KIT-OF-PARTS (KoP) DESIGN FOR ARCHITECTURE CO-CREATION GAMES

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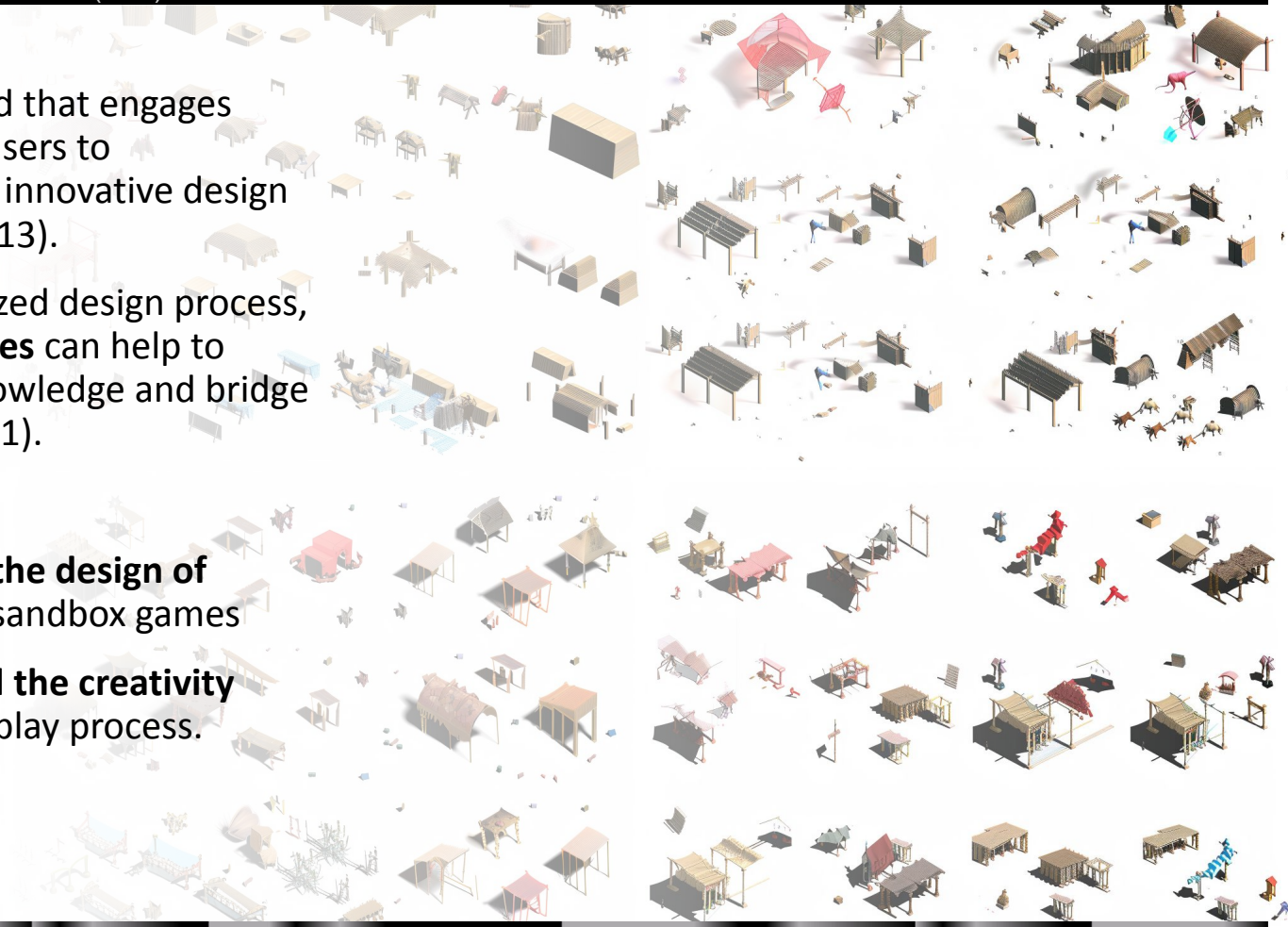
Co-creation is a method that engages stakeholders and end-users to cooperatively generate innovative design ideas (Ind & Coates, 2013).

