

An Improved Fisheye Zoom Algorithm for Visualizing and Editing Hierarchical Models

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REV'07, October 15, New Delhi



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Outline

1. The problem
2. Fisheye zooming
3. Existing approaches
4. The algorithm
5. Conclusions & Demo

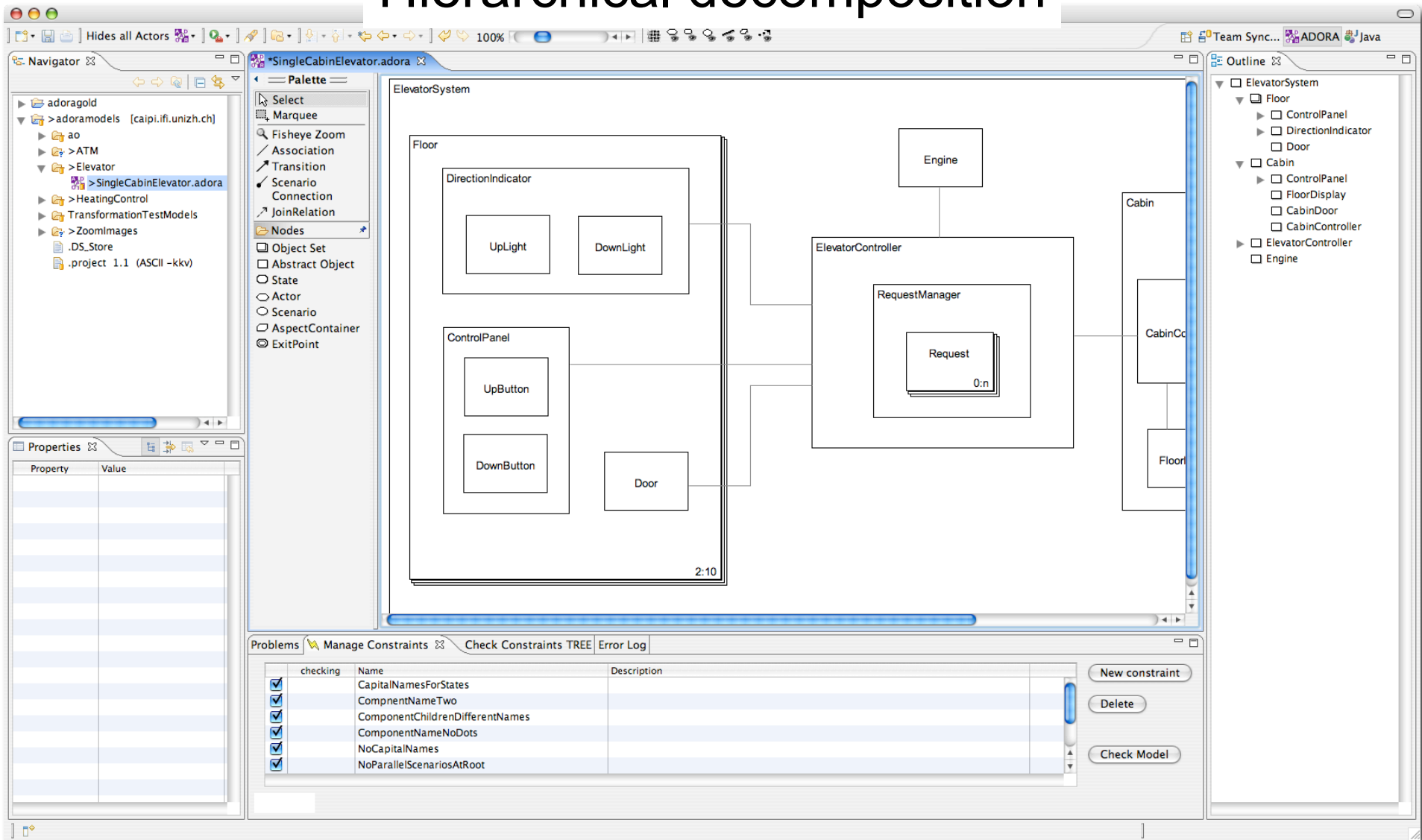


Outline

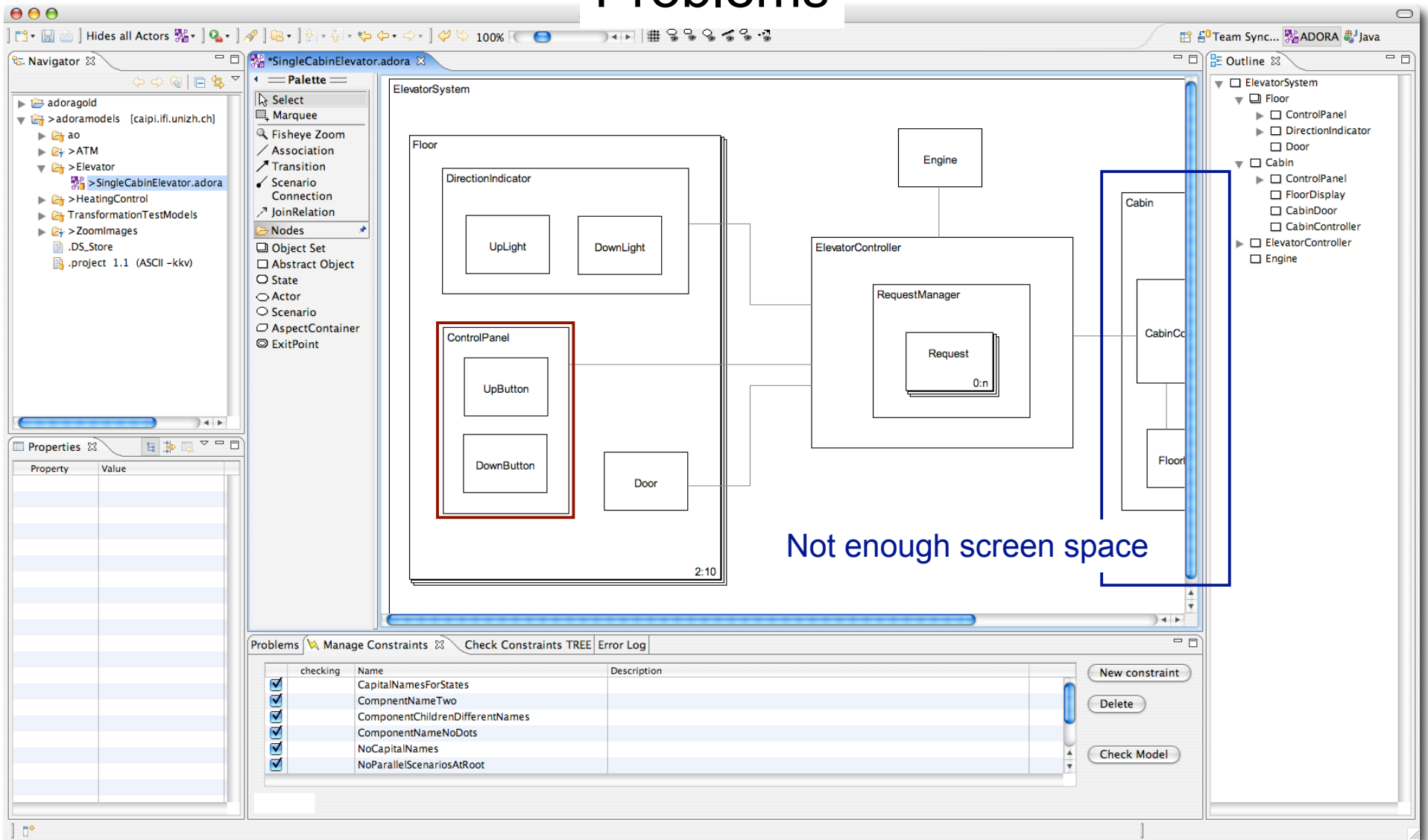
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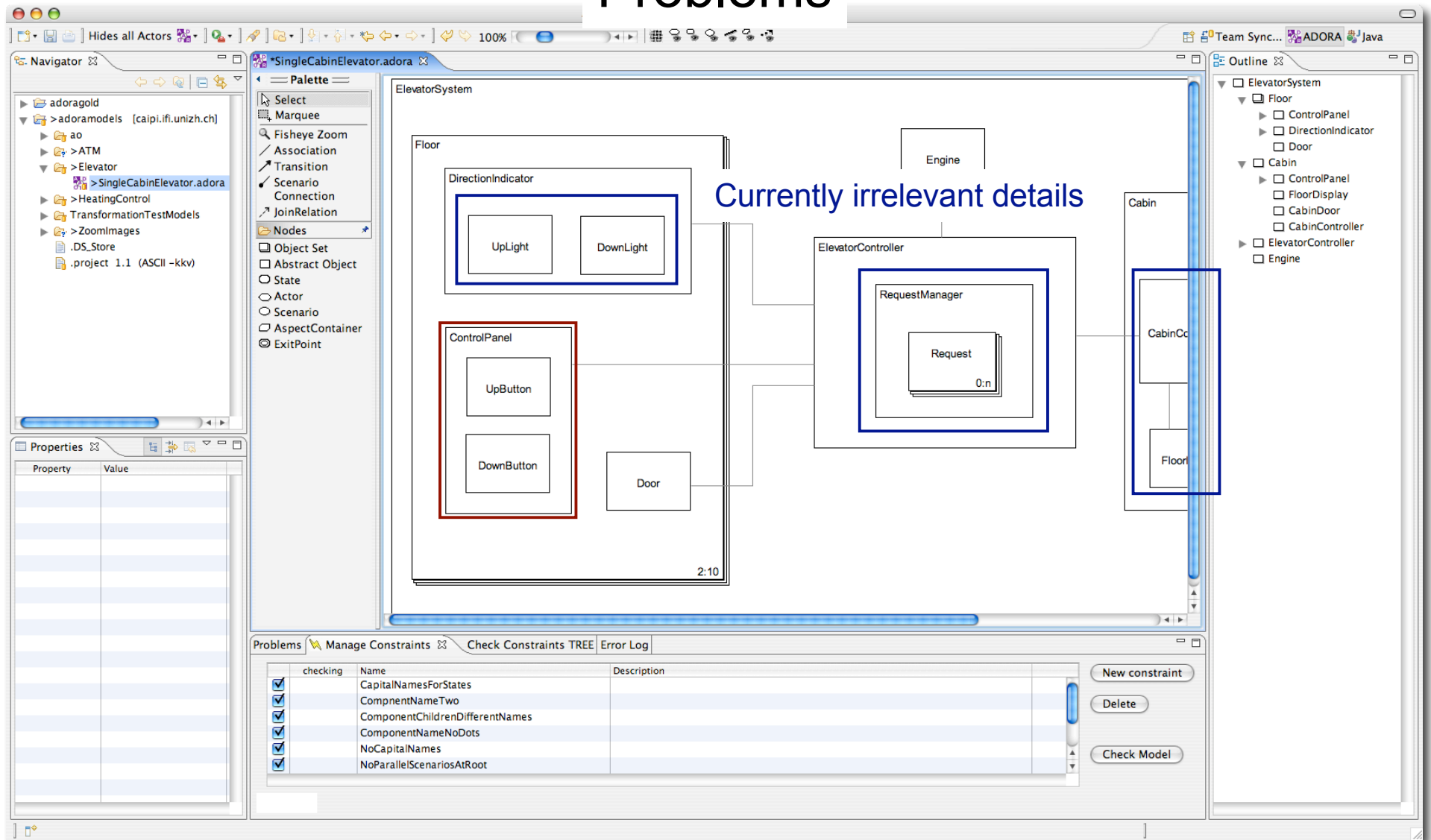
Hierarchical decomposition



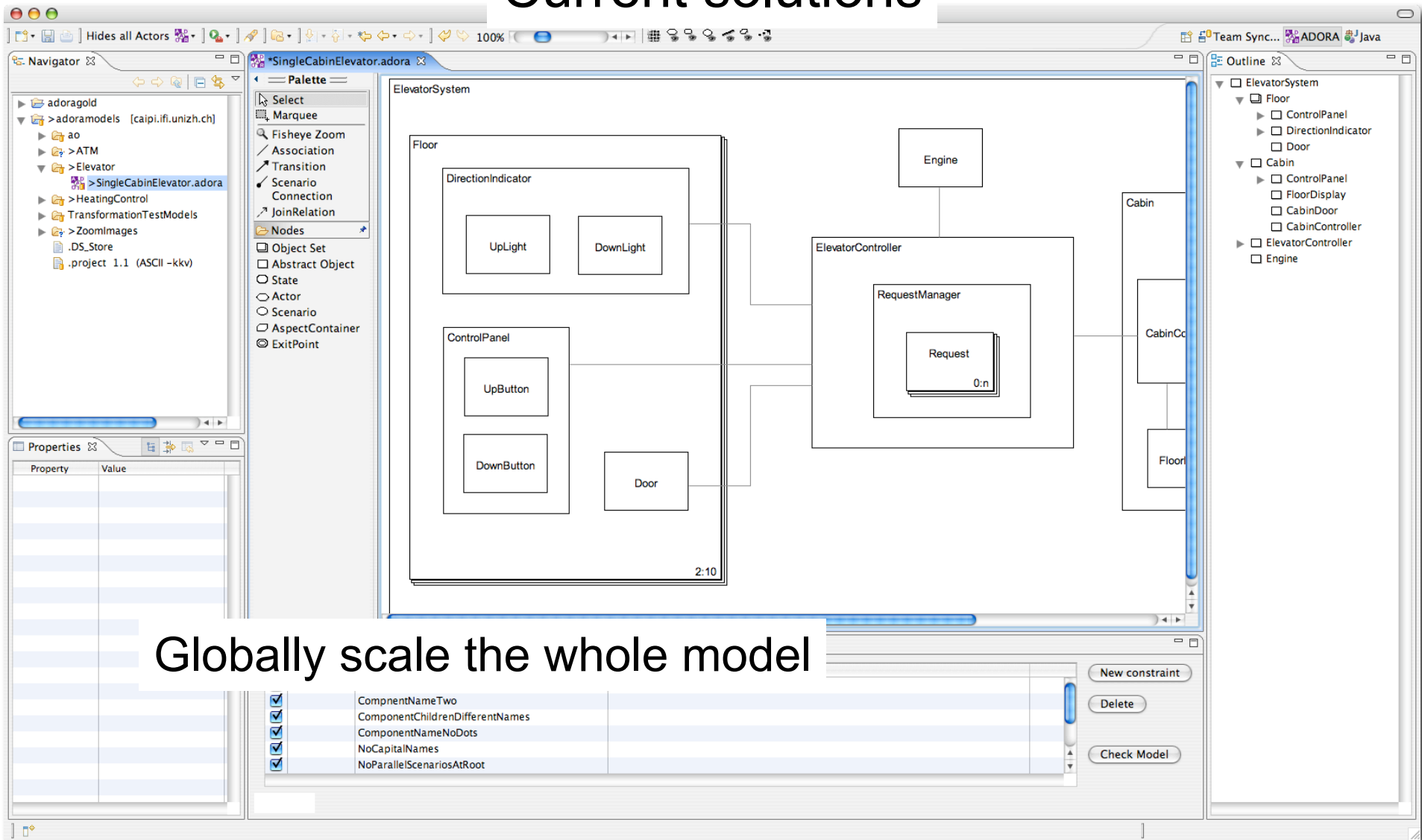
Problems



Problems



Current solutions



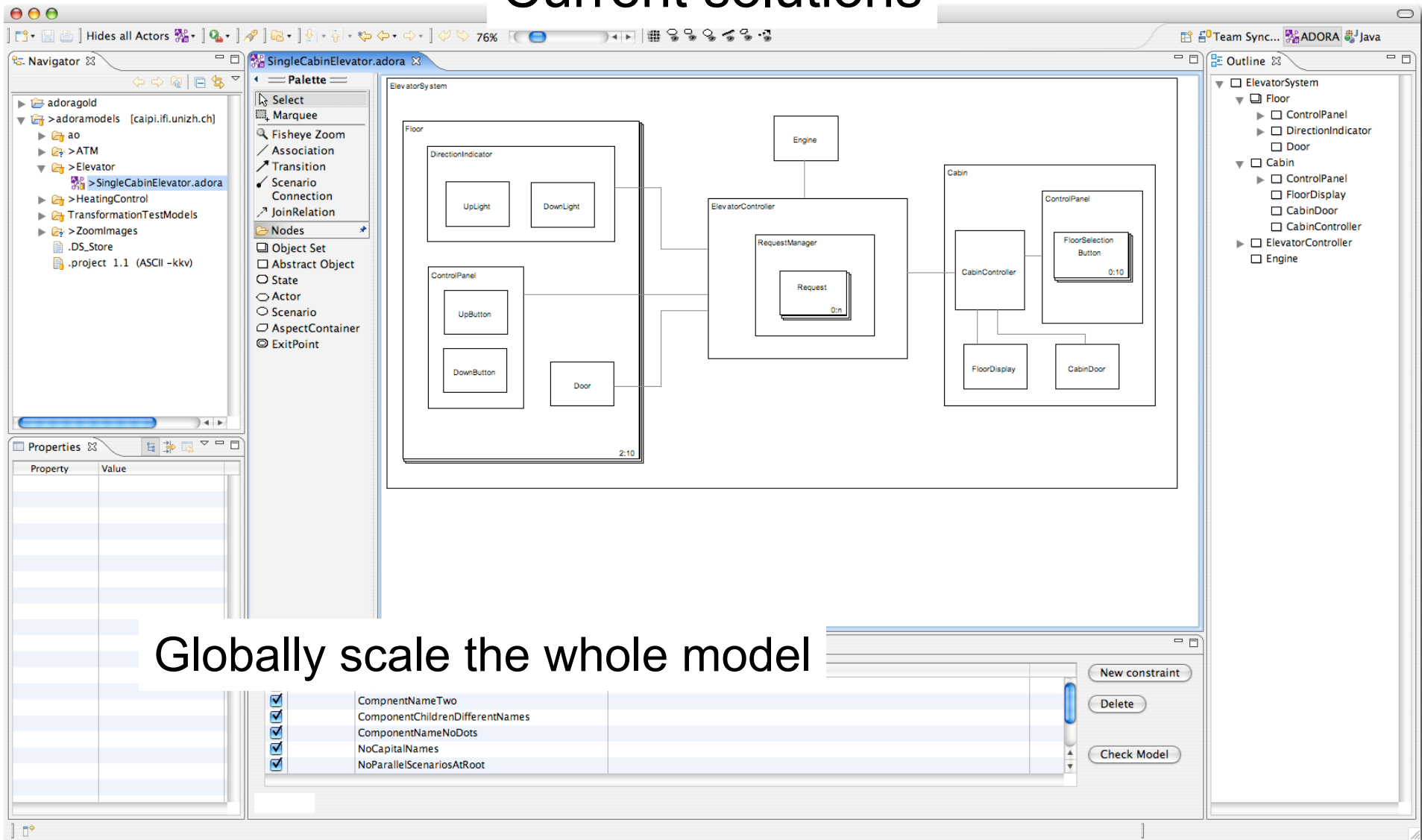
Globally scale the whole model



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Current solutions



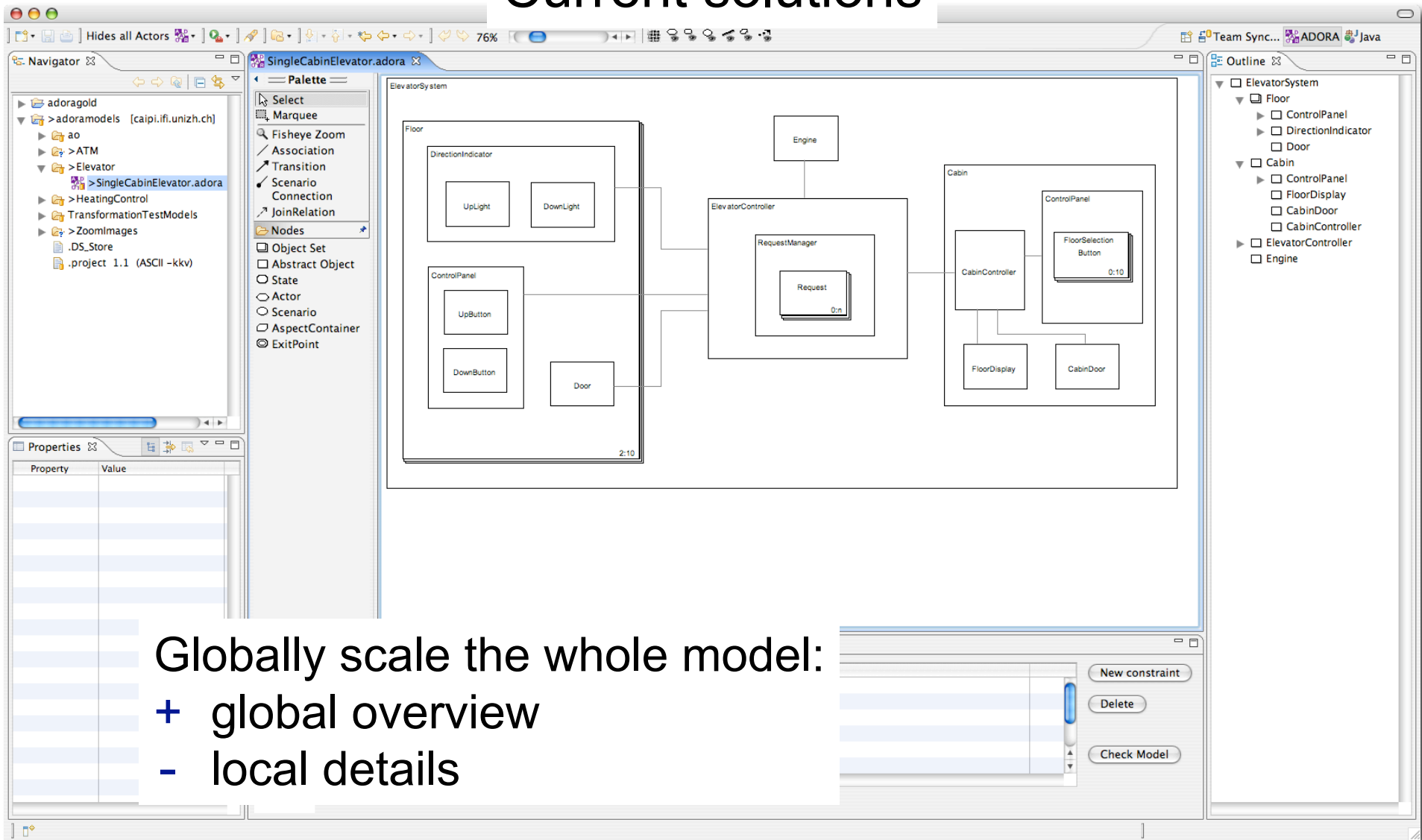
Globally scale the whole model



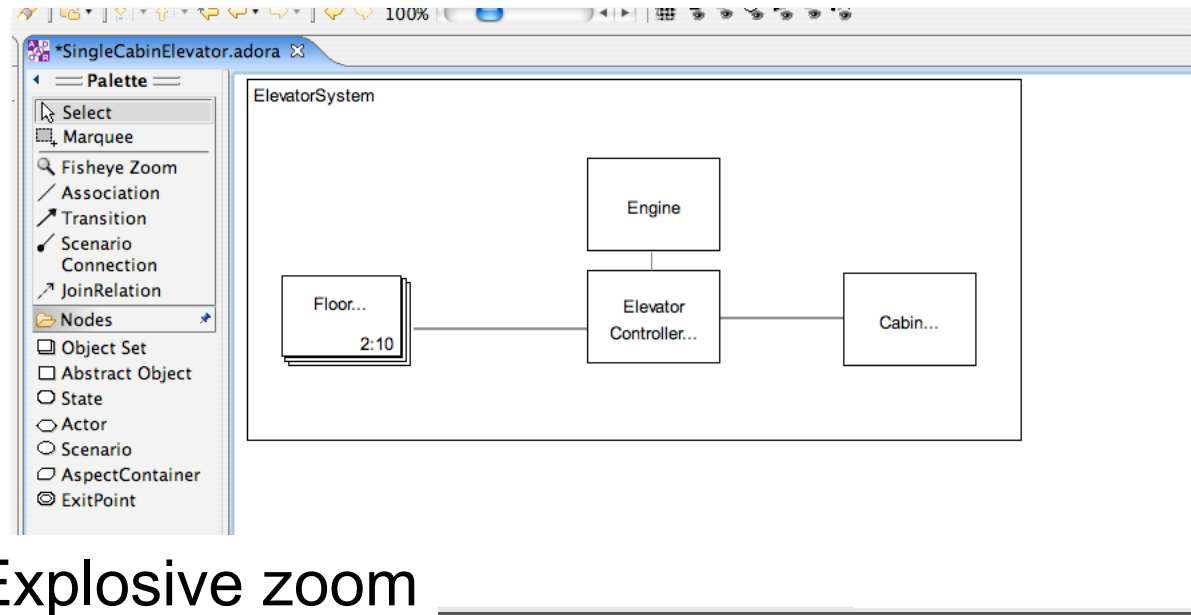
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Current solutions



Current solutions



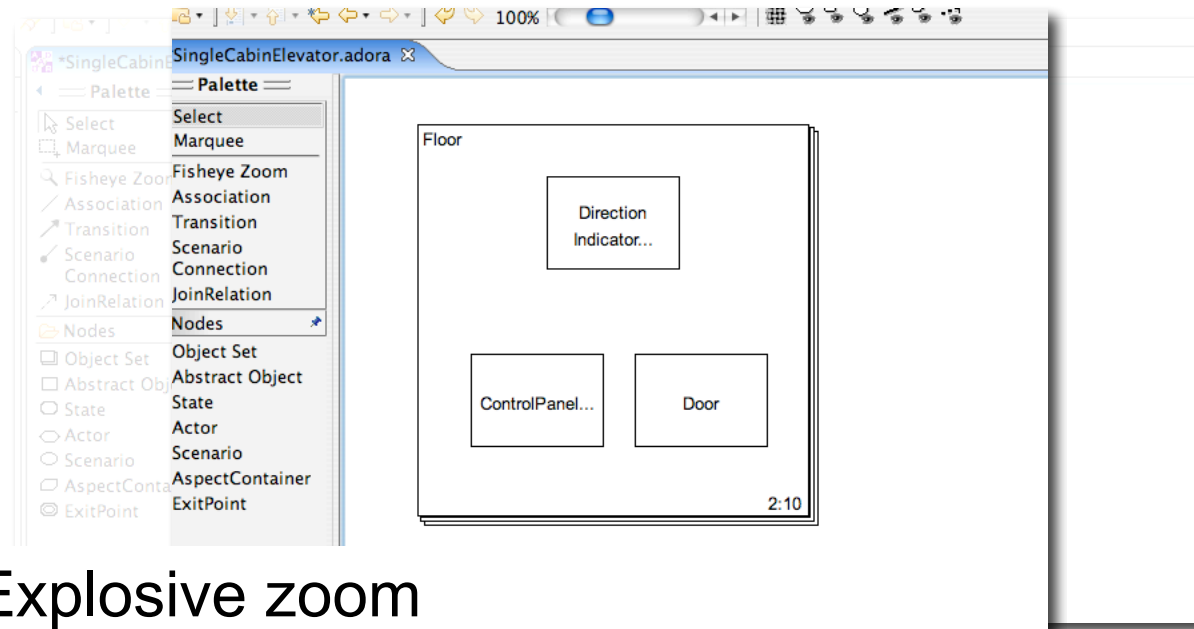
Explosive zoom



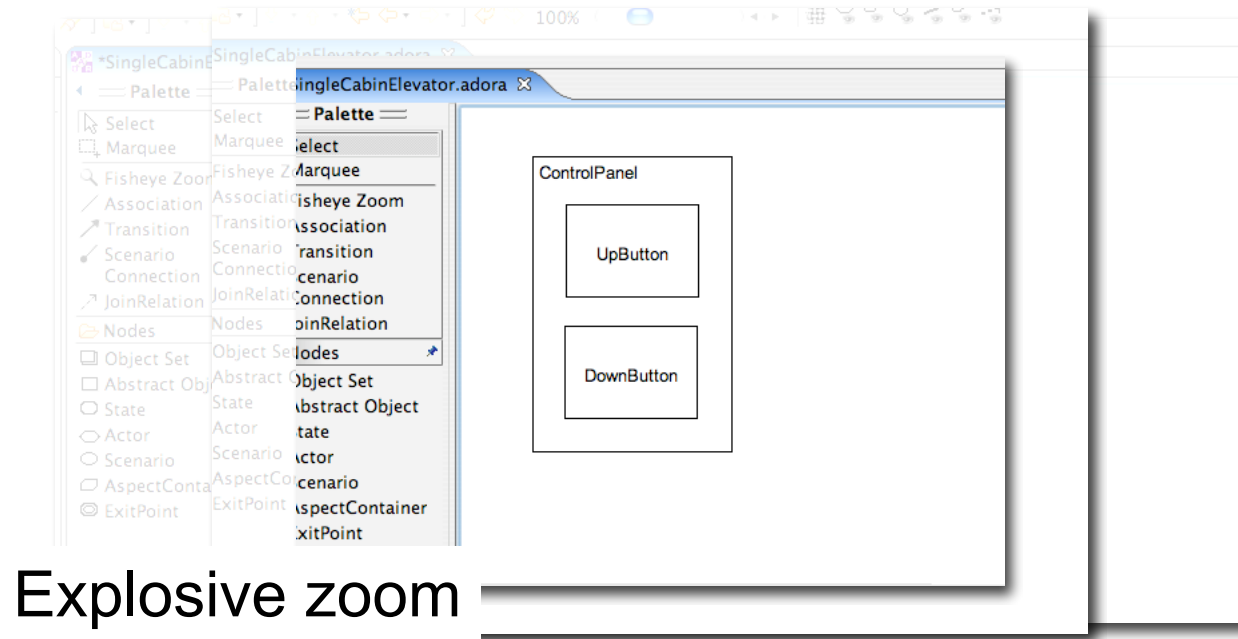
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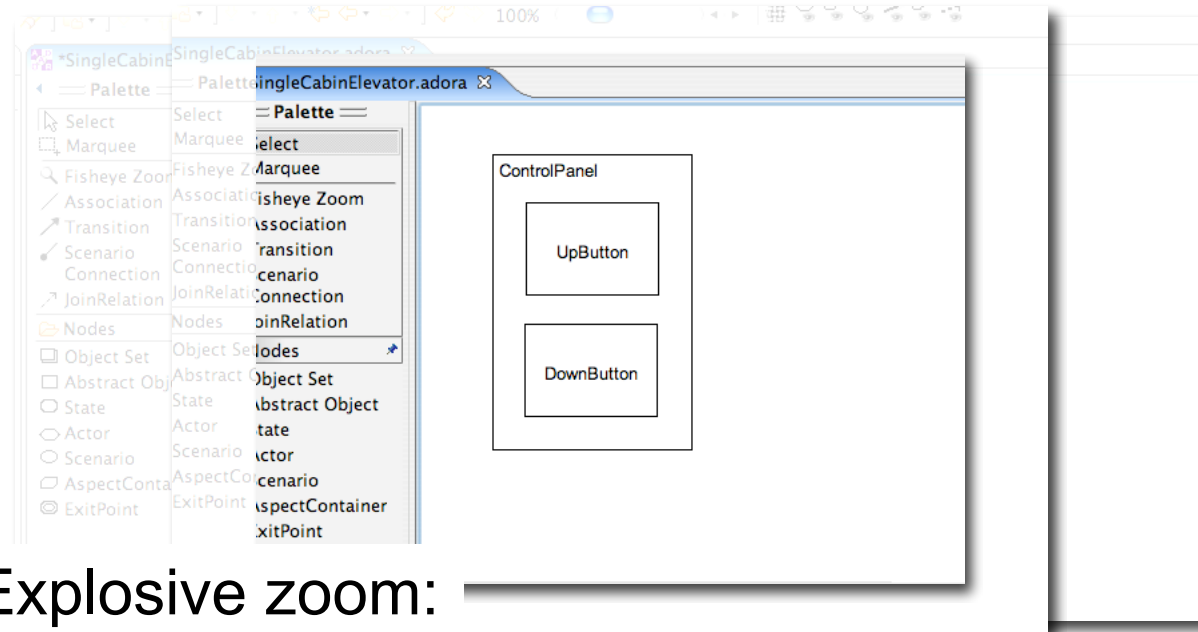
Current solutions



