RAE2026

Volumetric Behaviour Analysis of Hong Kong Public Housing Flats: Space, Behaviour and Design

Dr ir Gerhard Bruyns

SD PolyU

07.2025

Contents

1	Descriptor	03
2	Researcher profile	06
3	Research questions	07
4	Research output	10
5	Research field and key references	17
6	Research methods, prototypes and materials	30
7	Research outcomes, findings and further research	49
8	Research dissemination	55
9	References	58

Volumetric Behaviour Analysis (VBA) of Hong Kong Public Housing Flats: Space, Behaviour and Design

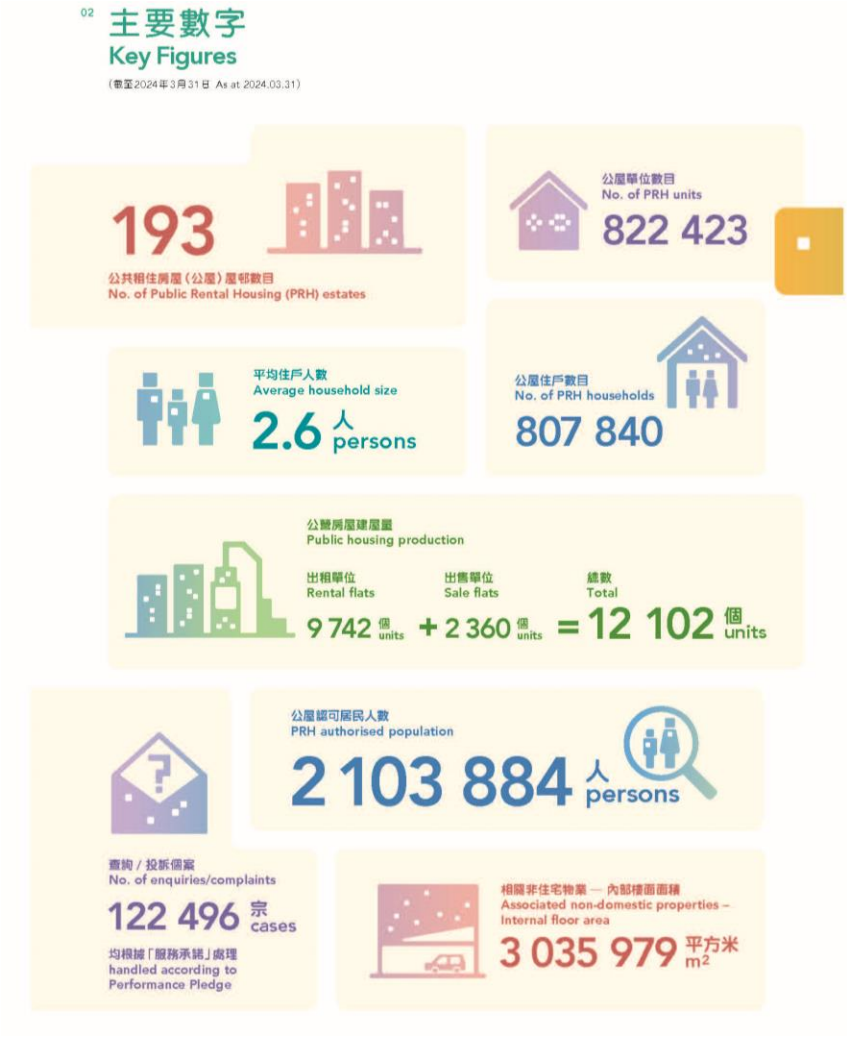
Descriptor

The *Volumetric Behaviour Analysis* (VBA) programme (HK$1.341 million GRF, 2023–2025), builds on a series of research investigations that began with several domestic interior studies of spatial practices and investigated whether, and how, they were informed by military strategies and urban theories.

Initial field research, visual analysis and documentation demonstrated that the organisation of furniture and domestic objects could be systematically codified based on their behavioural significance. This opened new avenues for volumetric and behavioural analysis specifically in residential interior studies of public housing in Hong Kong. Since 2018, research in this under-examined field has provided a foundational framework to examine the socioeconomic effects of spatial compression and how domestic space is commodified through the concept of the ‘square foot society’ (Bruyns, 2016).

