



30 JULY – 3 AUGUST *Los Angeles*
SIGGRAPH2017

CO-LOCATING STYLE-DEFINING ELEMENTS ON 3D SHAPES

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MOTIVATION



- *what* and *where* of style elements



explicit and *localized*
geometric elements



style

MOTIVATION



- *what* and *where* of style elements



“a **distinctive** manner which permits the **grouping** of works into related **categories**”

-- Eric Fernie [1995]

INPUT



- A set of shapes organized into different style labels



Ming



Children



Japanese

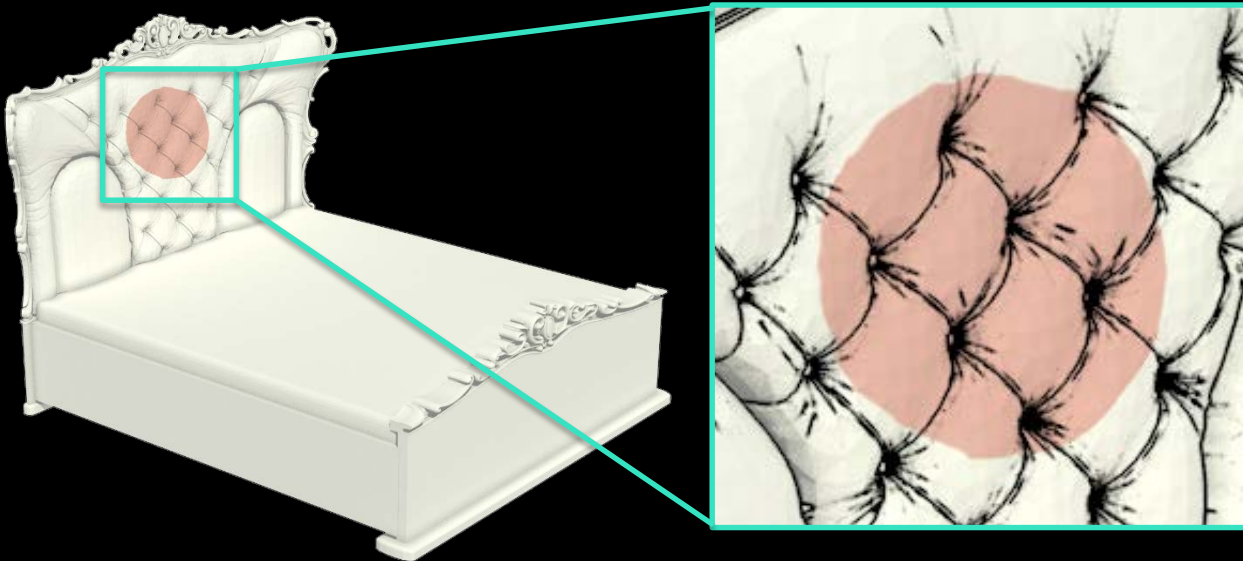


European

OUTPUT



- A set of *defining* elements for each style group

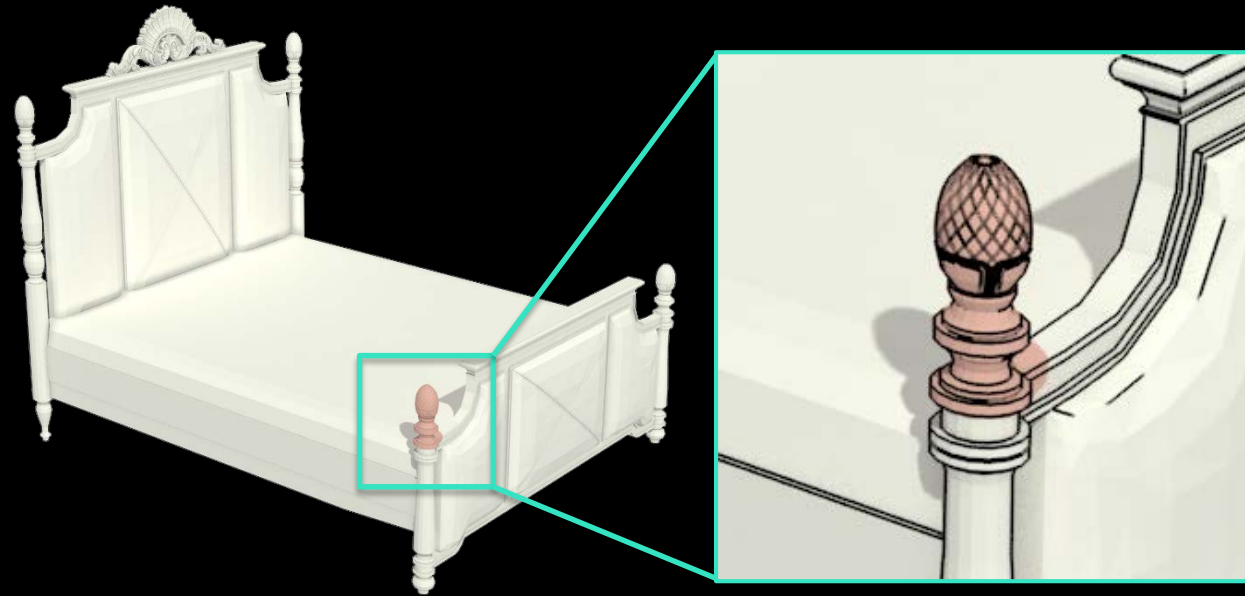


discriminative