In an increasingly digitized design process, **video game technologies** can help to democratise design knowledge and bridge skills gap (Sanchez, 2021).

This study aims to:

1. Experiment with **the design of building parts** in sandbox games
2. Try to **understand the creativity generated** in the play process.



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WHY PLAY: *combinatorial creativity*

- ‘Play’ is a participatory and experiential form of learning (Abt, 1978).
- helps to drive creativity to enhance co-created design solutions.
- Creativity can be ***combinatorial***, exploratory, and transformational (Boden, 2009)
- In sandbox games, players combine ready-made pieces (aka ***kit-of-parts***) to generate new creations
- This produces ***unfamiliar combinations of familiar ideas*** - a form of combinatorial creativity.

c. Juicy Salif
(*The inspiration-driven approach*)

Han, J., et al. (2017). Three driven approaches to combinational creativity. In DS 87-8 Proceedings of the 21st International Conference on Engineering Design (ICED 17)

SANDBOX VIDEO GAMES

- games without predetermined goals, allowing a greater degree of freedom and creativity.
- user co-created game contents had been around for at least two decades, e.g. Second Life as a virtual open world simulator (Gordon & Koo, 2008).
- However, it required significant amount of skills to 3D model and customise virtual objects.
- Today, games like Minecraft is much more accessible and user-friendly (UN-habitat, 2016).

