

Inverse procedural modeling



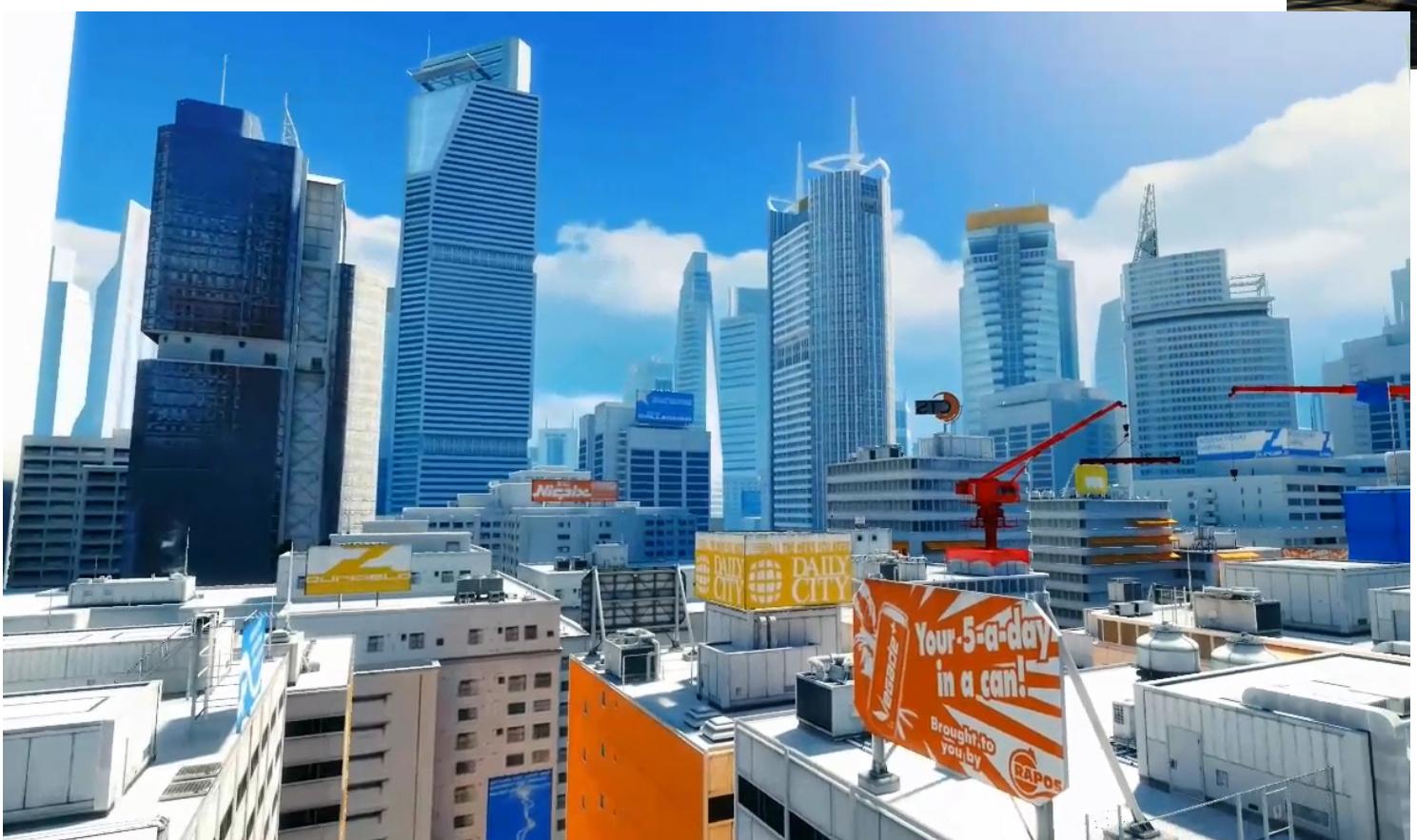
Shadow of the Tomb Raider



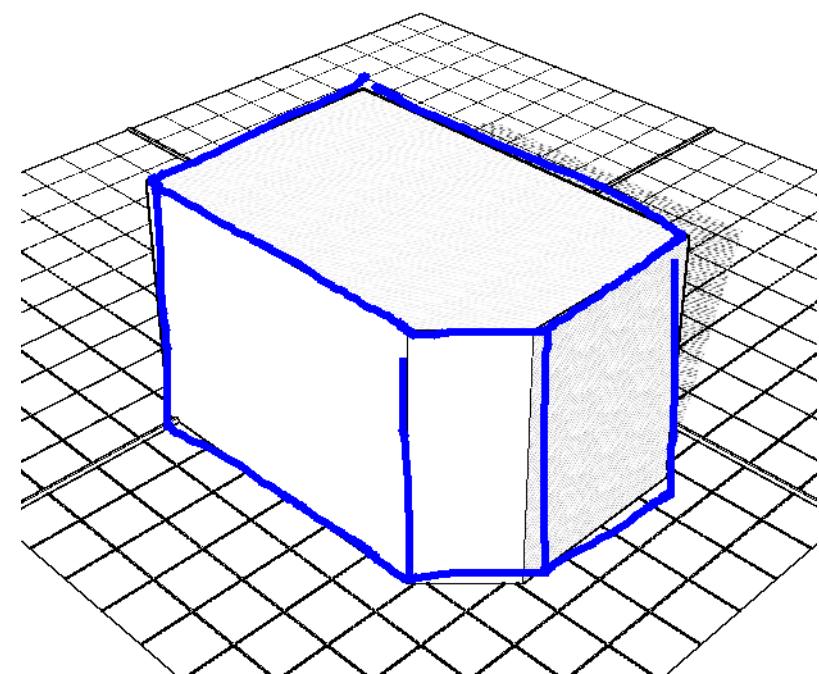
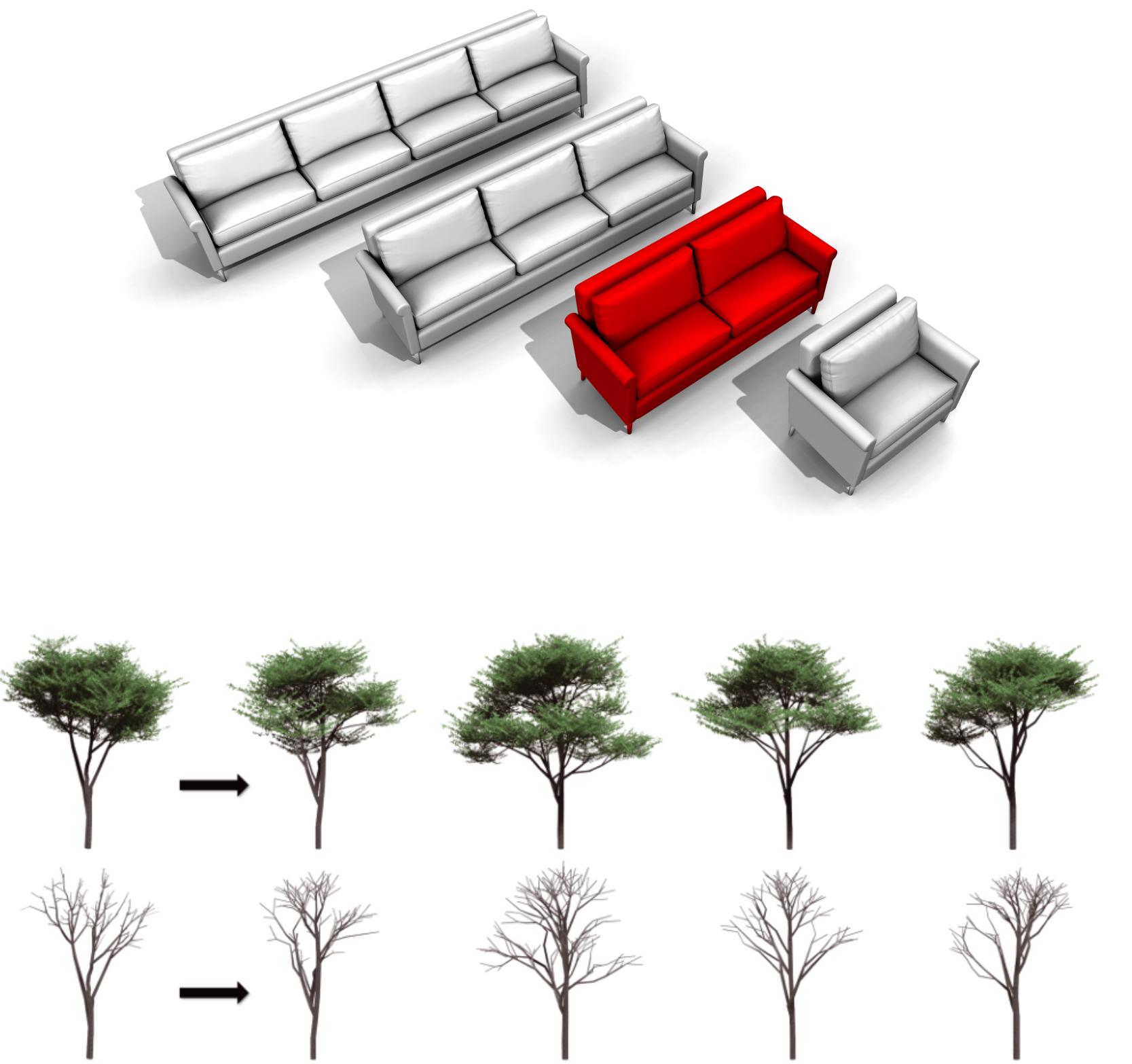
Shadow of the Tomb Raider



Crysis 2



Mirror's Edge



A Connection between Partial Symmetry and Inverse Procedural Modeling

Martin Bokeloh*

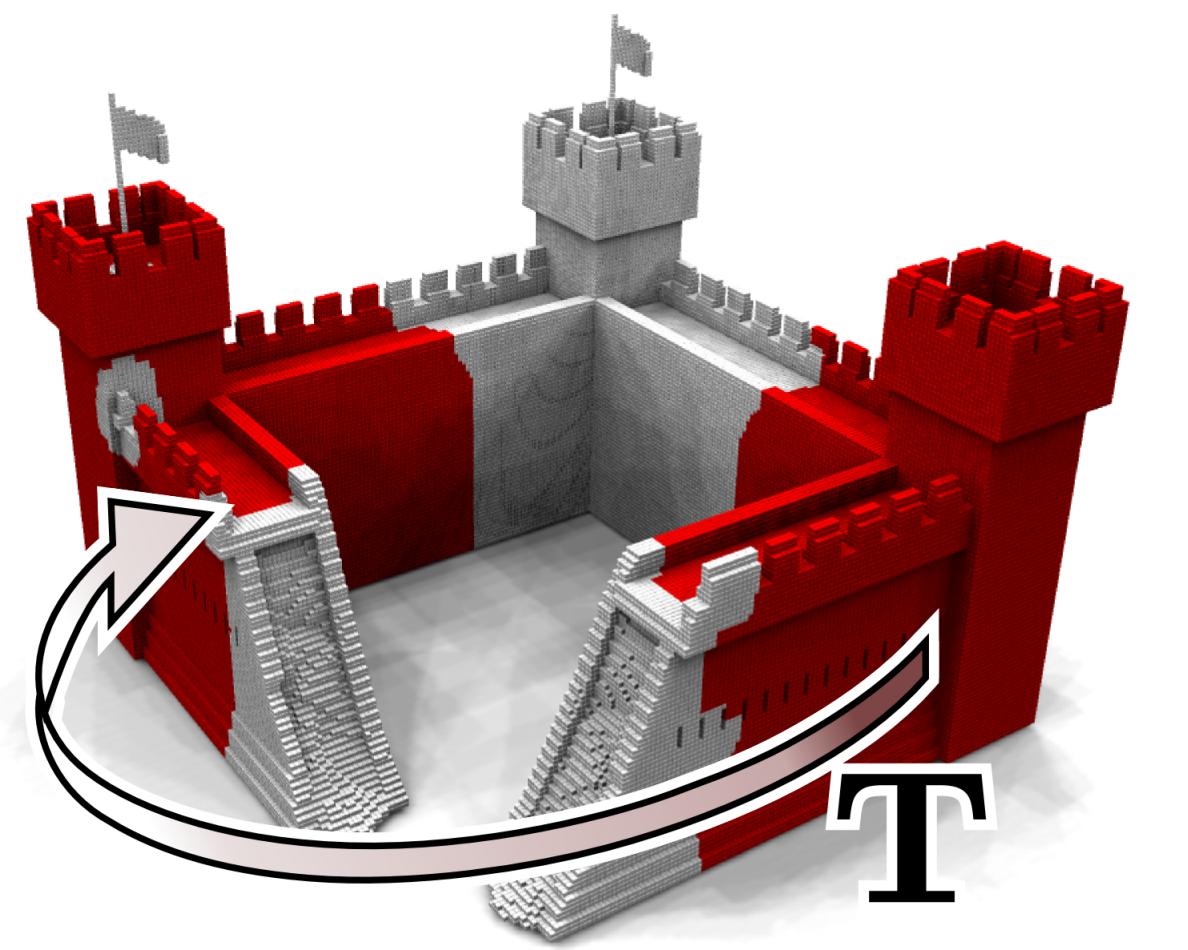
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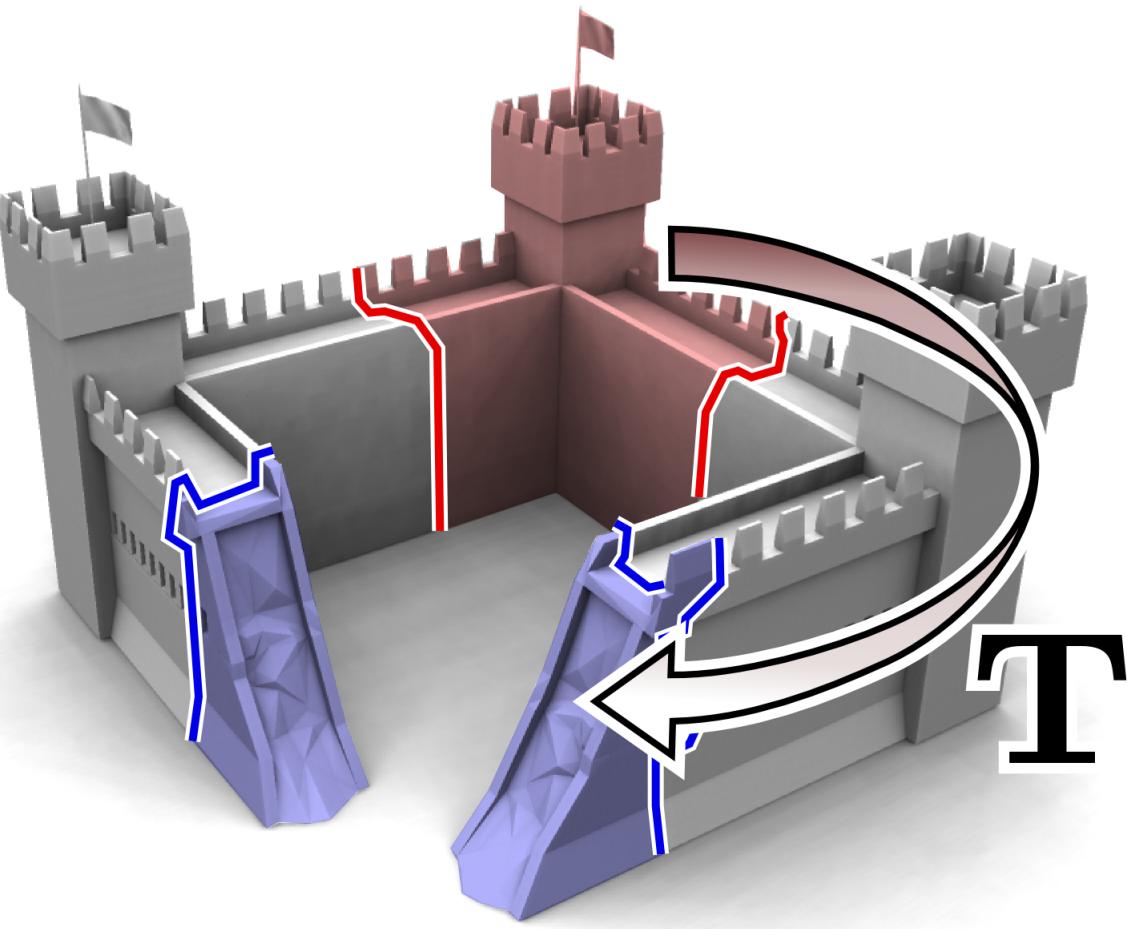
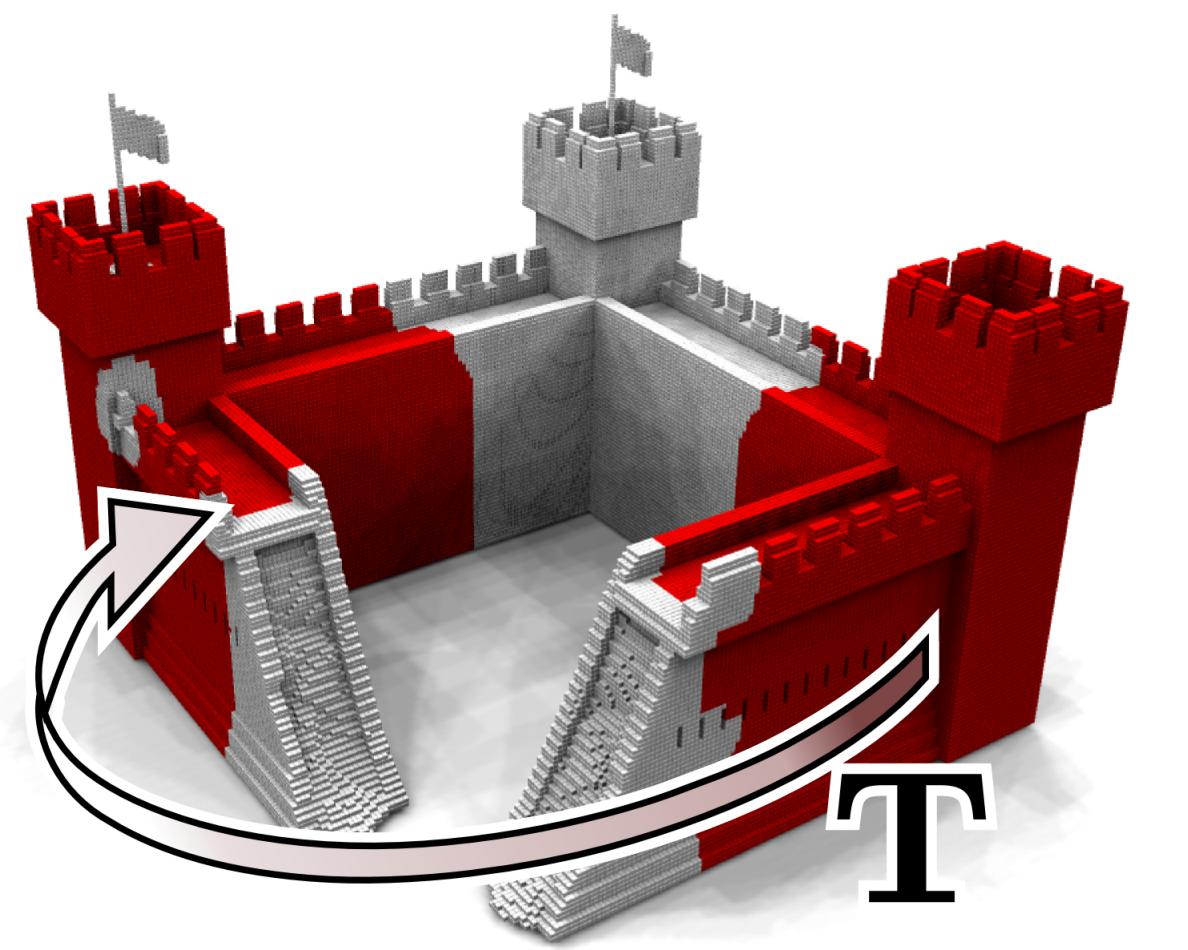
Michael Wand*

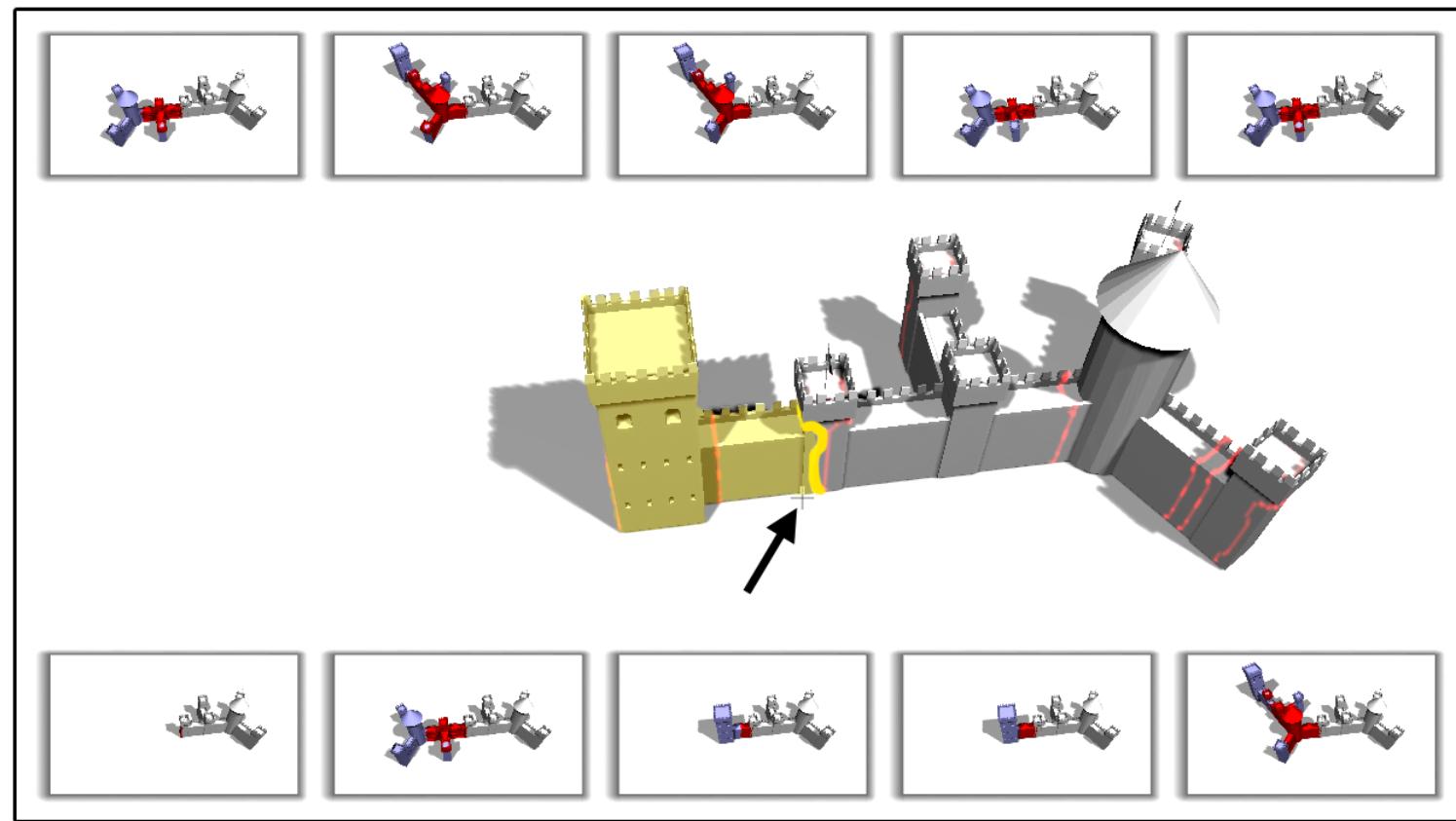
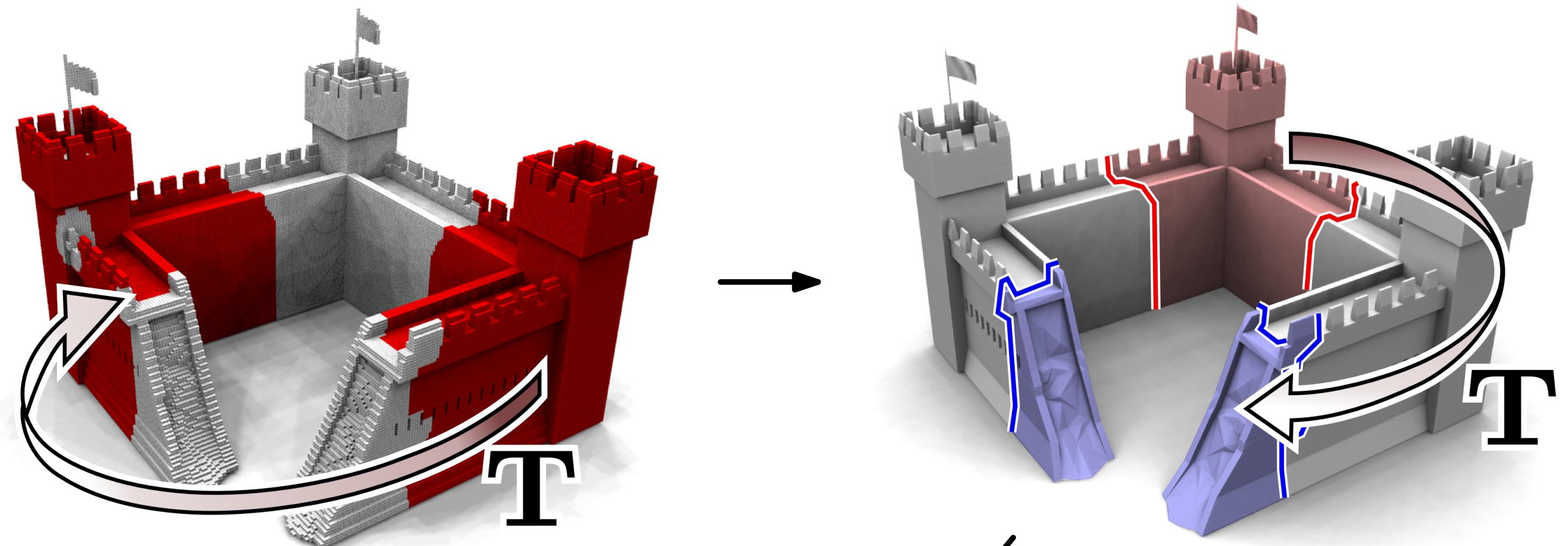
Saarland University and
Max-Planck-Institut Informatik

Hans-Peter Seidel*

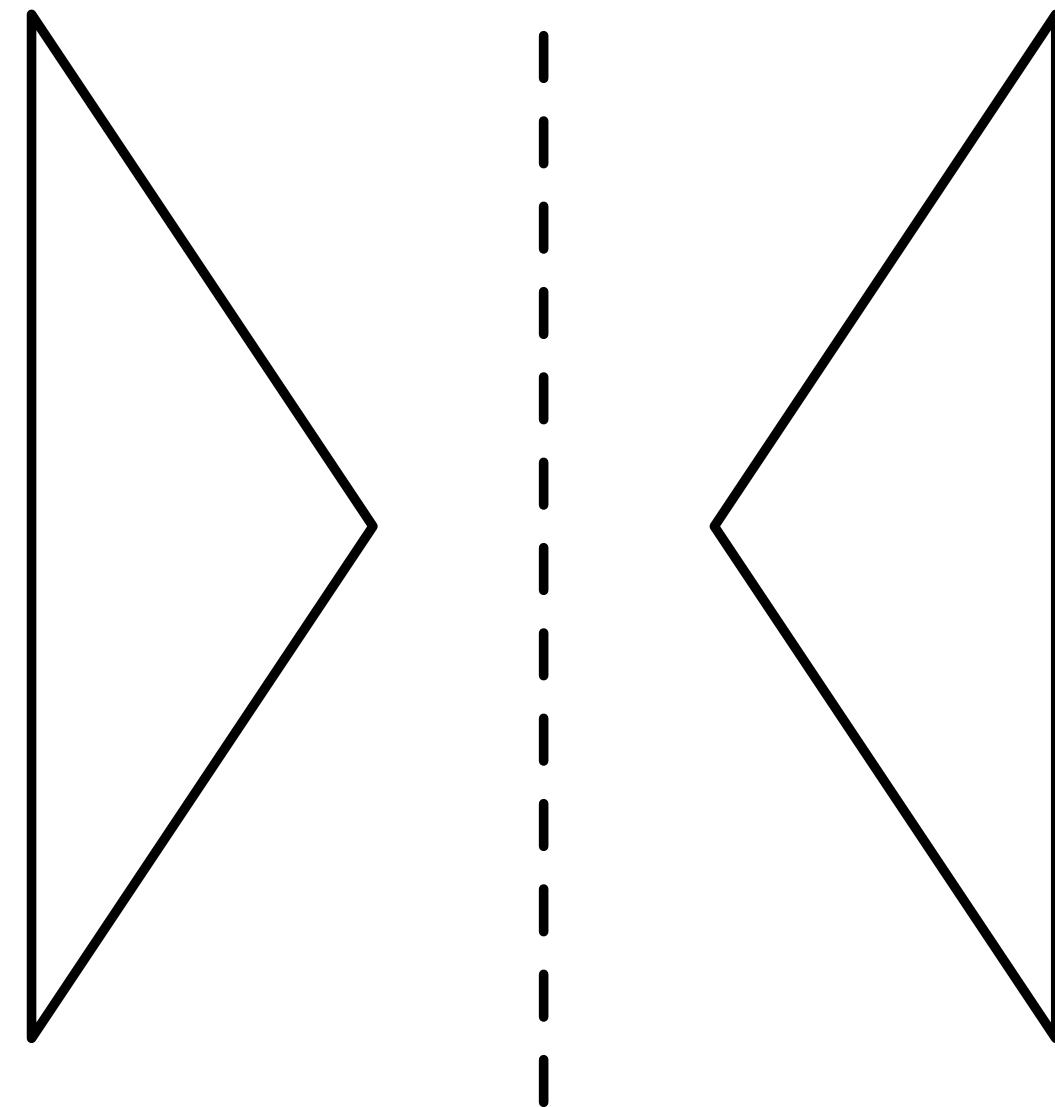
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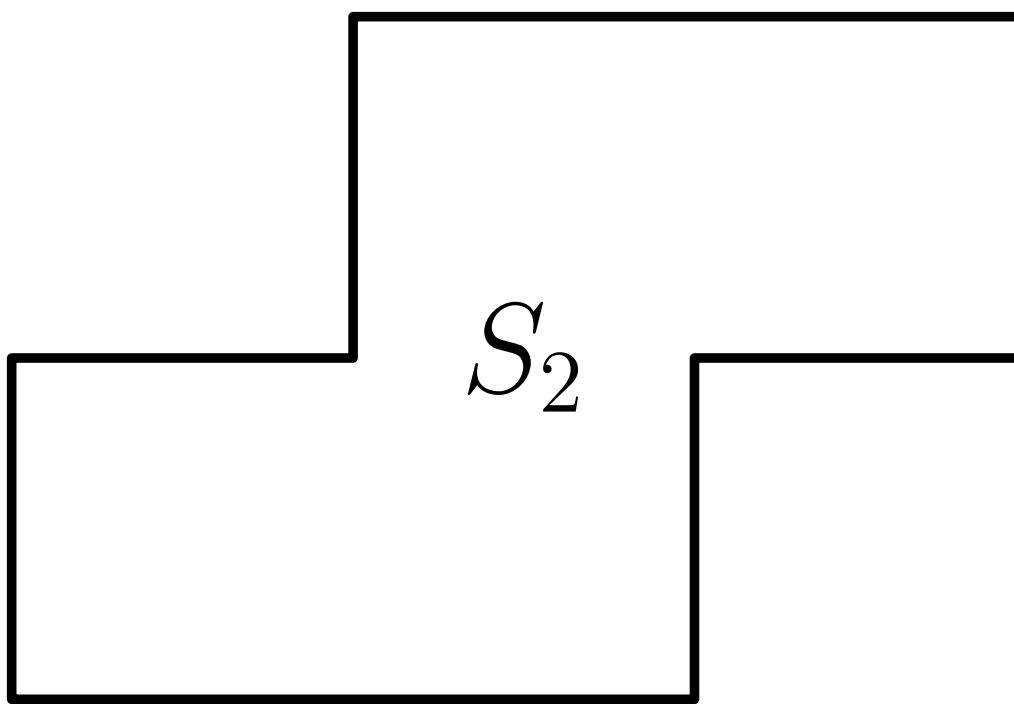
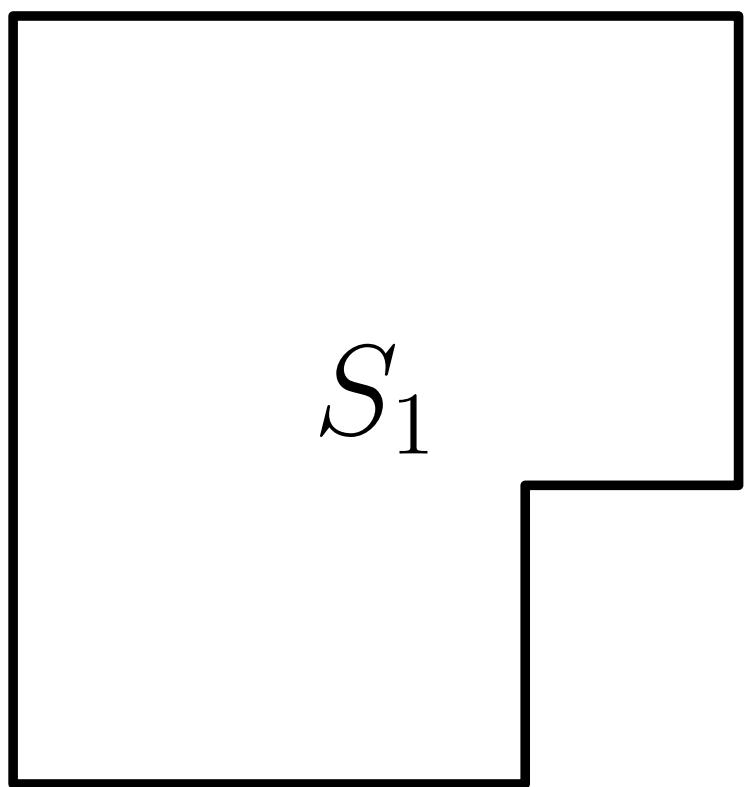