Current solutions



Current solutions



Explosive zoom:

- + local detail
- global context



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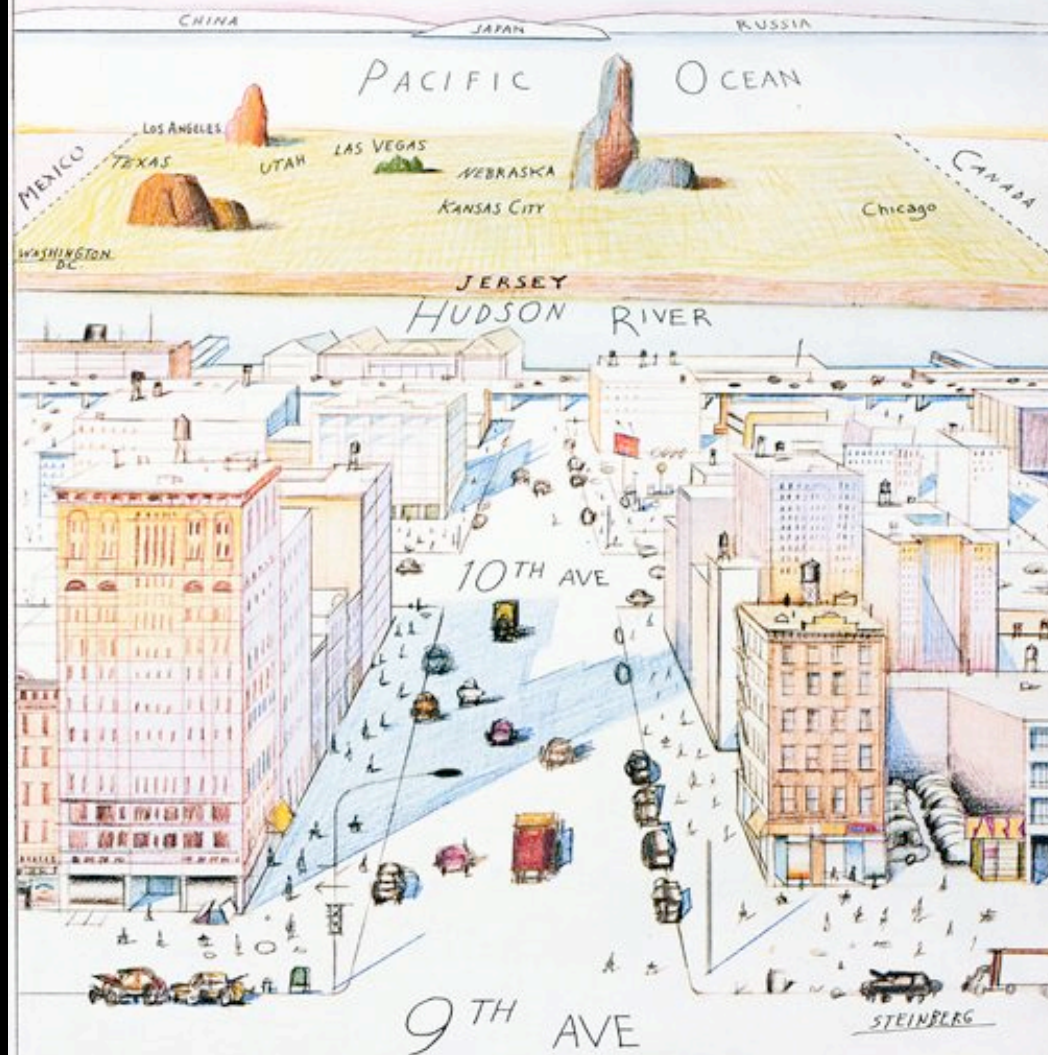
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Mar. 29, 1976

THE NEW YORKER

Price 75 cents



Mar.29,1976

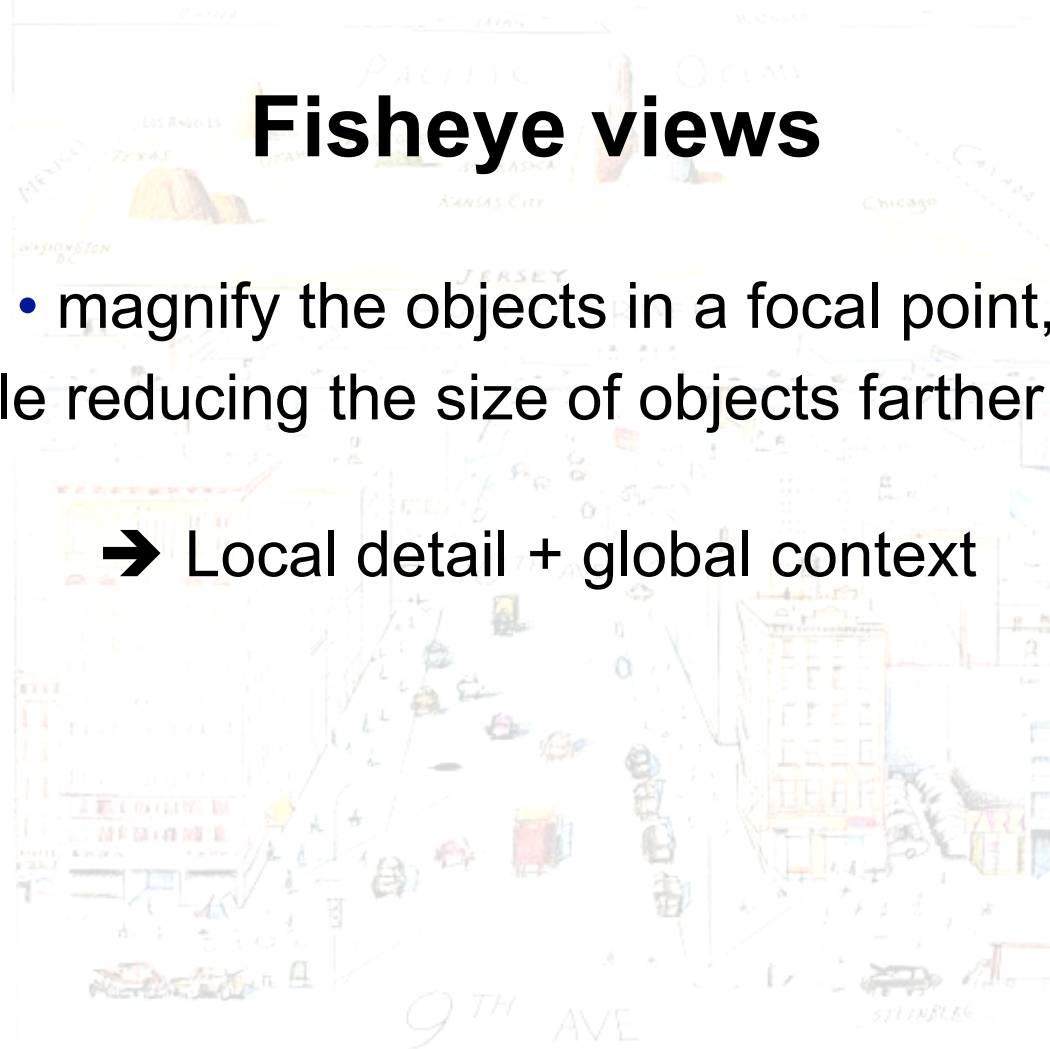
THE NEW YORKER

Price 75 cents

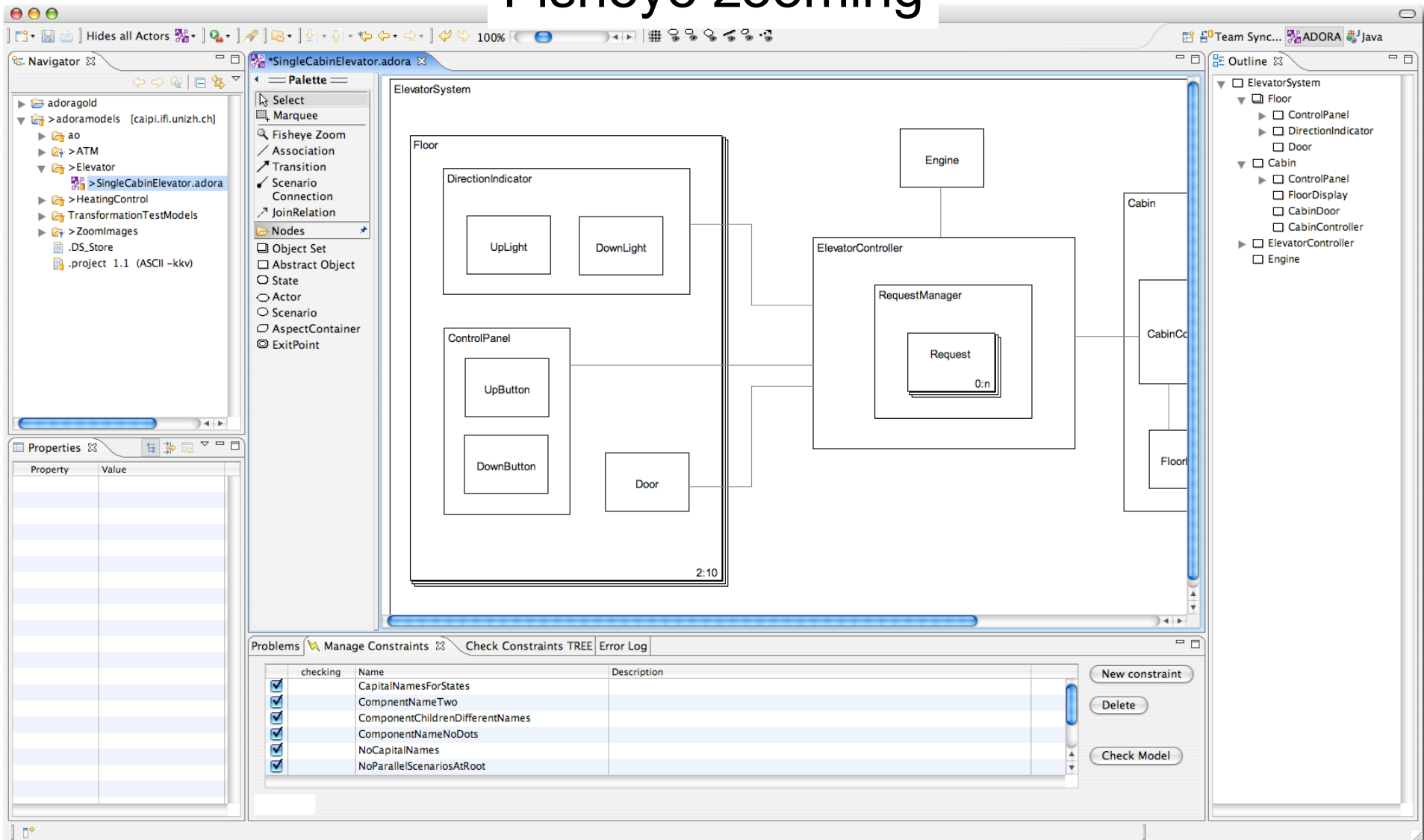
Fisheye views

- magnify the objects in a focal point,
- while reducing the size of objects farther away

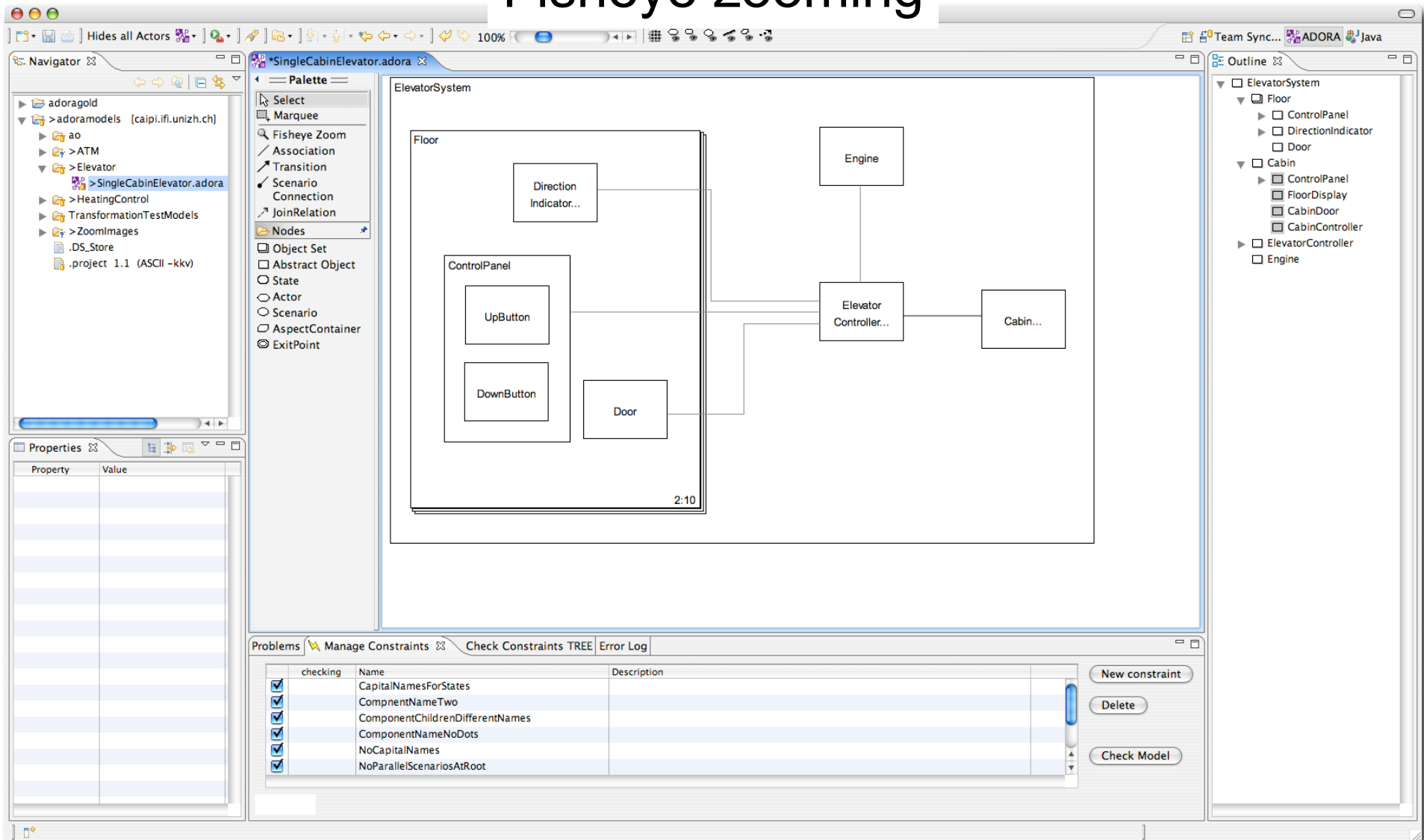
→ Local detail + global context



Fisheye zooming



Fisheye zooming



Zoom algorithm

Produce a **new layout** (position and size of the nodes)
if the size of a node changes because its inner
structure is shown or hidden.



Desired properties of a zoom algorithm

- no overlapping of nodes
- preserve the user's **mental map**
- **stability** of the layout
- permit **editing** operations
- no remarkable **delay**
- **multiple** focal points

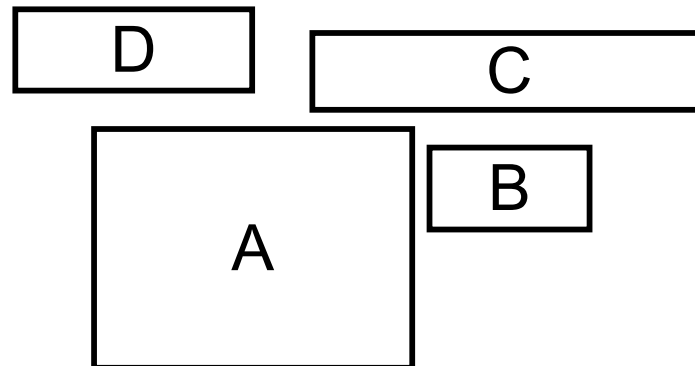


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Existing approaches: Translation vectors



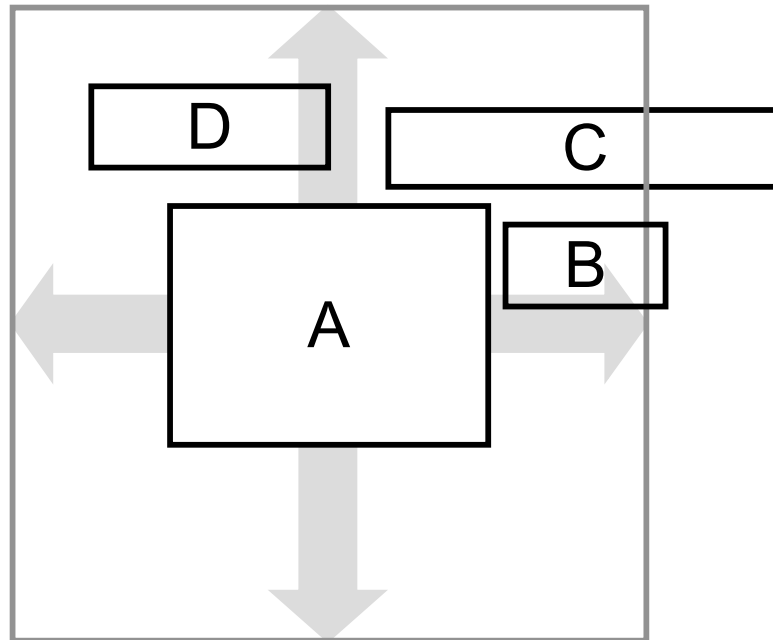
M.-A. D. Storey and H. A. Müller. Graph Layout Adjustment Strategies. In GD '95: *Proceedings of the Symposium on Graph Drawing*, pages 487-499, 1996.

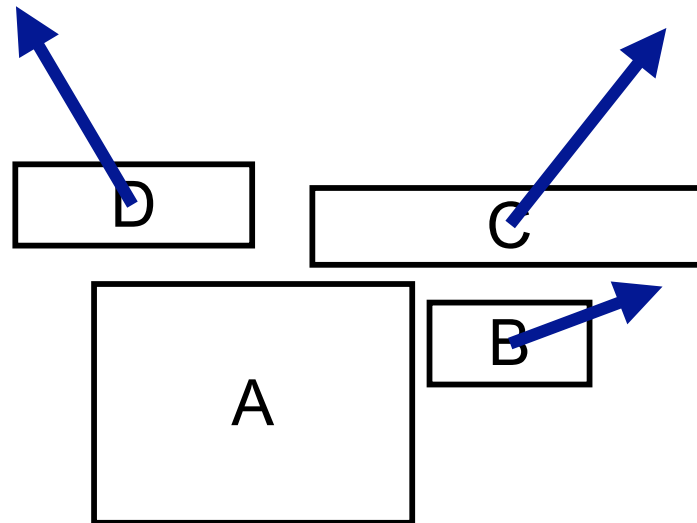
S. Berner, S. Joos, M. Glinz, and M. Arnold. A Visualization Concept for Hierarchical Object Models. In *Proceedings of the 13th IEEE International Conference on Automated Software Engineering (ASE-98)*, pages 225-228, 1998.

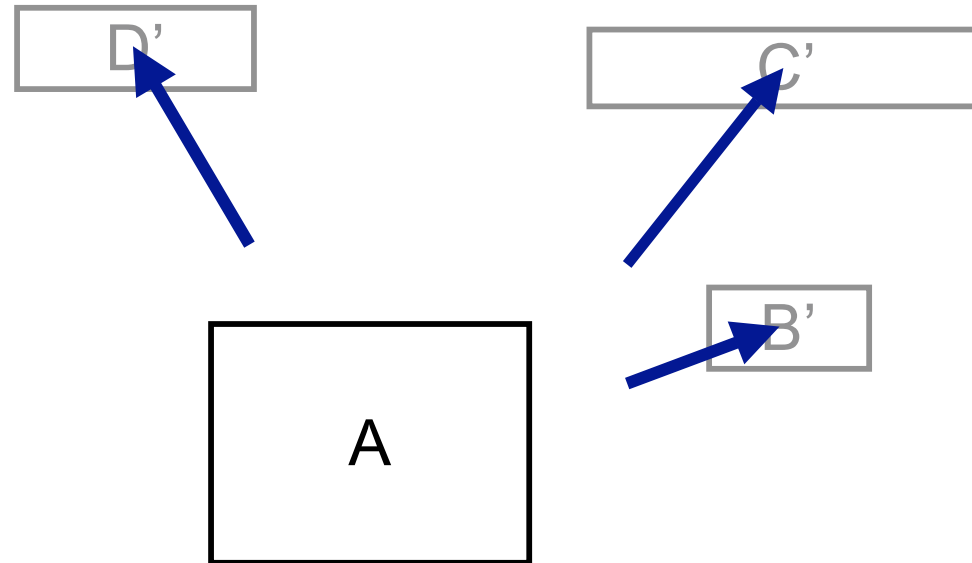


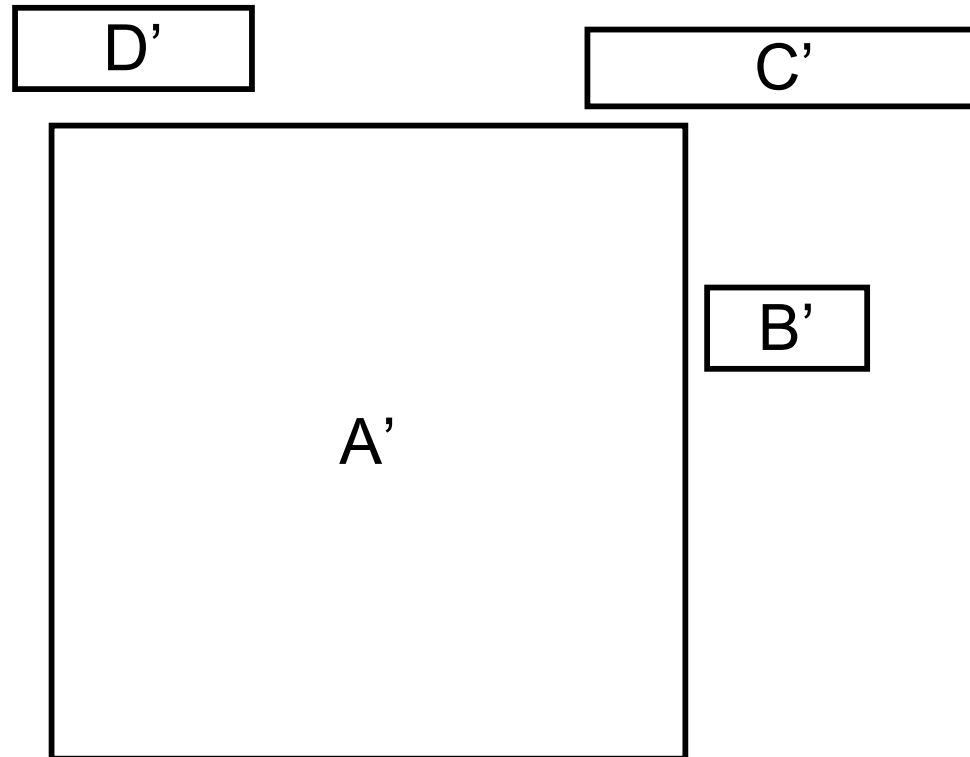
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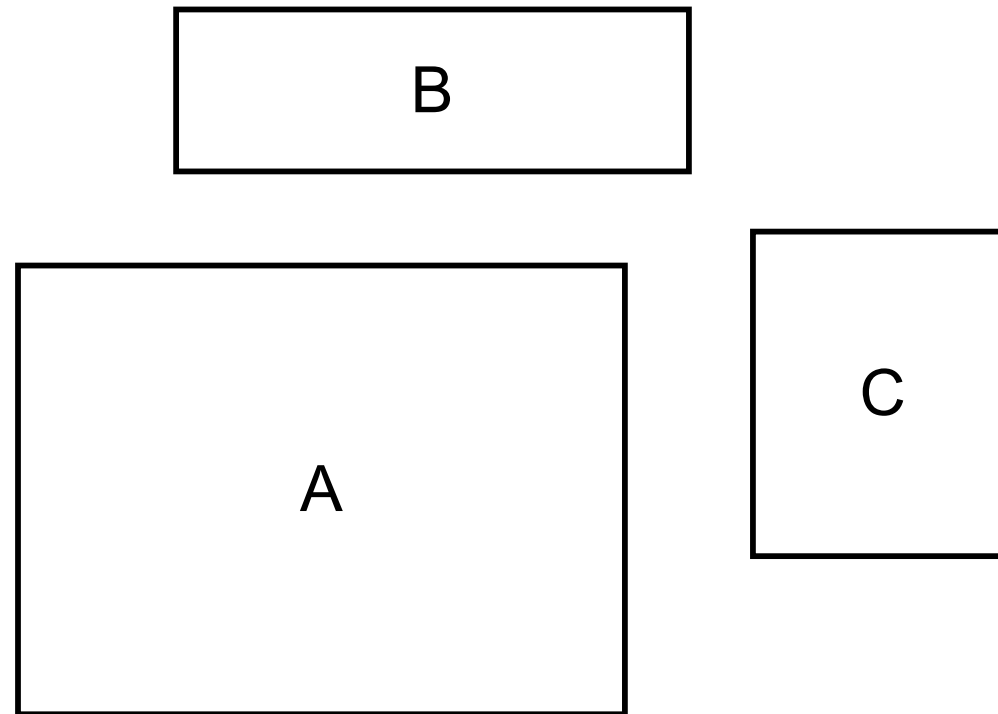