OUTPUT



- A set of *defining* elements for each style group



complete

KEY IDEA



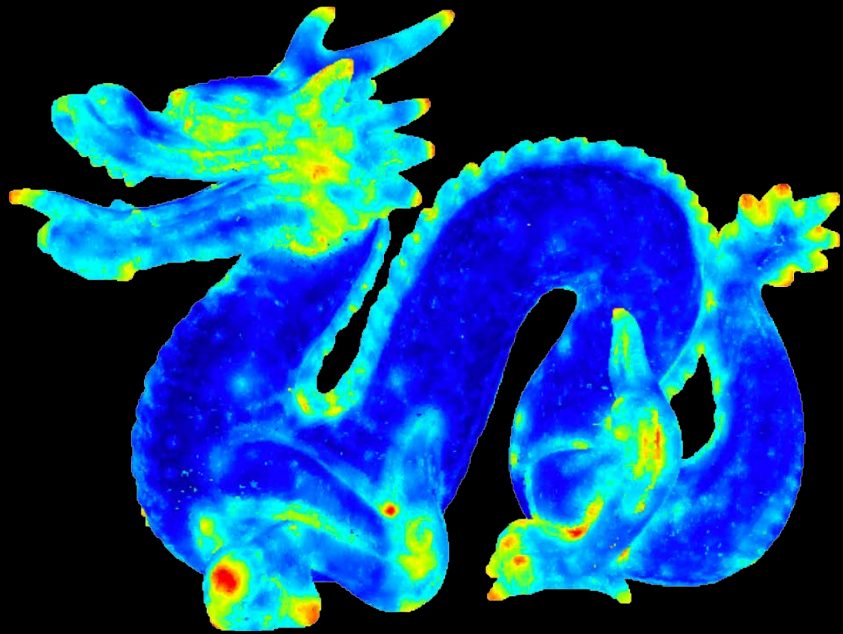
localized = concrete surface patches

Iterative optimization

defining = *discriminative* + *complete*

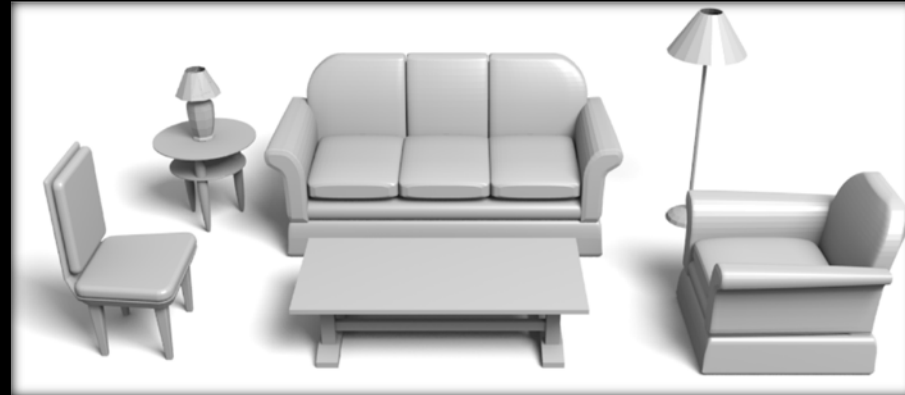
Feature selection

RELATED WORK

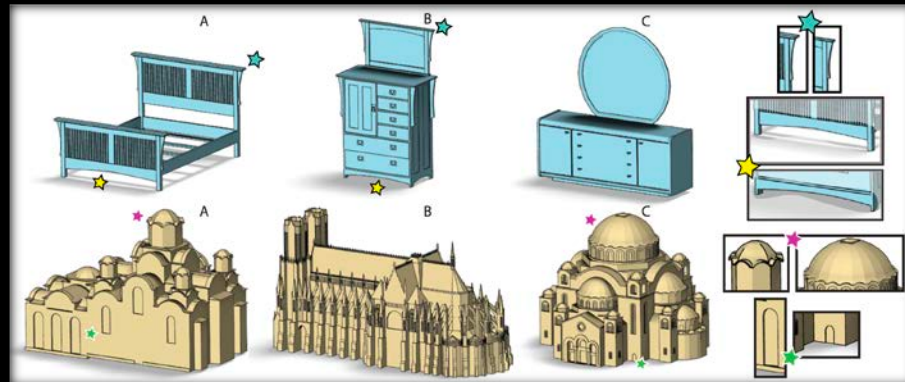


[Shtrom et al. 2013]

Saliency detection



[Liu et al. 2015]



[Lun et al. 2015]

Style similarity measure

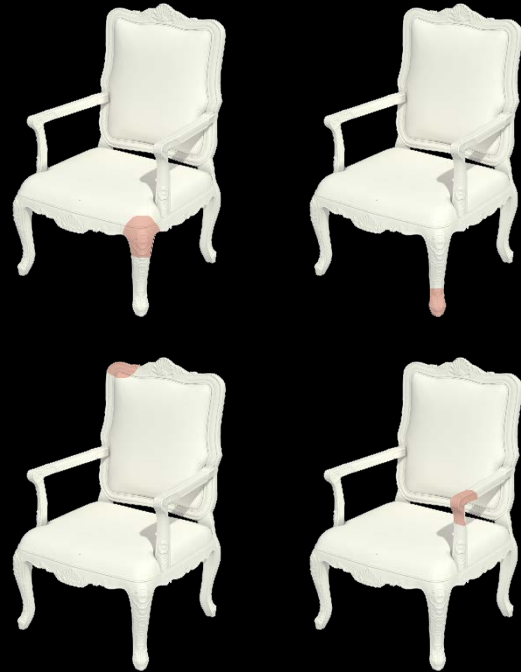
OVERVIEW



Initial
elements



Candidate
elements

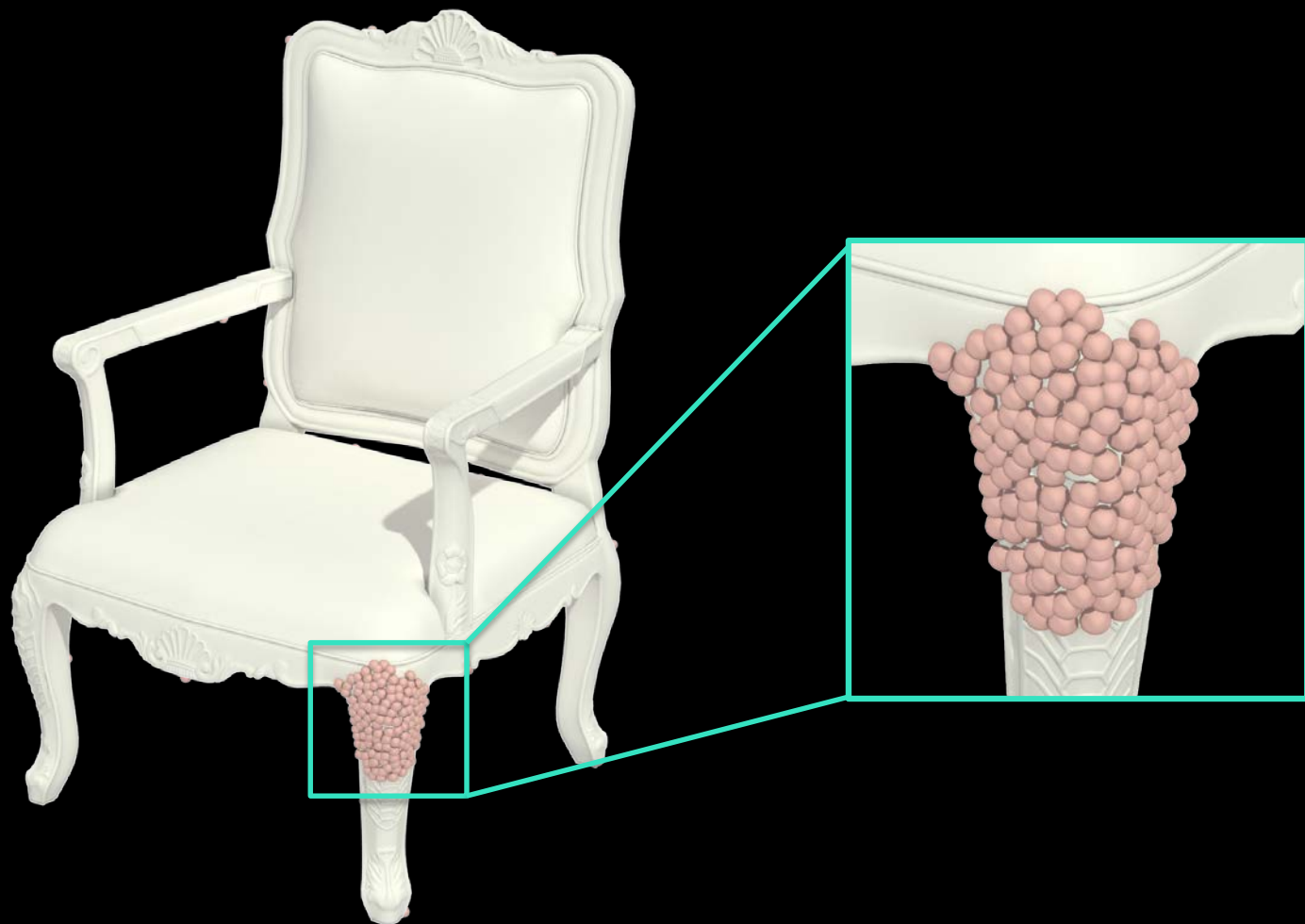


Discriminative
elements

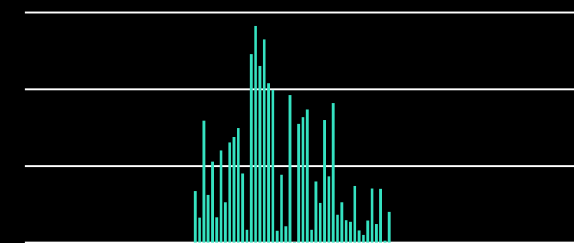
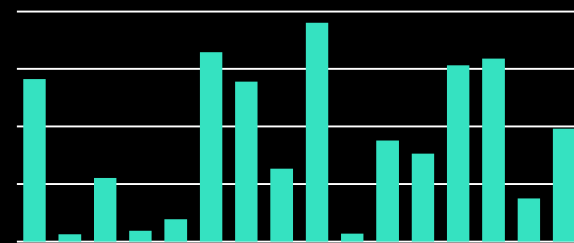


