Adaptive modularized constructions made in a flux

# Agent-based Methods for Farication-oriented Design of Adaptive Modular Prefab Concrete Construction

Prof. AA Dipl.(Hons) Achim Menges
Dipl.-Ing. David Stieler
University of Stuttgart, Institut for Computational Design and Construction ICD

SPP 2187

## Motivation

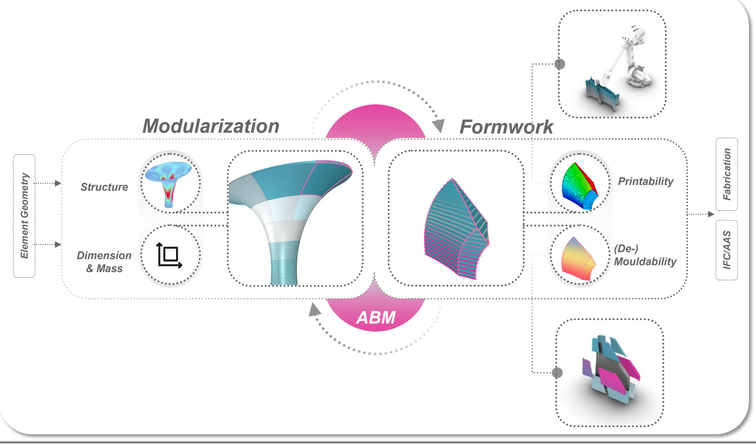
### The Concrete Paradox

- Cost of formwork dictates form of building elements
- More concrete used than necessary
- Suitable building typologies unaddressed due to formwork cost
- Additive formwork feasible method to make form economically and ecologically affordable

### Automated bespoke Planning

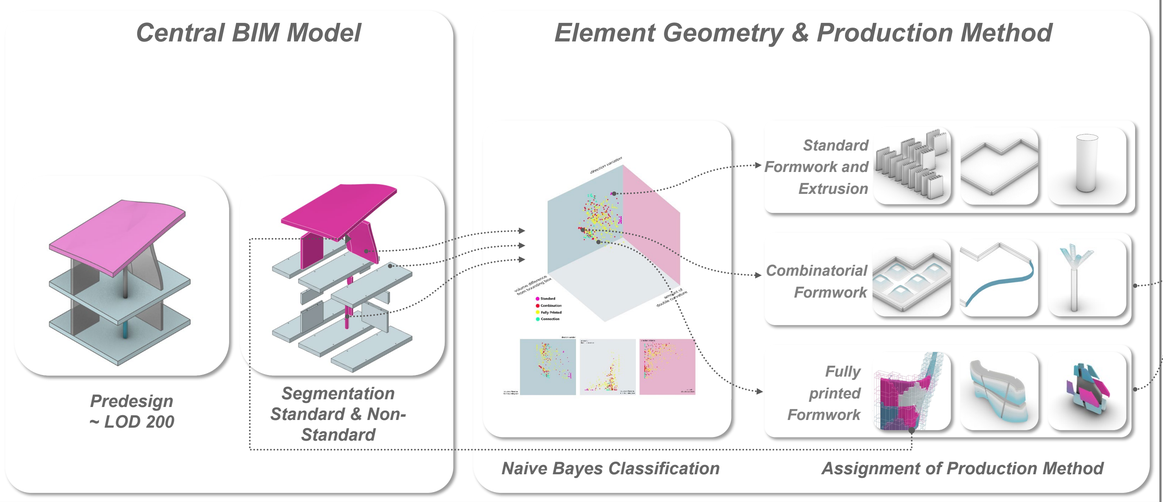
- Existing planning tools are tailored towards usage of standardized elements
- Additive formwork requires new planning tools
- Modularization and formwork planning offer potential to reduce production expenditures and material usage