This three-year VBA study (2023–2026) investigates the gap between the design intentions of public housing in Hong Kong and how residents use and adapt to their environments. Hong Kong’s public housing system accommodates 2.16 million residents across 822,423 units (Hong Kong Housing Authority, 2024) and faces severe space constraints alongside increasing demand. The project examines the mismatch between planned and standardised ‘as-designed’ layouts and residents’ ‘as-lived’ experiences and evolving needs. It introduces a strategic methodological shift from a planimetric section to vertical section–based analysis, examining how volumetric spaces are occupied rather than solely represented in two-dimensional layouts. By integrating digital modelling, 3D scanning, semi-structured interviews, spatial coding techniques, volumetric behavioural analysis and ergonomics into the research process, and conducting a comparative analysis that synthesises the data to better understand ‘as lived’ spatial dynamics, the project has revealed new findings and will inform potential new solutions for the development and adaptation of existing public housing when the study concludes in 2026.

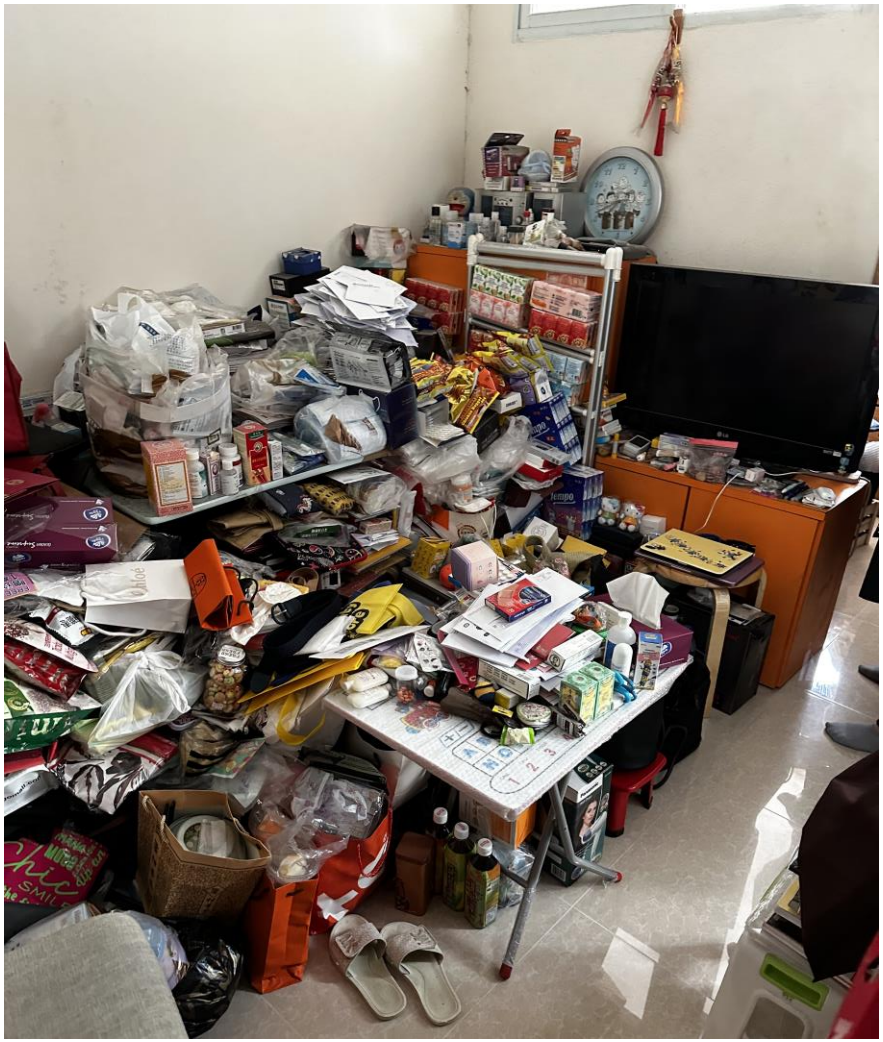
Volumetric Behaviour Analysis (VBA) of Hong Kong Public Housing Flats: Space, Behaviour and Design