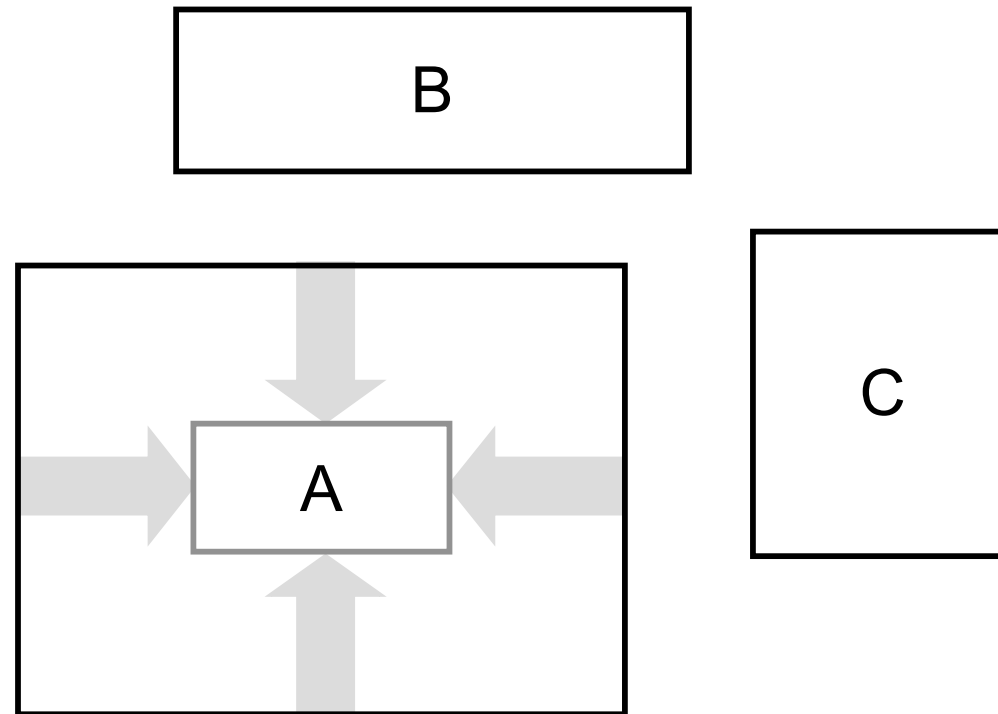


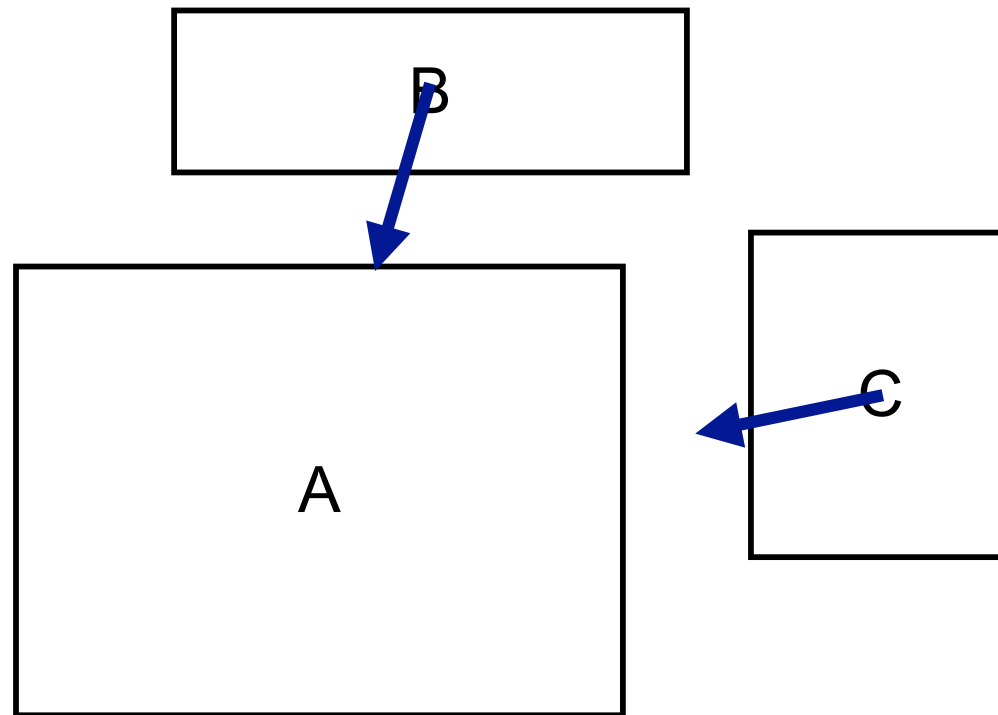


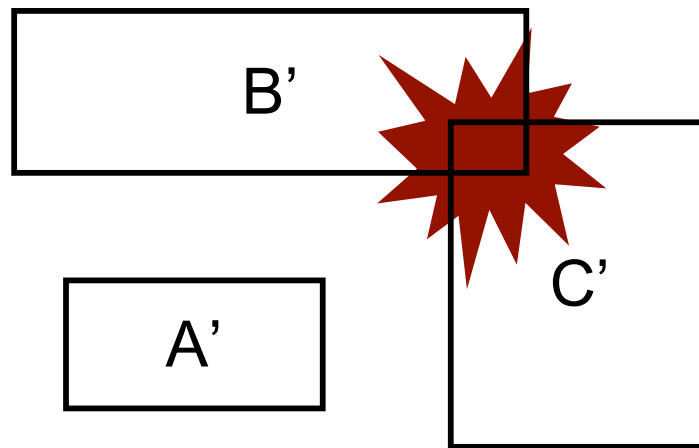


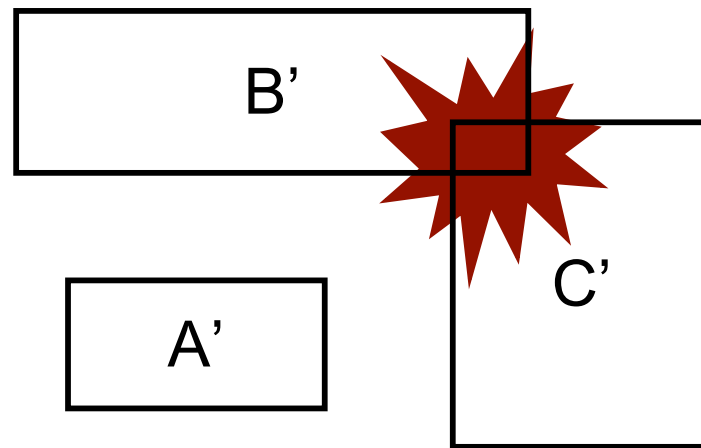
Translation vectors: Problems





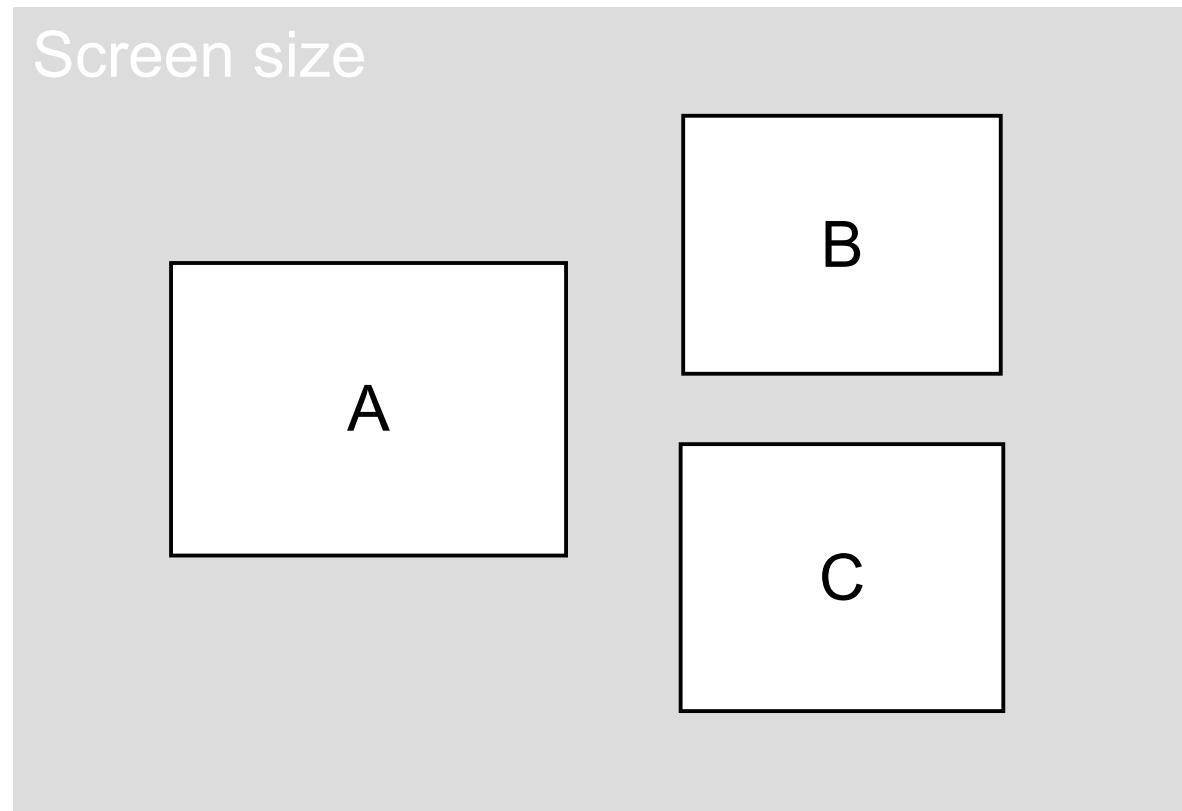






- overlapping of nodes

Existing approaches: Continuous Zoom



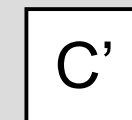
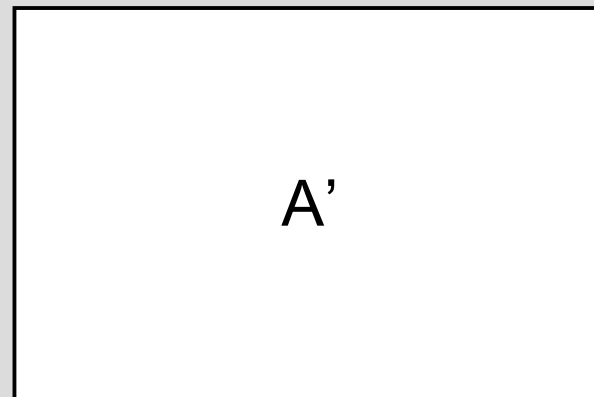
L. Bartram, A. Ho, J. Dill, and F. Henigman. The Continuous Zoom: A Constrained Fisheye Technique for Viewing and Navigating Large Information Spaces. In *UIST '95: Proceedings of the 8th Annual ACM Symposium on User Interface and Software Technology*, pages 207-215, 1995.



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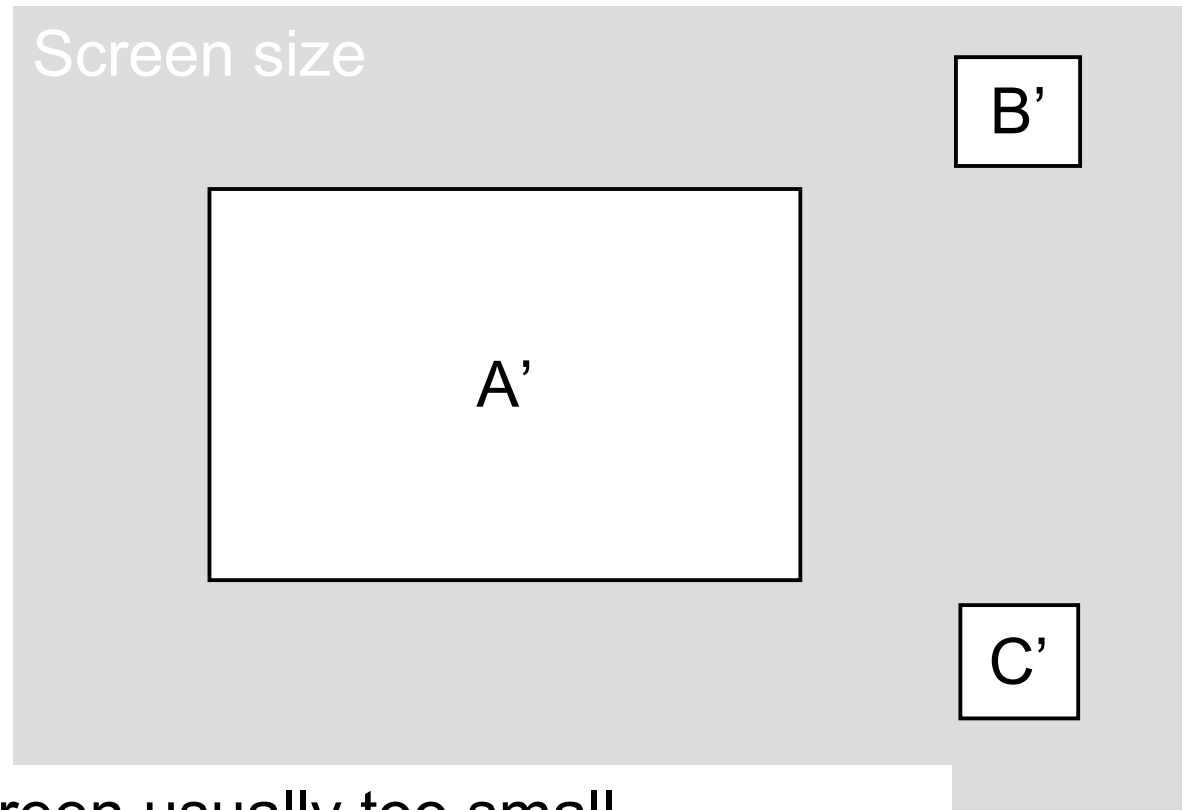
Screen size



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Screen size



- screen usually too small
- global scaling destroys mental map
- projection not editable



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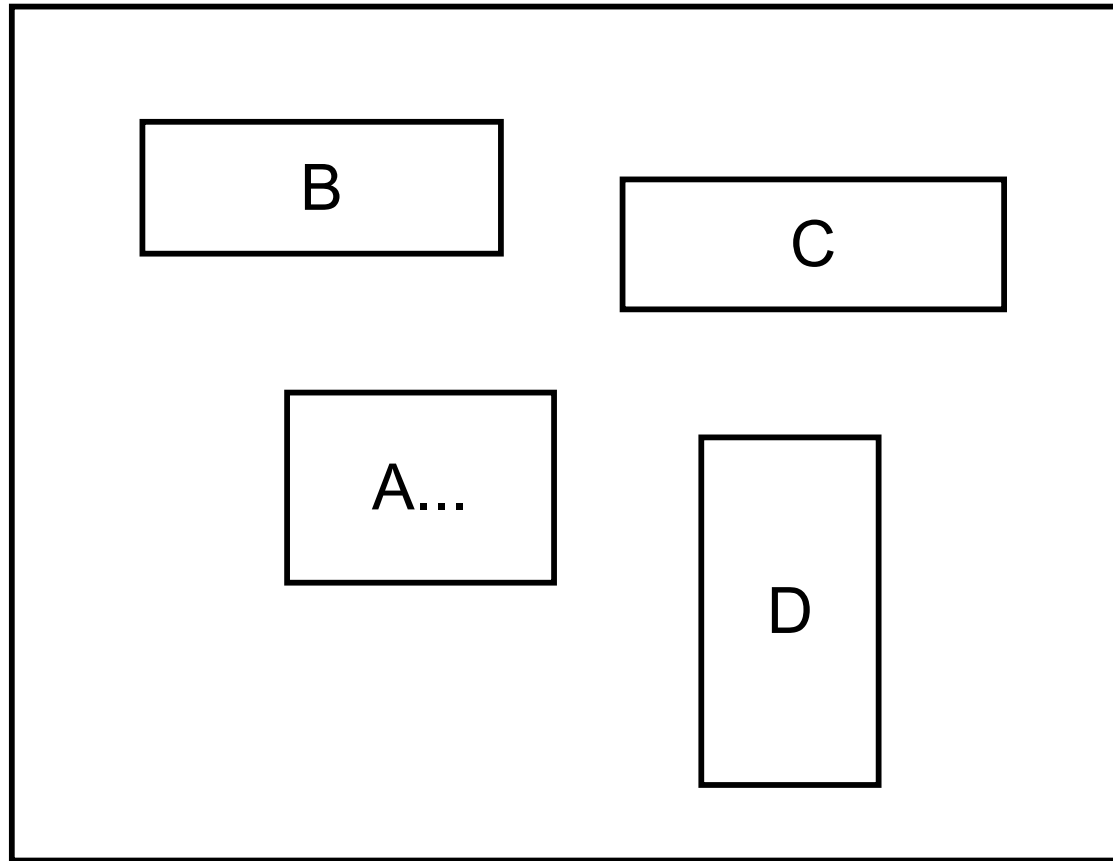
Zooming-In

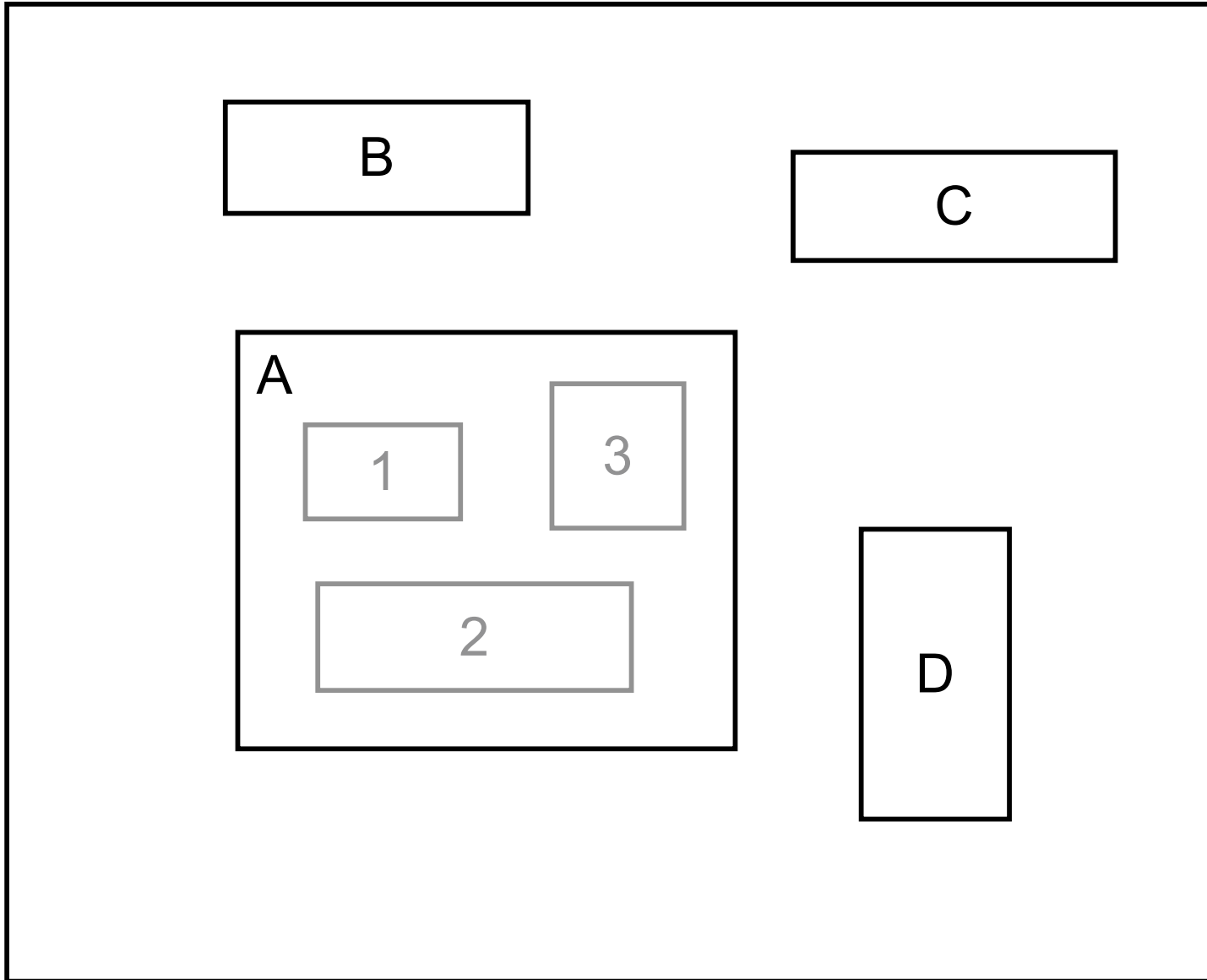
Increase the level of detail in a focal point.

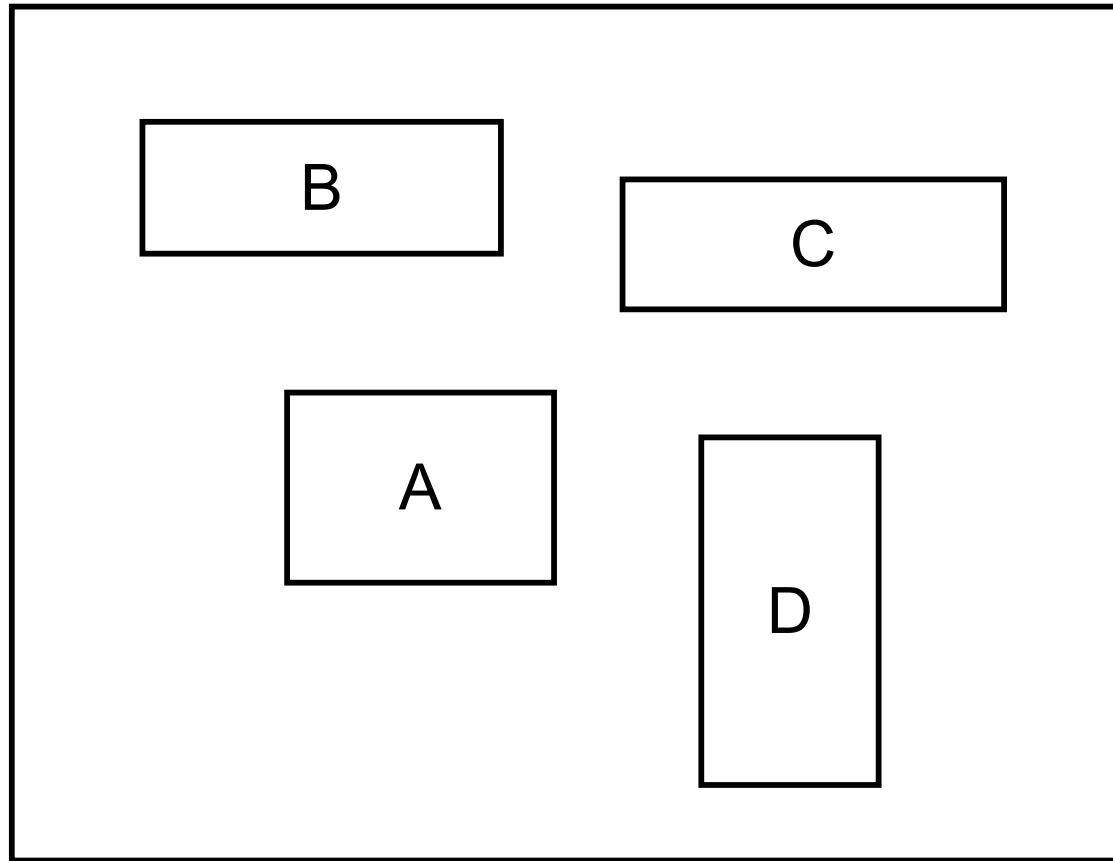


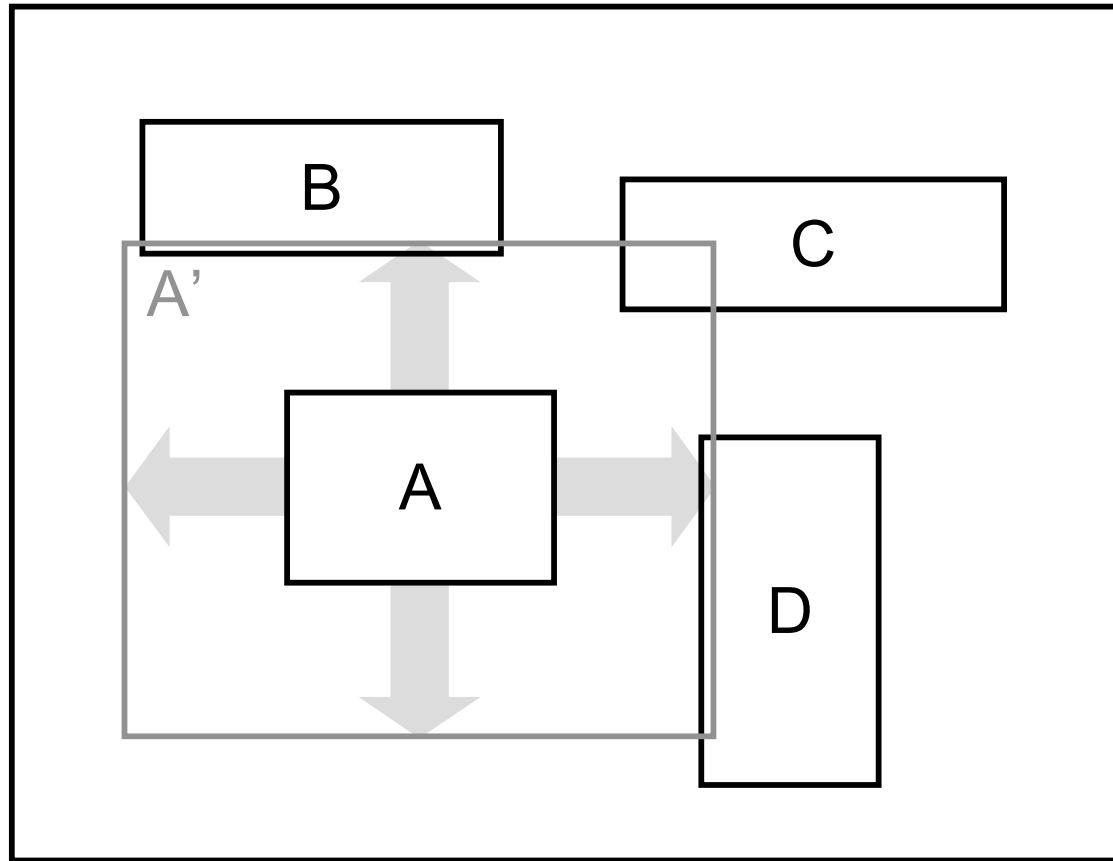
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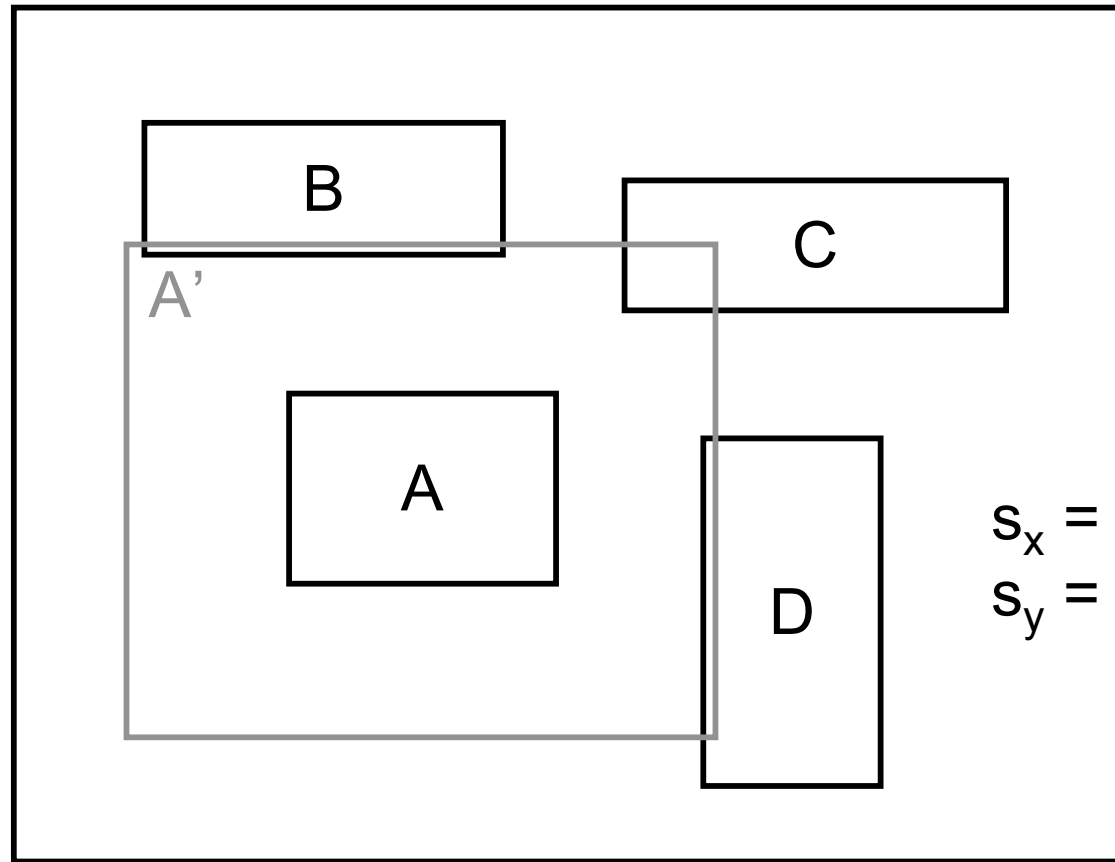