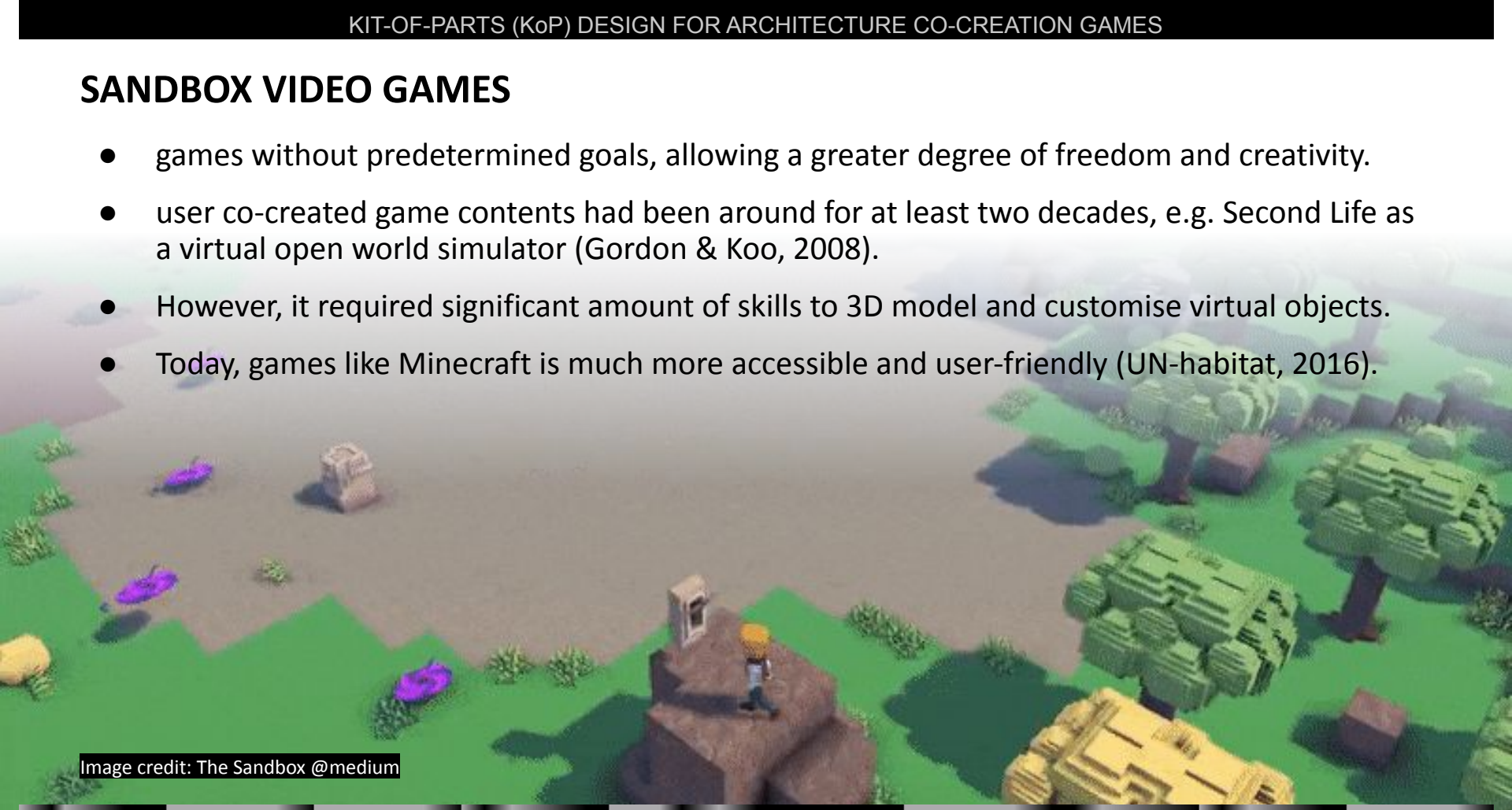

Image credit: The Sandbox @medium

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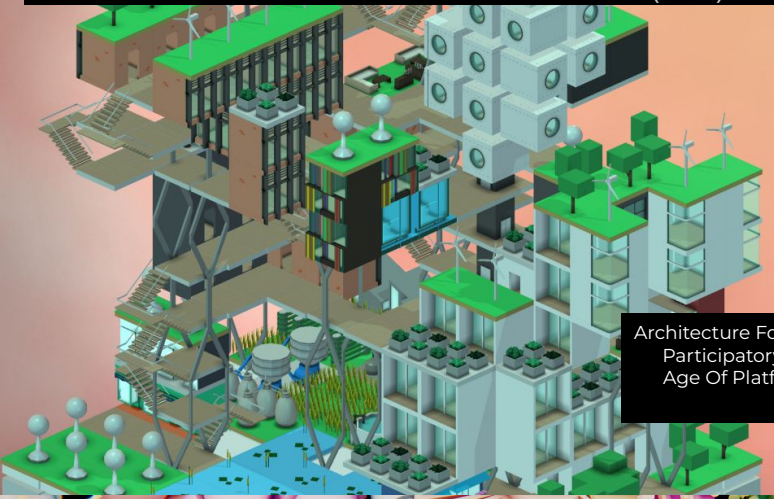
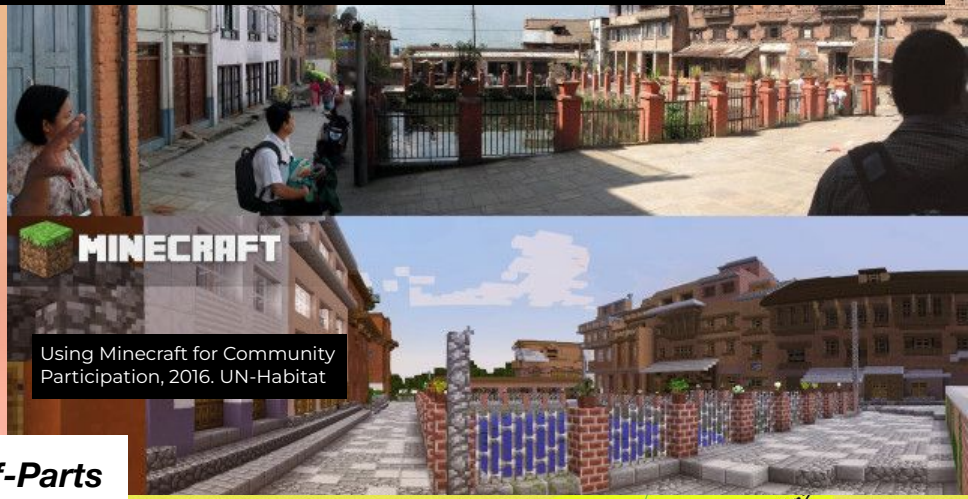