Hong Kong Housing Authority 2023-2024 Annual Report and expressions of the public housing context and public importance.
https://www.housingauthority.gov.hk/mini-site/haar2324/common/pdf/14-Full-TC-EN-version.pdf

Source of photo: Hong Kong Housing Authority

Volumetric Behaviour Analysis (VBA) of Hong Kong Public Housing Flats: Space, Behaviour and Design



Photographic documentation of dwelling conditions from Flat Case PHNS3T.

Personal Profile: Dr ir Gerhard Bruyns

Dr ir Gerhard Bruyns's research examines urban morphologies and the strategic processes that shape future urban form. Since RAE 2020, as principal investigator, he has focused on two complementary research programmes: the first explores the concept of 'regional design' through studies on China's development of the Greater Bay Area, and the second – a GRF-funded project (HK$ 1.341million, 2023–2025) on volumetric behaviour analysis conducts detailed surveys and ethnographic studies of public housing in Hong Kong, examining the design intentions and the lived experiences of residents and their families, as well as how these environments have been altered, adapted and extended.

Bruyns began his academic career at PolyU in 2013. He is a tenured member of the faculty in the School of Design and is currently Director of the Postgraduate Research Programme (PhD) and Associate Dean of Academic Programmes for the School. Educated as an architect in South Africa, he holds an MSc and a PhD from TU Delft. He has lectured and contributed to architectural and urbanism education internationally, in Europe, South Africa, South America and across Asia. He is a member of the executive team of the International Forum on Urbanism (IFOU), Associate Editor of *Design Studies* (Elsevier) and editor-in-chief of PolyU's *Cubic Journal – Design Social, Economies, Making*.

Research Questions

The *Volumetric Behaviour Analysis* project continues Bruyns's long-term exploration of mixed and multidisciplinary methods and methodologies to analyse and understand everyday spatial practices and the strategic or tactical adaptations that arise in response to the domestic constraints of public housing environments.

Building on prior published research (Bruyns, 2019) and the work of Harvey (2012), Bruyns has worked further developed the overarching questions and re-examined how the contemporary design parameters and constraints of standardised public housing can be reconsidered, with the aim of creating more effective, liveable spaces for residents.

The central research questions guiding this work are as follows:

1. What can a volumetric analysis of existing interior spaces and how residents furnish, use and behave within their homes reveal about public housing in Hong Kong?
2. How can the findings from this volumetric behaviour analysis be deployed to inform the modification or design of existing and new public housing in Hong Kong?

Research Questions

[Image]

Image not included. Please contact the author for permission to view or reuse.

Public housing in the Quarry Bay area of Hong Kong. Source: Thomson Reuters Foundation, 2018. https://news.trust.org/item/20181031005809-3mnfe/

Research Questions

[Image]

Image not included. Please contact the author for permission to view or reuse.

Parker Estate, also known as the Monster Building, located in Quarry Bay, Hong Kong Island. Source: © Ching Wai Ji, used with permission.

Research Outputs

To date, the Volumetric Behaviour Analysis research project (2023–2025) has produced the following outputs:

- Three academic papers
  - Two on methods and methodologies
  - One on findings
- Three conference presentations and publications
  - Three on methods and methodologies
- Seven datasets
  - Two text-based datasets
  - Two cloud point datasets
  - Three 2D- and 3D-model datasets

Research Outputs

Academic papers

Methods and Methodologies

- Bruyns, G. J. B., Elkin, D., Navarrete, A., & Lee, V. (2024). Vicarious domestic states – The post-domestic turn of digital twinning habitual settings, PAD: Pages on Art and Design, 25(16). https://www.padjournal.net/wp-content/uploads/2024/02/09-25PAD-122023-BRUYNS-ET-AL.pdf