Defining
elements

INITIAL ELEMENTS



Geometric features



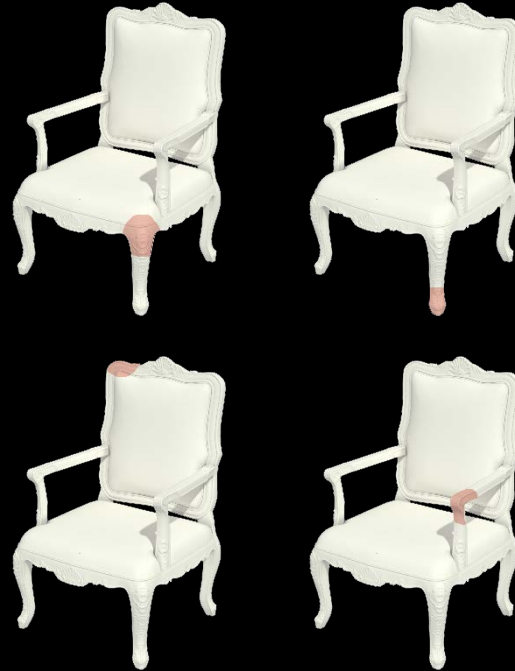
OVERVIEW



Initial
elements



Candidate
elements



Discriminative
elements

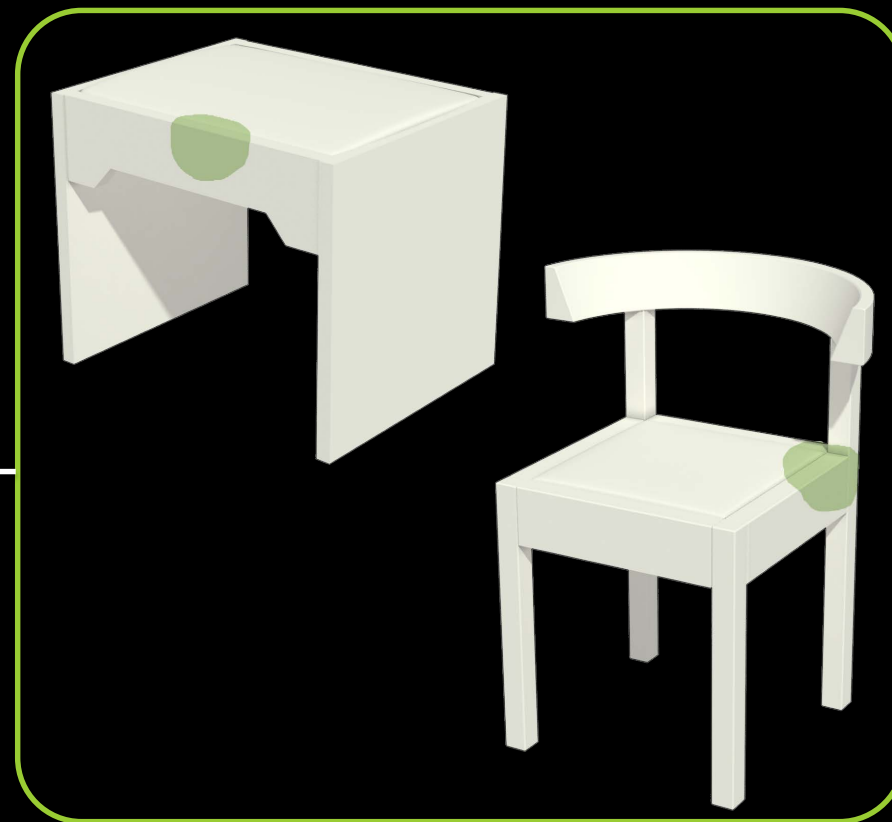
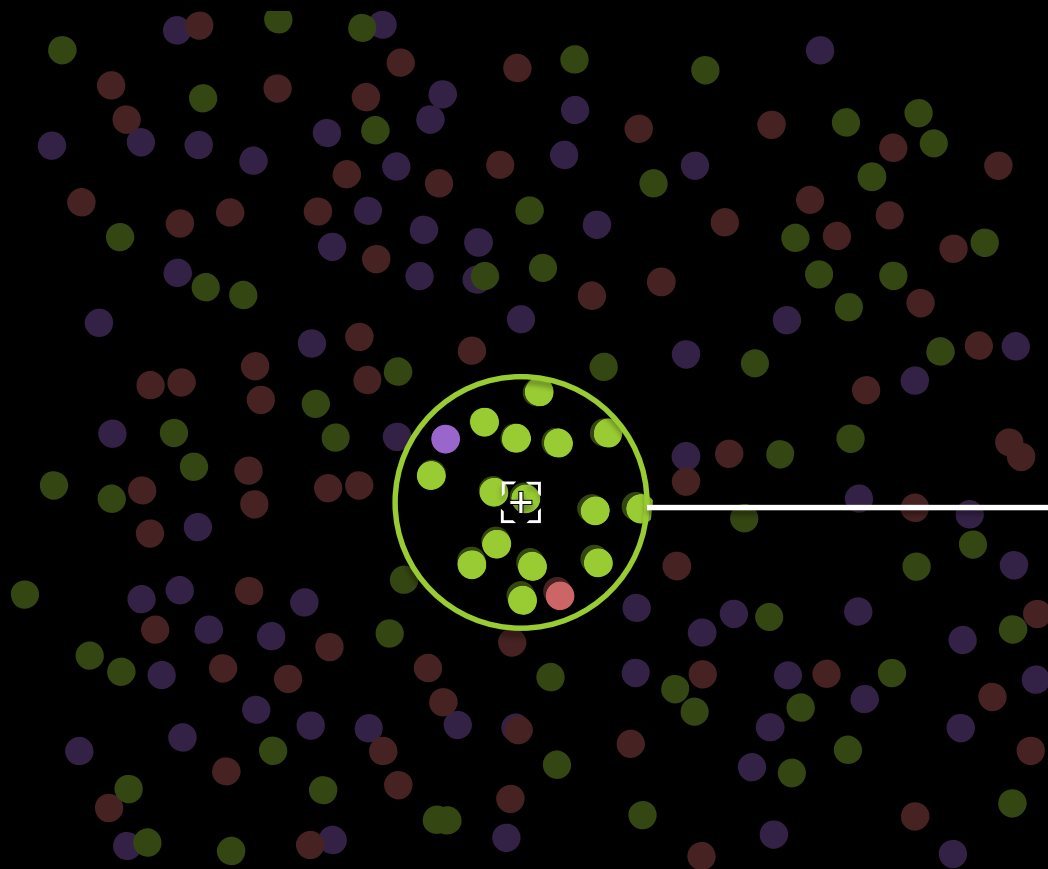


