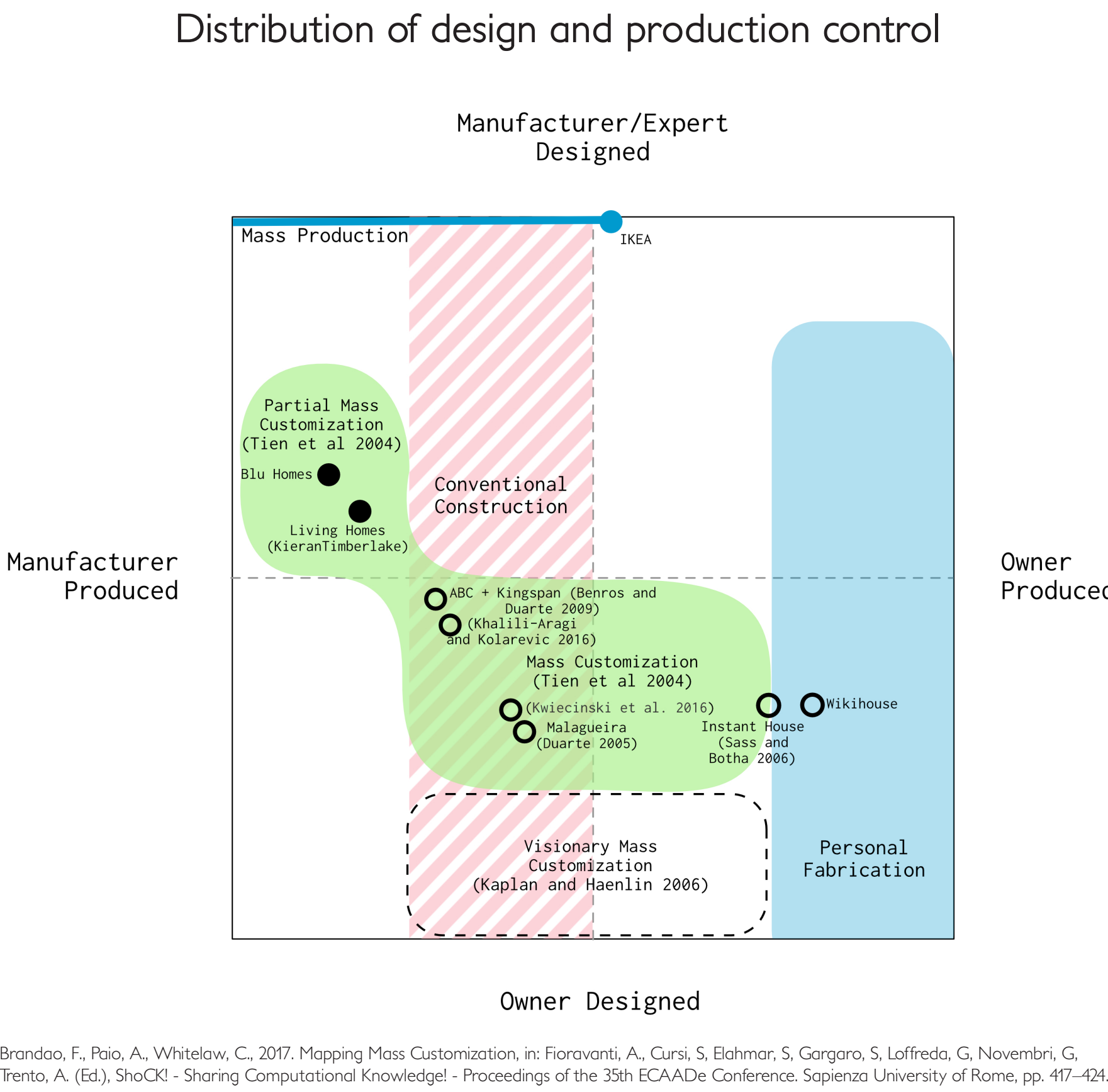