This paper presents a methodological approach focused on creating digital twins of domestic spaces using LiDAR technology to produce detailed 3D scans of homes in Hong Kong. As a pilot study, it examines how these digital replicas support behavioural simulation and data archiving

- Elkin, D., & Bruyns, G. (2024). Generative-inferential spatial-semantic AI: Normative rational social imperatives at another socio-technical horizon. HKIA Journal, 80. (Accepted/in press). https://cdn.prod.website-files.com/6400232a60a13567f329db25/68011afb235a7b05ee8a0c0a_HKIA%20Journal%20issue%2080-preview.pdf

This paper explores how emerging environmental scanning technologies, combined with AI-driven semantic segmentation, are transforming architectural representation and design. It considers the potential of generative-inferential spatial-semantic (GISS) AI to produce new digital architectures from existing data and argues for the need to balance technical innovation with critical sociological reflection.

Research Outputs

Academic papers (cont.)

Findings

- Bruyns, G. J. B. (2019). Tactical interiority: Hong Kong's lived interiors as praxis for tactical living in high-density landscapes. *Interiors – Design / Architecture / Culture*. Taylor and Francis Online. doi: 10.1080/20419112.2019.1642571. https://www.tandfonline.com/doi/abs/10.1080/20419112.2019.1642571

As a foundational study, this paper explores how Hong Kong's compressed domestic interiors drive tactical adaptations to housing constraints. Drawing on ethnographic insights, it introduces the concept of the 'square-foot society' to highlight how spatial practices reflect cultural and social needs.

Research Outputs

Conference papers

Methods and Methodology

- Bruyns, G. J. B., Elkin, D., & Choi, H. S. (2023). Morphological “spatial” clouds. Harnessing LIDAR approaches as measure in volumetric and spatial complexity. 30th International Seminar of Urban Form (ISUF2023): Praxis of Urban Morphology, Belgrade, Serbia. https://isuf2023.org/wp-content/uploads/2023/09/ISUF2023-Book-of-apstracts-NEW.pdf (p. 221).

This paper outlines the methodological approach of using LiDAR technologies to link point cloud data with environmental features for multilevel spatial analysis. It also serves as a pilot study, presenting three case studies from Hong Kong that illustrate the challenges and potential of applying 3D digital tools in spatial research.

- Choi, H.S., Bruyns, G. J. B., & Elkin, D. (2023). Morphological crossovers. Spatial compression, typologies and artificial intelligence in the assessment of vertical settings. 30th International Seminar of Urban Form (ISUF2023): Praxis of Urban Morphology, Belgrade, Serbia. https://isuf2023.org/wp-content/uploads/2023/09/ISUF2023-Book-of-apstracts-NEW.pdf (p. 252).

This paper introduces AI-based methods for spatial analysis through two public site case studies in Hong Kong. The findings demonstrate AI’s potential to generate and redefine spatial descriptors.

Research Outputs

Conference papers (cont.)

Methods and Methodology

- Bruyns, G. J. B., Choi, H.S., Elkin, D., & Endemann, H. (2023). Material and experiential measures of the giga morphological contexts. Linking mega compact settings to a human centred design framework. 30th International Seminar of Urban Form (ISUF2023): Praxis of Urban Morphology, Belgrade, Serbia. https://isuf2023.org/wp-content/uploads/2023/09/ISUF2023-Book-of-apstracts-NEW.pdf (p. 220).

This paper proposes initial conceptual linkages and methodologies for connecting spatial form with human experience in volumetrically complex settings.

Research Outputs

Seven Datasets

Text-Based Datasets (n = 2)

- Semi-structured interviews conducted with public housing residents, transcribed into text and translated from Cantonese into English (n = 20).
- Interview data coding and thematic analysis of the interviews (n = 20).

These datasets comprise a collection of qualitative data in which the primary form of information is text. They are publicly accessible at https://data.mendeley.com/datasets/74j8zn8z5y/1.

Point Cloud Datasets (n = 2)

- Public housing flats digitally scanned (n = 20).
- VDA datasets generated from the scans (n = 20).

