Appearance	Appeared Previously				Appeared Previously							
Smooth						First Appearance	Appeared Previously						
Symbolize		First Appearance	Appeared Previously						Appeared Previously				
Typify								First Appearance					Appeared Previously

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Aggregate				First Appearance				6					
Amalgamate				3									
Classify		First Appearance	Appeared Previously										11
Collapse				First Appearance									
Combine	1				5								12
Displace					First Appearance			7					
Enhance						First Appearance							13
Eliminate								First Appearance					
Exaggerate					First Appearance			8					
Induction		First Appearance	Appeared Previously										
Merge						First Appearance							
Omit	First Appearance				Appeared Previously								
Refine				4				9					
Select		First Appearance	2					10					14
Simplify	First Appearance	Appeared Previously											
Smooth						First Appearance							
Symbolize		First Appearance	Appeared Previously										
Typify								First Appearance					



# (1) determining a typology of multi-scale mapping operators

	Raisz (1962)	Steward (1974)	Robinson et al. (1978)	DeLucia & Black (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1996)	Dent (1999)	Yaolin et al. (2001)	Slocum et al. (2005)	Regnauld & McMaster (2007)	Foerster et al. (2007)
Aggregate				3				6					
Amalgamate				3									
Classify		1	2										11
Collapse				3									
Combine	1				5								12
Displace					5			7					
Enhance						1							13
Eliminate								8					
Exaggerate					5			8					
Induction		1	2										
Merge		1	2			1							
Omit	1				5								
Refine				4				9					
Select		1	2		5			10					14
Simplify	1												
Smooth						1							
Symbolize		1	2										
Typify								8					

# (1) determining a typology of multi-scale mapping operators

	Raisz (1962)	Steward (1974)	Robinson et al. (1978)	DeLucia & Black (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1996)	Dent (1999)	Yaolin et al. (2001)	Slocum et al. (2005)	Regnault & McMaster (2007)	Foerster et al. (2007)
Aggregate				█				6					
Amalgamate				█									
Classify		█	█										11
Collapse				█									
Combine	█				5								12
Displace					█			7					
Enhance						█							13
Eliminate								█					
Exaggerate					█			8					
Induction		█	█										
Merge						█							
Omit	█				█								
Refine				█				9					
Select		█	█					10					14
Simplify	█	█	█										
Smooth						█							
Symbolize		█	█										
Typify								█					█

█ First Appearance  
 █ Appeared Previously

# (1) determining a typology of multi-scale mapping operators

	Raisz (1962)	Steward (1974)	Robinson et al. (1978)	DeLucia & Black (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1996)	Dent (1999)	Yaolin et al. (2001)	Slocum et al. (2005)	Regnault & McMaster (2007)	Foerster et al. (2007)
Aggregate				3				6					
Amalgamate				3									
Classify		1											11
Collapse				3									
Combine	1				5								12
Displace					5			7					
Enhance						1							13
Eliminate								8					
Exaggerate					5			8					
Induction		1											
Merge						1							
Omit	1												
Refine				4				9					
Select		2						10					14
Simplify	1												
Smooth						1							
Symbolize		1											
Typify									1				