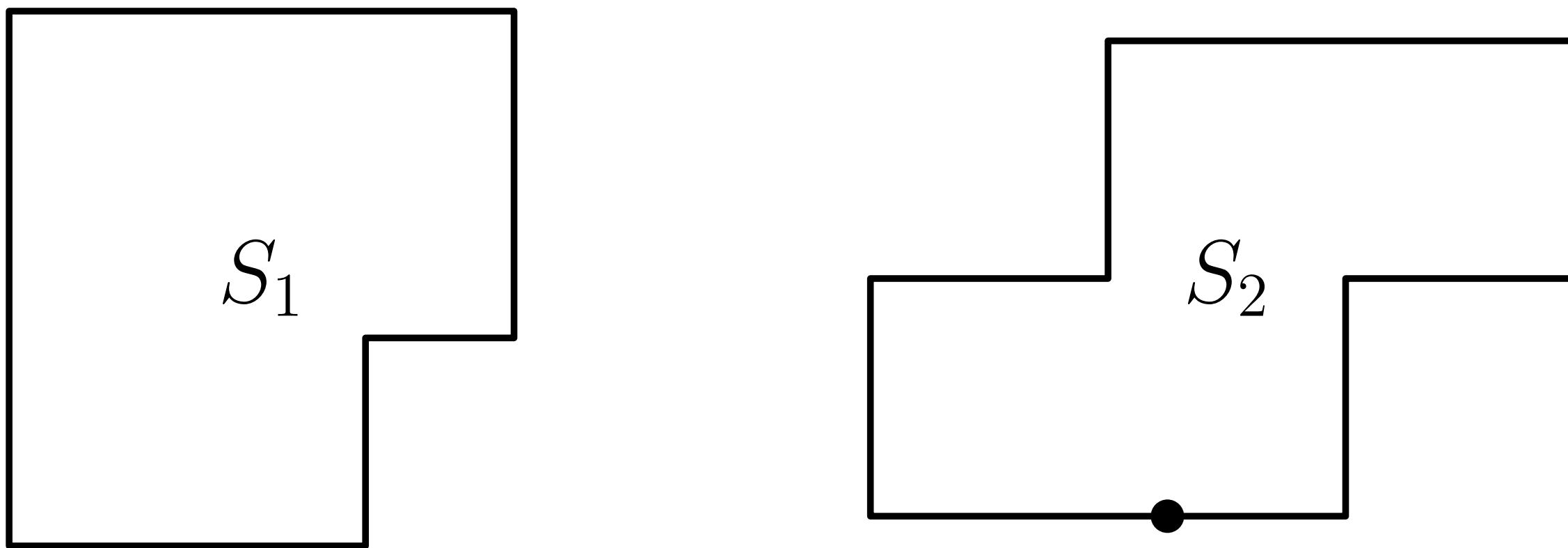
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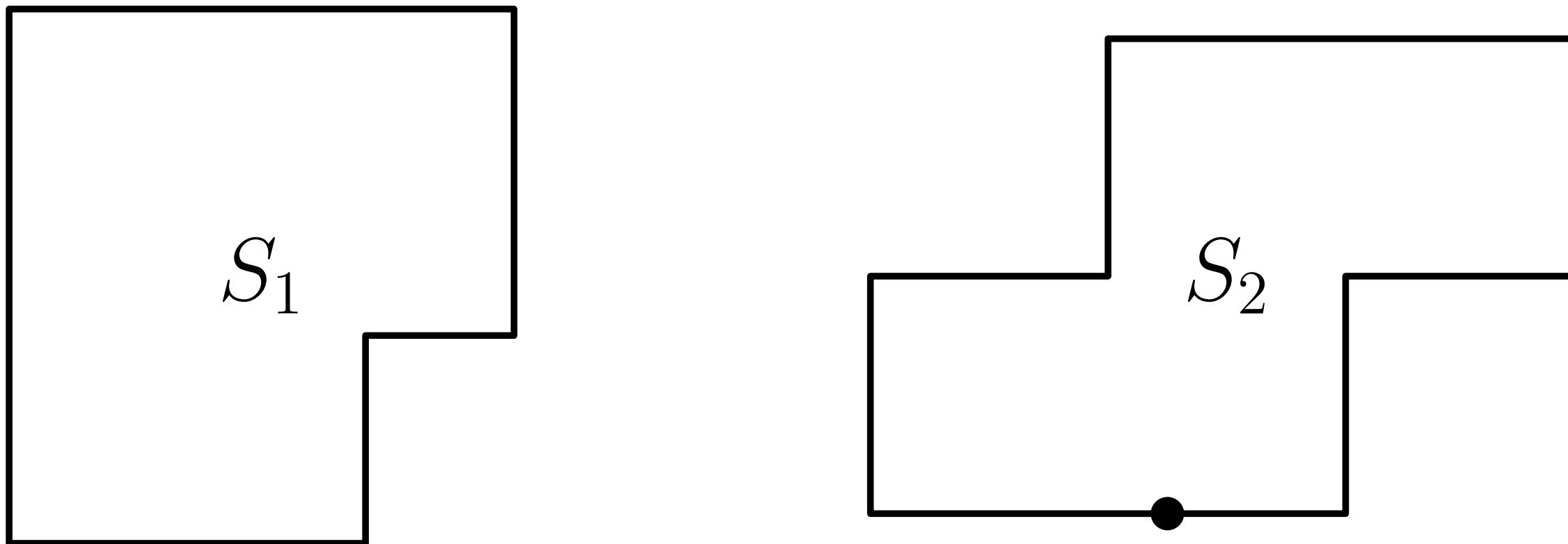
r -similarity



r -similarity

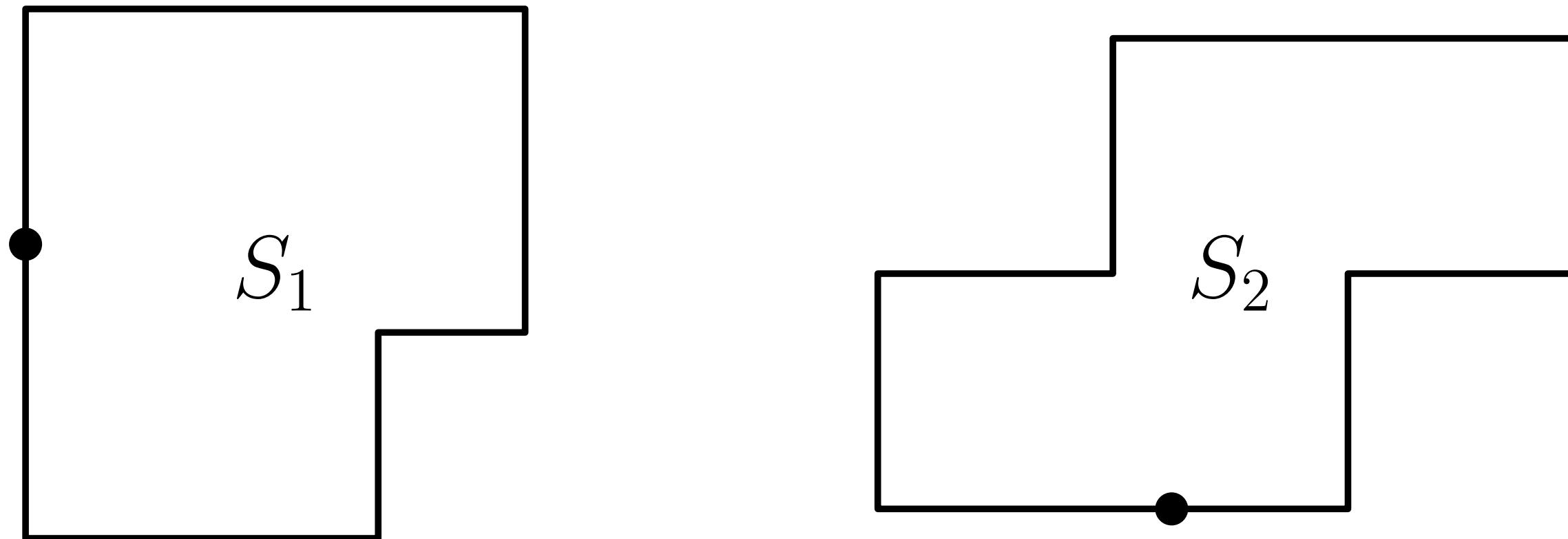


r -similarity



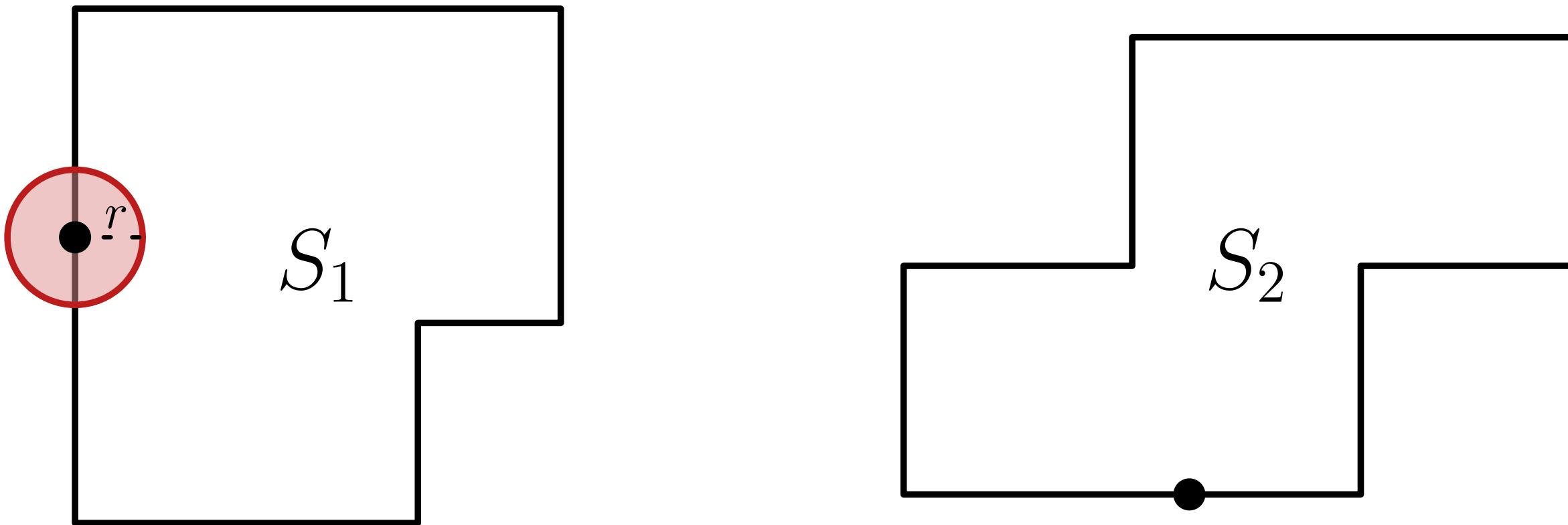
$$T \in \mathcal{T} = \begin{array}{c} \uparrow \\ \leftrightarrow \\ \downarrow \end{array} \quad \begin{array}{c} \circlearrowleft \\ \circlearrowright \end{array}$$

r -similarity



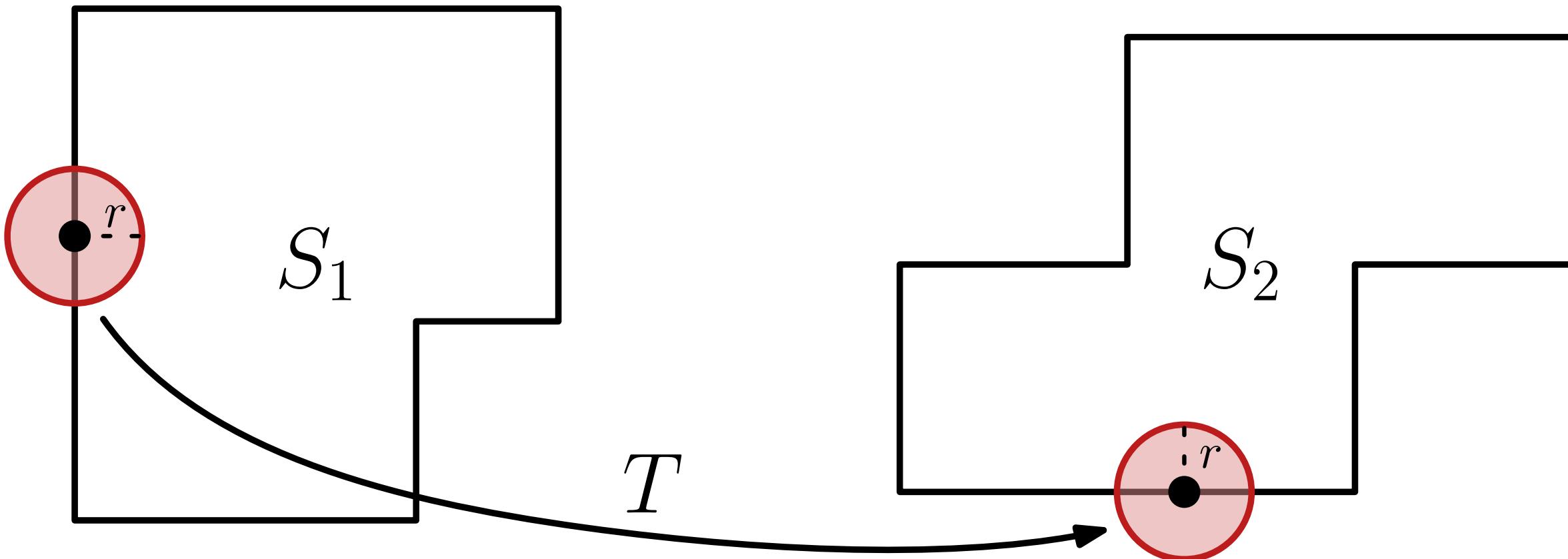
$$T \in \mathcal{T} = \begin{array}{c} \uparrow \\ \leftrightarrow \\ \downarrow \end{array} \quad \circlearrowleft$$

r -similarity



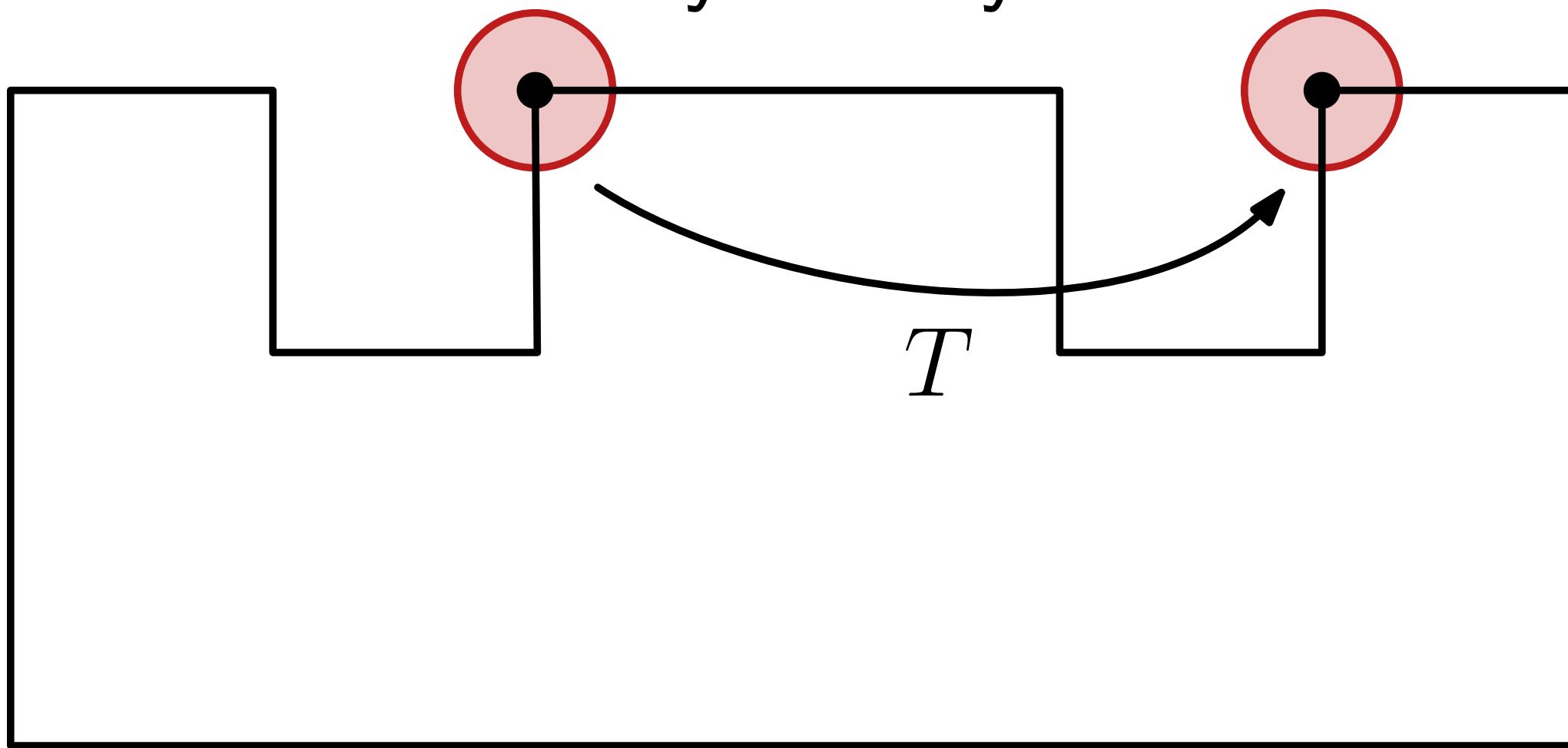
$$T \in \mathcal{T} = \begin{array}{c} \uparrow \\ \leftrightarrow \\ \downarrow \end{array} \quad \circlearrowleft$$

r -similarity



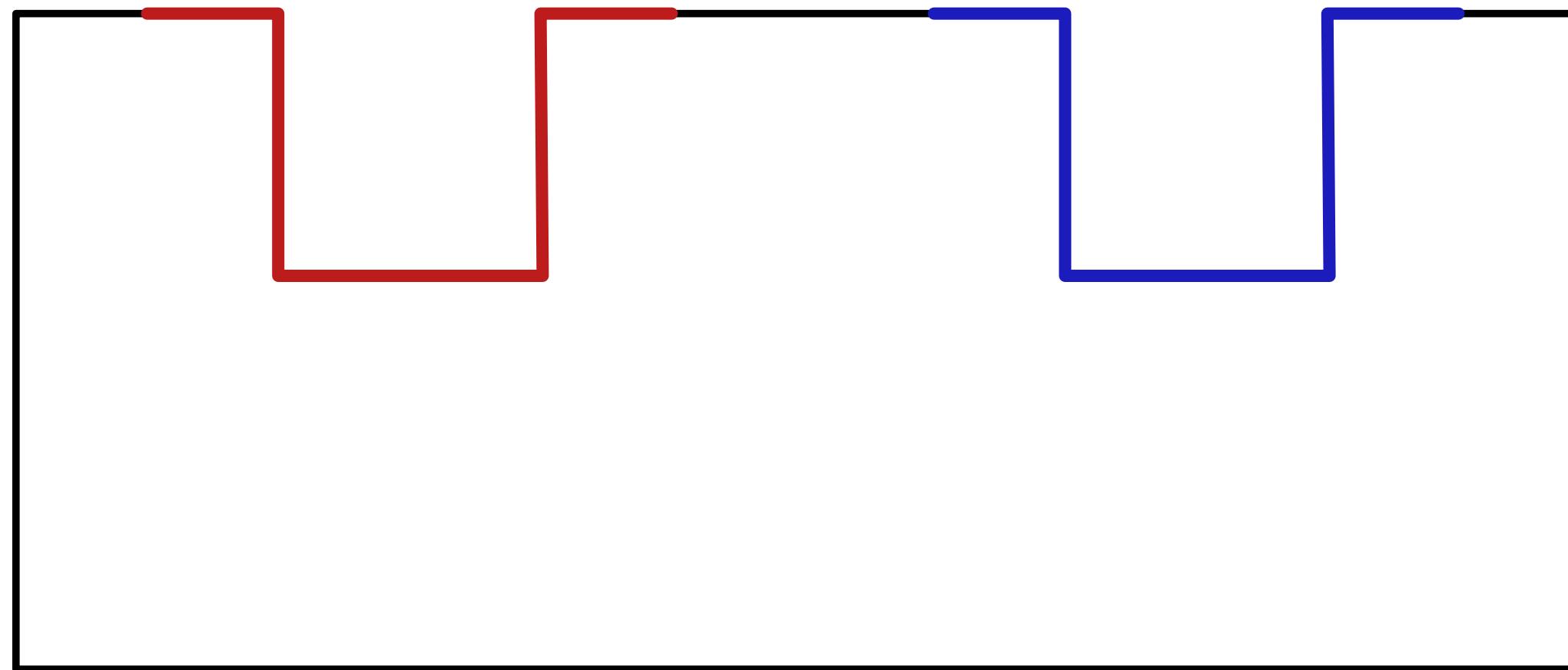
$$T \in \mathcal{T} = \begin{array}{c} \leftrightarrow \\ \circlearrowleft \end{array}$$

r-symmetry



$$T \in \mathcal{T} = \begin{array}{c} \uparrow \\ \leftrightarrow \\ \downarrow \end{array} \quad \circlearrowright$$

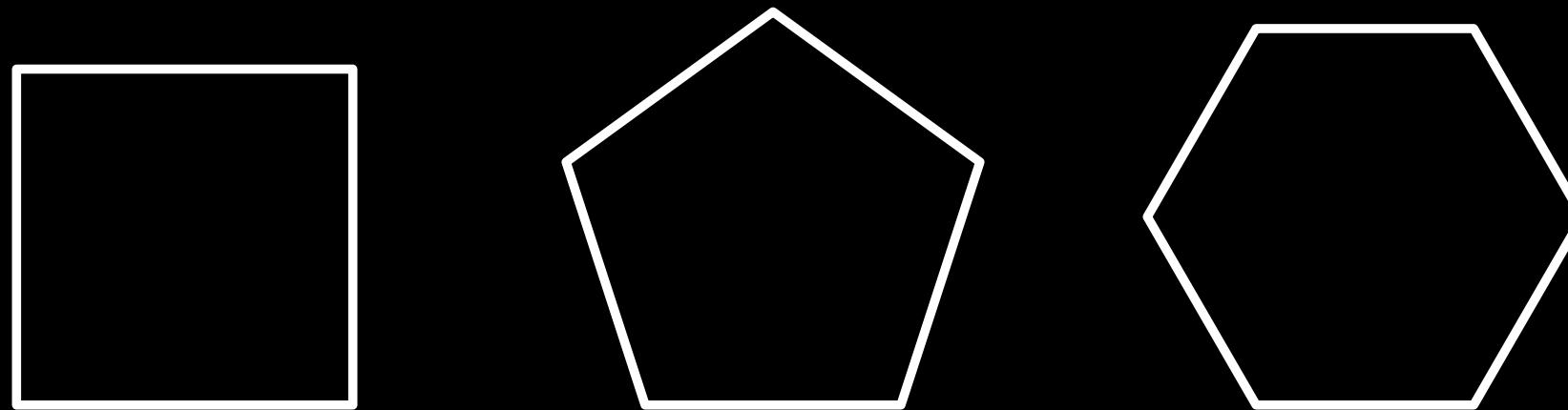
r-symmetry



$$T \in \mathcal{T} = \begin{array}{c} \uparrow \\ \leftrightarrow \\ \downarrow \end{array} \quad \begin{array}{c} \circlearrowleft \\ \circlearrowright \end{array}$$

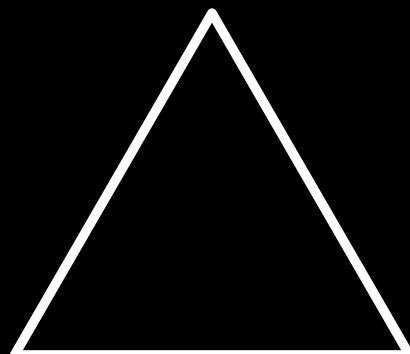
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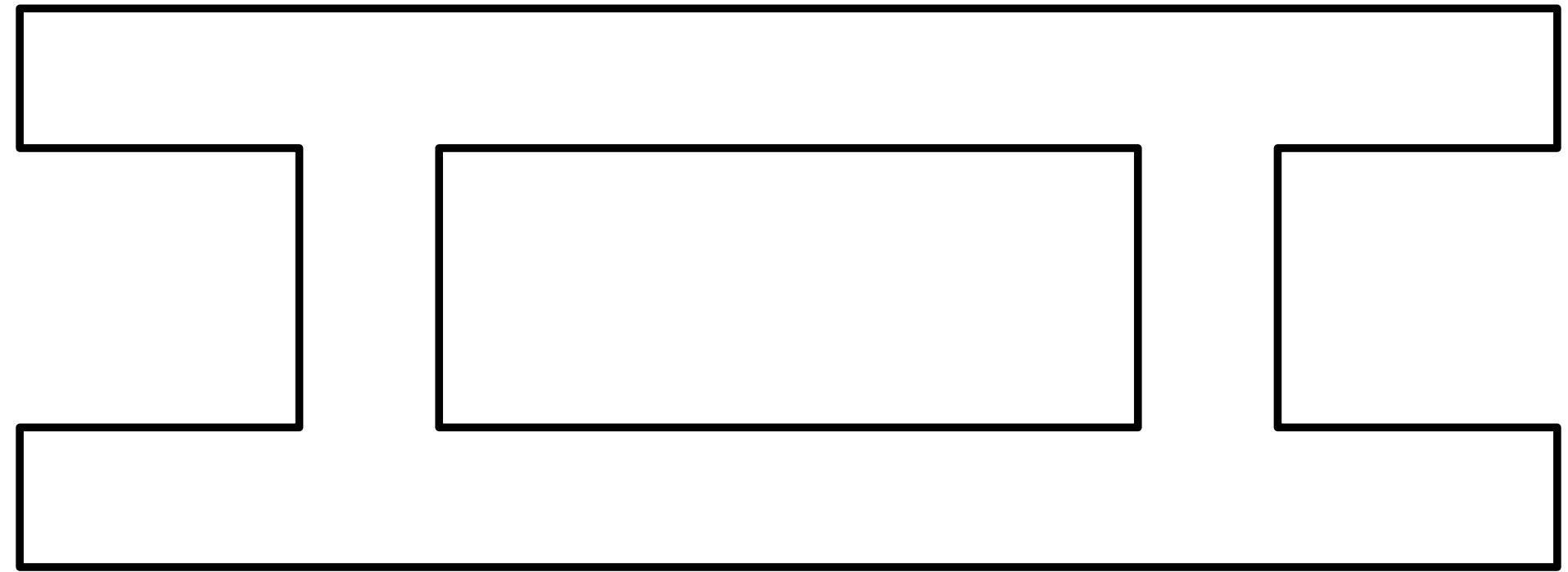
Consider any regular k -gon P for $k > 3$ and a line ℓ . If \mathcal{T} is the set of rigid transformations (translations and rotations), how much of the perimeter of P is r -similar to ℓ ?

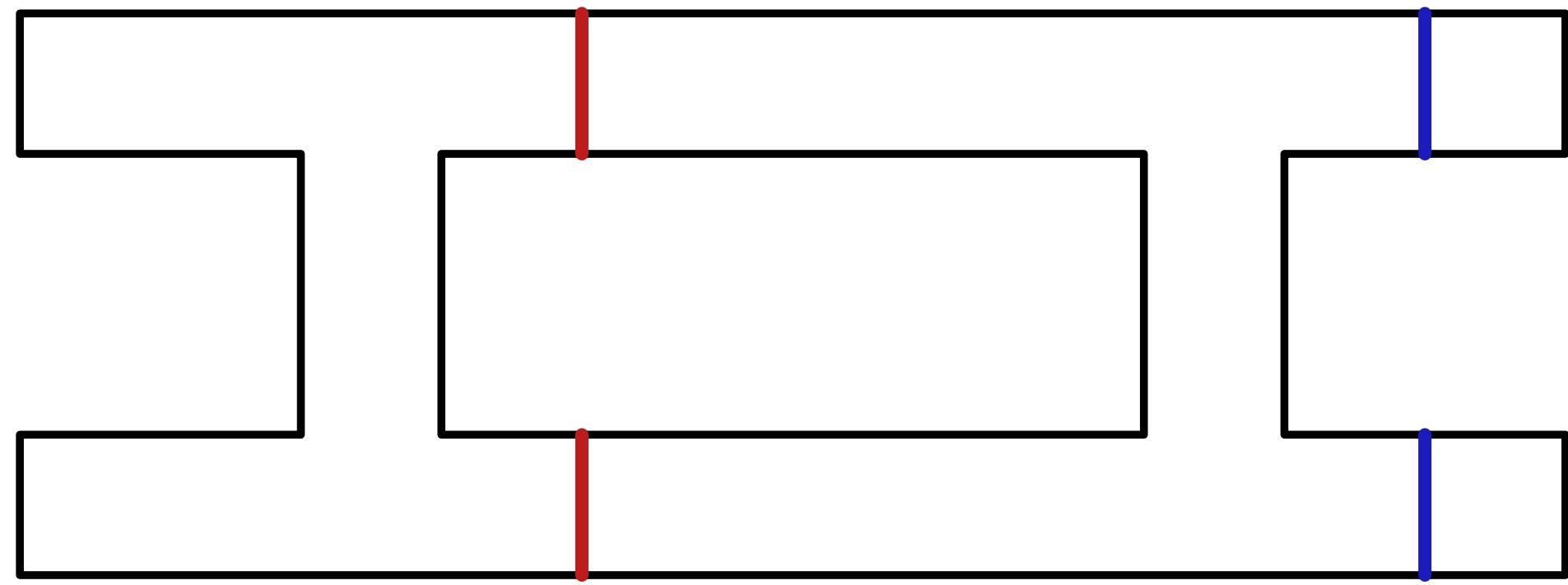


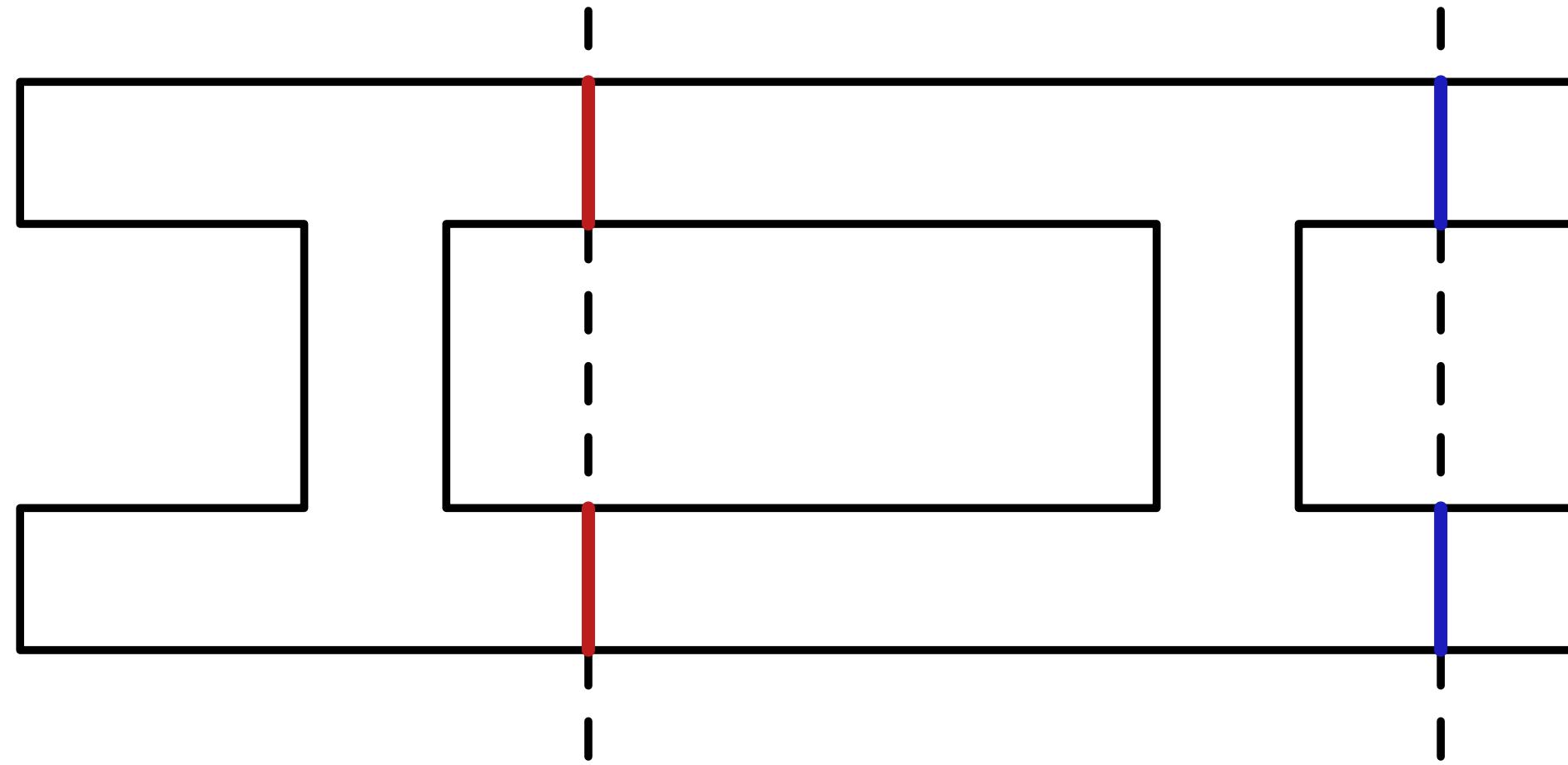
Assignment 2

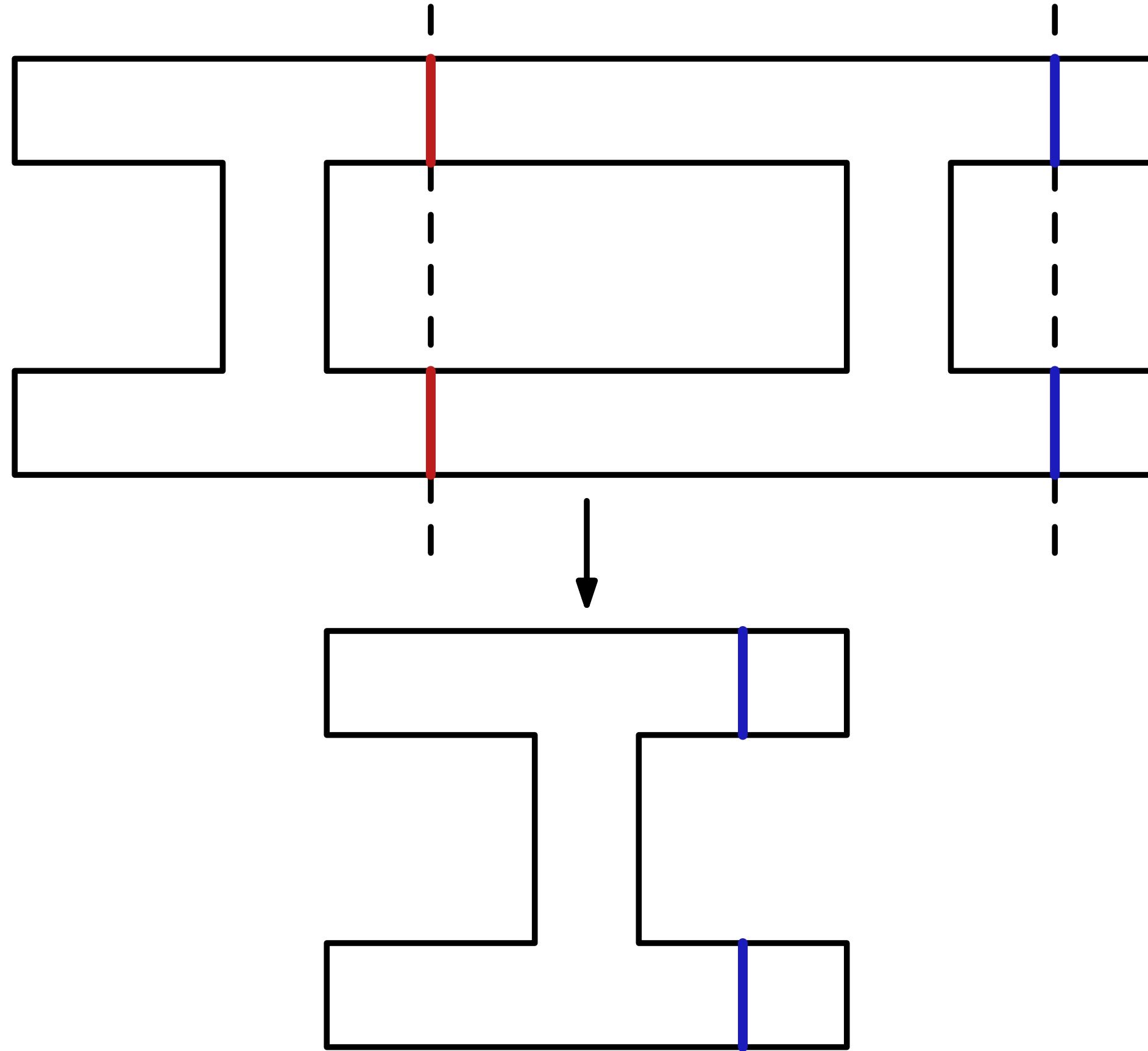
Why does the answer to the previous question not apply when $k = 3$?

