Space Modeler User Guide Labelling a space model

June 1, 2022

Workflow





Label hierarchies

Labeling functions

Labeling guidelines

Summary

Overview

Label hierarchies

- Space ontologies
- 'Space layout' class hierarchy
- Default ontologies
- Browse class hierarchies (optional)

Labeling functions

Labeling guidelines

Summary

Space ontologies

Each space or space element in a layout has multiple labels

- Space: 'LivingRoom', 'DiningRoom', 'Hallway', ...
- Space element: 'Door', 'UnitDoor', 'VisibleLightTransmissionSE', ...

Labels reference classes in multiple, linked space ontologies*:

- Space layout' ontology
 Generic classes for spaces and space elements
- Element and Function ontologies
 Specific classes for spaces and space elements
 Reuse classes in 'Space layout' ontology
- → Class hierarchies

Model generalization relationships between classes in an ontology



***Ontology**: 'a representation, formal naming and definition of the categories, properties and relations between the concepts, data and entities that substantiate one, many, or all domains of discourse.'

https://en.wikipedia.org/wiki/Ontology_(information_science)

Space Modeler User Guide – Labeling a space model

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'Space layout' class hierarchy

http://spacepatterns.com/ontologies/space_model_002/common/space_layout.owl



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Default space ontologies

- Space ontologies are encoded in the Web Ontology Language (OWL)
- Residential spaces and their related spaces are included by default
- Additional space ontologies may be included (e.g. for office spaces)

Space layout	http://spacepatterns.com/ontologies/space_model_002/common/space_layout.owl
External space	http://spacepatterns.com/ontologies/space_model_002/common/space_external_classes.owl
Residential spaces	http://spacepatterns.com/ontologies/space_model_002/common/space_residential_classes.owl
Circulation spaces	http://spacepatterns.com/ontologies/space_model_002/common/space_circulation_classes.owl
Service spaces	http://spacepatterns.com/ontologies/space_model_002/common/space_service_classes.owl
Enclosure elements	http://spacepatterns.com/ontologies/space_model_002/common/enclosure_element_classes.owl
Circulation elements	http://spacepatterns.com/ontologies/space_model_002/common/circulation_element_classes.owl
Furnishing elements	http://spacepatterns.com/ontologies/space_model_002/common/furnishing_element_classes.owl
Equipment elements	http://spacepatterns.com/ontologies/space_model_002/common/equipment_element_classes.owl
Architectural	http://spacepatterns.com/ontologies/space_model_002/view/architectural.owl
People circulation	http://spacepatterns.com/ontologies/space_model_002/view/people_circulation.owl
Functional unit	http://spacepatterns.com/ontologies/space_model_002/view/functional_unit.owl
Lighting	http://spacepatterns.com/ontologies/space_model_002/view/lighting.owl
Air circulation	http://spacepatterns.com/ontologies/space_model_002/view/air_circulation.owl

Default space ontologies classes http://spacepatterns.com/ontologies/space_model_002/_space_ontologies_classes.txt



Specific classes are relevant for labeling:

- 'LivingRoom' is a specific class
- 'CommunalSpace' is a generic class

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Summary

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Reload	Ctrl+Shift-R		
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Edit ontology catalog file			
Loaded ontology sources			
Check for plugins			
Close window	Ctrl-W		
Preferences			
Exit			

Ontology imports	Ontology Prefixes	General class axioms

Imported ontologies:

Direct Imports 🕒

Indirect Imports

To use the reasoner click Reasoner > Start reasoner V Show Inferences

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Annotations 🕀	

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Indirect Imports

To use the reasoner click Reasoner > Start reasoner V Show Inferences

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Overview

Label hierarchies

Labeling functions

- Show
- Format
- Find
- Replace

Labeling guidelines

Summary

Show labels > Spaces

Spaces

- Subspaces
- Space elements

Show labels > Spaces

Show objects

- Spaces
- Subspaces
- Space elements

Show labels > Subspaces

Show labels > Subspaces

Show labels > Space elements

- Subspaces
- Space elements

Show labels > Space elements

Show objects Spaces

- Subspaces
- Space elements

Show labels > Selected object only

O All labels

Acronyms

O Full label names

Show objects

Spaces

Subspaces

Space elements

Show labels > All object occurrences

- O Matching labels O All labels
- Acronyms
- O Full label names

Show objects

- Spaces
- Subspaces
- Space elements

Overview

Label hierarchies

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- Show
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- Find
- Replace

