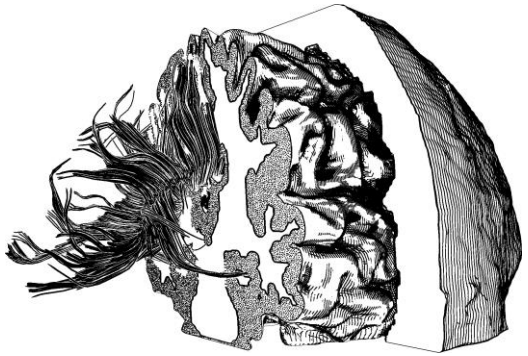
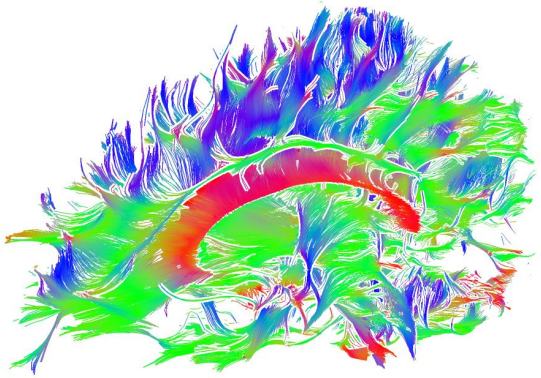
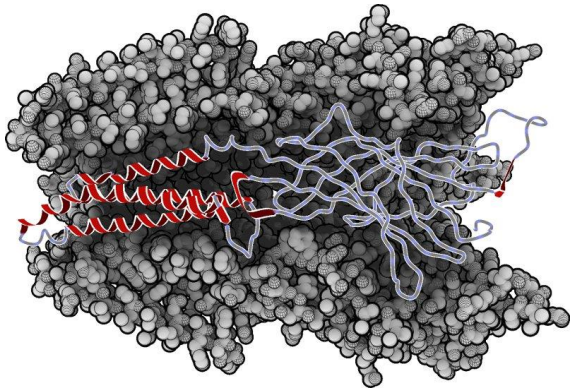




Abstraction in Scientific Data Visualization: Application to Brain Connectivity and Structural Biology

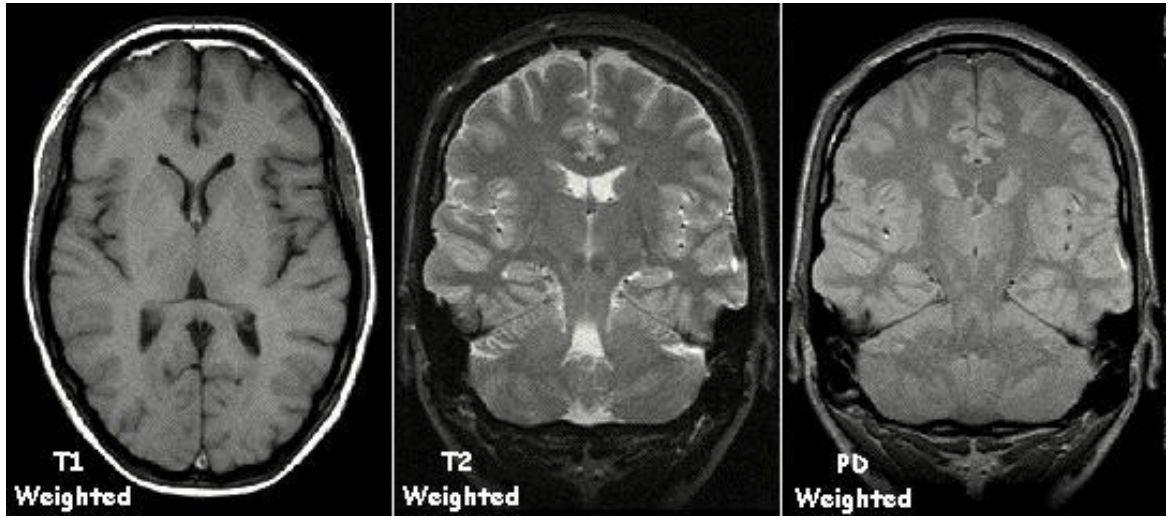
Tobias Isenberg

informatics mathematics Inria

Visualization as a Field

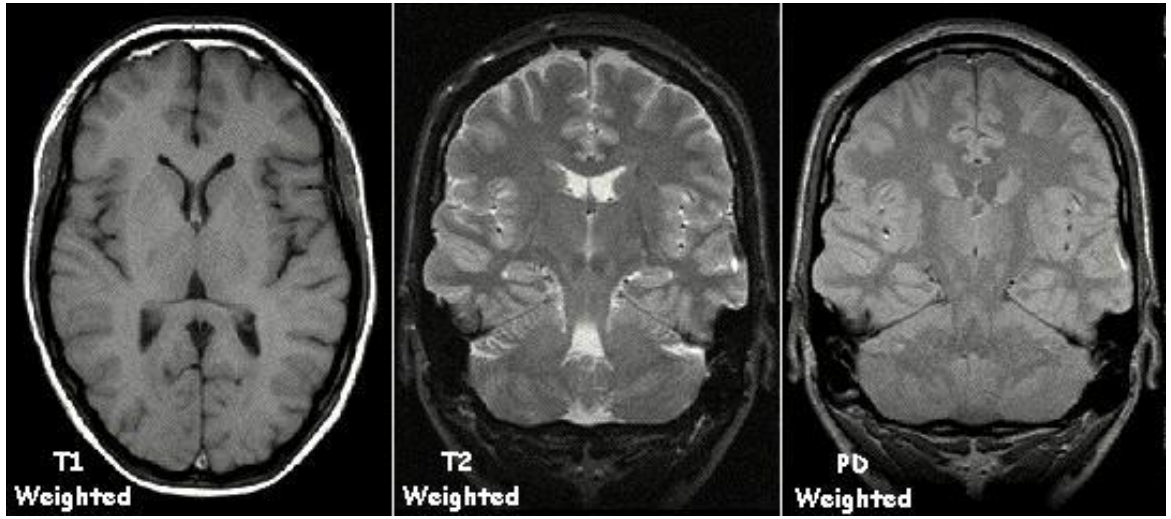
MRI scanner/
MRI modalities

Visualization as a Field



MRI scanner/
MRI modalities

Visualization as a Field



MRI scanner/
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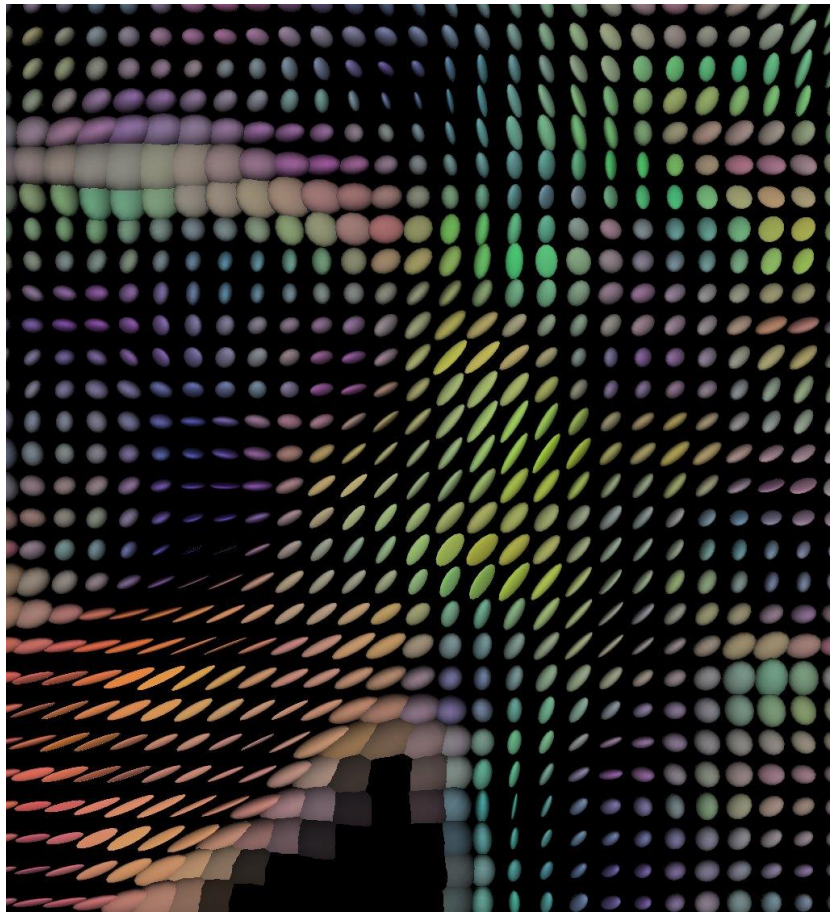
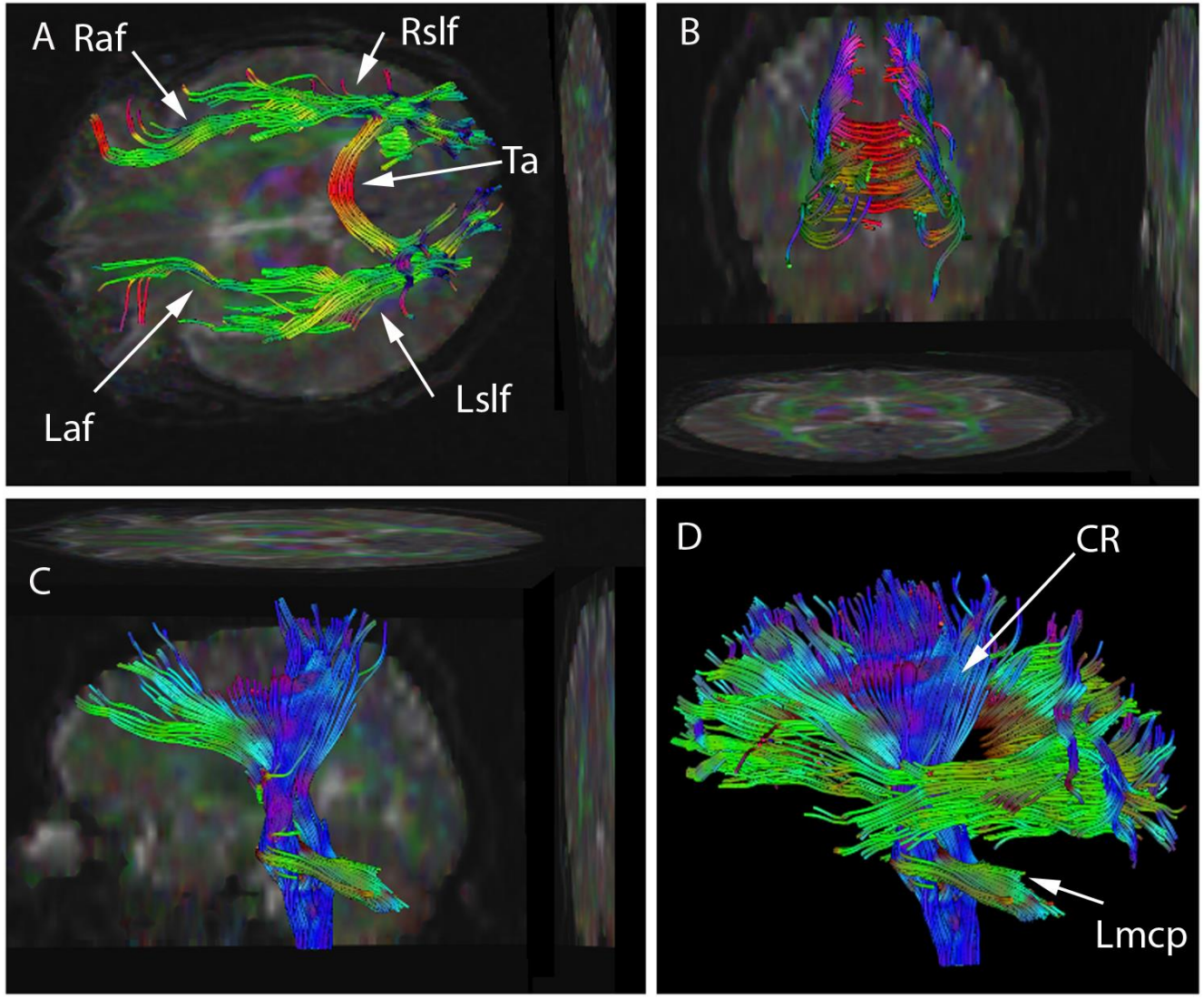


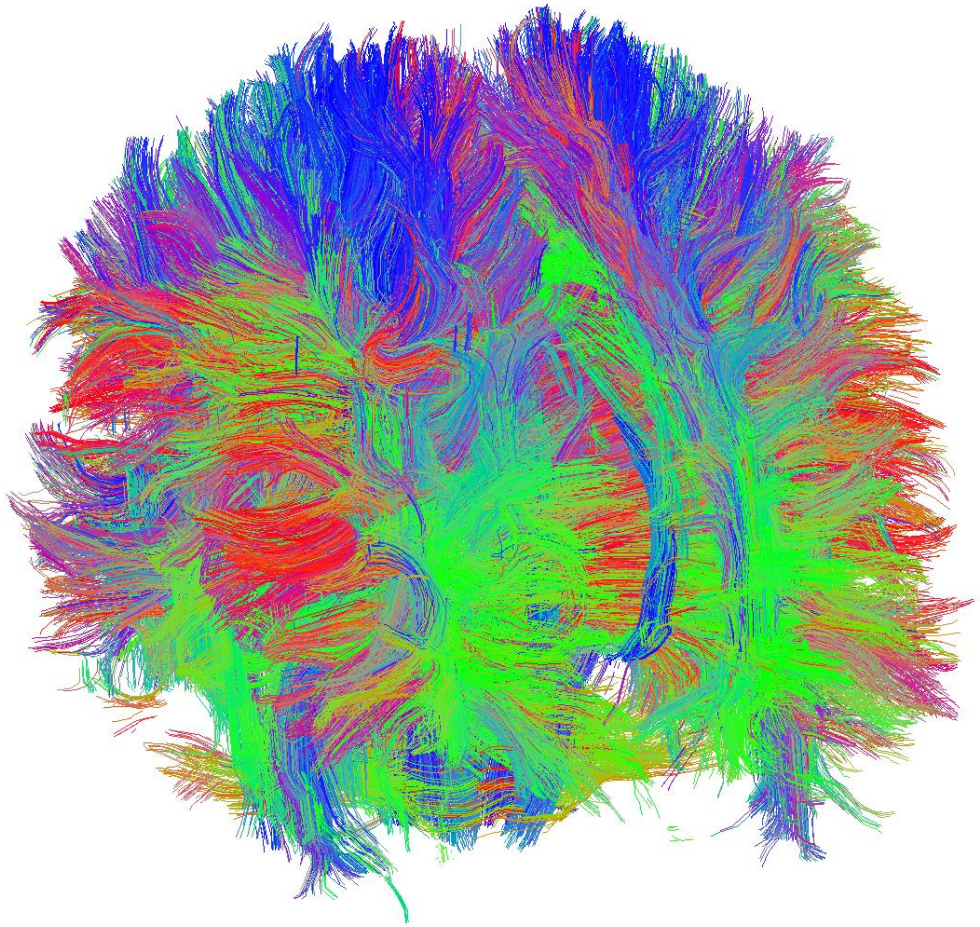
representation of DTI as tensors
[image: Thomas Schultz]

Visualization as a Field

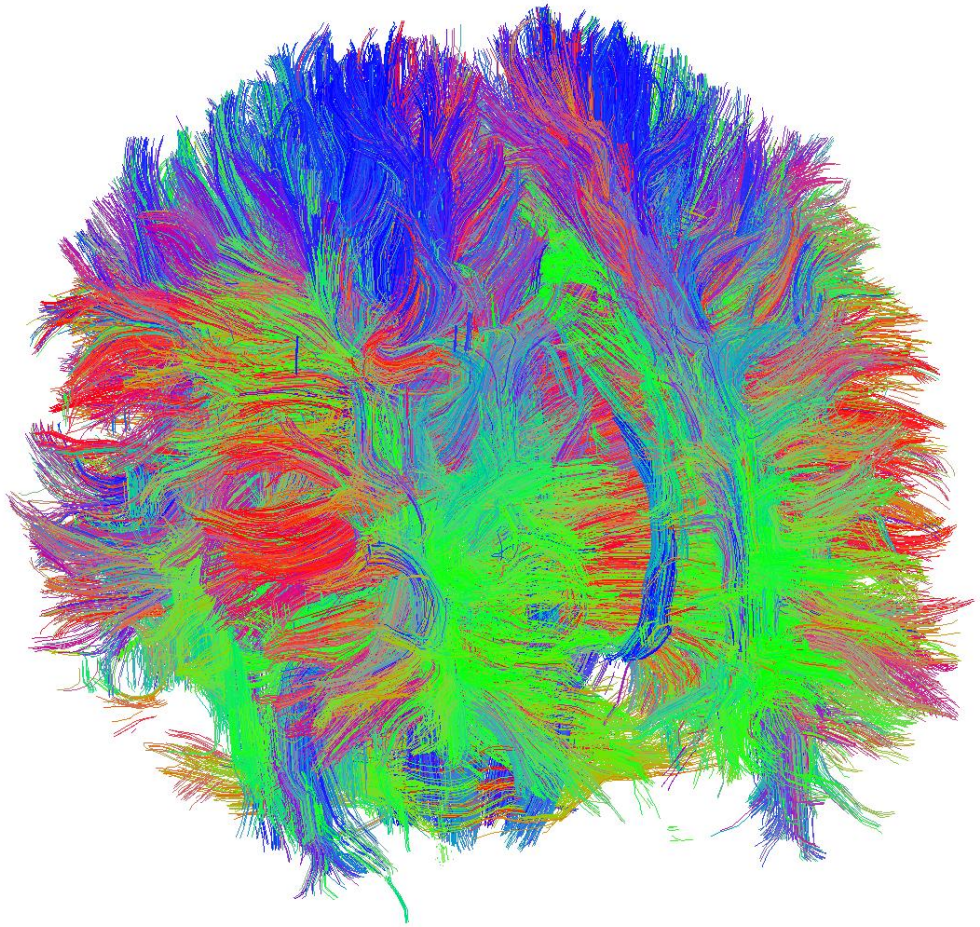


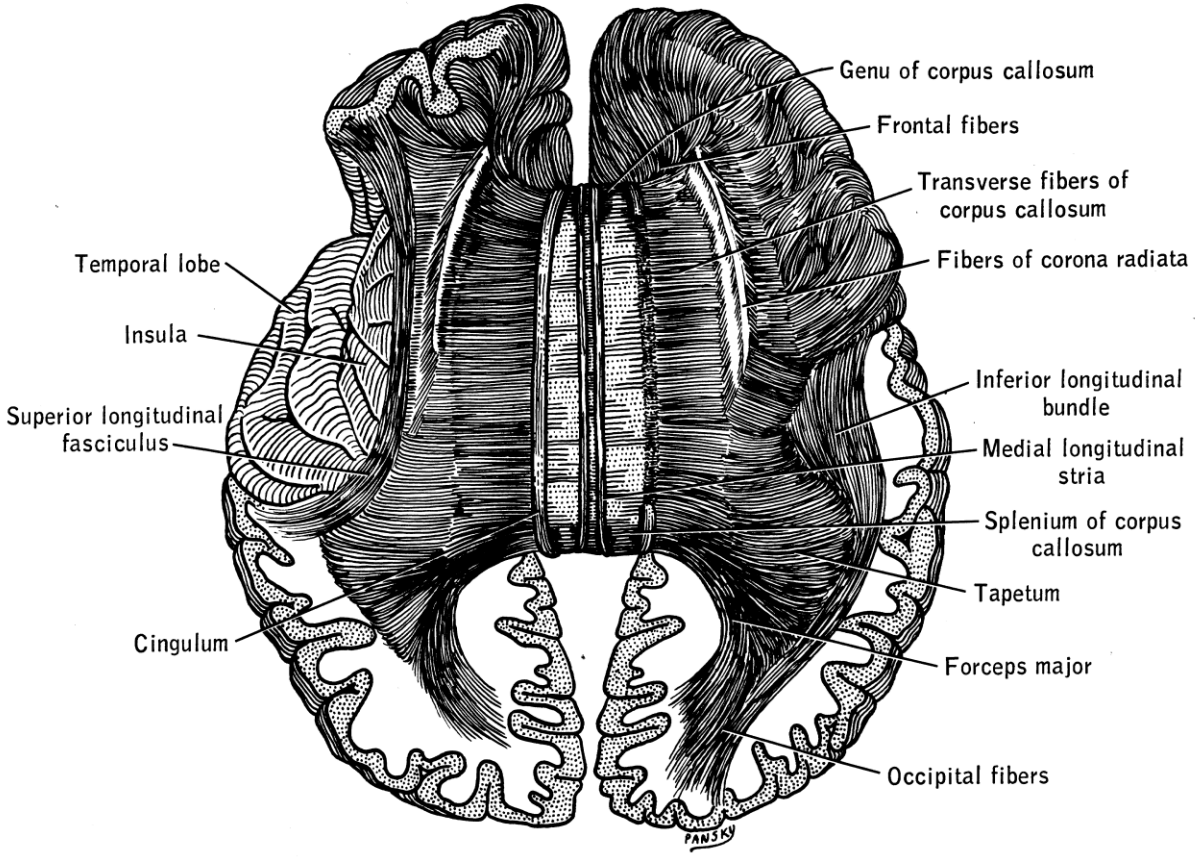
[image: Aaron G. Filler]