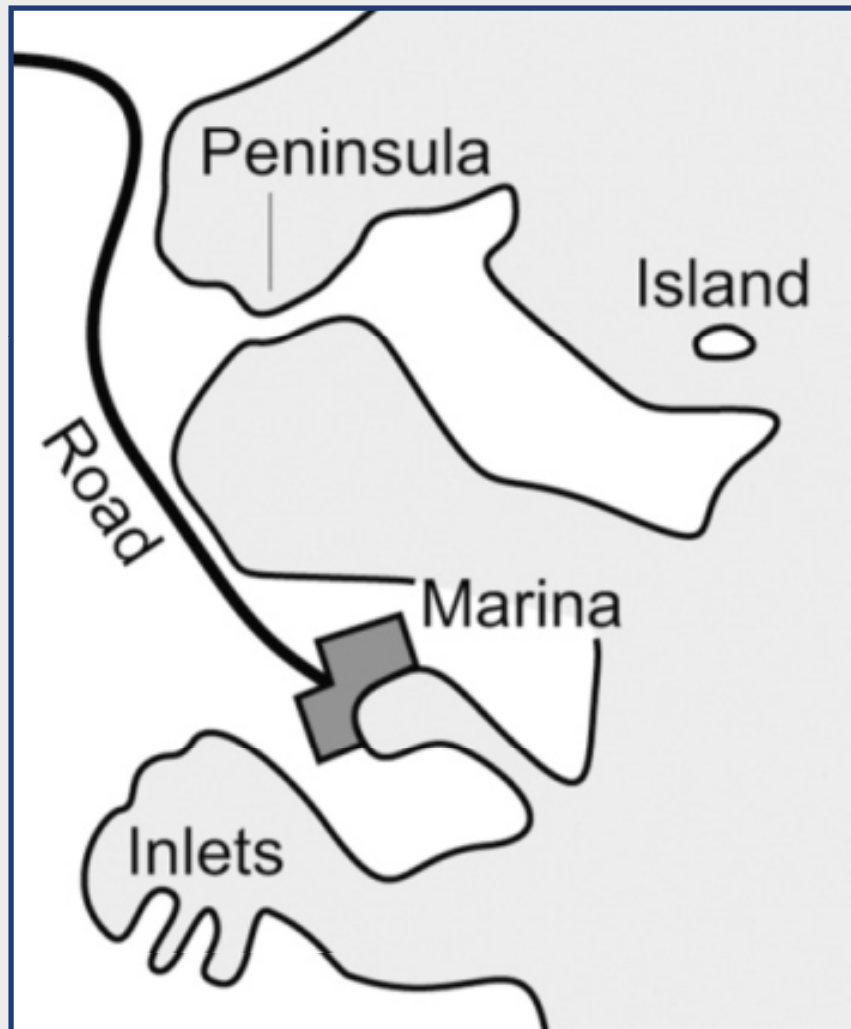
(1) determining a typology of multi-scale mapping operators

	Raisz (1962)	Steward (1974)	Robinson et al. (1978)	DeLucia & Black (1987)	Keates (1989)	McMaster & Monmonier (1989)	McMaster & Shea (1992)	Lee (1996)	Dent (1999)	Yaolin et al. (2001)	Slocum et al. (2005)	Regnault & McMaster (2007)	Foerster et al. (2007)
Aggregate				First Appearance		Appeared Previously		6					
Amalgamate				3									
Classify		First Appearance	Appeared Previously										11
Collapse				First Appearance									
Combine	1				5								12
Displace					First Appearance			7					
Enhance						First Appearance							13
Eliminate								8					
Exaggerate					First Appearance			8					
Induction		First Appearance	Appeared Previously										
Merge						First Appearance							
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Refine				4				9					
Select		First Appearance	2		Appeared Previously			10					14
Simplify	First Appearance	Appeared Previously											
Smooth						First Appearance							
Symbolize		First Appearance	Appeared Previously										
Typify								First Appearance					Appeared Previously

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Aggregate				First Appearance		Appeared Previously		6					
Amalgamate				3									
Classify		First Appearance	Appeared Previously										11
Collapse				First Appearance		Appeared Previously							
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Displace					First Appearance	Appeared Previously		7					
Enhance						First Appearance	Appeared Previously						13
Eliminate								8					
Exaggerate					First Appearance	Appeared Previously		8					
Induction		First Appearance	Appeared Previously										
Merge						First Appearance	Appeared Previously						
Omit	First Appearance				Appeared Previously								
Refine				4		Appeared Previously		9					
Select		First Appearance	2		Appeared Previously			10					14
Simplify	First Appearance	Appeared Previously											
Smooth						First Appearance	Appeared Previously						
Symbolize		First Appearance	Appeared Previously										
Typify								First Appearance					Appeared Previously

