# MEng Innovation by Design
# 2019/2020 Ideate-Prototype-Realize

SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN


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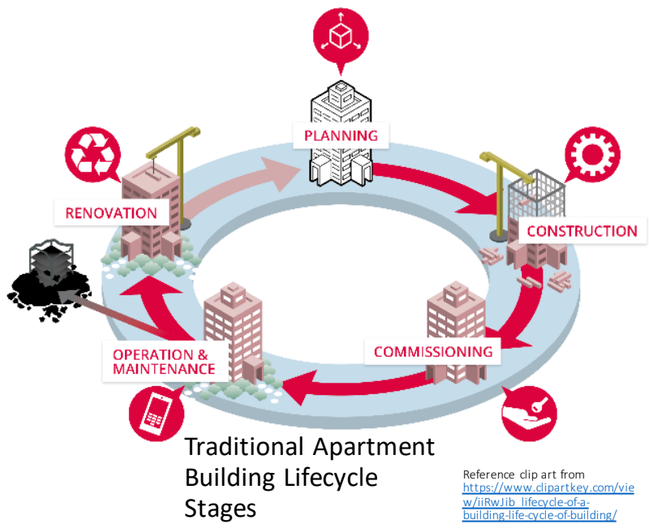
## Mass Customized Urban Residential High-Rise Strategy for Social Cohesion

Aim/Purpose : To help Users be involved in the process and realization of their ideal home environment through the collection of data and customization strategies in the realms of community, sharing and personal preferences while keeping it economical.
This design research is applicable as a guide to develop the computational tools and used for generation of urban high-rise type residential developments. The research investigates and explores different types of modeling systems that enable the generation of massing proposals and fomulates and formalizes the requirements needed for these




Traditional Apartment Building Lifecycle Stages

Reference clip art from https://www.clipartkey.com/view/iiRwJib_lifecycle-of-a-building-life-cycle-of-building/

## Why - Opportunity

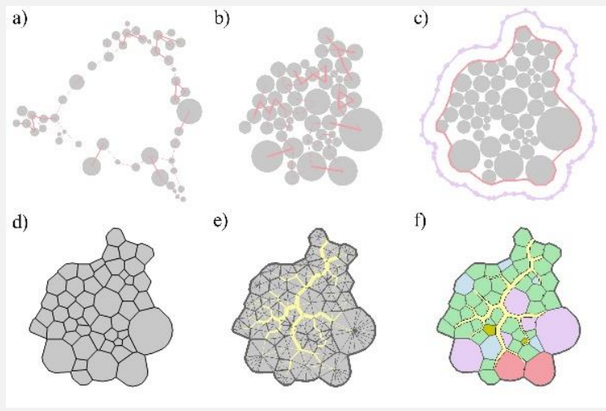
With the development and advancement of computational design and modeling tools. It is possible to do more using current systems and technologies. Current processes of building and apartment design and construction are outdated.
I want to explore the possibilities of customizing each unit in an apartment development for their users/residents.

## How – Research and Evaluation

- Finding the properties and parameters in an apartment building development most crucial to the parties involved.
- Analyzing those properties and gathering relevant data from potential end users and owners.
- Testing out different methods of optimization/ generation of solutions. To find the optimal method.
- Gathering feedback from industry professionals and end users to gain insight and further development of system.

Modular Units

Urban Village Project
https://www.urbanvillageproject.com/




Computational Parametric Modelling

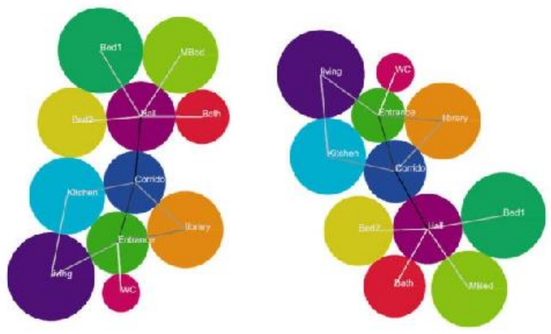
Joel Simon – evolving floorplans
Evolving Floorplans – 2017

AI & GANs Generative Models

*Stanislas Chaillou, Harvard Graduate School of Design | Feb 26th, 2019*

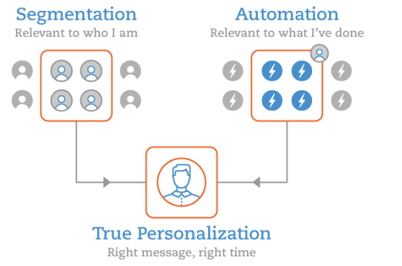
Performance Analysis

Autodesk office
https://autodesk.typpad.com/bimtoolbox/2017/06/generative-design-applied-on-buildings.html