Visualization of Complex Datasets



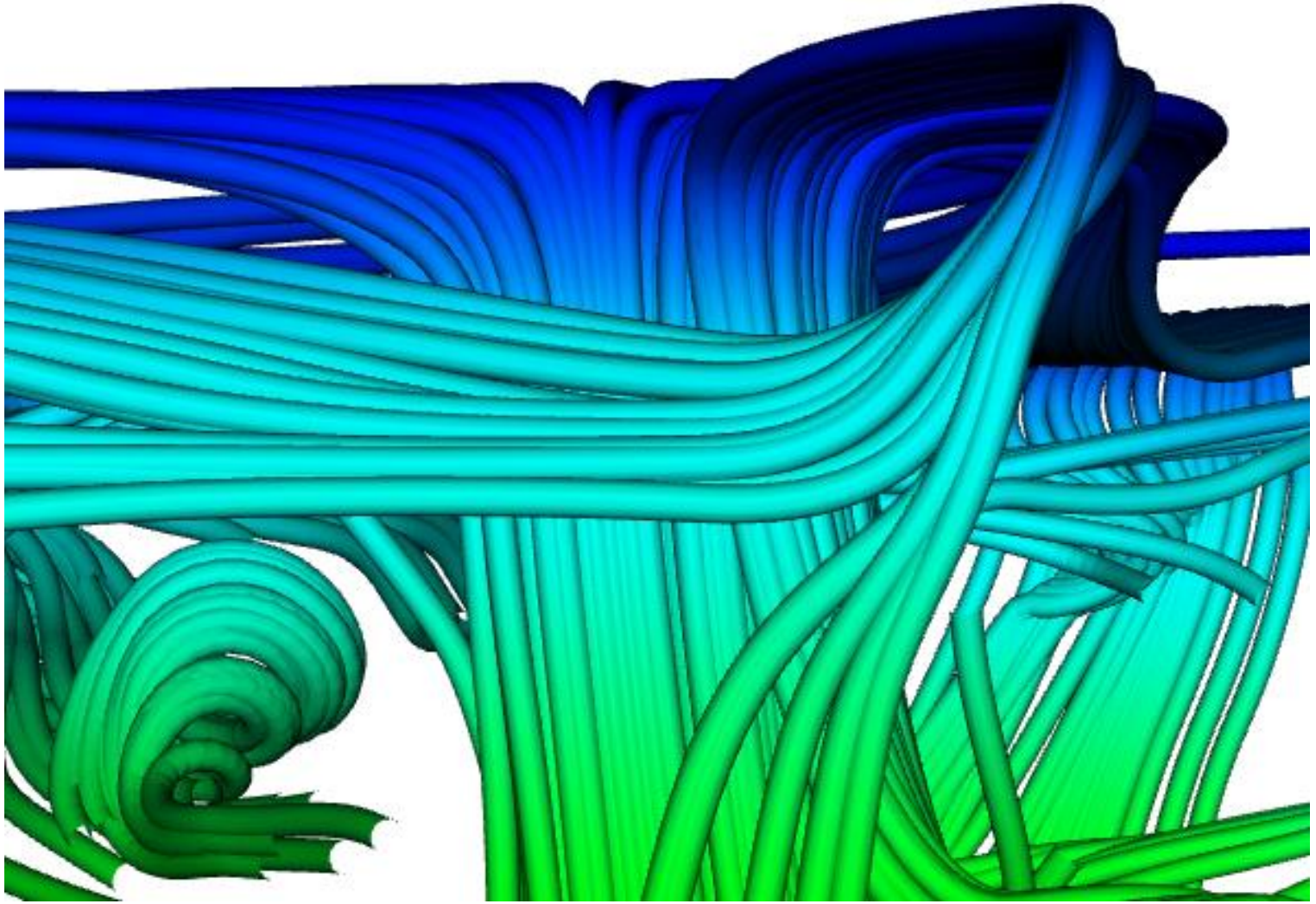
Visualization of Complex Datasets





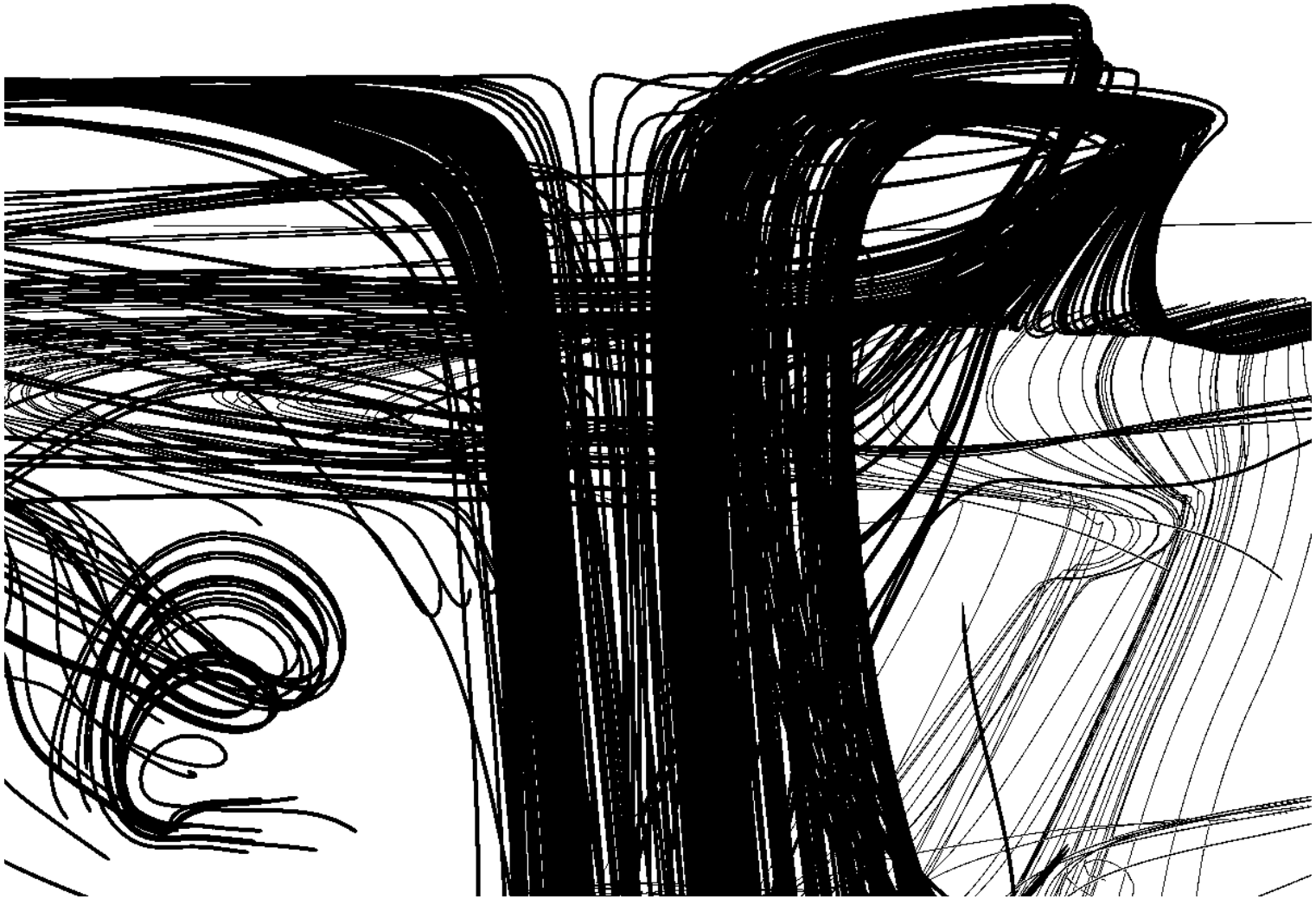
from House and Pansky, 1960

Abstraction: Adjusting the Visual Representation



TVCG / IEEE VIS 2009, with M. H. Everts, H. Bekker & J. Roerdink

Abstraction: Adjusting the Visual Representation



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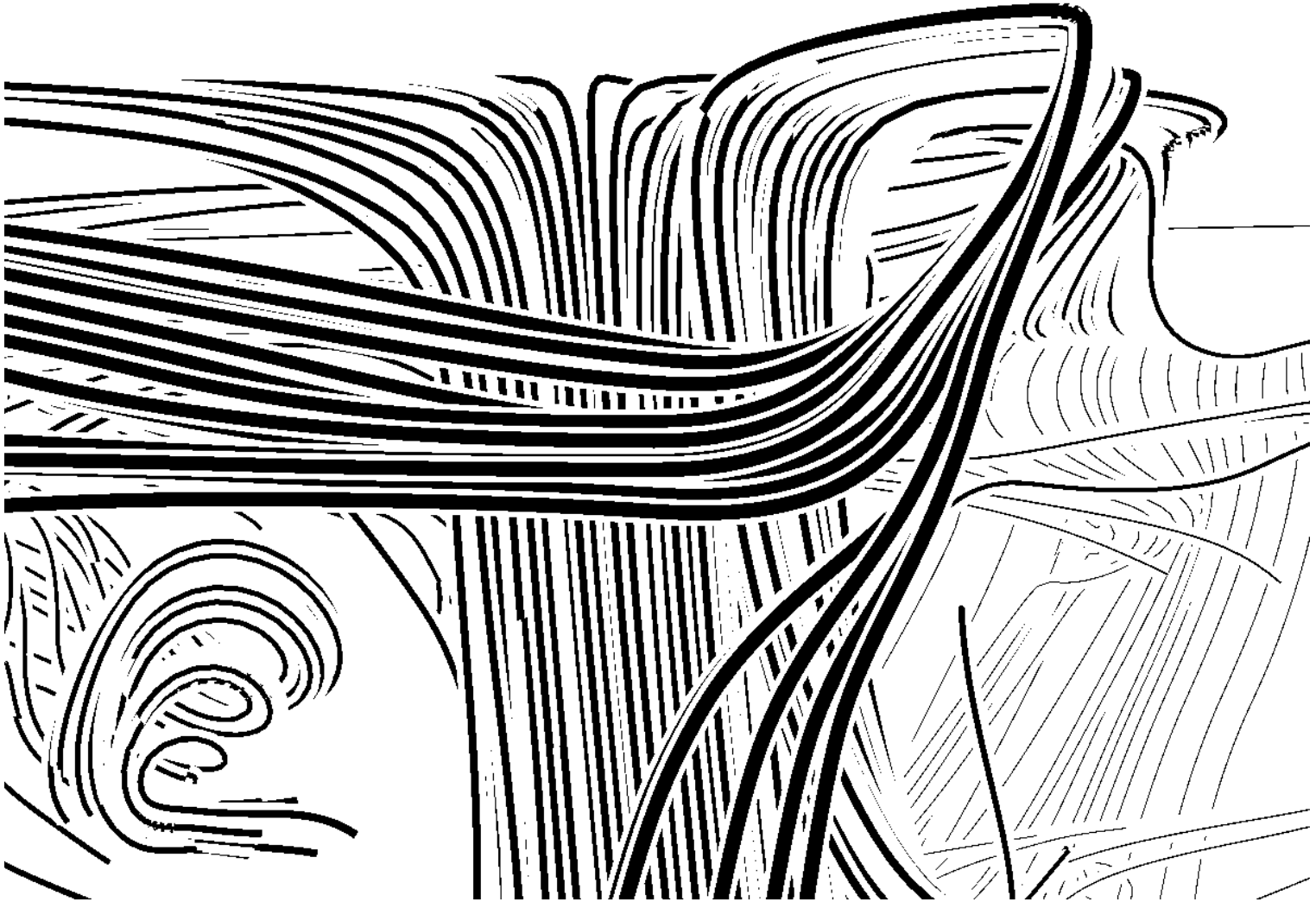

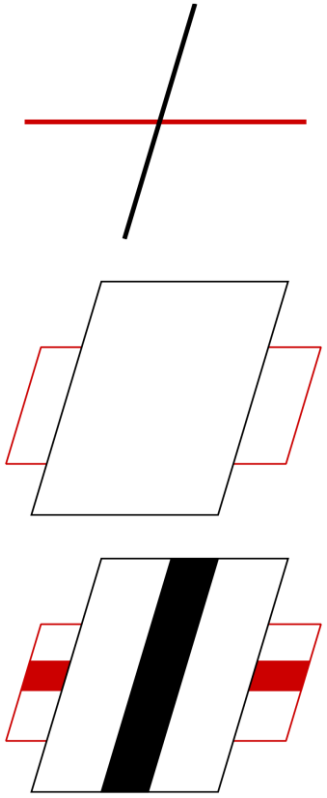

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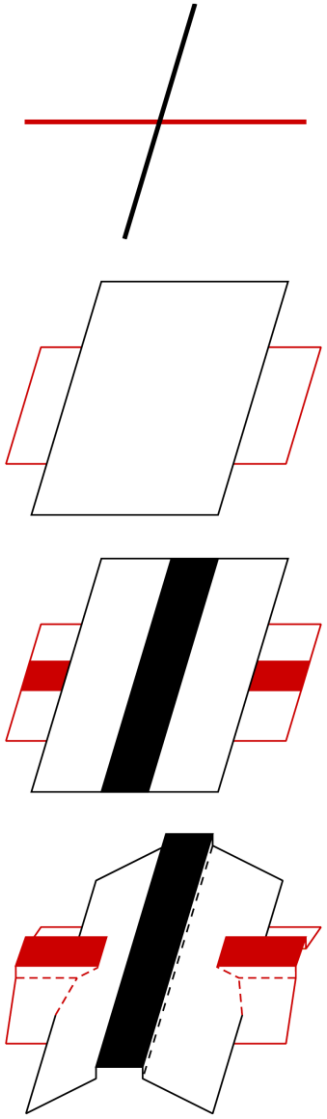


TVCG / IEEE VIS 2009, with M. H. Everts, H. Bekker & J. Roerdink

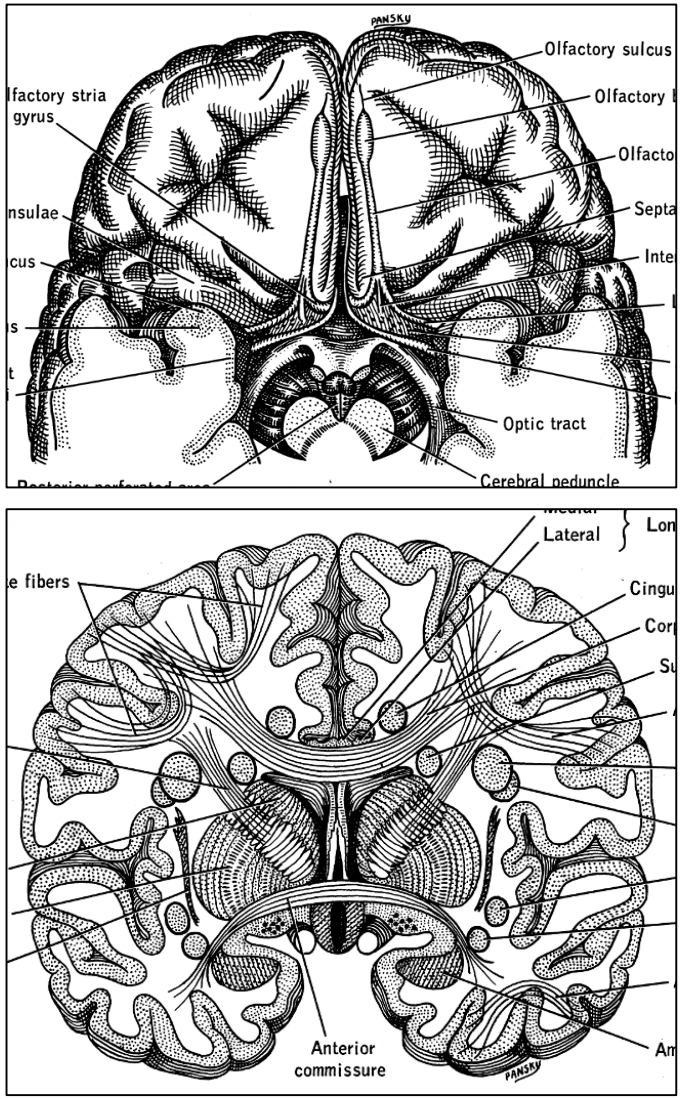
Depth-Dependent Halos

TVCG / IEEE VIS 2009, with M. H. Everts, H. Bekker & J. Roerdink

Depth-Dependent Halos

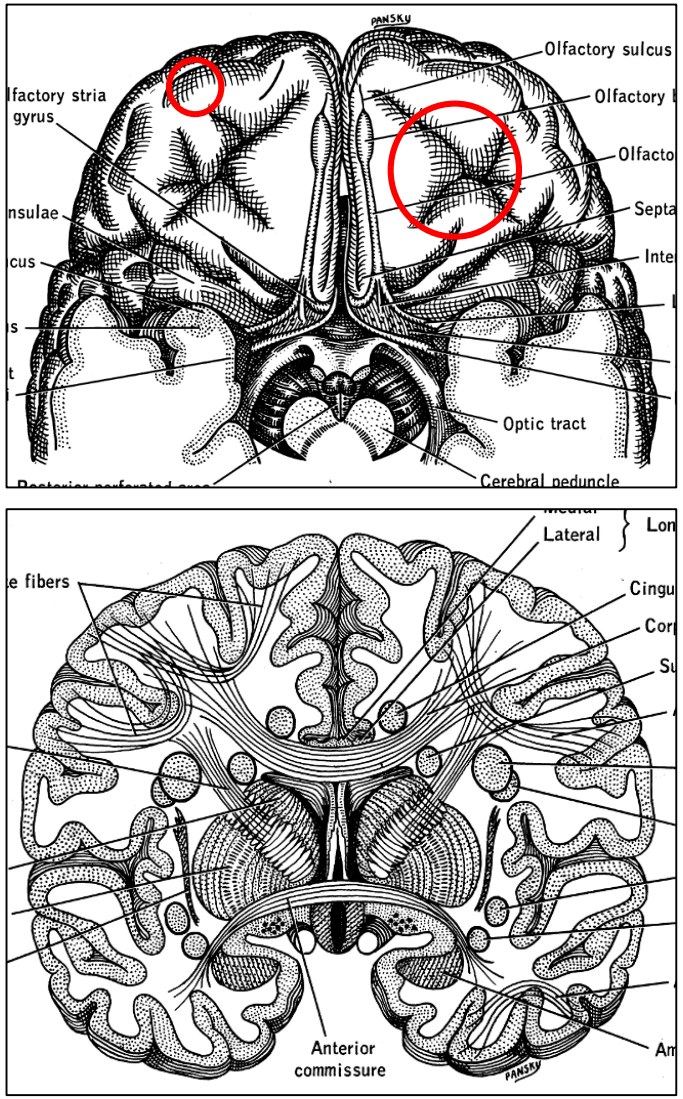
TVCG / IEEE VIS 2009, with M. H. Everts, H. Bekker & J. Roerdink

Adding Visualization of Context



from House and Pansky, 1960

Adding Visualization of Context



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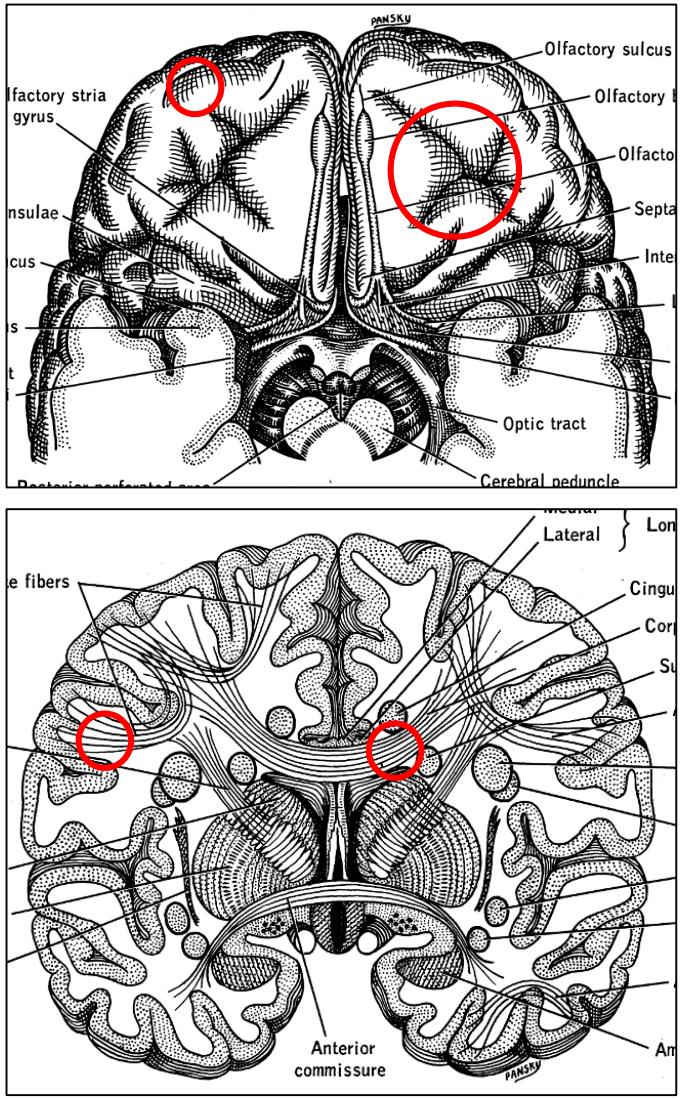

from House and Pansky, 1960

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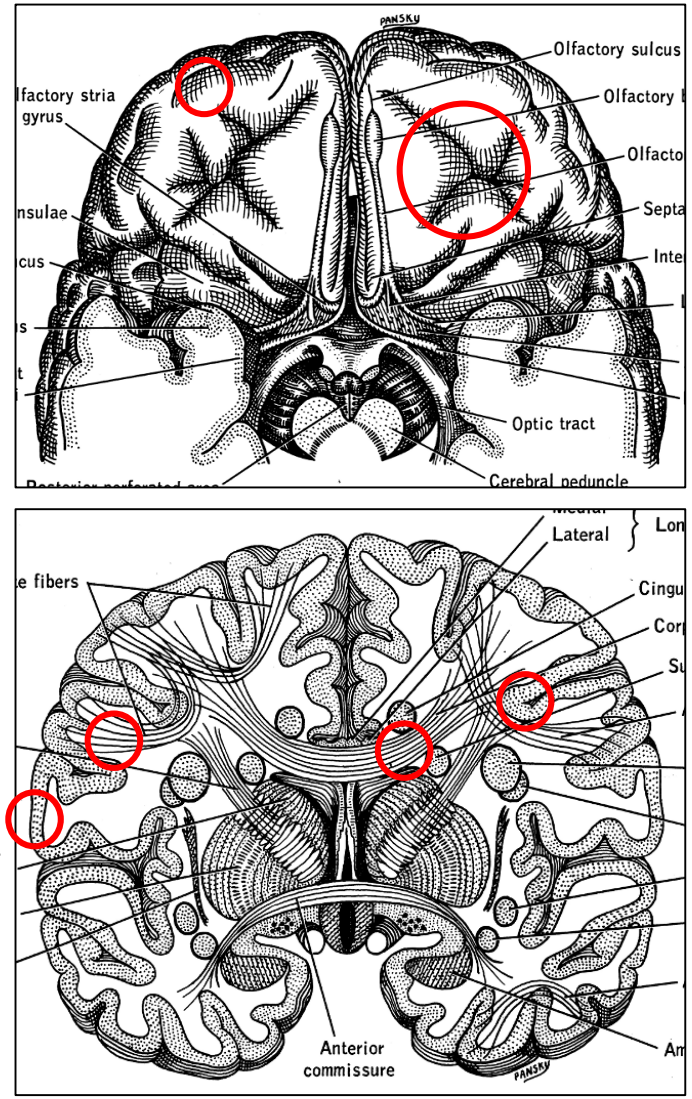
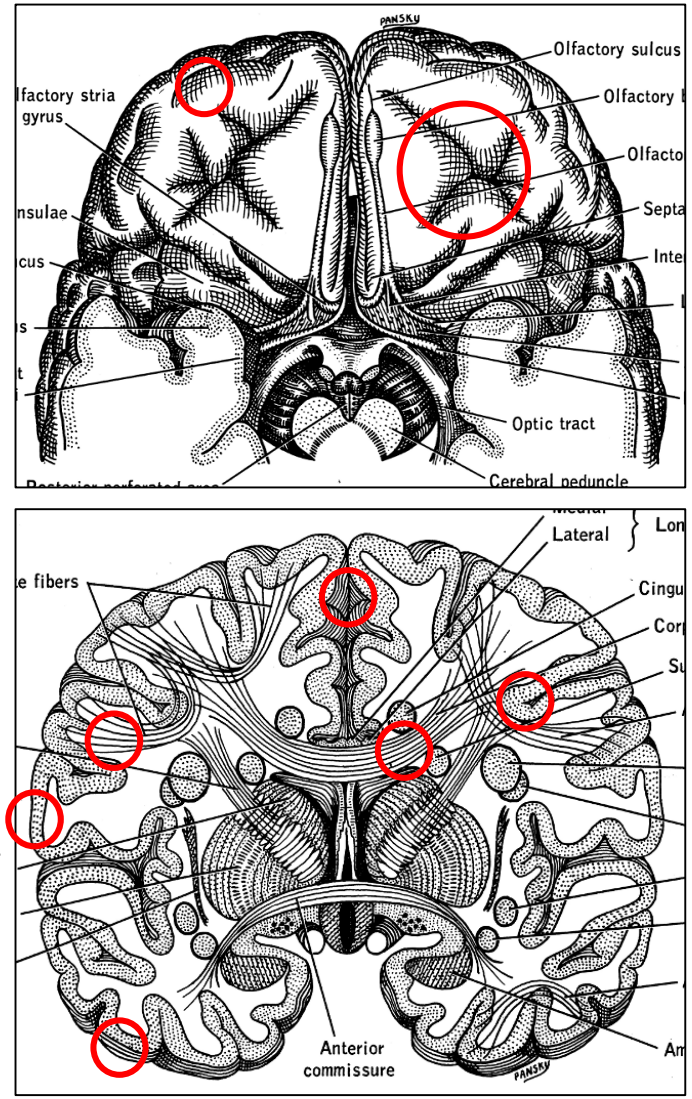