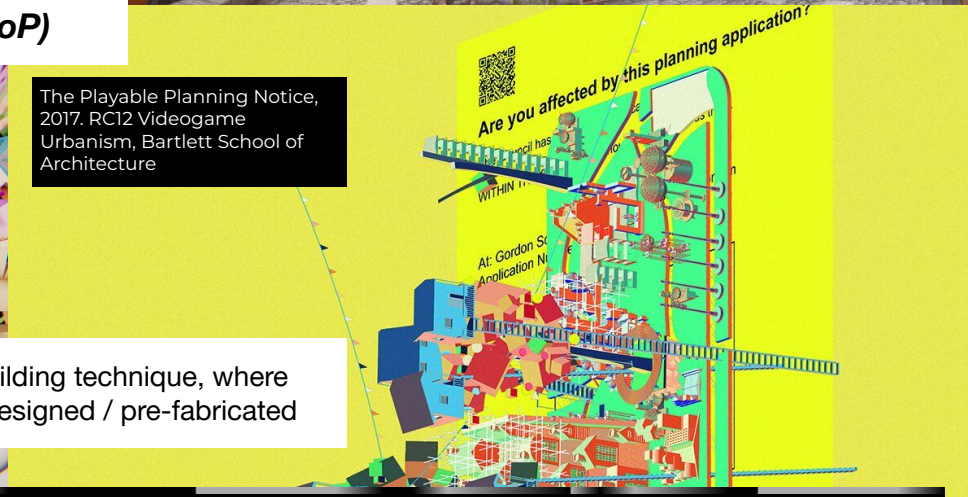
Architecture For The Commons Participatory Systems In The Age Of Platforms, 2020. Jose Sanchez,



Using Minecraft for Community Participation, 2016. UN-Habitat

Kit-of-Parts (KoP)

Platform Sandbox v.3, 2017. Damjan Jovanovic



The Playable Planning Notice, 2017. RC12 Videogame Urbanism, Bartlett School of Architecture

An object-oriented building technique, where components are pre-designed / pre-fabricated

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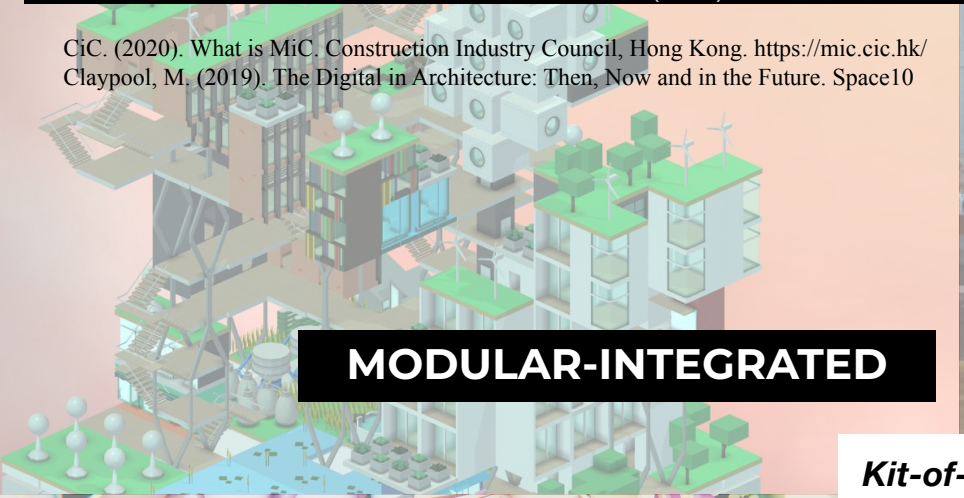
CiC. (2020). What is MiC. Construction Industry Council, Hong Kong. https://mic.cic.hk/
Claypool, M. (2019). The Digital in Architecture: Then, Now and in the Future. Space10



MODULAR-INTEGRATED

DISCRETE

Kit-of-Parts (KoP)

MODULAR

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the in-between spaces from the **stacking method** performed regularities, the parts simultaneously constrain and enable the **spatial arrangements**

MODULAR-INTEGRATED

DISCRETE

Self-similar parts abstract from a real-world understanding

Kit-of-Parts (KoP)

MODULAR

allowing greater degree of freedom in the **activity scenario**

with respect to the **granularity** of parts, too many to choose from can be overwhelming, too little can restrict the **technical possibility**