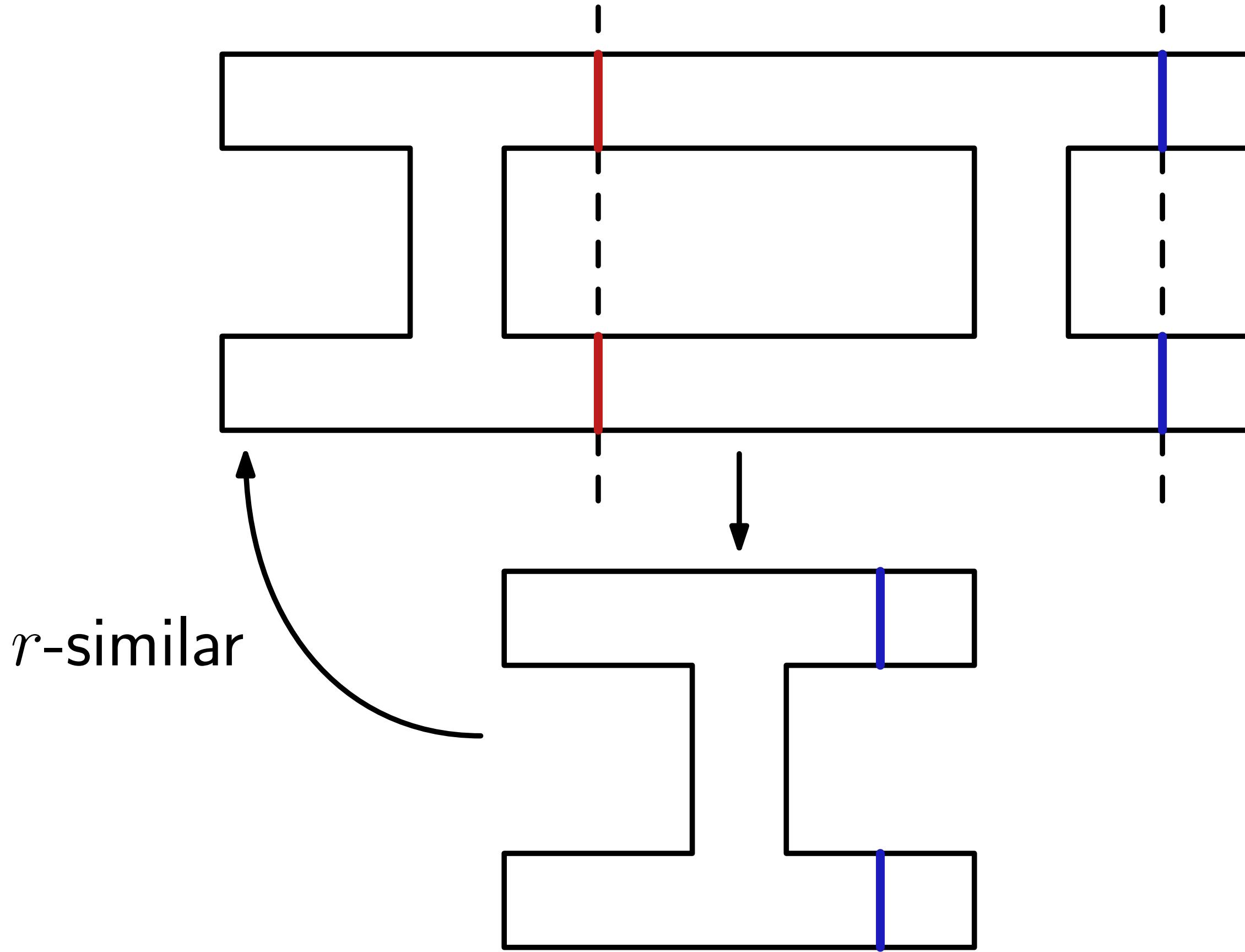


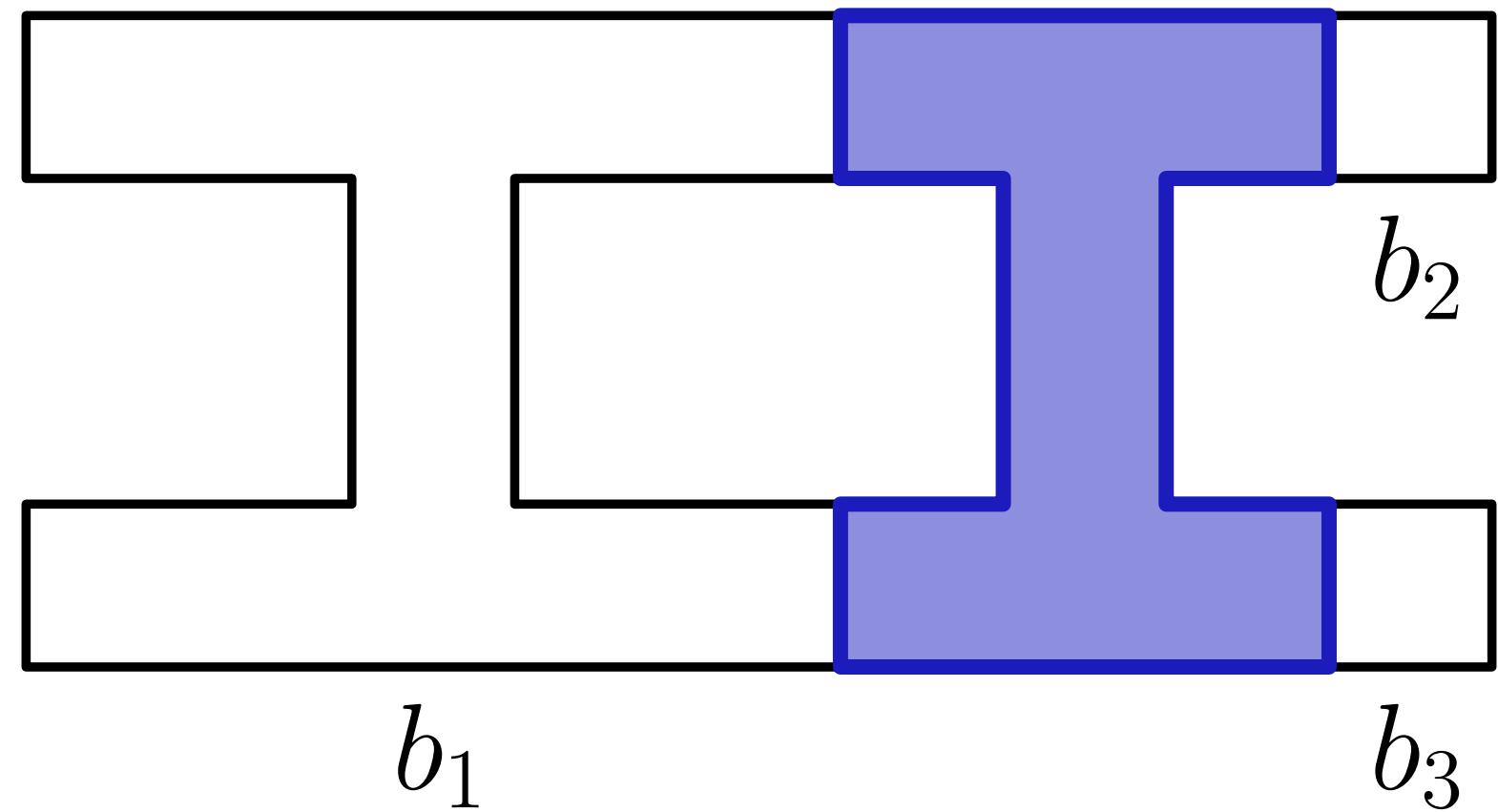
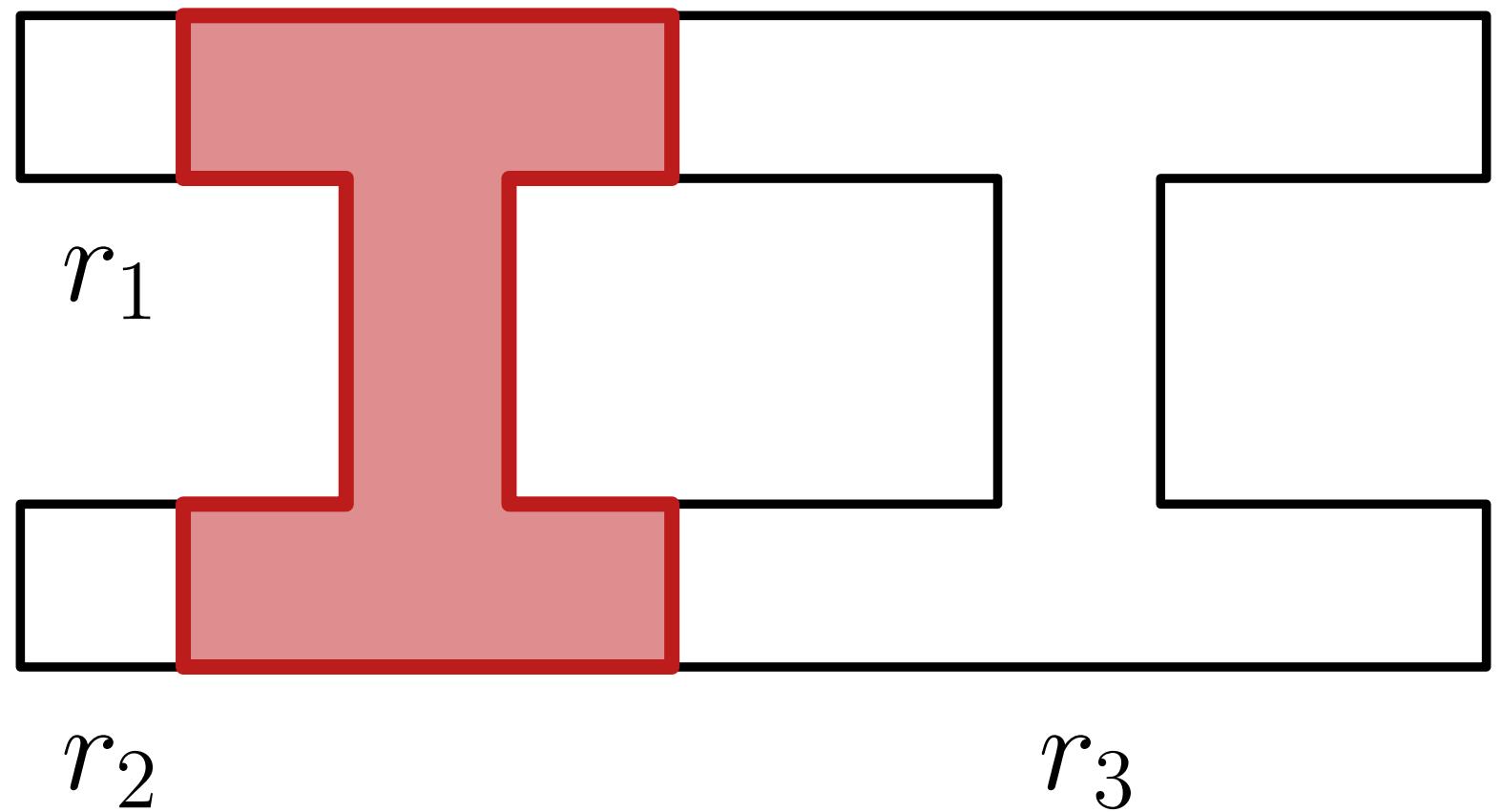


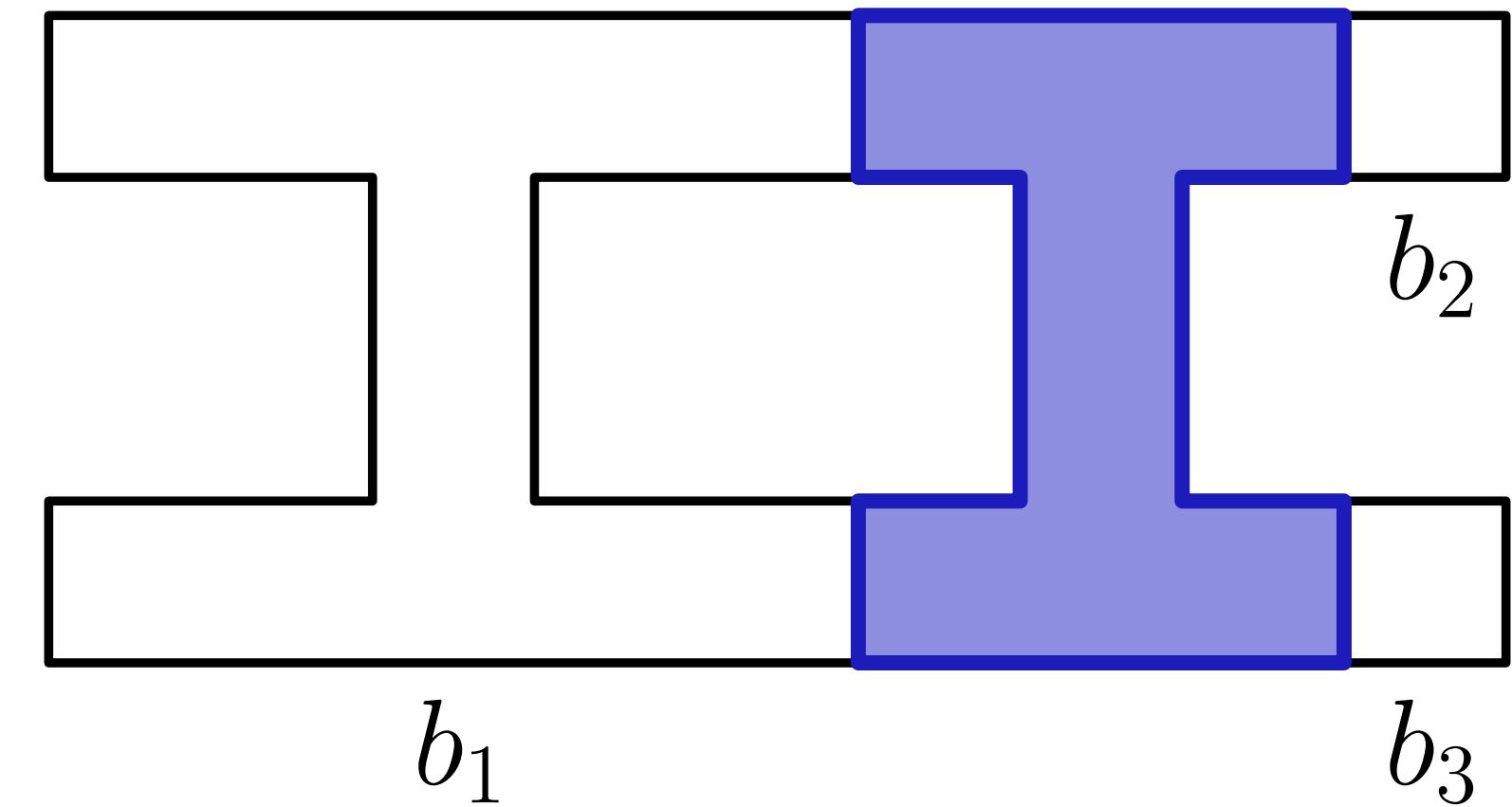
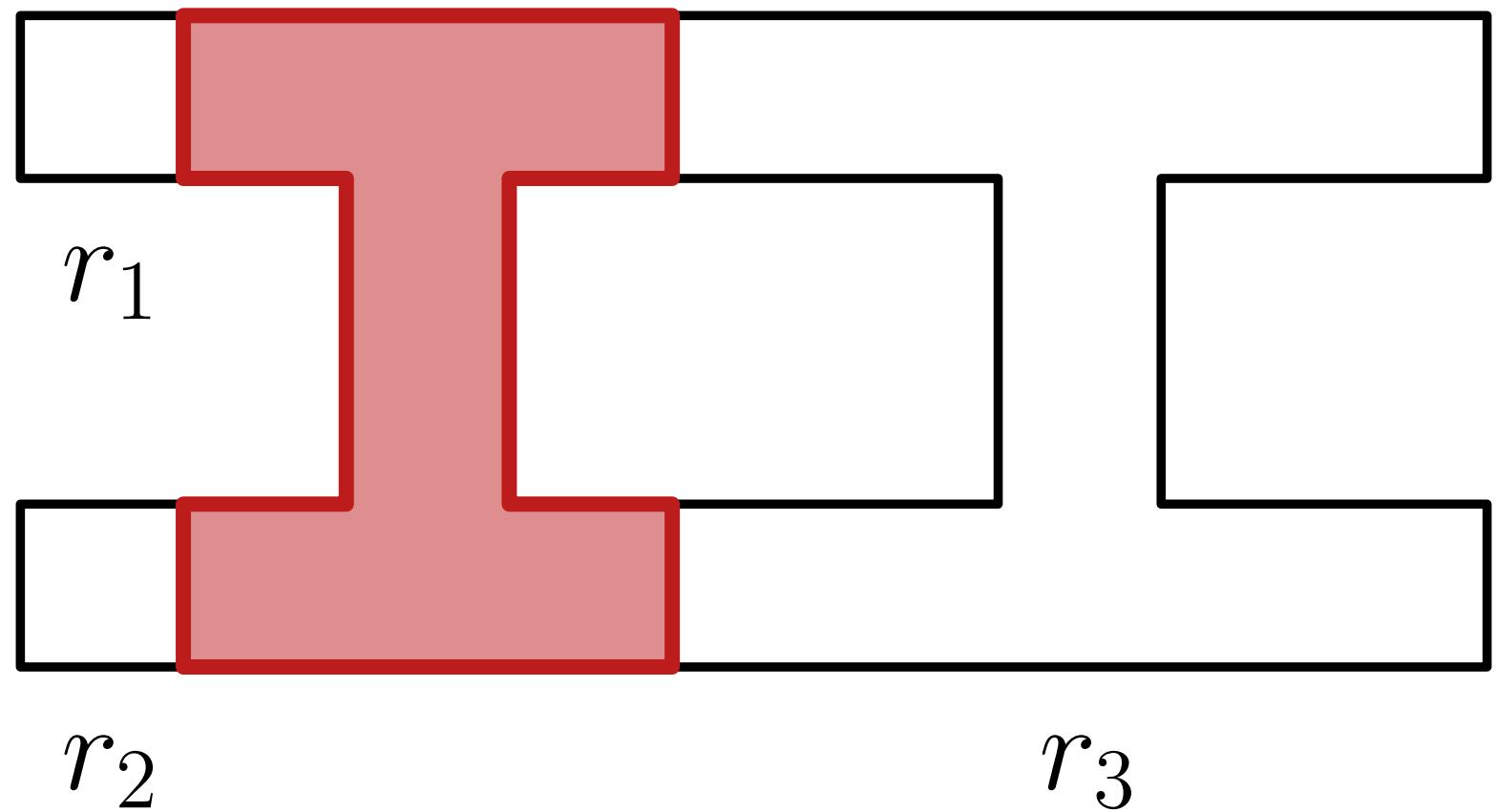












r_1

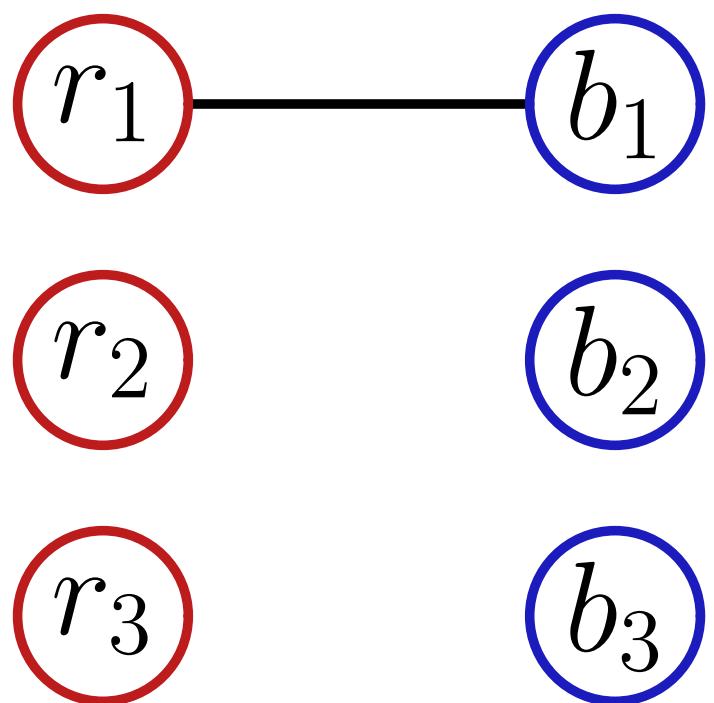
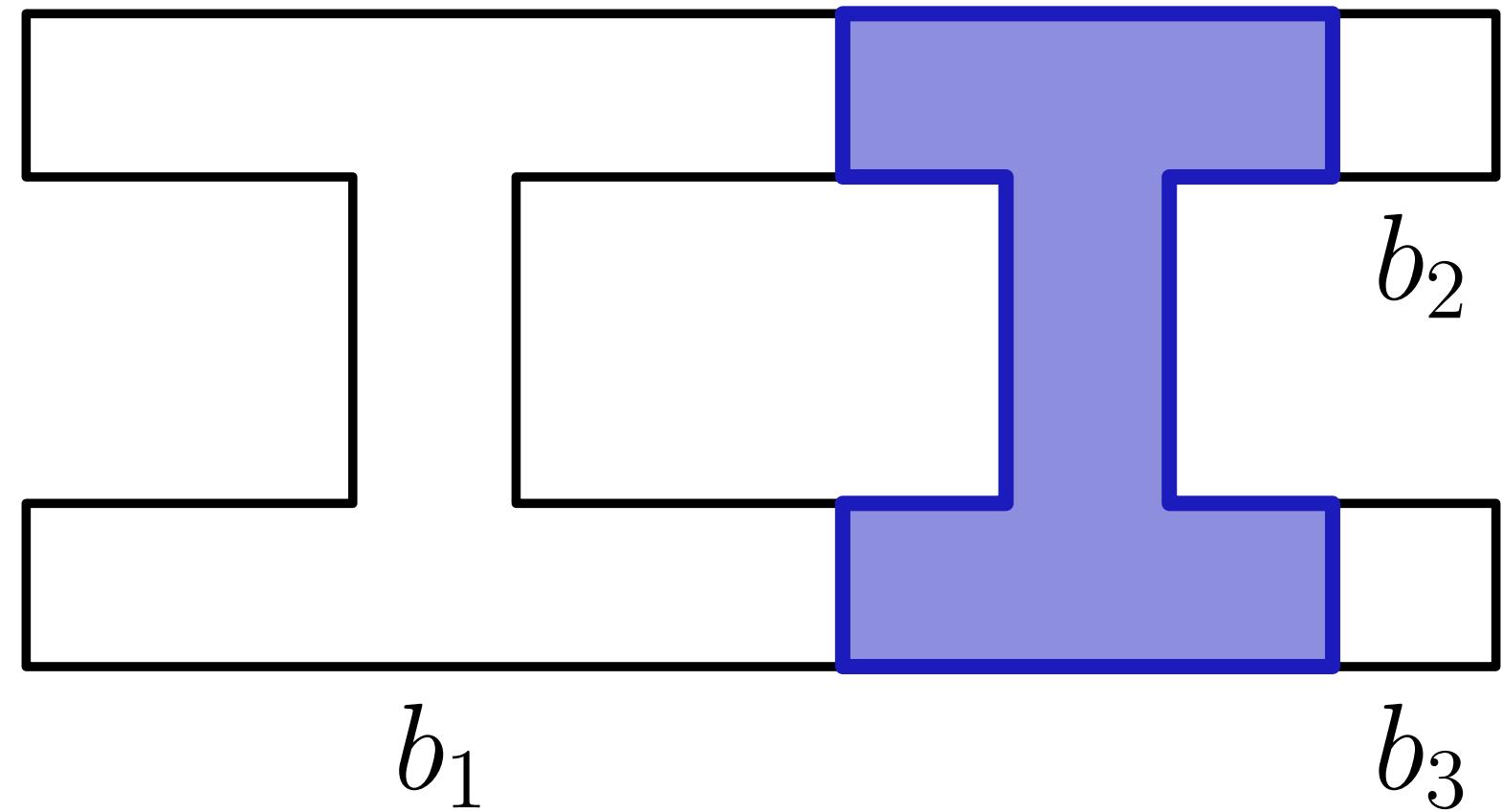
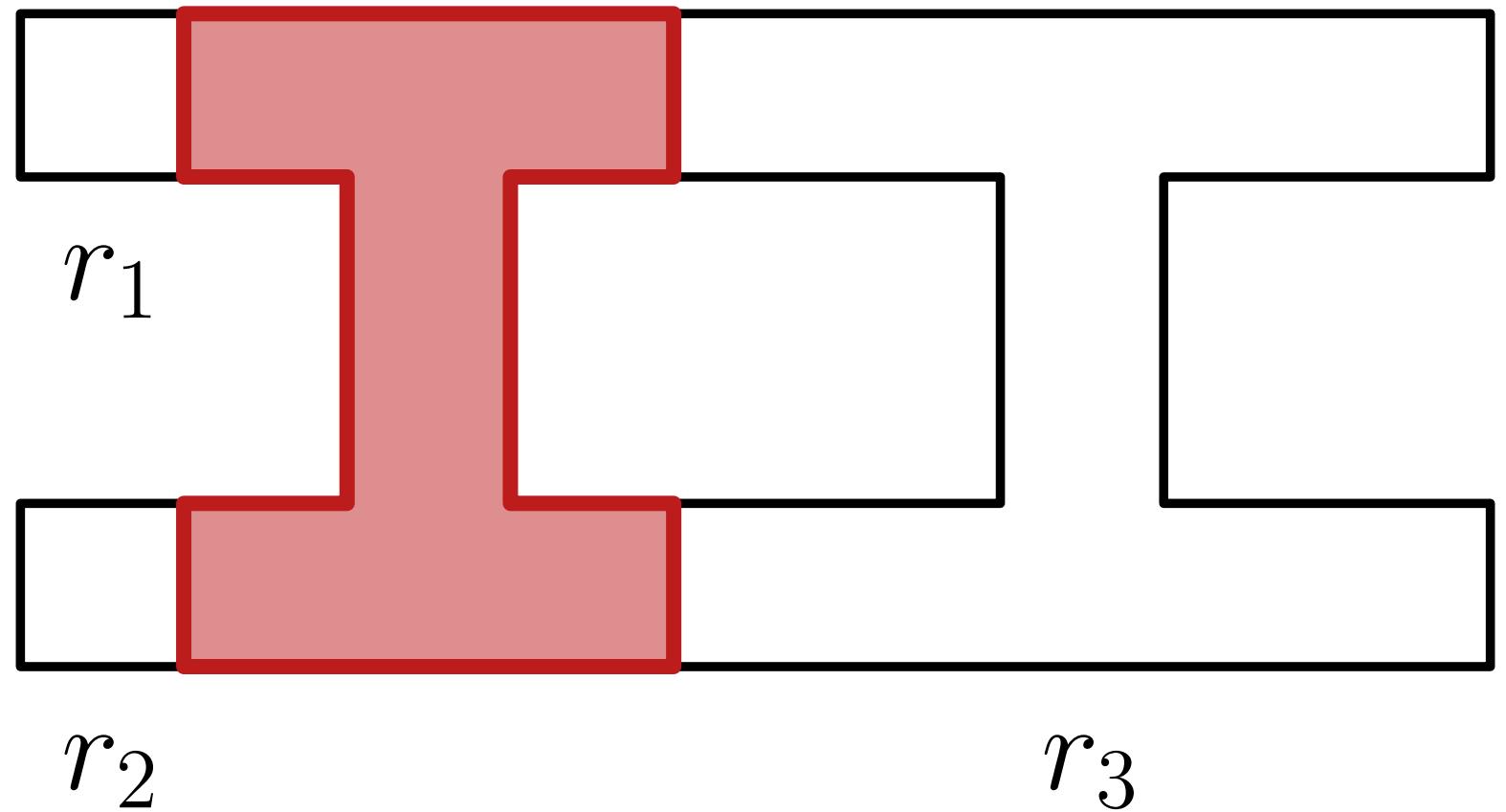
r_2