from House and Pansky, 1960

Adding Visualization of Context



from House and Pansky, 1960

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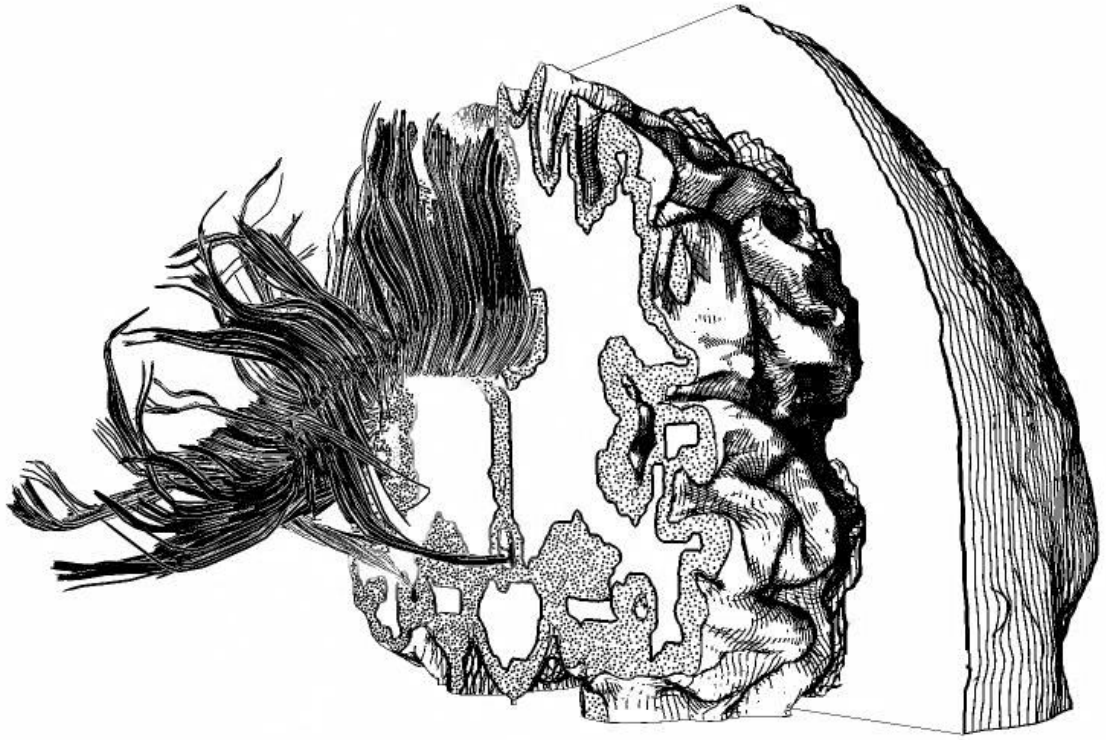
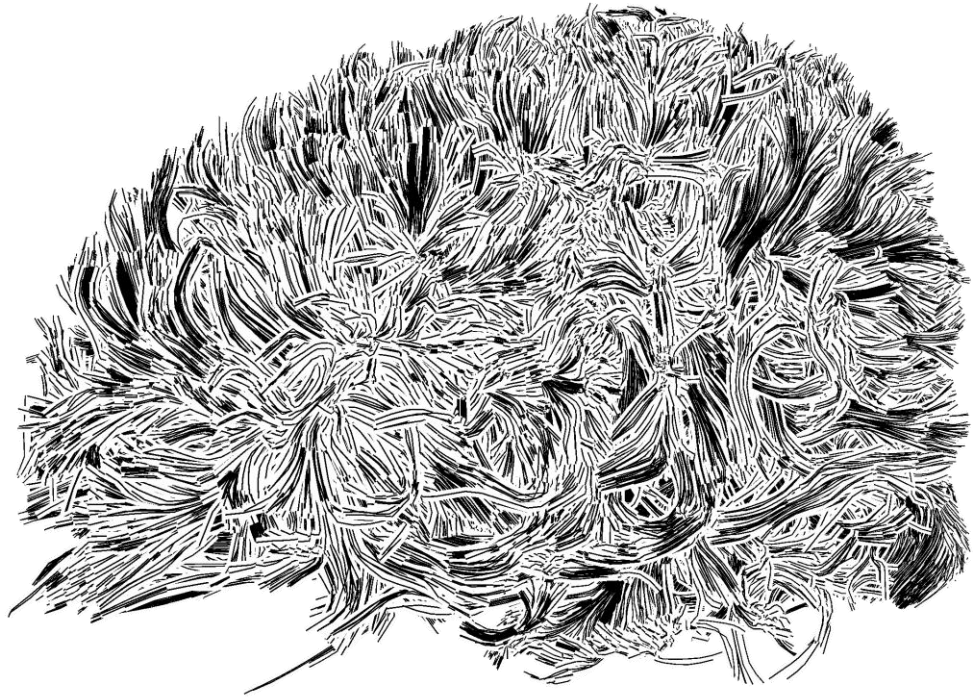


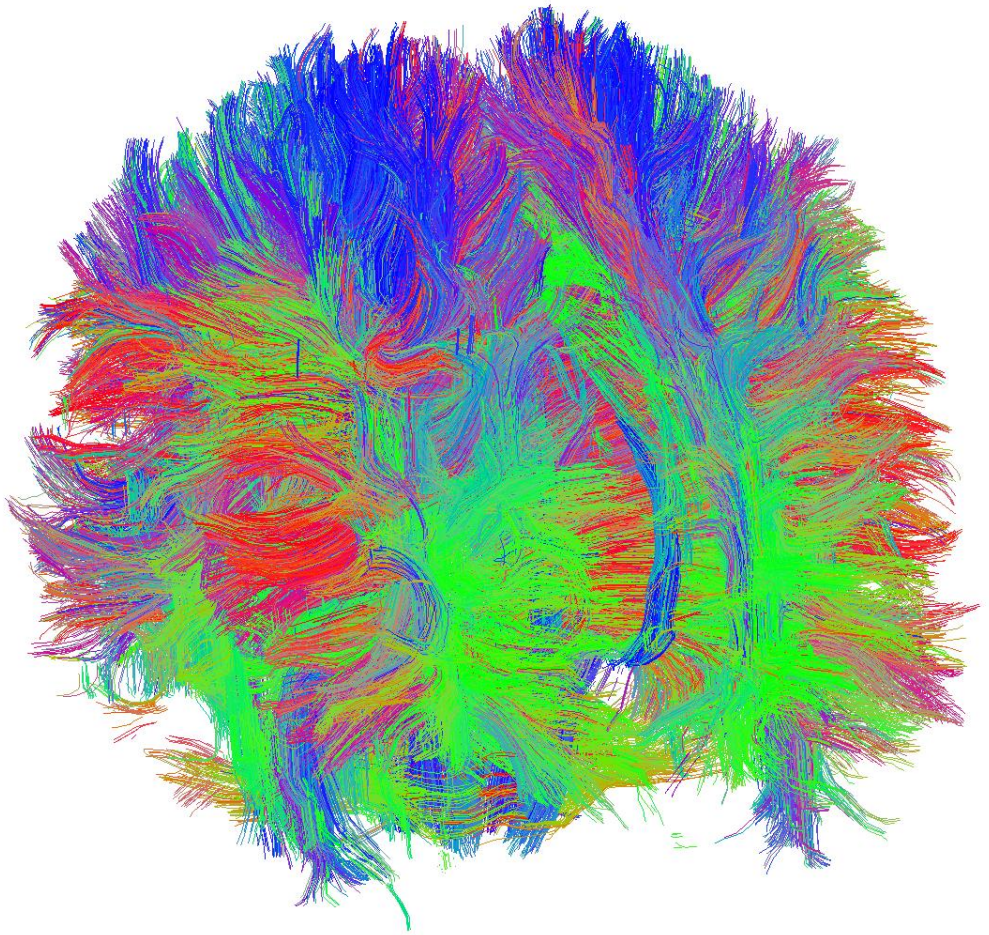
CGF / EuroVis 2010, with P. Svetachov & M. H. Everts

Selections vs. Full-Brain Datasets

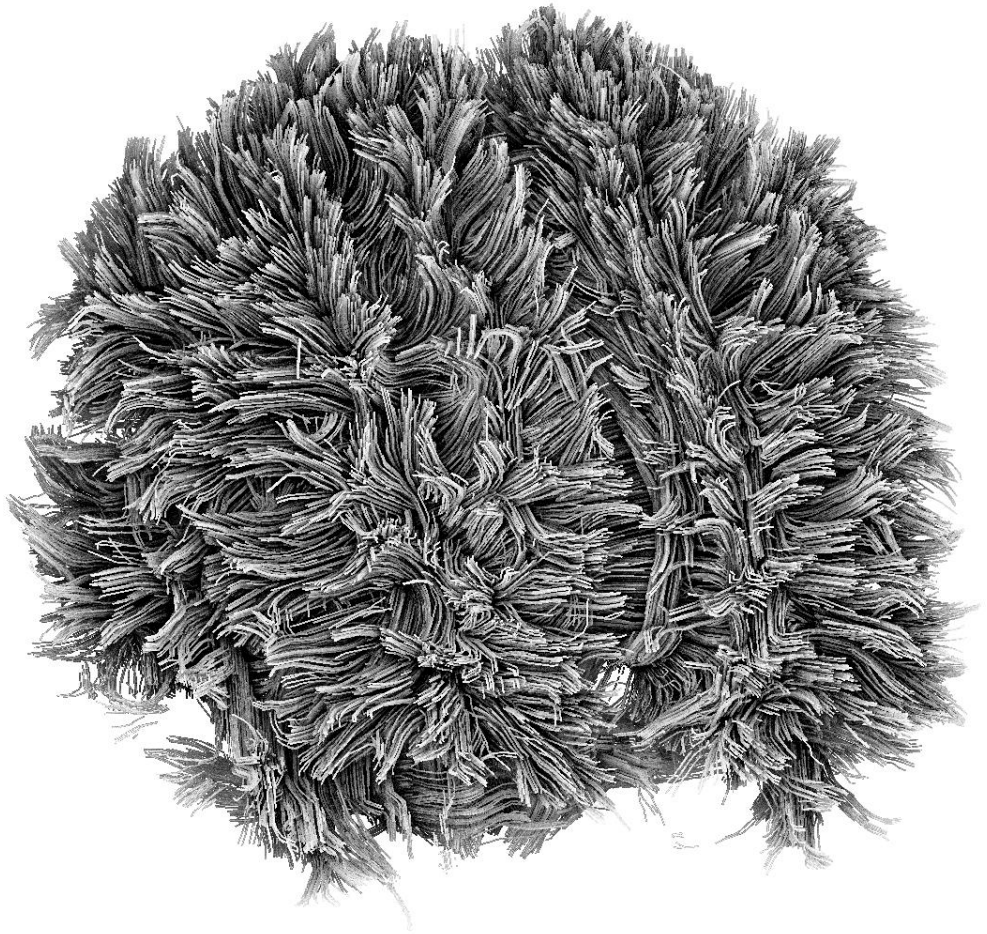
Selections vs. Full-Brain Datasets



Visual Abstraction for Full-Brain Datasets

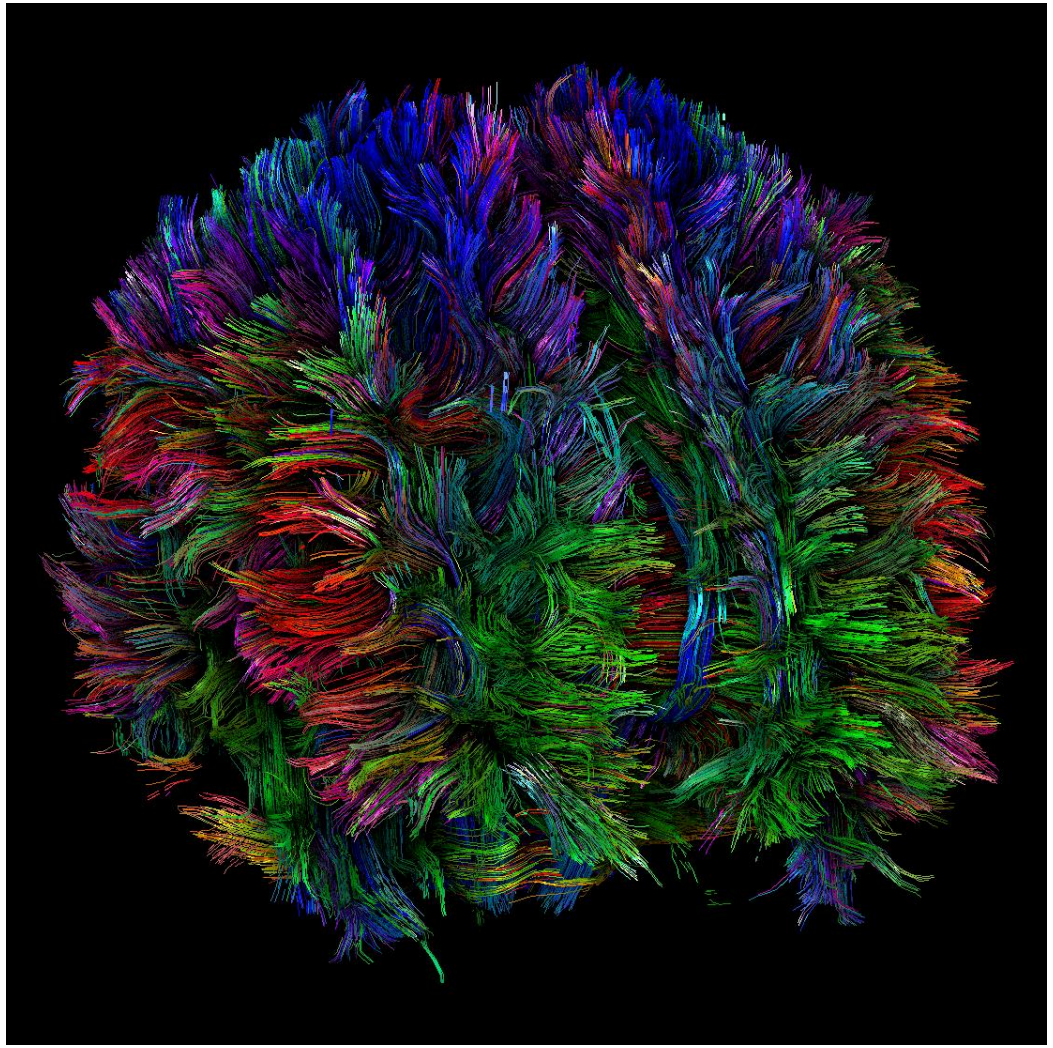


Visual Abstraction for Full-Brain Datasets



[LineAO: Eichelbaum et al., 2013]

Visual Abstraction for Full-Brain Datasets



[LineAO: Eichelbaum et al., 2013]

Photometric vs. Structural Abstraction

Photometric vs. Structural Abstraction

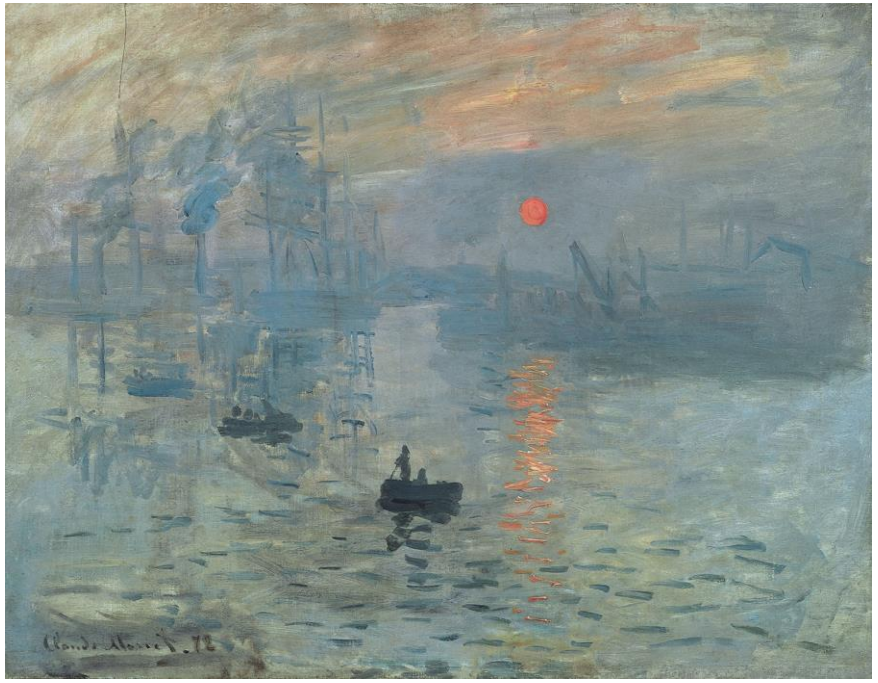
data representation

Photometric vs. Structural Abstraction

data representation

data values/characteristics

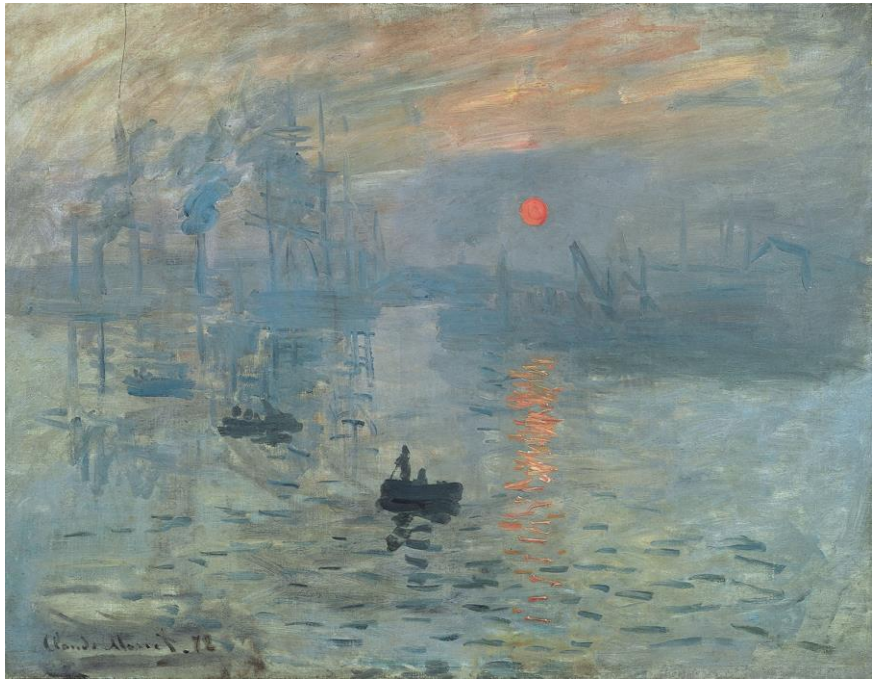
Photometric vs. Structural Abstraction



Monet: Sunrise, 1872

data
values/characteristics

Photometric vs. Structural Abstraction



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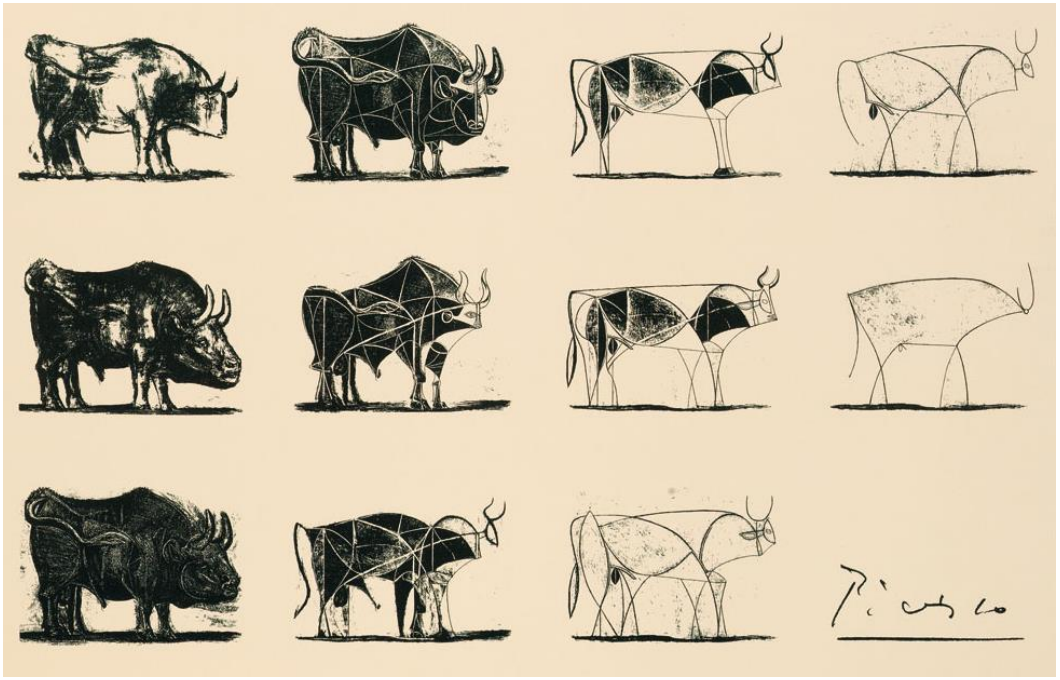

Picasso: The Bull, 1945/46

Brain Fiber Tract Similarity Analysis

TVCG 2015, with M. H. Everts, E. Begue, H. Bekker & J.B.T.M. Roerdink

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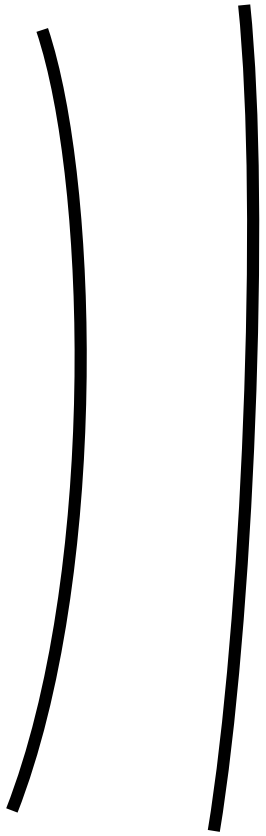

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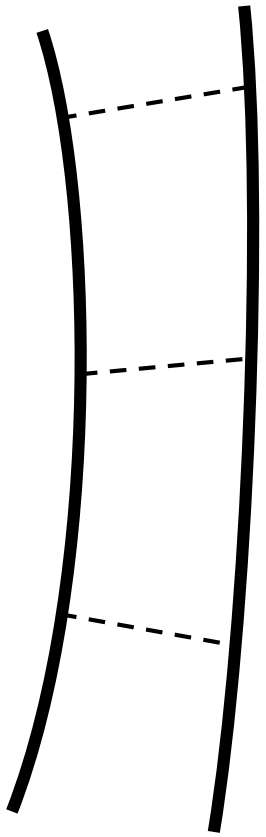