Defining
elements

CANDIDATE ELEMENTS



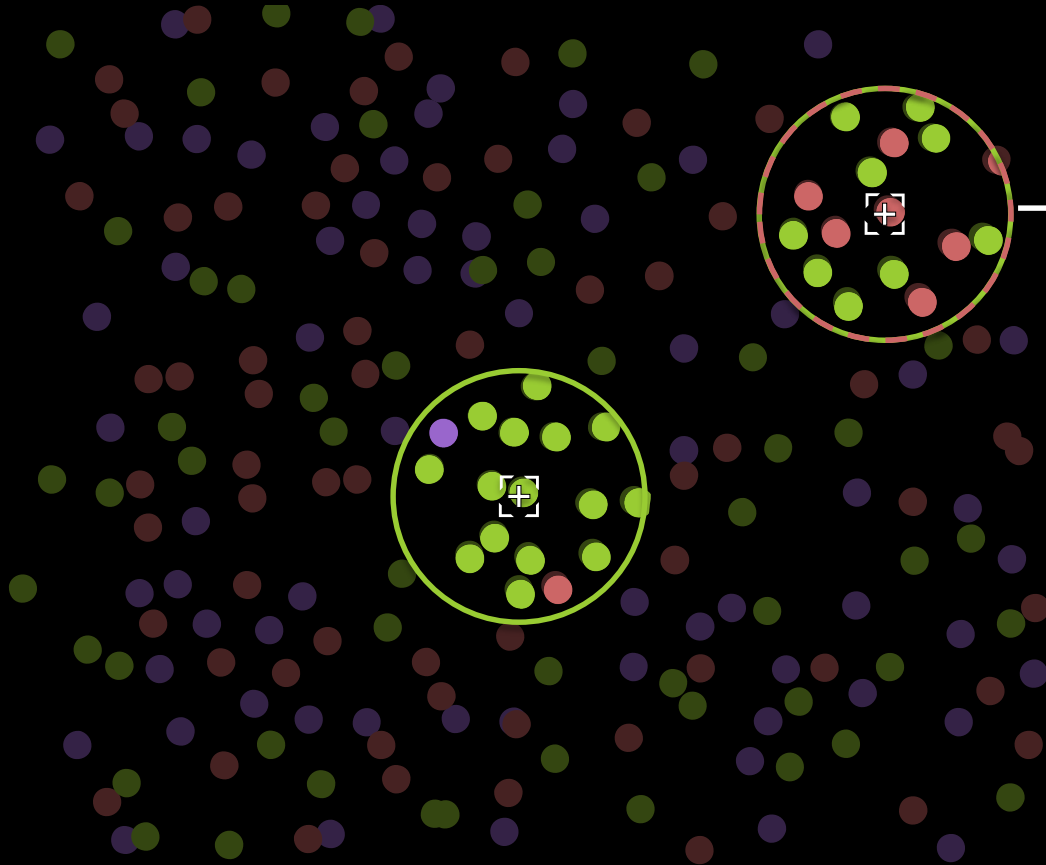
- Density peaks – frequently appearing



CANDIDATE ELEMENTS



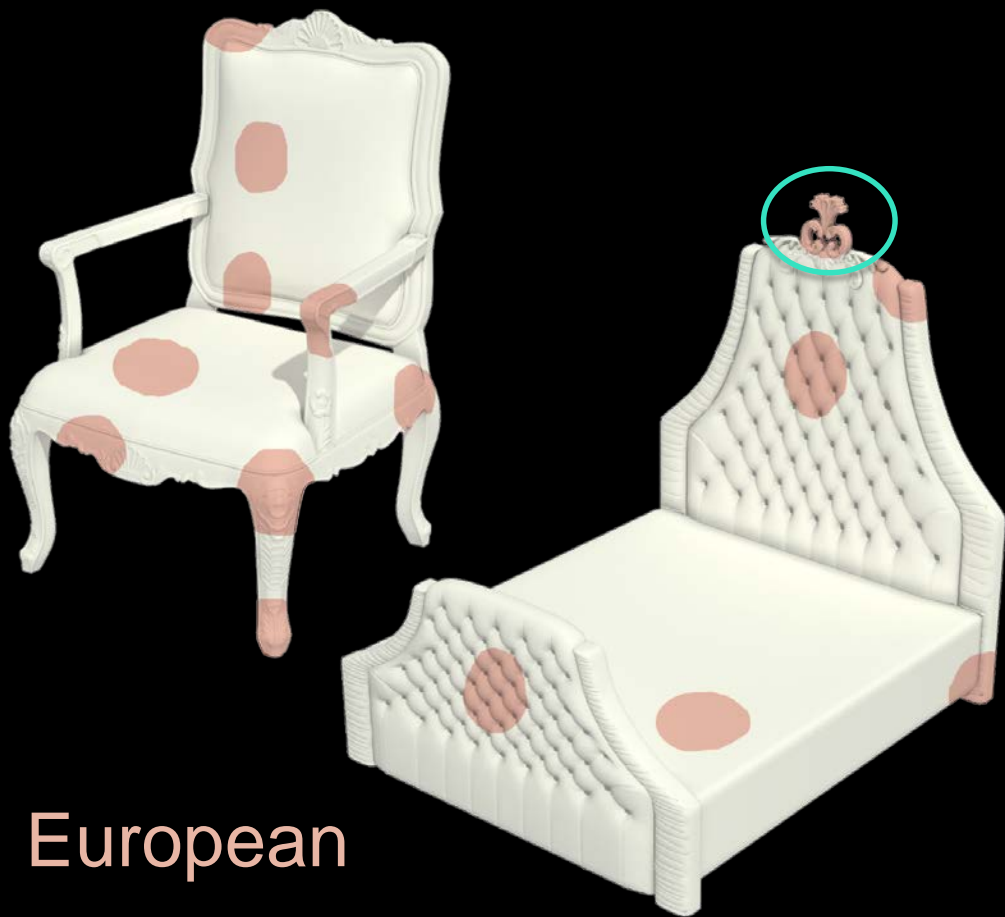
- Density peaks – frequently appearing



CANDIDATE ELEMENTS



- Density peaks – frequently appearing



European



Ming



CANDIDATE ELEMENTS



- Element distance measure
 - Refinement: style-sensitive feature weights



Nearest
Neighbors
(before):



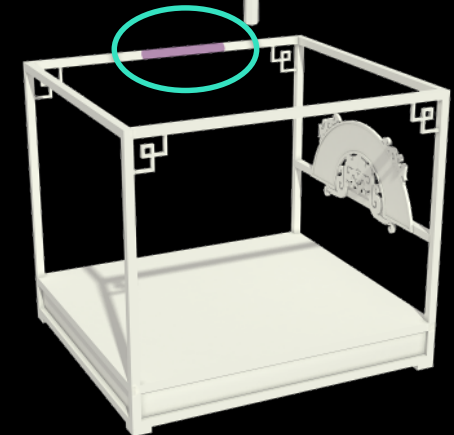
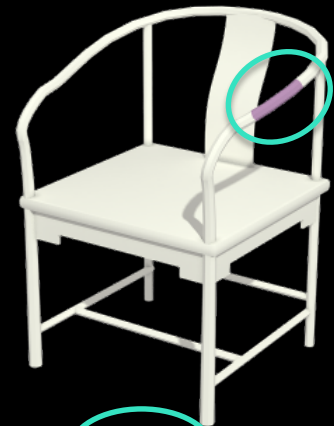
CANDIDATE ELEMENTS



- Element distance measure
 - Refinement: style-sensitive feature weights



Nearest
Neighbors
(after):