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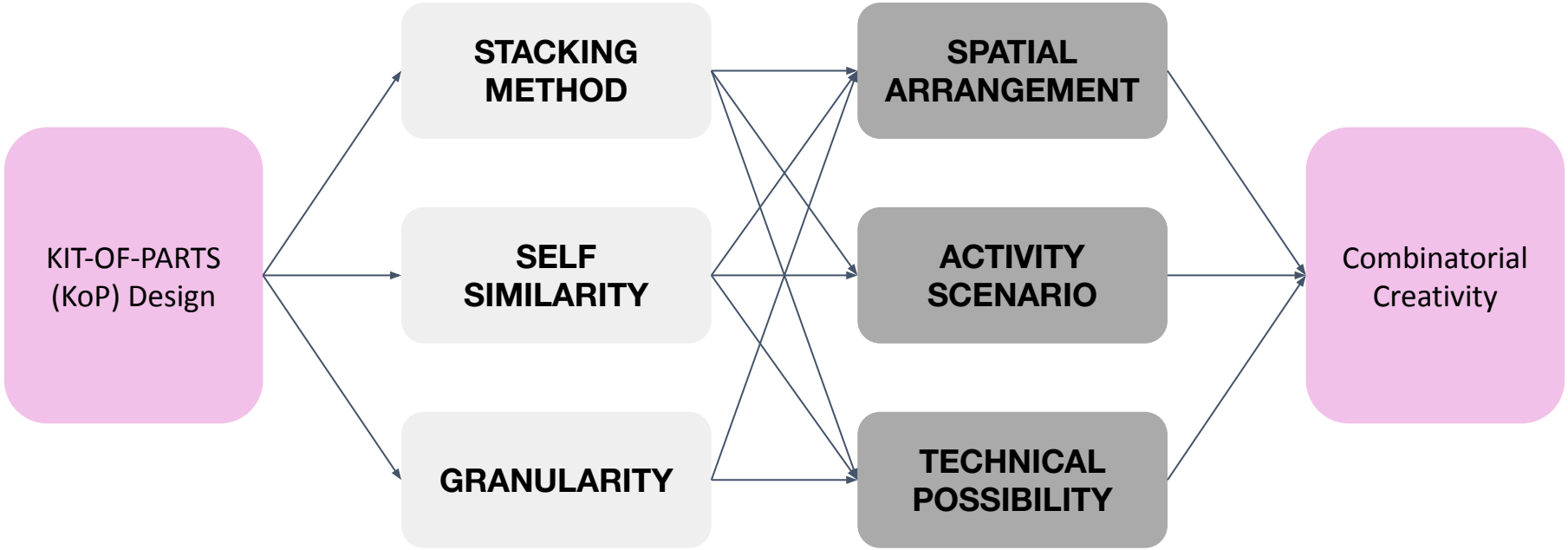

KOP-CREATIVITY RELATIONSHIP MAPPING

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KIT-OF-PARTS (KoP) Design

Research Questions

to understanding the relationship between KoP and creativity:

- How are technical possibilities, spatial arrangement, and activity scenario affected by parts design ?

Combinatorial Creativity

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Research Method

Through participatory action research, the study engages residents of public housing in Hong Kong:

1) To understand their **preferences of community activities** through focus-groups. Based on thematic analysis results,
2) To consolidate **an integrated spectrum of KoP design** from the precedent and literature reviews
3) To **design** KoP systems and **test** in a custom sandbox game with designers and residents
4) To study the **combinatorial creativity** generated in the process.