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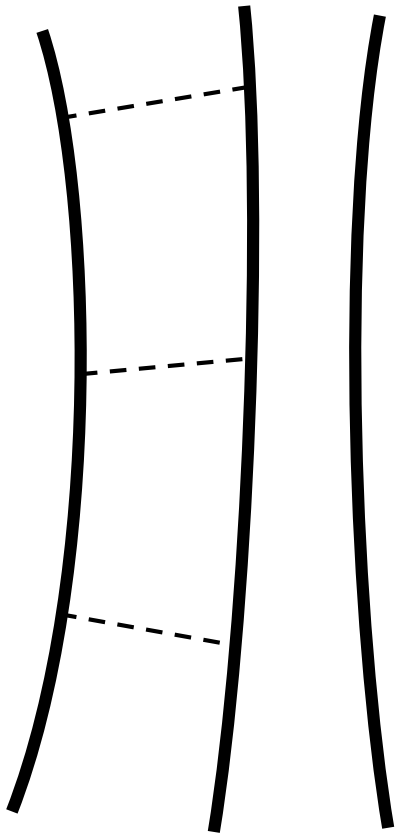

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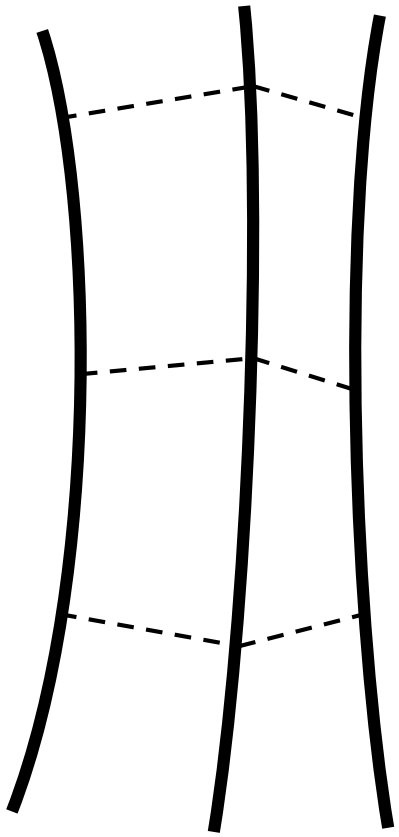

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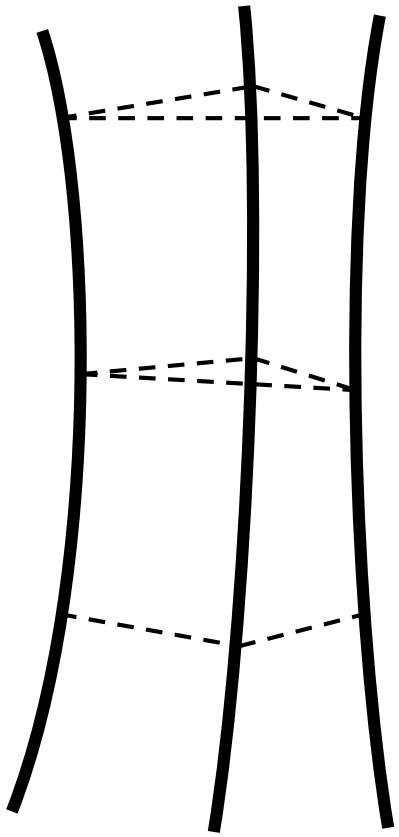

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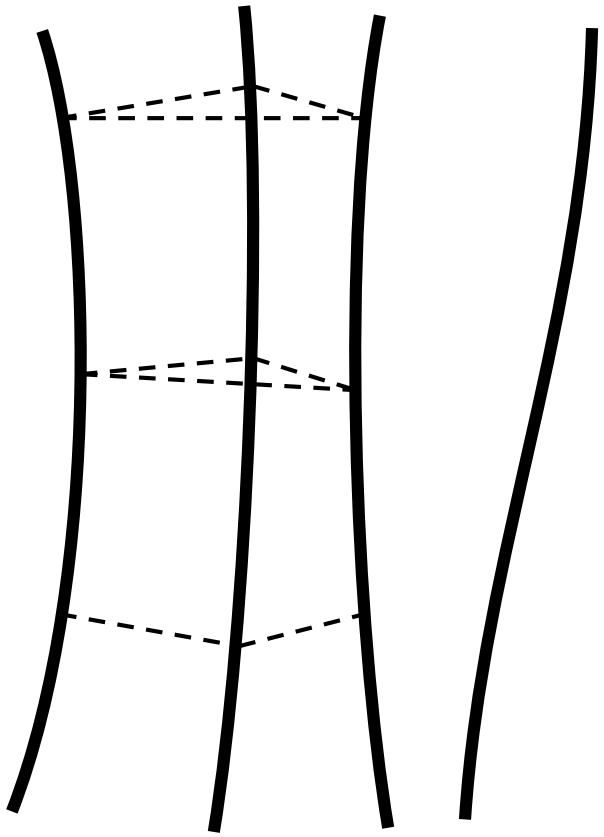

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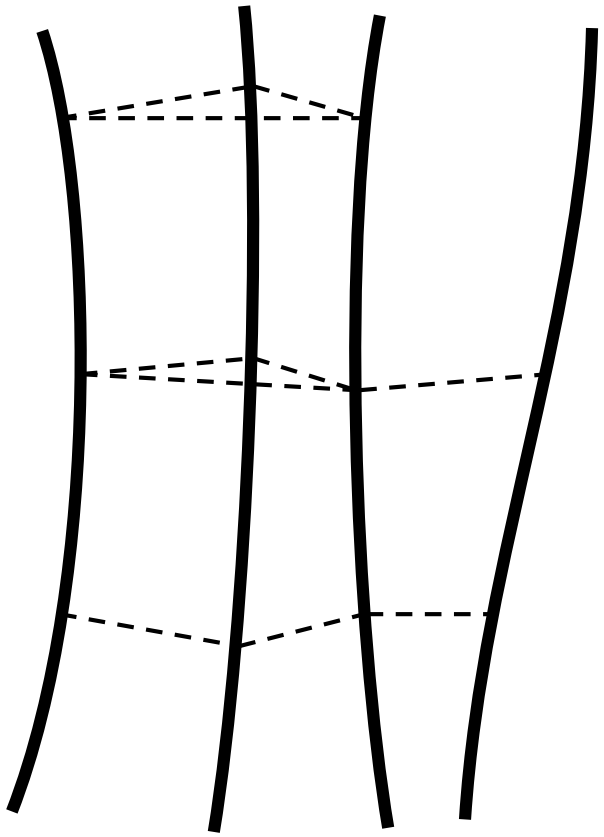

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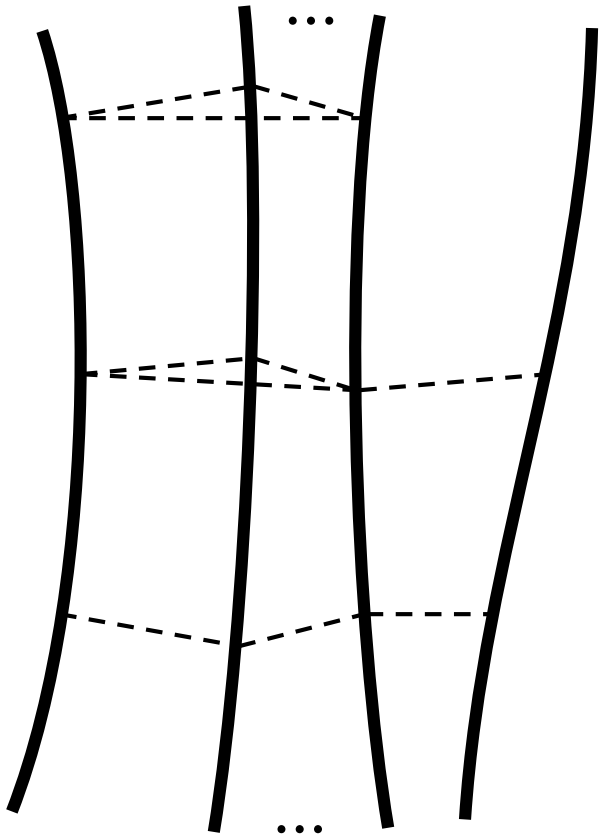

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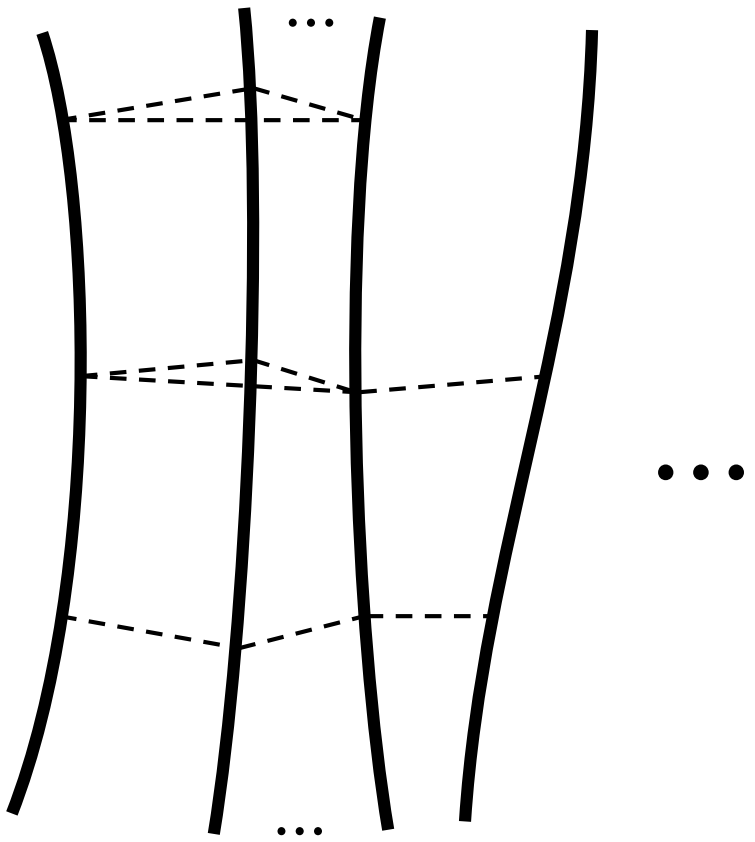
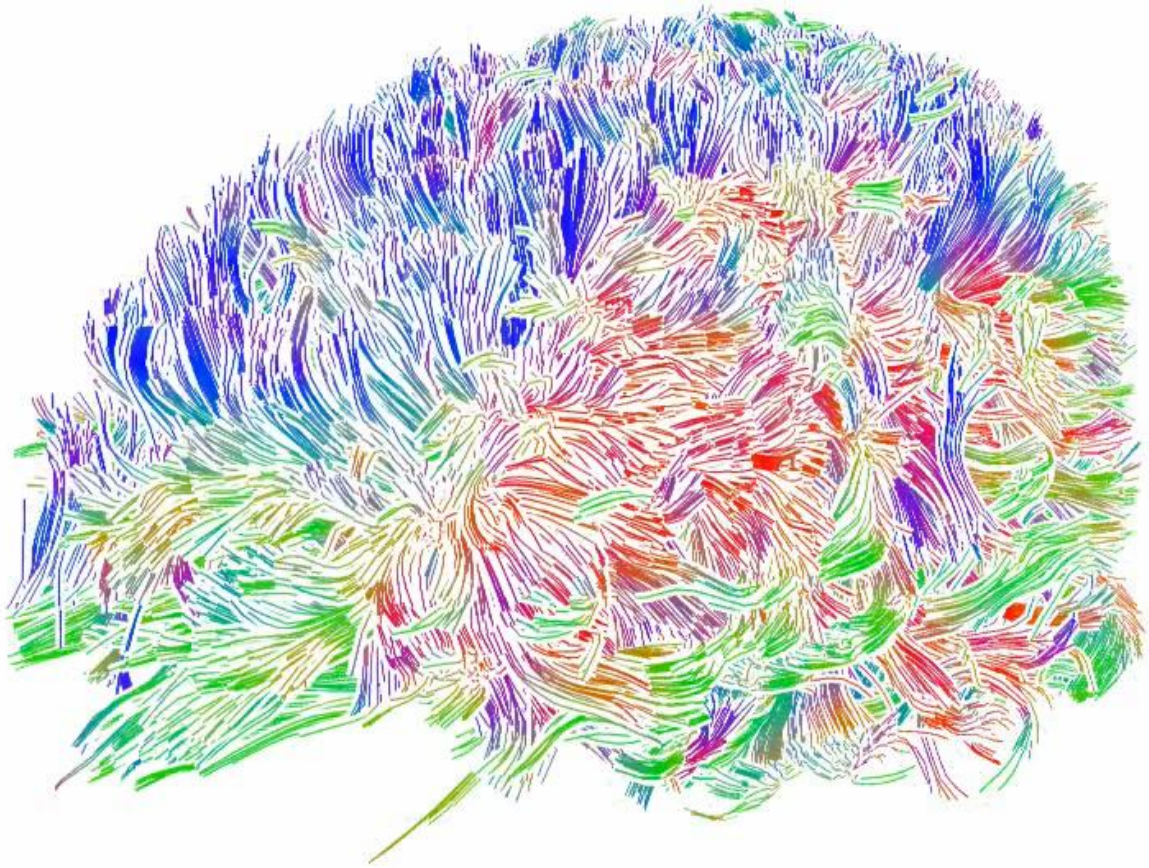


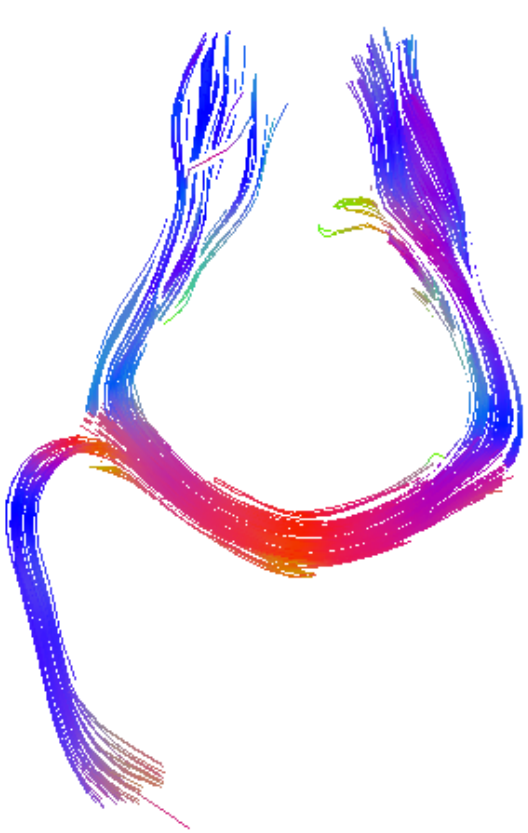
TVCG 2015, with M. H. Everts, E. Begue, H. Bekker & J.B.T.M. Roerdink

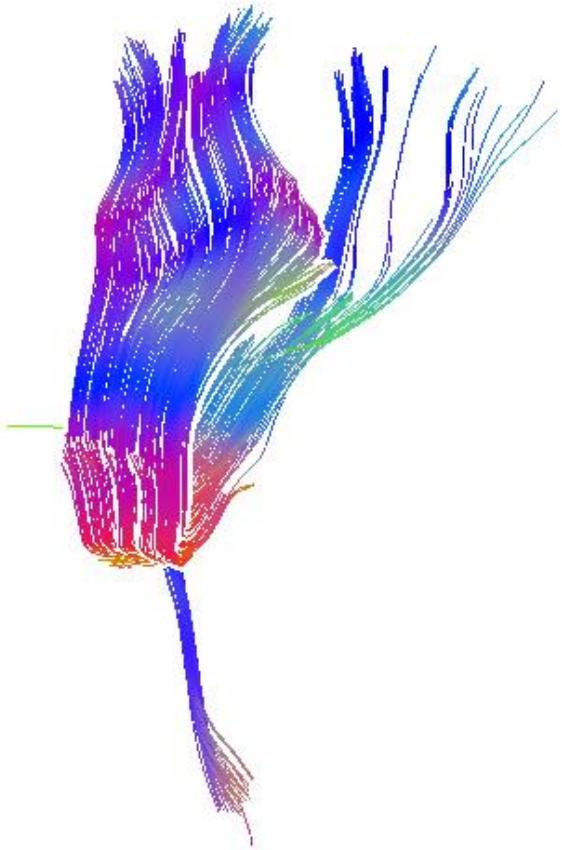
Brain Fiber Tract Contraction



TVCG 2015, with M. H. Everts, E. Begue, H. Bekker & J.B.T.M. Roerdink

Contraction based on Similarity/Proximity





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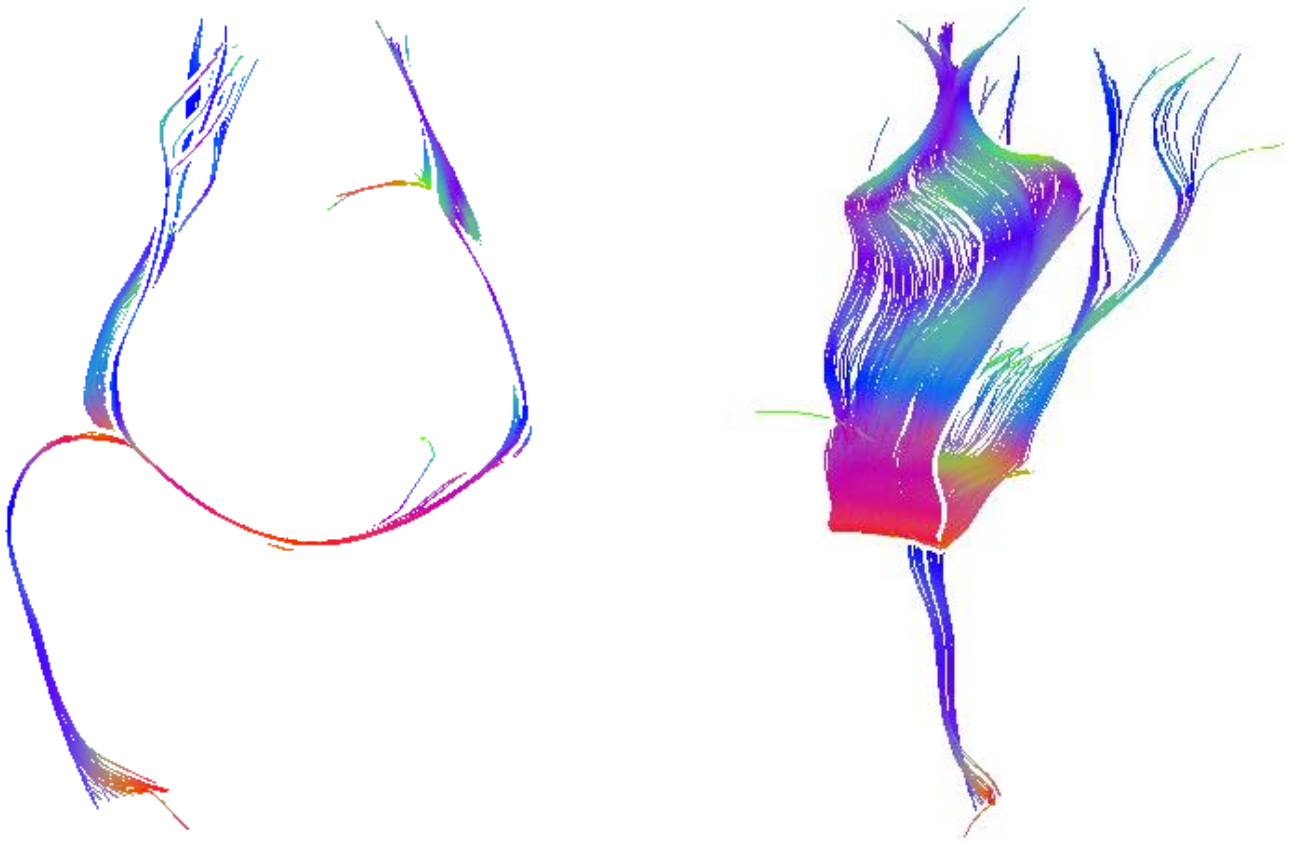
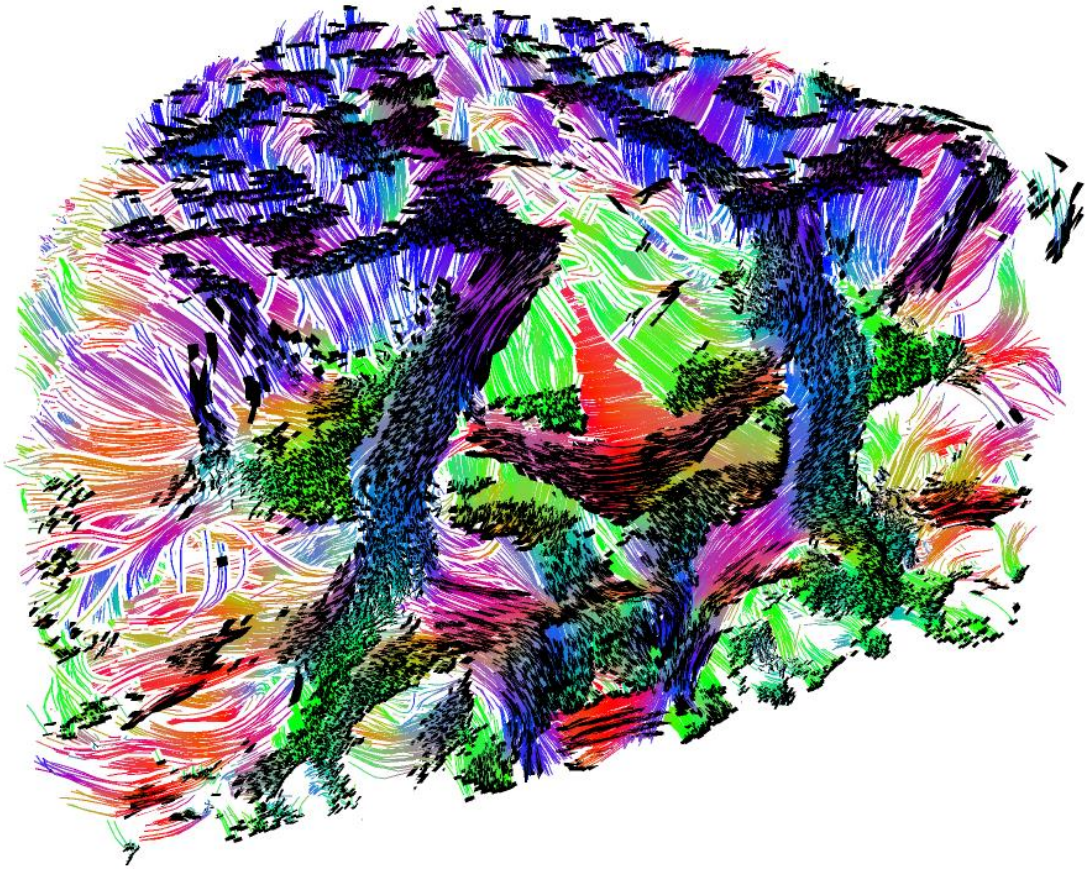