Physics Based Spatial Planning

Physics based spatial planning
https://www.urbanvillageproject.com/




Combined approach of Segmentation and Personalization

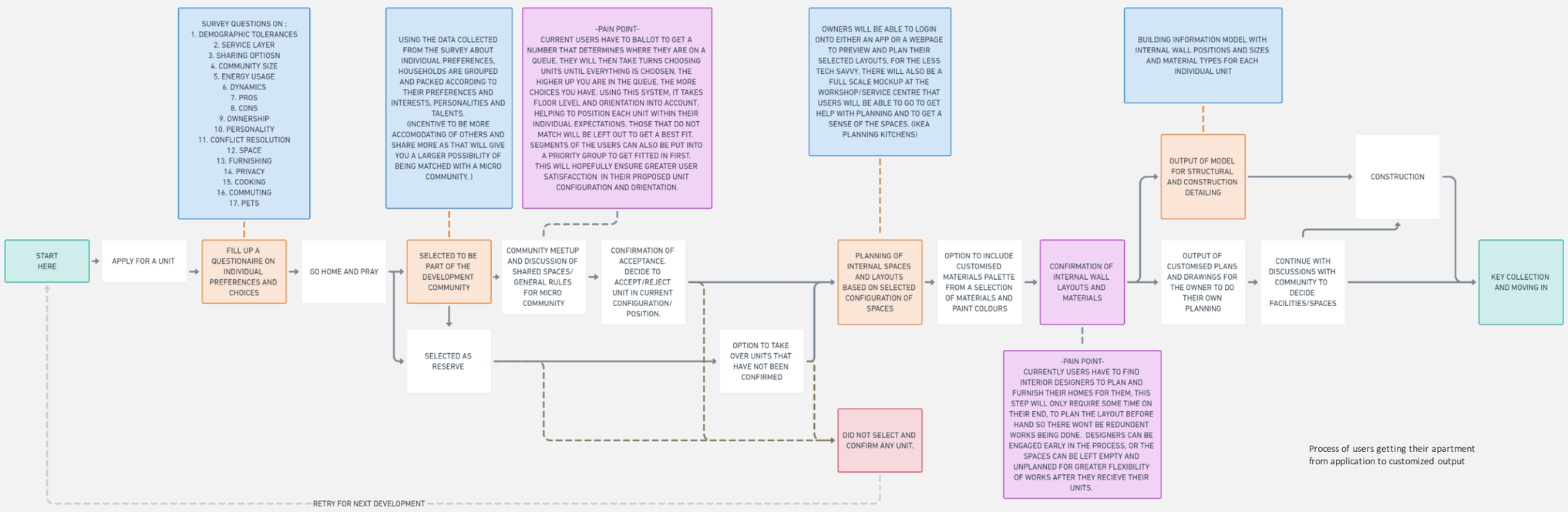
True Personalization
https://dsvmpwx9v65l5.cloudfront.net/imager/dsvmpwx9v65l5_cloudfront_net/assets/blog/blog_gen_z_and_personalization_graphic_V2_c769d5d879c03cf167ff2b93bdd28e8d.png

## What – Proposed Solution

- Proposed solution is a system comprising of 4 different Phases.
- First phase will be Data collection, collection of relevant data and information on the users, and the site.
- The second phase analyses the collected information and translates the information into physical and positional data to be input into the computational model.
- The third phase is the generation of the solution/s based on the balanced data from phase 2.
- the fourth phase evaluates the performance of the design based on the initial parameters. Collected data from the evaluation are fed back into the generation of the solution.
- Phases 3 and 4 are repeated until a satisfactory model is achieved.

## System Operations –

- 1. In the first step the potential user's data is collected and input together with information of the site and the housing development.
- 2. The second step selection process analyses the collected information and thru a combination of micro segmentation and personalization, includes and groups users into "micro communities".
- 3. After the selection, the third step is the confirmation of the unit that was demarcated for the user. Followed by the planning of the internal spaces with different levels of personalization.
- 4. The fourth step consists of the generation of the complete model packaged together with the relevant data for the engineers and builders to be developed and used for construction planning and prefabrication.




Process of users getting their apartment from application to customized output

The architectural discipline has been experiencing a lot of changes to the way in which its professionals engage in design. The perpetual progression of computing hardware and the significant advancement of Computer Aided Architectural Design (CAAD) has seen Architecture evolve from a practice of principally analogue techniques to one that relies practically exclusively on the digital medium. As a result, the tasks of the architect has seen substantial transformation. Architecture, once a discipline of pencil and paper, now shares creative approaches and applications with Computer Science, Interactive Media, Robotics, and Computer programming. These modern partners provide alternative views and methods of what it is to be a creative professional, questioning the practice of architecture to step beyond the preconceived boundaries and means of operating embodied within conventional practice. Architects can now adapt new approaches for the construction of the built environment.

This research explores developing computational techniques and explores how they can be utilized to augment the way in which urban high-rise developments and buildings may be designed with a focus on highly customized proposals converging around social issues and strategies. This research also adopts the use of a computational design software called Wallacei - an industry developed generative software used to develop and spawn solutions after analysis and scoring. Through an architectural lens, it explores the social aspects of cohesion, developing an understanding for these and how these aspects are converted into different fitness values for the program to optimize solutional generation.

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jtc Breaking New Ground

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