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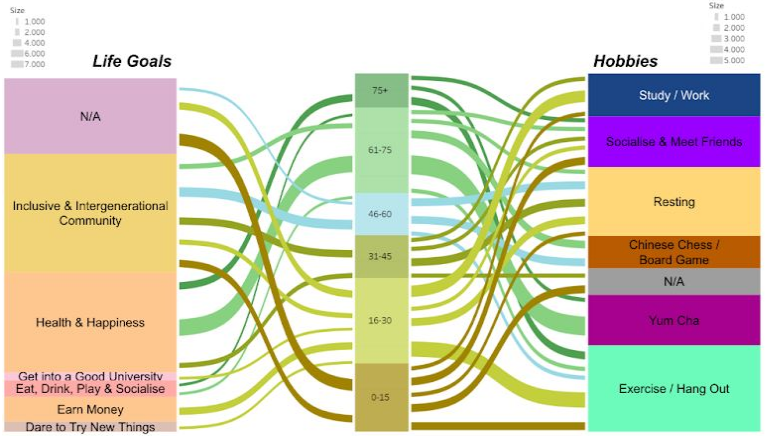
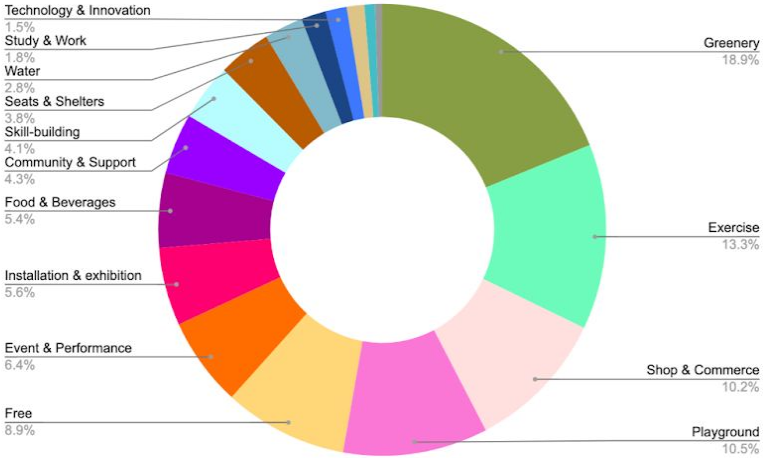
OBJECTIVES 1

To understand their preferences of community activities through focus-groups. Based on thematic analysis results:





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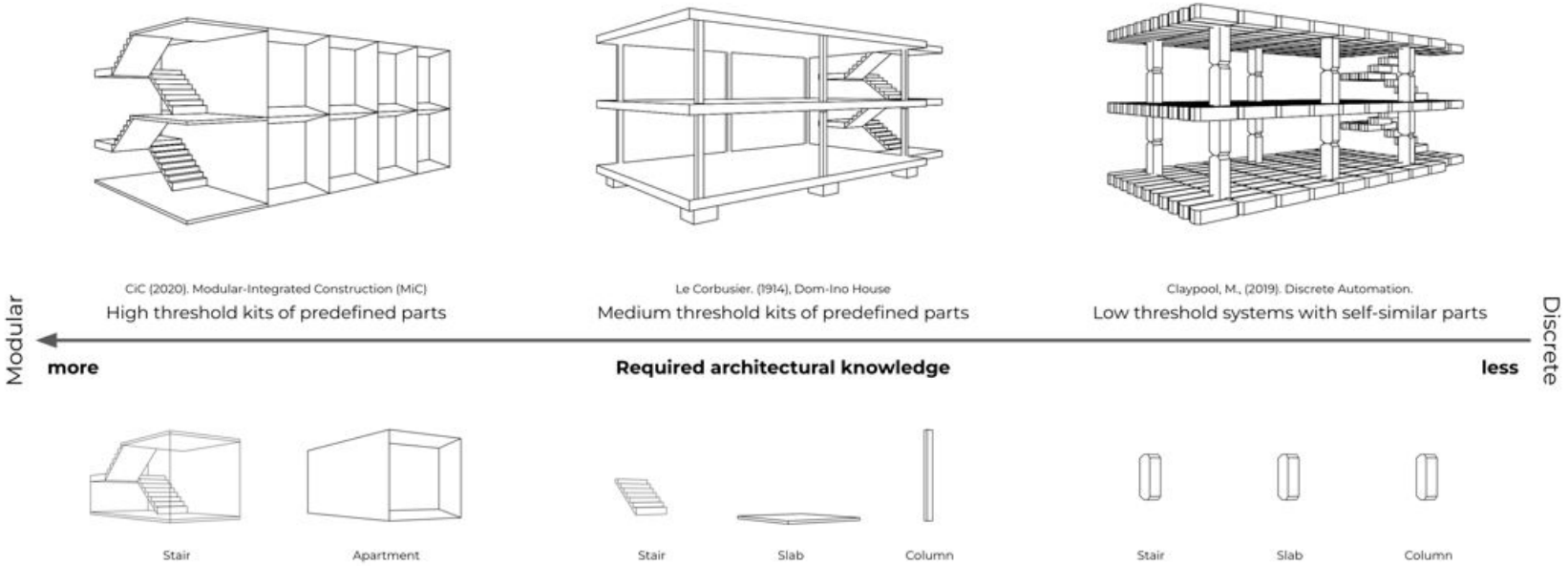
OBJECTIVES 2