TVCG 2015, with M. H. Everts, E. Begue, H. Bekker & J.B.T.M. Roerdink

Visual Evidence: Brain’s sheet-like Structure



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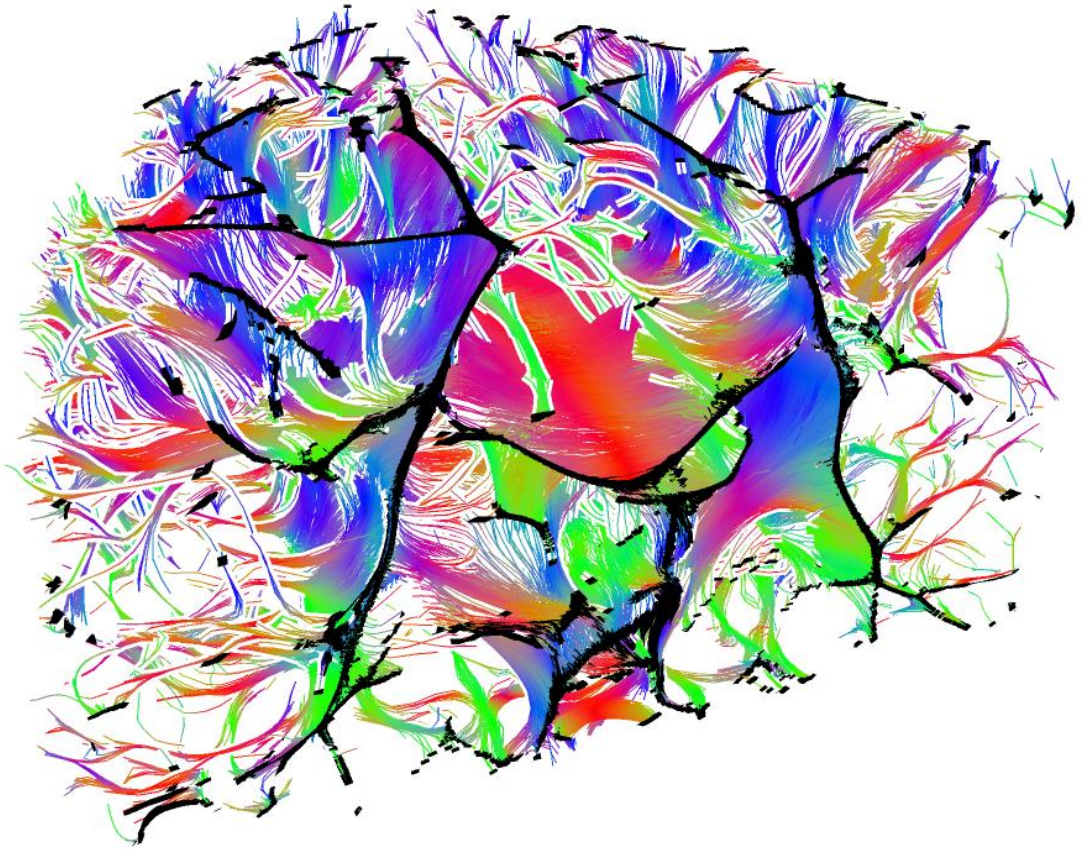
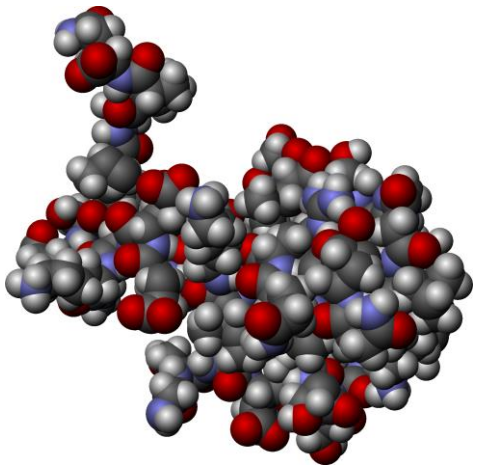
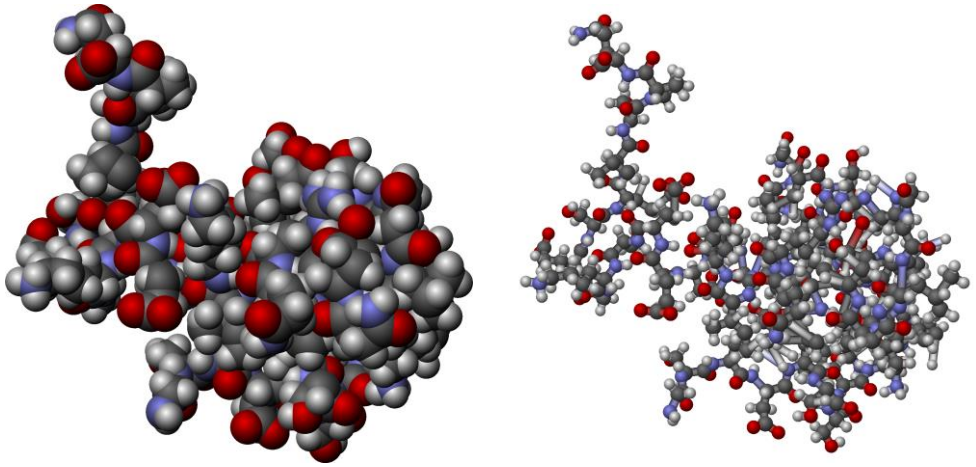


TVCG 2015, with M. H. Everts, E. Begue, H. Bekker & J.B.T.M. Roerdink

Structural Abstraction in Structural Biology

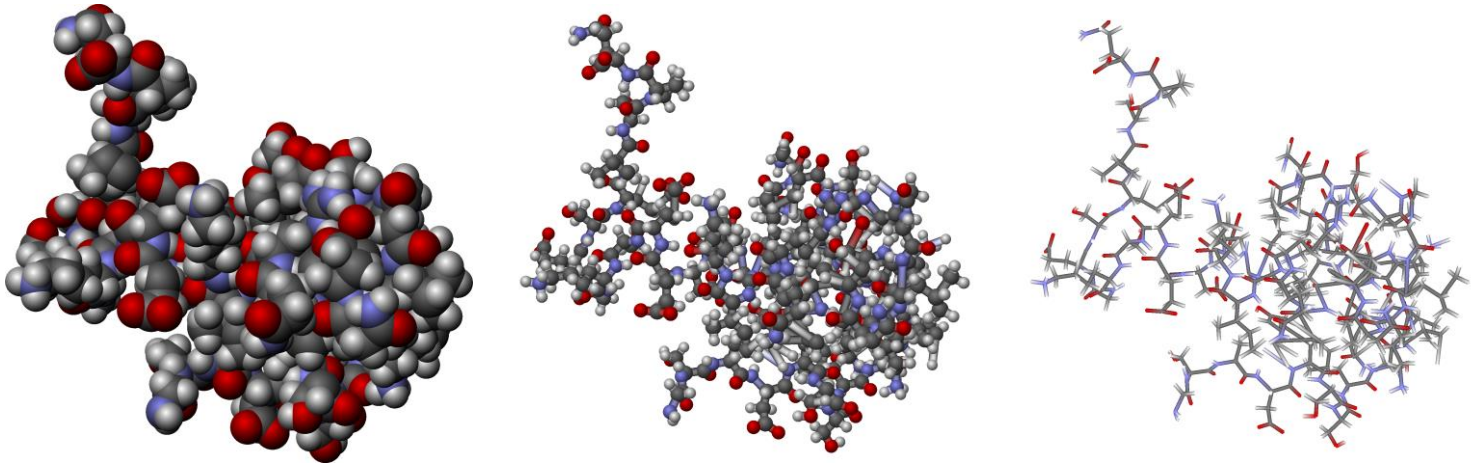


Structural Abstraction in Structural Biology



EuroVis/CGF 2011, with M. v. d. Zwan, W. Lueks & H. Bekker

Structural Abstraction in Structural Biology



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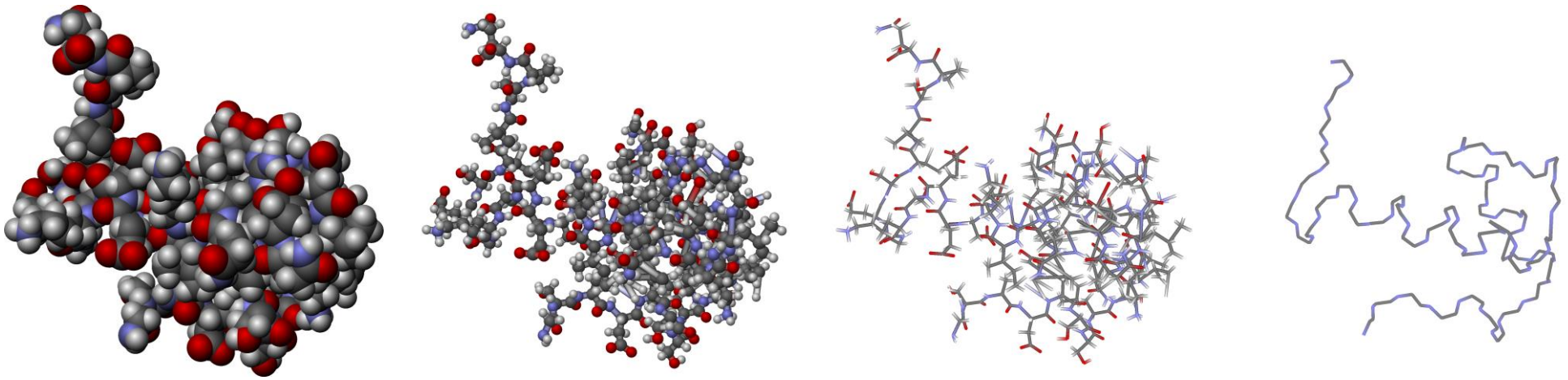
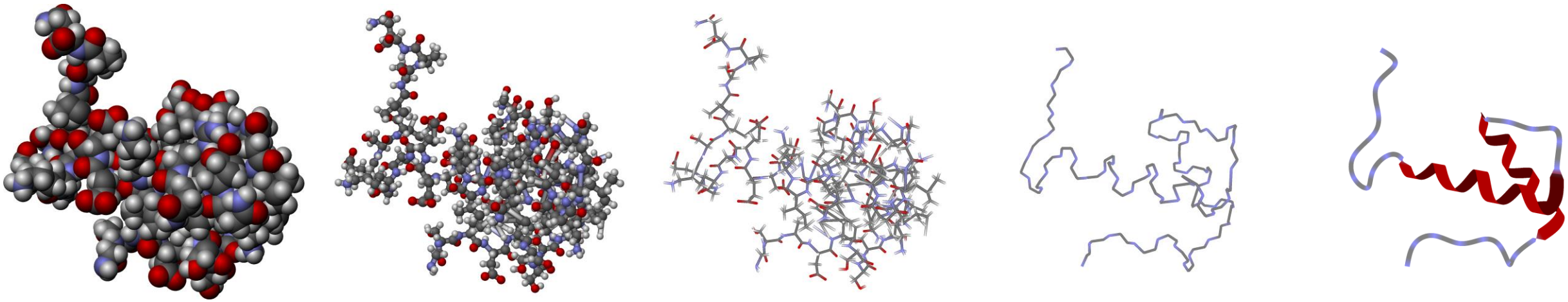
Structural Abstraction in Structural Biology



EuroVis/CGF 2011, with M. v. d. Zwan, W. Lueks & H. Bekker

Structural Abstraction in Structural Biology



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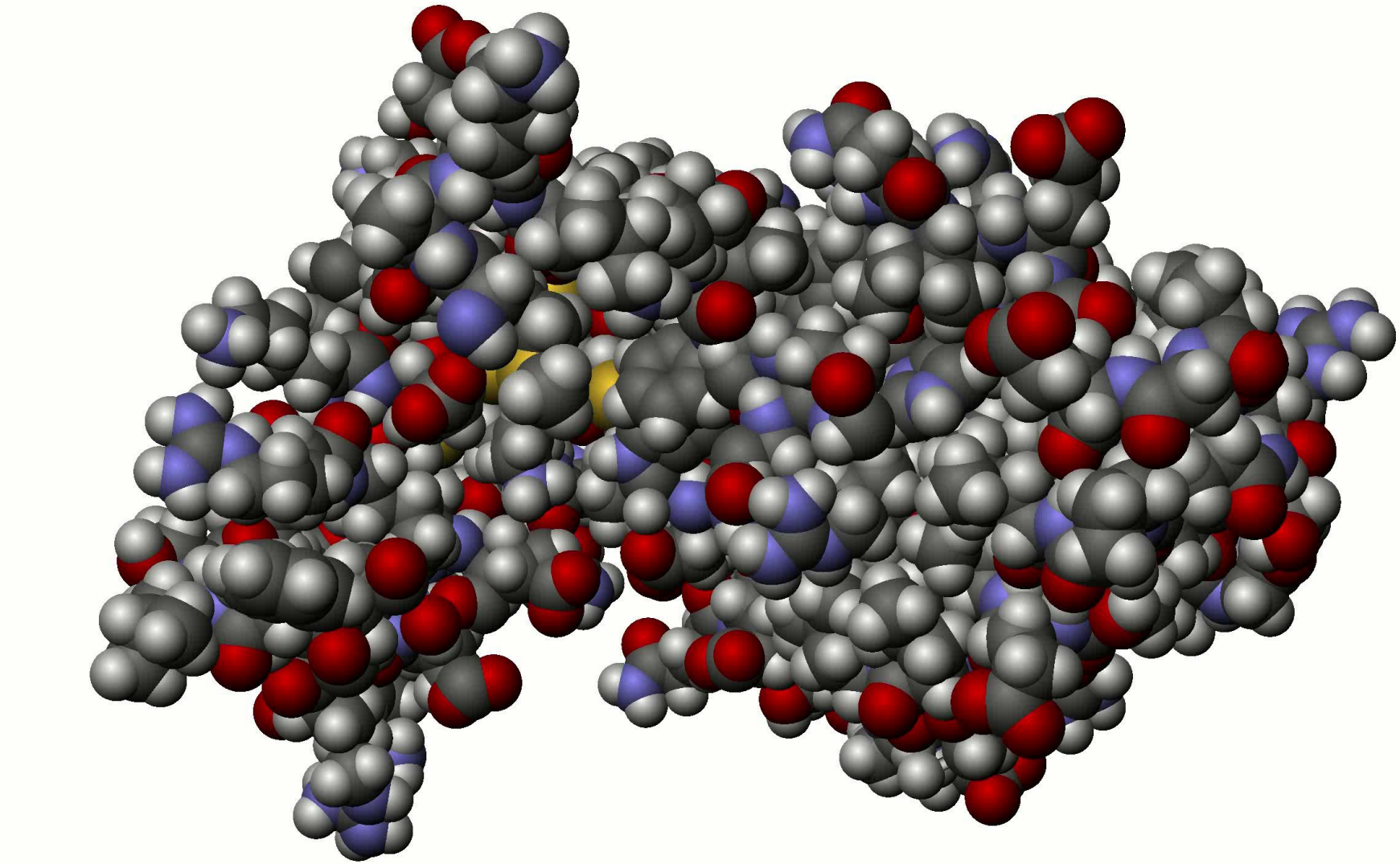

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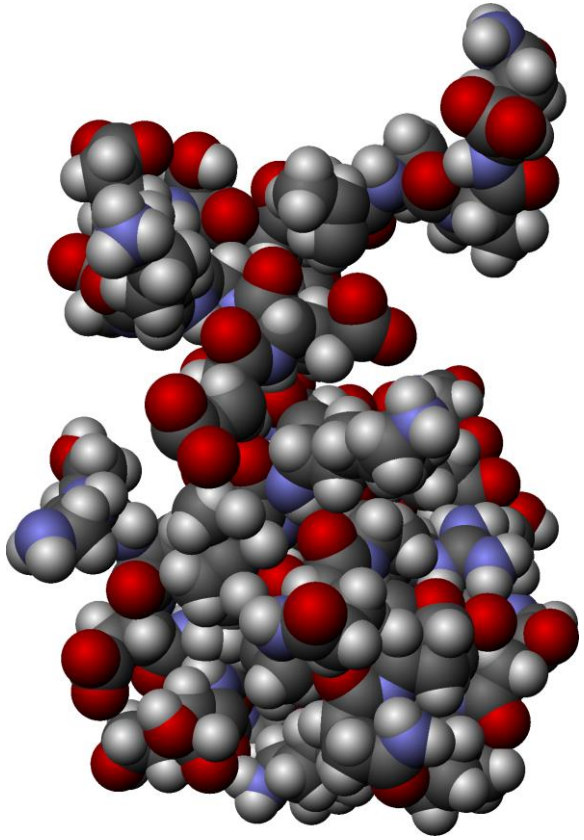
Photometric Abstraction in Structural Biology



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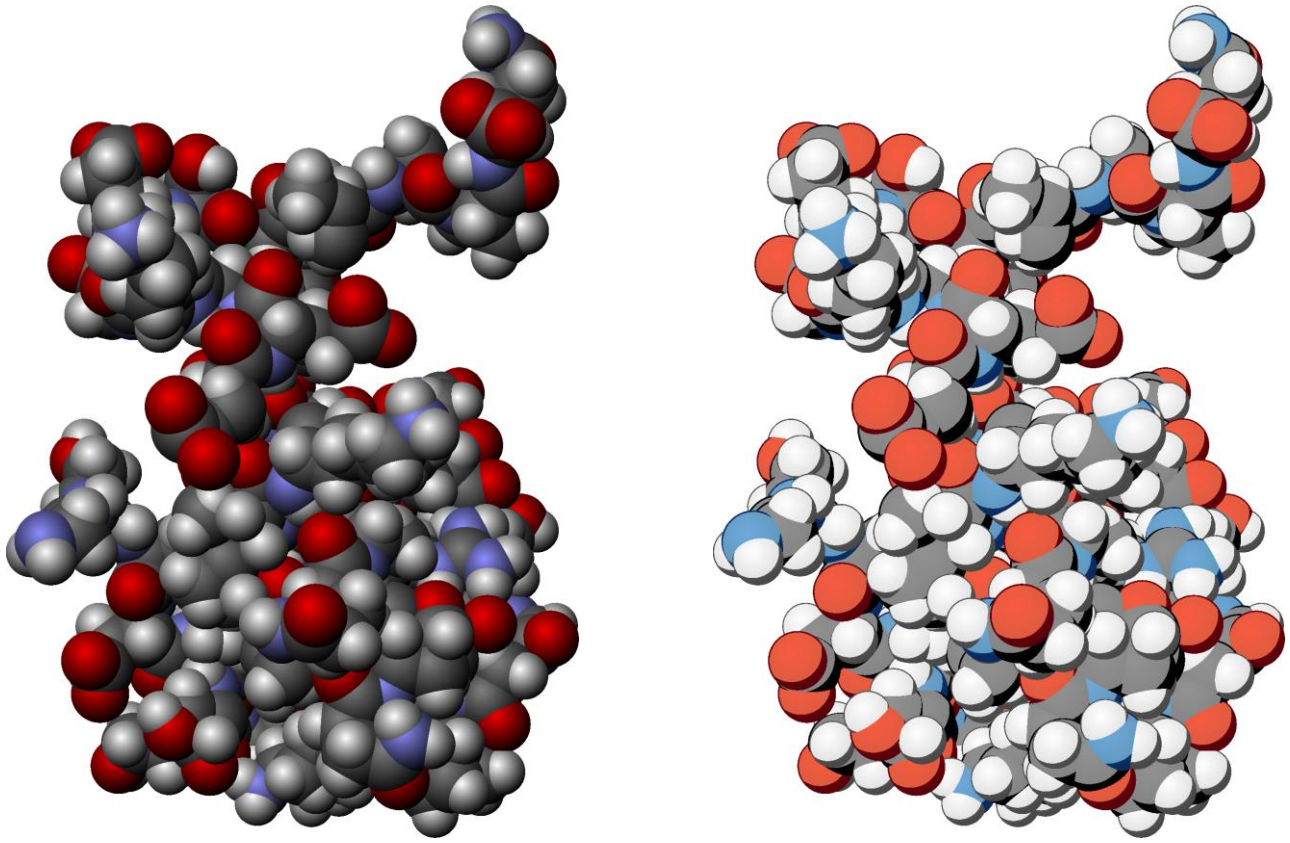

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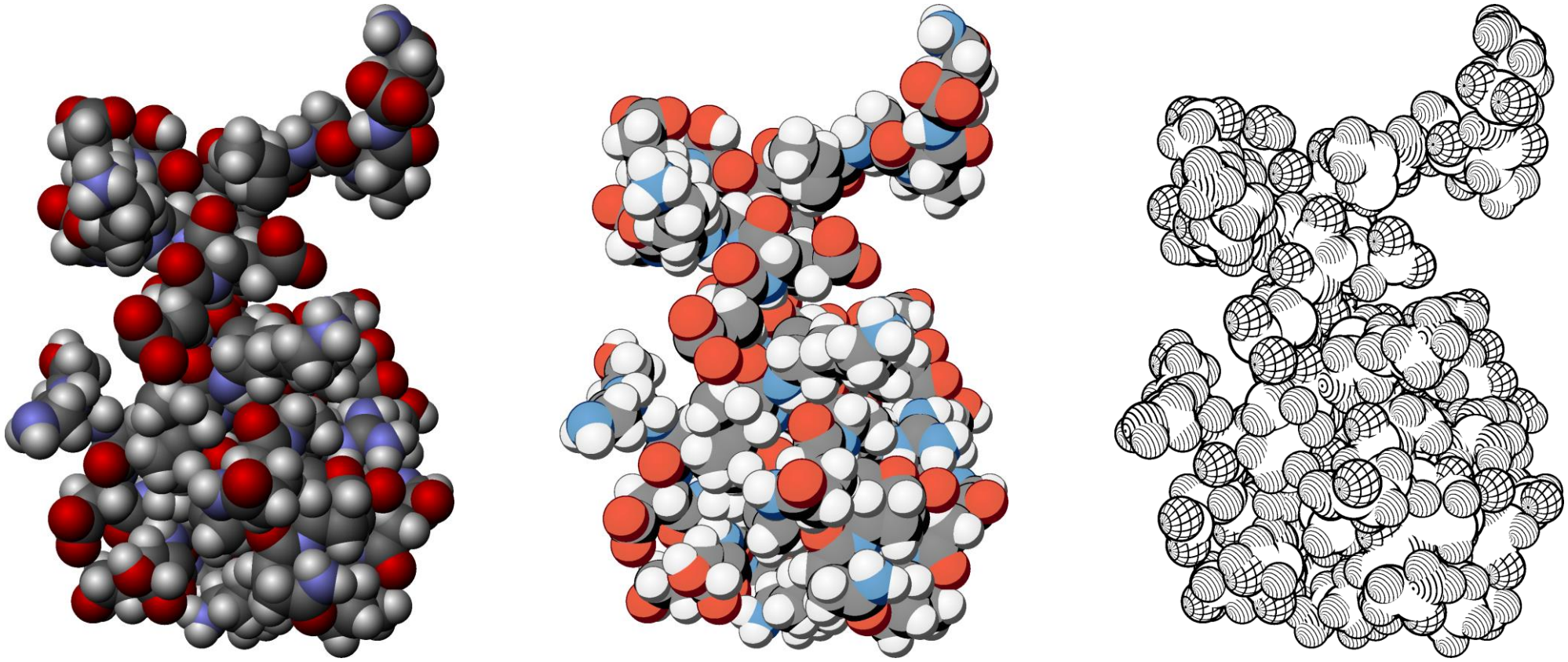