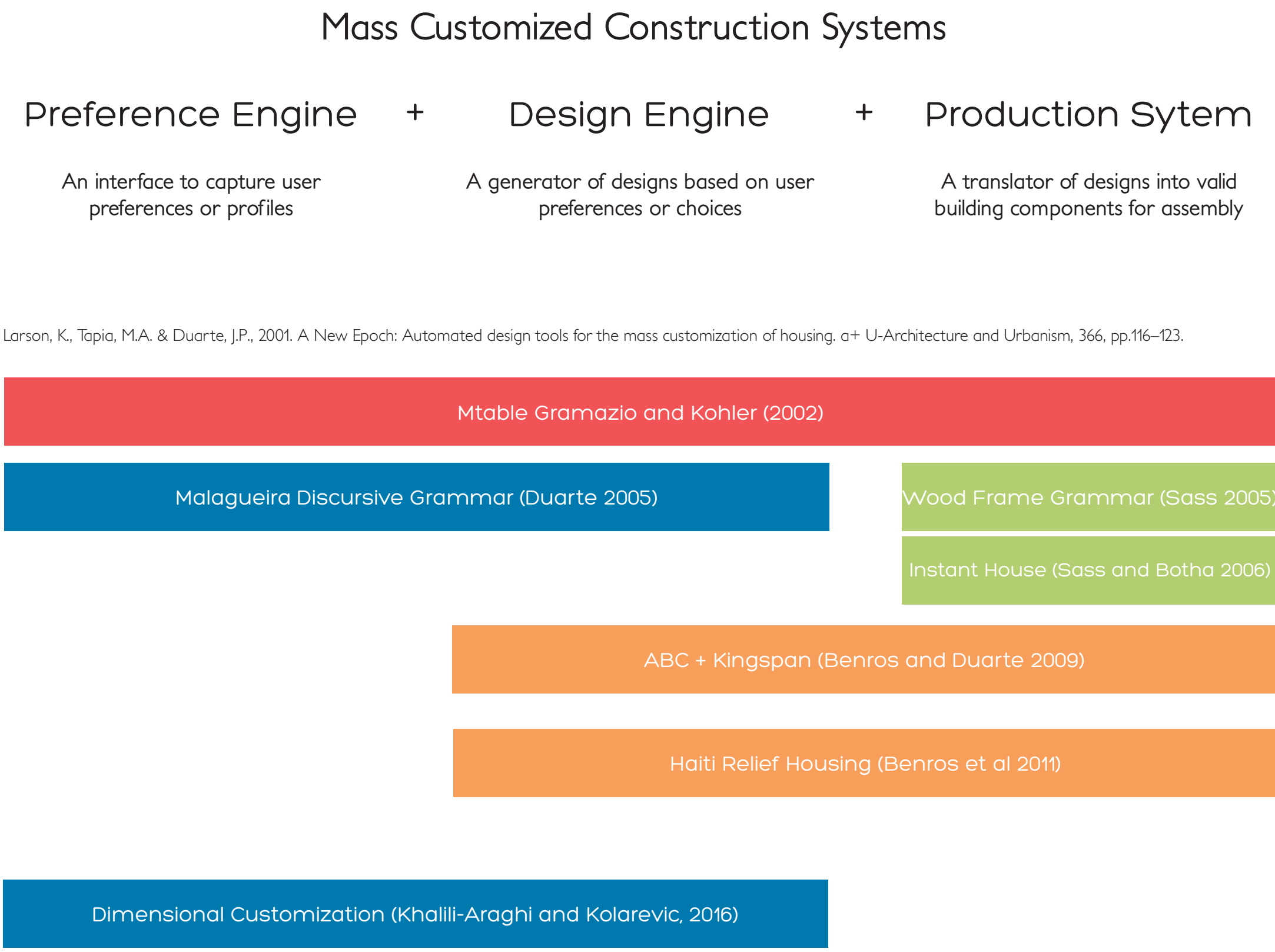