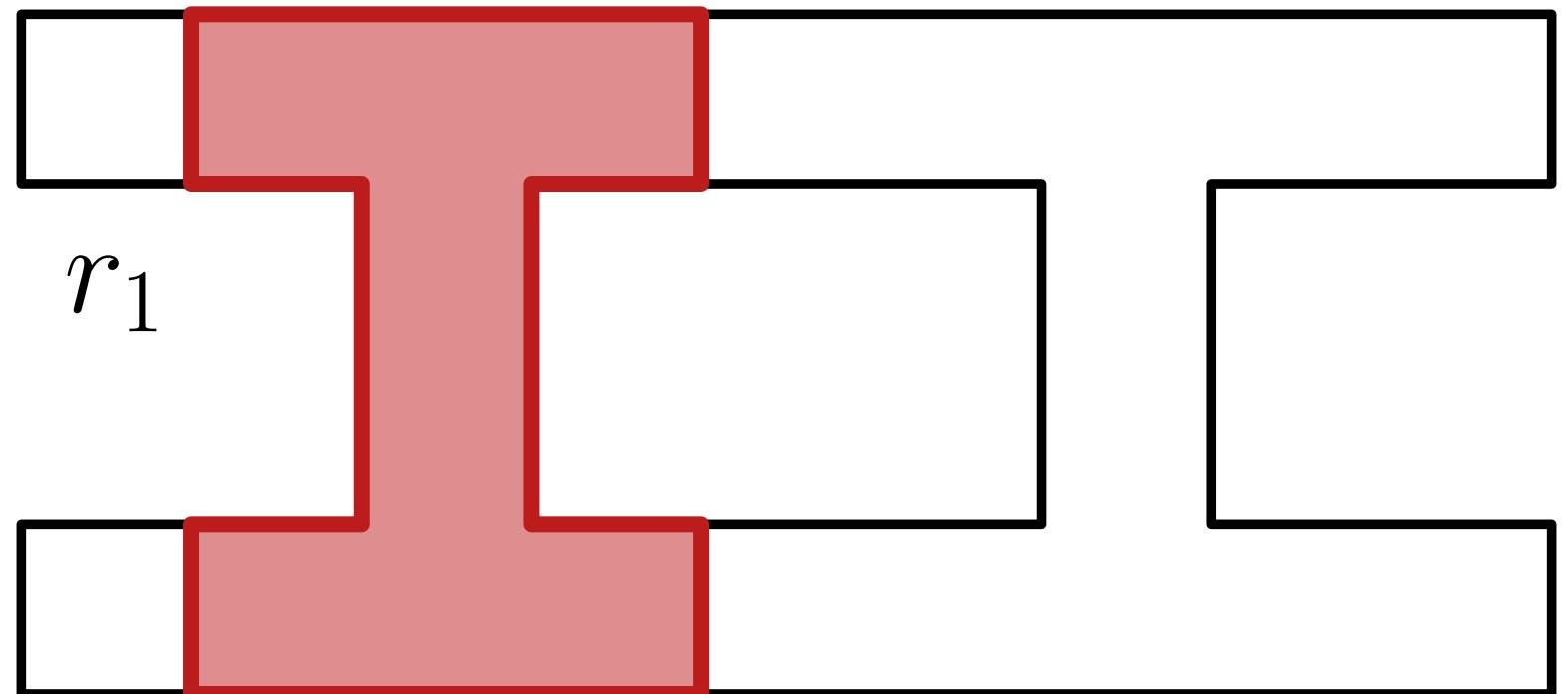
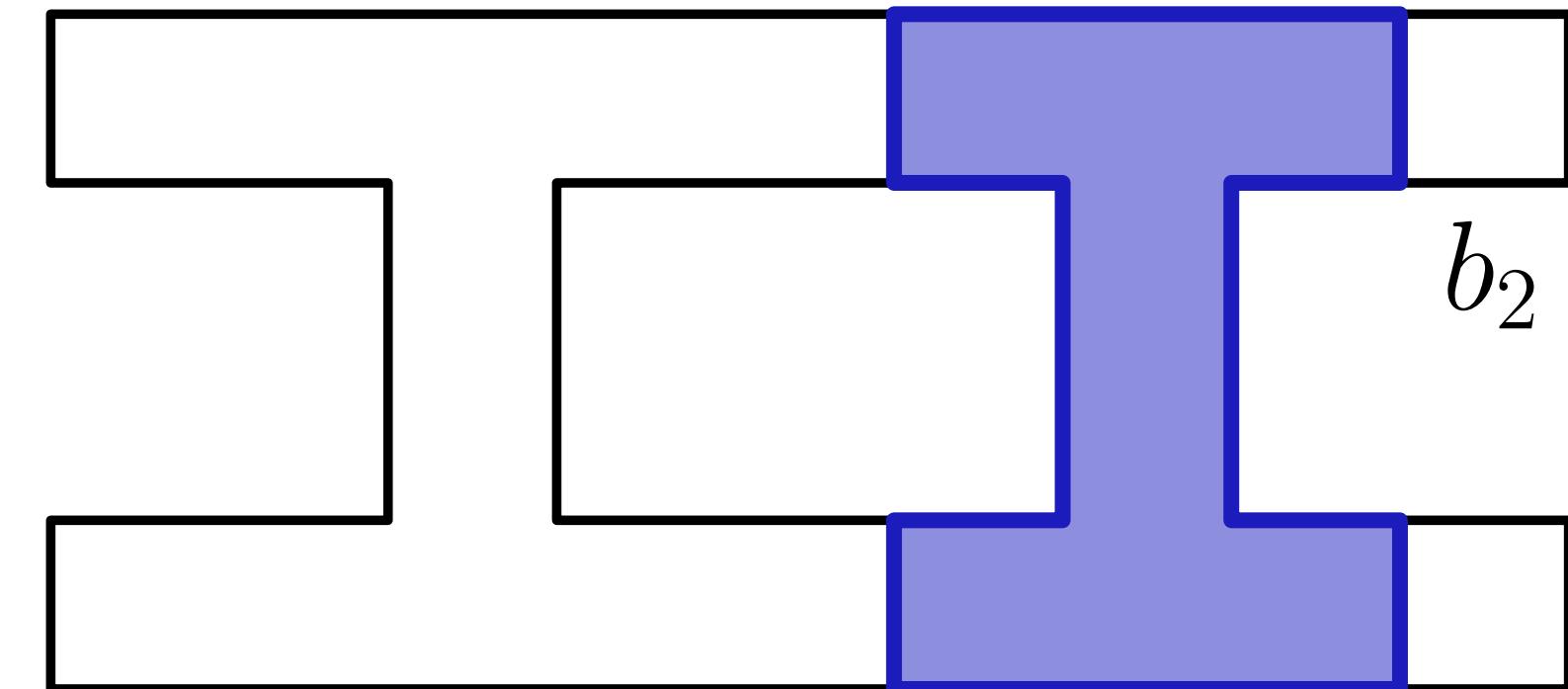
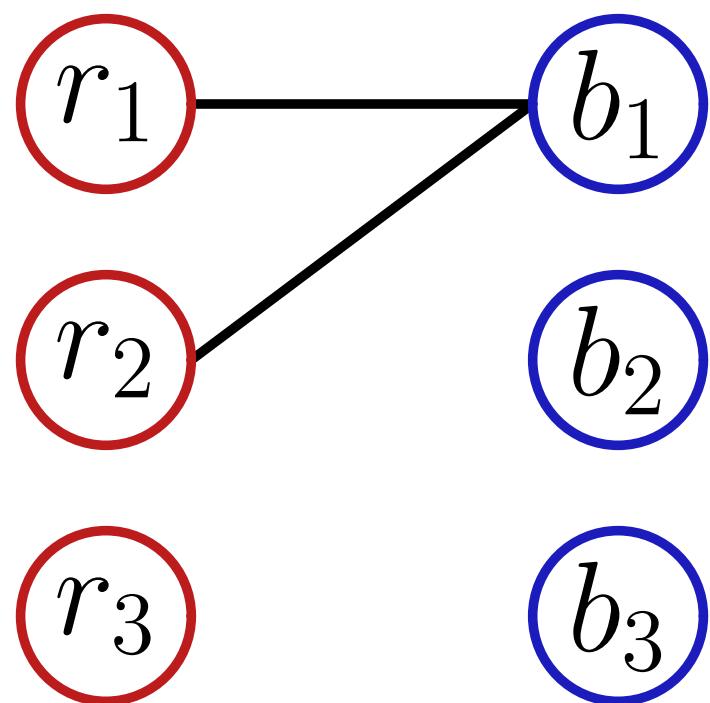
r_3

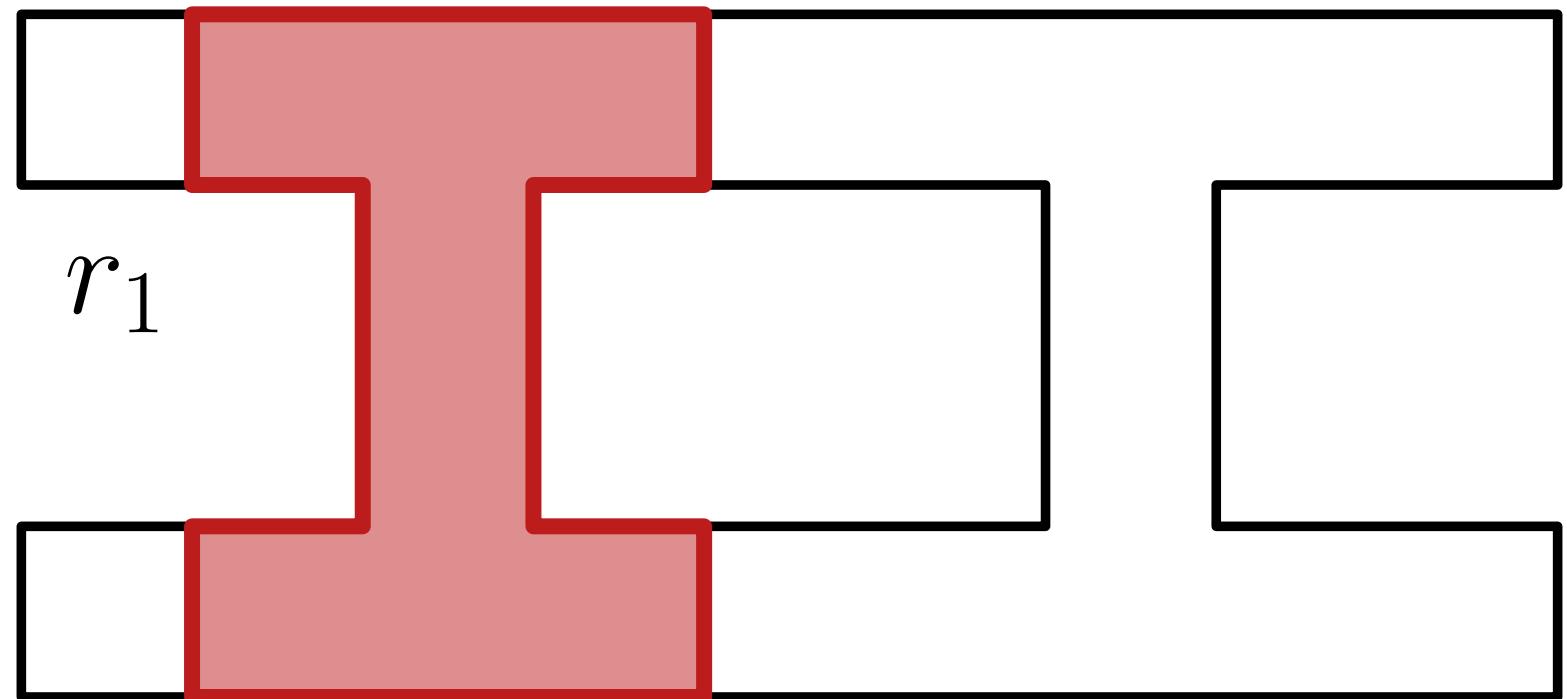
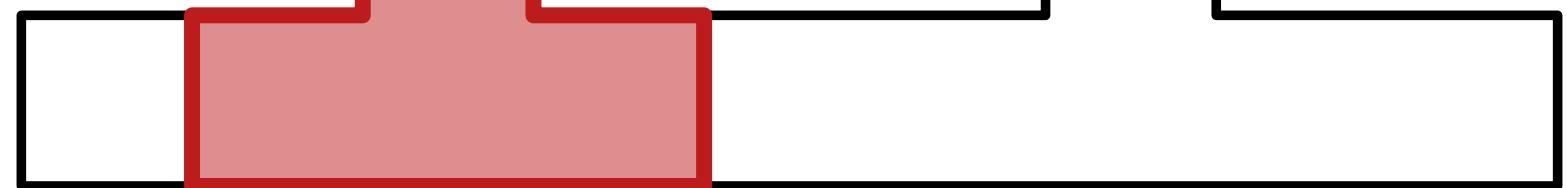
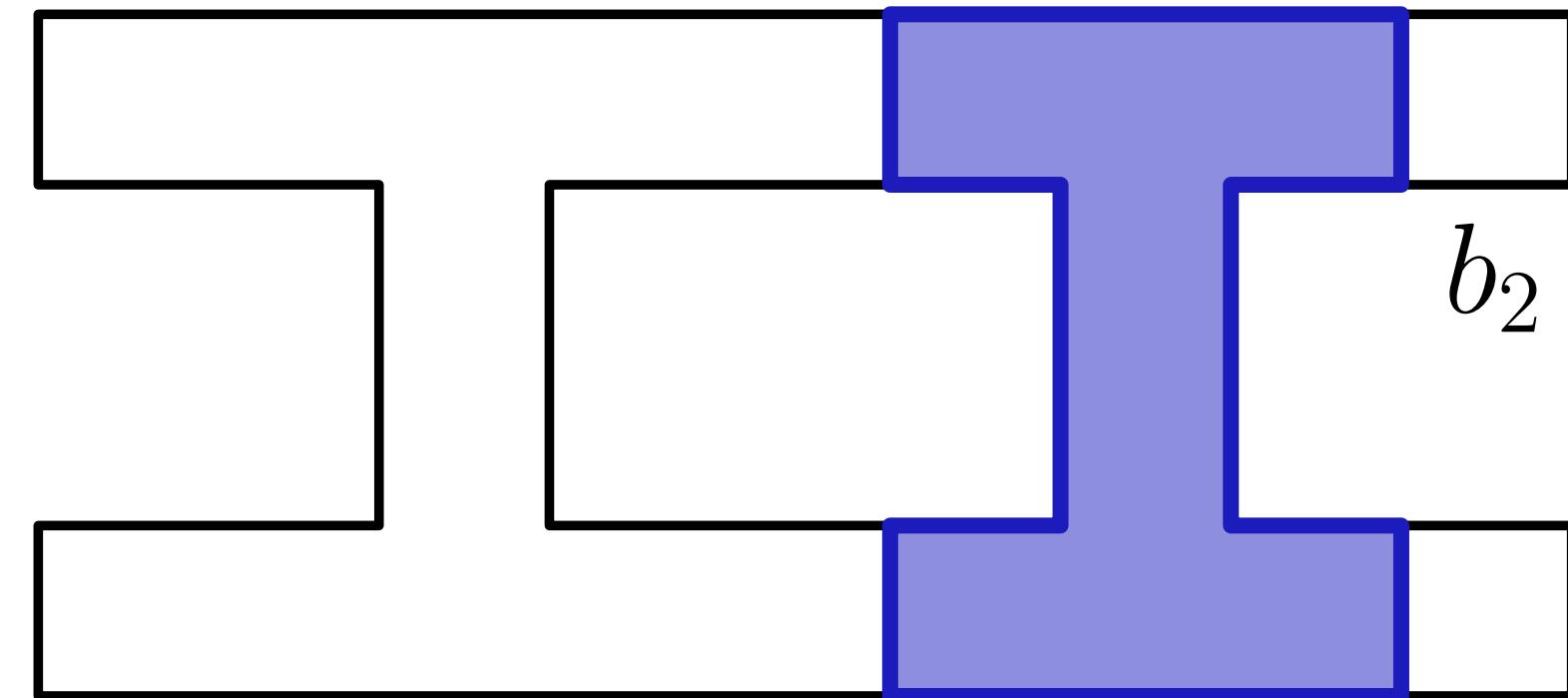
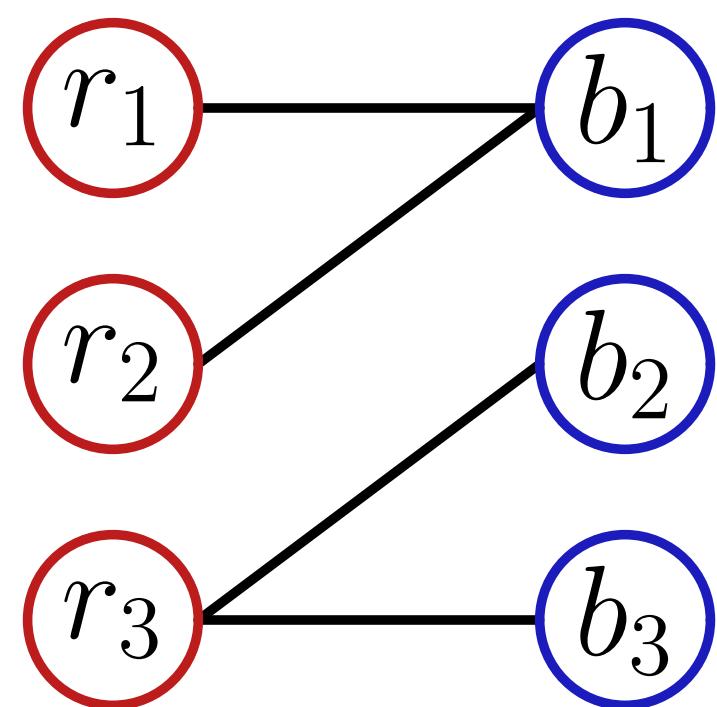
b_1

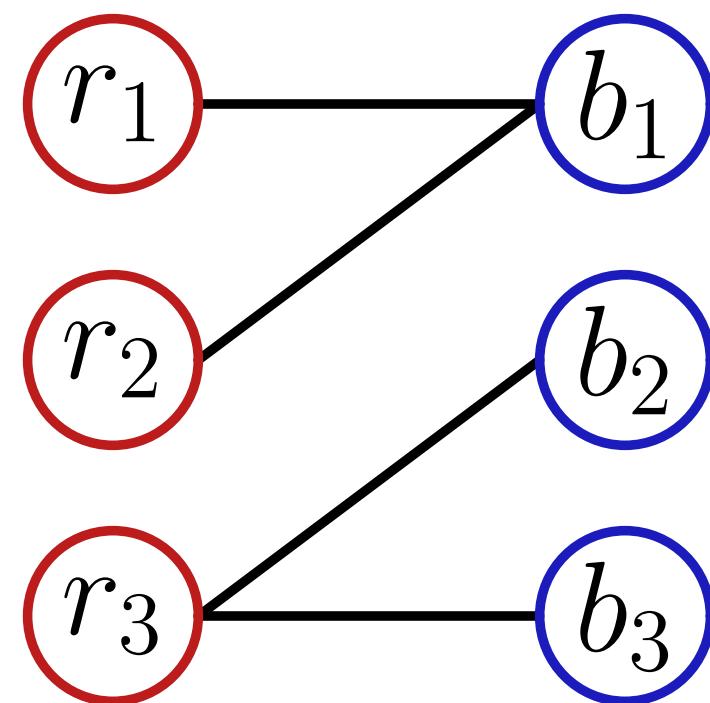
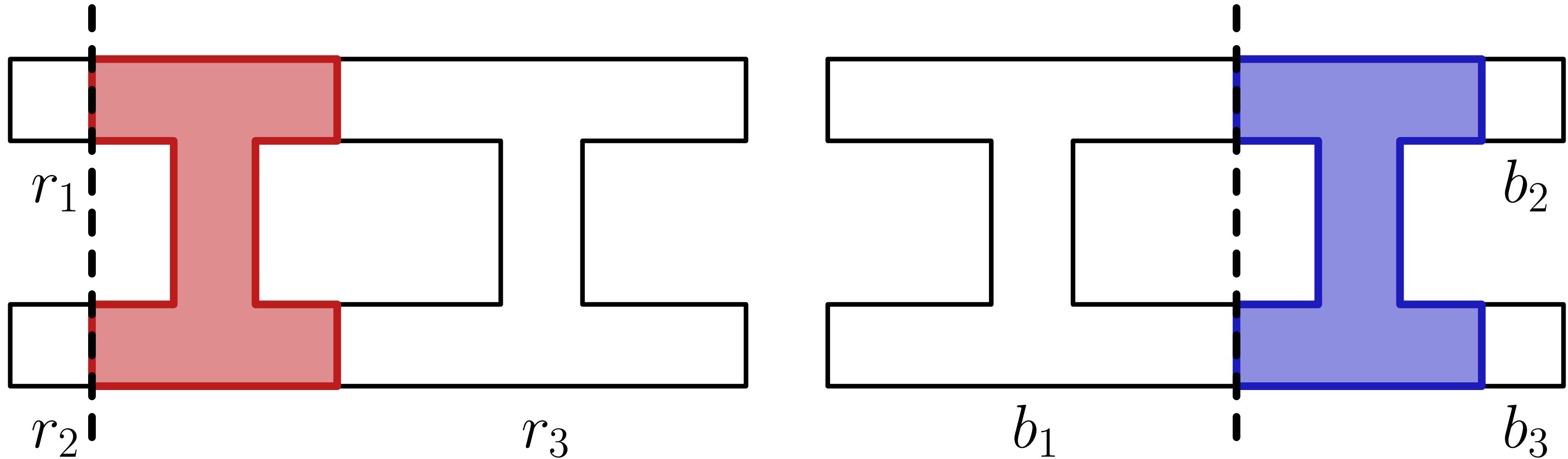
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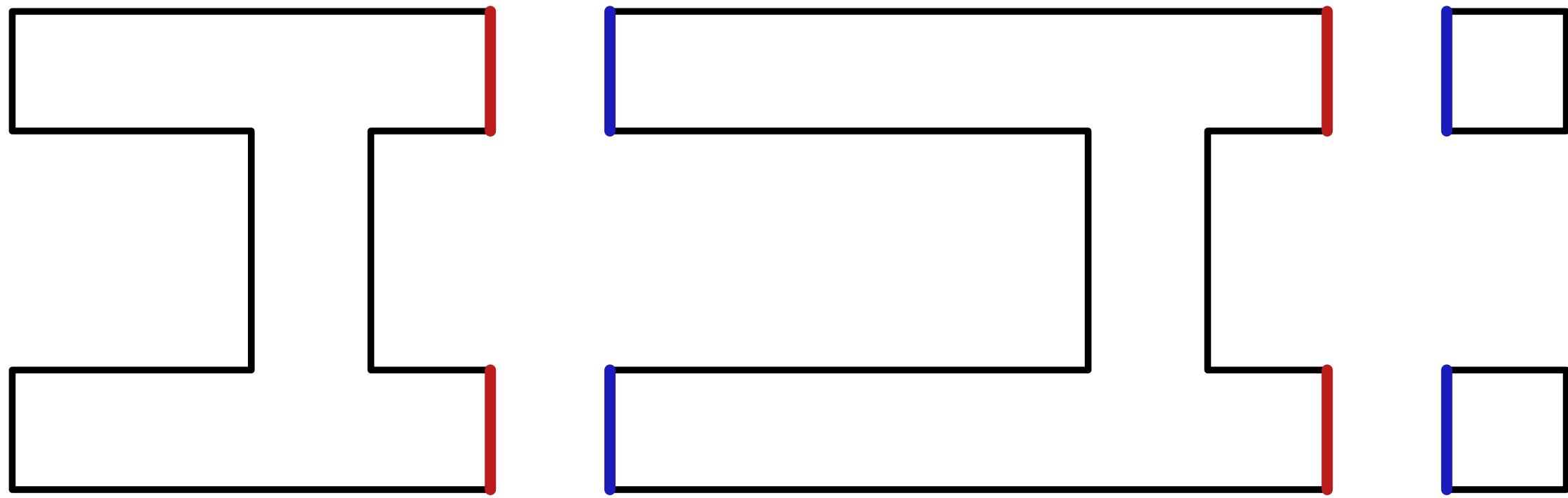
b_3

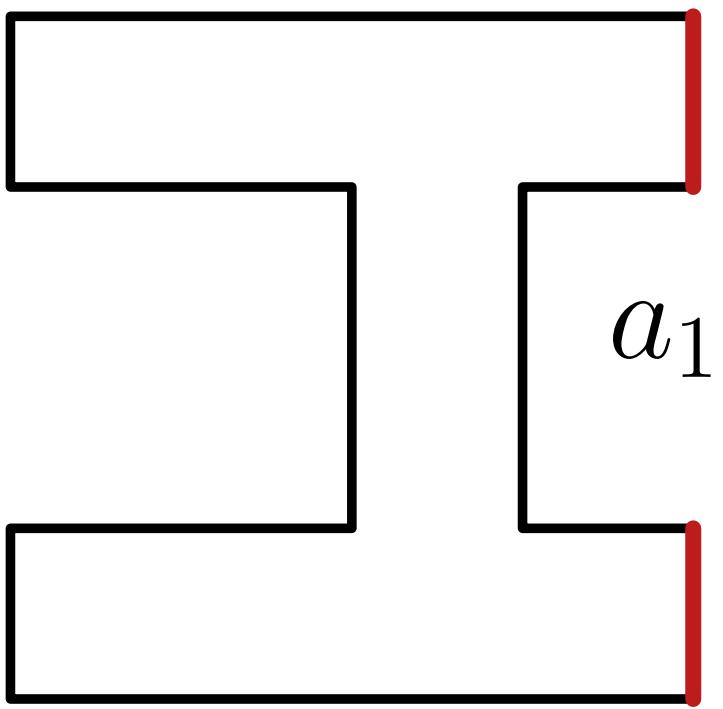
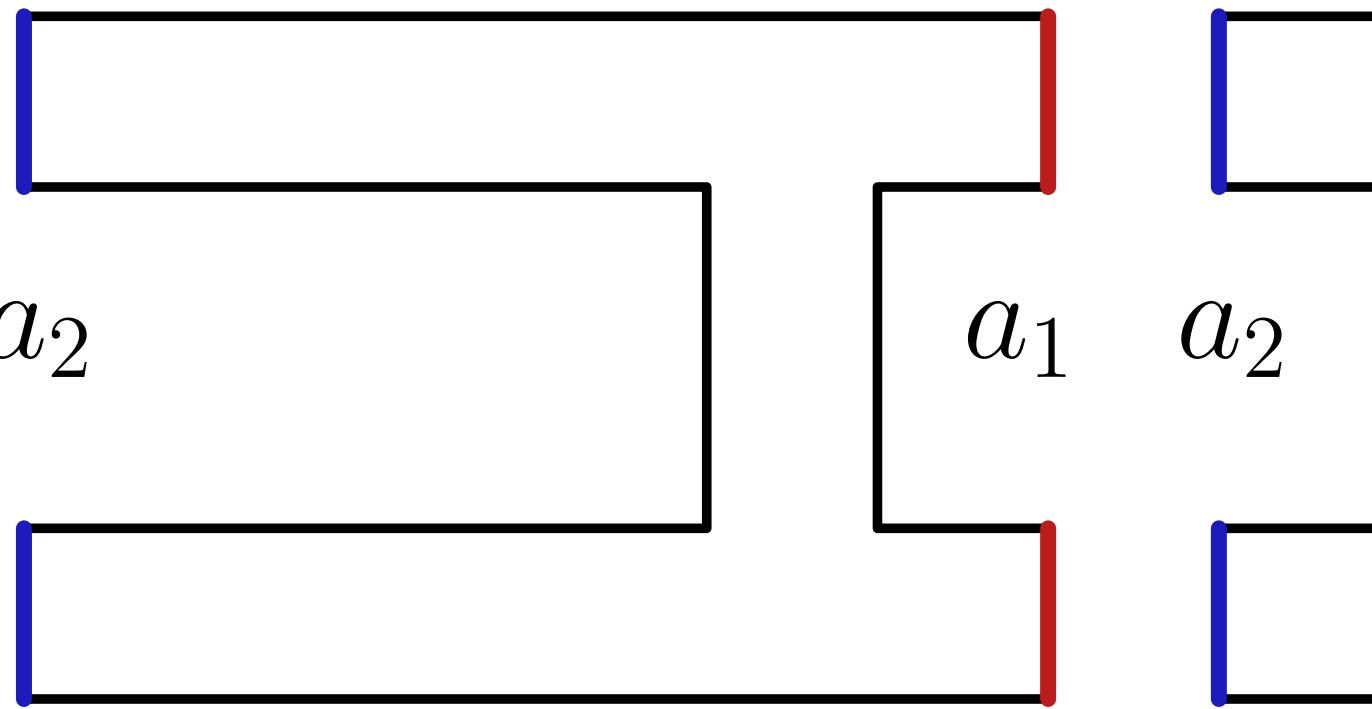
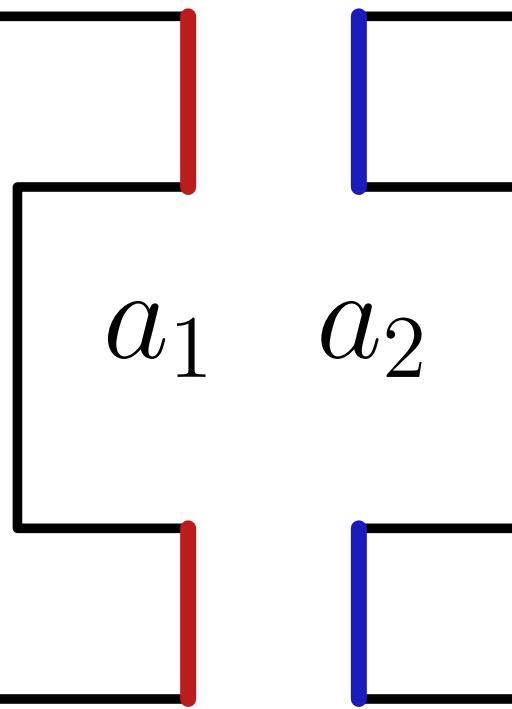


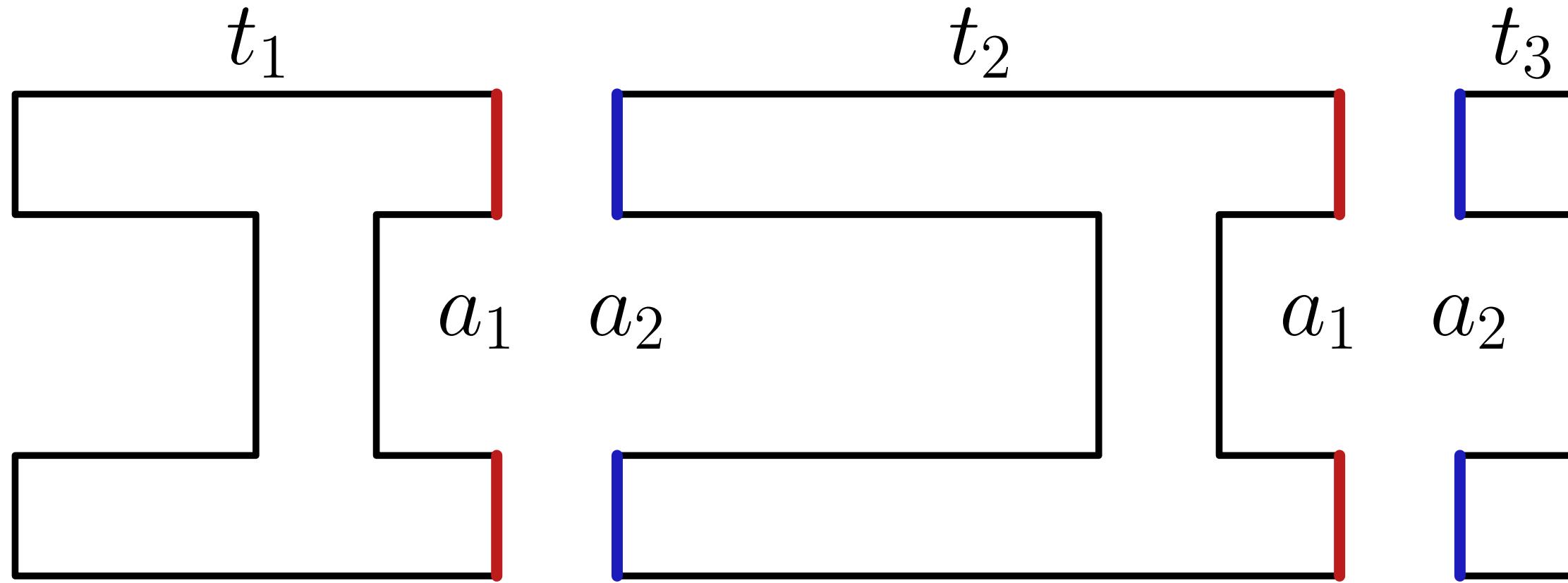
 r_1 r_2 r_3  b_1 b_2 b_3 

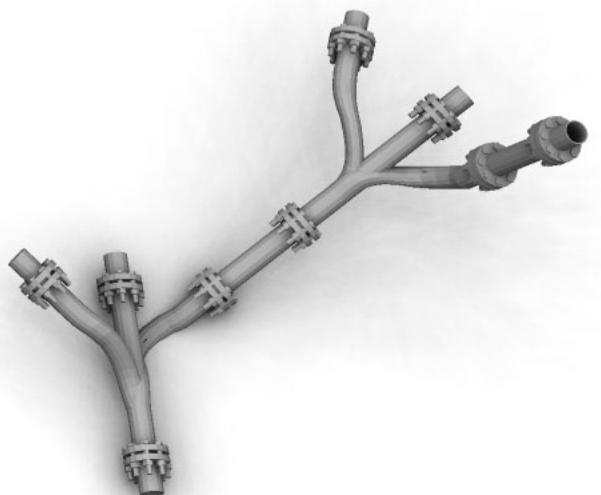
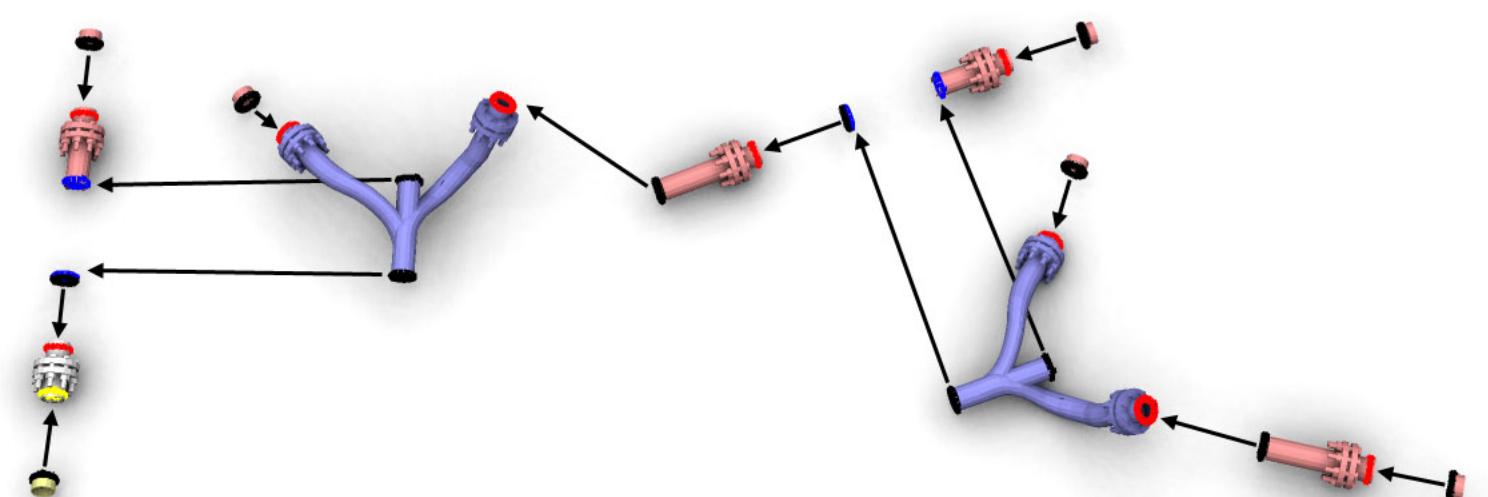
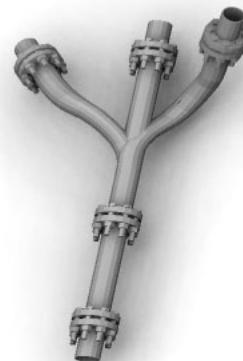
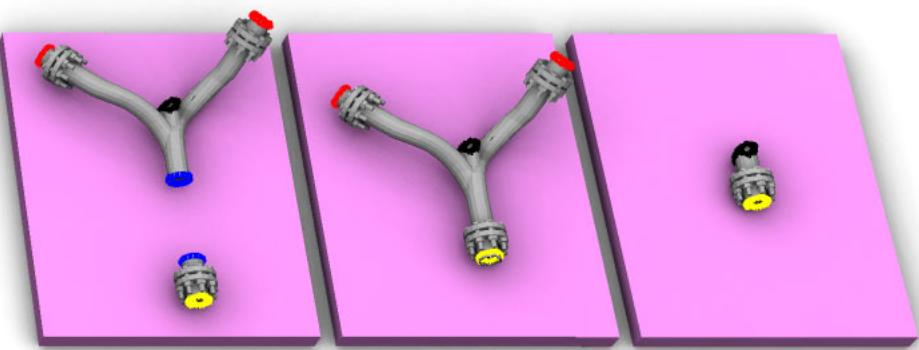
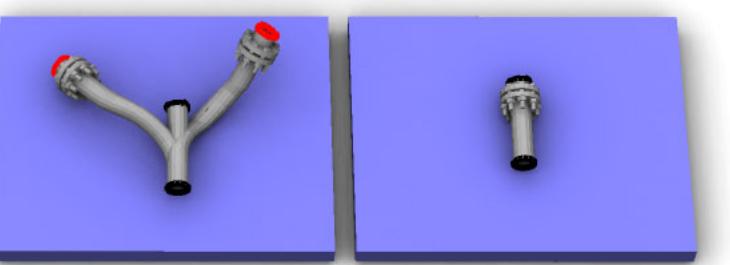
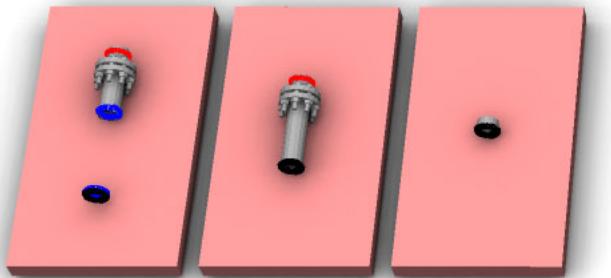
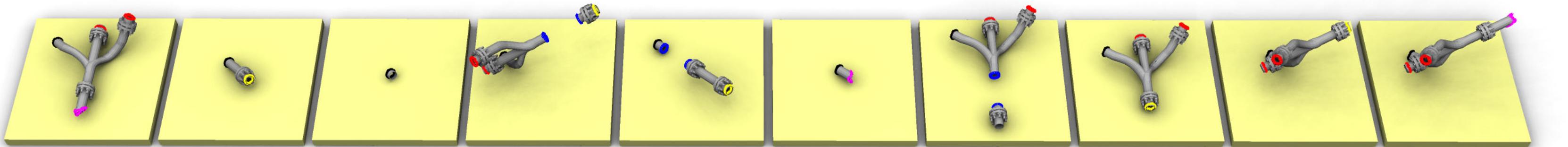
 r_1  r_2 r_3  b_1 b_2 b_3 





t_1  t_2  t_3 


$$a_1 \rightarrow \{t_2\}, \{a_1\}$$
$$a_1 \rightarrow \{t_3\}, \{\}$$



<https://www.youtube.com/watch?v=dGjw67XCbxA>

Assignment 3

What do we need to take care of when we apply the rules of our grammar?