These datasets contain three-dimensional spatial data from digital scans of 20 flats. Each scan captures millions of points representing the physical layout and surfaces of the flats. They are publicly accessible at https://data.mendeley.com/datasets/vrxnh3dzv5/2.

Research Outputs

Seven Datasets (cont.)

Two- and Three-Dimensional Model Datasets (n = 3)

- As-built three-dimensional volumetric models, developed from Hong Kong Housing Authority documents (HEBROS) (n = 20).
- Annotated two-dimensional floor plans, including gross floor area and net floor area data (n = 20).
- Eighty sections drafted, with four sections per case: 20 movable item isometric drawings drafted (one per case); 20 loose furniture isometric drawings drafted (one per case); 20 fixed furniture isometric drawings drafted (one per case); 20 volumetric clump isometric drawings drafted (one per case).

These datasets support spatial, functional and volumetric analyses of the domestic environments of 20 public housing flats in Hong Kong. They are publicly accessible at https://data.mendeley.com/datasets/rzz7jf94b2/1.

Research Field & Key References

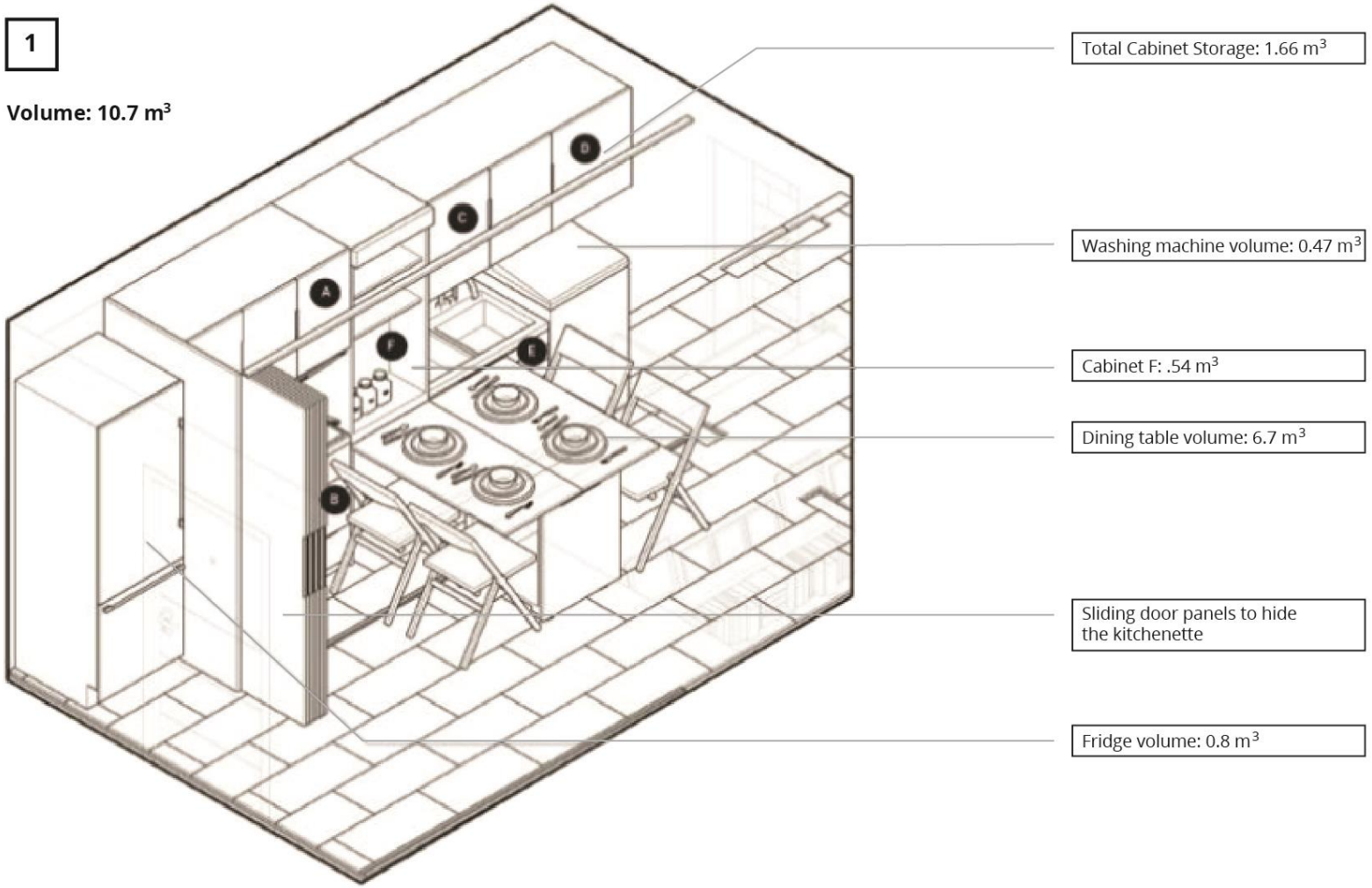
Background

In 2016, Bruyns developed the concept of the *square foot society*, examining how spatial compression and the high economic value assigned to each square foot influence everyday domestic life. This research informed the development of a methodological framework that shifted the analytical focus from isolated floor plans to a three-dimensional analysis of spatial layouts, emphasising the strategic arrangement of objects and elements within highly confined volumes (as illustrated on the following page).