To consolidate an integrated spectrum of parts design from the precedent and literature reviews



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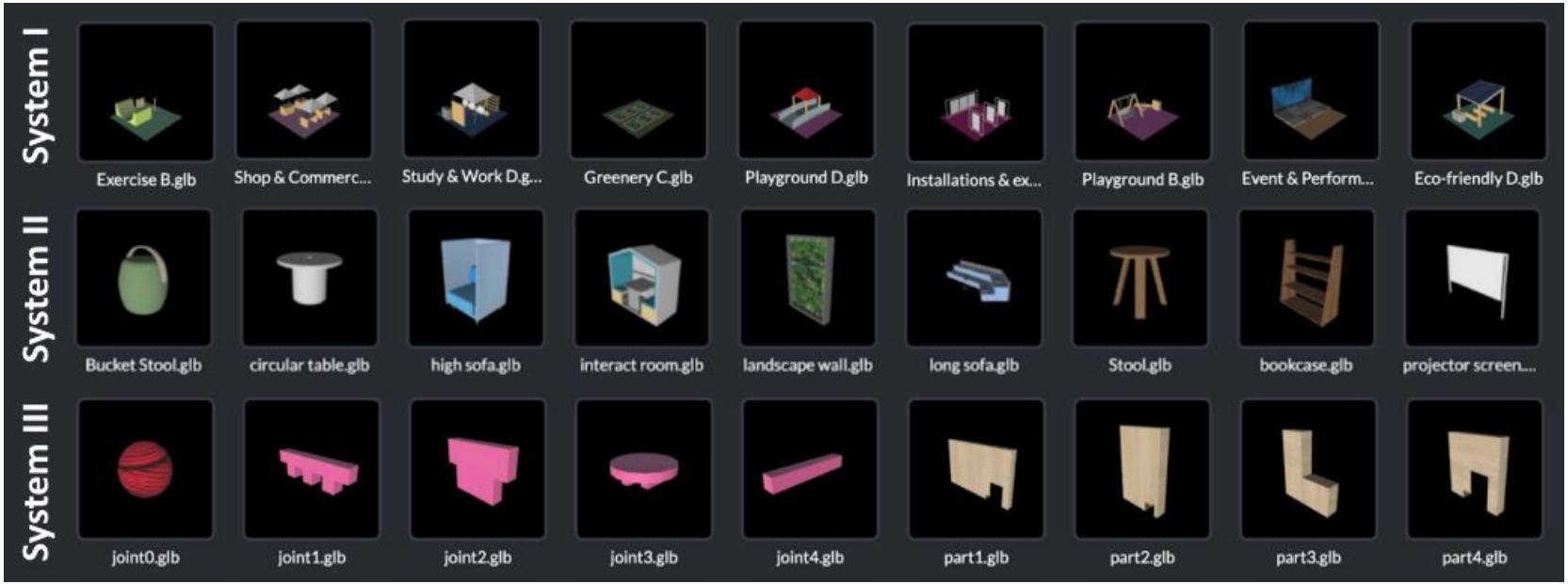
OBJECTIVES 3

To design KoP systems and test in a custom sandbox game with designers and residents



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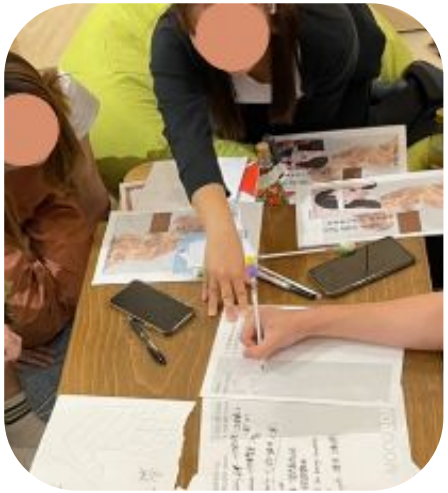
OBJECTIVES 4

To study the combinatorial creativity generated in the process.