Inverse Procedural Modelling of Trees

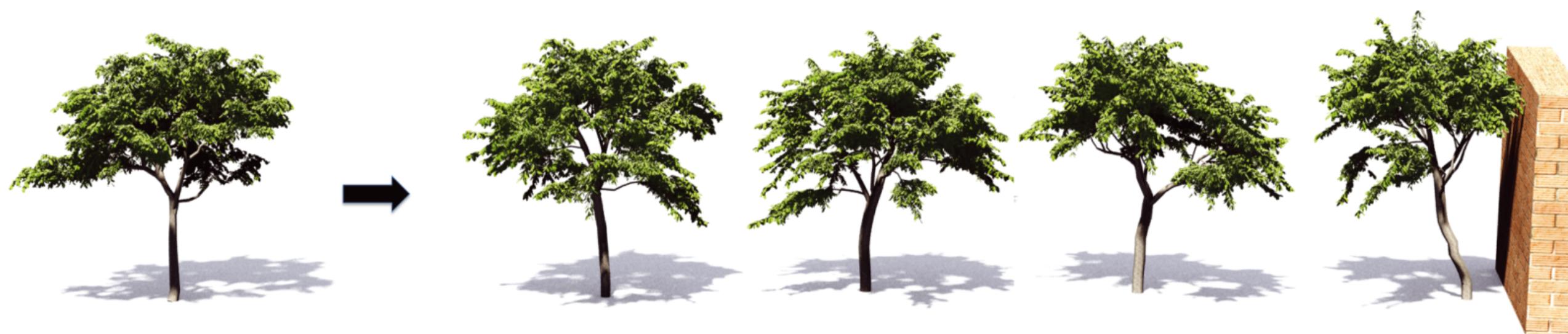
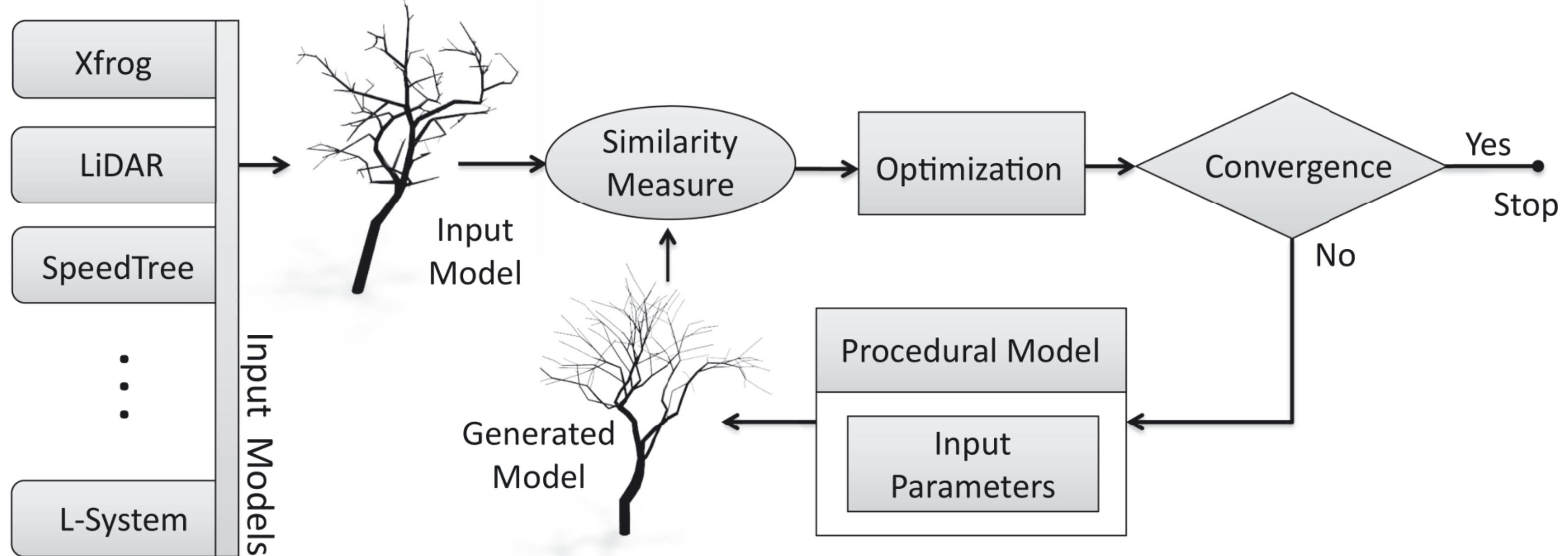
O. Stava¹, S. Pirk², J. Kratt², B. Chen³, R. Měch¹, O. Deussen² and B. Benes⁴

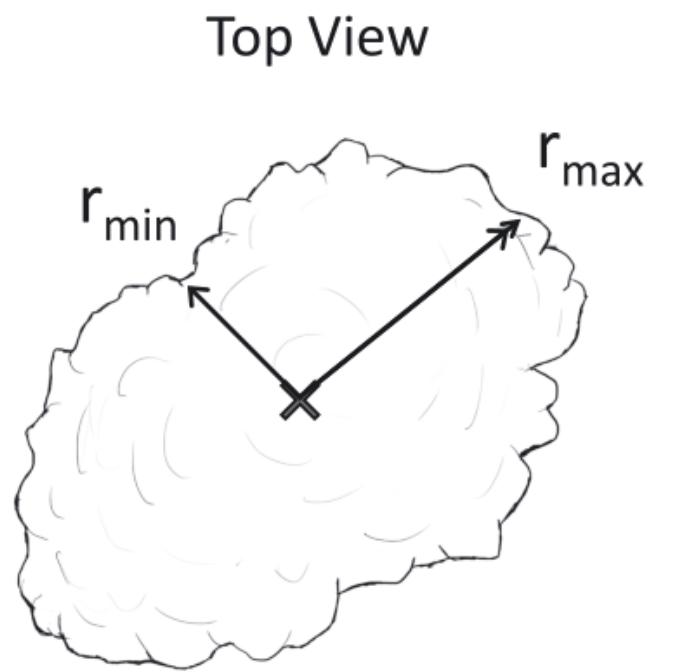
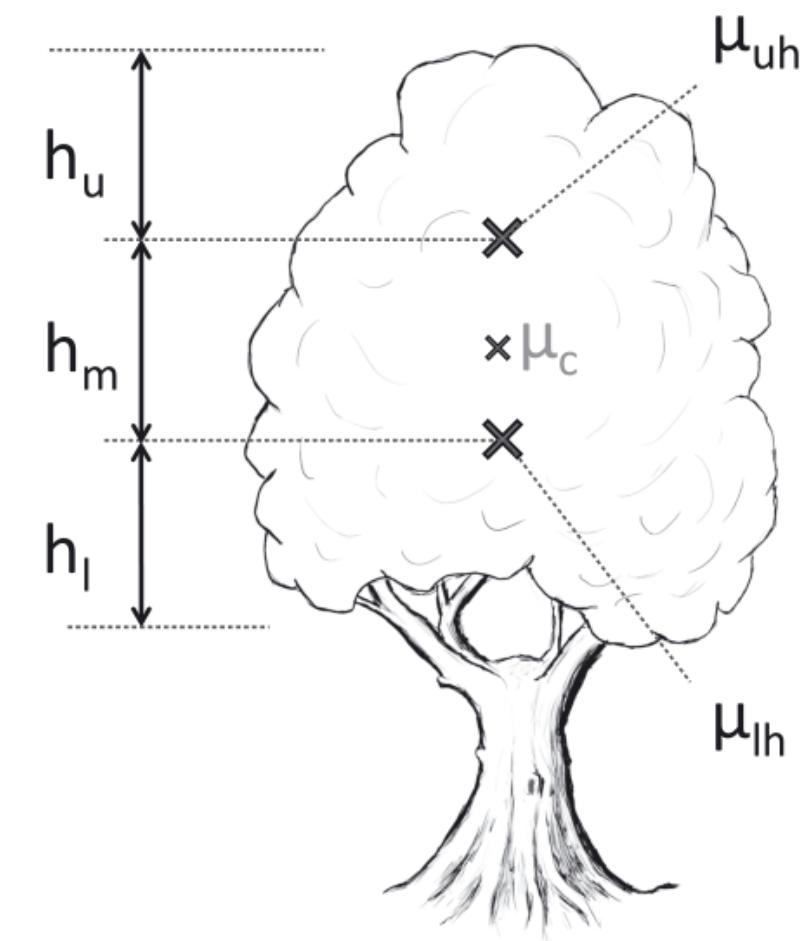
¹Adobe Systems Inc., San Jose, CA, USA
{ostava, rmech}@adobe.com

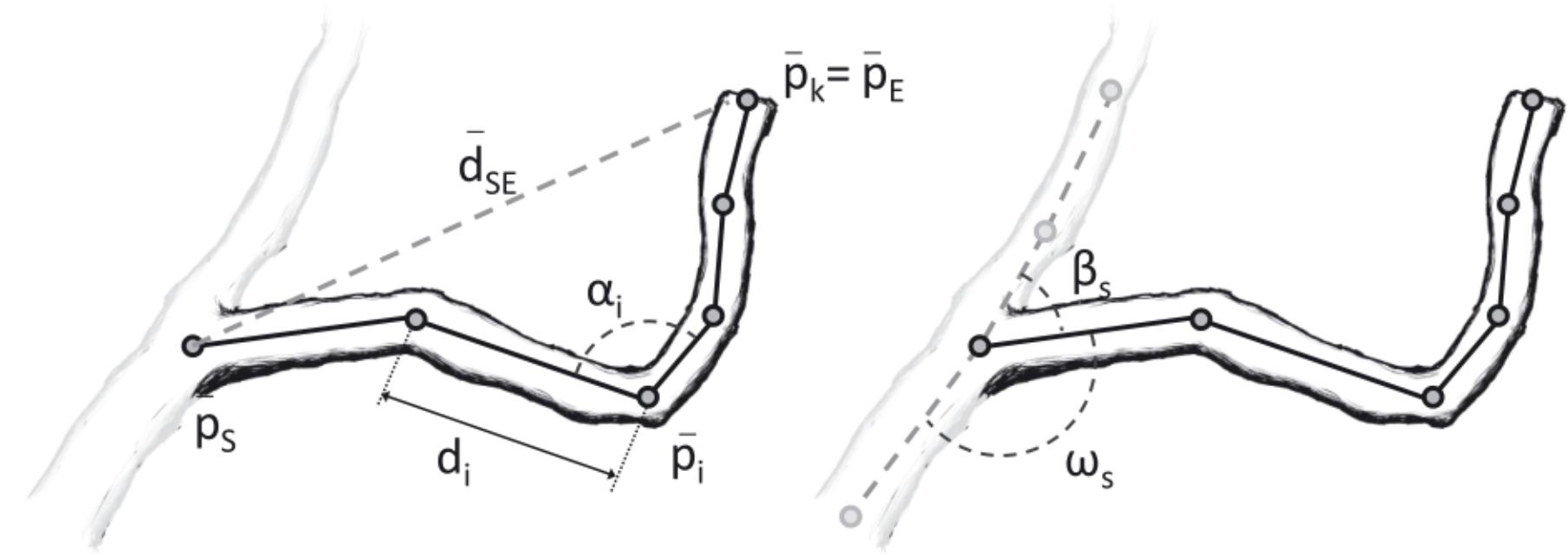
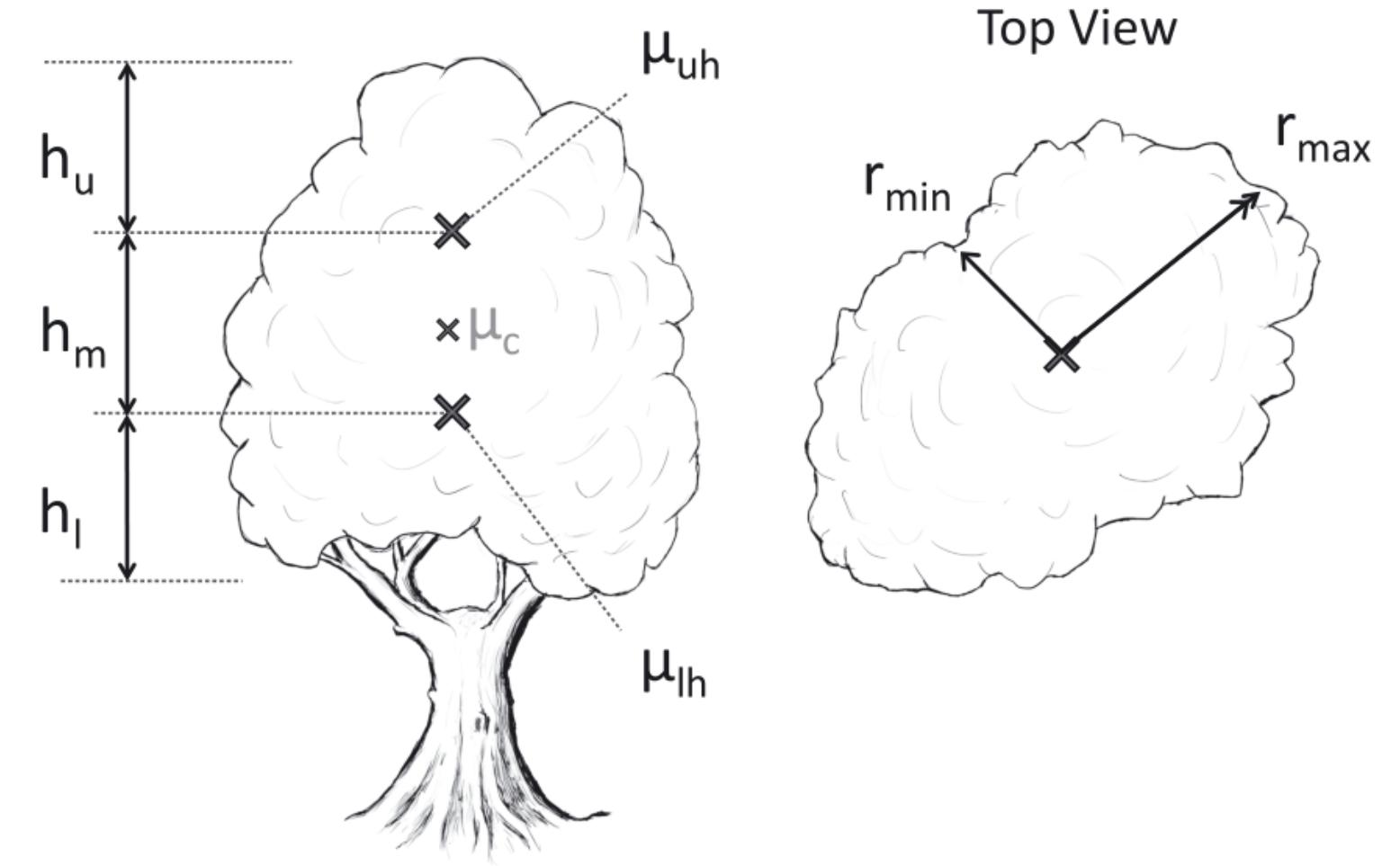
²University of Konstanz, Konstanz, Germany
soeren.pirk@gmail.com, {julian.kratt, oliver.deussen}@uni-konstanz.de

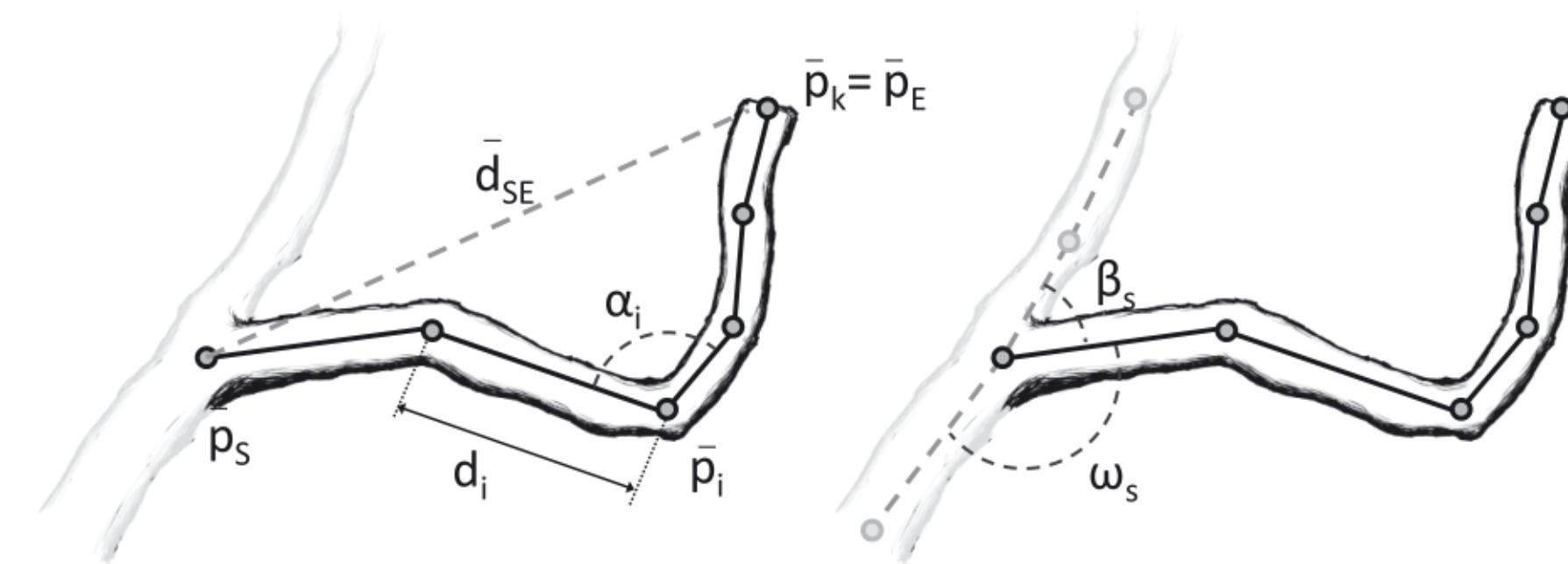
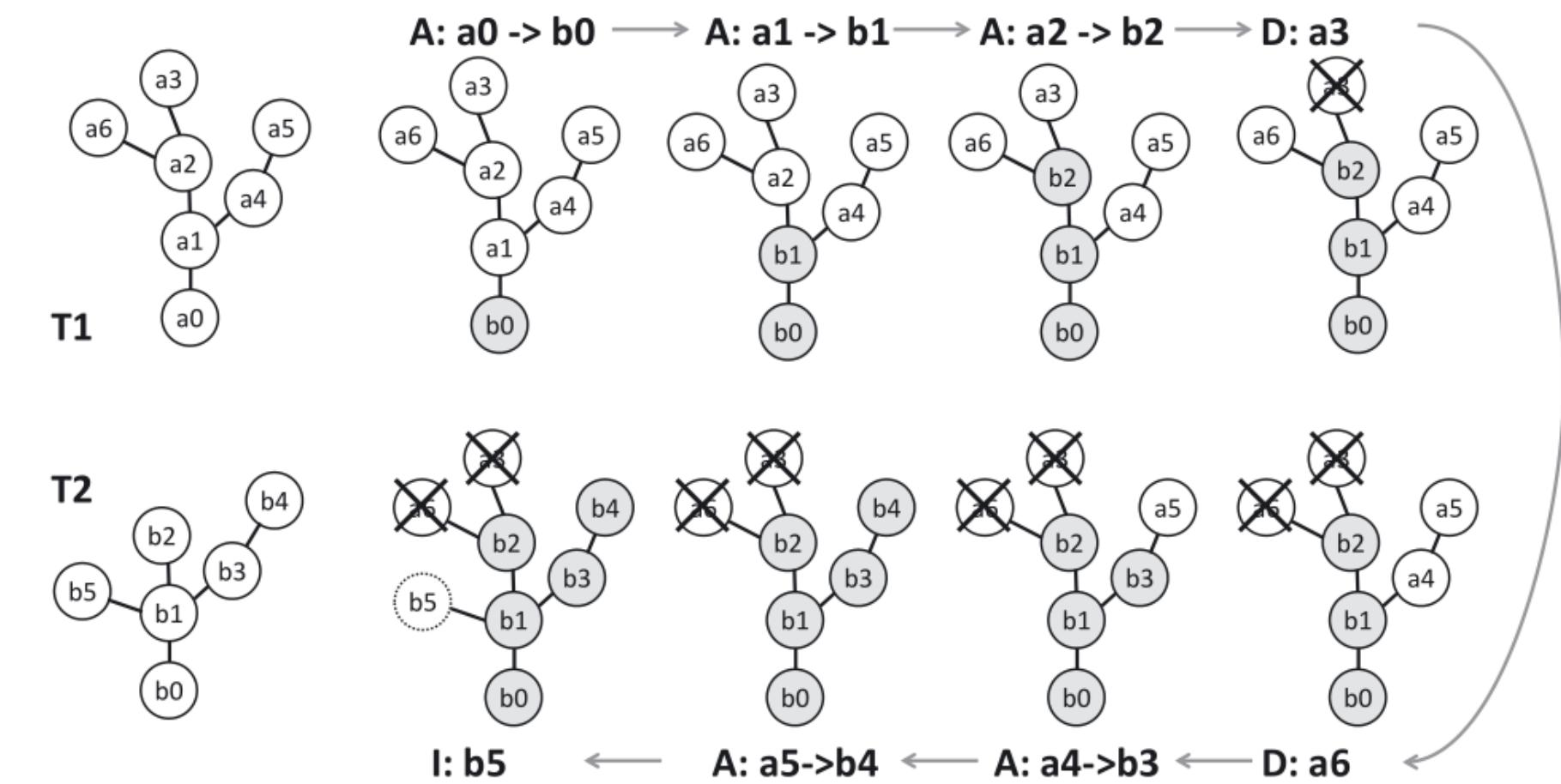
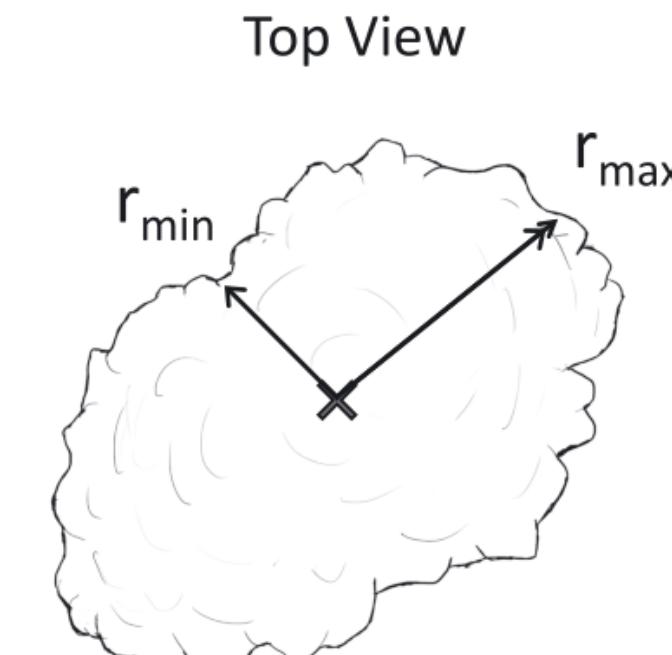
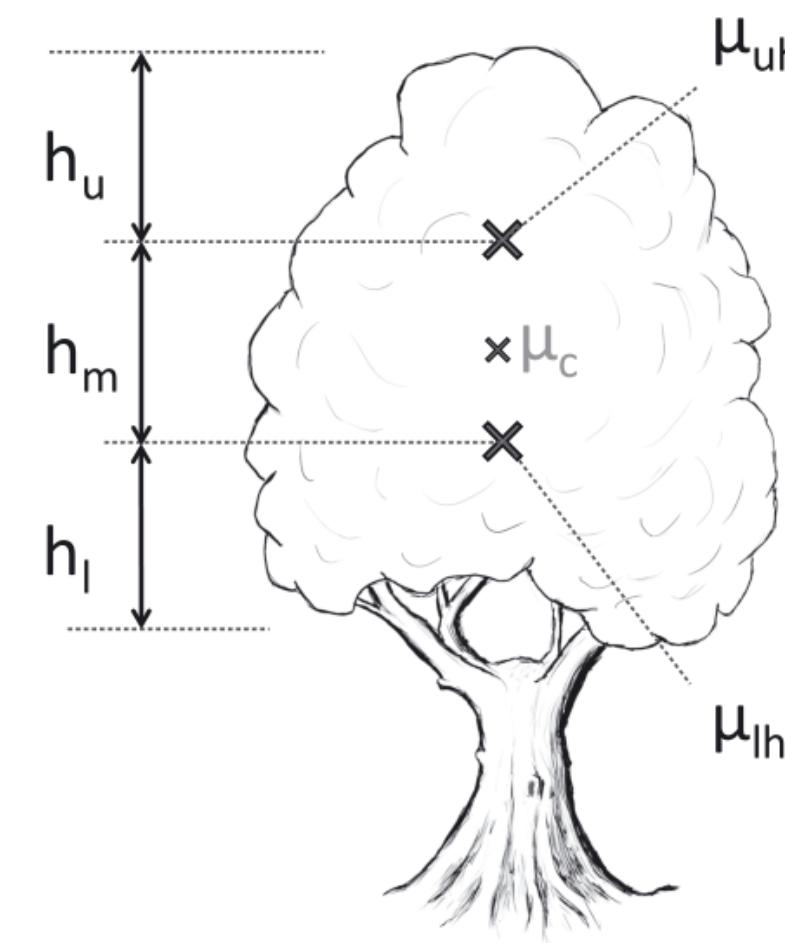
³Shenzhen Institut of Advanced Technology, Shenzhen, China
baoquan.chen@gmail.com

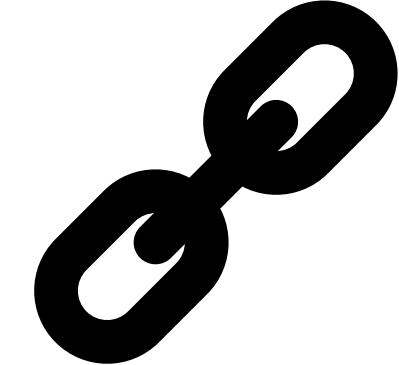
⁴Purdue University, West Lafayette, IN, USA
bbenes@purdue.edu

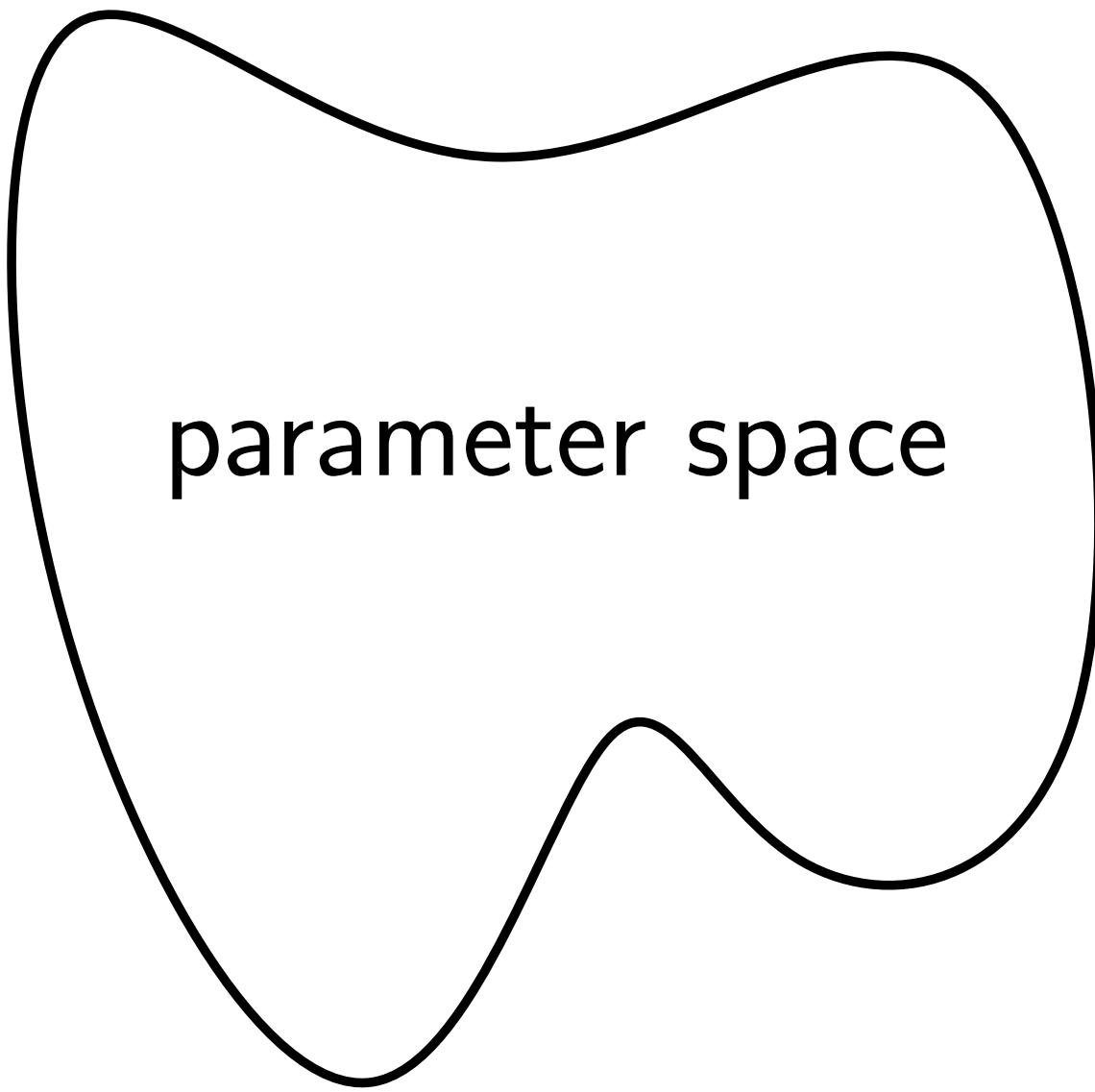
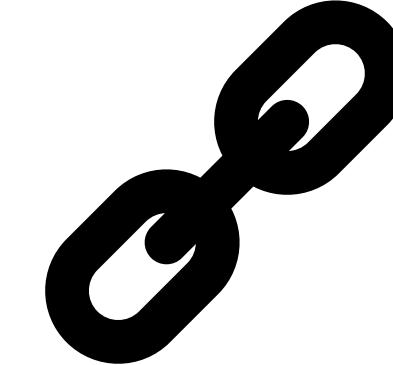