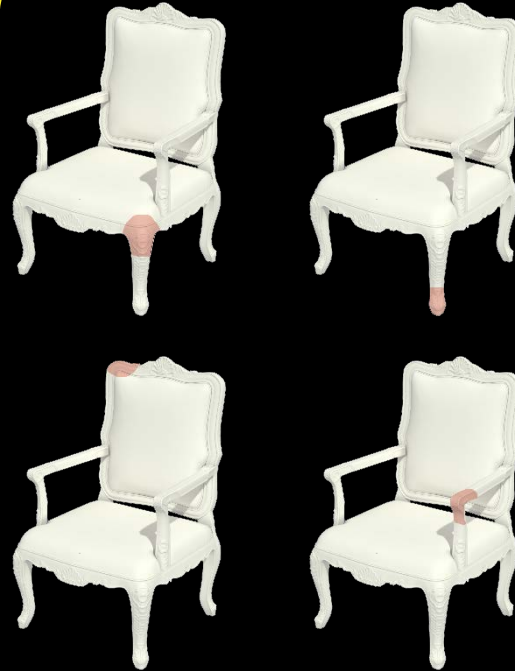
OVERVIEW



Initial
elements



Candidate
elements



Discriminative
elements

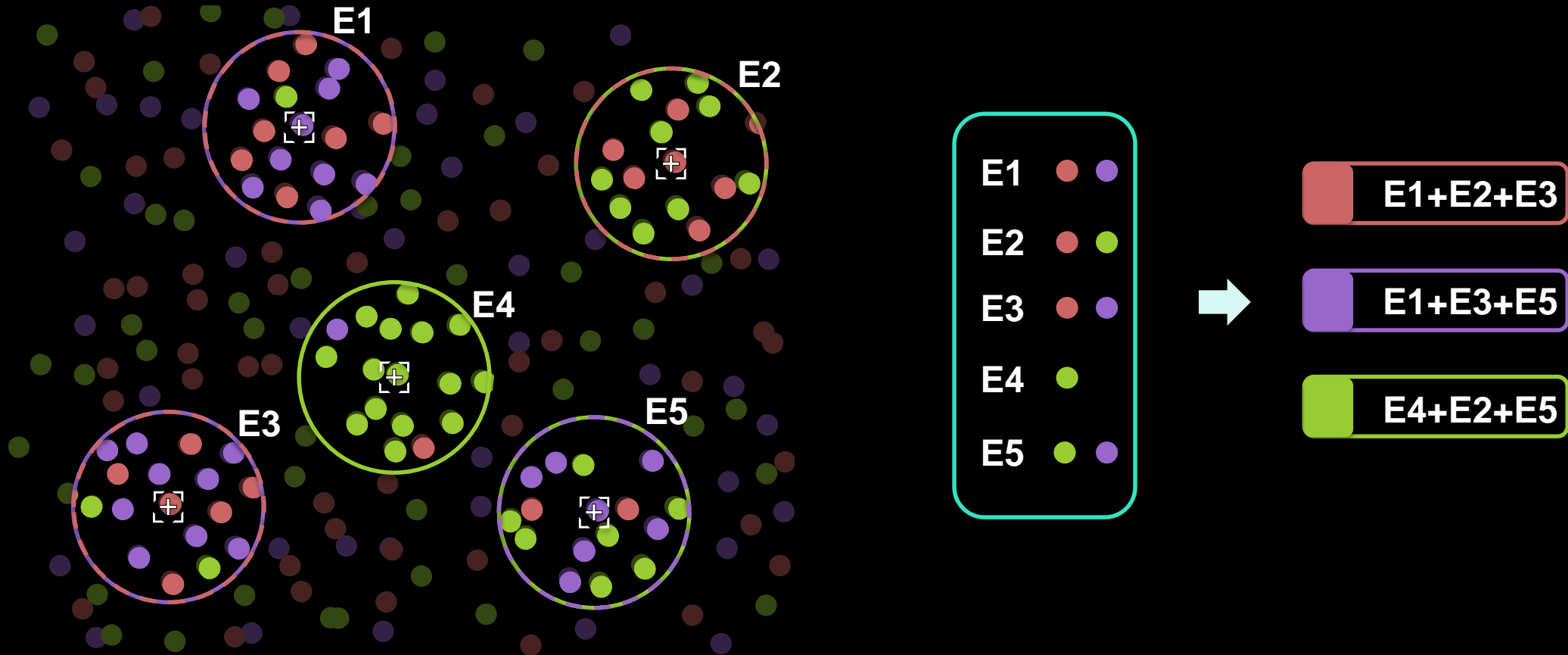


Defining
elements

DISCRIMINATIVE ELEMENTS



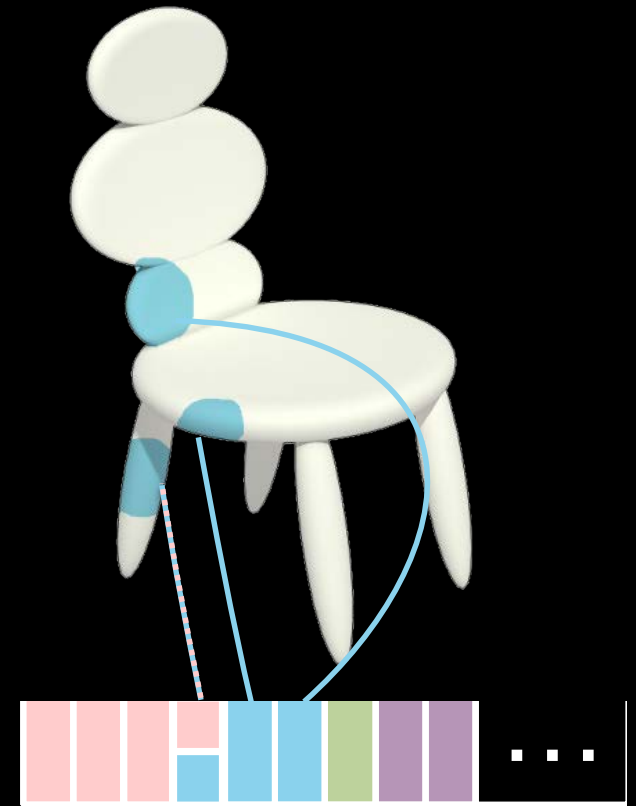
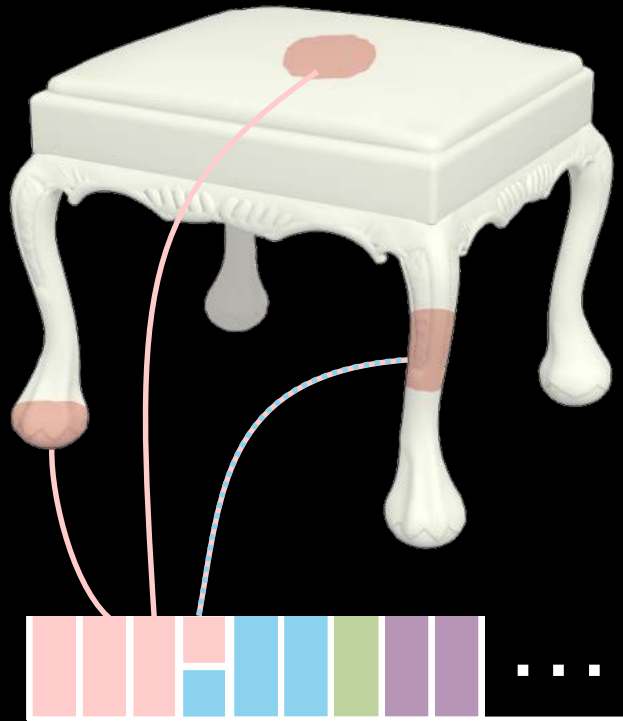
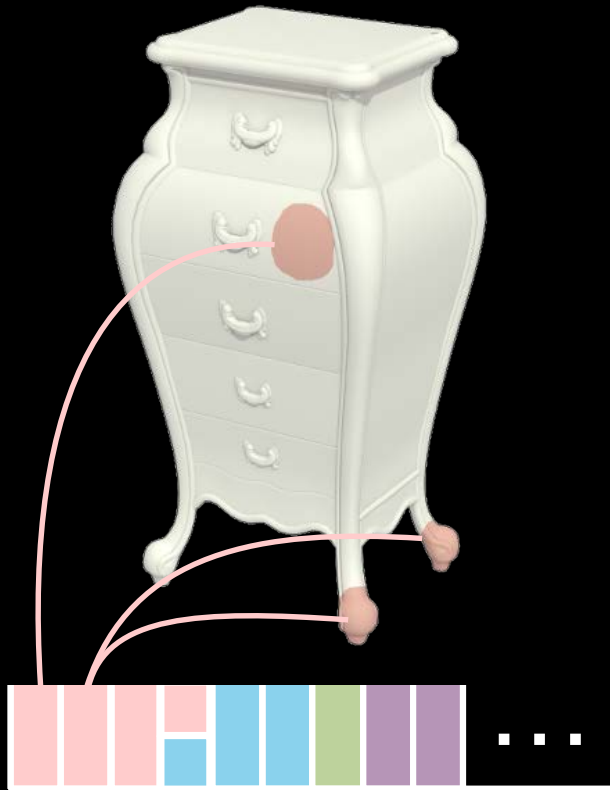
- Element selection – “feature” selection