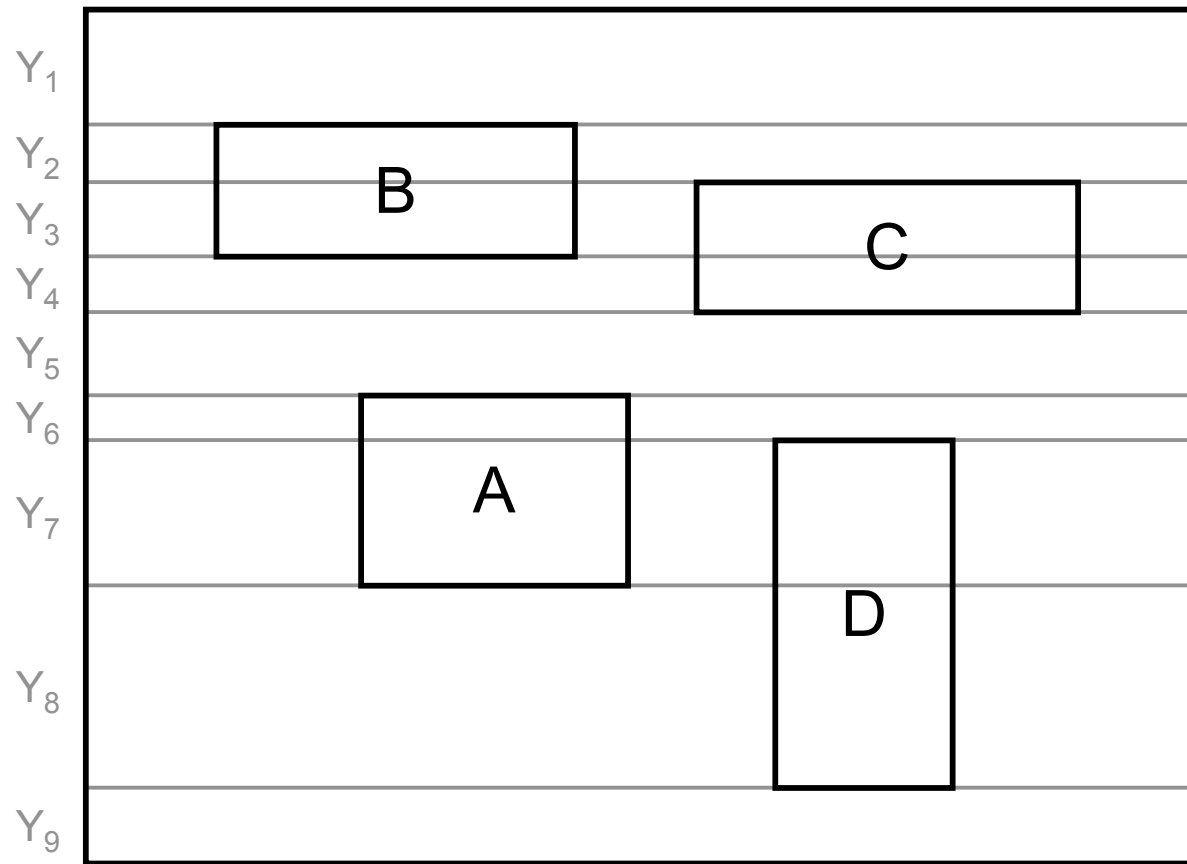
Scale factors

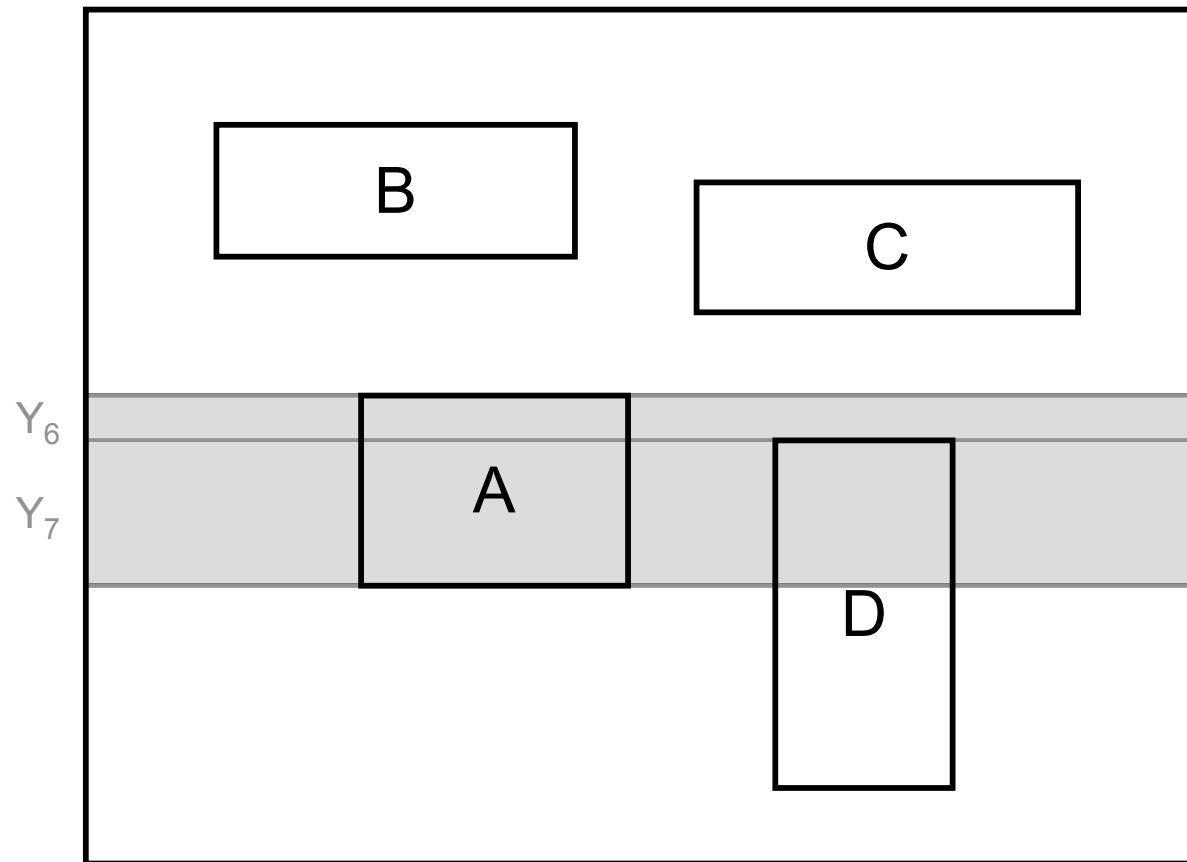


$$s_x = w(A') / w(A)$$
$$s_y = h(A') / h(A)$$

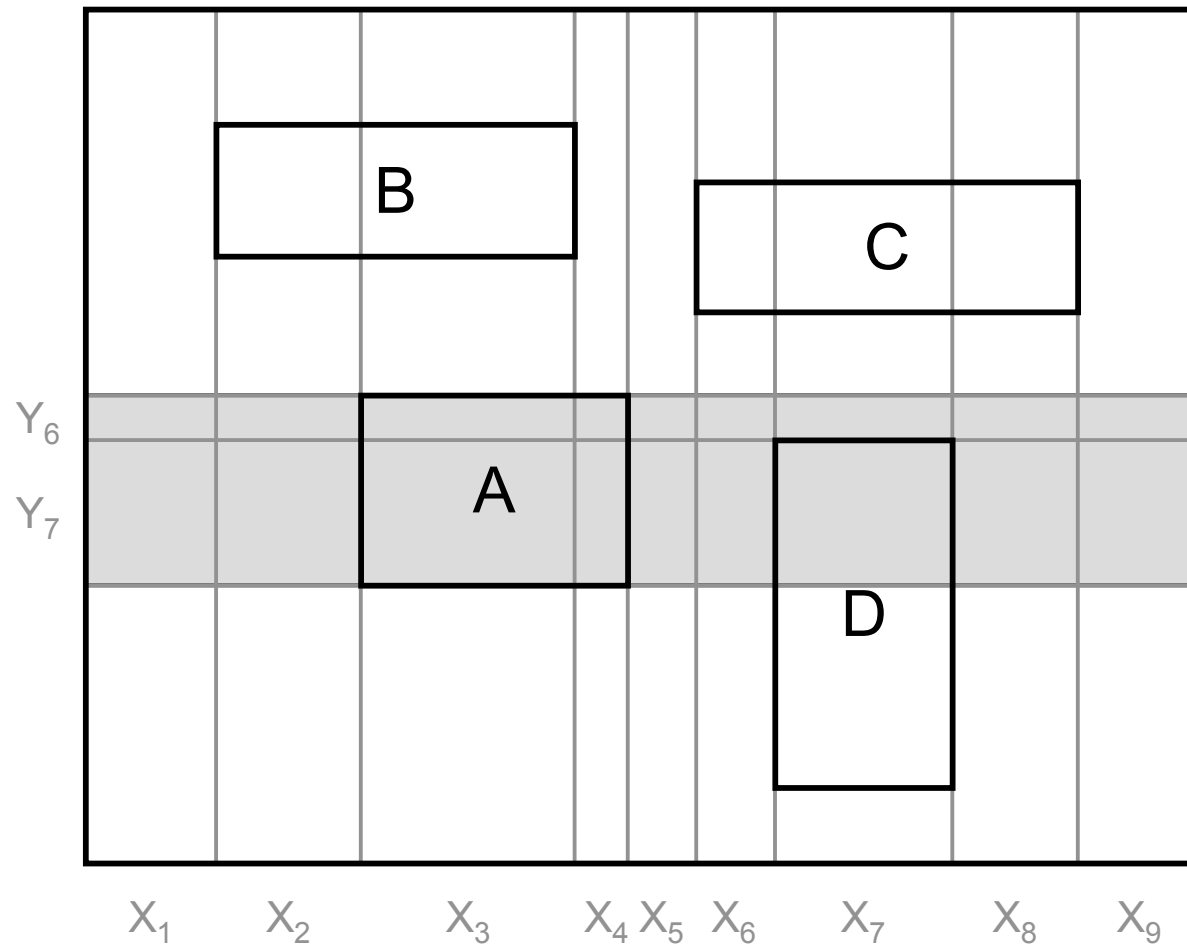


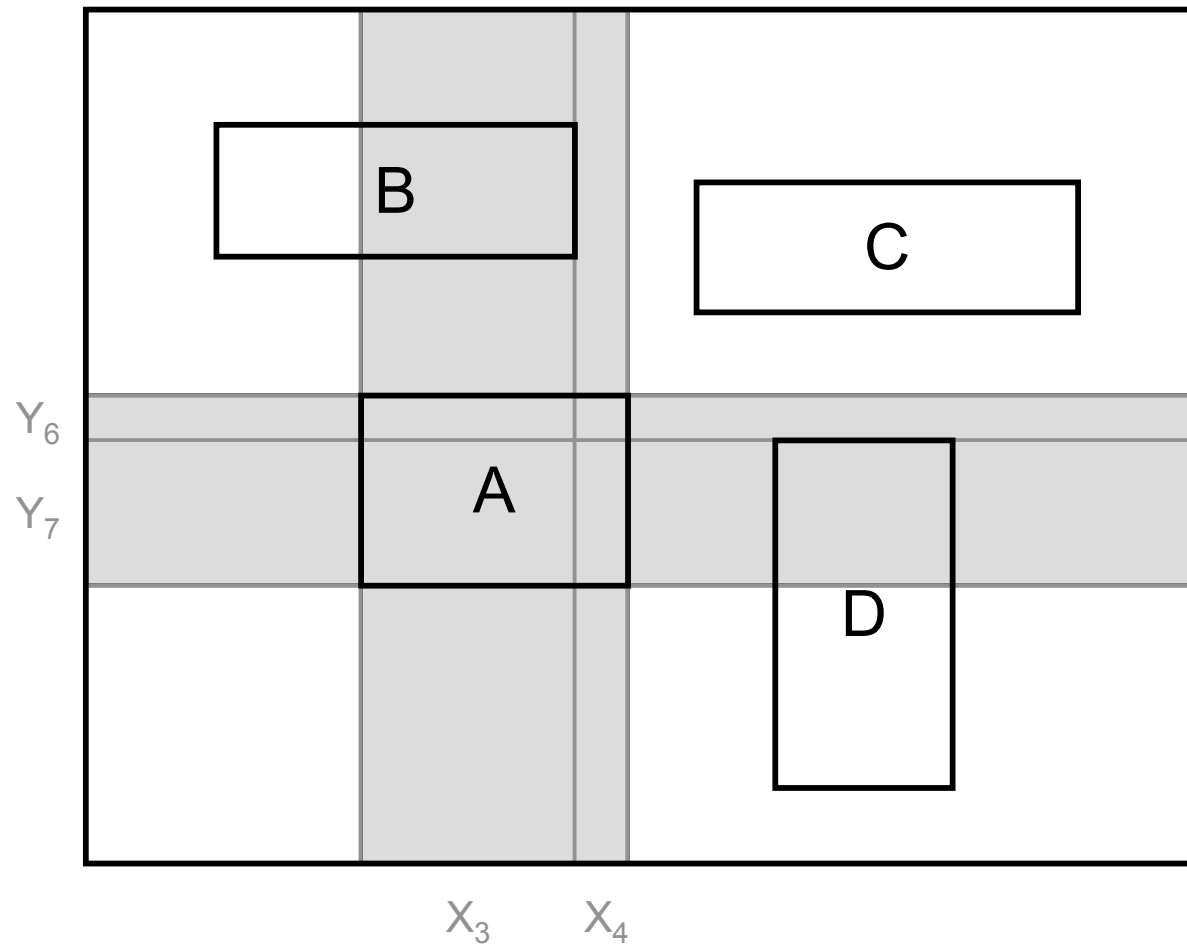
Vertical intervals



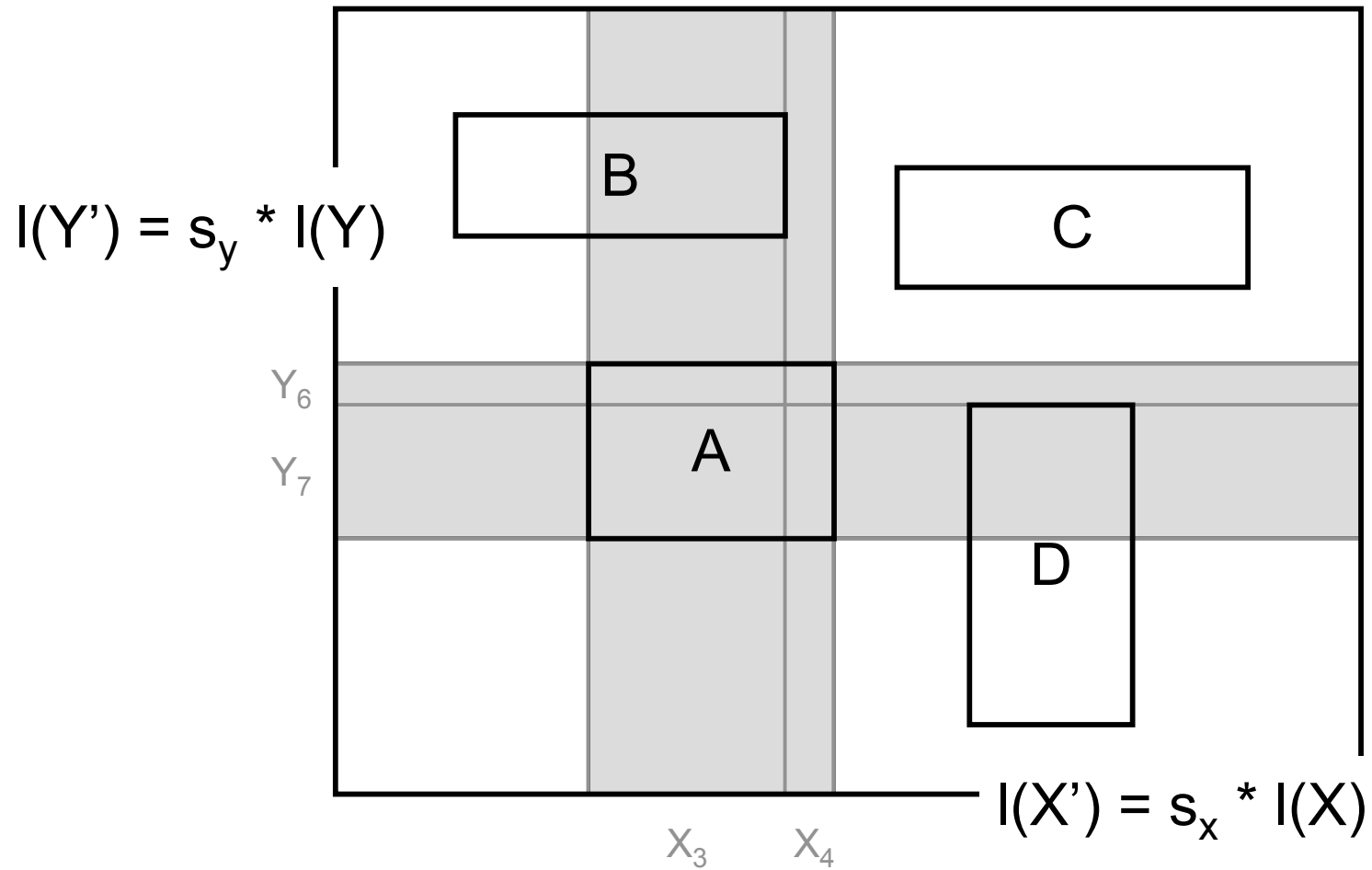


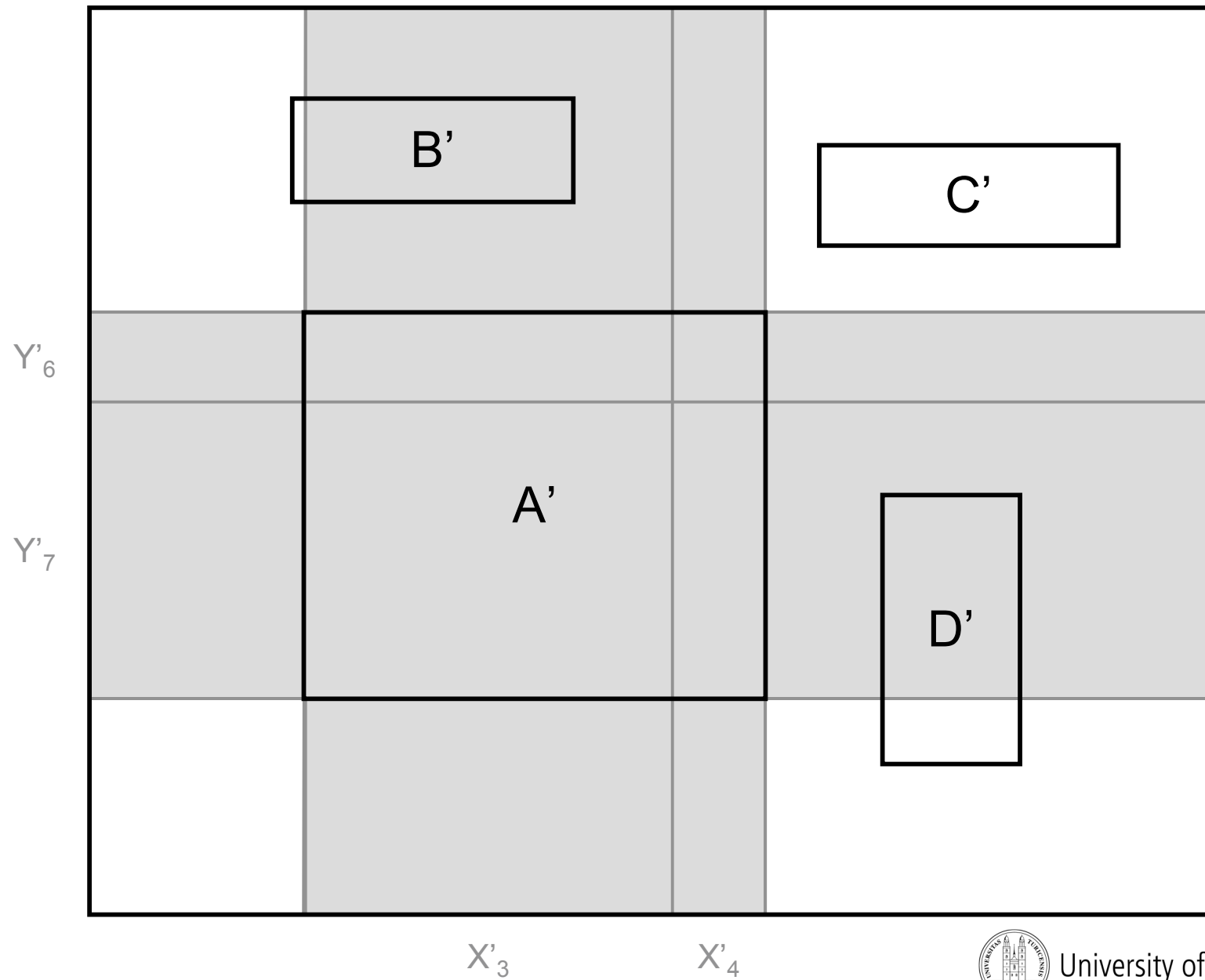
Horizontal intervals

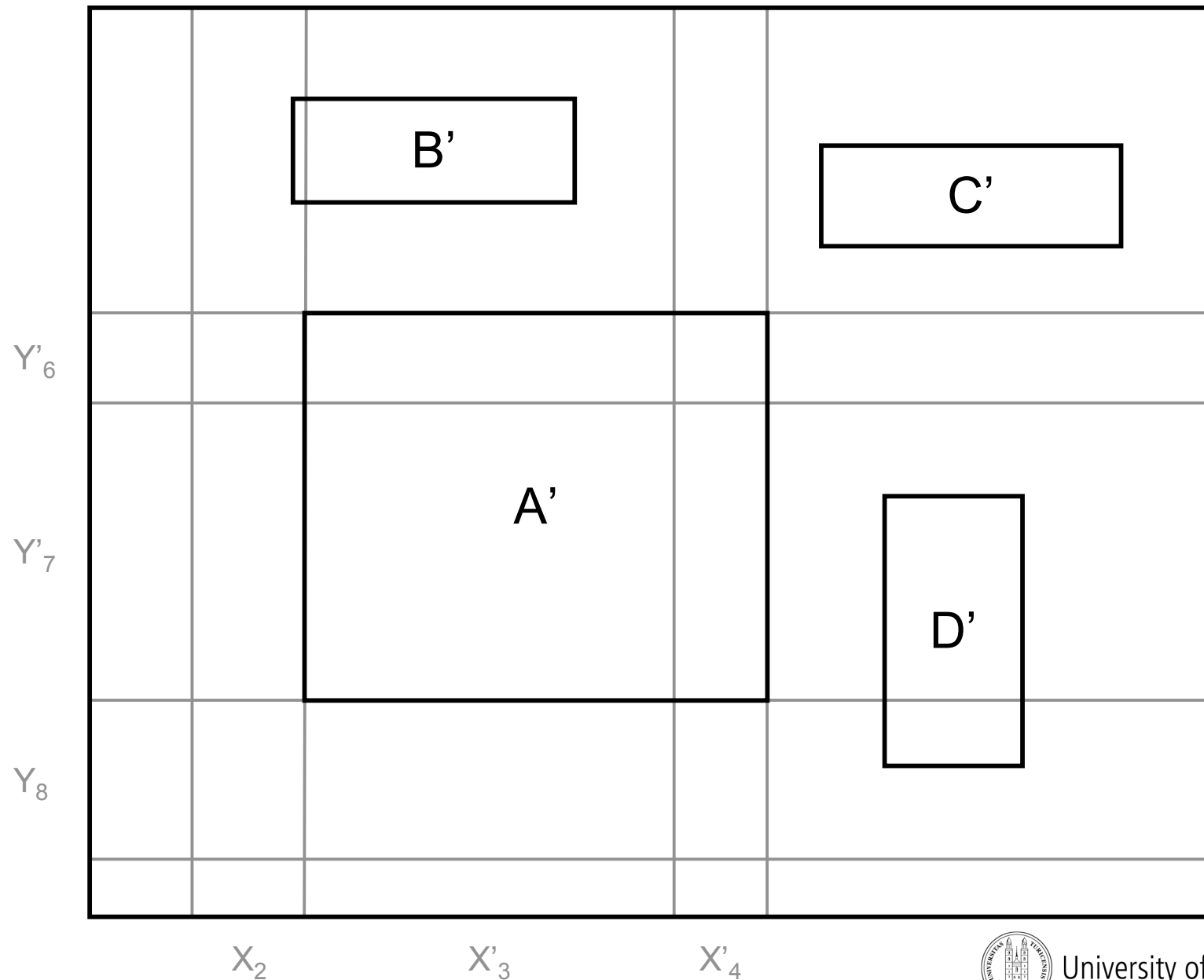


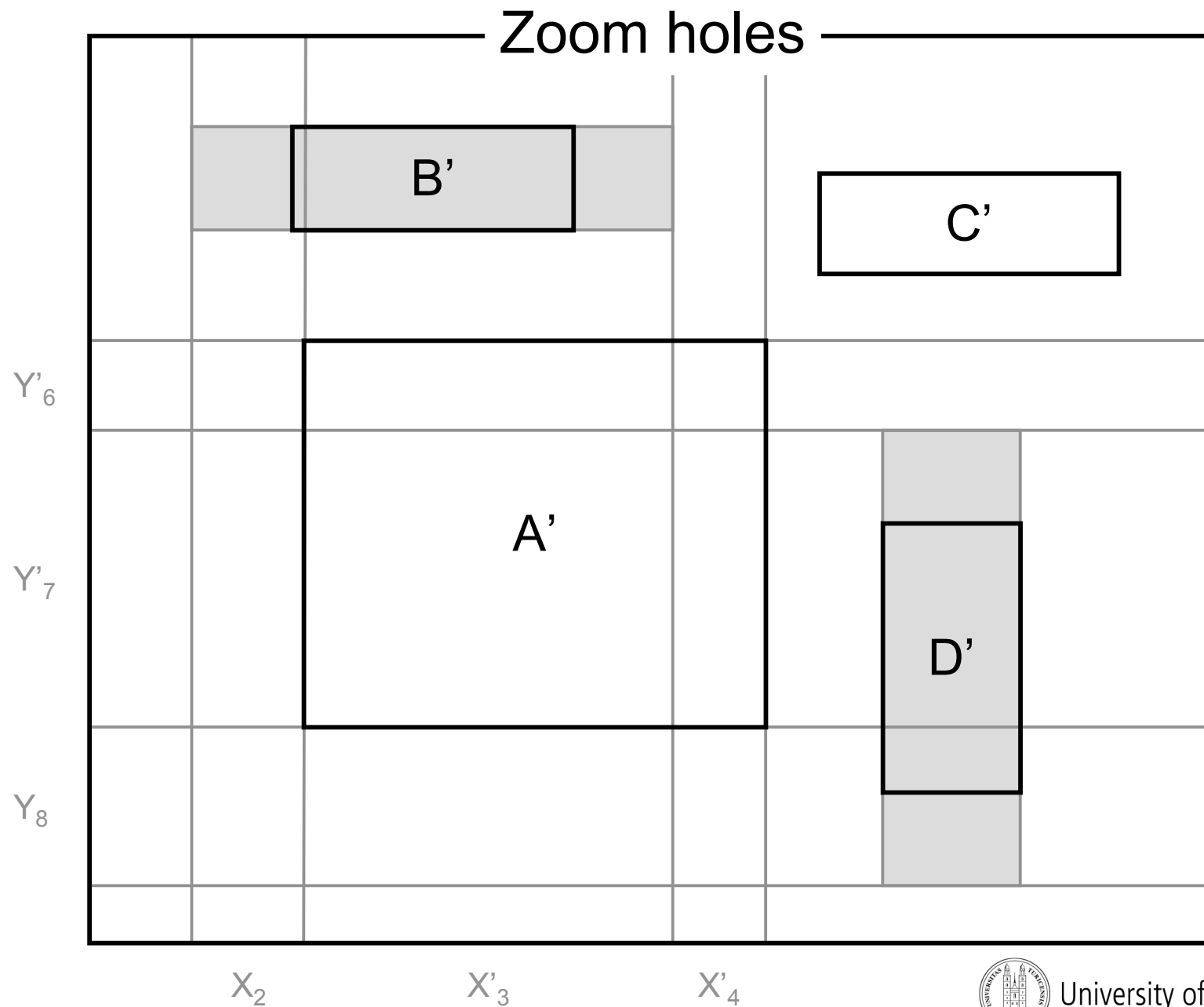