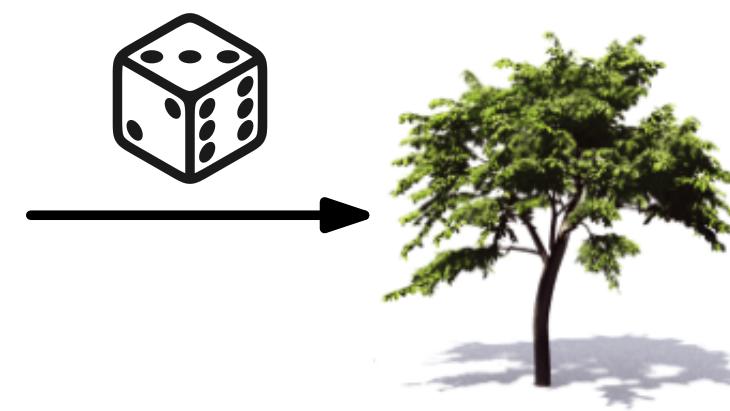
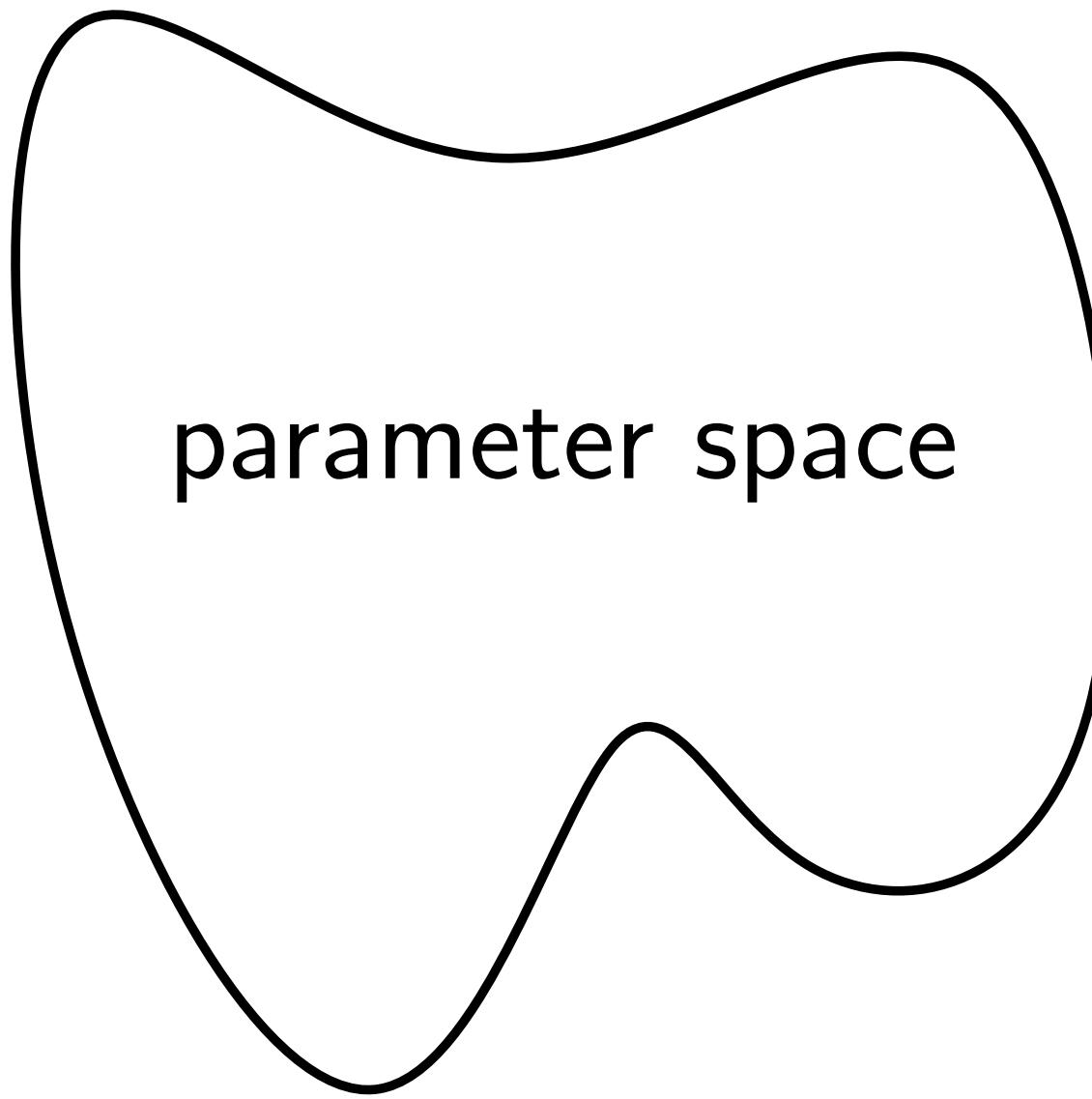
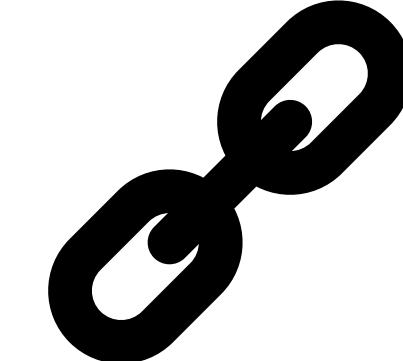


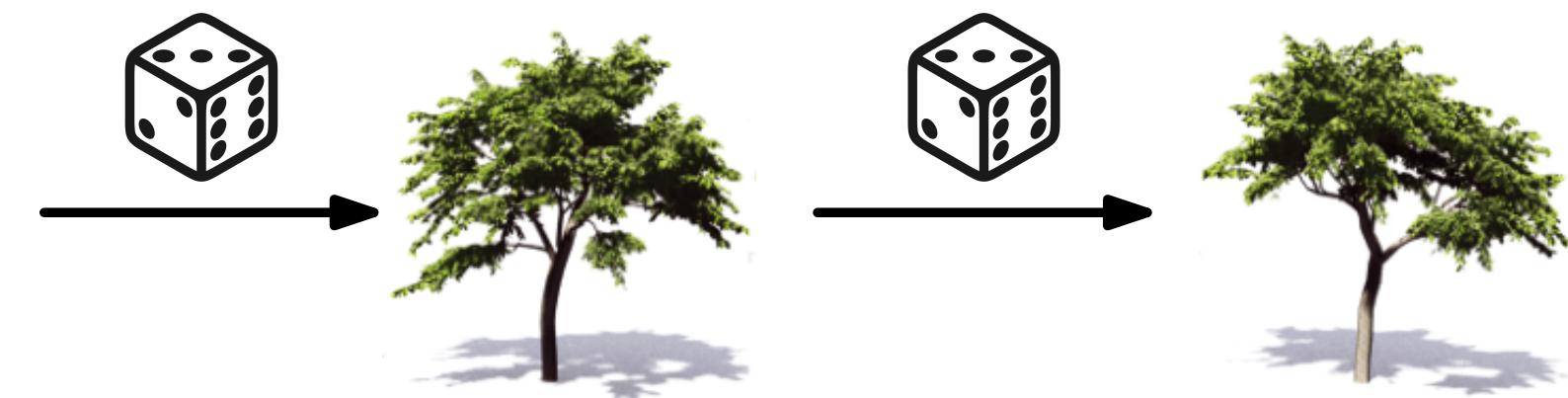
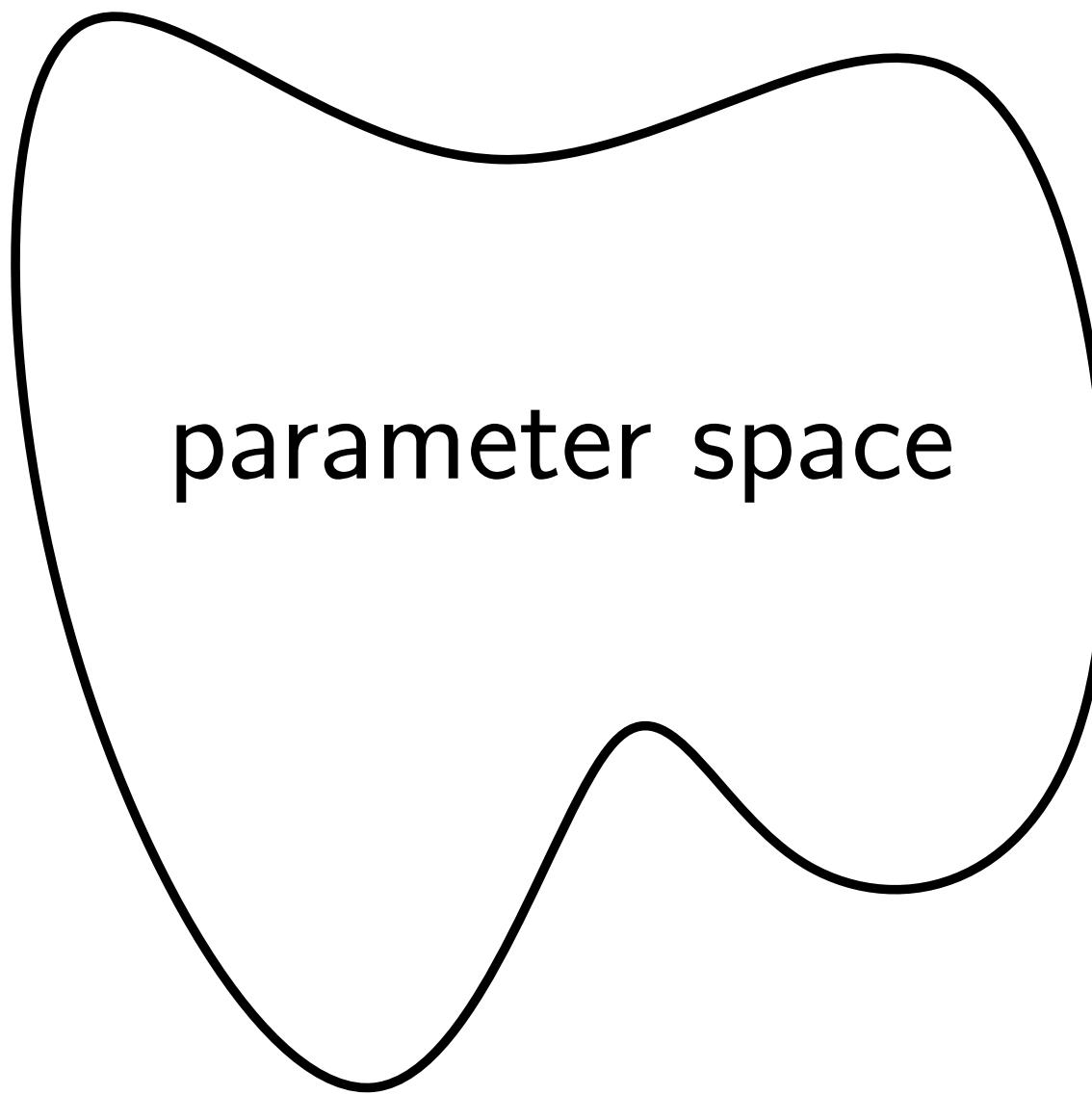
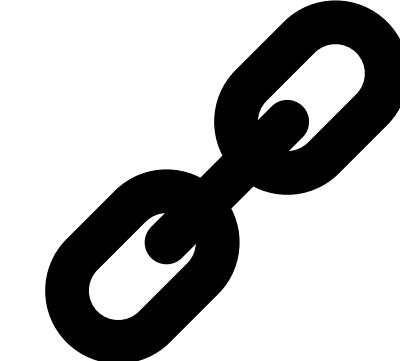


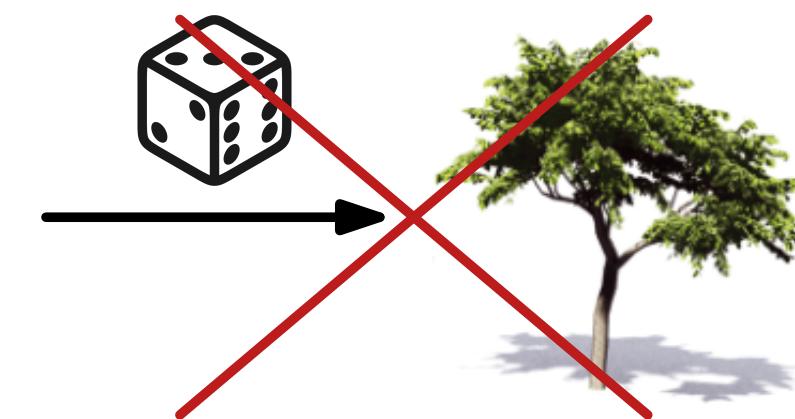
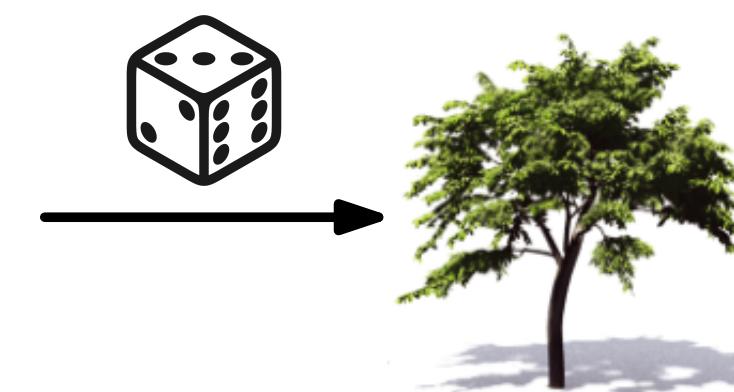
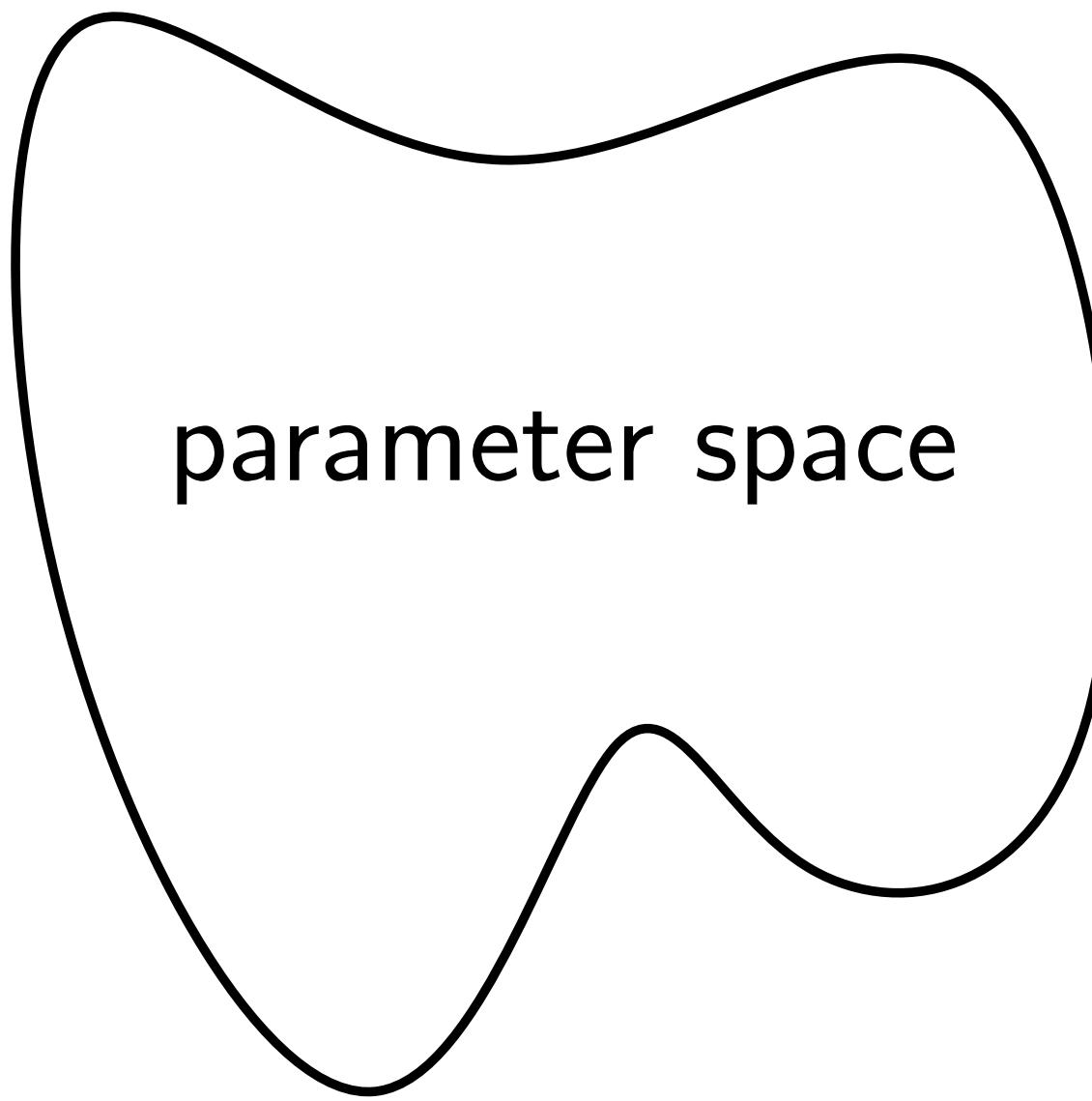
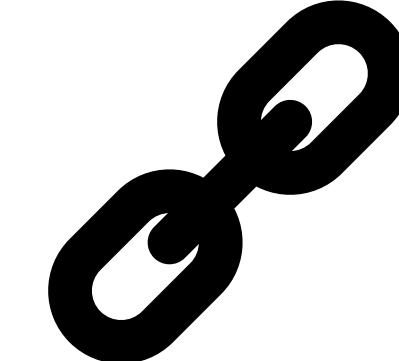


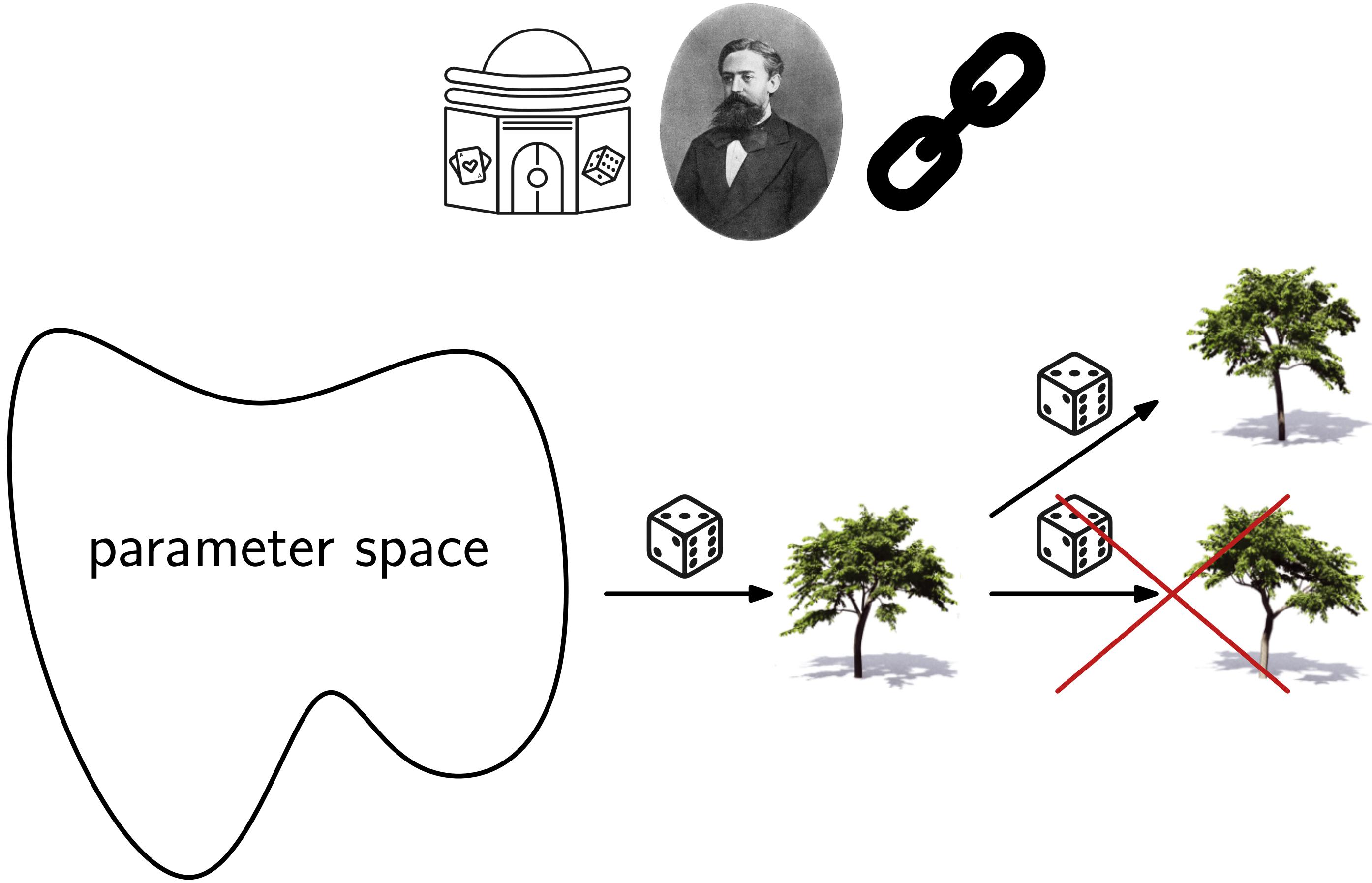


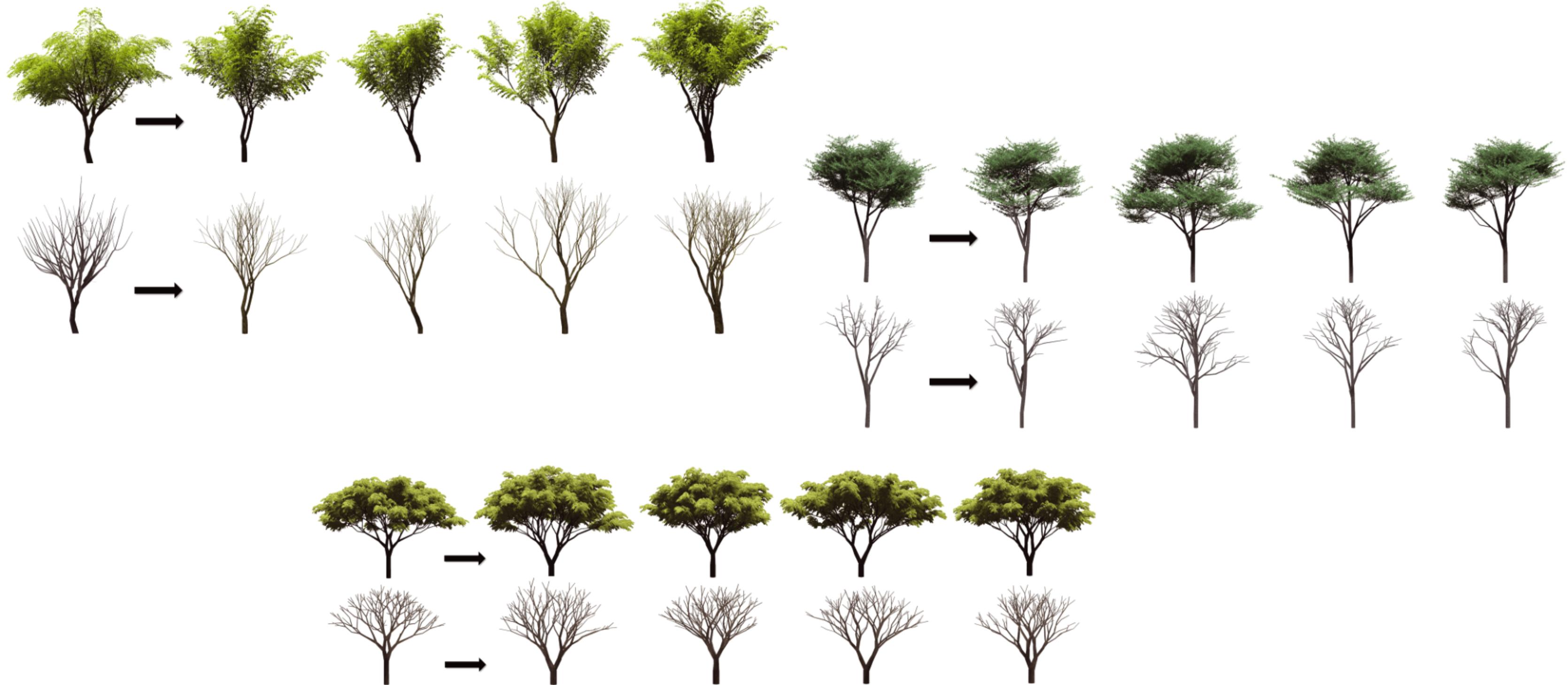












Assignment 4

Name another technique that we've seen before that could be used to explore the parameter space.

Interactive Sketching of Urban Procedural Models

Gen Nishida¹

Ignacio Garcia-Dorado¹

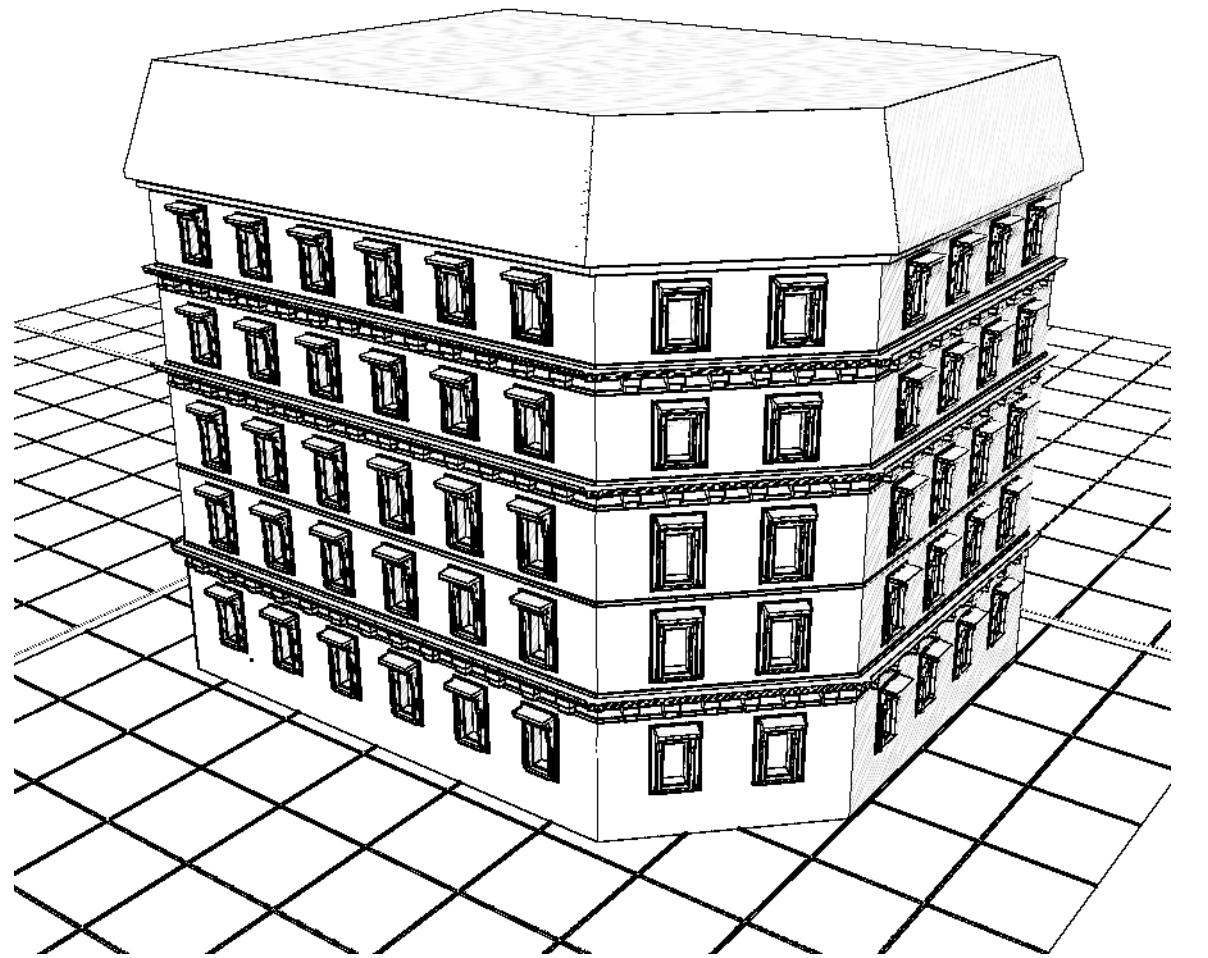
Daniel G. Aliaga¹

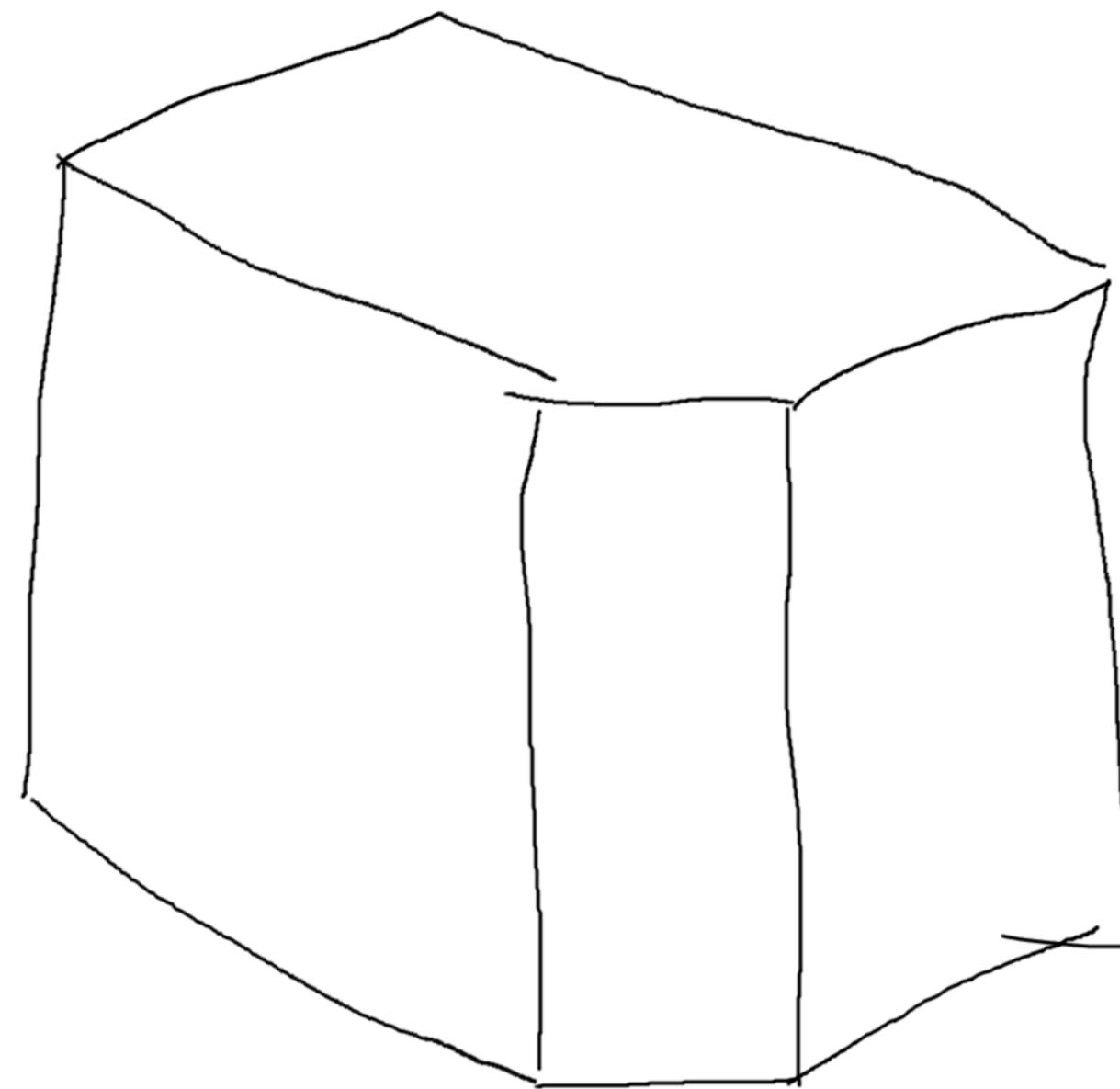
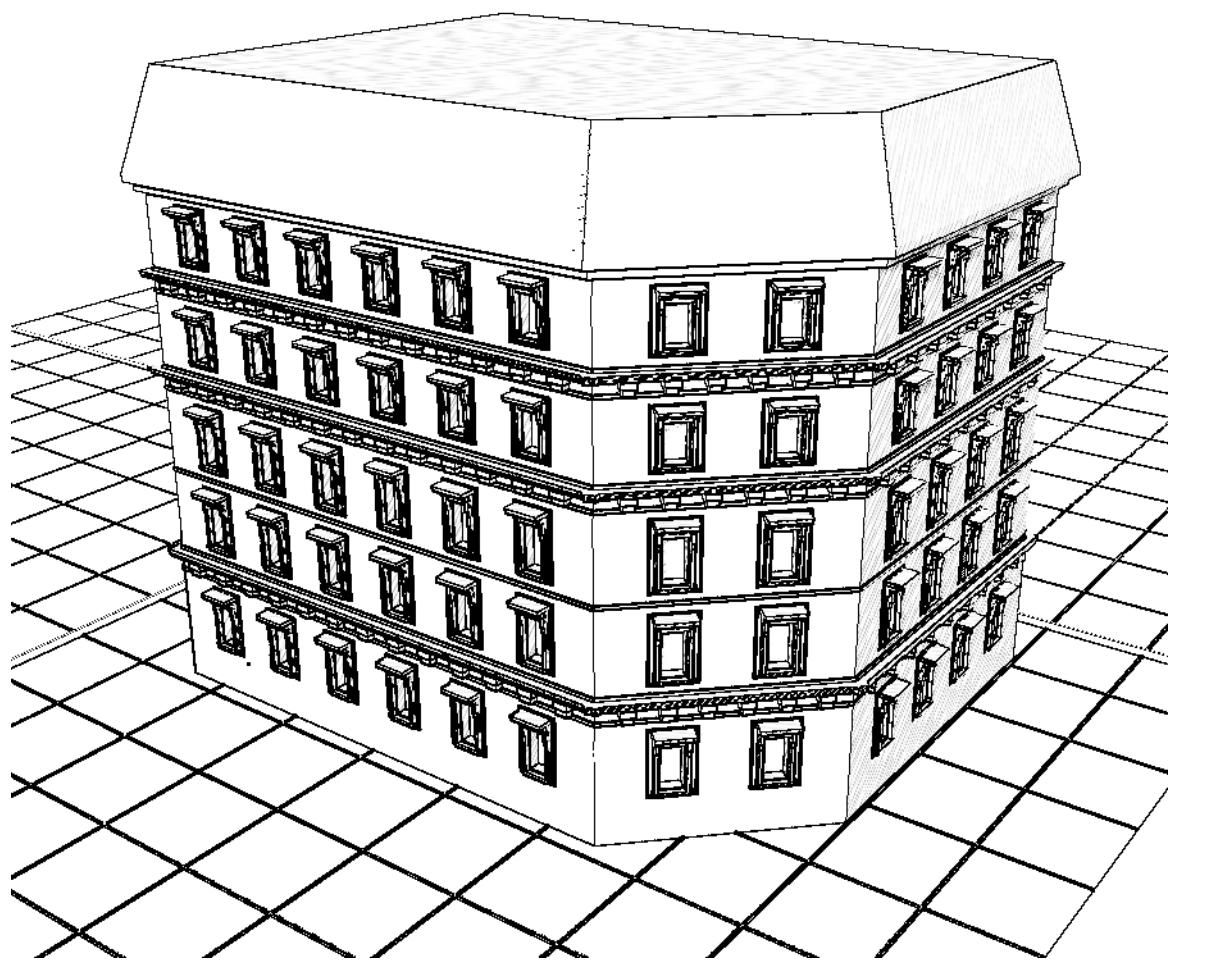
Bedrich Benes¹