DISCRIMINATIVE ELEMENTS



- Shape representation – **bag-of-words model**



DISCRIMINATIVE ELEMENTS



- Feature selection + classification per style

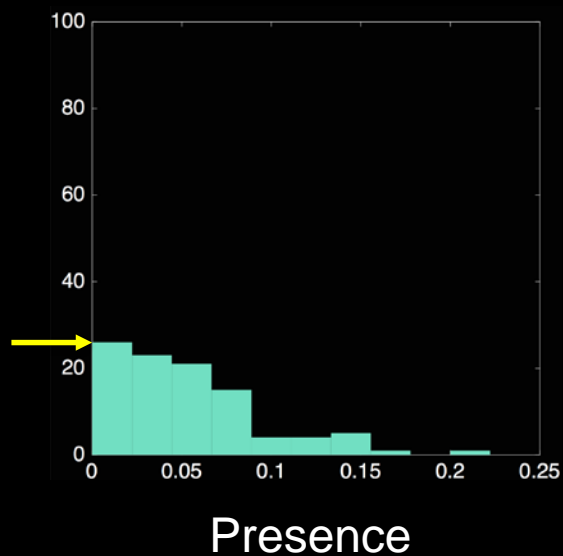


Positive

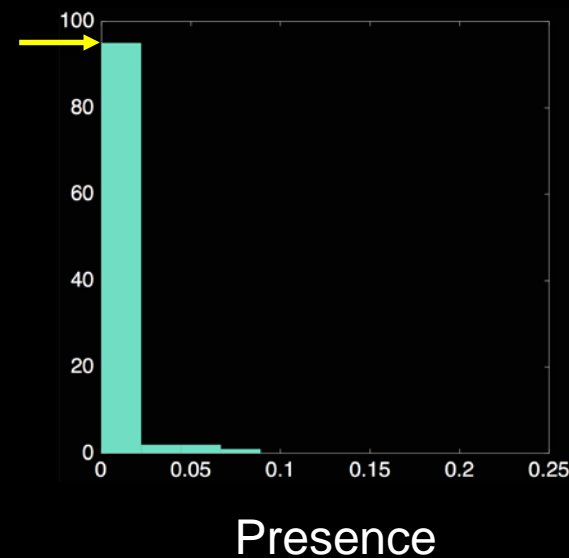


Negative

DISCRIMINATIVE ELEMENTS



Positive



Negative

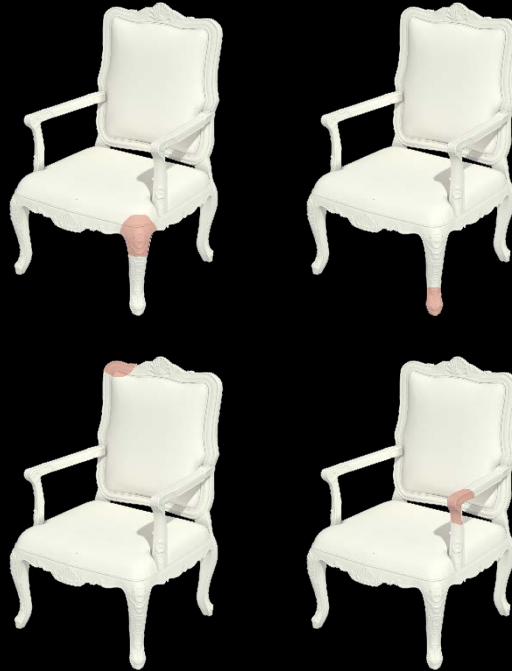
OVERVIEW



Initial
elements



Candidate
elements



Discriminative
elements



Defining
elements

DEFINING ELEMENTS



- Iteratively combine the selected discriminative elements:

iter #1 :



Positive



Negative

DEFINING ELEMENTS

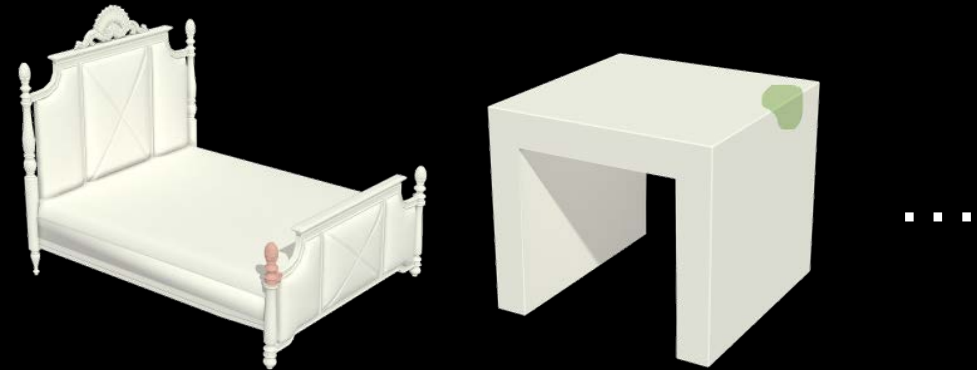


- Iteratively combine the selected discriminative elements:

iter #2 :



Positive



Negative

DEFINING ELEMENTS



- Iteratively combine the selected discriminative elements:

iter #3 :



Positive



Negative

RESULTS



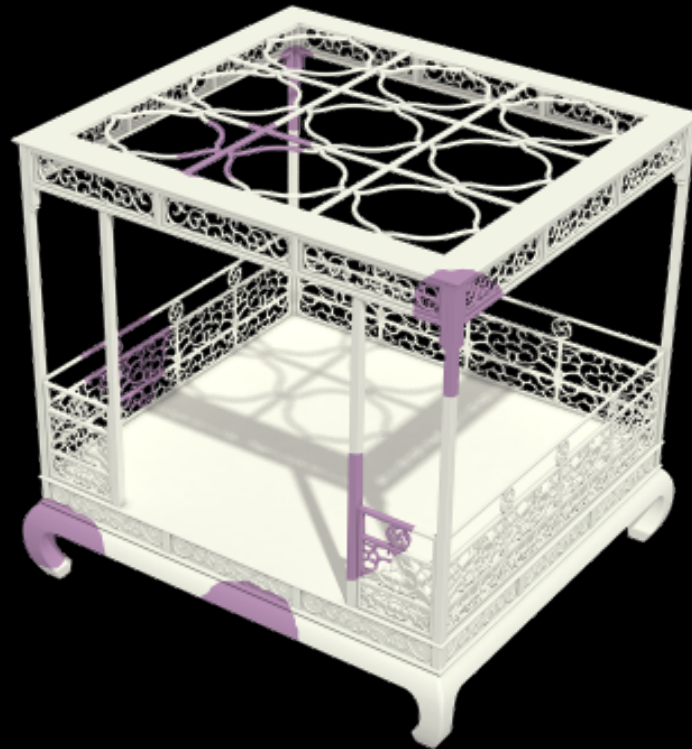
- Positive defining elements for **European** furniture



RESULTS



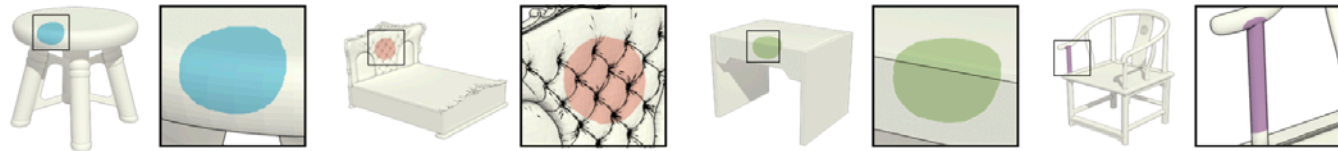
- Positive defining elements for **Ming** furniture