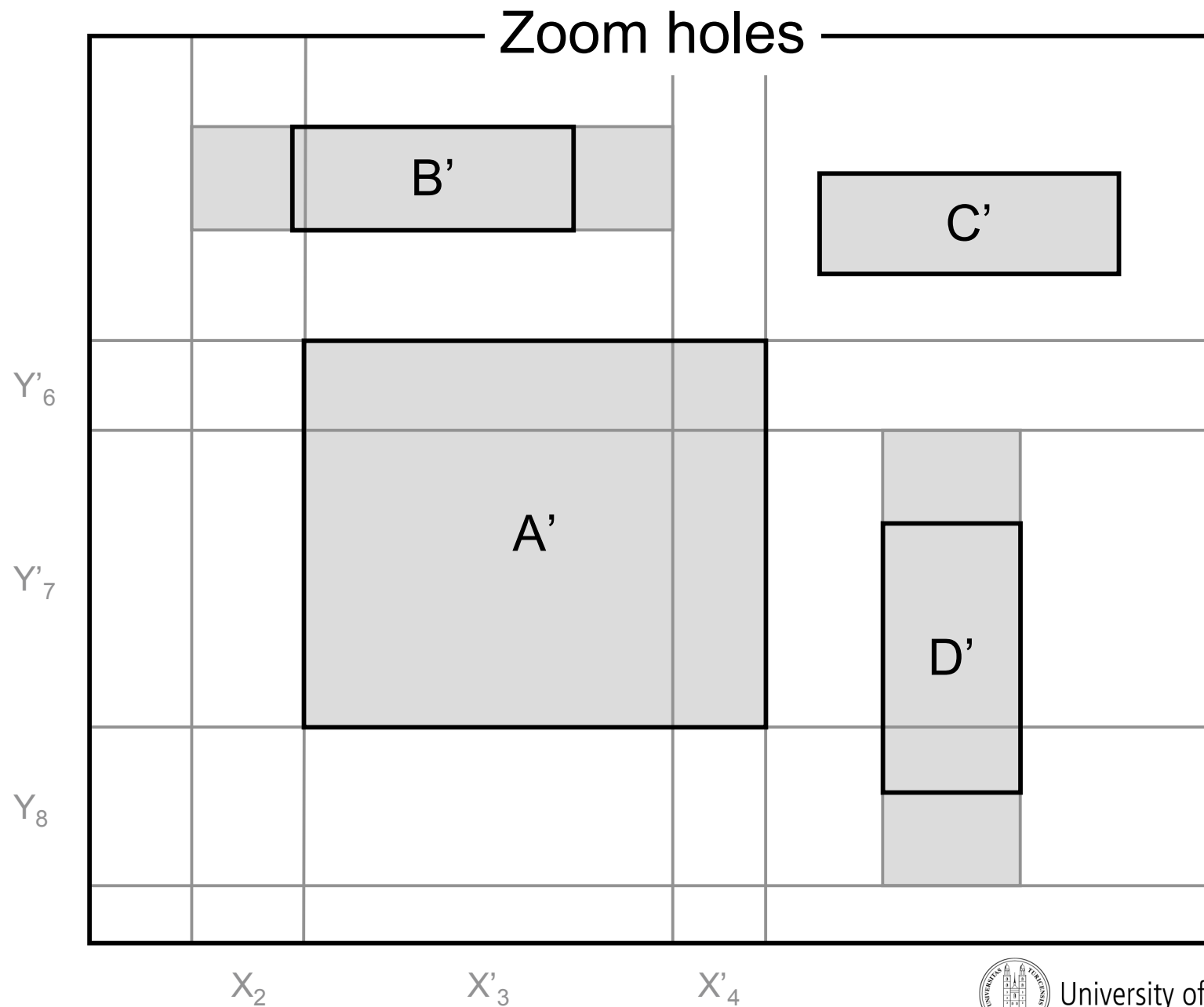
Scale interval sizes

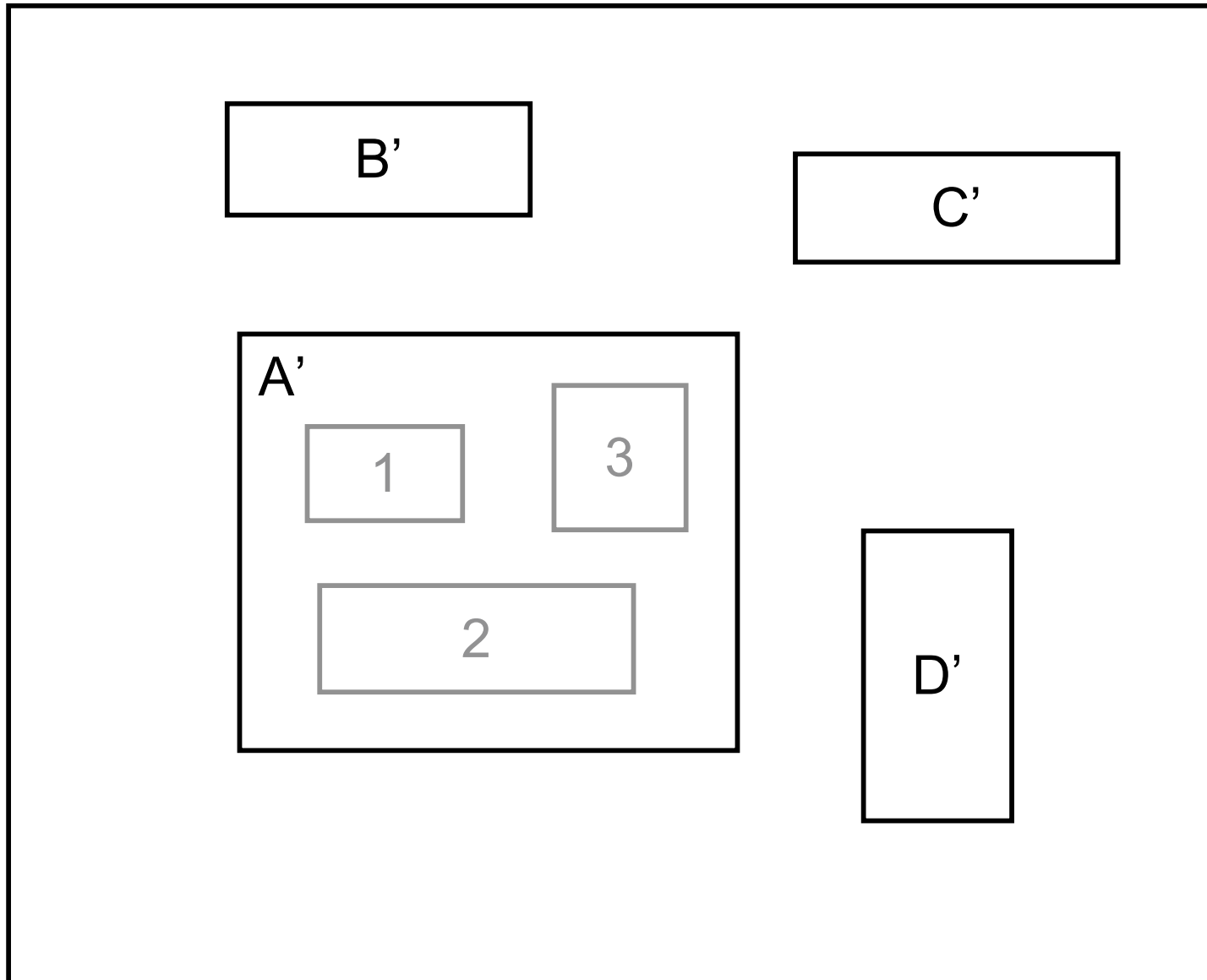












Zooming-Out

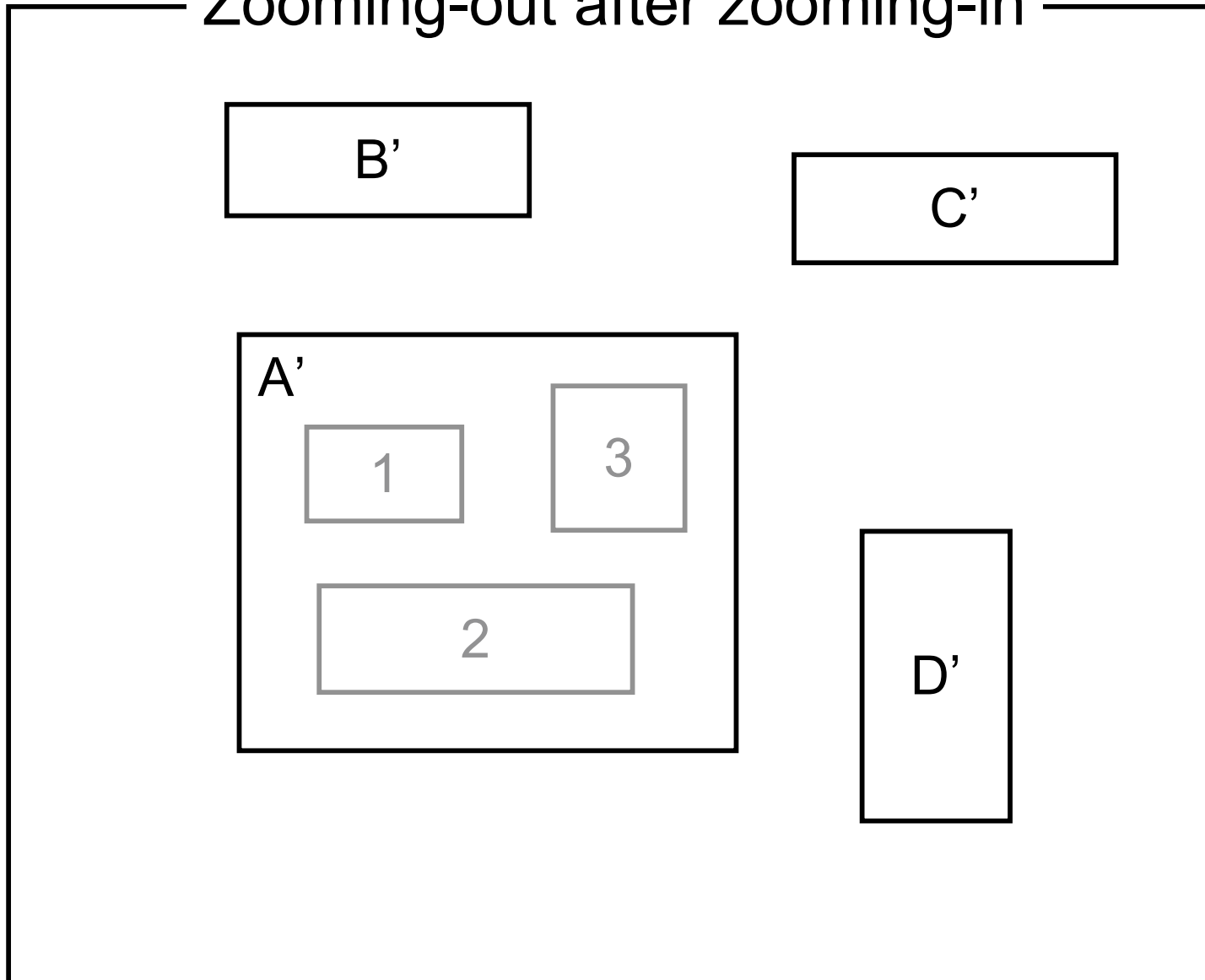
Decrease the level of detail to get a more abstract view.

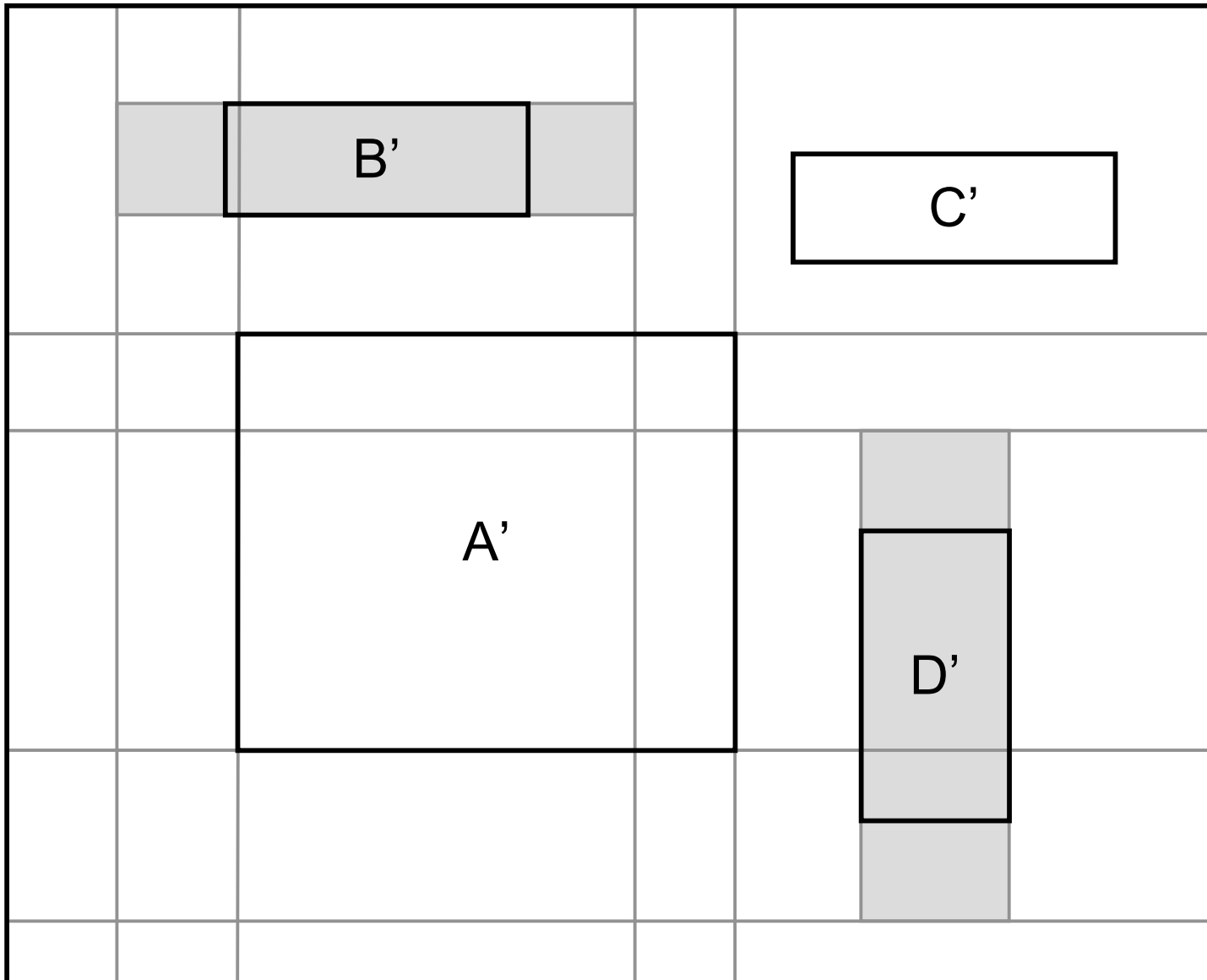


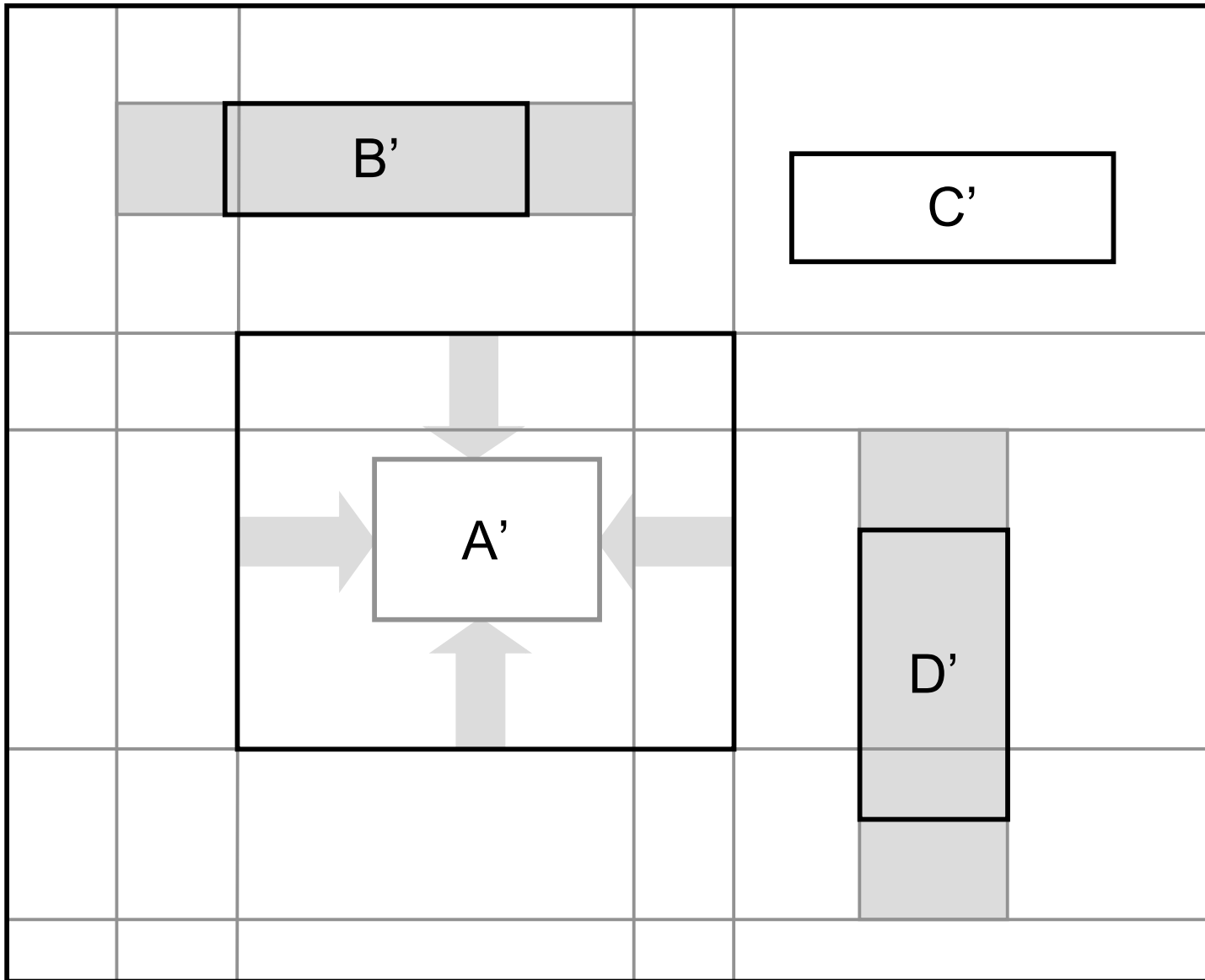
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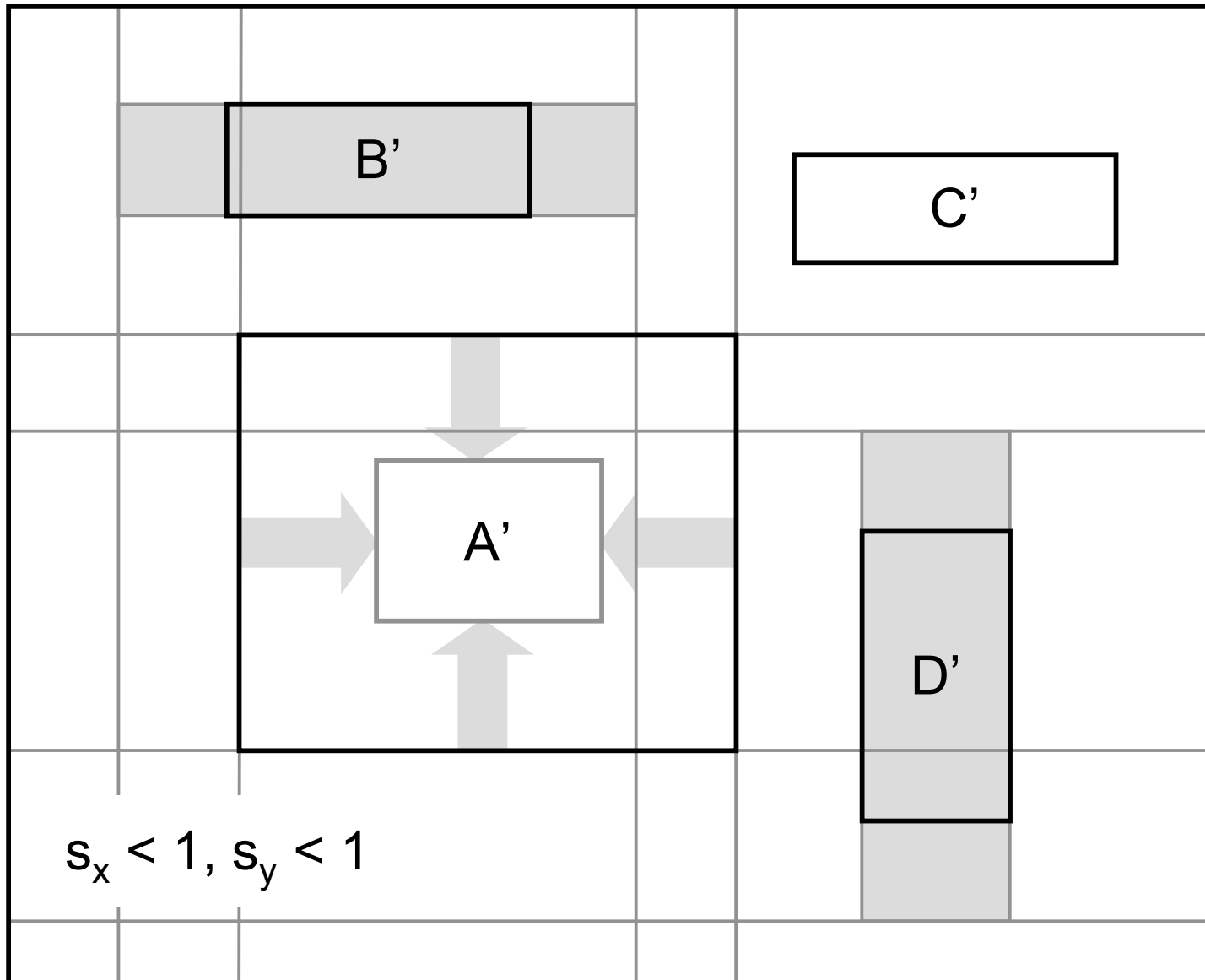