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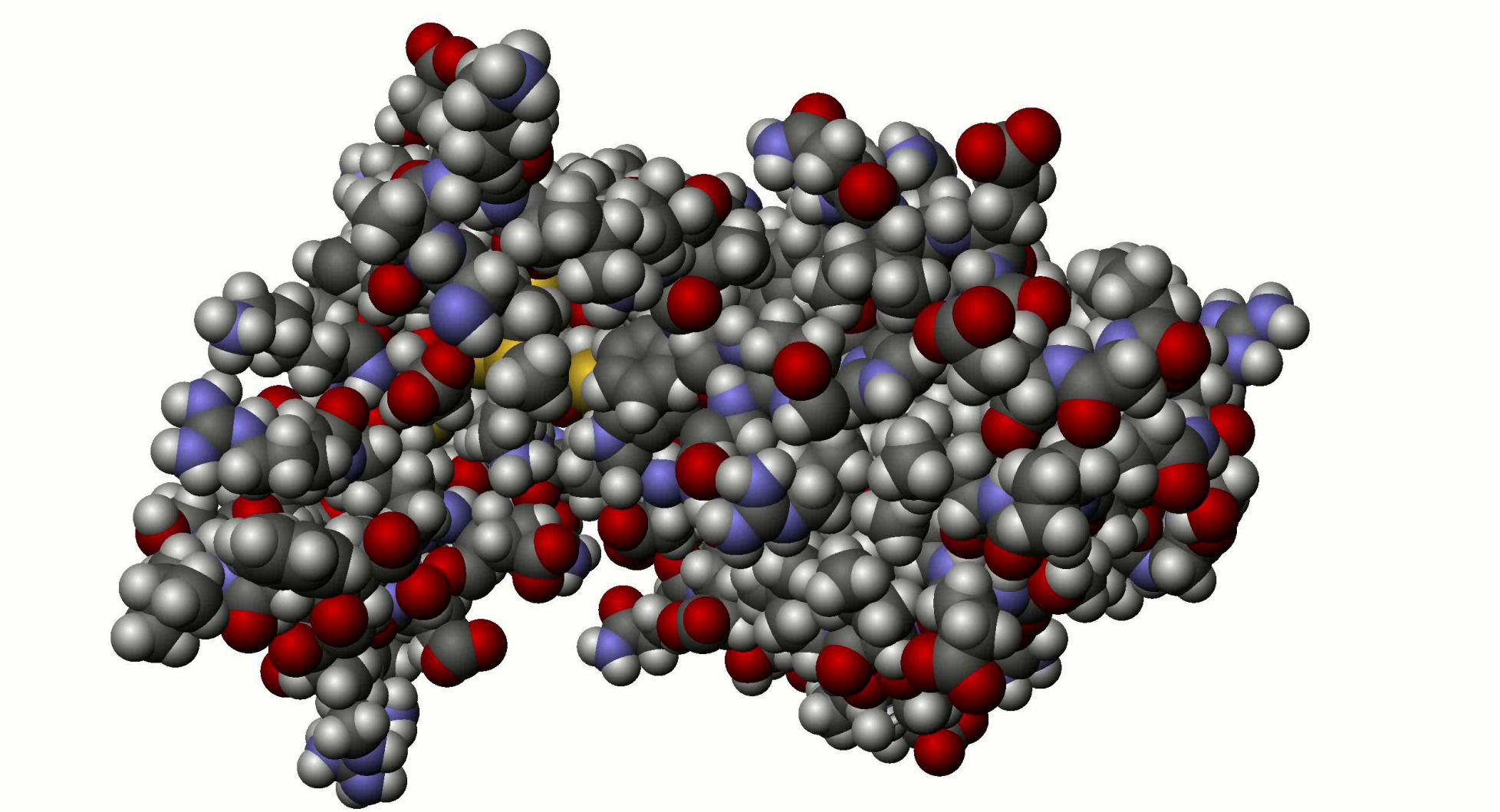

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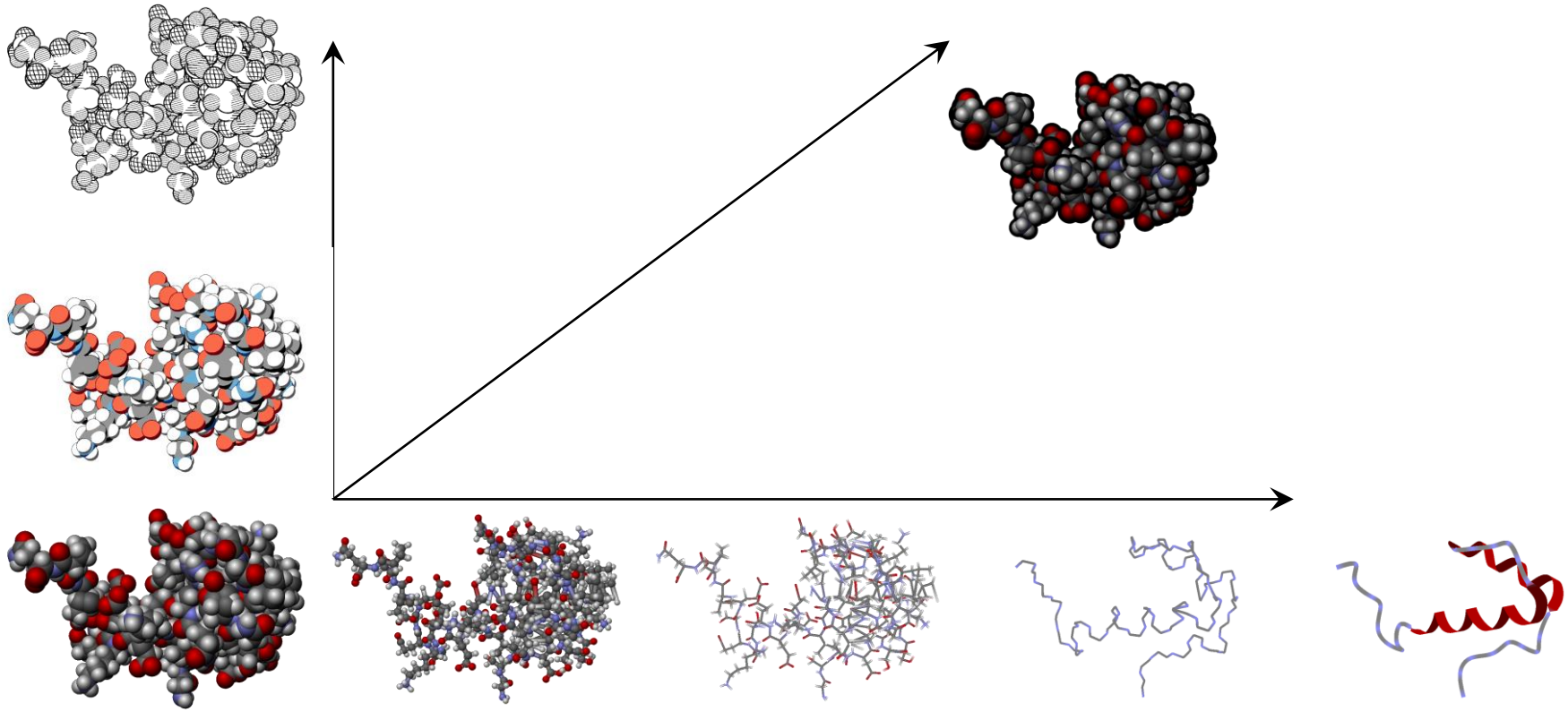
An Abstraction Space



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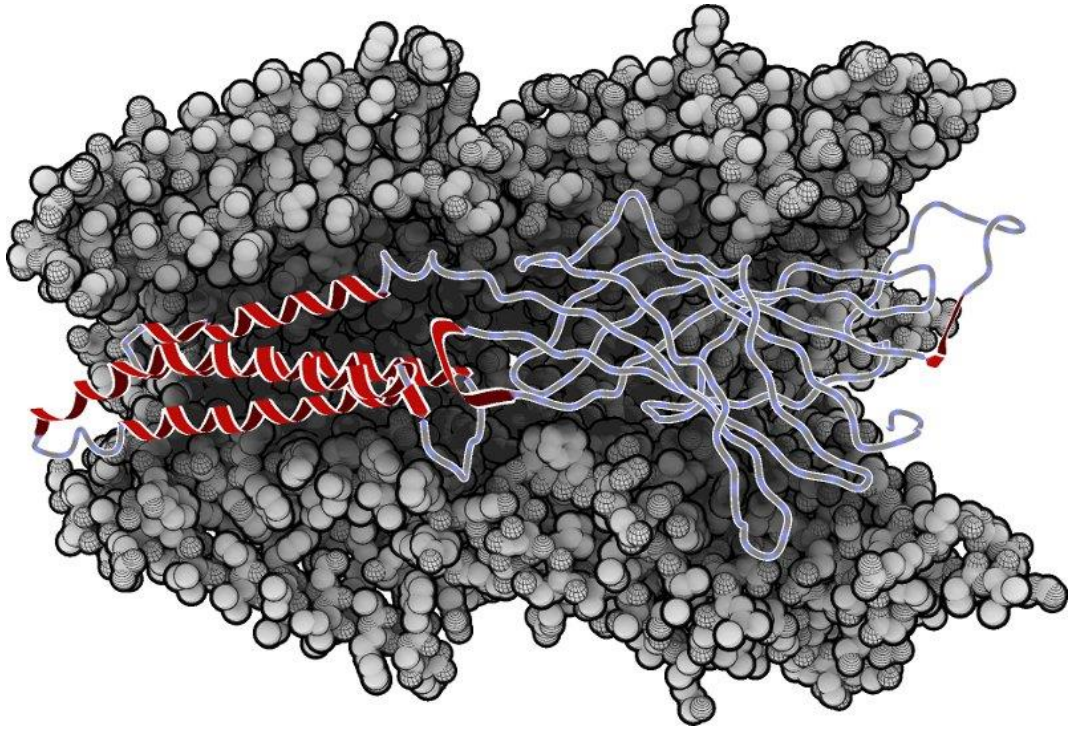
Applications



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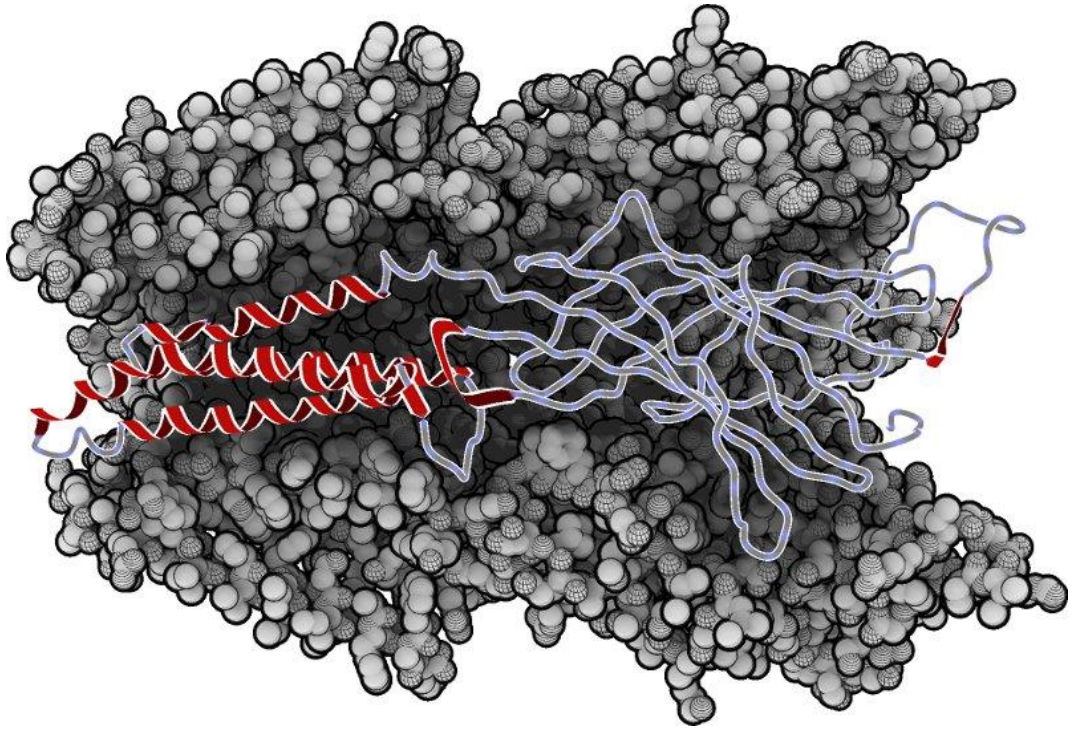

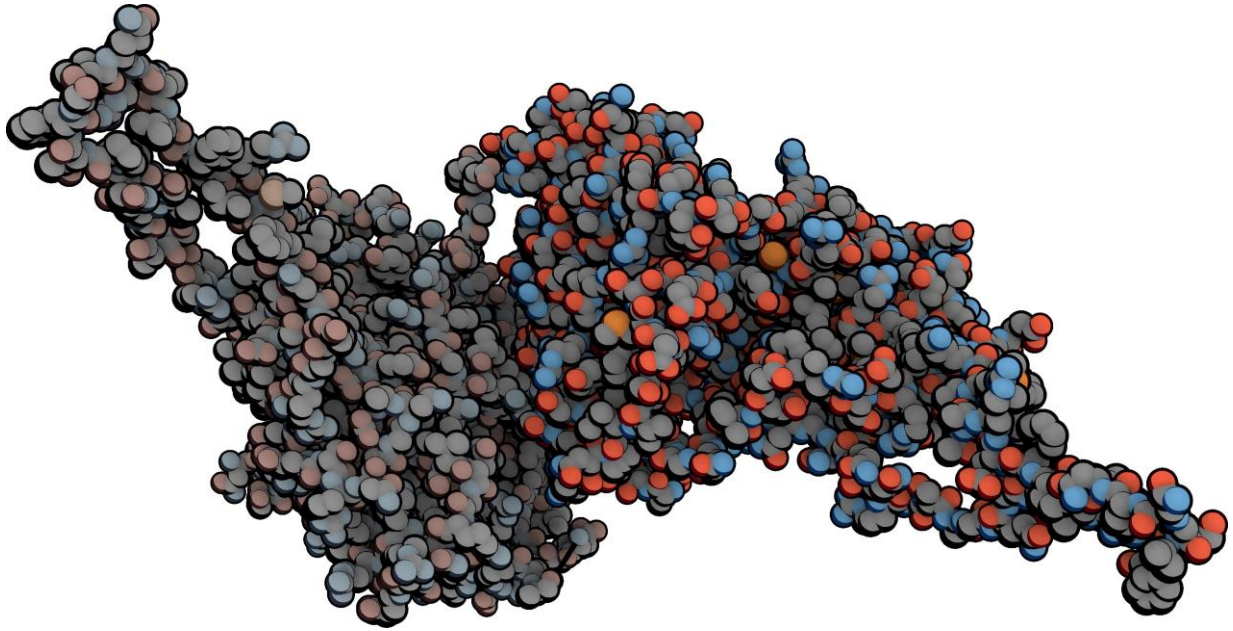

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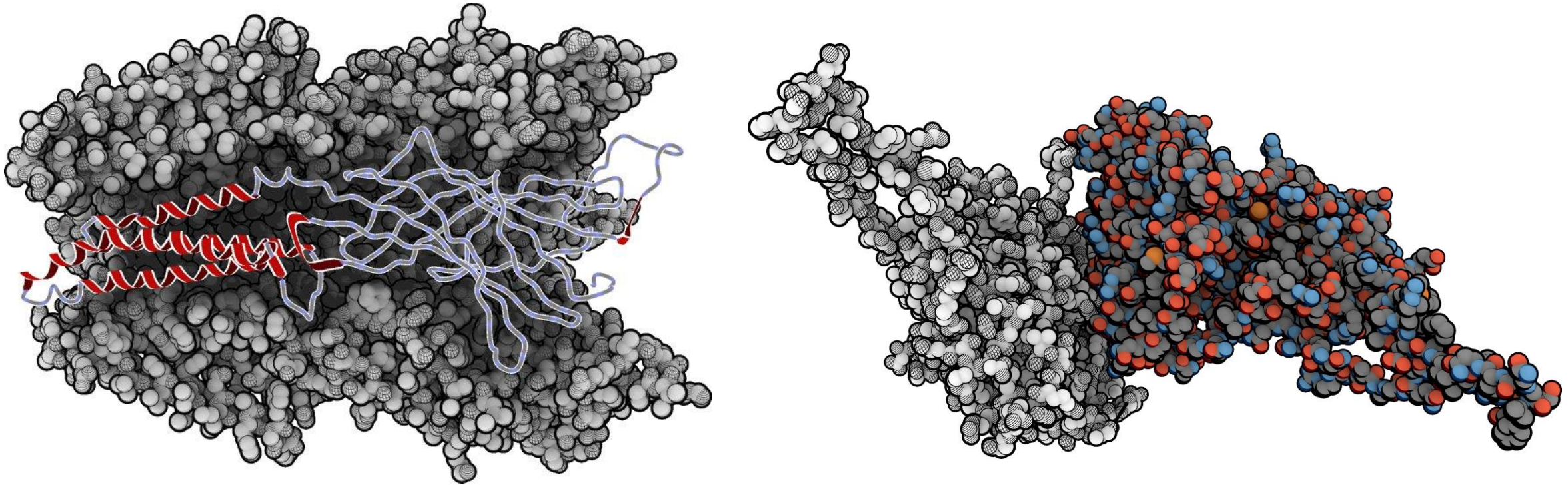

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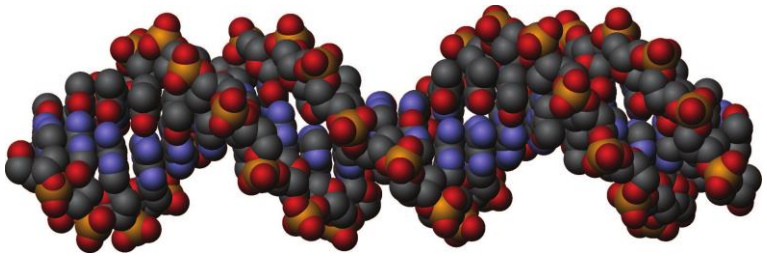
Spatially Continuous Abstraction Control



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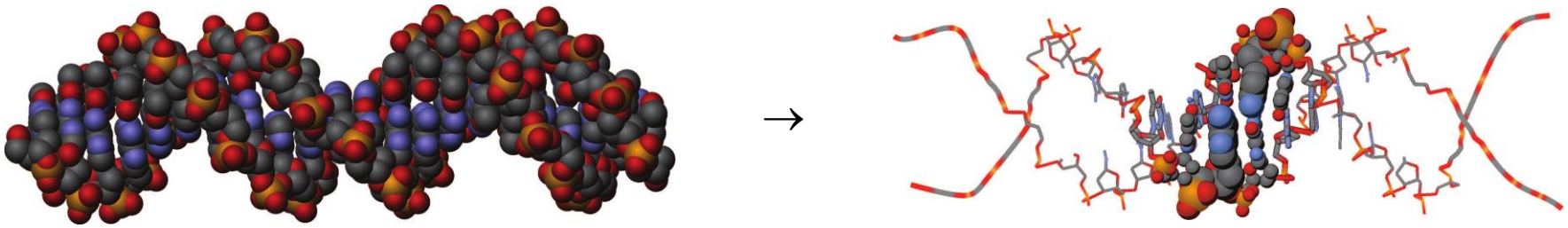

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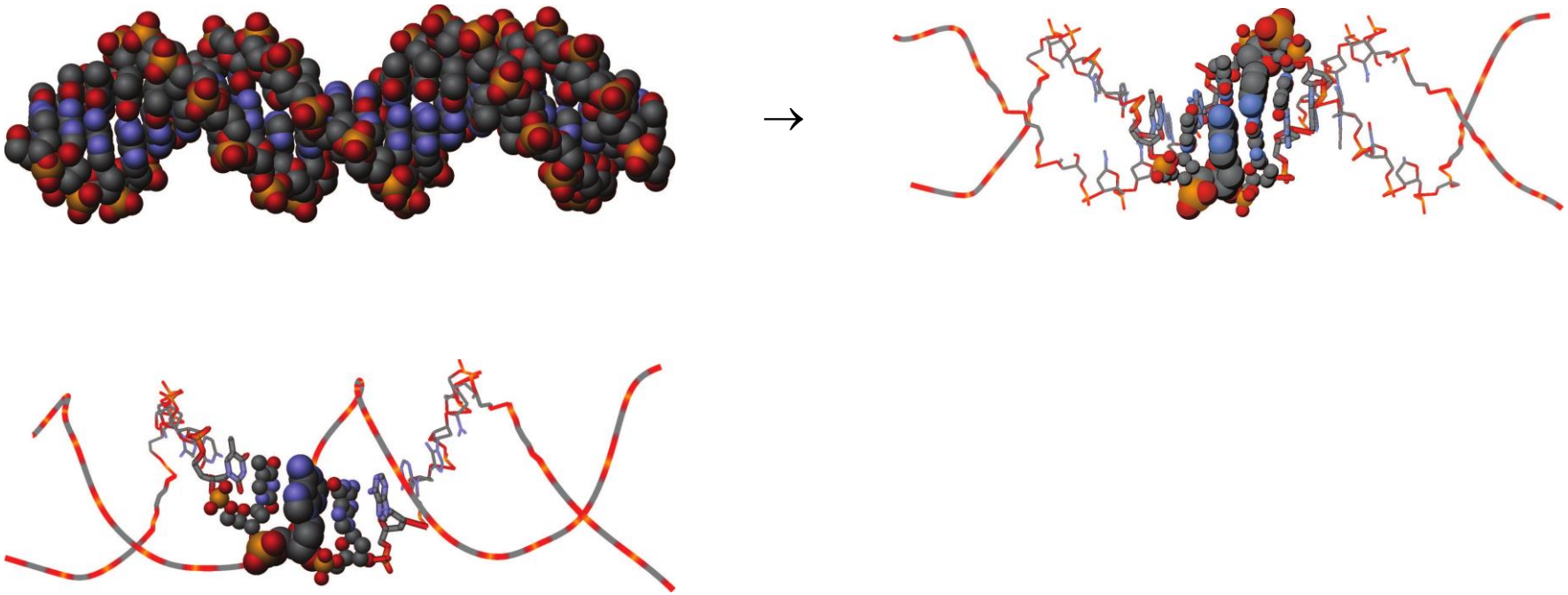