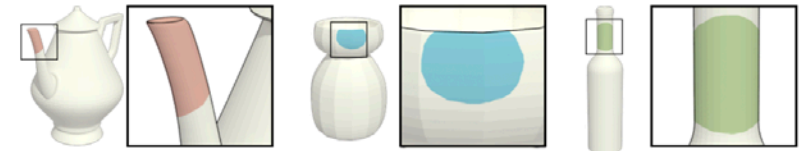
RESULTS



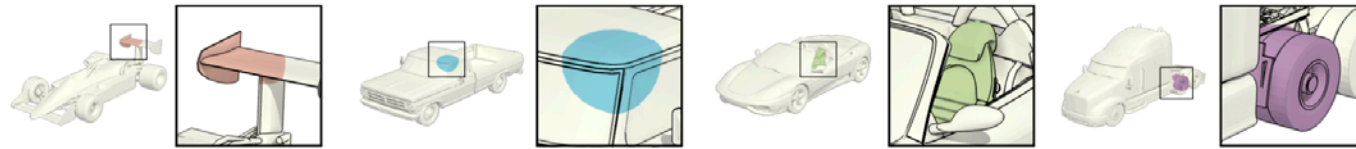
- Examples of style-defining elements



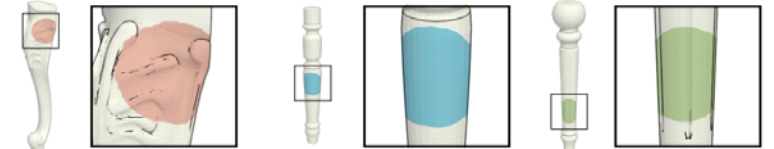
(a) Furniture



(b) Drinking vessels



(c) Cars



(d) Furniture legs

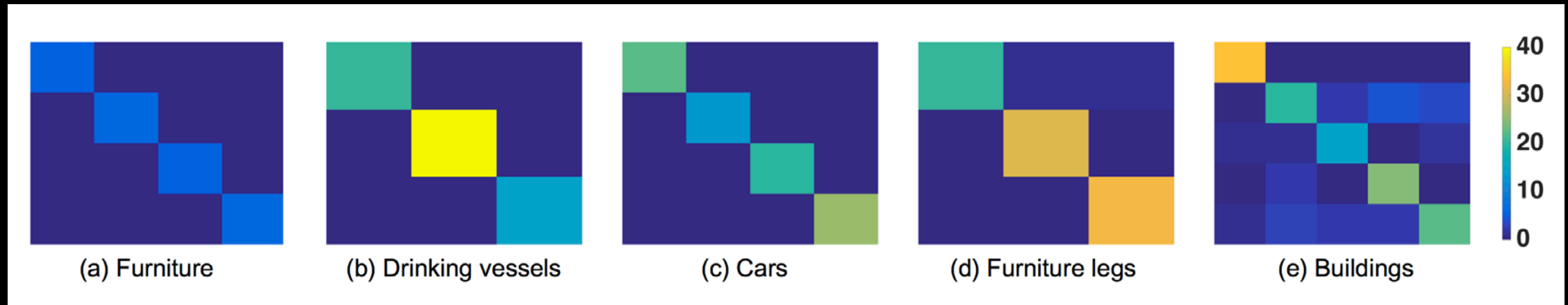


(e) Buildings

EVALUATION



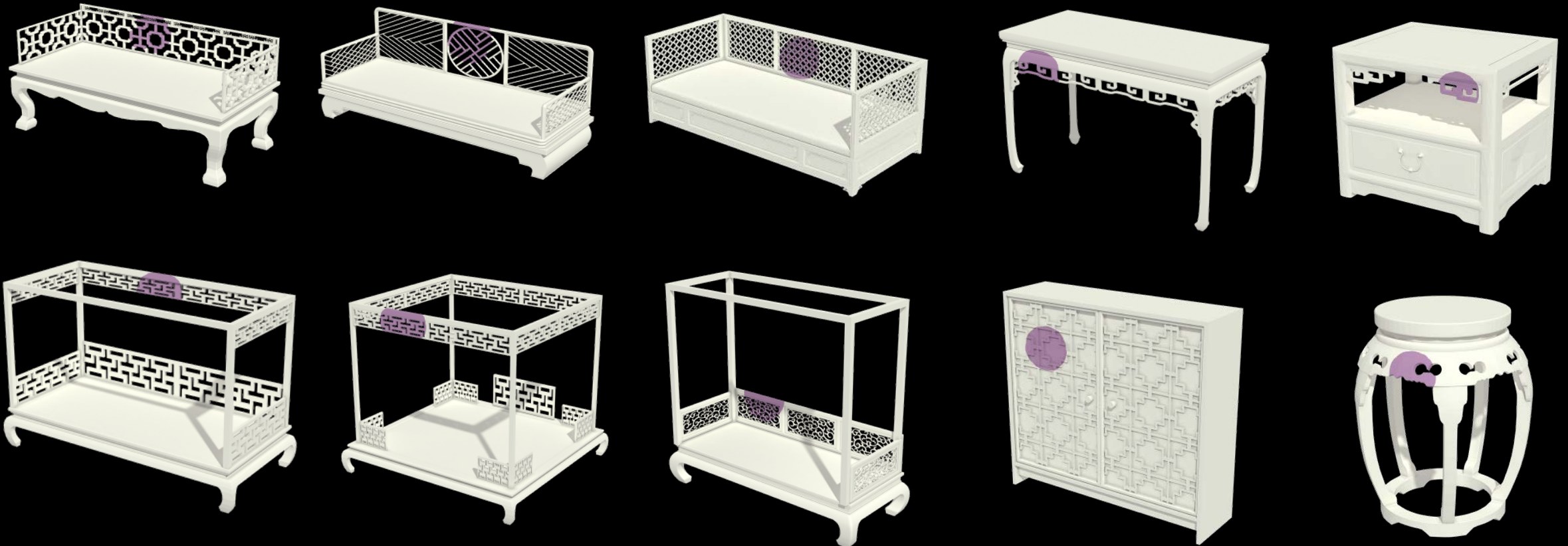
- Defining element **occurring frequency**
 - Entry (i, j) : average percentage of defining elements of style i that appear in shapes of style j



EVALUATION



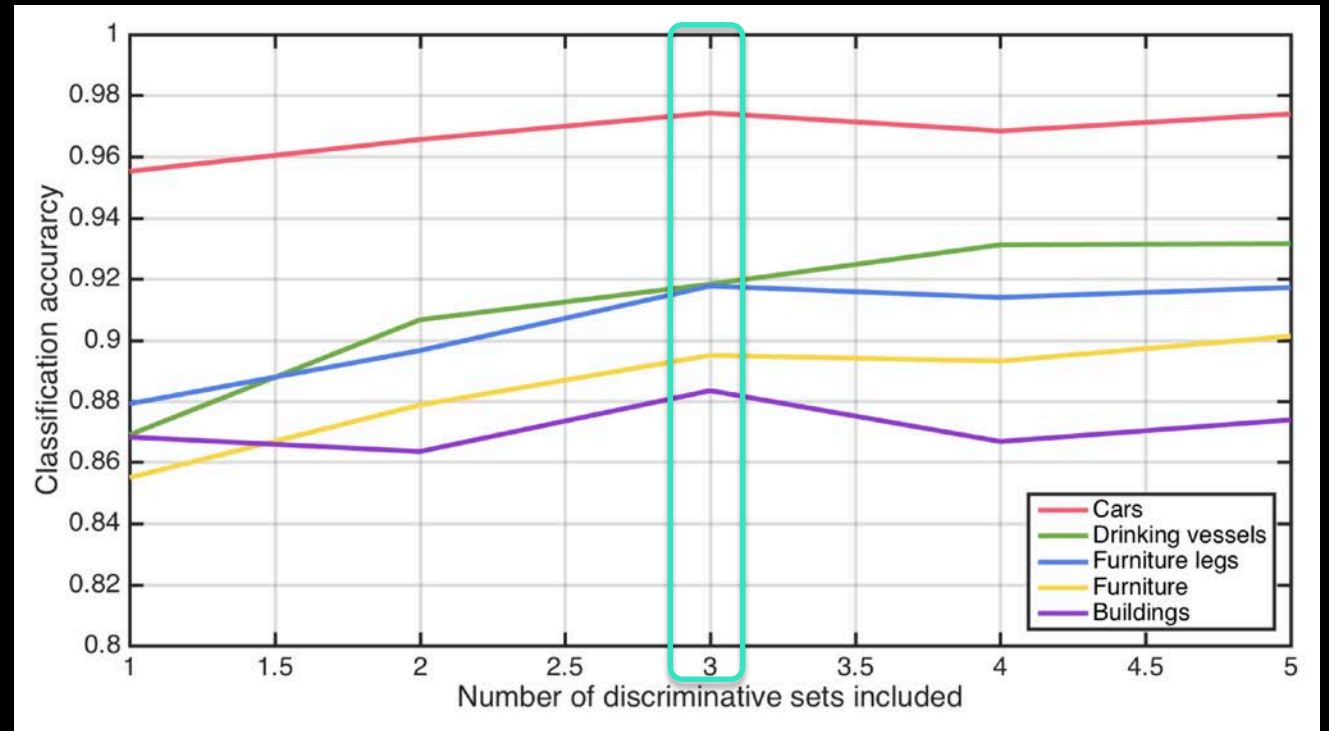
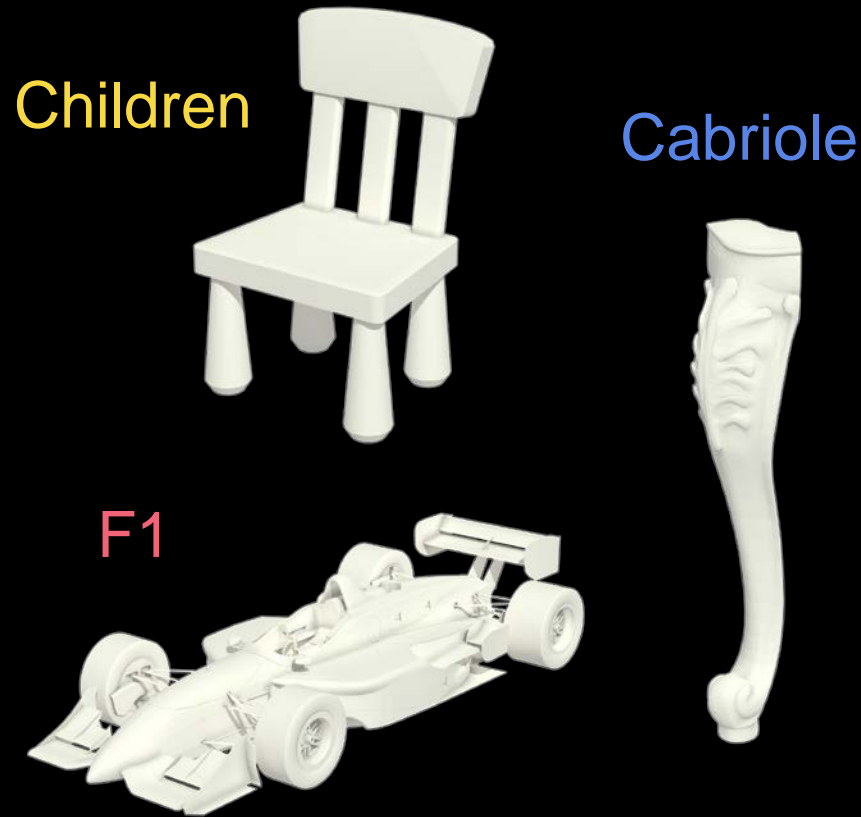
- Defining element **occurring frequency**