Four workshops were held, each using a different KoP system. Different participants were involved in each game, but in general, six participants.

First, participants uses a 2D map and guiding worksheets to plan facility allocation. Then, they used the sandbox game to prototype scenarios.

Finally, participants review their public space design in VR and finetune parts arrangement.

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PRELIMINARY RESULTS

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Game I - **MODULAR INTEGRATED SYSTEM**

- As each module represented 5% of land area, creative process became a game of numbers.
- Despite the design's coherence in the initial stage, it did not fully meet the surveyed user needs, prompting a shift towards fulfilling the need indicators within limited space.
- In Round 2, lobbying efforts led to minor changes as players negotiated for equilibrium.
- However, all parties preferred maintaining the status quo to avoid unpredictable actions from others, fearing a less desirable outcome.
- This fear significantly hindered the creative process, prompting reflection on planning practices in high-density contexts with limited spatial resources and diverse interests - planners often opt for "safe choices" to avoid unfavourable outcomes.

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Game II - **MODULAR SYSTEM**

- The outcome showed participants were more conscious of the **density** between objects and their **orientation**.
- With the modules no longer integrated, the negotiation shifted to determining **how and where** to place the selected facilities as a team.
- This sparked discussions on the types of arrangements that could support **community-building activities**,
- Leading to the development of **activity scenarios** with vibrant colours and a mobile library

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Game III - **DISCRETE SYSTEM**

- Participants were **confused at start** with how to use the parts; after periods of **trial-and-error,** they began to develop an understanding of how to form **open / enclosed space** by arranging elements
- the **abstract** and **granular** character of the parts, provided **freedom** to manipulate, arrange and play. This enabled different technical possibilities, **from stacking and interlocking, to parallel and diagonal orientation to configure a sense of space**.
- Participants were able to **split the design tasks** and work in parallel for efficiency, nevertheless, there **preserved a sense of visual coherence** when their individual work comes together.

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Game III - **DISCRETE SYSTEM**

However, it was challenging to kick-start the design process:

- participants had to be shown with some reference images and examples of **formal guidance** (e.g. a step-by-step playbook).
- Also, the outcome began to **exhibit repetitive visual similarities** as the game progressed, partly affected by the guidance.

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Game IV - **MIXED SYSTEM (MODULAR + DISCRETE)**

- Participants first used discrete parts to set apart different areas, resembling a **figure-ground exercise**;
- then, replaced some of the elements with modular parts to give **variation of spatial quality**, accentuating the social areas.
- However, as imagination took off, there were parts, like the tensile structure that spanned across the entire courtyard, that **participants wanted but were not in the kit**. As a result:
    - designers had to 3D model those parts
    - Open-source platforms were also used to search for proxies that can help demonstrate the idea.

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FINDINGS & DISCUSSIONS

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1. KoP & Combinatorial Creativity

In KoP design, the various granularities, stacking methods, and self-similarity offer advantages like precise adjustments, intricate compositions, and visual appeal:

- The levels of **granularity** influenced **technical possibilities**, including the level of design detail, participant effort, and customization options.
- **Stacking methods** affected largely the **spatial arrangement**, especially the figure-ground relationships and parts orientation.
- **Self-similar** parts make it easy to identify patterns and assemble complex **activity scenario** designs - the absence of predefined functions encouraged creativity, experimentation and a sense of discovery, enabling and encouraging users to explore different **combinatorial** configurations.

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2. MODULAR OR DISCRETE?

- **Modular-integrated** systems are best suited for spatial planning exercise and to simulate potential managerial decision making outcomes.
- **Modular** systems required architectural understanding and provided specific spatial functions, while
- **Discrete** systems allowed intricate compositions and fostered creativity.
- However, both systems require careful consideration to avoid generic outcomes and maintain a balance between guided variety and design abstraction.
- A **mixed** system allowed greater flexibility, but limitations can include overwhelming options based on the number of parts, and a constraint on the scale threshold based on gameplay complexity.

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Post-processed Game IV co-creation results, where vegetation, people, and other background details were added to visualise and approximate the implementation of the design

Connect & Collab!

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