The theoretical foundation of this study draws on Harvey's (2012) concept of housing as a commodity within capitalist urbanisation and on Madden and Marcuse's (2016) research on housing injustice and spatial segregation. Both perspectives provide a critical lens for examining urban social dynamics through the study of domestic conditions and housing standards.

Hong Kong's unique urban characteristics – particularly extreme spatial compression and hyper-density – have given rise to distinctive forms of domestic life, making these frameworks especially relevant. Such conditions have stimulated the emergence and deployment of interior 'tactics' as acts of necessity, resistance and adaptation (Wilson, 2015), resulting in what Gottlieb and Hang (2011) described as 'inner-informalities'. These theoretical insights inform this study's methods and methodology, which involve documenting and analysing spatial use and occupation through advanced coding and scanning technologies. Brought together, they establish a novel analytical approach within interior and housing studies to address the challenges of 'hyper-dense' living conditions and identify potential future solutions.

Research Field & Key References



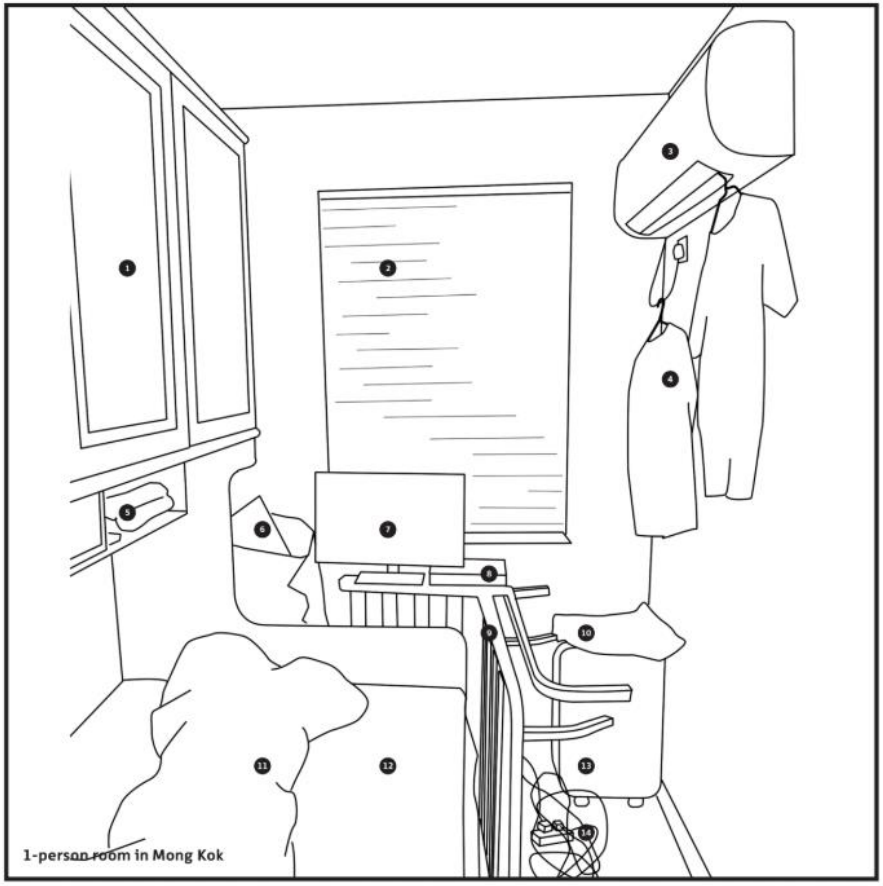
Spatialisation of the square foot society – an example that illustrates the use of the space in volumetric terms; sourced from an academic paper presented at Contested_Cities Congreso Internacional, Madrid 2016 (Article no. 2-012): 'Model and the Lived, Beyond the 60m^2 Mean: An Investigation into Hong Kong's Domestic Models and Its Square Foot Societies.'