### Consistent Feedback

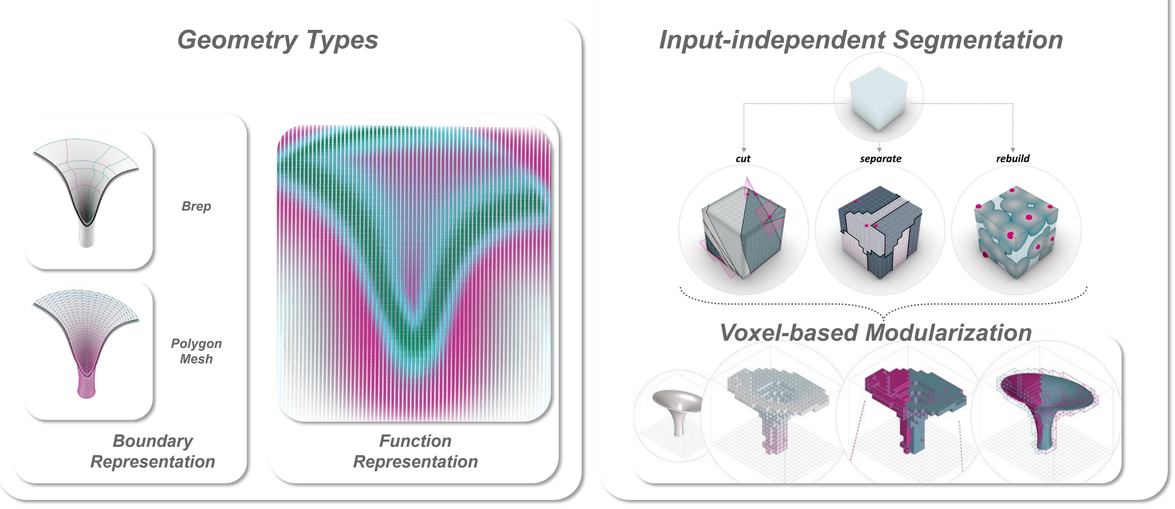



## Methods

### Planning Integration



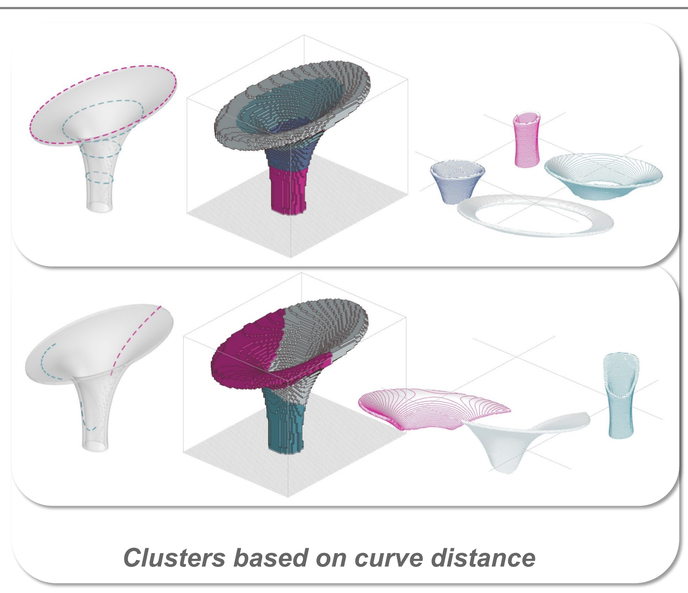

### Freeform Modularization



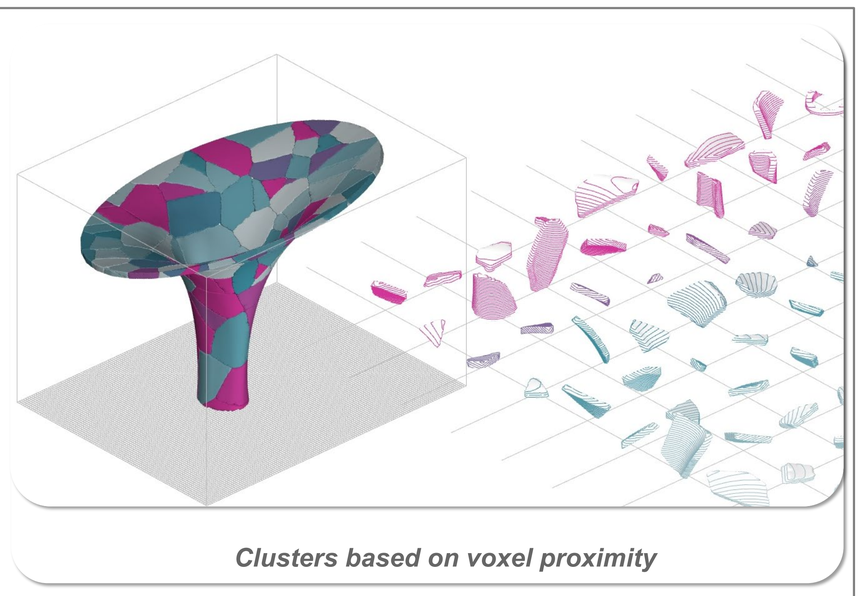

## Results

### Geometric Foundations

- Input independent
- From hollow CAD design to solid, watertight modules
- Foundation for formwork planning and production
- Voxel approach capable of forming any module geometry
- Multiple resolution steps allow integration of complex connections



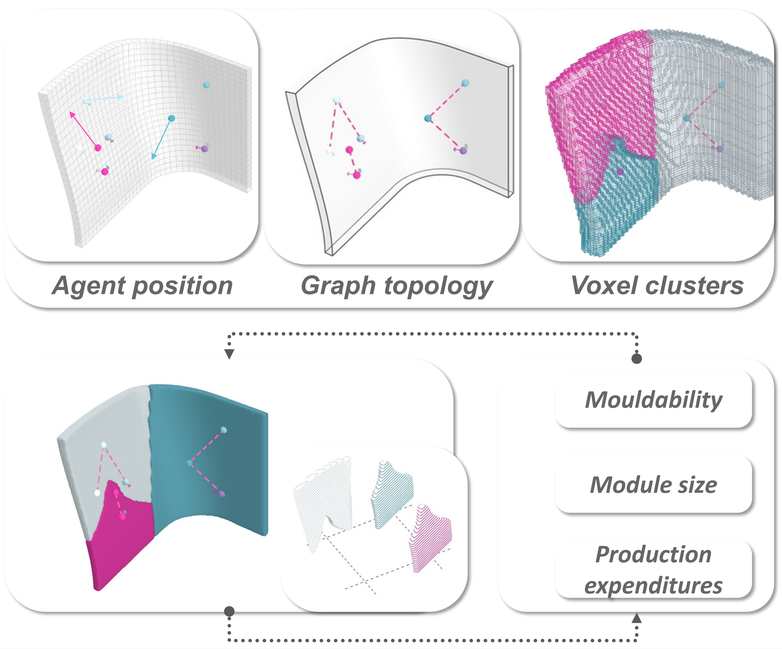
Clusters based on curve distance



Clusters based on voxel proximity

### Agent-based model & Outlook

- Establish feedback loop informed from:
  - Formwork planning
  - Printability
  - Print expenditures
  - Module size
- Interaction topology
- Physical prototypes
- Address connections & reinforcement




## Contact

University of Stuttgart
ICD Institute for Computational Design and Construction

Dipl.-Ing. David Stieler
david.stieler@icd.uni-stuttgart.de

www.icd.uni-stuttgart.de