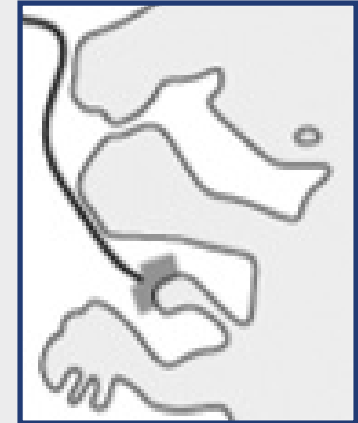
## examining **symbology**



*original*



*reduced*



*adjusted w/  
symbology*



*adjusted w/  
geometry*



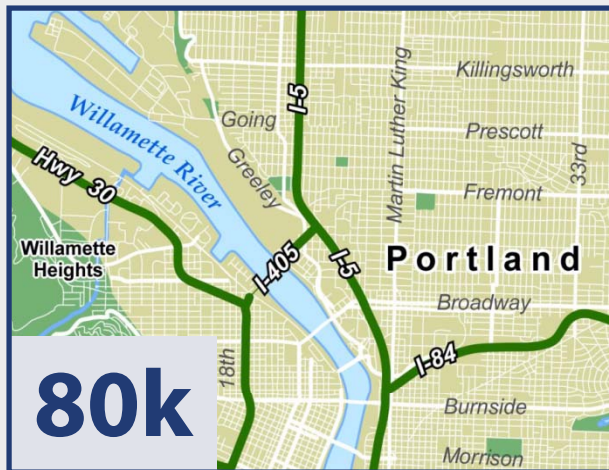
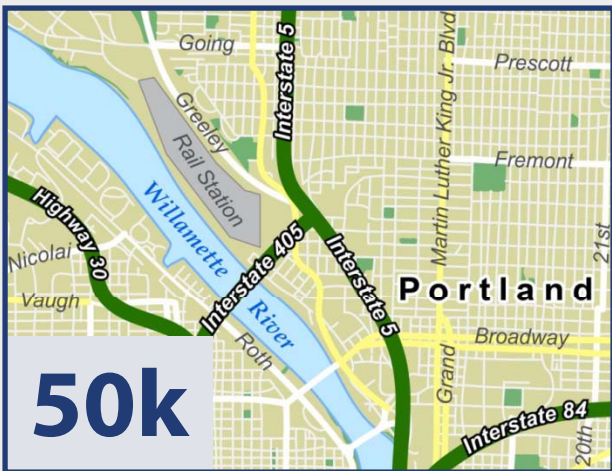
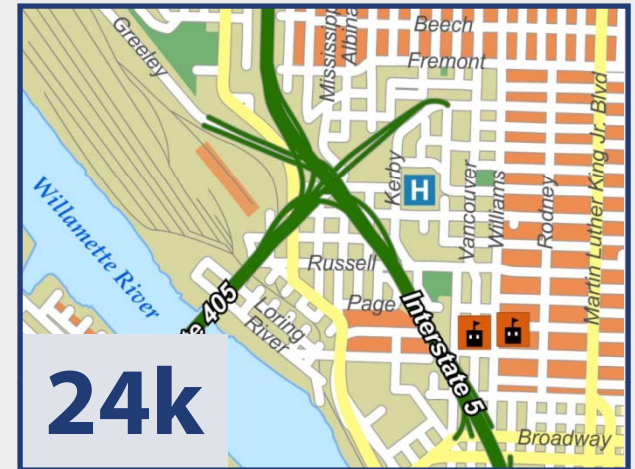
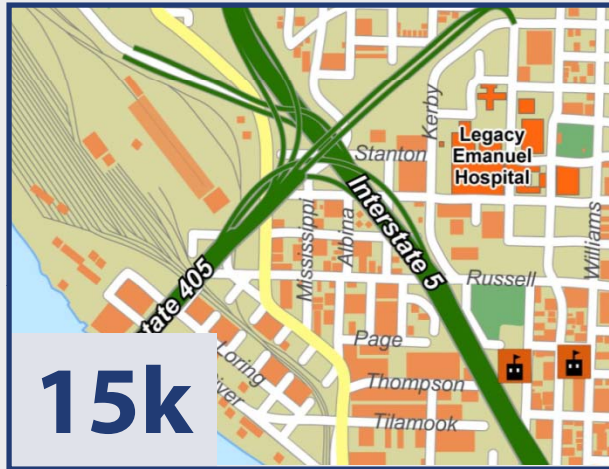
*symbology &  
geometry*