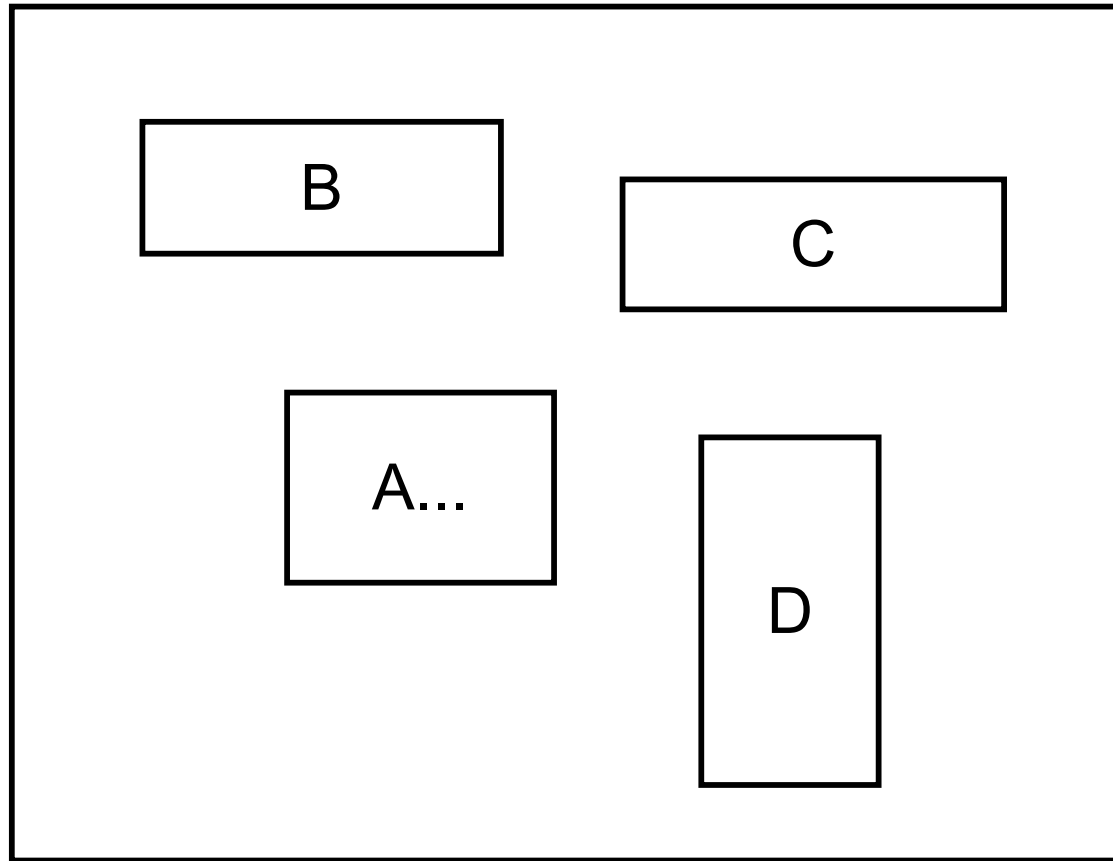
Zooming-out after zooming-in



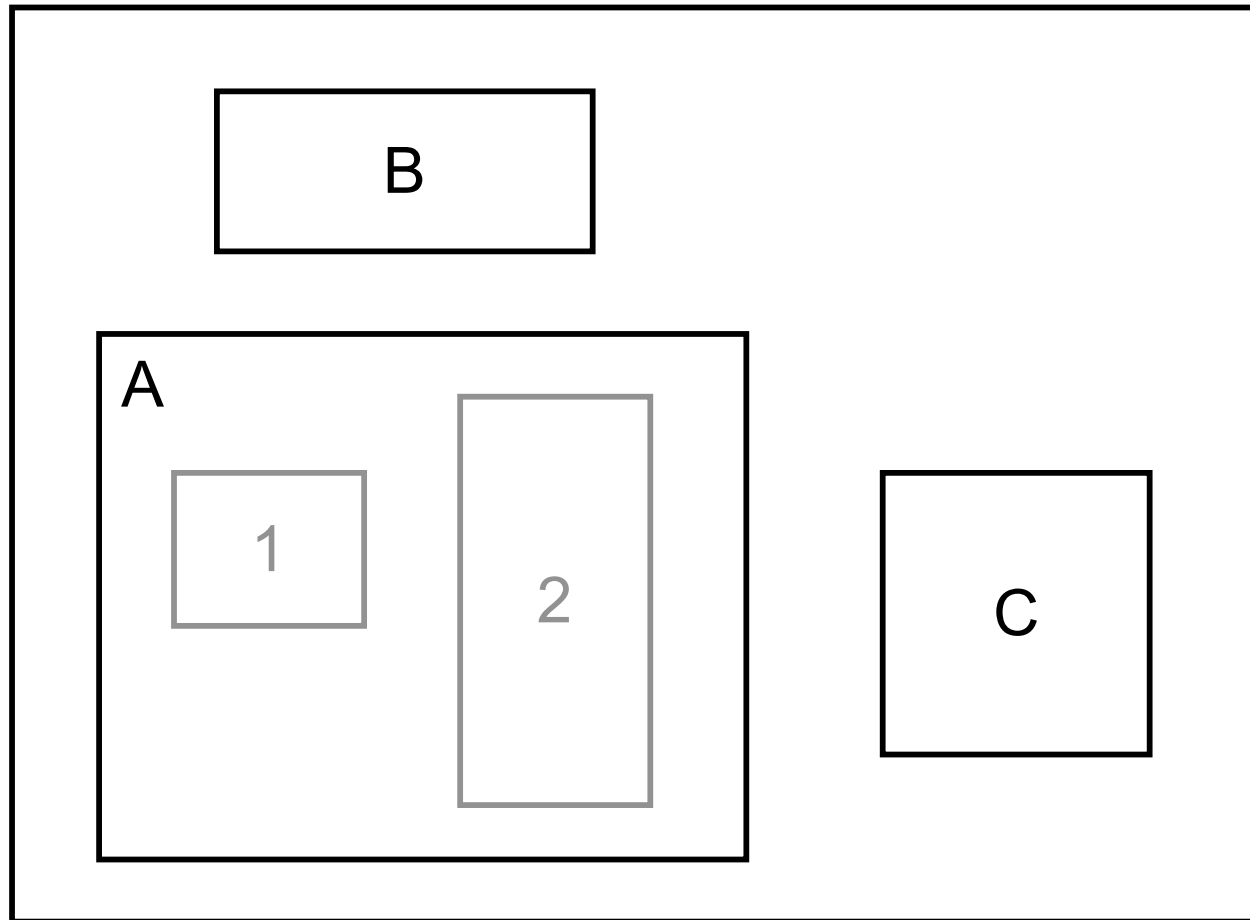


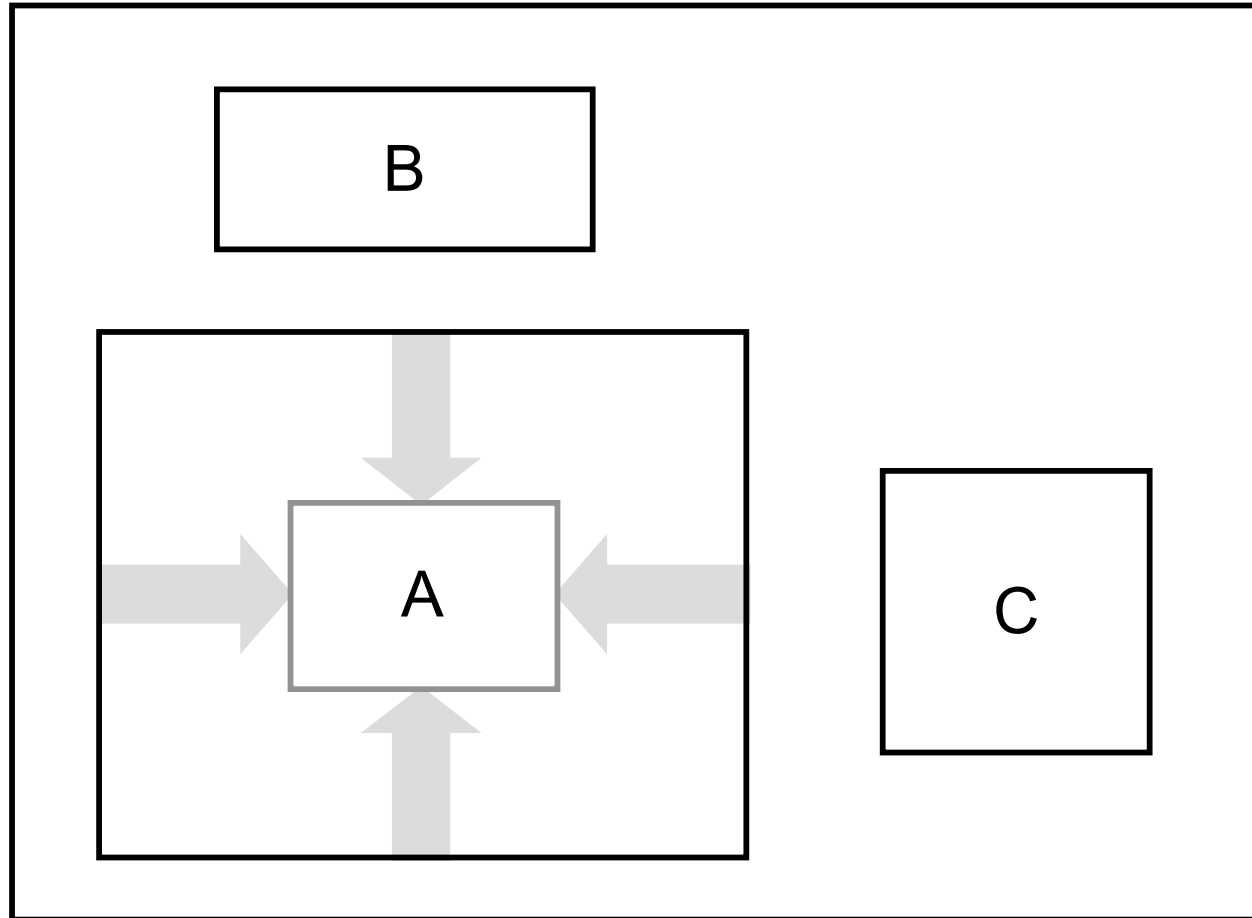


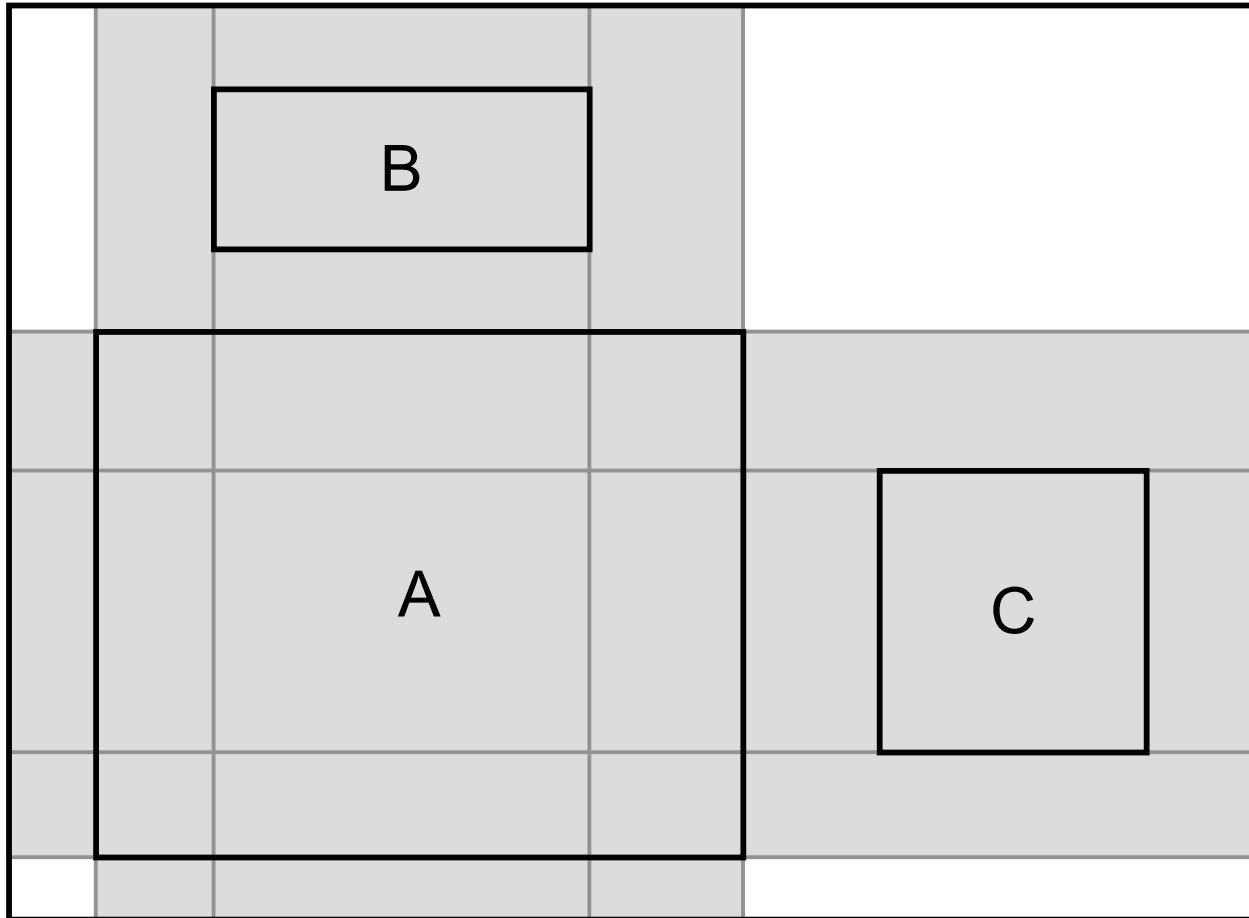


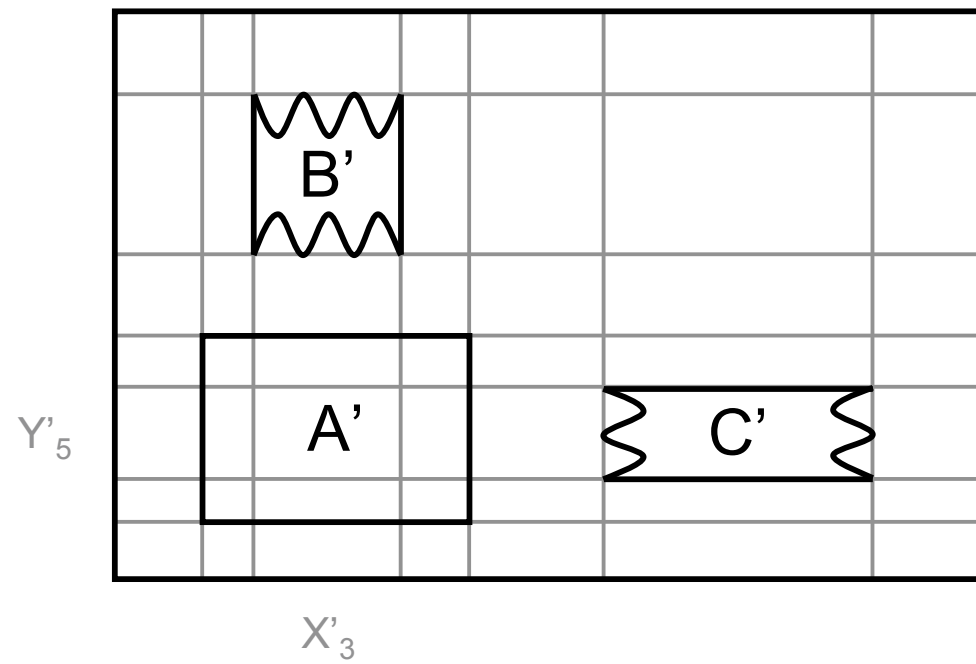


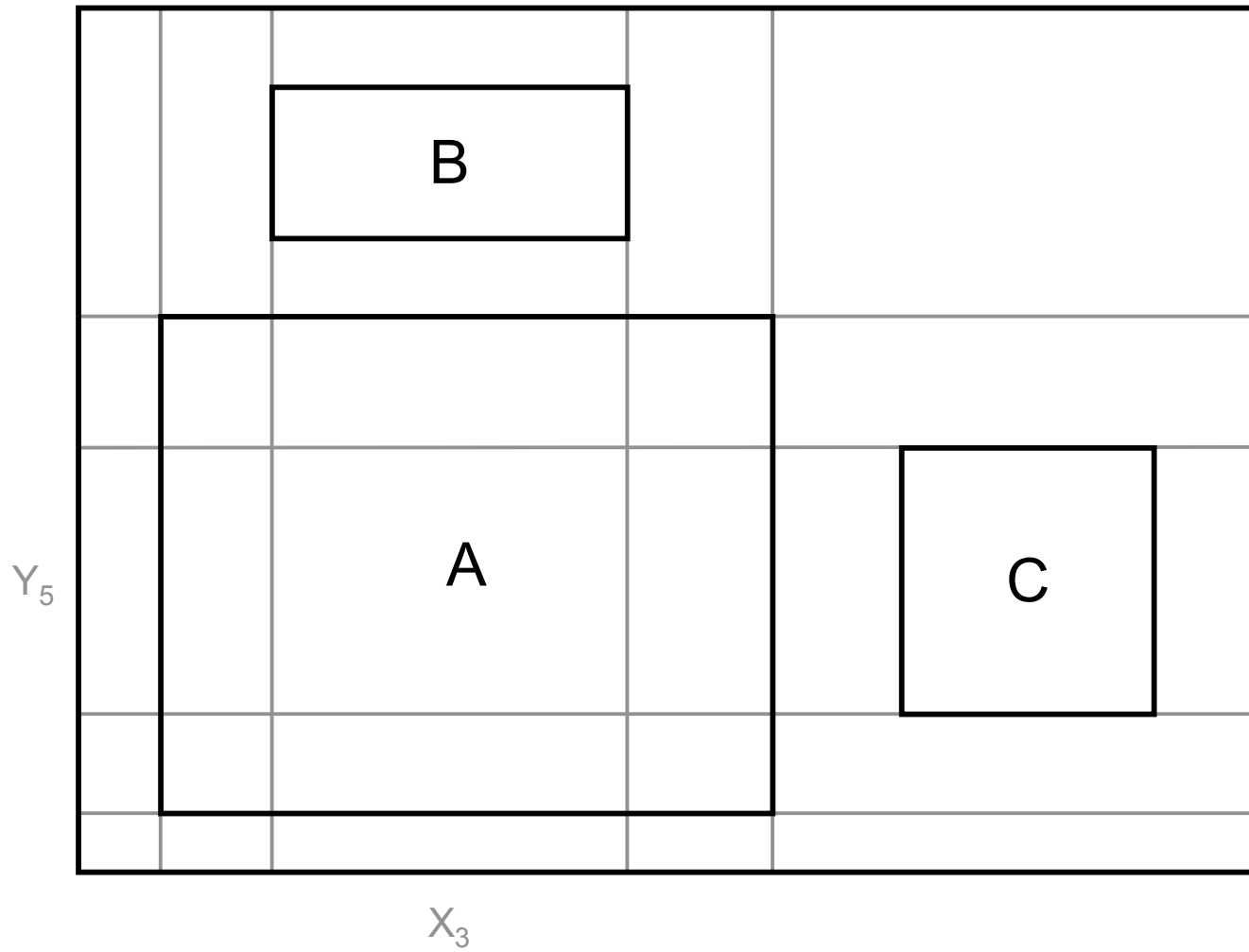
Zooming-out

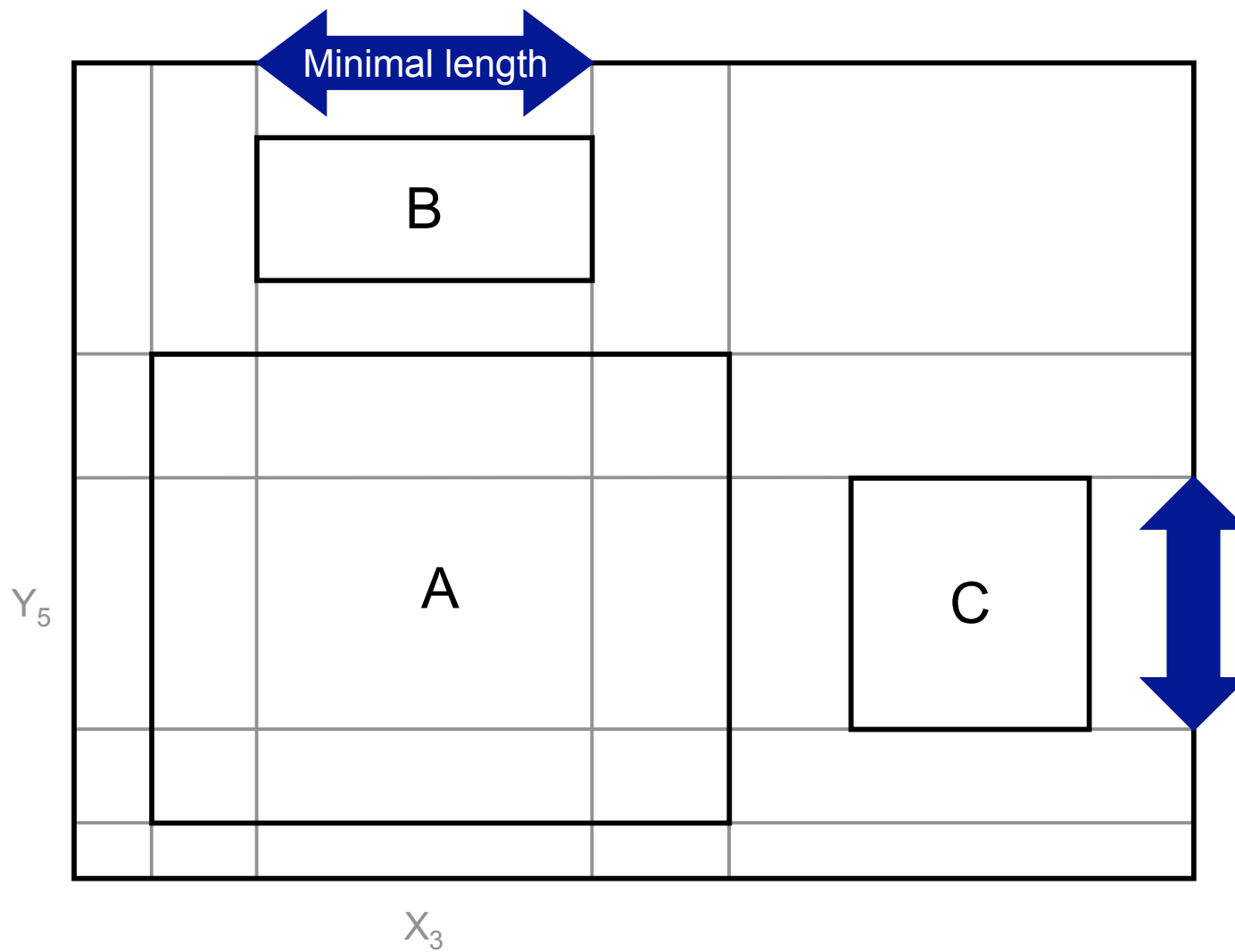


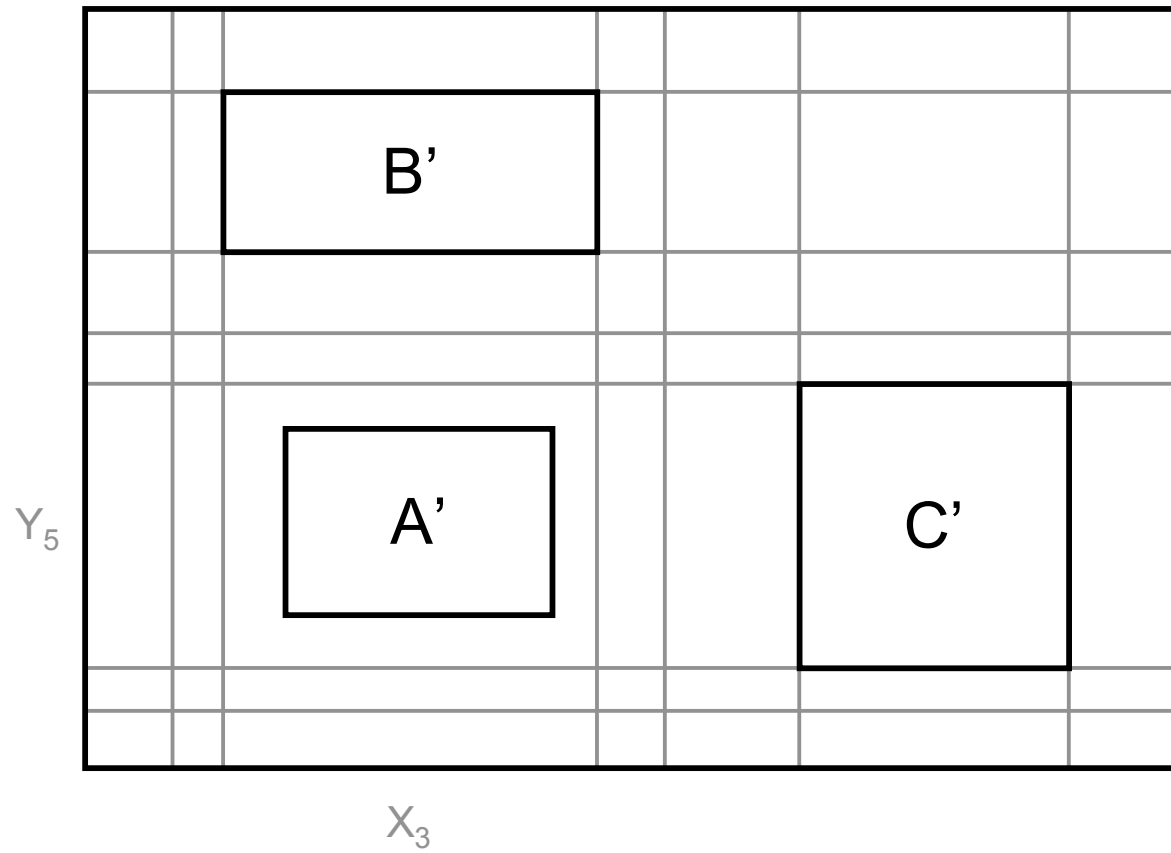


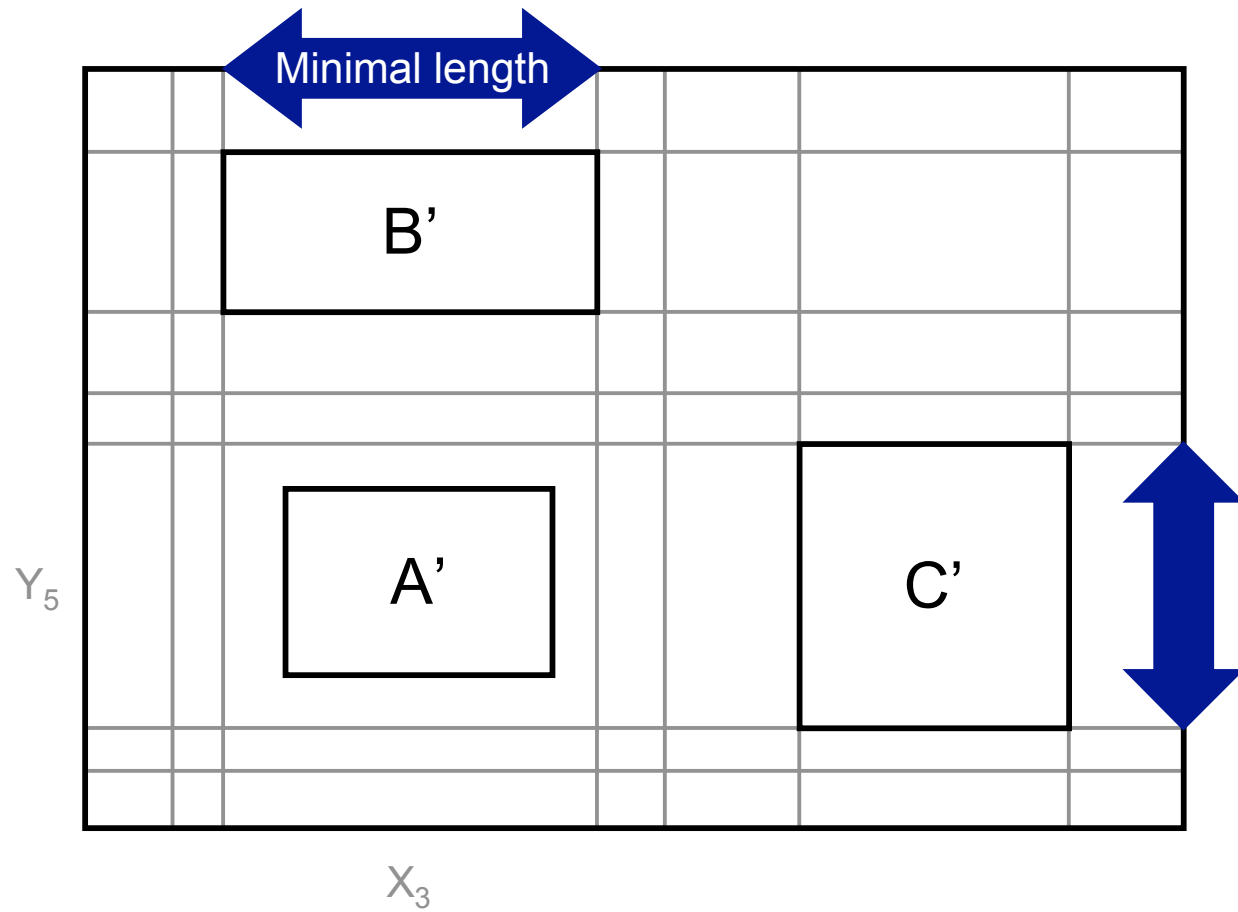


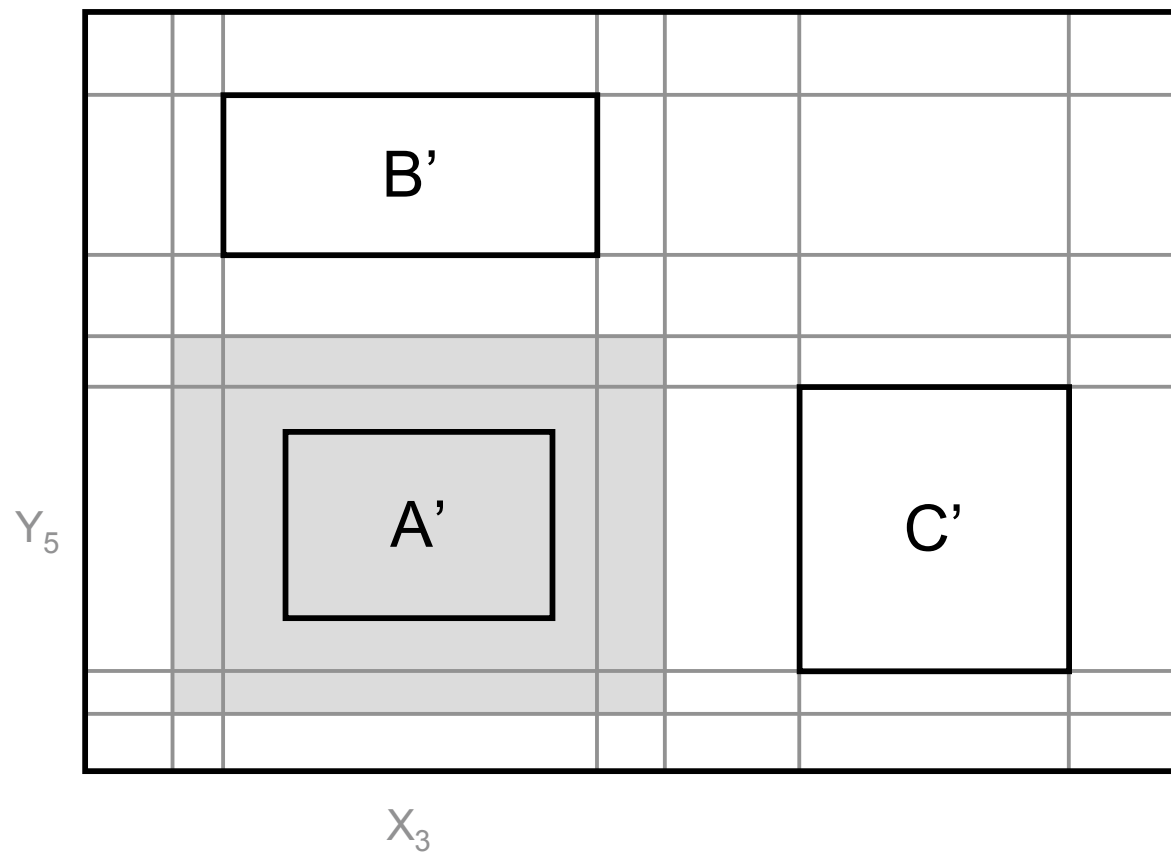