EVALUATION



- Style classification accuracies (**discriminative**)



STYLE-AWARE APPLICATIONS



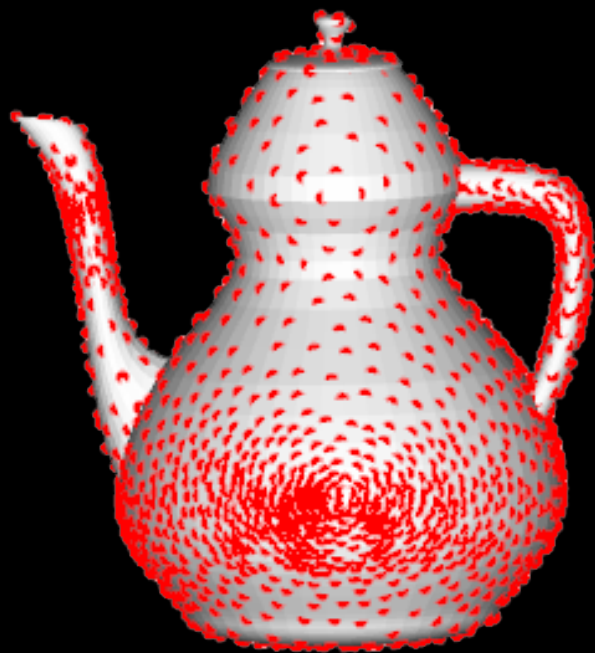
- Style-revealing scalar field



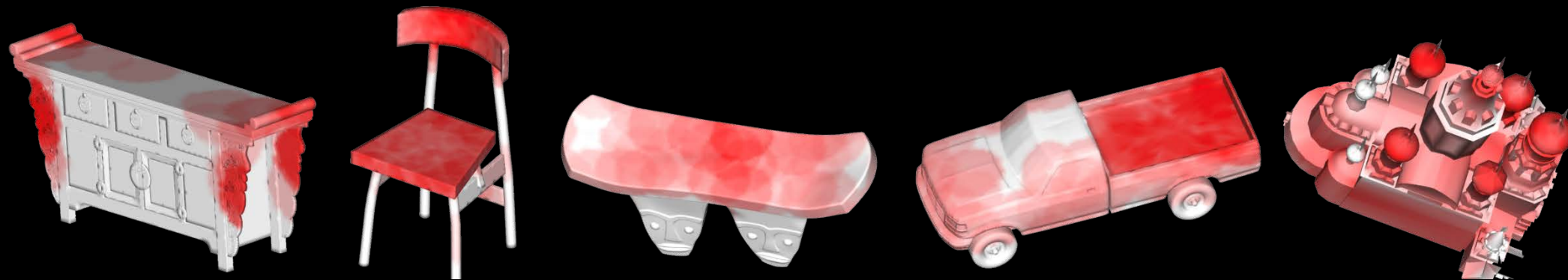
STYLE-AWARE SAMPLING



- Place more samples on style-related regions



STYLE-REVEALING VIEW SELECTION

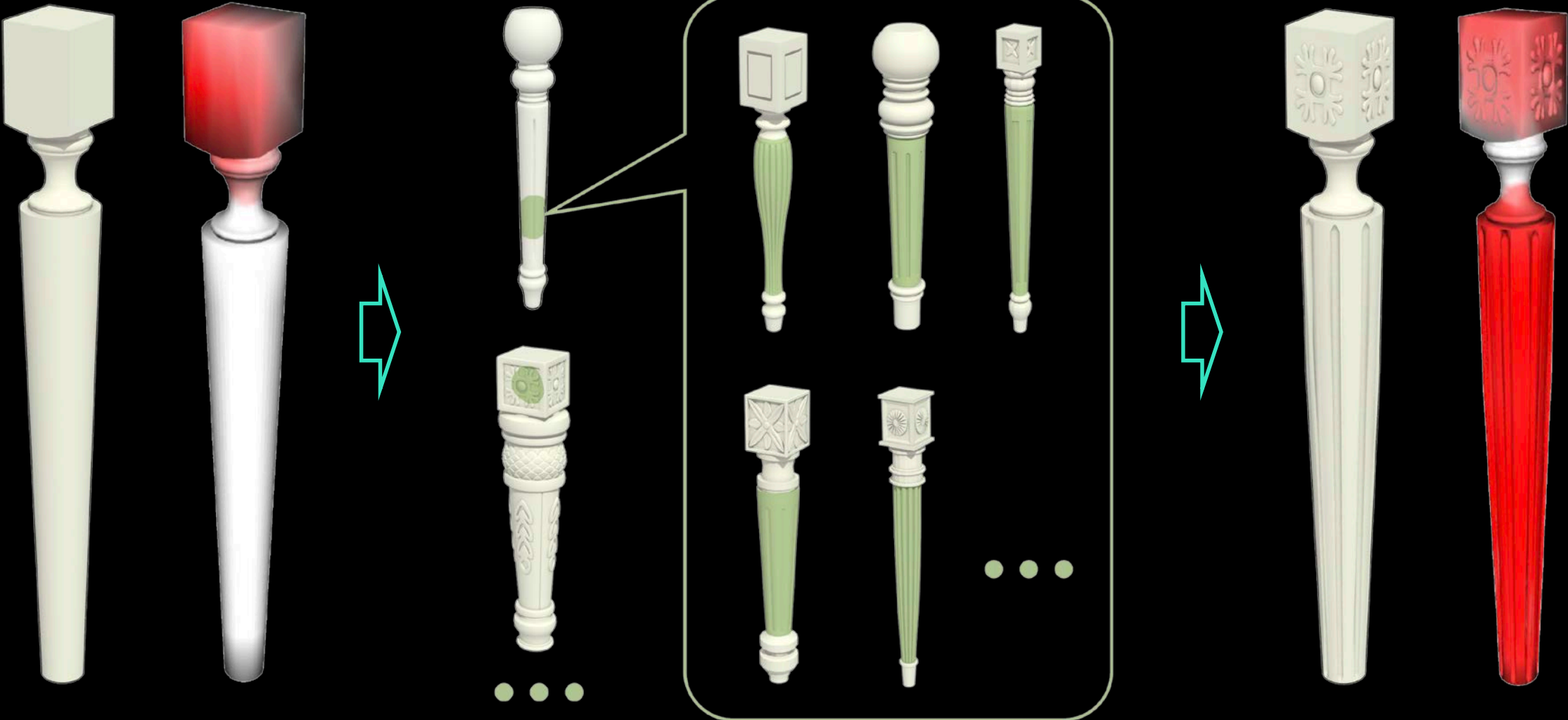


Style-revealing viewpoints



Saliency-based viewpoints

STYLE-DRIVEN MODELING



CONCLUSION

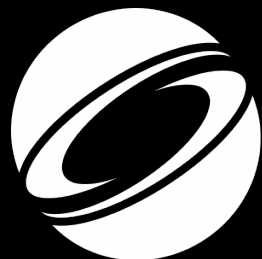


- **Localized** style-**defining** elements
 - Localized = concrete surface patches
 - Defining = discriminative + complete
- A novel **iterative** method based on **feature selection**
- **Style-aware** applications

LIMITATION AND FUTURE WORK



- Initial elements are **local** and **isotropic patches**
 - Anisotropic, structural, and more global
- The defining elements of a style are **not intrinsic** to the style, but are **defined relative to other styles**
 - Explore in an intrinsic manner and from a set of example shapes with a single style



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THANK YOU!

ACKNOWLEDGMENTS

Anonymous reviewers & funding from

*NSFC, 973 Program, Guangdong Science and
Technology Program, Shenzhen Innovation Program,
Natural Science Foundation of SZU, NSERC*