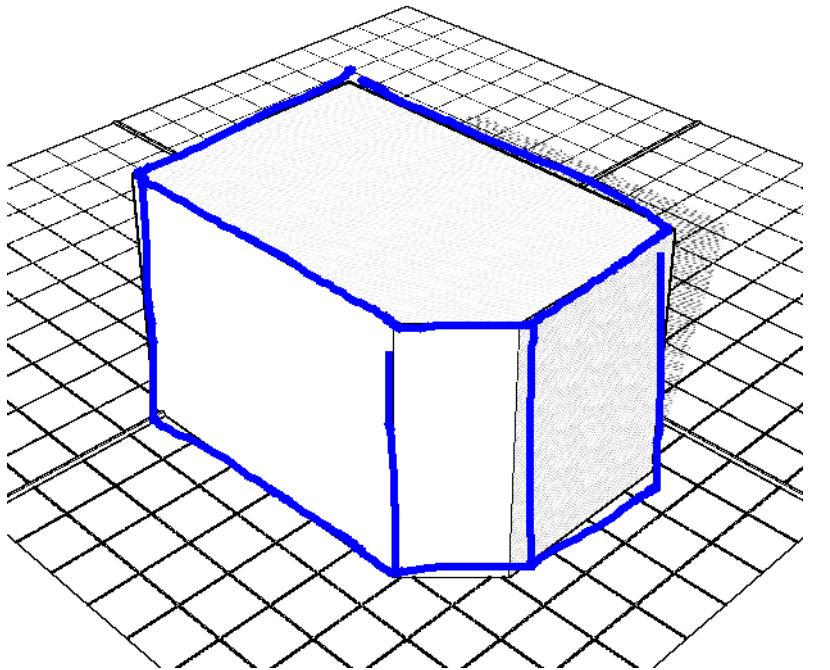
Adrien Bousseau²

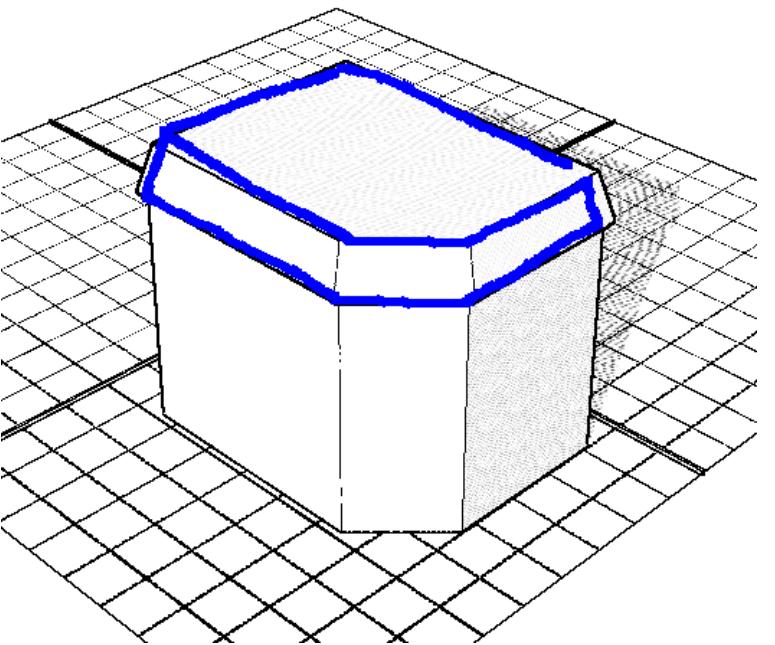
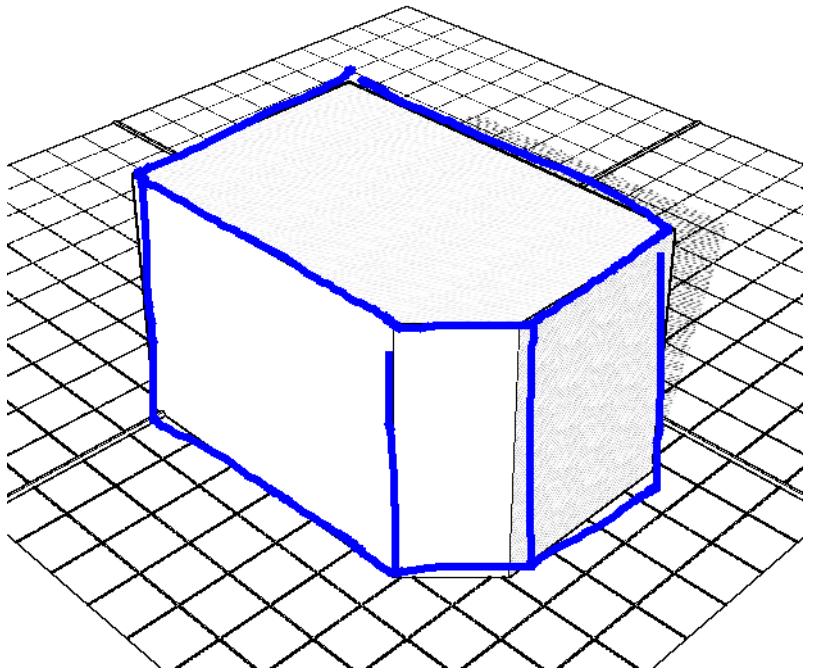
¹Purdue University

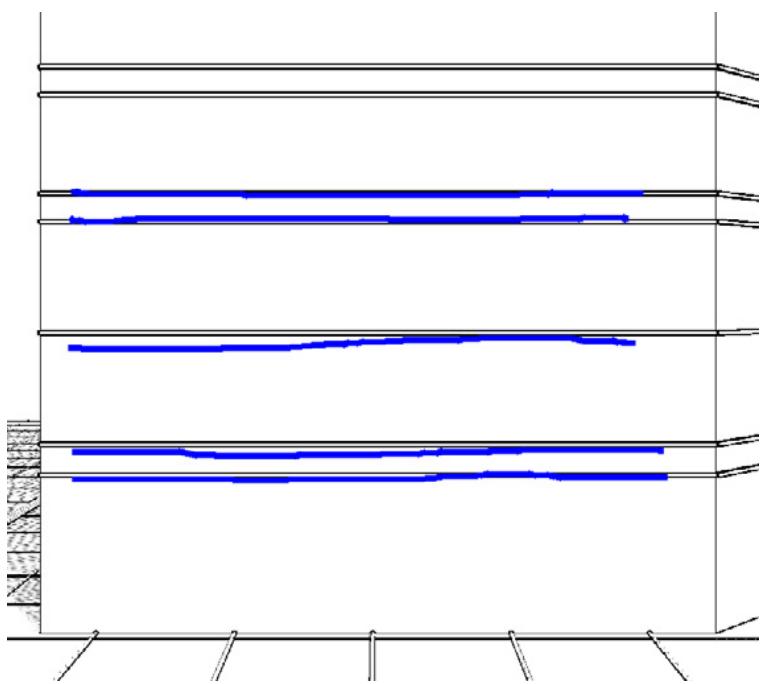
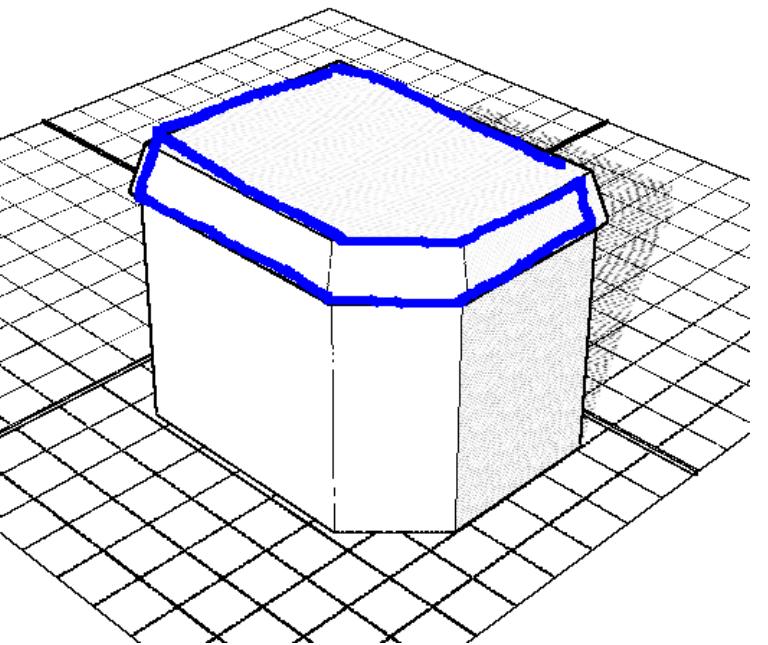
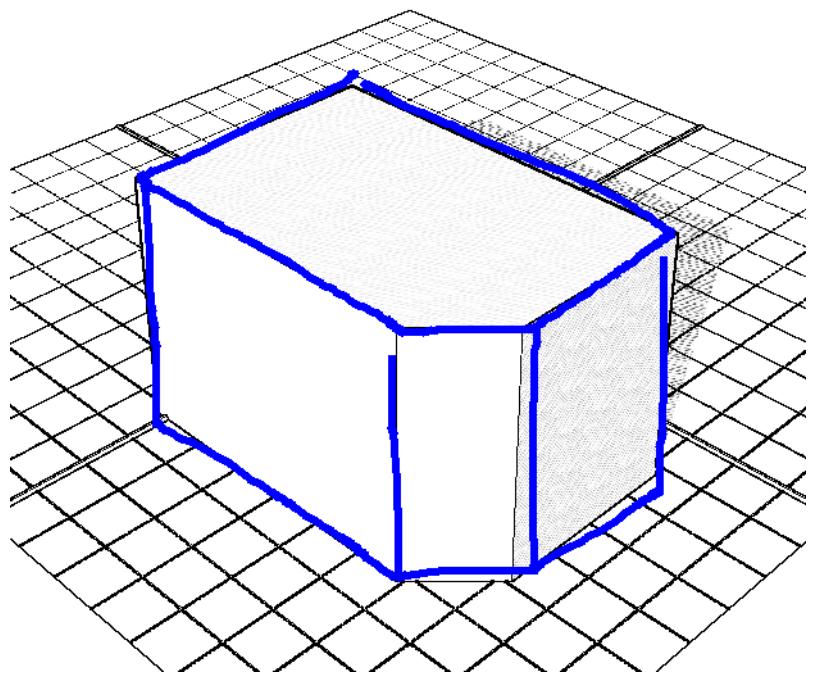
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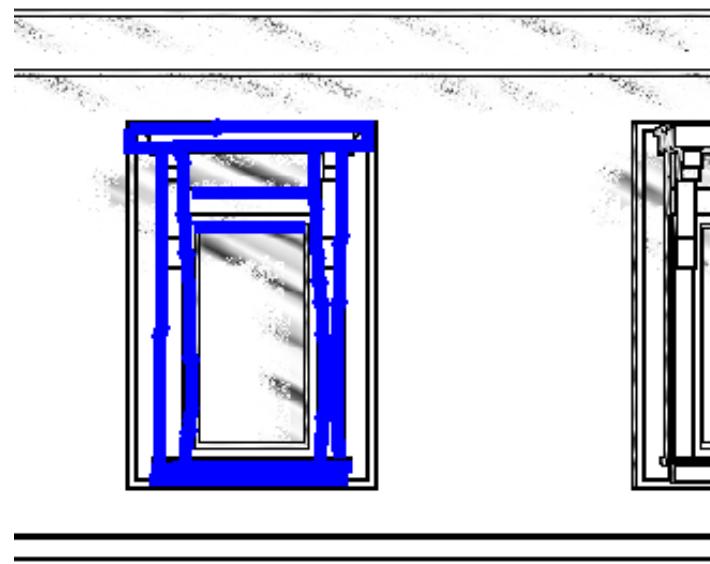
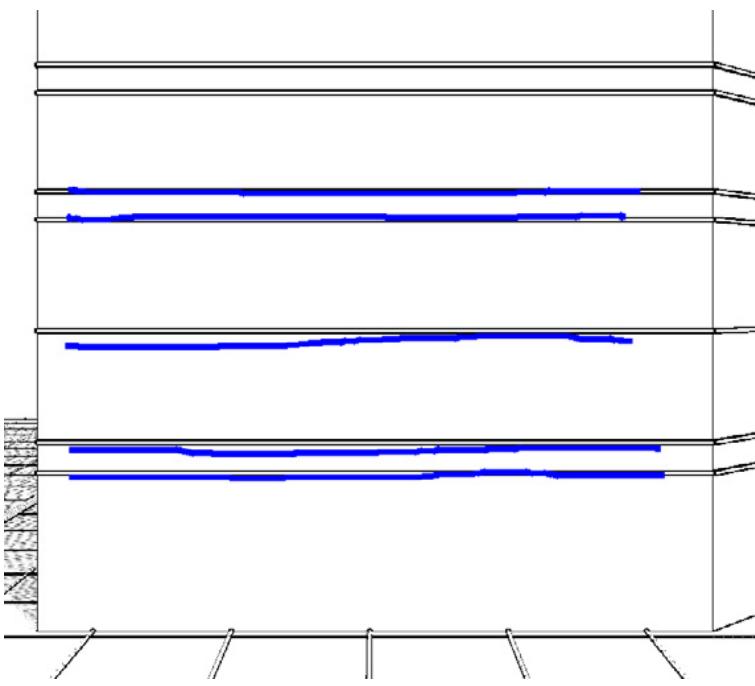
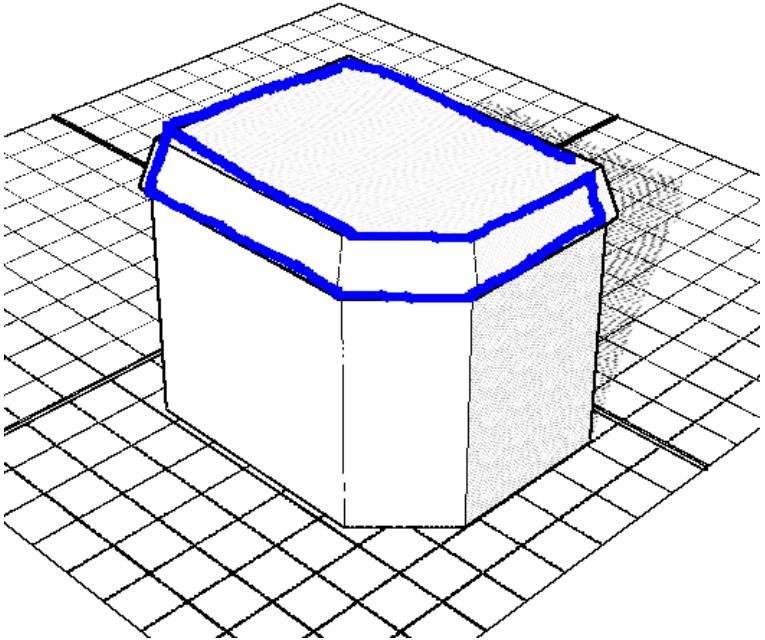
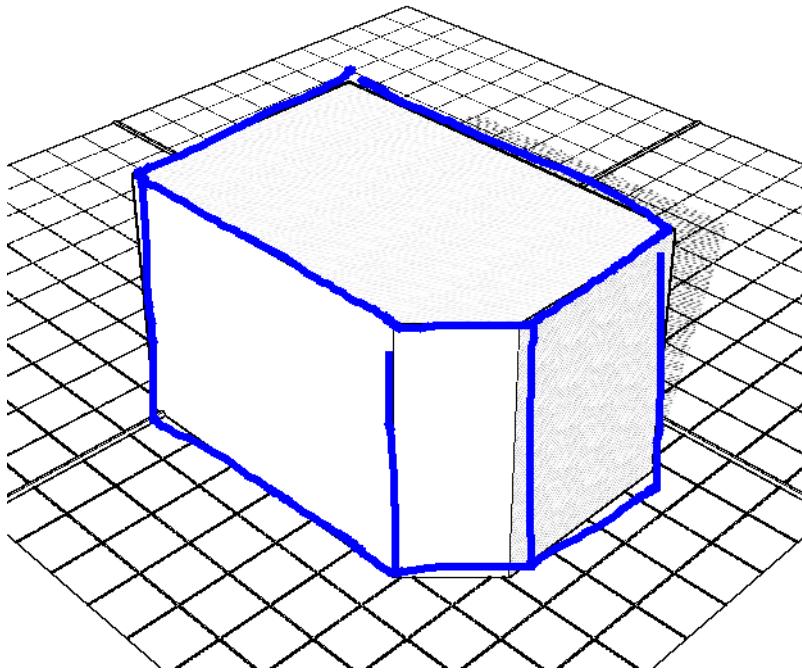


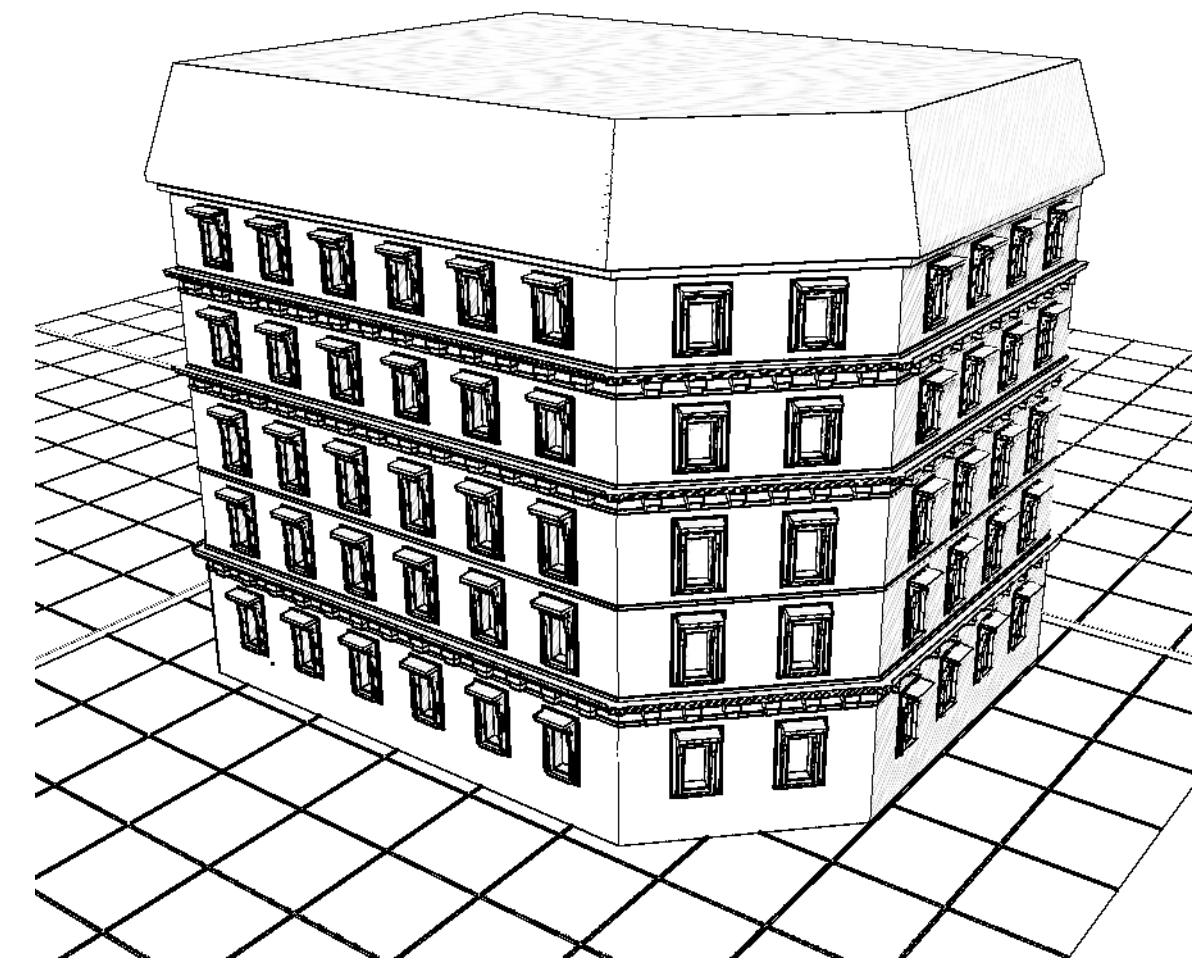
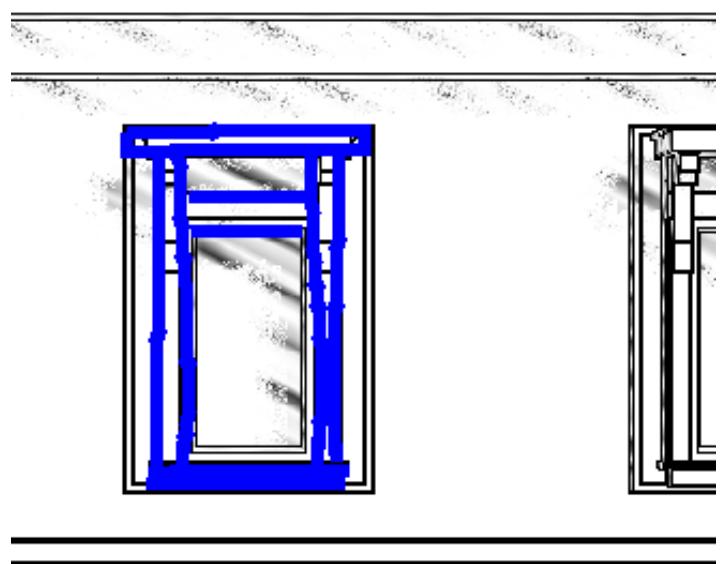
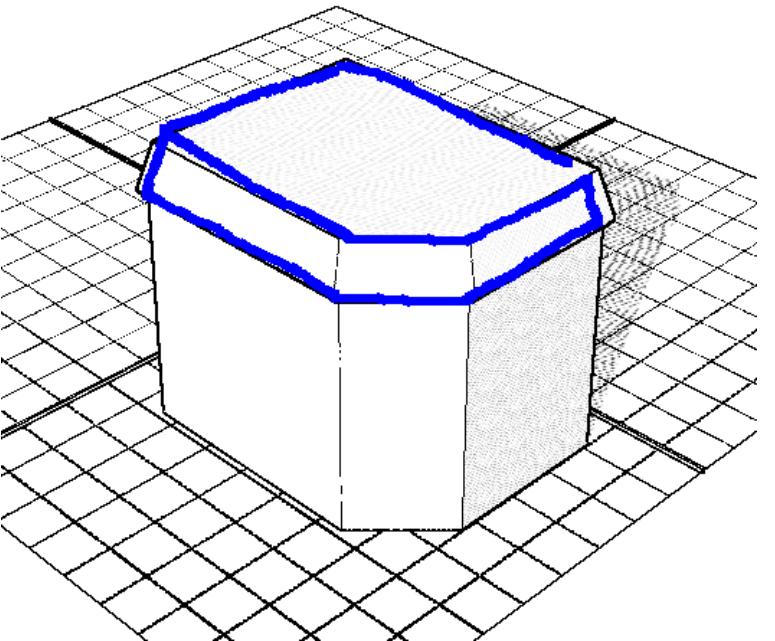
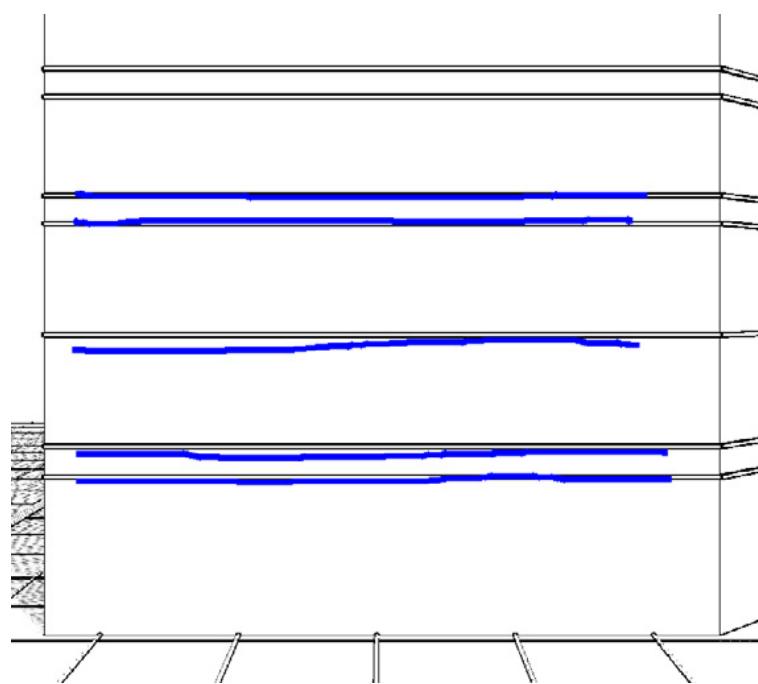
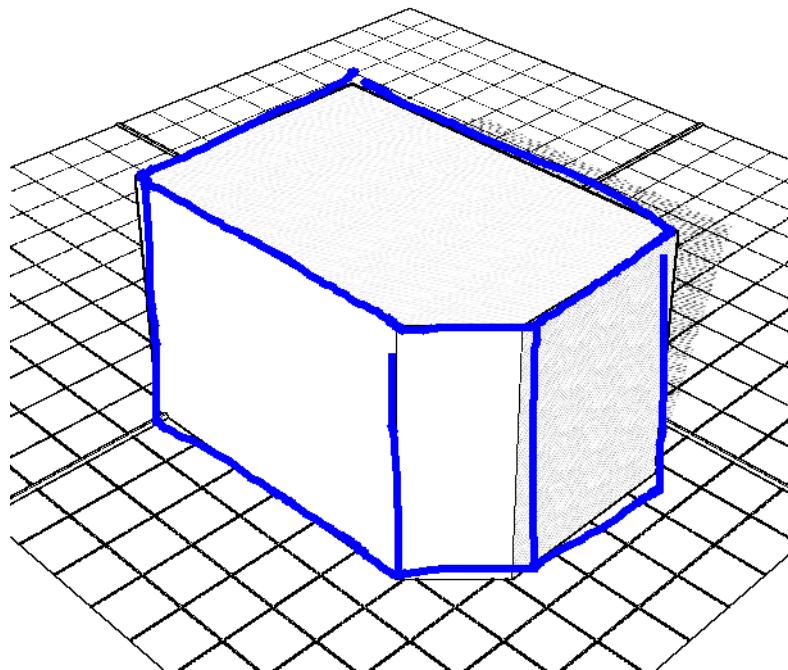


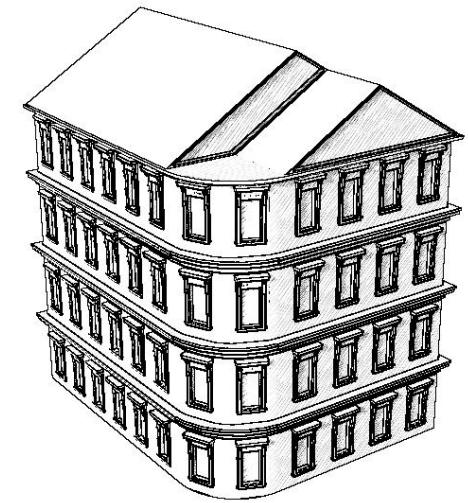
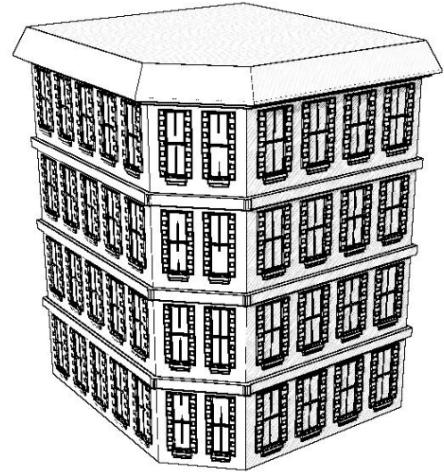
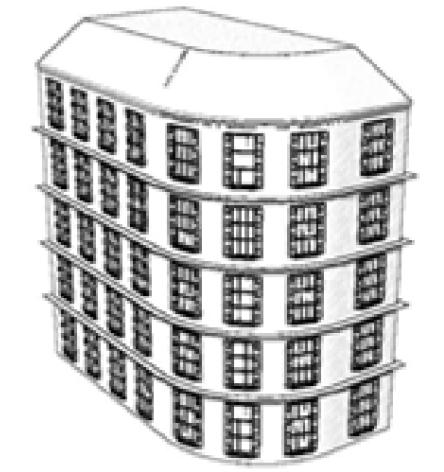
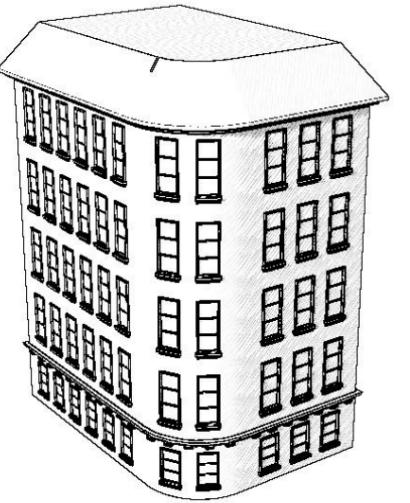
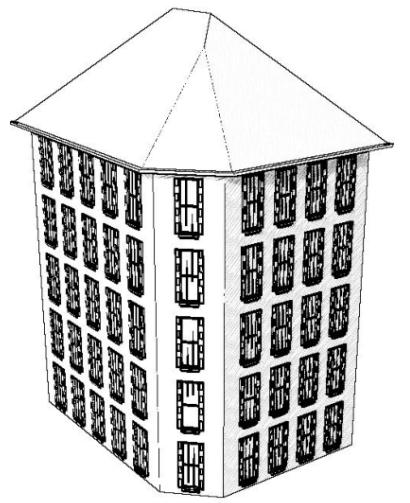
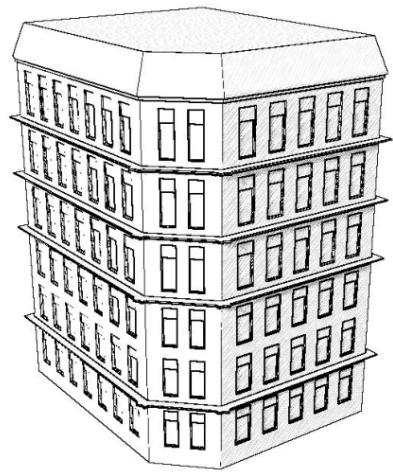