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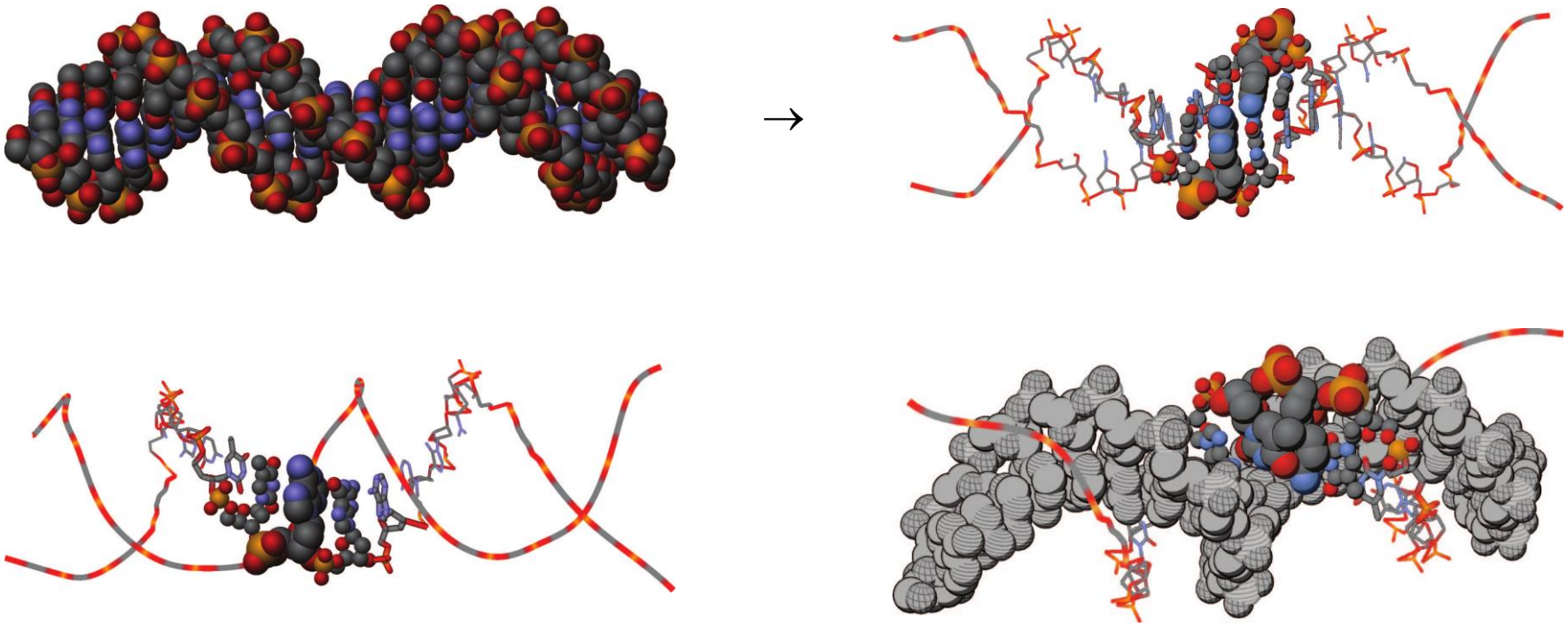

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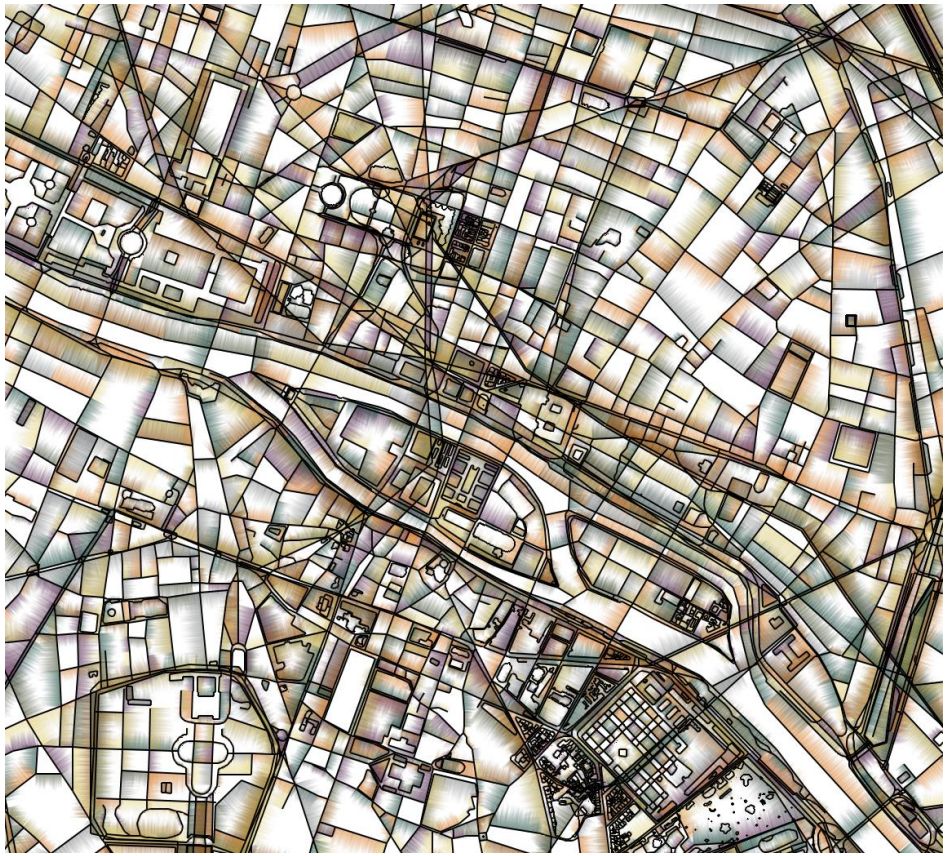
Other Domains for Abstraction



TVCG 2013, with S. Kim, R. Maciejewski, A. Malik, Y. Jang & D. S. Ebert

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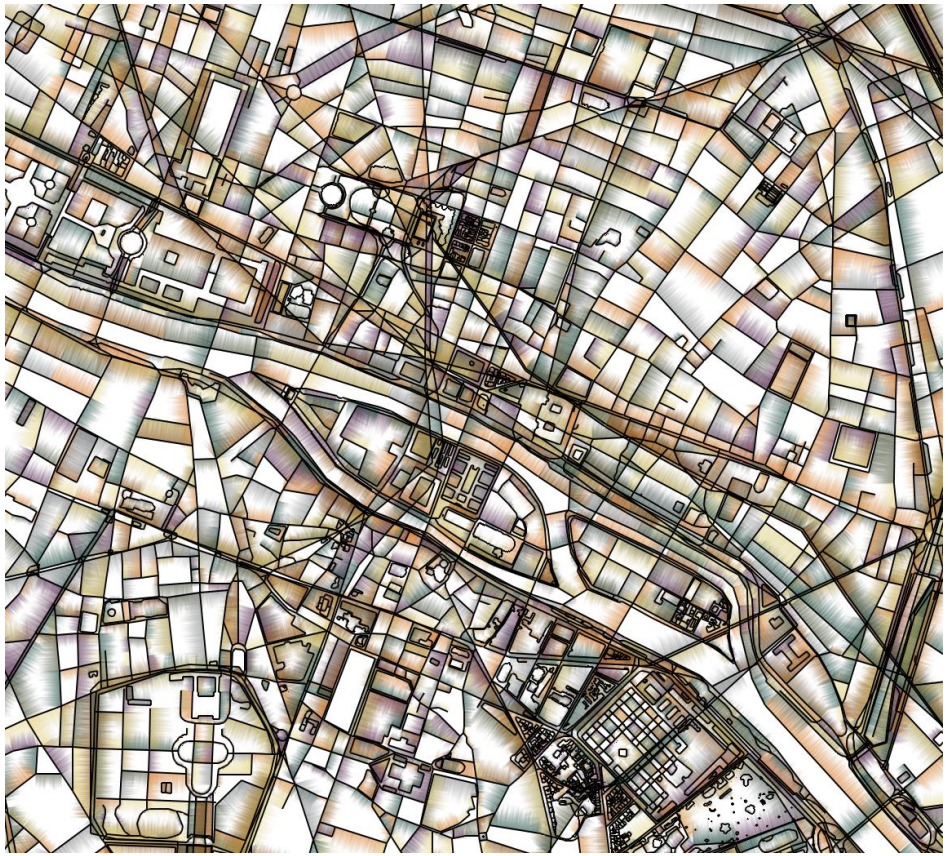

Tarbell 2003: http://www.complexification.net/gallery/machines/substrate/

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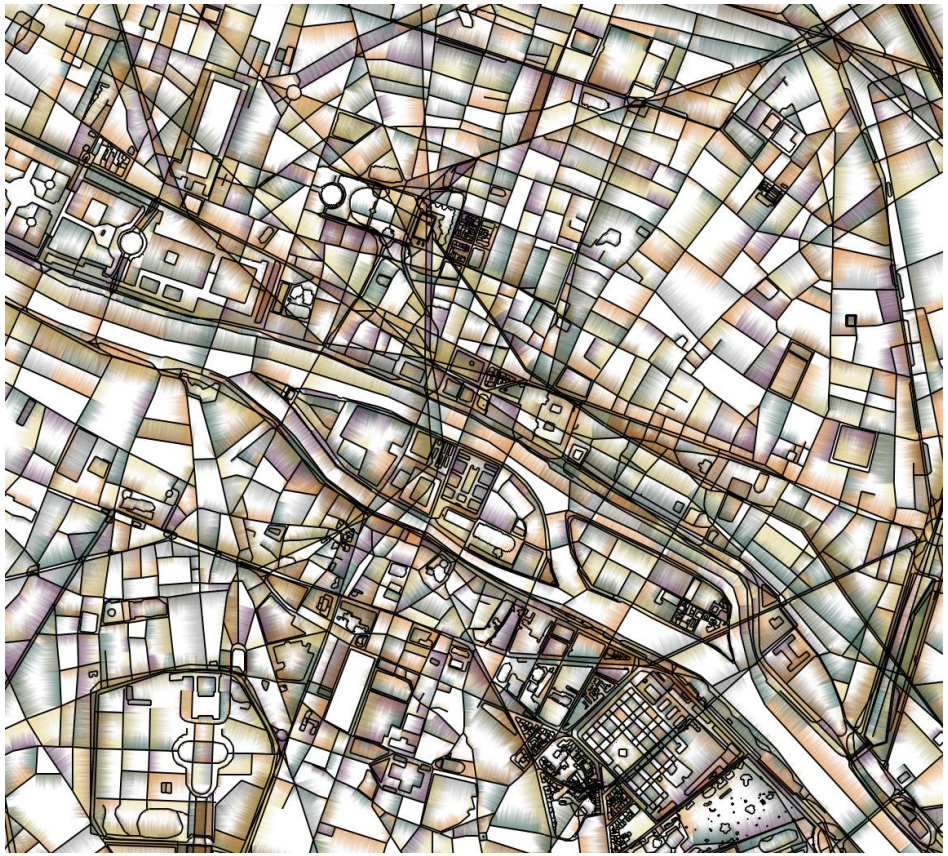

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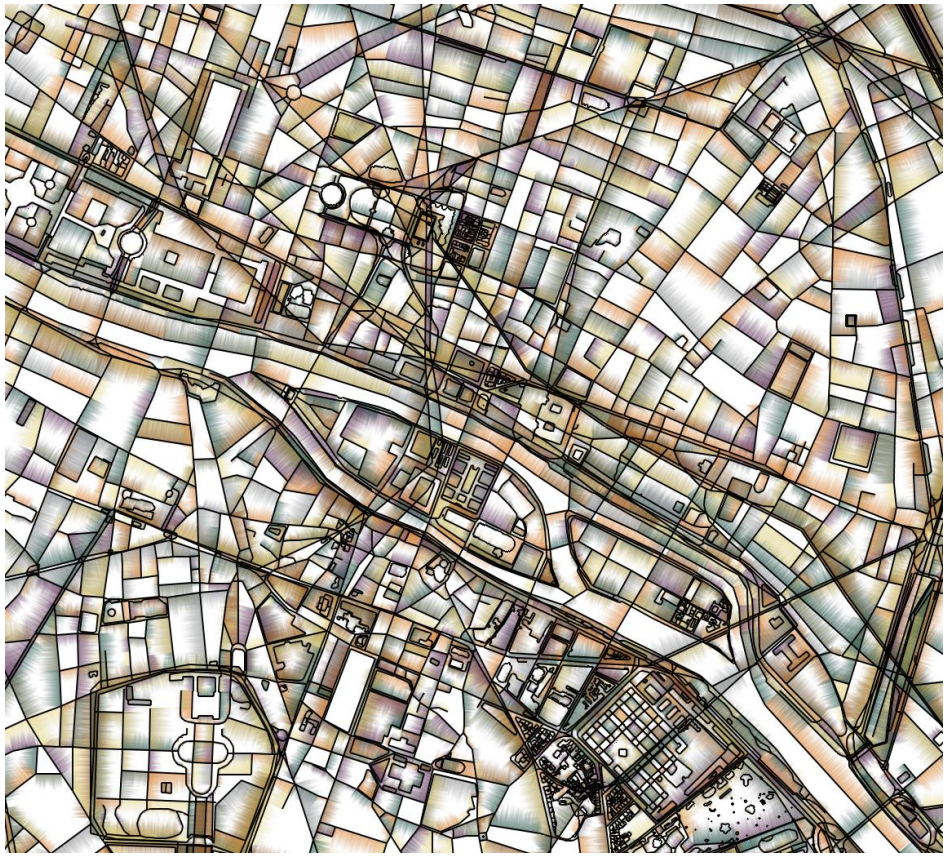

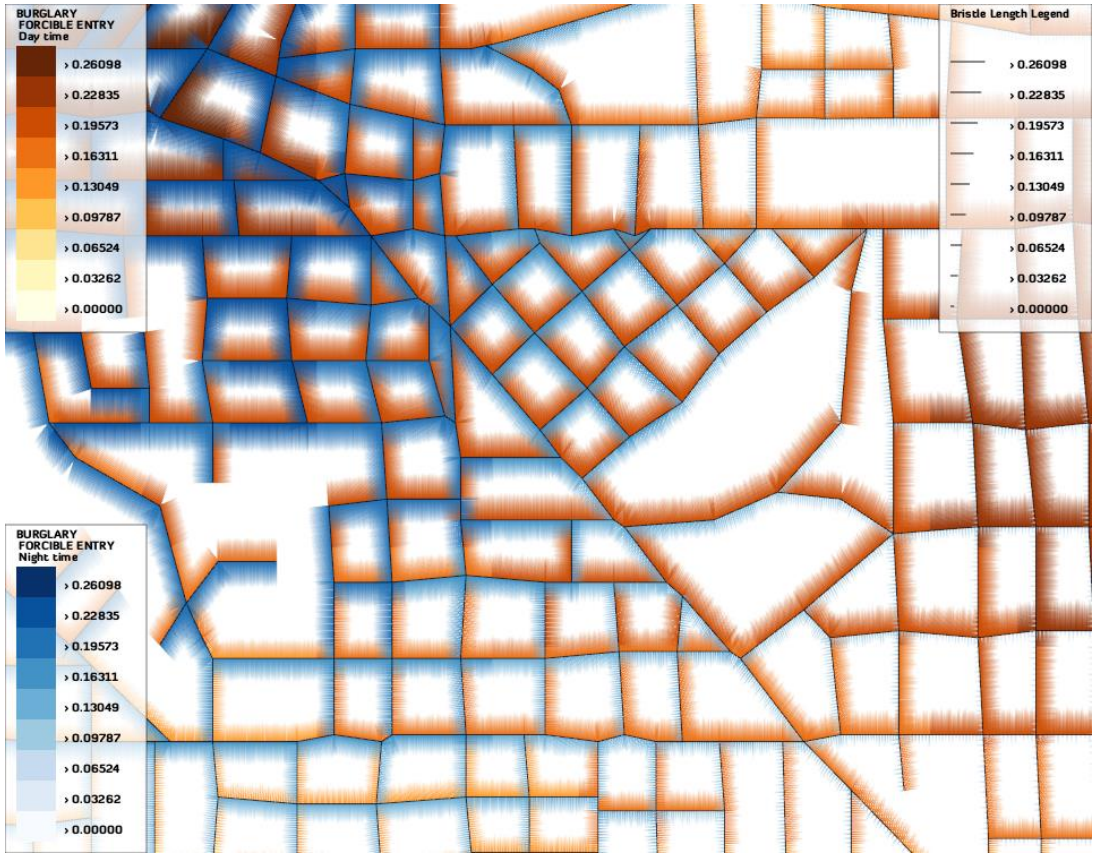

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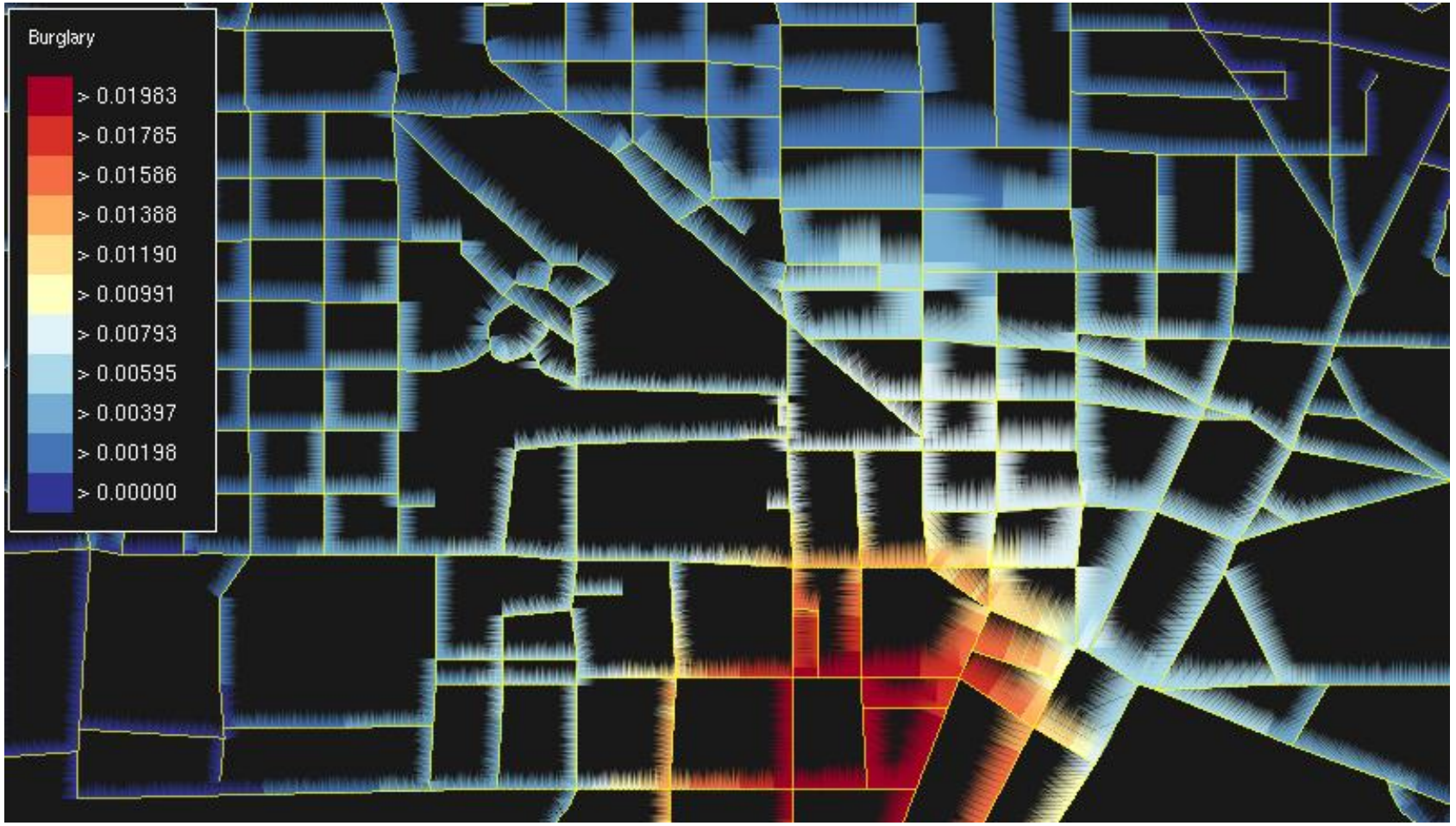

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What can we learn about abstraction?

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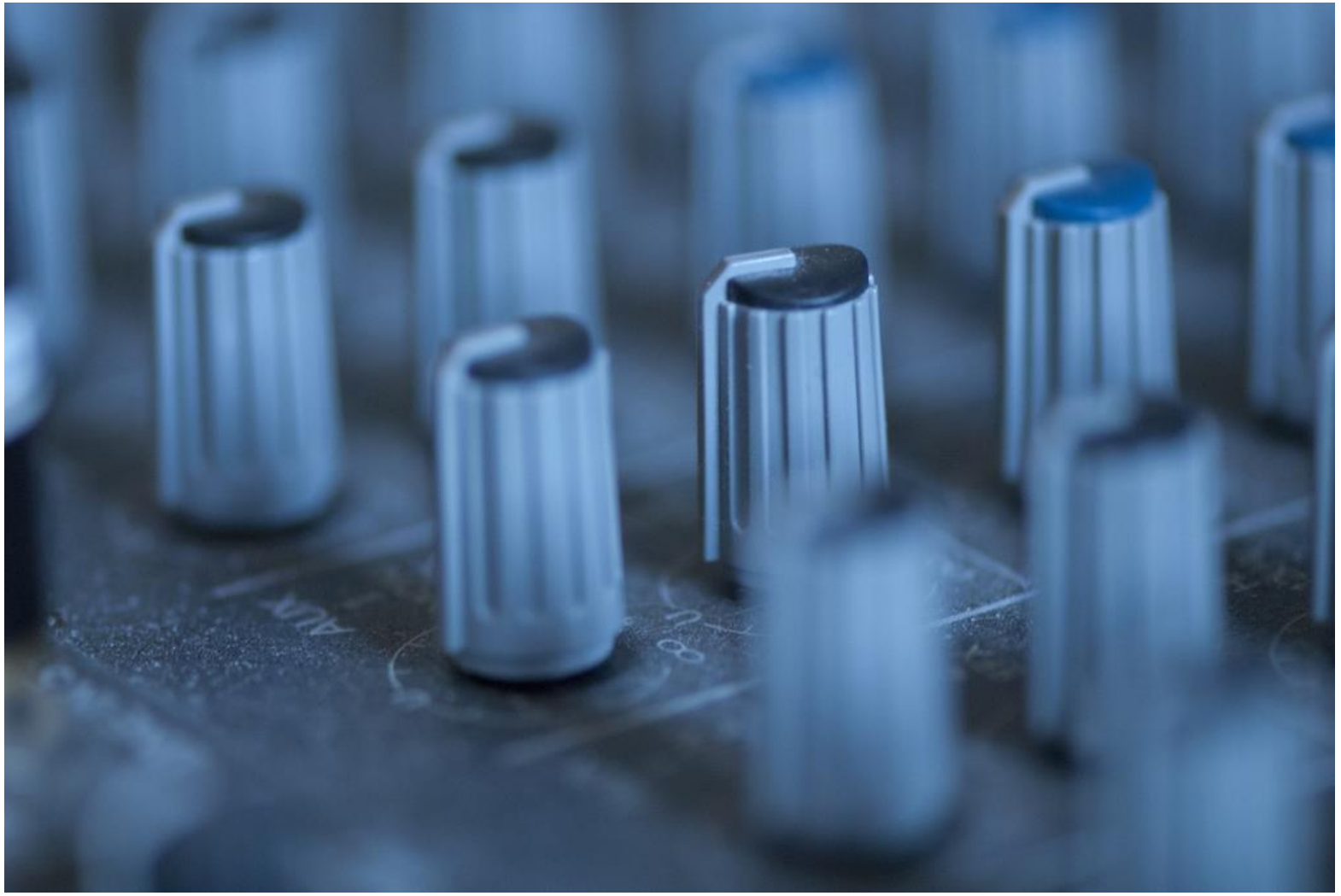

[Flickr: Ryan Allred; CC BY 2.0]