Labeling guidelines

Summary

Format > Primary class labels

Find		«
Type class		
Replace		
Type class		
< Find >	Replace	
Find All	Replace All	
Reset		
⊬ -× + +	A A - +	
View	More	
Show labels		
□ Spaces		
Subspaces		
Space elements		
O Selected object only		
All object occurrences	50	
Format labels		
Primary class labels		
O T TITTICI Y 01000, Tag 100		
O Matching labels		
O All labels		
Acronyms		0 1
O Full label names		-
Show objects		

- Spaces
- Subspaces
- Space elements

Primary class label:

Bedroom

All labels:

InternalSpace, WholeSpace,
 Bedroom, PrivateSpace,
 ResidentialUnitSpace-Res,
 FunctionalUnitSpace

Architectural, Space function

Format > Matching labels

Find					
PrivateSpace (Priv) ×					
Replace					
Type class					
to teach to	Destau				
< Piliti >	Replace				
Find All	Replace All				
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⊬ → ↔ →	A A - +				
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Show labels					
□ Spaces					
Subspaces					
Space elements					
All object occurrence	95				
Format labels					
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Matching labels					
Acronyms					
O Full label names		0	2	5 Arc	ch
Show objects					

Spaces

- Subspaces
- Space elements

Format > All labels

- Subspaces
- Space elements

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Format > Acronyms

Spaces

- Subspaces
- Space elements

Format > Full label names

Space elements

E

Overview

Label hierarchies

Labeling functions

- Show
- Format
- Find
- Replace

Labeling guidelines

Summary

Find > 'Bedroom' > Find

Next (>)

Previous (<)

Find All

Reset



Find > 'Bathroom' (leaf class label) > Find All



Show objects

- Spaces
- Subspaces
- Space elements



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Architectural, Space function

Find > 'ServiceSpace' (super-class label) > Find All



- Spaces
- Subspaces
- Space elements

Find > 'InternalSpace' (label in another ontology) > Find All



- Subspaces
- Space elements

Find > 'Door' (single label) > Find All



- Subspaces
- Space elements

Find > 'Door', 'ExternalEnclosureElement' (multiple labels) > Find All



- Show objects
- Spaces
- Subspaces

Label hierarchies

Labeling functions

- Show
- Format
- Find
- Replace
 - Replace label
 - Add label
 - Remove label

Labeling guidelines

Summary

Find > 'Bedroom' Replace > 'FamilyRoom'



Space elements

Replace



Save changes

Replace	
Replace All	
Save changes	
A A - +	
More	
	0 1 9
	Replace All

Show objects

Concert



Architectural, Space function

Changes are uploaded to the server (if a session is active) and downloaded as 'layout_label_edits.csv' (see User Guide 'Generating a space model')

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Label hierarchies

Labeling functions

- Show
- Format
- Find
- Replace
 - Replace label
 - Add label
 - Remove label

Labeling guidelines

Summary

Find > '' Replace > 'Street'



Find > '' Replace > 'Street'



O Full label names

Label hierarchies

Labeling functions

- Show
- Format
- Find
- Replace
 - Replace label
 - Add label
 - Remove label

Labeling guidelines

Summary

Remove label



Remove label



Remove label



Label hierarchies

Labeling functions

Labeling guidelines

- Incorrect or missing labels
- Required labels
- Labeling issues

Summary

Incorrect or missing labels

Correct and complete labels are required for accurate space model generation and analysis

'Architectural' layouts generated from input layouts may be incomplete due to **incorrect** or **missing labels**:

- Spaces may be labeled incorrectly (e.g. 'LivingRoom' instead of 'Stairway')
- Labels of space elements may be too generic (e.g. 'Door', 'Window'), that is, more specific labels may be missing (e.g. 'UnitDoor')

Solution:

- 1. Remove or insert labels of spaces and space elements in the 'Architectural' layout
- 2. Regenerate space model





Label hierarchies

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Summary

Required labels

External air space

• Insert 'ExternalAirSpace (ExtAir)' label

Unit door (e.g. for an apartment unit)

- Remove 'RegularDoor-Encl (Do-Encl)' label (default label for doors)
- Insert 'UnitDoor (UDo)' label

Additional labels are inserted automatically by the Space Modeler system to minimize the need for manual label edits



Label hierarchies

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- Incorrect or missing labels
- Required labels
- Labeling issues
 - Opening
 - Transparent door
 - Side entrance
 - Fixed window
 - Atrium/Space with rooflight
 - Undefined space/space element
 - External space
 - Non-residential space

Issue: Opening





 If openings are modeled in BIM, then space volumes are computed incorrectly: the same space is detected on both sides of an opening

Solution: Replace 'RegularDoor-Encl' with 'Opening' labels



Solution: Regenerated space model



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Issue: Transparent door



http://spacepatterns.com/sp/map/html/viewer.html?tags=Caccia;view=1_architectural_1_primary_space_property;proj=CA61;lod=4