# (1) determining a typology of multi-scale mapping operators

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<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="display: flex; flex-direction: column; gap: 5px;"> <div><span style="display: inline-block; width: 15px; height: 10px; background-color: black; margin-right: 5px;"></span> First Appearance</div> <div><span style="display: inline-block; width: 15px; height: 10px; background-color: #cccccc; margin-right: 5px;"></span> Appeared Previously</div> <div><span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> Macro-Level</div> </div> </div>															
<b>Content</b>															
Add		2	2		2			8	2	2					12
Eliminate	1				1	6	6				6	6			
Reclassify															
Reorder															
<b>Geometry</b>															
Aggregate					5										
Collapse															
Merge				3		7	7	9		7	7	7			
Displace								10							
Exaggerate															13
Simplify															
Smooth								6							13
<b>Symbology</b>															
Adjust Color															
Enhance														14	
Adjust Pattern															
Rotate															
Adjust Shape															
Adjust Size									11						13
Adjust Transparency															
Typify				4											

## (2) designing an example multi-scale mapping project



## (2) designing an example multi-scale mapping project


Map Scale	5K	10K	15K	20k	24k	30k	50k	65k	80k	100k	250k	500k
<b>Infrastructure</b>												
Buildings	C+	C-SfSt	GsSf	C-Gm	C-Gm	Sr	C-					
Rail	C+	Co	Sz	Gm	Gm	Gg	C-		C-			
Roads	C+	CoGdGoSz	GmSz		Se	Sz	C-SeSz	CcGd		GsSc	C-	C-Gs
<b>Cultural Features</b>												
Airports											C+	Ss
Hospitals		C+			Gc	C-						
Schools		C+	Gc		Gd		C-					
<b>Physical Features</b>												
Hydrography		C+				Go			Gx	Go	C-GsSe	
Vegetation		C+	Sp					C+C-Cc		C-		




### (3) developing an interface for exploration of this material

ScaleMaster.org

Example Multi-Scale Mapping Project



Previous Display Scale: 1:5,000




Current Display Scale: -

ScaleMaster Diagram

Map Scale	5K	10K	15K	20K	24K	35K	5
<b>Infrastructure</b>							
Buildings	C+	Sf St	Gs Sf	Gm	Gm	Sr	
Rail	C+	Co	Sz	Gm	Gm	Gg	
Roads	C+	Co Gd Go Sz	Gm Sz		Se	Sz	
<b>Cultural Features</b>							
Airports						Gc	
Hospitals		C+					