SUMMARY

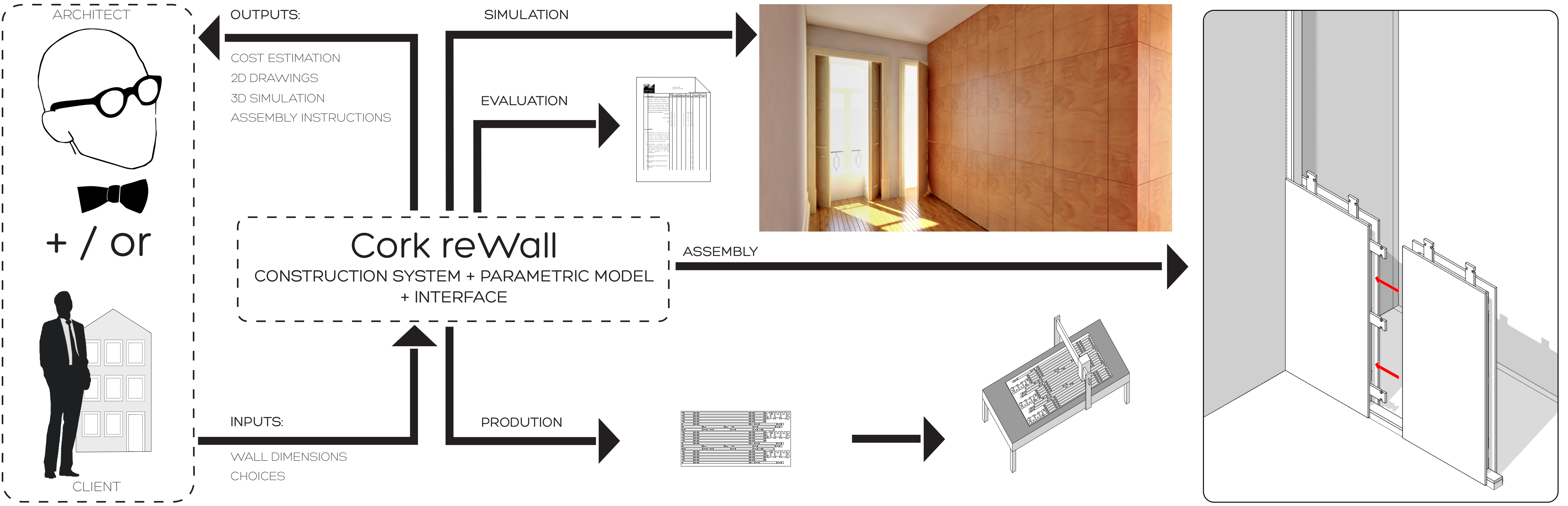
Developments in computational design methods and their integration with digital fabrication processes enable us to envisage a mass customized construction paradigm. Such is particularly suited to building renovation, a diversified corpus in which interventions are surgical and unique, and where partition walls are the most frequently replaced components. The main objective is to propose and implement a workflow to develop demountable and customizable construction systems of partition walls for the context of interior renovations and to evaluate the validity of the approach in its usability by architects and generic users. We foresee that the adoption of a file-to-factory process will present several advantages in this context: maximizing efficiency and speed of the construction process without reducing scope or increasing cost, contributing to a more sustainable construction process.