Solution: Insert 'VisibleLightTransmissionSE' labels



http://spacepatterns.com/ontologies/space_model_002/view/lighting.owl

Solution: Insert 'VisibleLightTransmissionSE' labels



Space elements



Solution: Insert 'VisibleLightTransmissionSE' labels



- Primary class labels
- ${\rm O}\,$ Primary class, Tag labels
- \bigcirc Matching labels
- O All labels
- Acronyms
- O Full label names

Show objects

- Spaces
- Subspaces
- Space elements



Solution: Regenerated space model



Acronyms
 Full label names

Show objects

Spaces

Subspaces

Space elements

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Issue: Side entrance



- O Selected object only
- All object occurrences

Format labels

- O Primary class labels
- O Primary class, Tag labels
- Matching labels
- All labels
- Acronyms
 Full label names
- Show objects
- Spaces
- Subspaces
- Space elements





Distances should be computed relative to (main) unit door only, not the (side) unit door



Pedestrian circulation, Distance to unit door [-]

0 1 2

Solution: Replace 'UnitDoor' with 'SideEntranceSE' labels



Solution: Replace 'UnitDoor' with 'SideEntranceSE' and 'Door' labels





Solution: Regenerated space model

Replace Type class < Find > Replace
< Find > Replace
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Find All Replace All Control Provide All Replace All R
Reset Save changes
View More
Show labels
Spaces
Do, IntEncle UDo, Encle FUAcc, FUPrimAcc, PedAccess
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Format labels
O Primary class labels
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Acronyms
O Full label names
Show objects
Spaces 0 1 2 5 Architectural, Space function
✓ Subspaces




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Issue: Fixed window

- All windows should be fixed (high-rise residential tower)
- By default, windows are operable



Solution: Replace 'OperableWindow' with 'FixedWindow' labels



http://spacepatterns.com/ontologies/space_model_002/common/enclosure_element_classes.owl

Solution: Replace 'OperableWindow' with 'FixedWindow' labels



Show objects

- Spaces
- Subspaces
- Space elements



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- Incorrect or missing labels
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 - Fixed window
 - Atrium/Space with rooflight
 - Atrium
 - Space with rooflight
 - Undefined space/space element



Issue: Atrium

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- Atrium has indirect natural light access
 - It should have direct access



41.82m

012 5 Natural ventilation, Must-pass distance to exterior [m]

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Natural ventilation, Must-pass



- Direct access to natural light
- Direct access to fresh air
- Perimeter space



- Atrium is a core space
- It should be a perimeter space

36.86m 54.68m 59.22命06m

- Atrium is on long natural ventilation paths
- It should be on short paths

44.19m

35.31m

40.49m

Solution: Add 'Atrium' label Add 'DirectFreshAirAccessSpace' label (if applicable)







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 - Fixed window
 - Atrium/Space with rooflight
 - Atrium
 - Space with rooflight
 - Undefined space/space element



Issue: Space with rooflight



Solution: Add 'DirectNaturalLightAccessSpace' Add 'DirectFreshAirAccessSpace' labels (if applicable)







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 - External space
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Issue: 'Undefined' space (or space element)

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			Space label
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Show labels			
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□ Subspaces			
Space elements			
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 All object occurrences 			
Format labels			
 Primary class labels Description 			
Primary class, Tag labels Matching labels			
O All labels	0 1 2	5 Architectural, Space function	
Acronyms Eull label names			

Issue: 'Undefined' space (or space element)



Cause: 'Undefined' space (or space element)



- Acronyms
- O Full label names

Cause: 'Undefined' space (or space element)



Cause: 'Undefined' space (or space element)

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Show labels		
□ Spaces		
□ Subspaces		
Space elements		
O Selected object only		
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Format labels		
Primary class labels		
Primary class, Tag labels		
Matching labels	0 1 2 5 Architectural Space function	
All labels		
 Acronyms 		
O Full label names		

Solution: Replace specific class label with generic class label



Solution: Replace specific class label with generic class label



	(Loggio) has been replaced with
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Type class	'ExternalAirSpace' label
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Type class	
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Reset Save changes	
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Issue: External space



Solution: Add specific external space labels



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Issue: Non-residential space



Solution: Replace existing labels with non-residential space labels



Label hierarchies

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Summary

Space Modeler User Guide – Labeling a space model

Summary

Labeling is semi-automated

- Labels are mostly inserted automatically by the Space Modeler system
- User manually inserts or removes labels, if necessary

Required labels

- 'ExternalAirSpace'
- 'UnitDoor'

Labels that frequently need to be inserted by user

- 'Elevator'
- 'VisibleLightTransmissionSE' (for transparent doors)