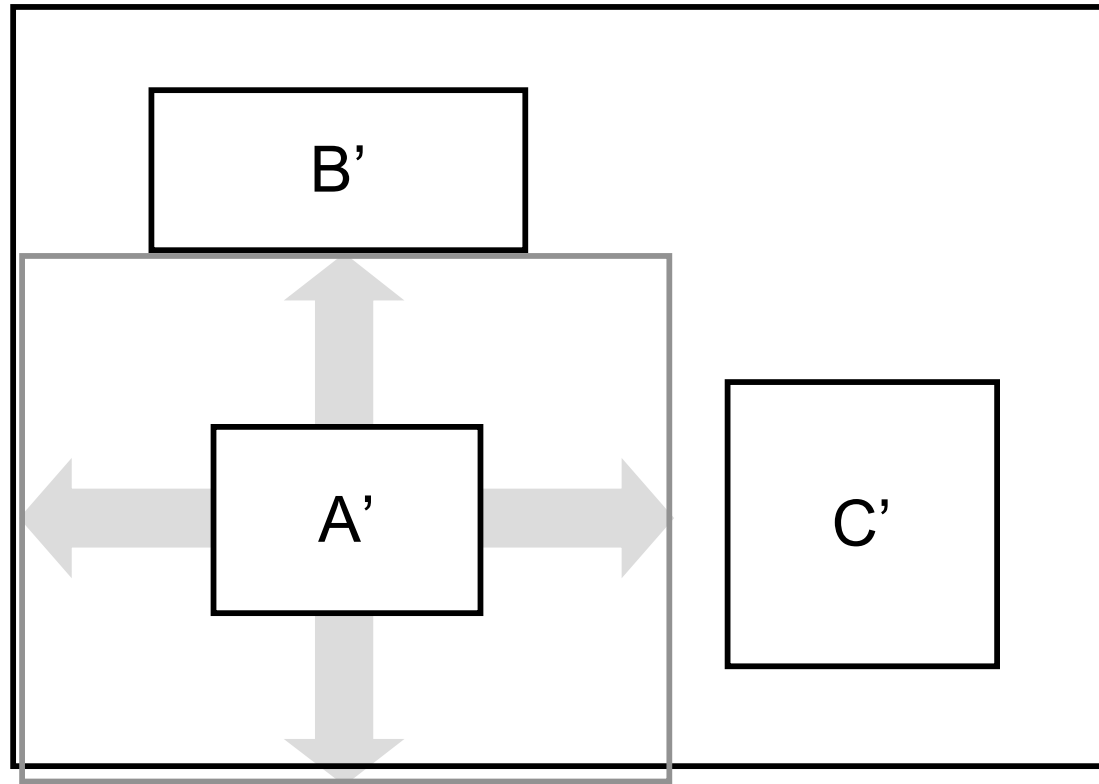


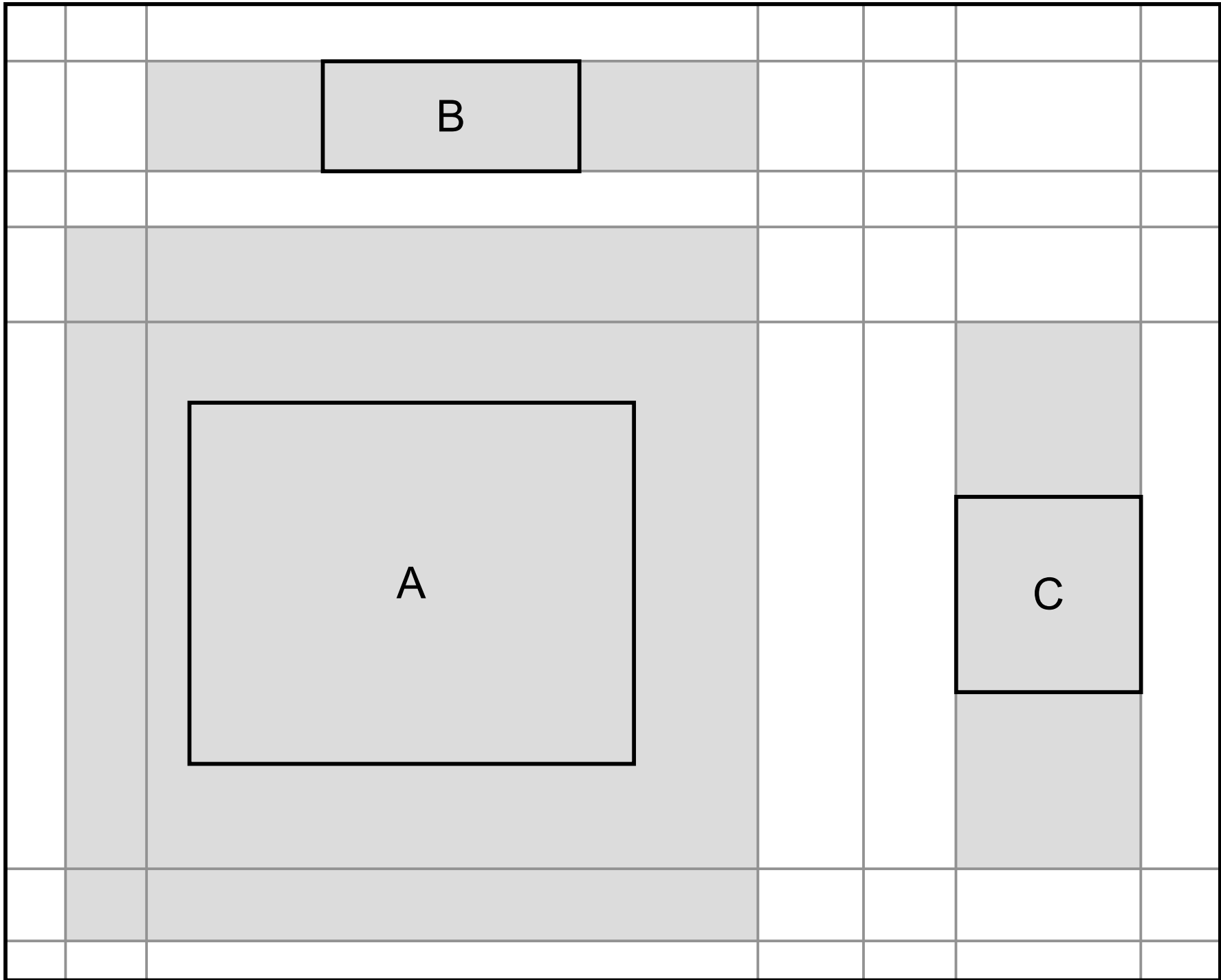


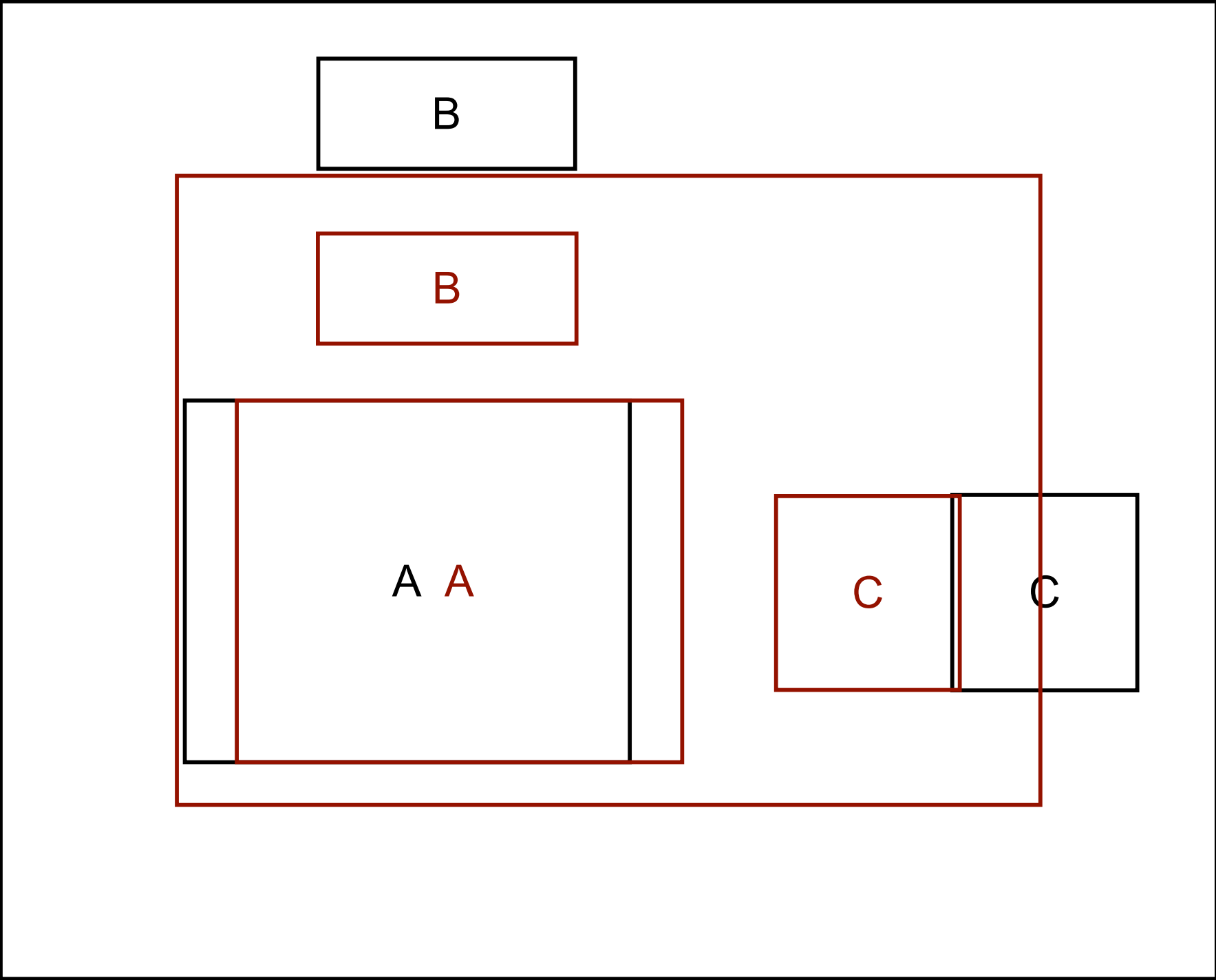


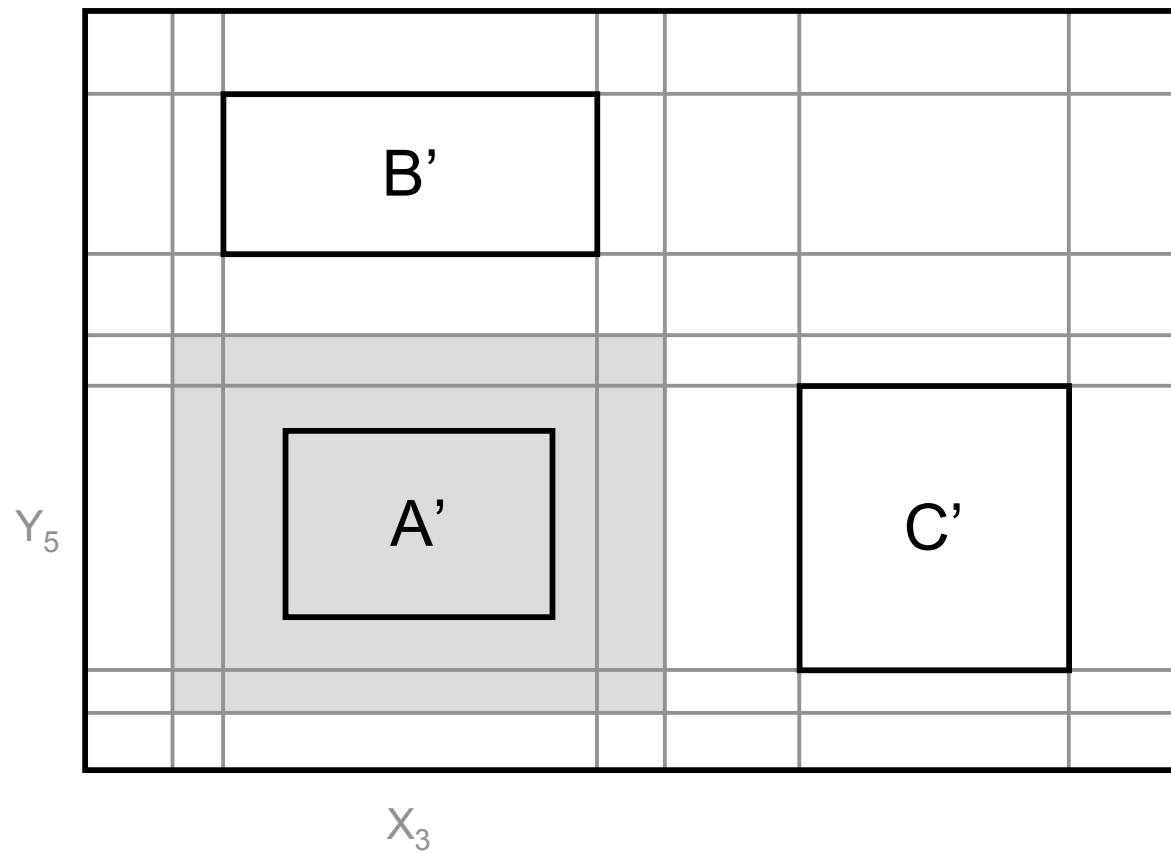


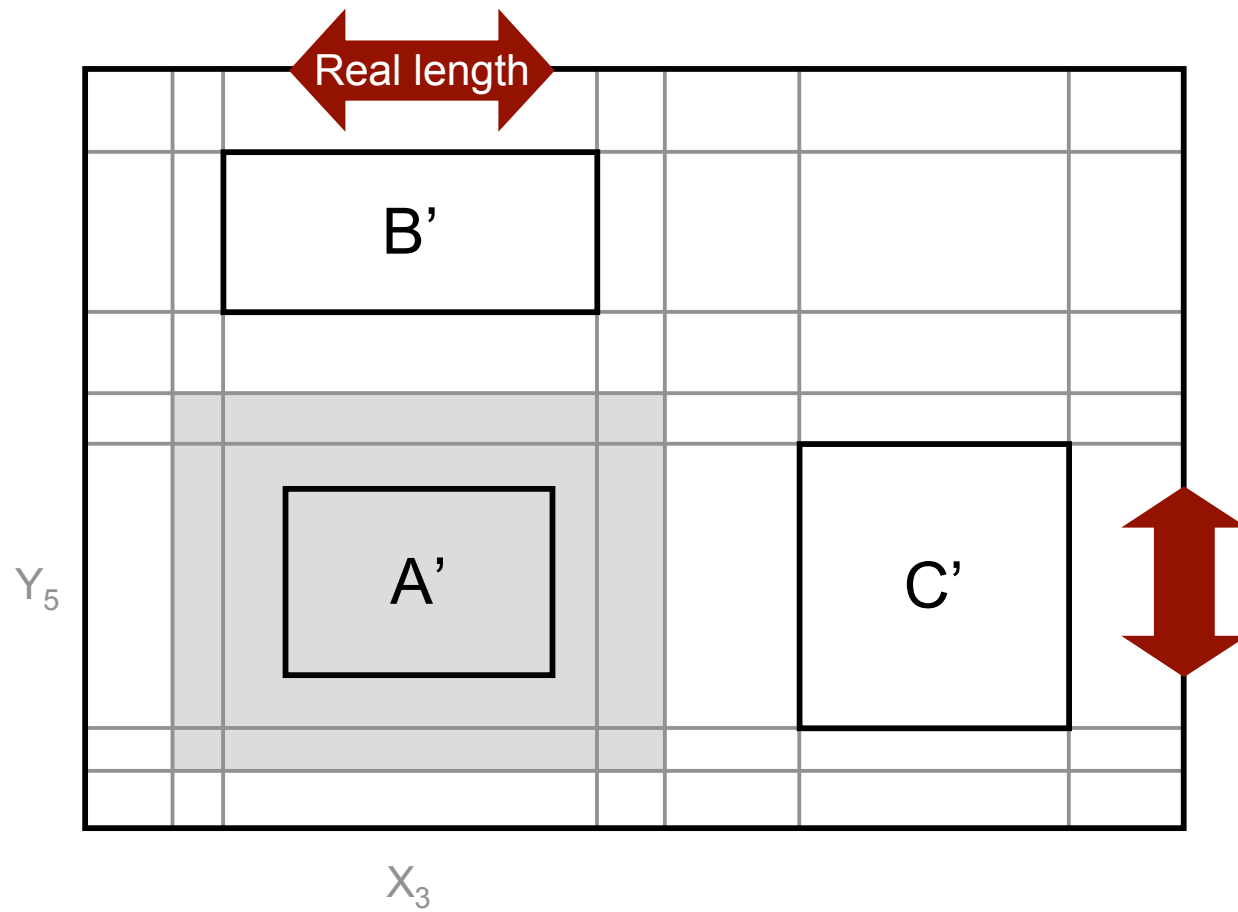


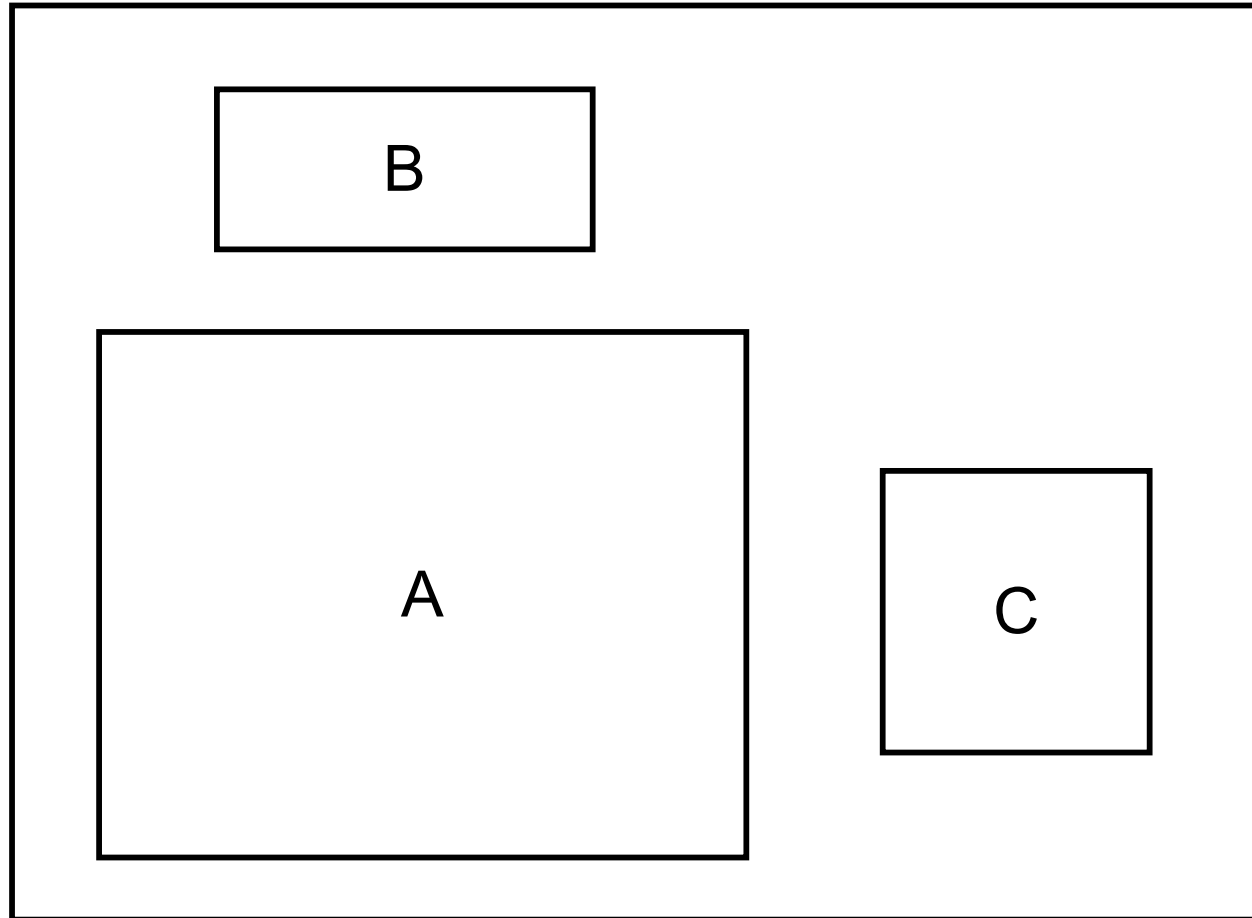












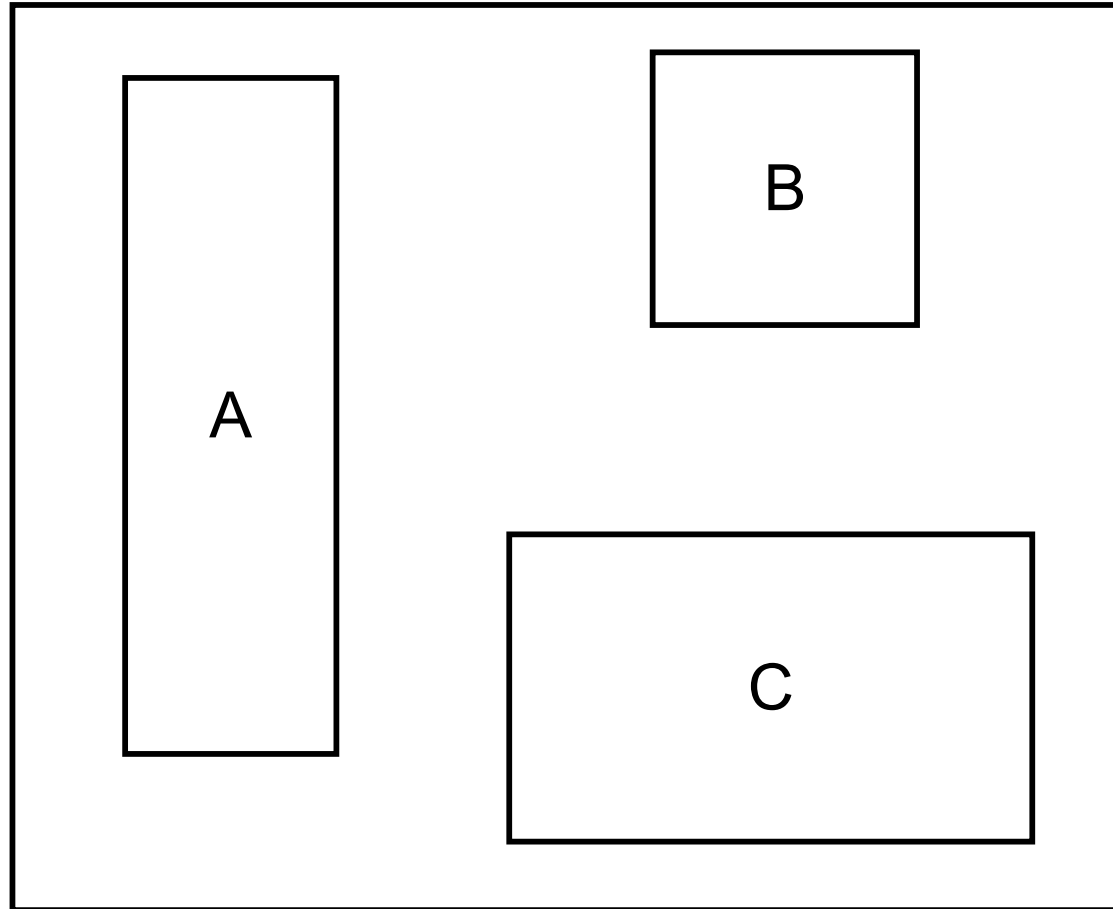
Editing Hierarchical Models

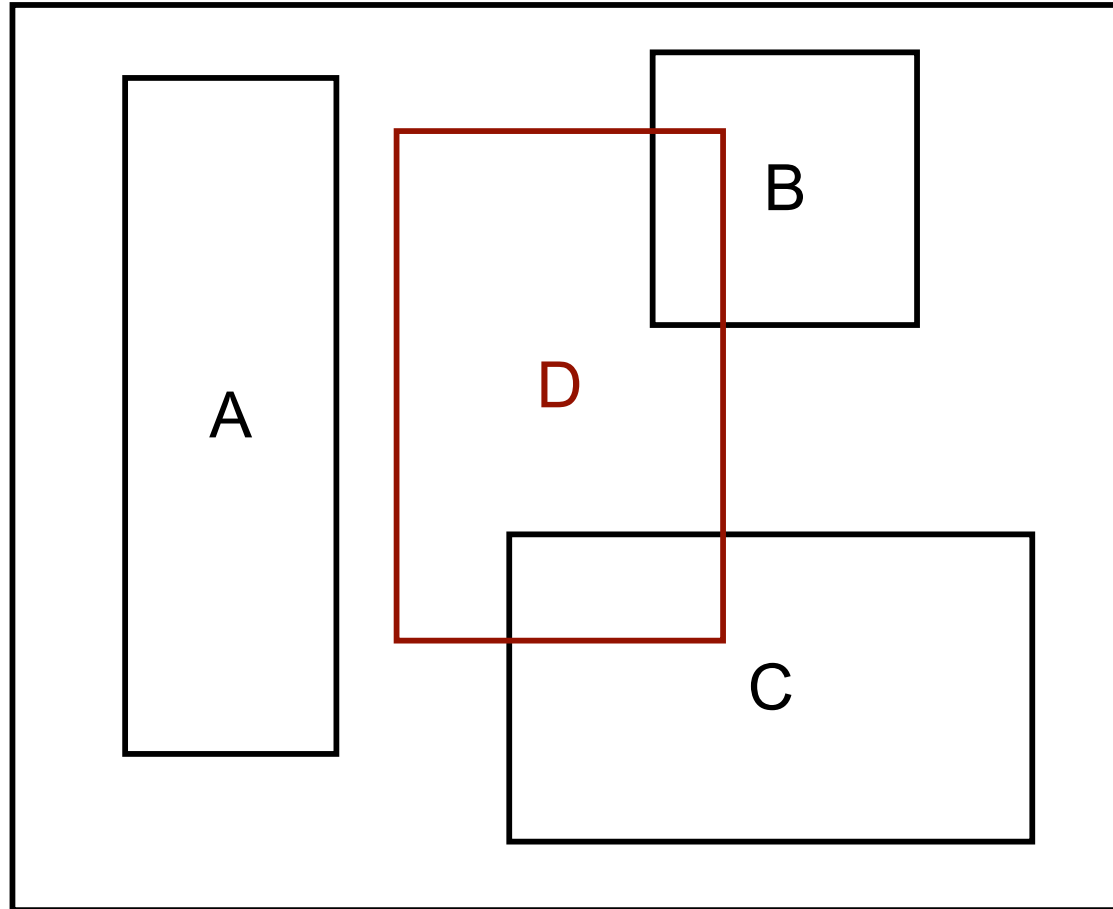
Use the zoom algorithm to **adapt the layout** when a node is inserted or deleted.