OBJECTIVE

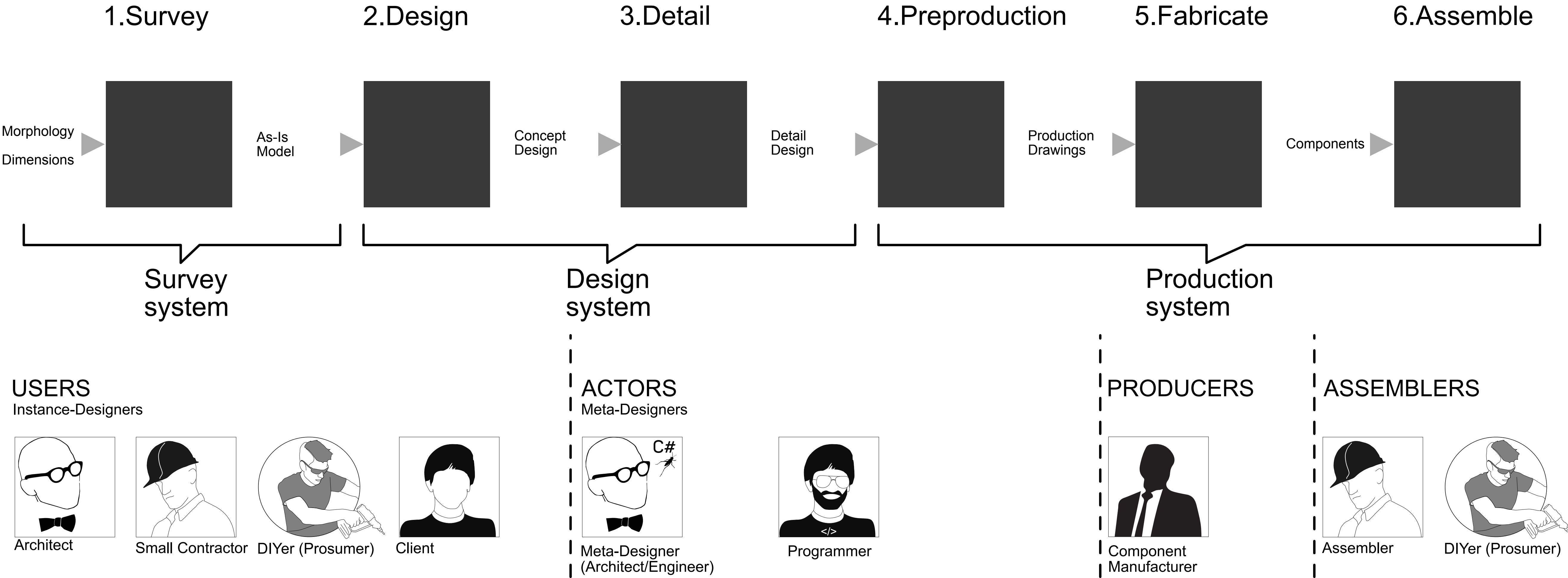
The main objective of the present research is to develop and implement a workflow for the development of demountable and customizable construction systems of partition walls for the context of the renovation of interior spaces by generic users. The workflow will be evaluated in its usability by meta-designers and instance designers. Furthermore, we seek to understand if our interactive algorithms of room survey and computational design tools, involving algorithms and design grammars, allow meta-designers to develop demountable and mass-customizable construction systems configurators that generic users can use to generate solutions for their contexts.

- To achieve our main goal we need to:
1. Integrate our interactive algorithms for room surveys and computational design tools with existing platforms for mass-customizable configurators.
  2. Generalize the principles of our partition wall design grammars and integrate them into components that meta-designers may use to develop their own construction systems.