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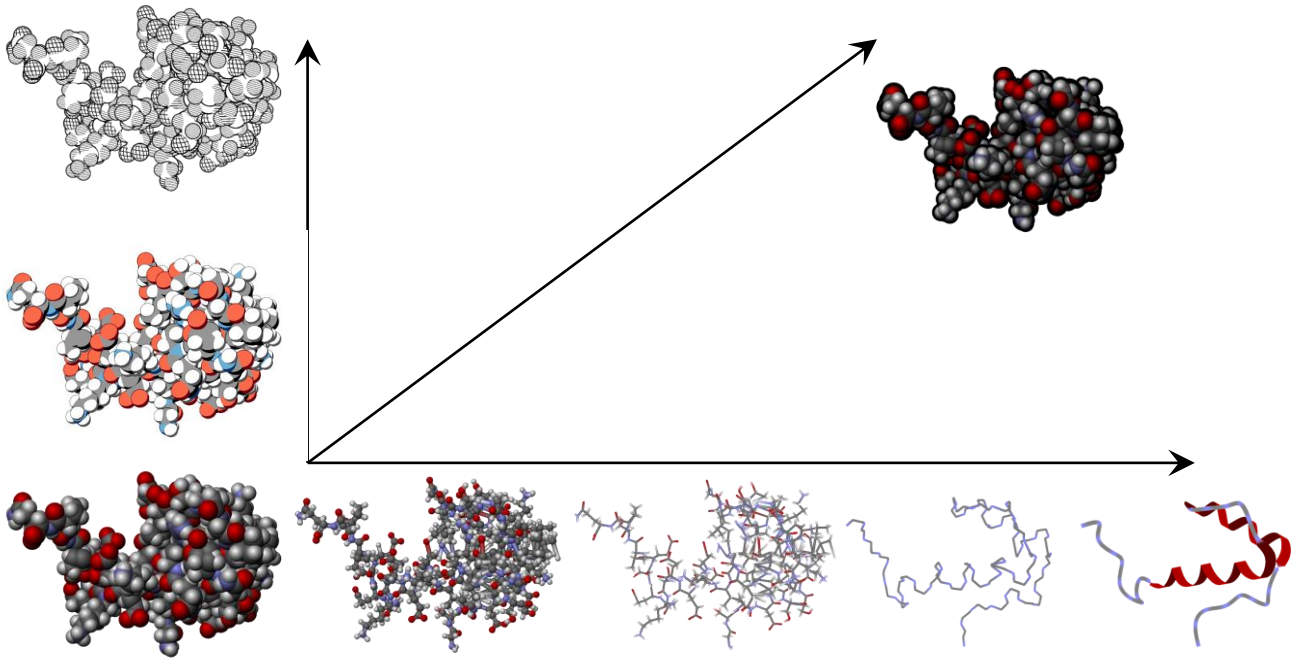

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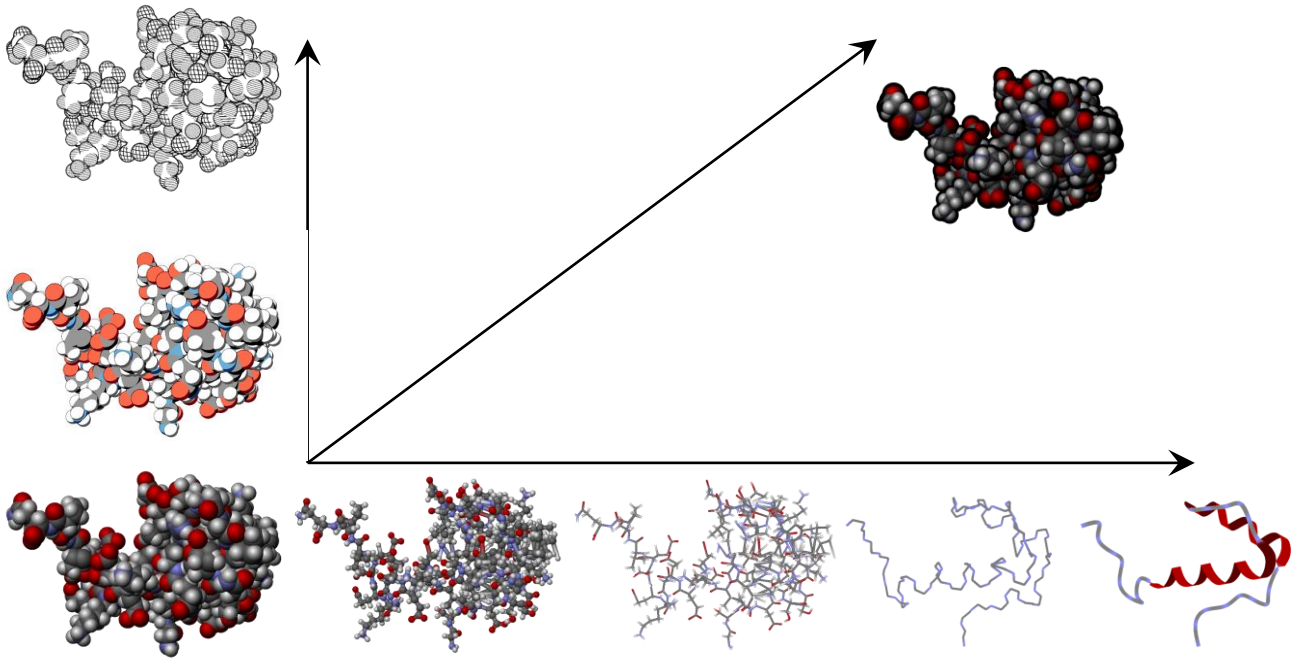

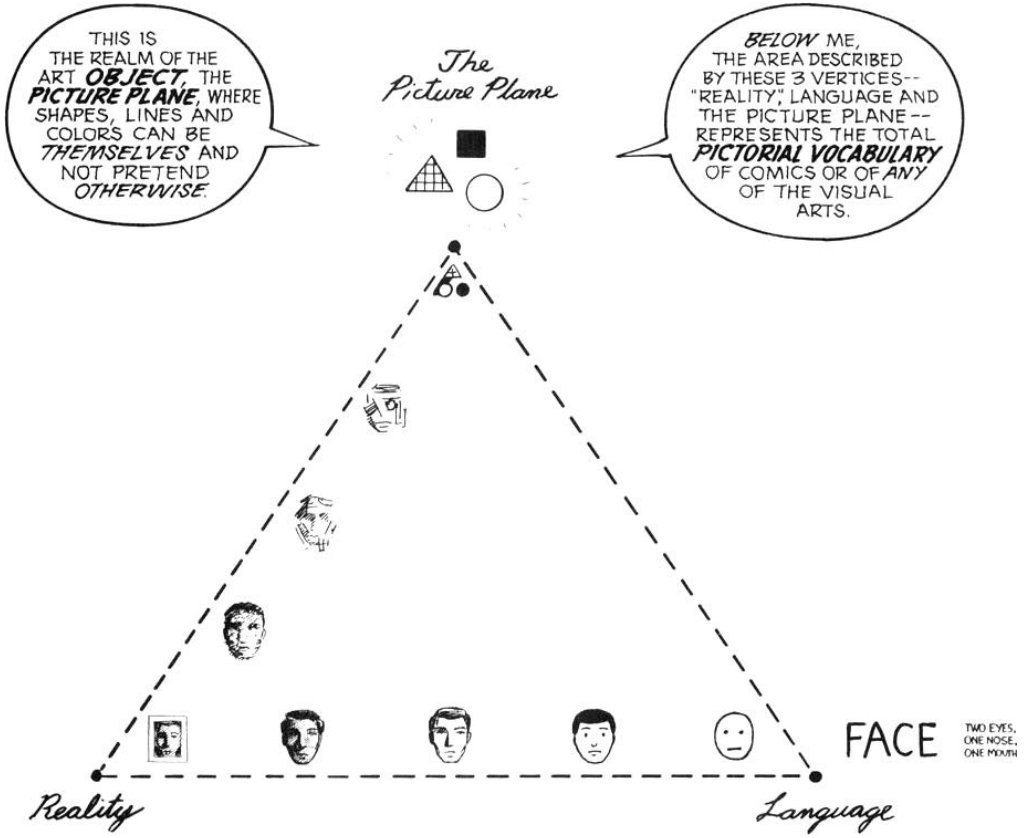

[McCloud, 1993]

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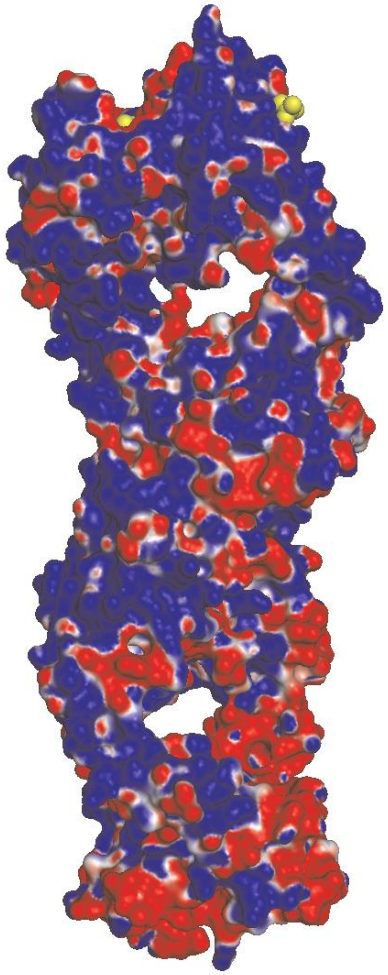
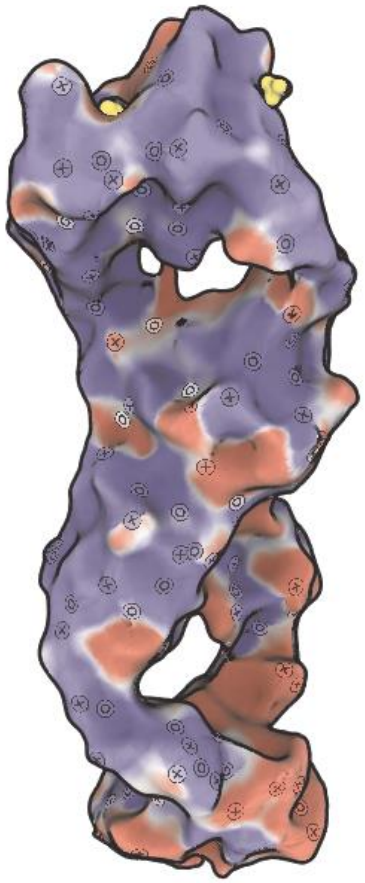
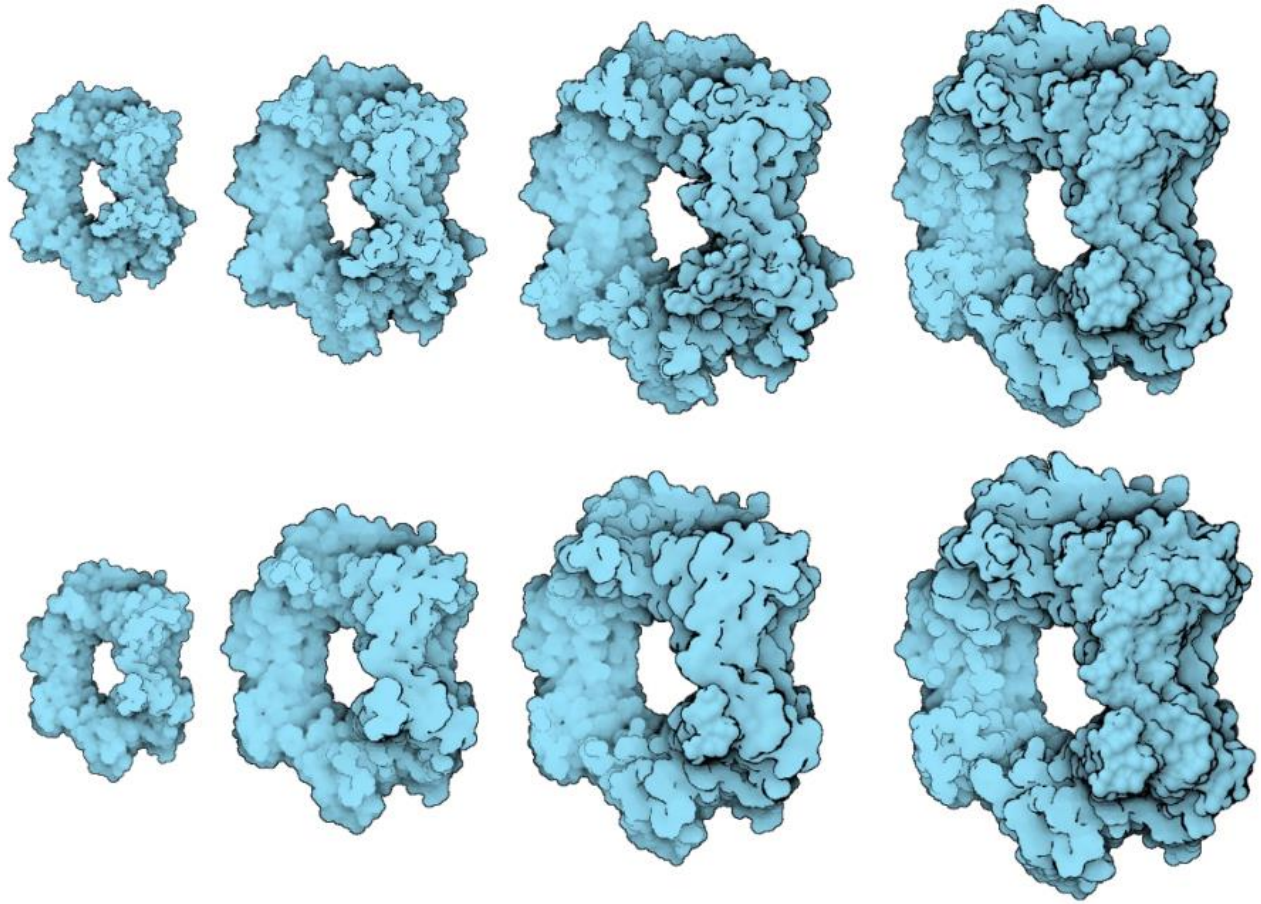




[Cipriano et al., 2007]



[Parulek et al., 2014]

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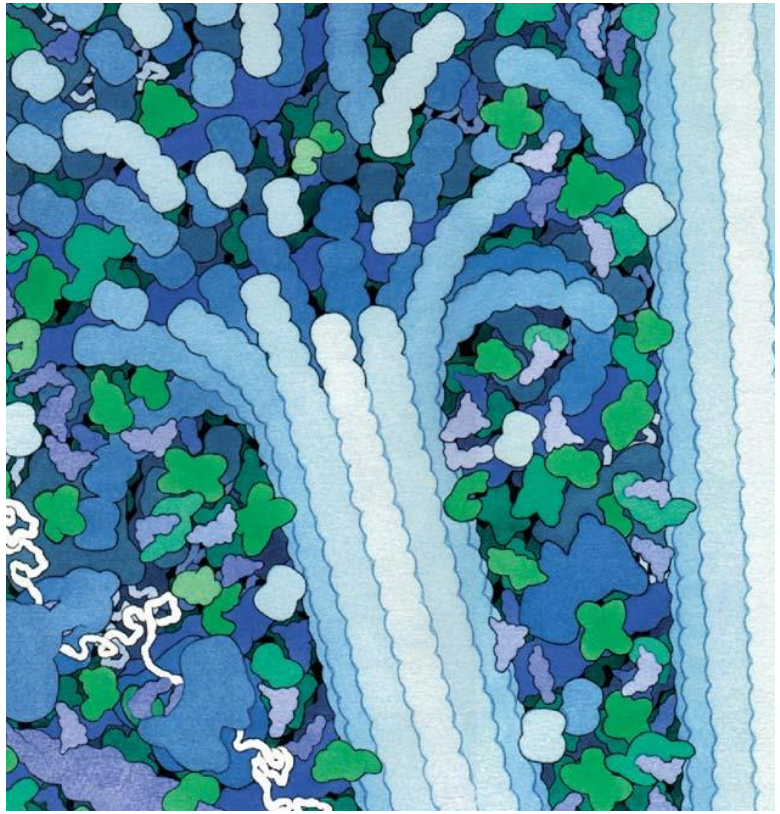
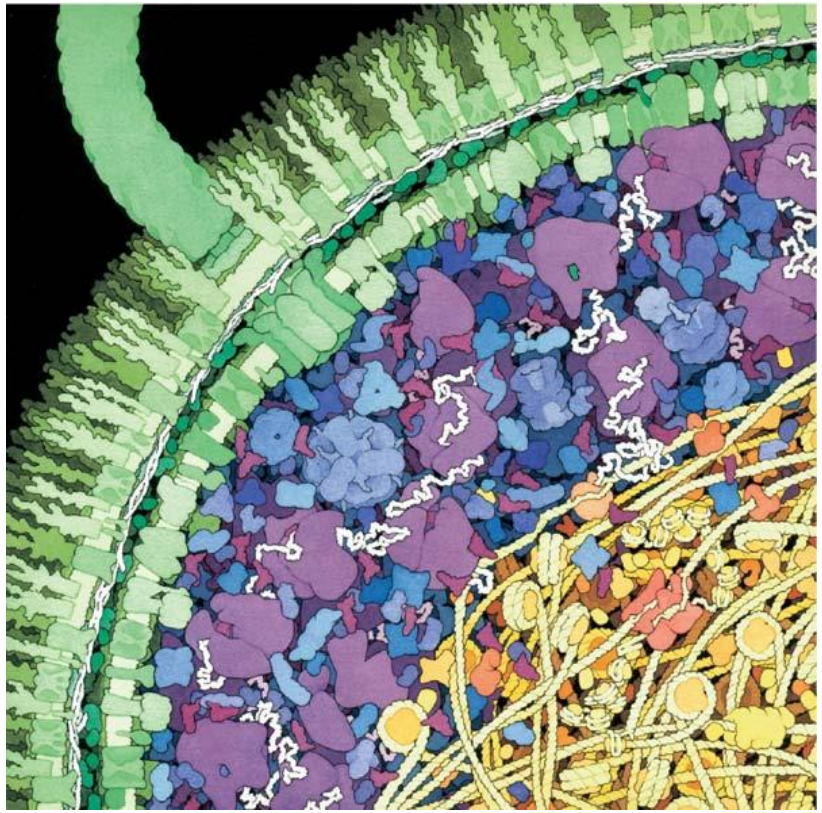
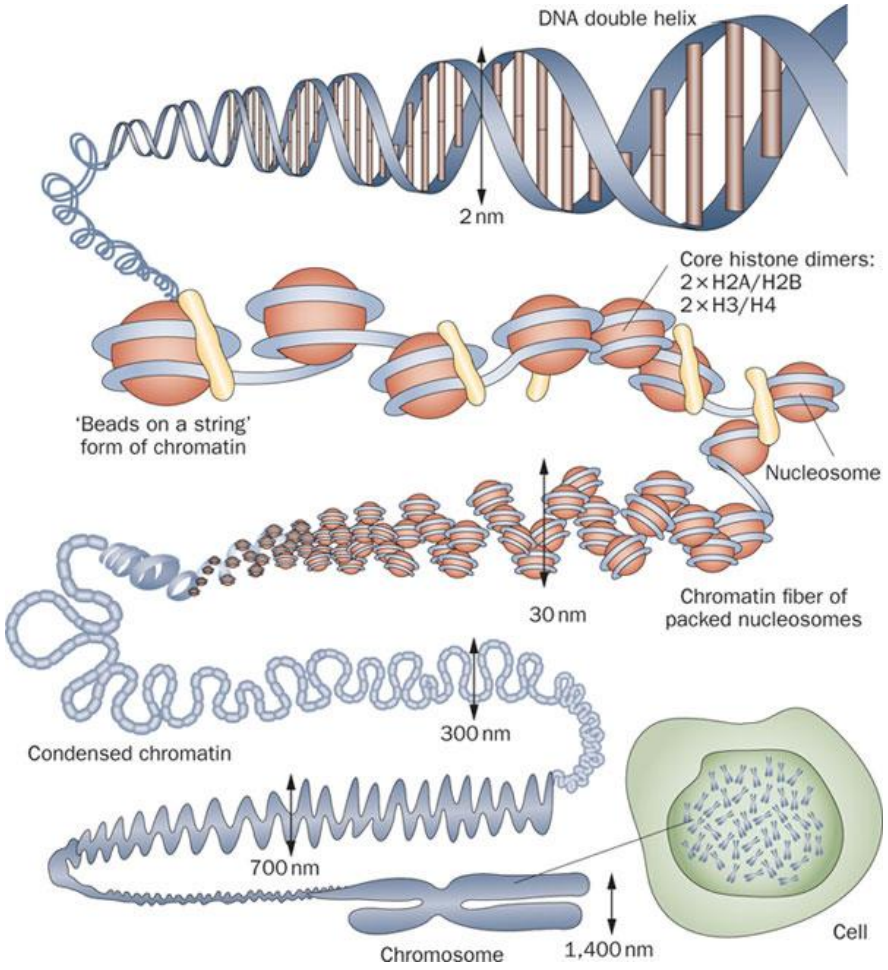




[Goodsell, 2005]



[Tonna et al., 2010]

What can we learn about abstraction?

Thanks

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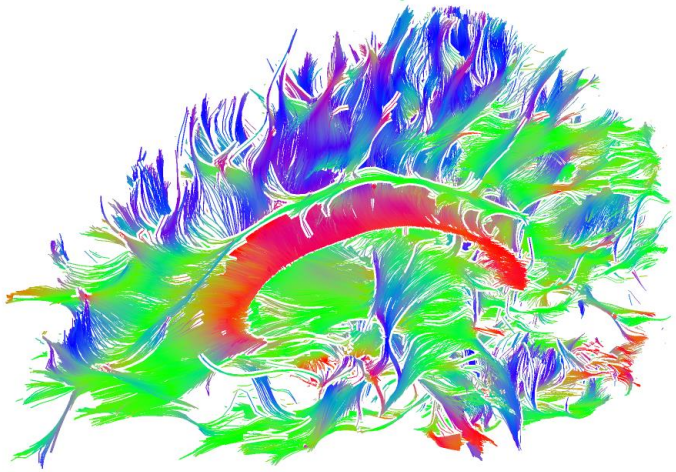

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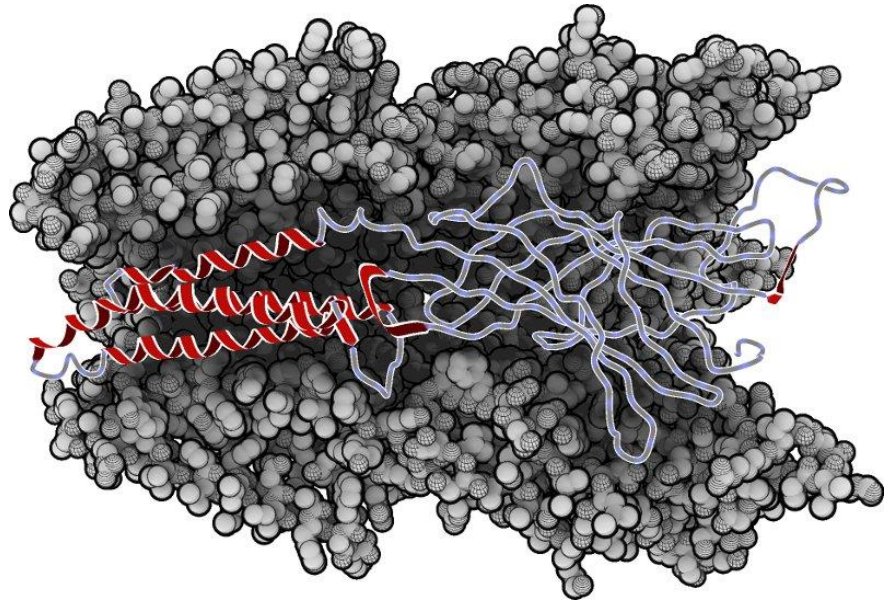

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