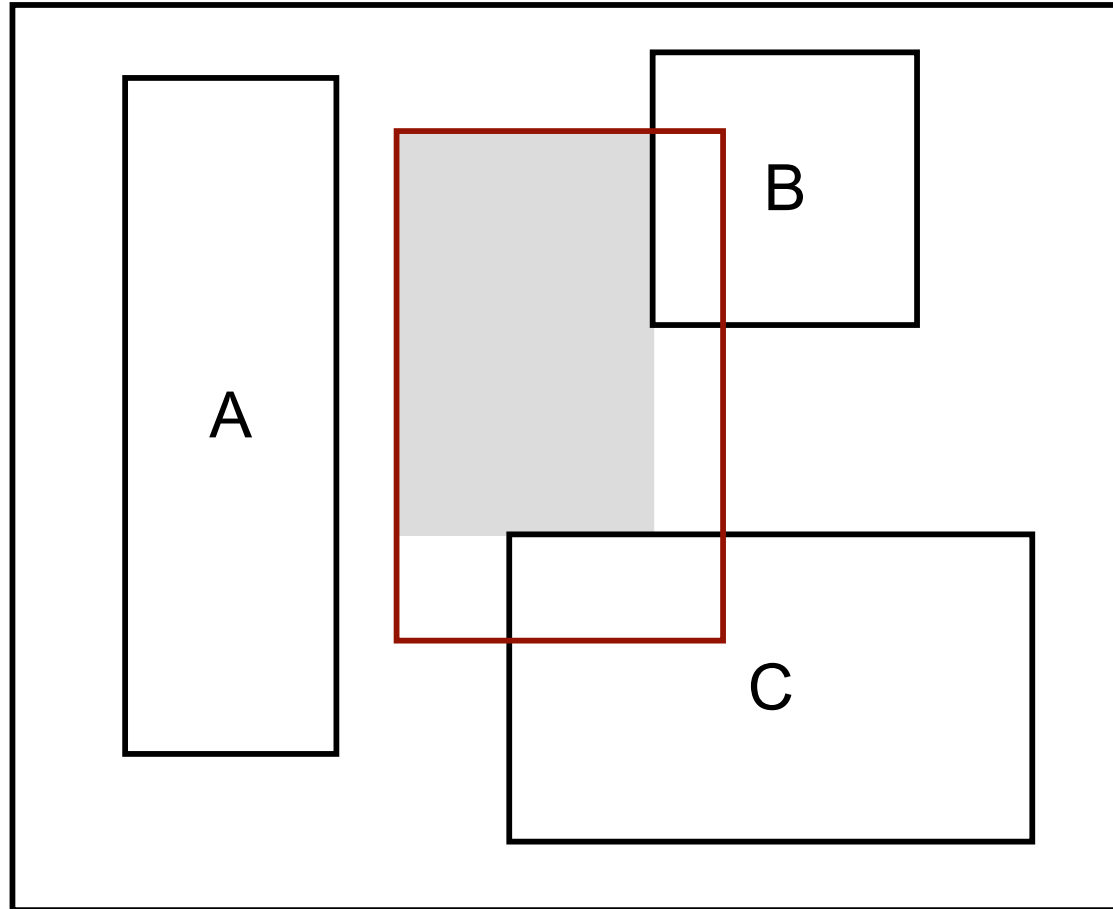


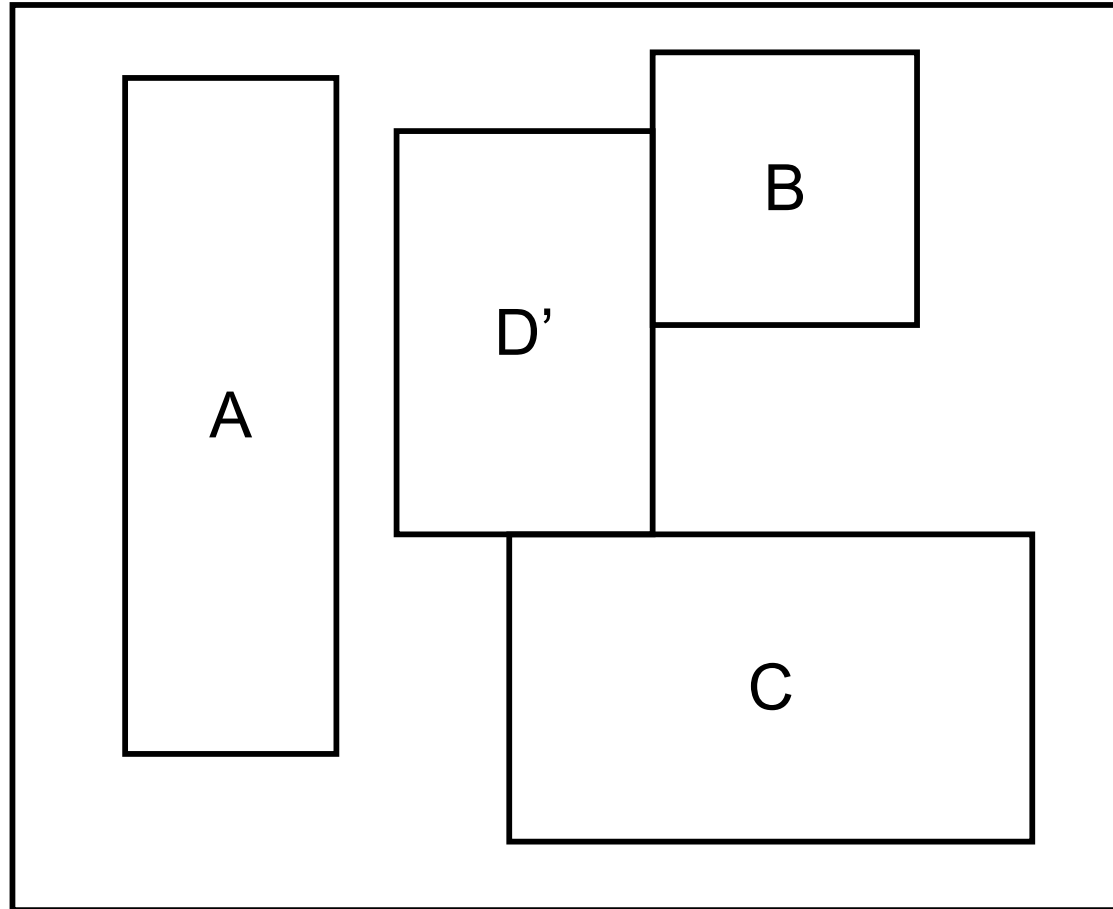
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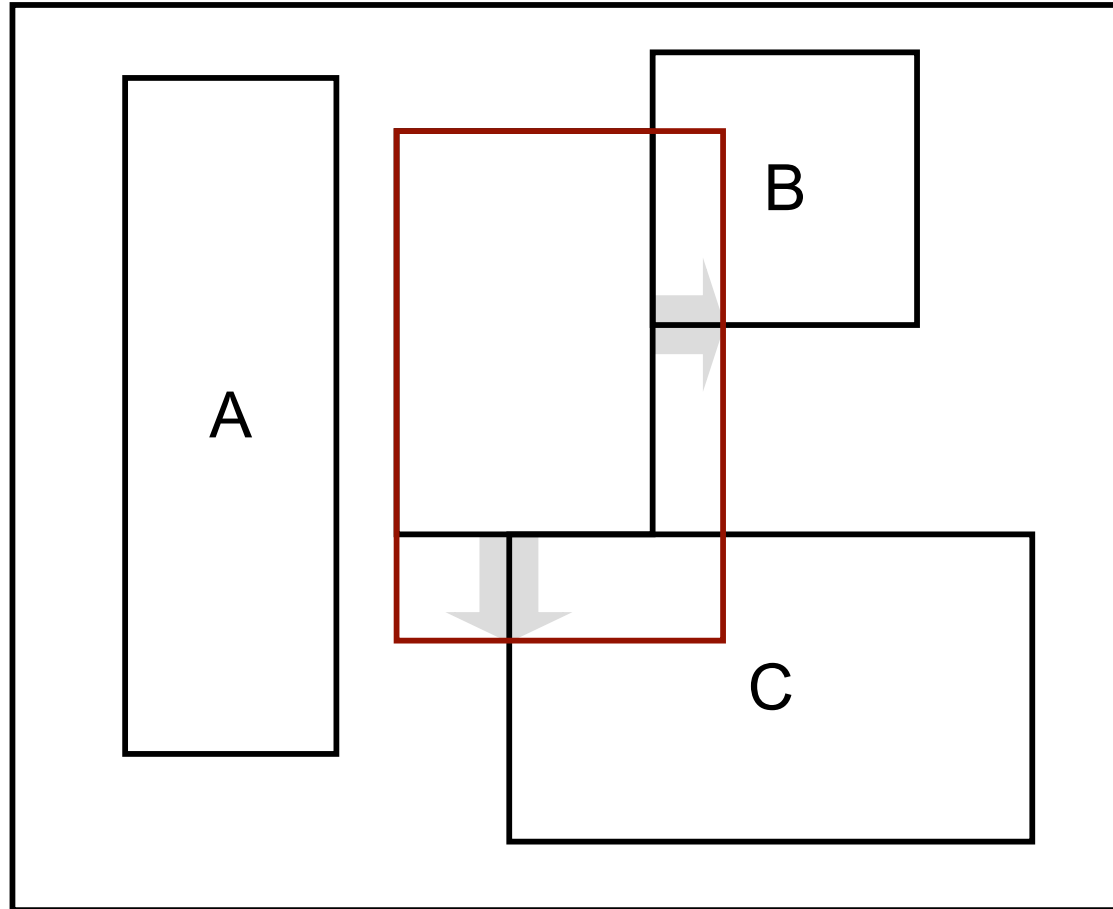


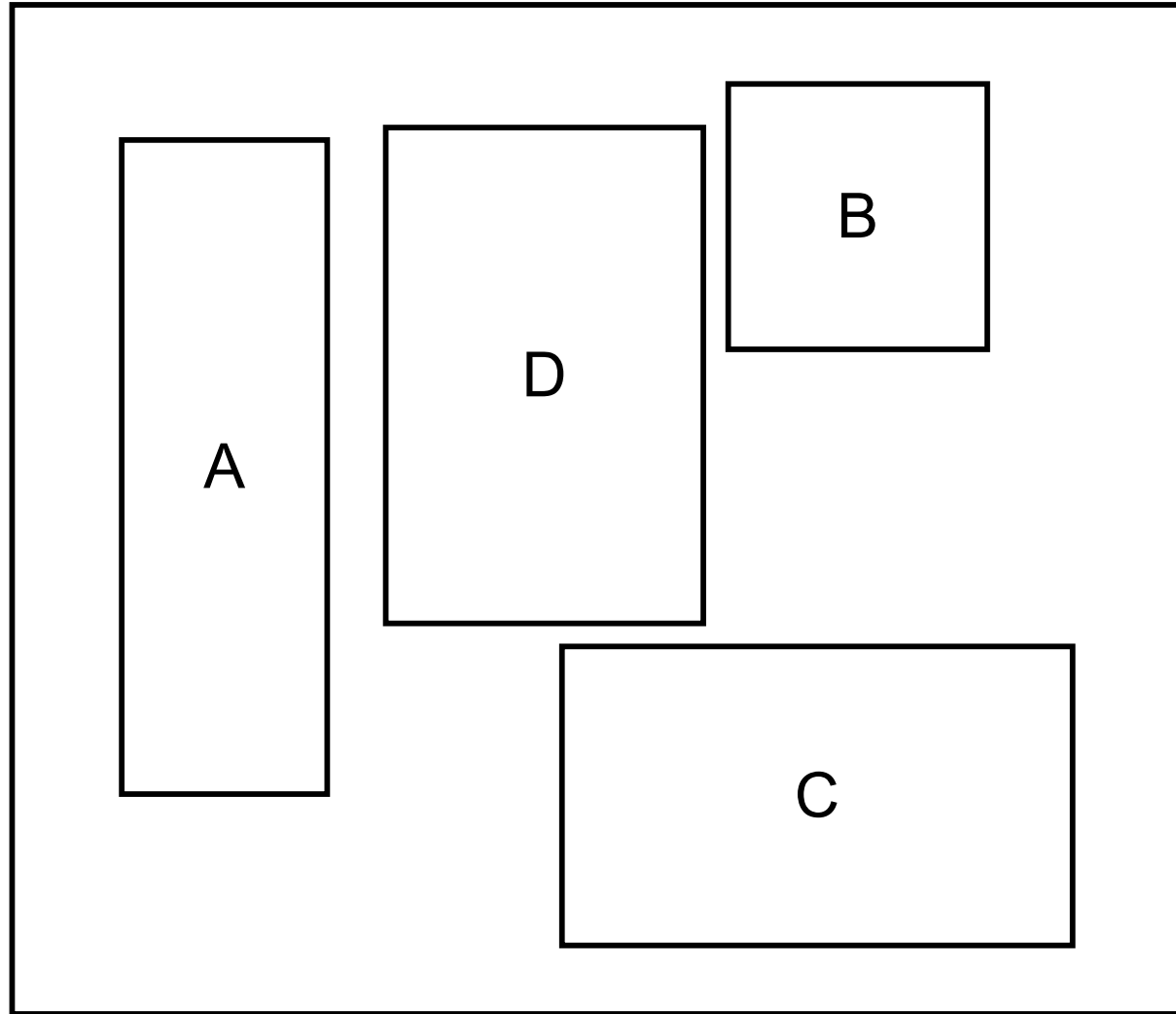












Additional editing operations

- remove node
- move node
- resize node



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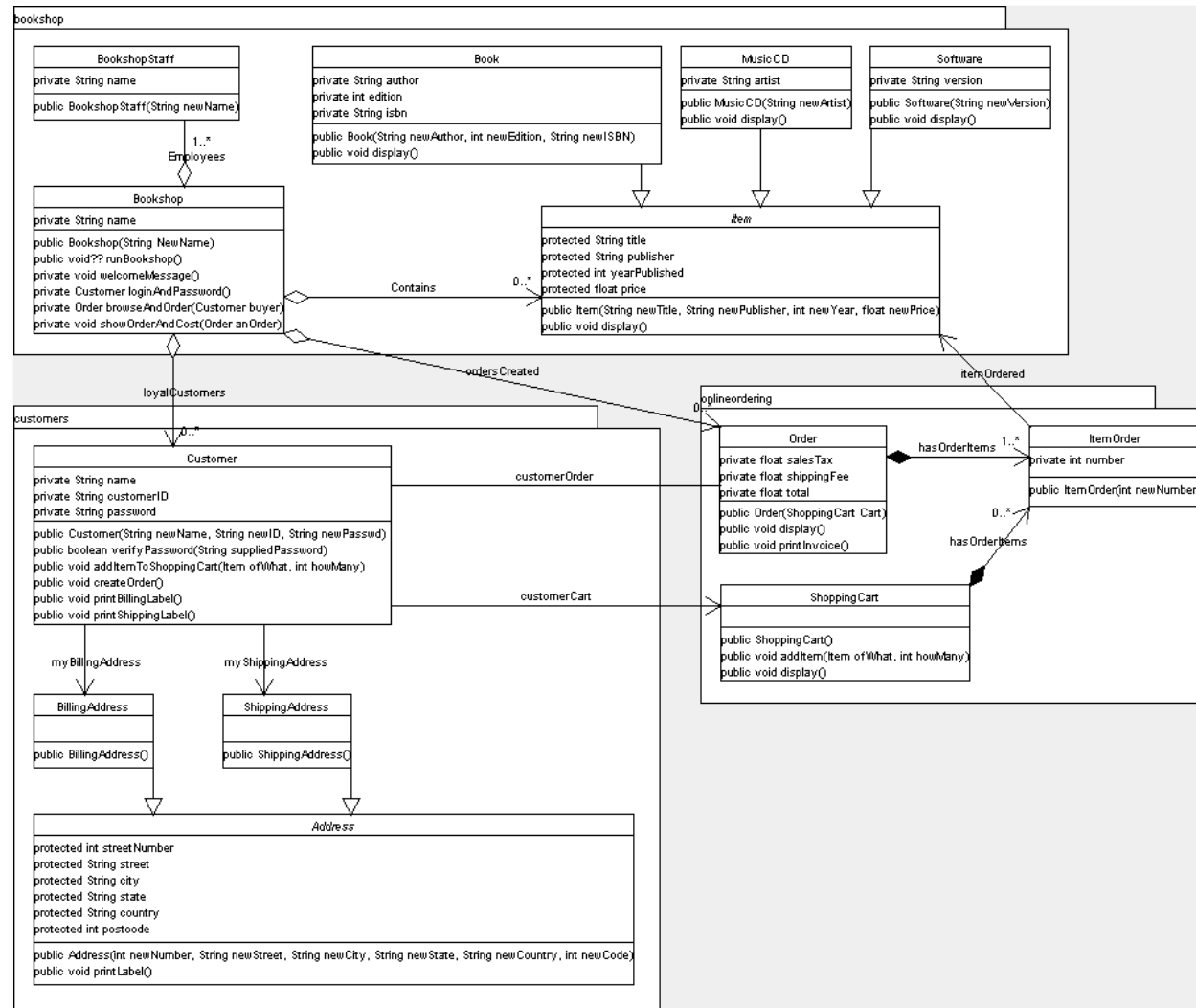


Desired properties of a zoom algorithm

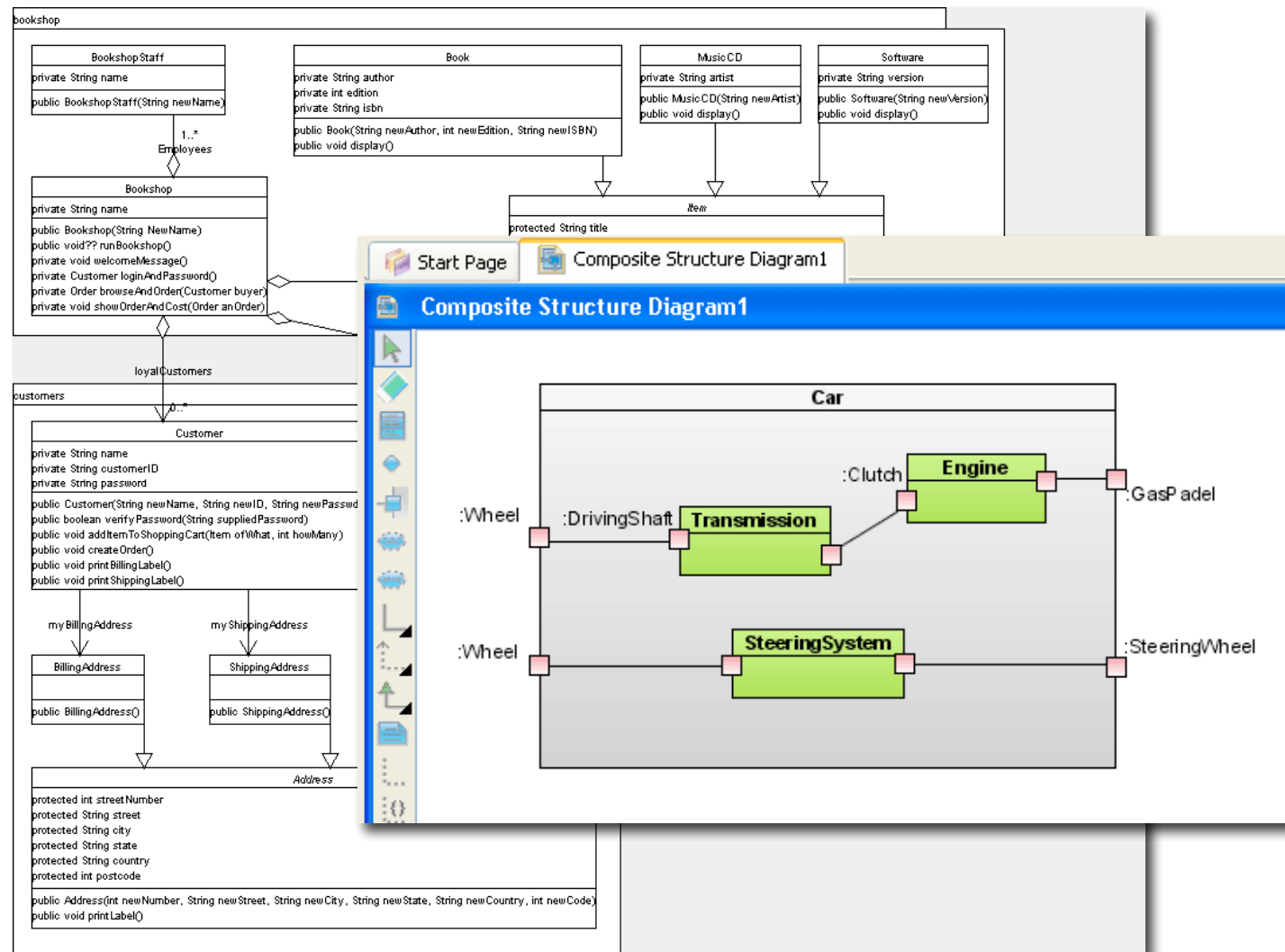
- no node **overlaps** → scaling non-overlapping intervals
- preserve the user's **mental map** → order of intervals
- **stability** of the layout → real length, scaling
- permit **editing** operations → support editing
- no remarkable **delay** → linear number of intervals
- **multiple** focal points → zoom multiple nodes



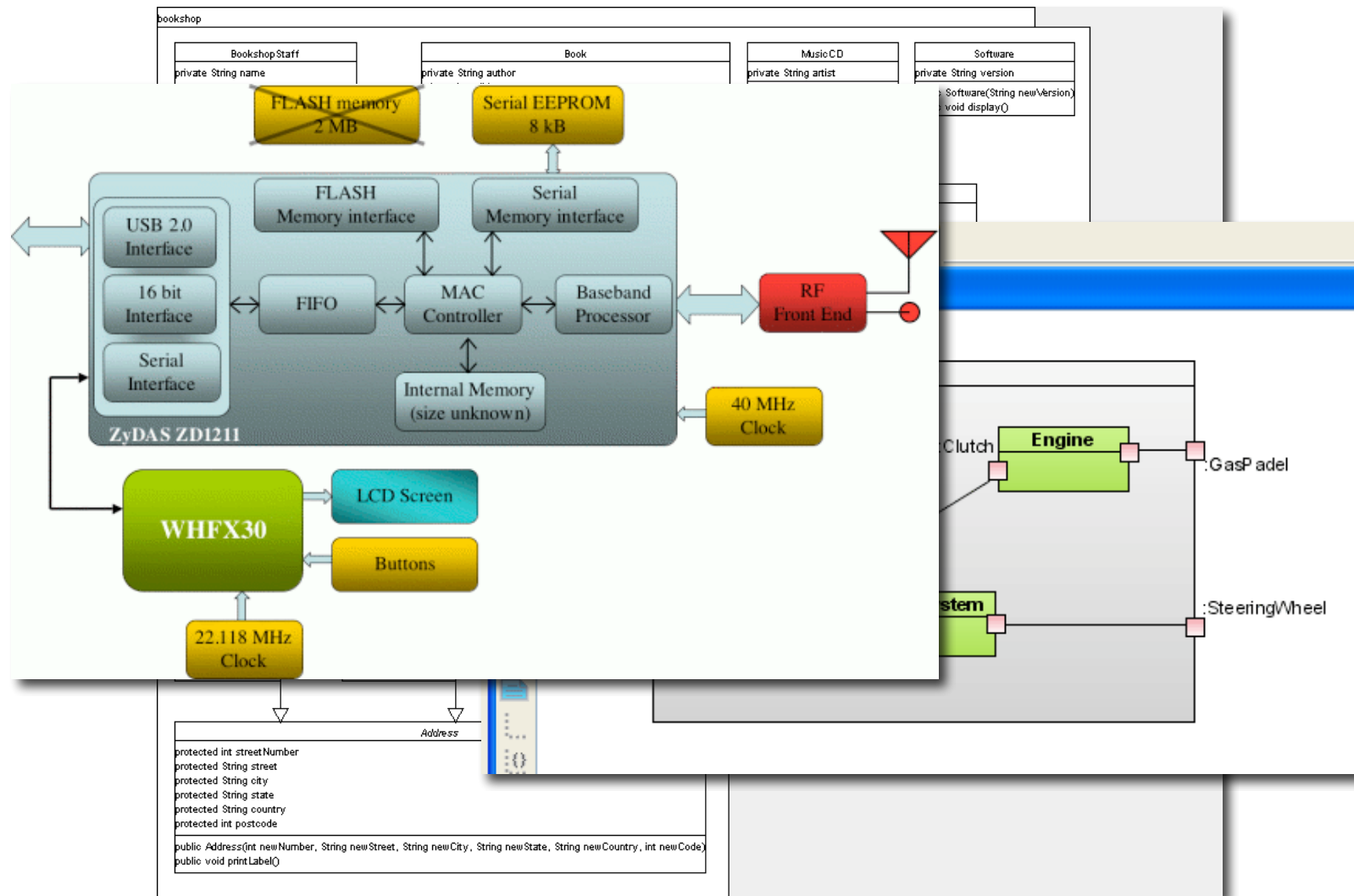
Applications



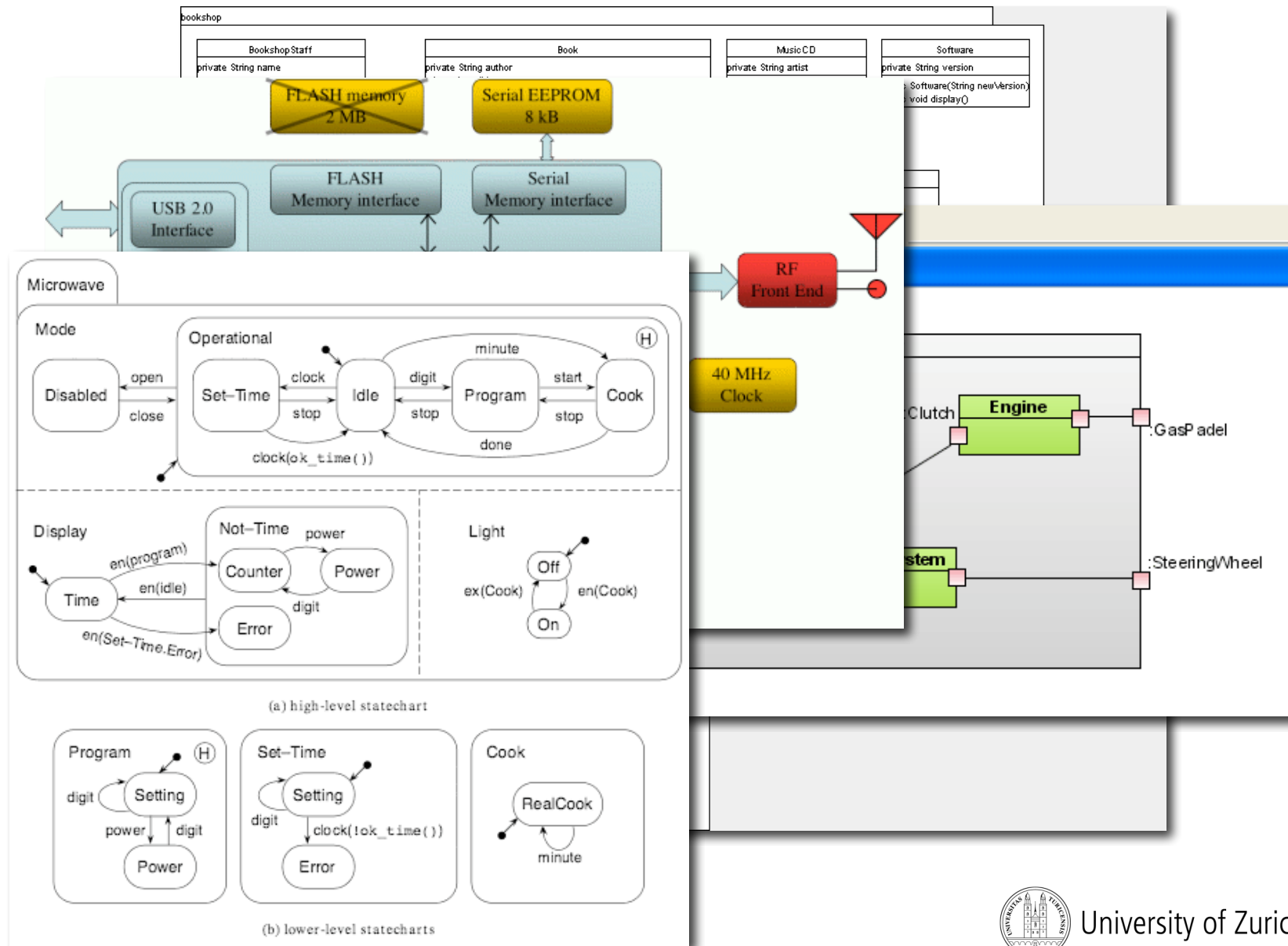
Applications



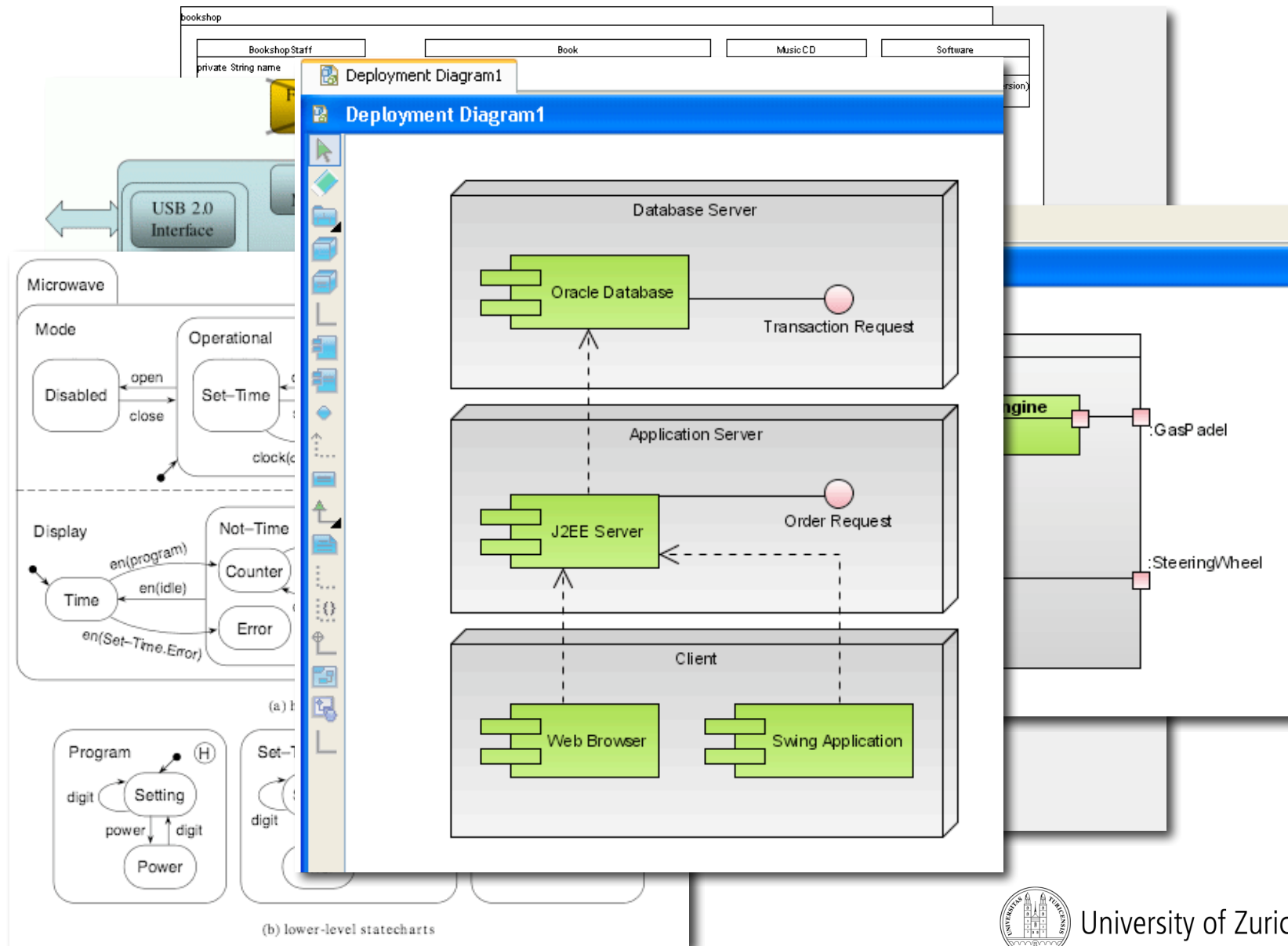
Applications



Applications



Applications



Limitations / Future work

- screen still too small: combine with scrolling, scaling
- connections between nodes
- connection labels
- filtering (specific) nodes
- visualization of model transformations



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