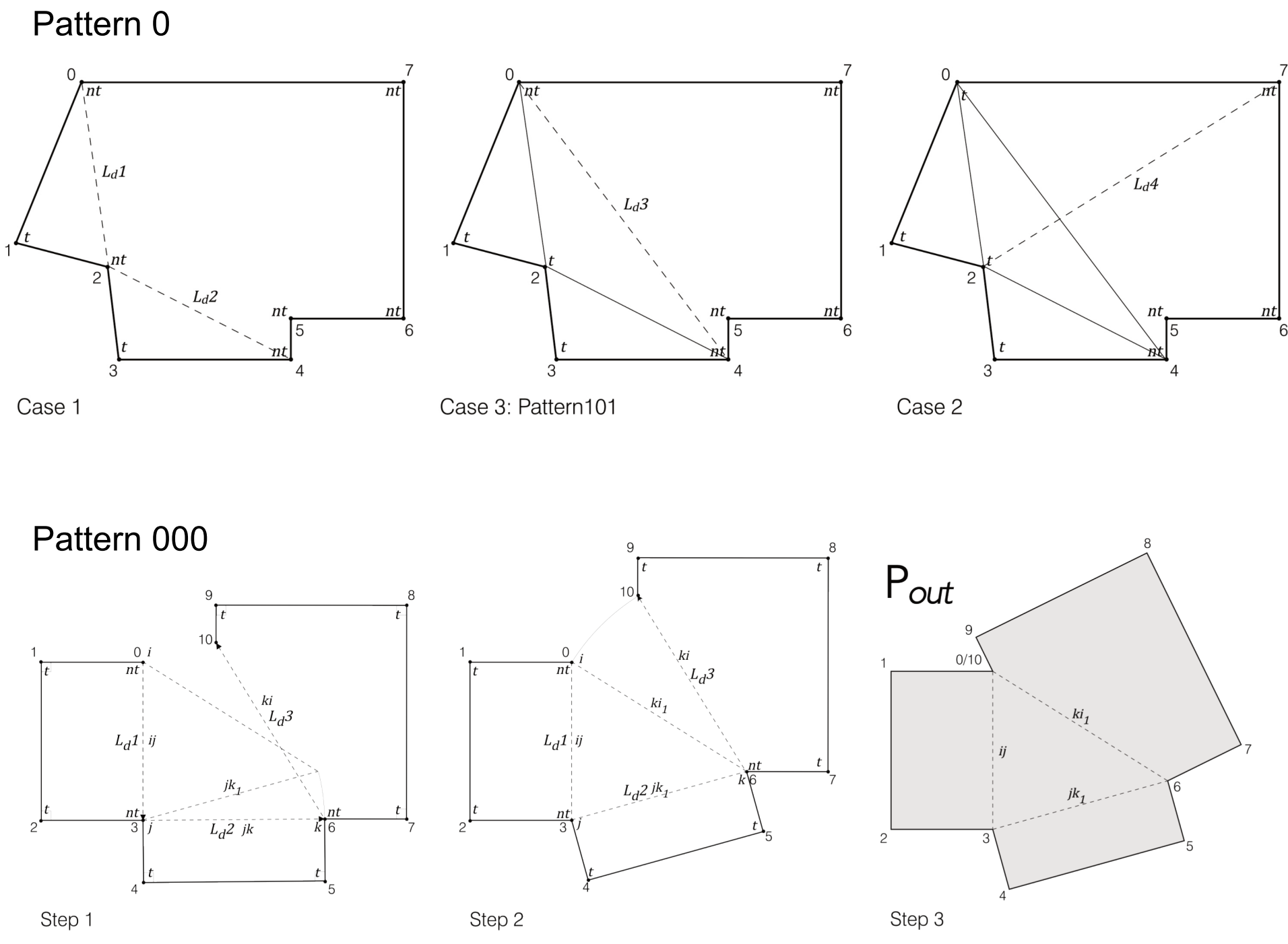
METHODOLOGY

Larson et al (2001) defined the basic anatomy of a mass-customization system in architecture has being composed of 3 sub-systems: a preference engine, a design engine and a production system. Yet, when this model is applied to the case of building renovation it quickly becomes evident that it does not take into account a fundamental aspect in the construction process - the collection of survey data. In our research we revise the model originally proposed by Larson to take into account the lack of consideration of the survey stage. Furthermore, we developed a low-key semi-automated survey system that allows generic users to survey their own spaces. This system generates a parametric model of the surveyed space that can be updated at anytime from the procurement to the construction process. We also argue that the prevailing view of mass-customization in architecture fails to take into account the open nature of the AEC industry, in which innovation is mostly socially driven (Habraken 2003). Thus, for a mass customized construction paradigm to come into effect it must recast the roles of all the stakeholders in the process. Consequently we propose a workflow that seeks to indicate how architects may extend their practices to develop design-to-fabrication systems for generic clients (instance-designers).