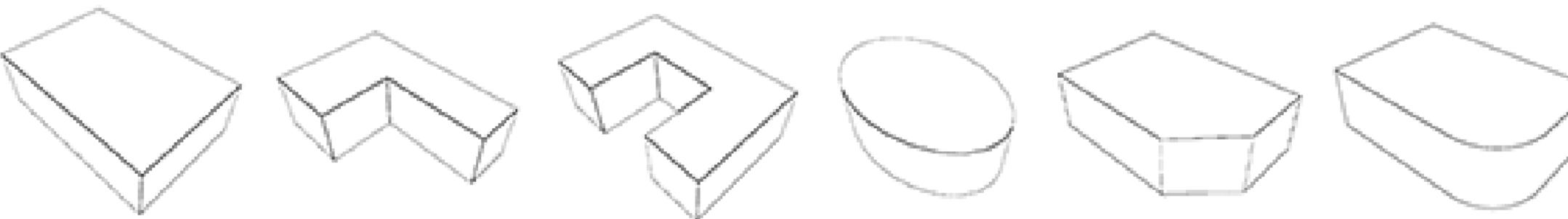




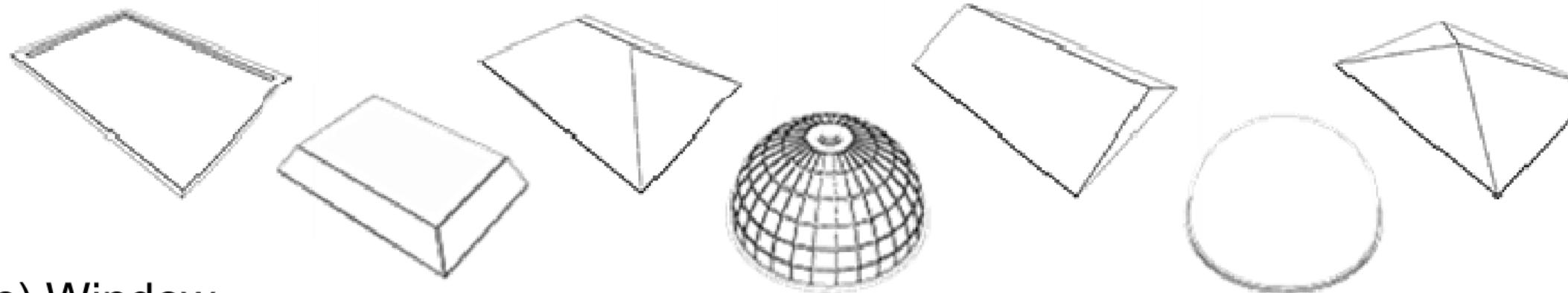




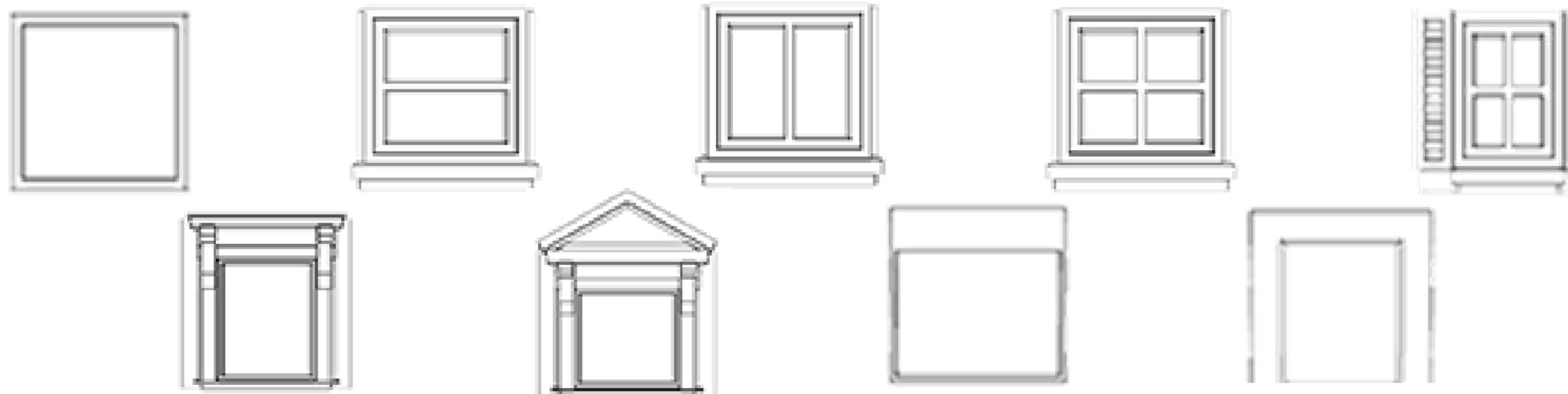
a) Building mass



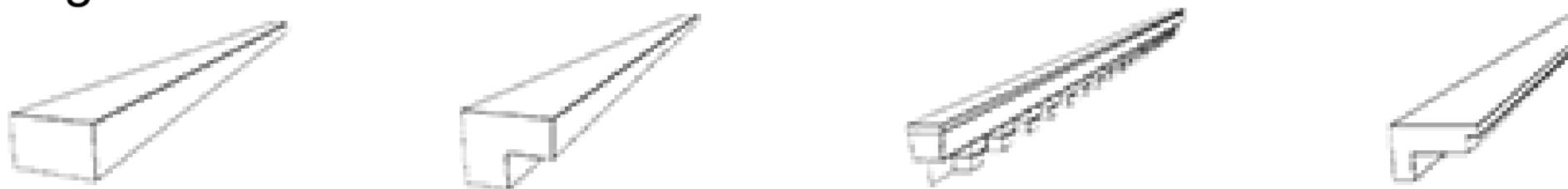
b) Roof



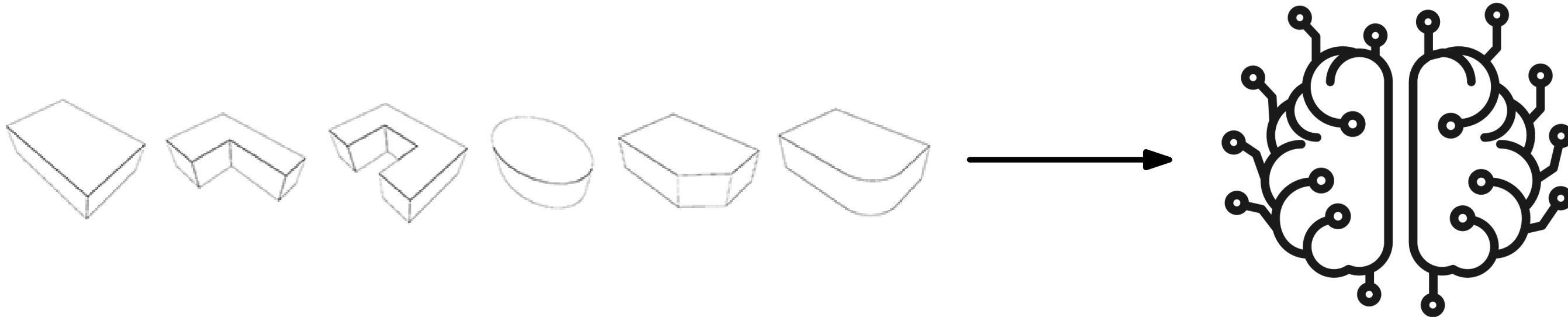
c) Window



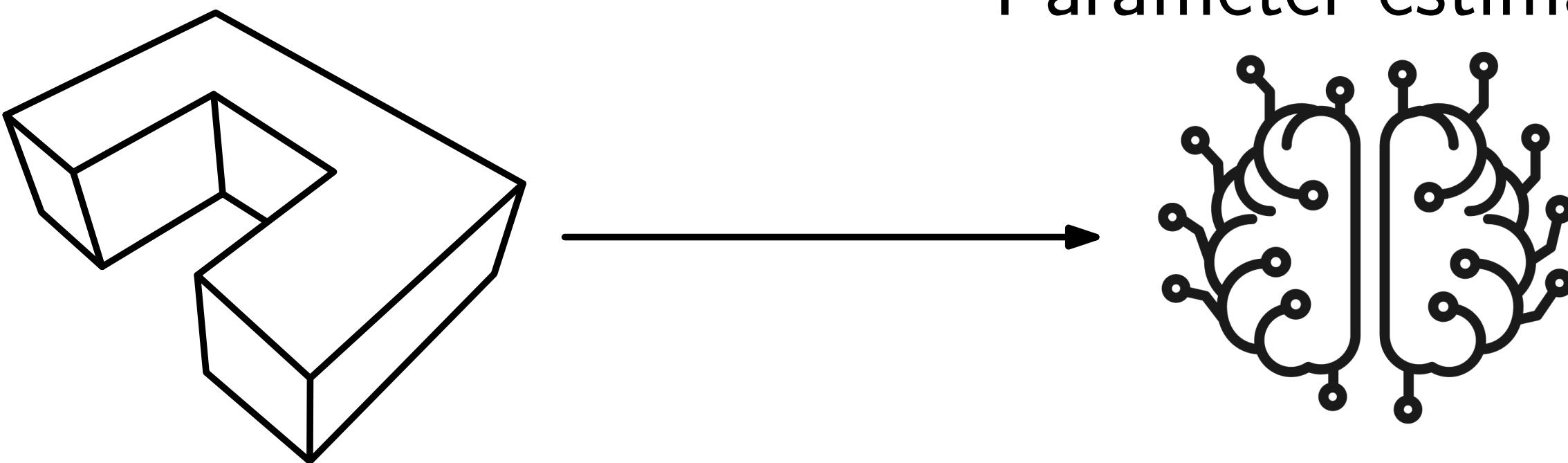
d) Ledge

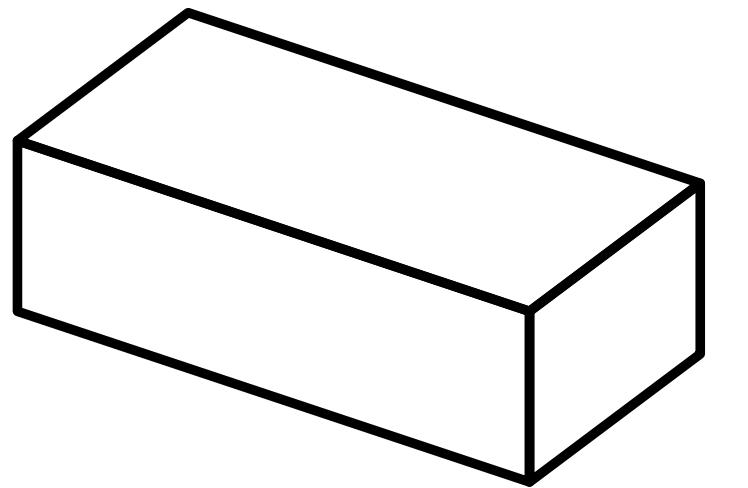


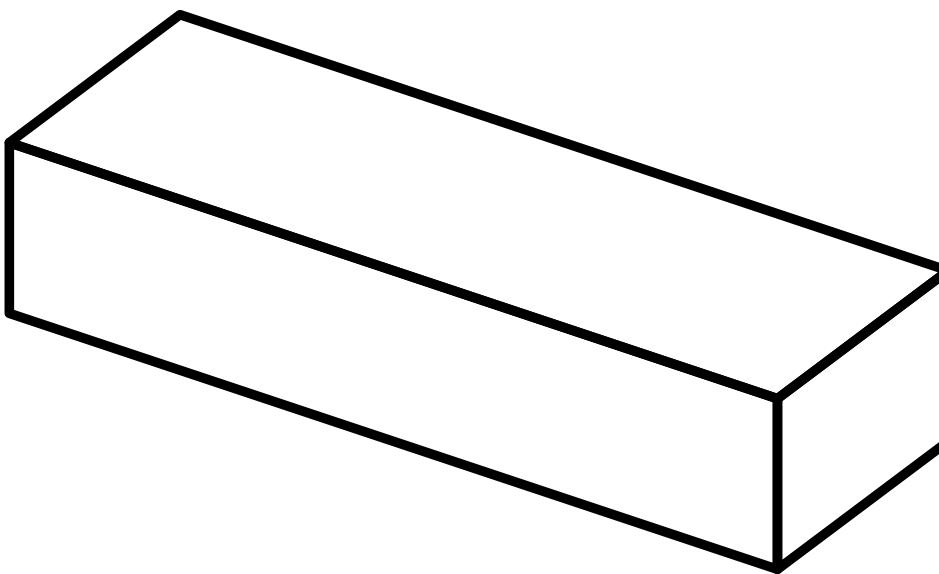
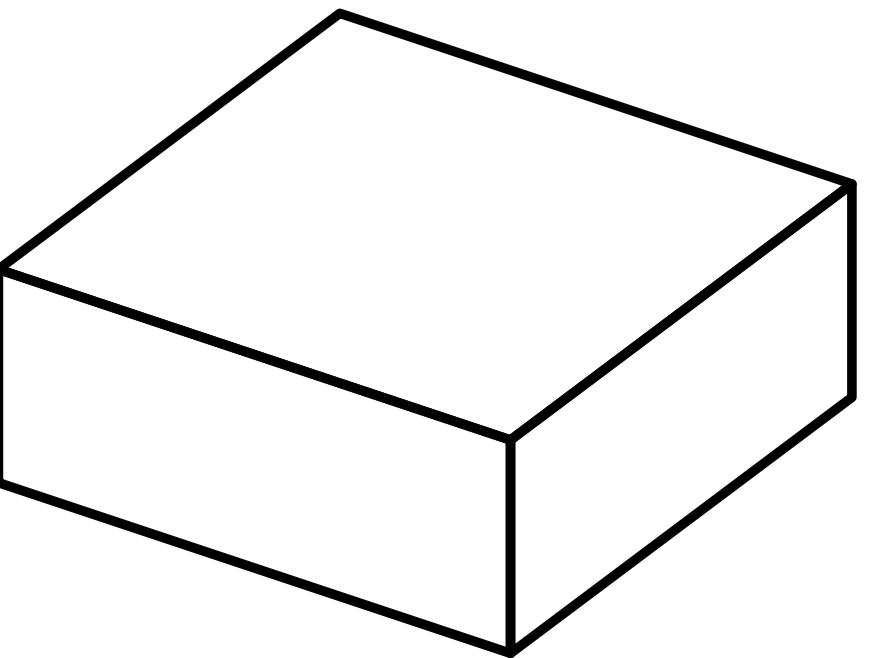
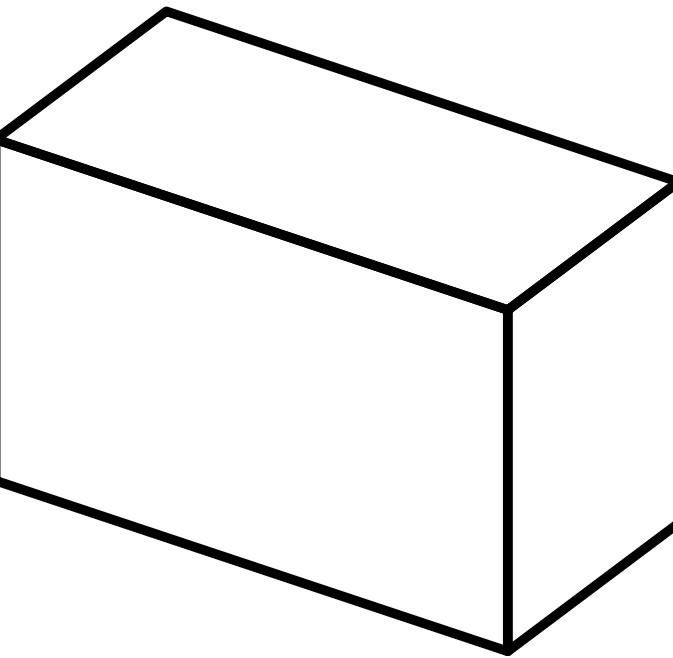
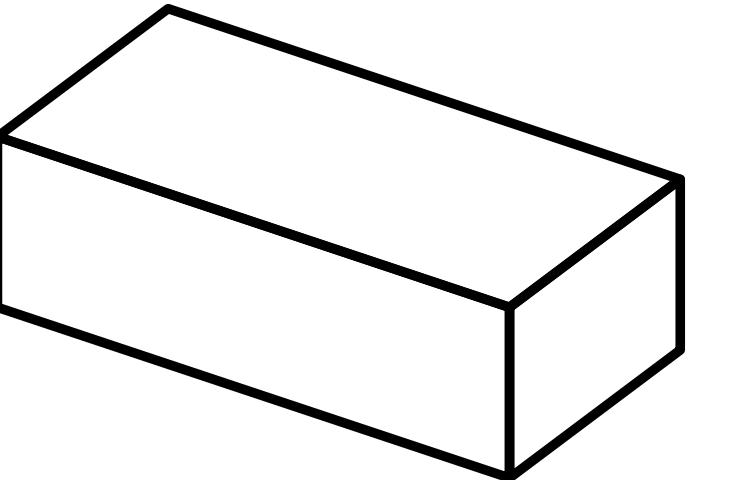
Recognition

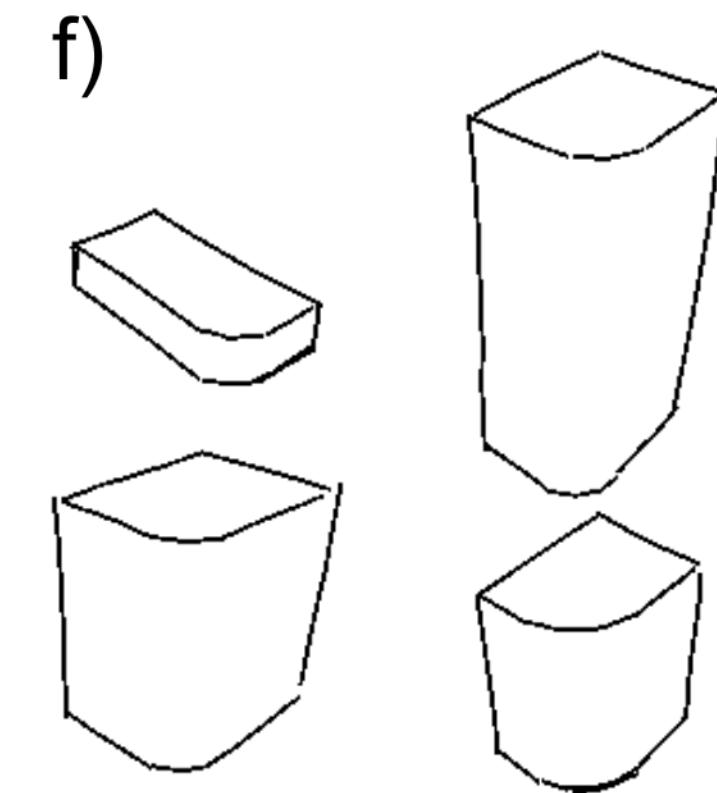
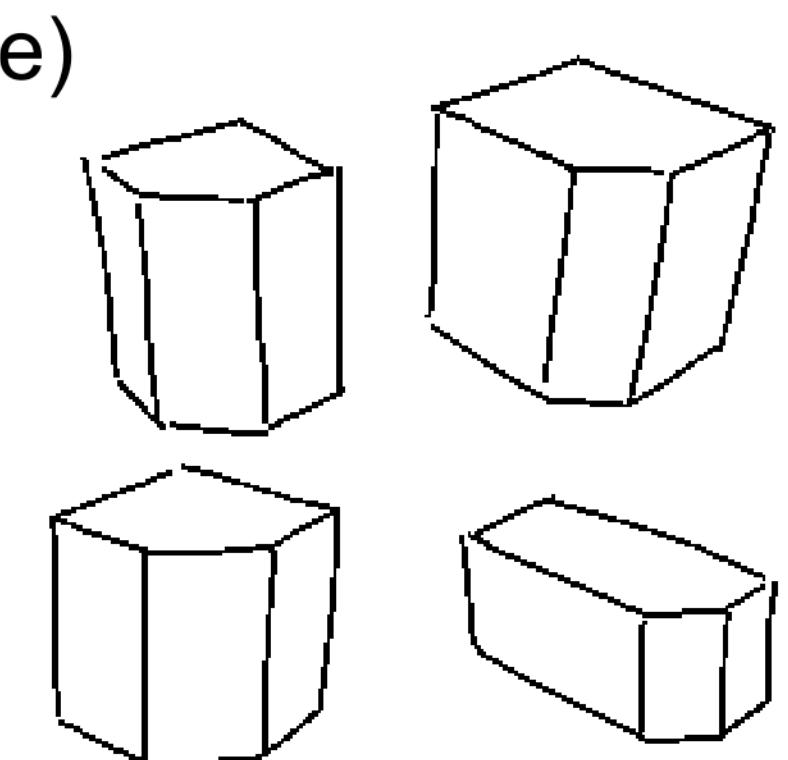
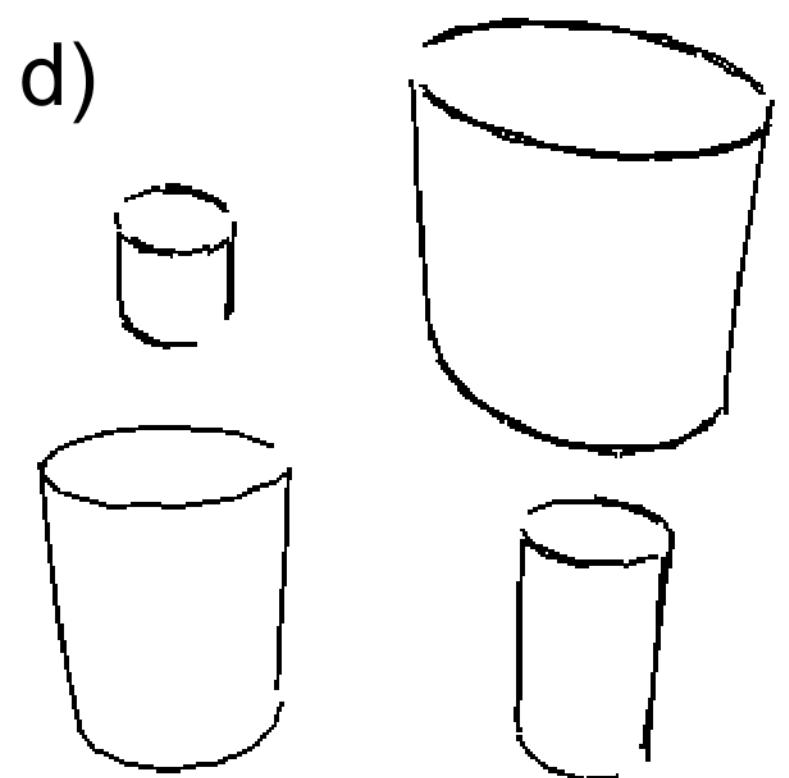
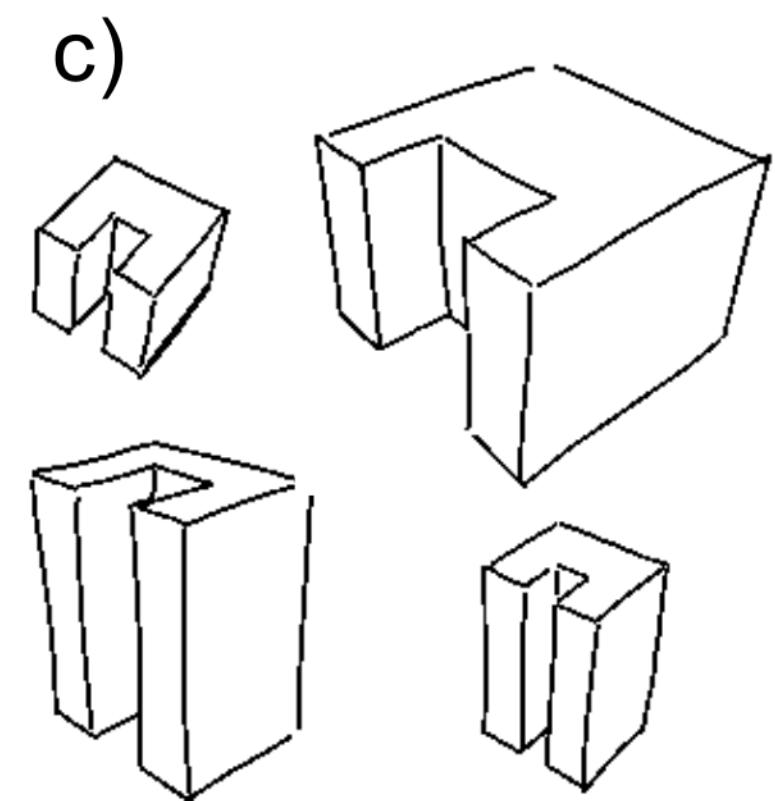
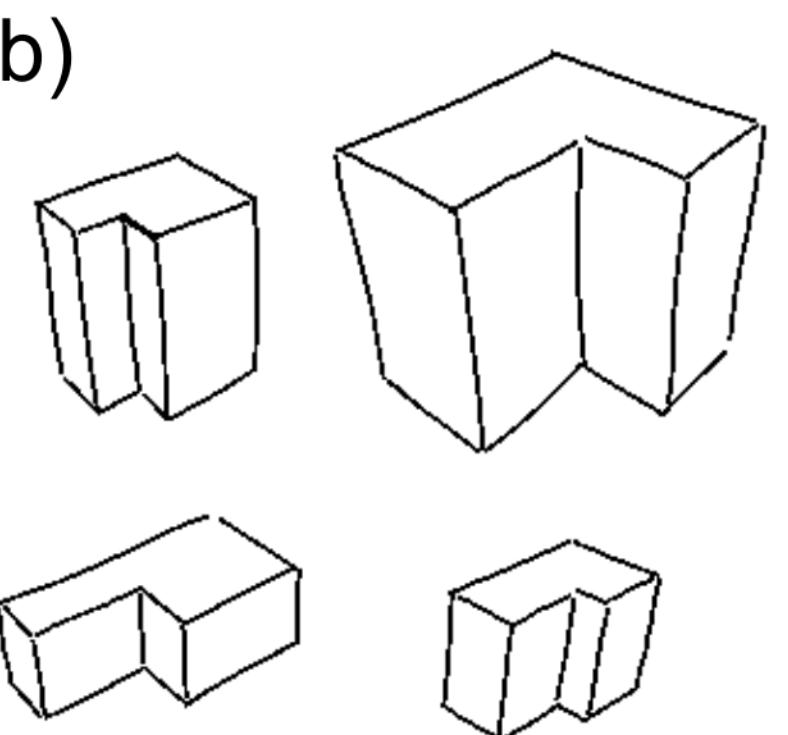
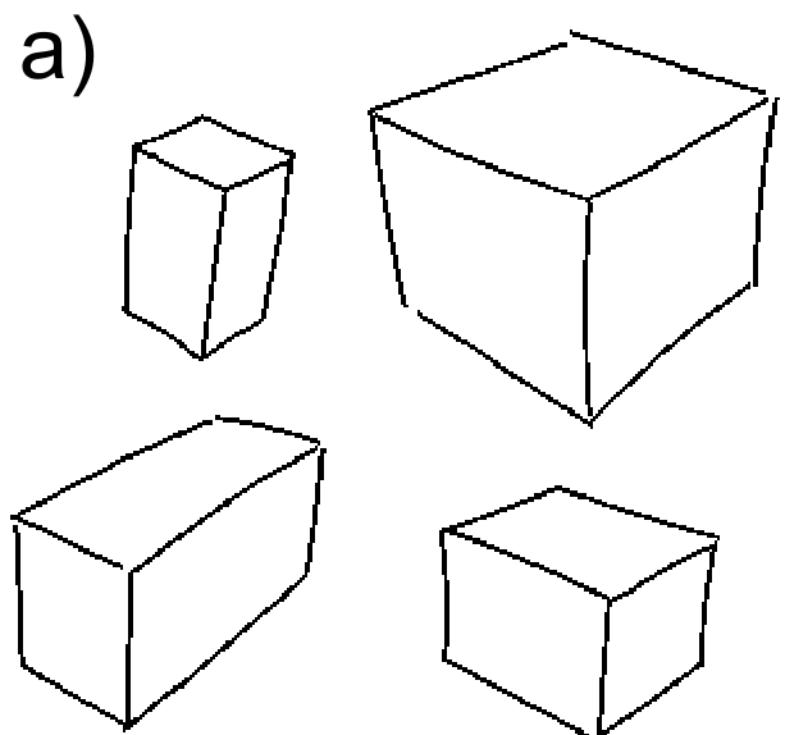


Parameter estimation

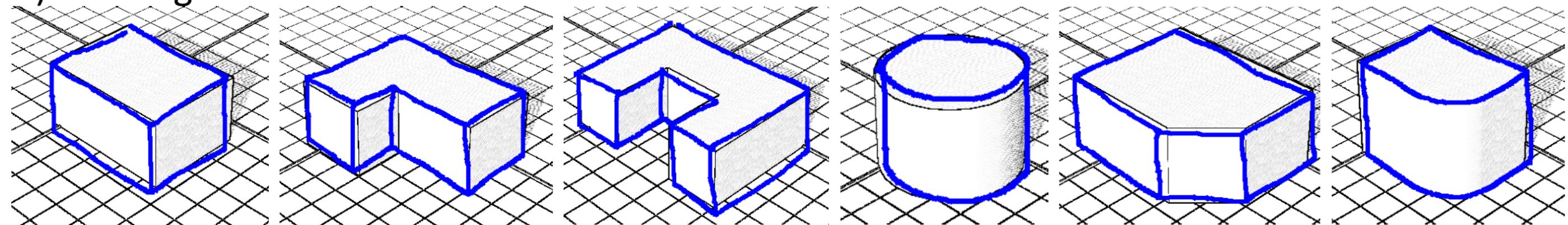




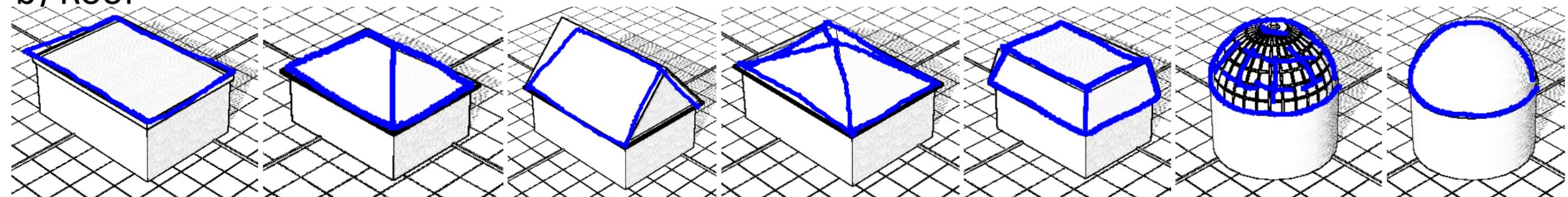




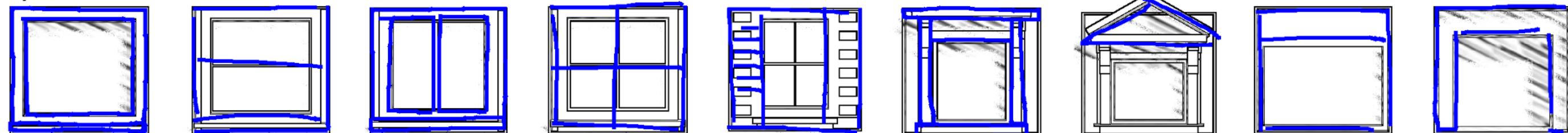
a) Building mass



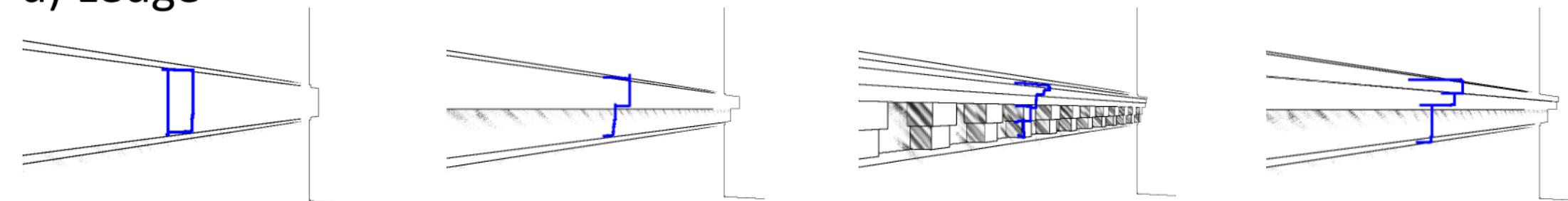
b) Roof



c) Window



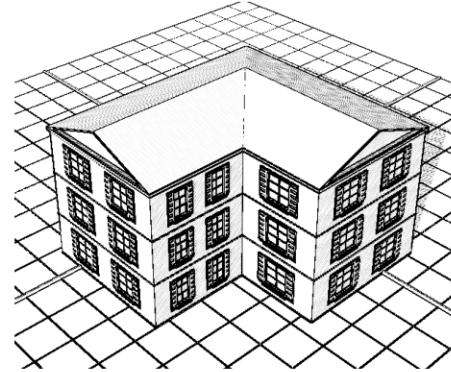
d) Ledge



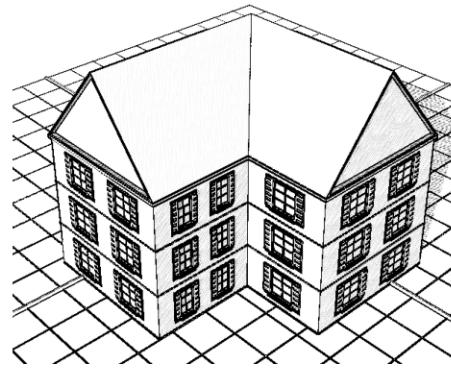
a)

Grammar

```
...
<param roof_slope="20"/>
...
<rule name="TopFace">
  <roofGable slope="roof_slope"/>
</rule>
```



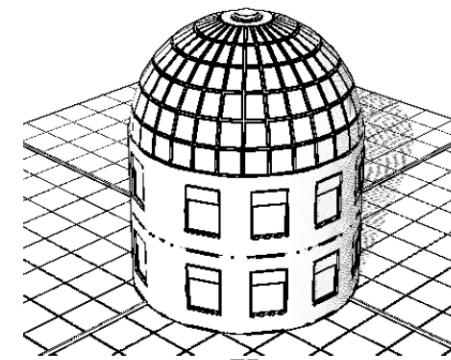
```
...
<param roof_slope="50"/>
...
<rule name="TopFace">
  <roofGable slope="roof_slope"/>
</rule>
```



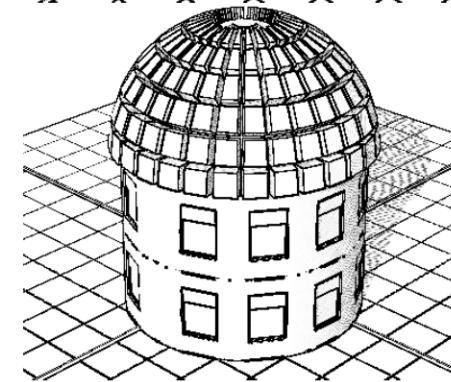
b)

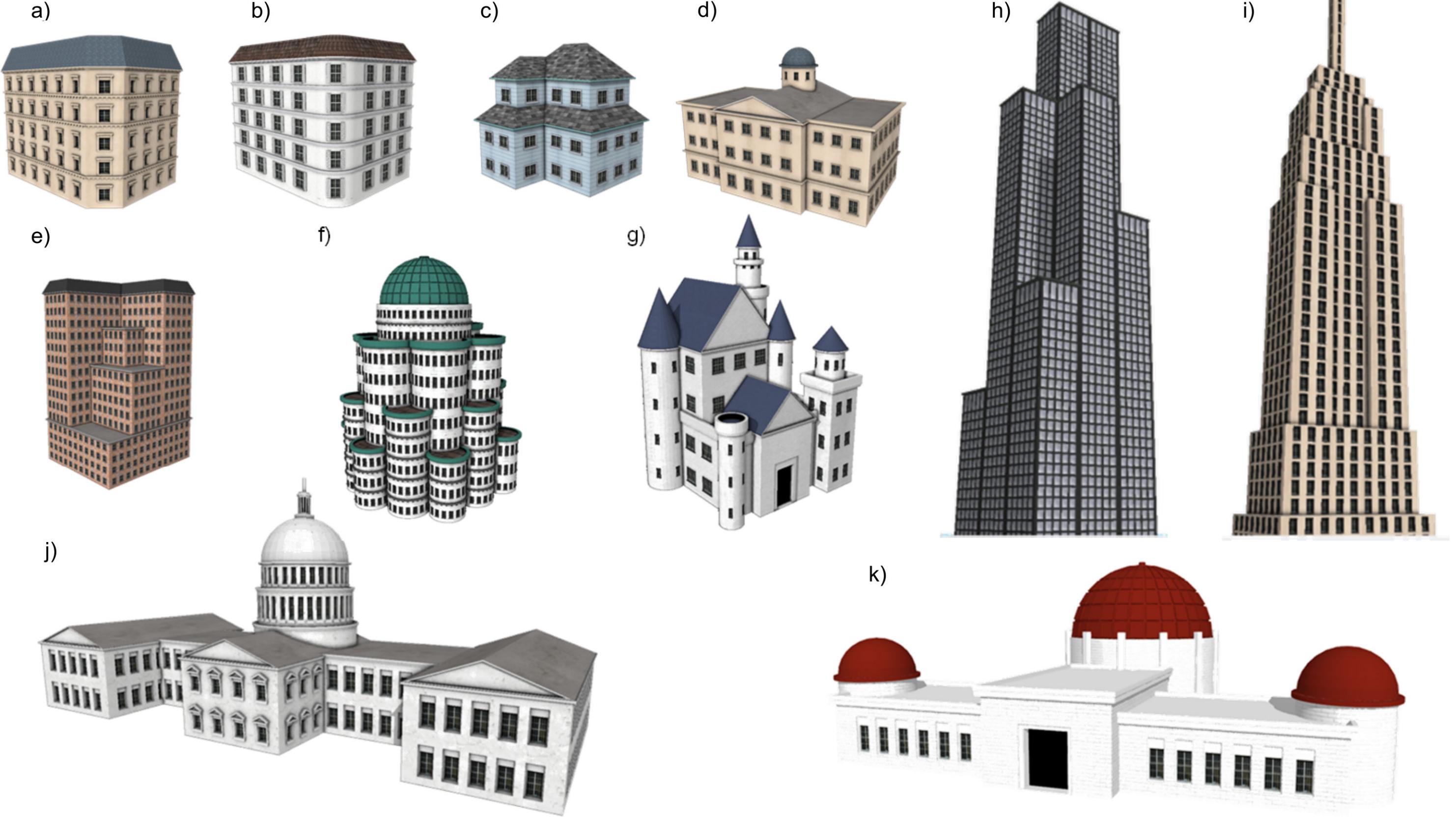
Grammar

```
...
<param panel_height="0.1"/>
...
<rule name="RoofPanel">
  <extrude height="panel_height "/>
</rule>
```



```
...
<param panel_height="1"/>
...
<rule name="RoofPanel">
  <extrude height="panel_height "/>
</rule>
```





<https://www.youtube.com/watch?v=rn4T9Y9PbgQ>

Assignment 5

Name two other types of content that could be generated through the same system with minimal adjustment.