**Illustration** | Explanation



original map scale      reduced      adjusted

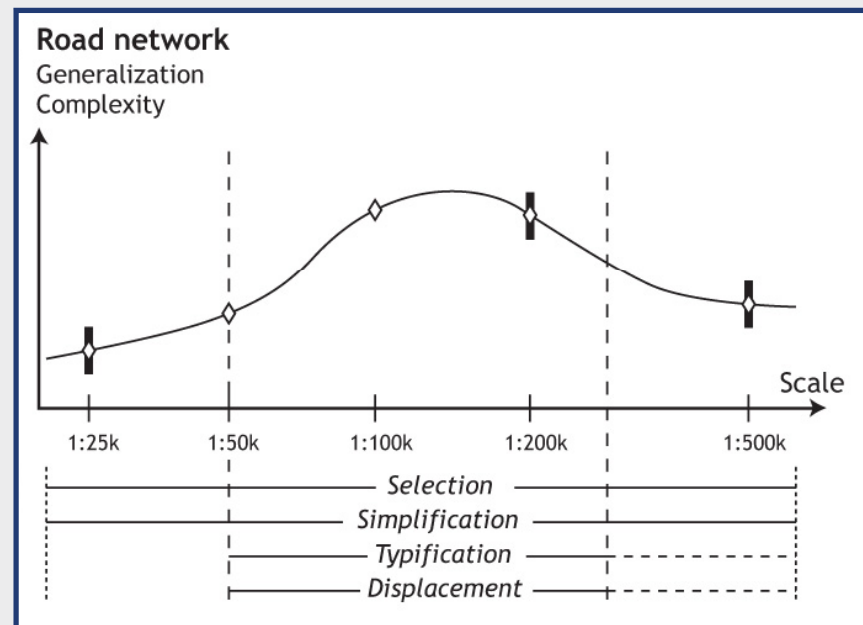
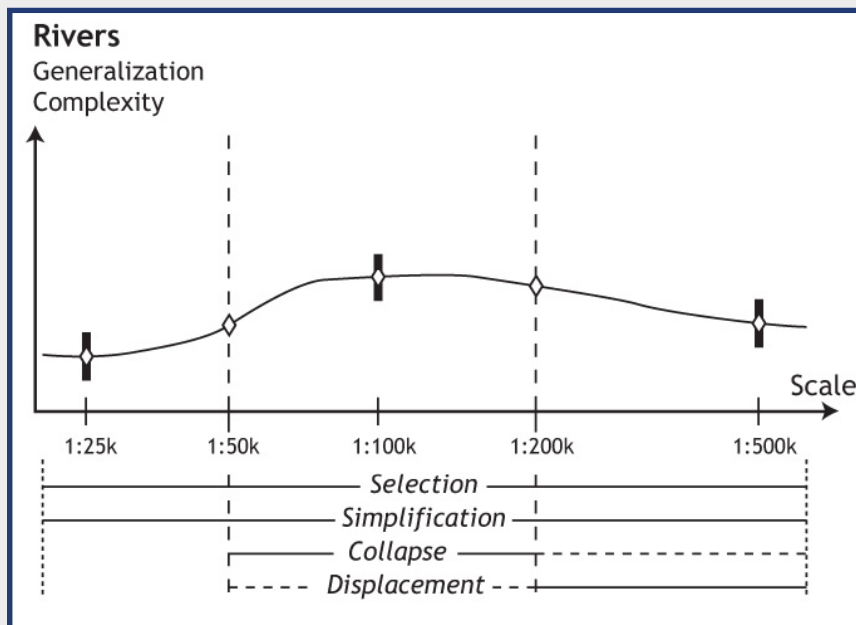
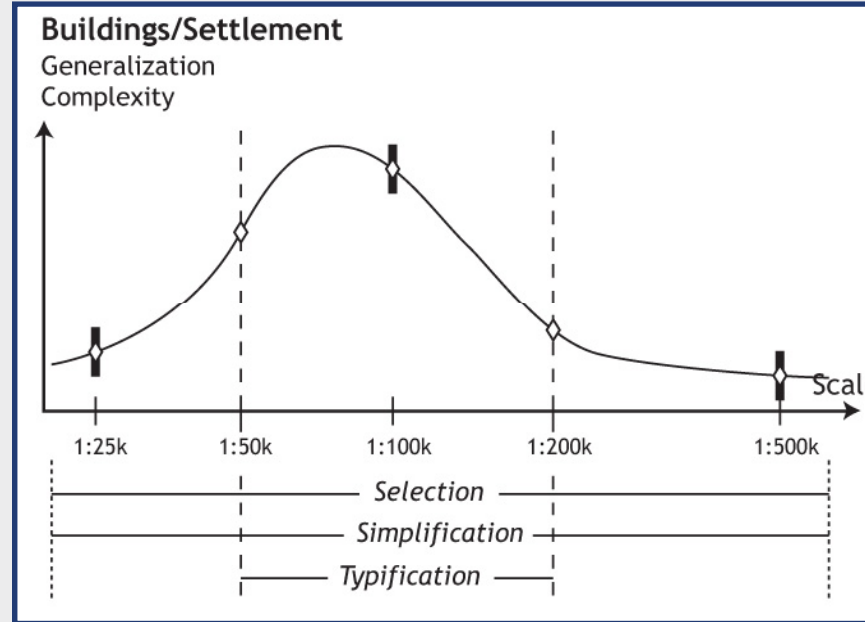
**Content** | Geometry | Symbolization

- C+** **add** insertion of features
- C-** **eliminate** removal of features
- Cc** **relassify** revision to the grouping of features based on their attributes
- Co** **reorder** adjustment to the stacking position of features



## future directions

scope of generalization operators from Cecconi et al. (2002)



**questions?**

*visit*  
**[www.scalemaster.org](http://www.scalemaster.org)**

**thanks for your time!**

~Rob, Mike, Carolyn, Doug, and Cindy