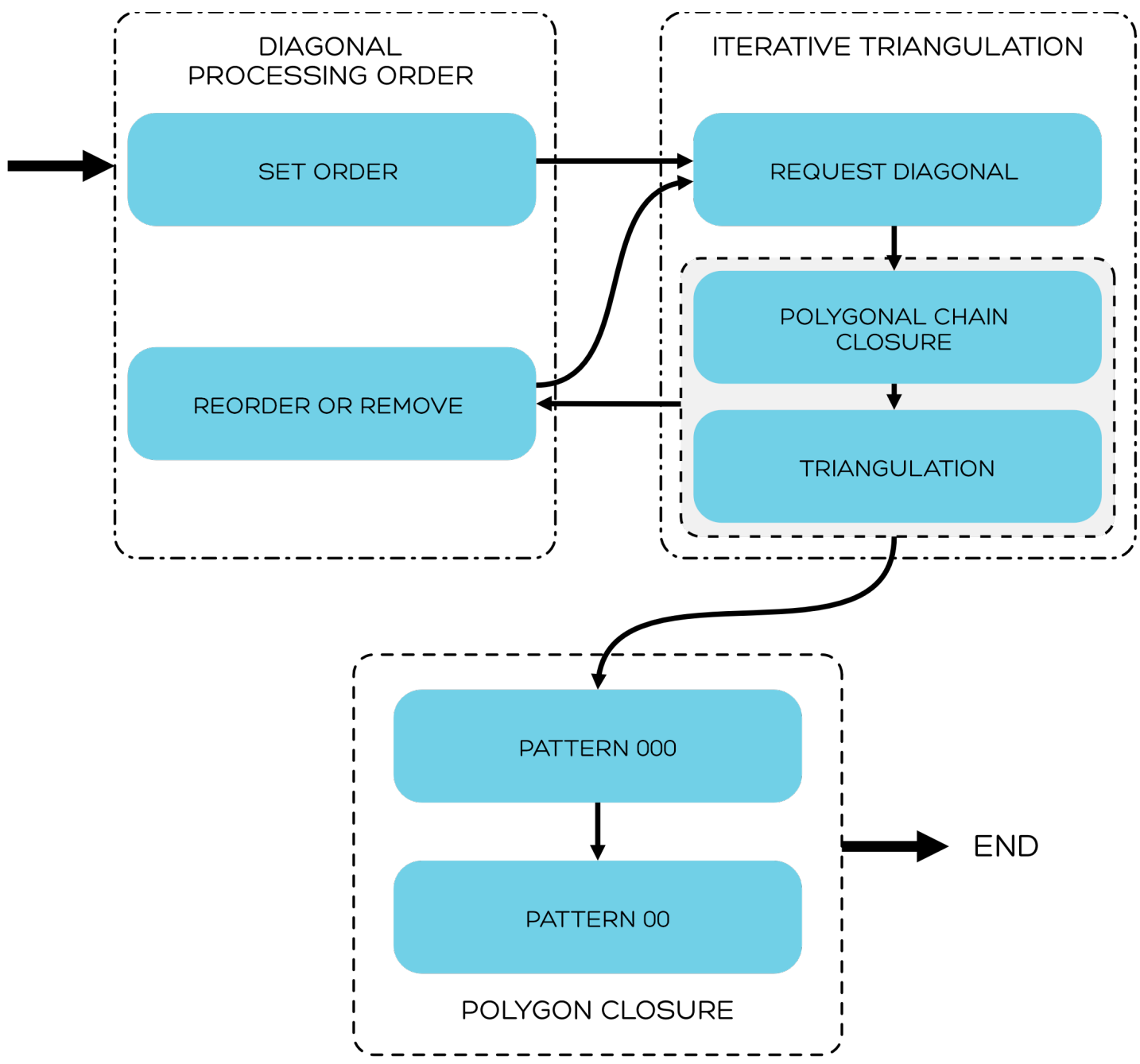


SURVEY SYSTEM

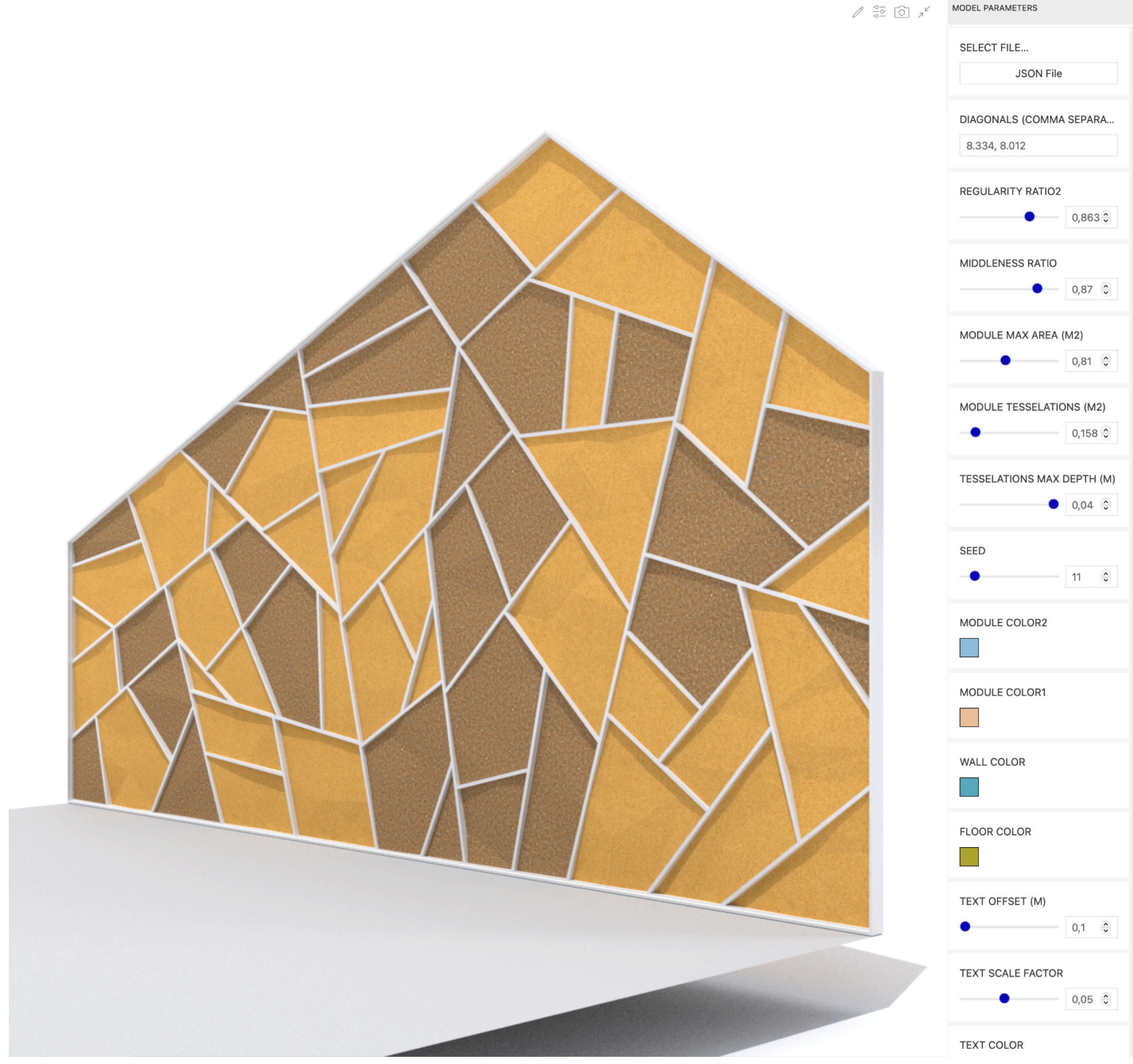
Precisely capturing context is a fundamental first step in dealing with built environments. Previous research has demonstrated that existing methods for generating as-is floor plans of non-orthogonal rooms by non-expert users do not produce geometrically accurate results. We investigated empirical triangulation methods, traditionally used by architects and other building professionals in surveying building interiors, and found a set of patterns that are consistently used. We implemented these patterns into algorithms that may be used to iteratively triangulate polygons: Pattern 0, Pattern 00 and Pattern 000. These algorithms were then used to develop an interactive algorithm to implement a low-key semi-automated workflow of room survey. In this process we tested several possible heuristics to reduce the number of requested diagonals. RoomSurveyor implements the above interactive triangulation algorithm to assist users in surveying interior spaces by automating drawing of the space plan. It is a plugin for Grasshopper visual programming environment and can be used to implement configurators for building renovation.



General Algorithmic Workflow



Example Web Configurator



Silva Brandão, Filipe Jorge da, Alexandra Paio, e Adriano Lopes. «Triangulation Algorithms for Generating As-Is Floor Plans». Nexus Network Journal 22, n. 2 (2 de Junho de 2020). <https://doi.org/10.1007/s00004-020-00491-3>.

Brandão, Filipe, Alexandra Paio, e Adriano Lopes. «Interactive Algorithm for Generating Accurate As-Built Plans by Building Owners». Em Proceedings of the 37th ECAADe and 23rd SIGraDi Conference, 2:69–78. Porto: University of Porto, 2019. [http://papers.cimn.coad.org/cgi-bin/work/paper/ecaadesignad/2019\\_473](http://papers.cimn.coad.org/cgi-bin/work/paper/ecaadesignad/2019_473).

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