Research Field & Key References

Expanding on this work, in 2019, Bruyns developed the concept of *tactical interiority*, which explores the connections between tactical and military thinking within urban and interior environments. This research was informed by the discussions of Aureli (2011) and Lathouri (2019) on interior space as a political and tactical arena. The study involved on-site documentation of several residential units, followed by a visual coding process (as shown on p. 21).

This marked a turning point in his research, revealing the potential to link spatial elements and everyday objects with human behaviour. Tactical interiority served as a preliminary investigation into how residents actively adapt their living environments, laying the groundwork for the current *Volumetric Behaviour Analysis* (VBA) project. VBA introduced the integration of photo-documentation and spatial coding as initial steps toward volumetric analysis and identified key adaptive patterns, including volumetric transformations, behavioural adjustments and shared practices within mixed-use domestic spaces.

Research Field & Key References



1. 4-doors cabinet integrated to the bed frame
2. Window
3. Air conditioner
4. Clothes hanging on the air conditioner and the power cable
5. Drawers for storing small objects integrated to the bed frame
6. Large bag for storage
7. Television in front of the bed
8. Playstation 4
9. Folded bedframe
10. Empty bag
11. Blanket
12. Bed mattress
13. Trolley 0.05 m3
14. Cables of the electronics lying on the ground

An example of photograph coding from tactical interiority research (2019). In this method, photographs are coded by linking observed inhabitant behaviours – categorised by type using ATLAS.ti software – to specific physical conditions within occupied flats, enabling the identification and localisation of behavioural patterns that support statistical analysis of spatial usage trends.

Research Field & Key References

Theoretical Framework

Building on the methodological foundations established in Bruyns's square foot society and tactical interiority research, the VBA project adopts a multidisciplinary theoretical framework. This framework integrates three primary areas of study: (1) housing and interior design, (2) volumetric and spatial analysis, focusing on how domestic spaces are organised and utilised, and (3) behavioural studies related to everyday life and inhabitation practices.

In addition to these core domains, the research extends into broader political and urban contexts, recognising that domestic space is deeply embedded within social, economic and infrastructural systems. Drawing on van Ham (2012), the study examines 'housing behaviour' by exploring the complex factors that influence housing decisions – from economic constraints to cultural norms and institutional structures. These behavioural insights are critical for shaping responsive social policies, particularly within the hyper-dense context of Hong Kong.

Aligned with Marshall-Baker's (2000) conception of interior design as inherently interdisciplinary, the study underscores how spatial arrangements and environmental conditions within compact homes affect well-being, development and daily life. Ergonomics, therefore, plays a vital role in determining the functionality and quality of these constrained spaces. Finally, the study addresses future planning by engaging with socioeconomic inequalities and the geopolitical challenges that define urban life in Hong Kong. This comprehensive approach positions the domestic sphere as a critical site where design, governance and lived experience intersect.

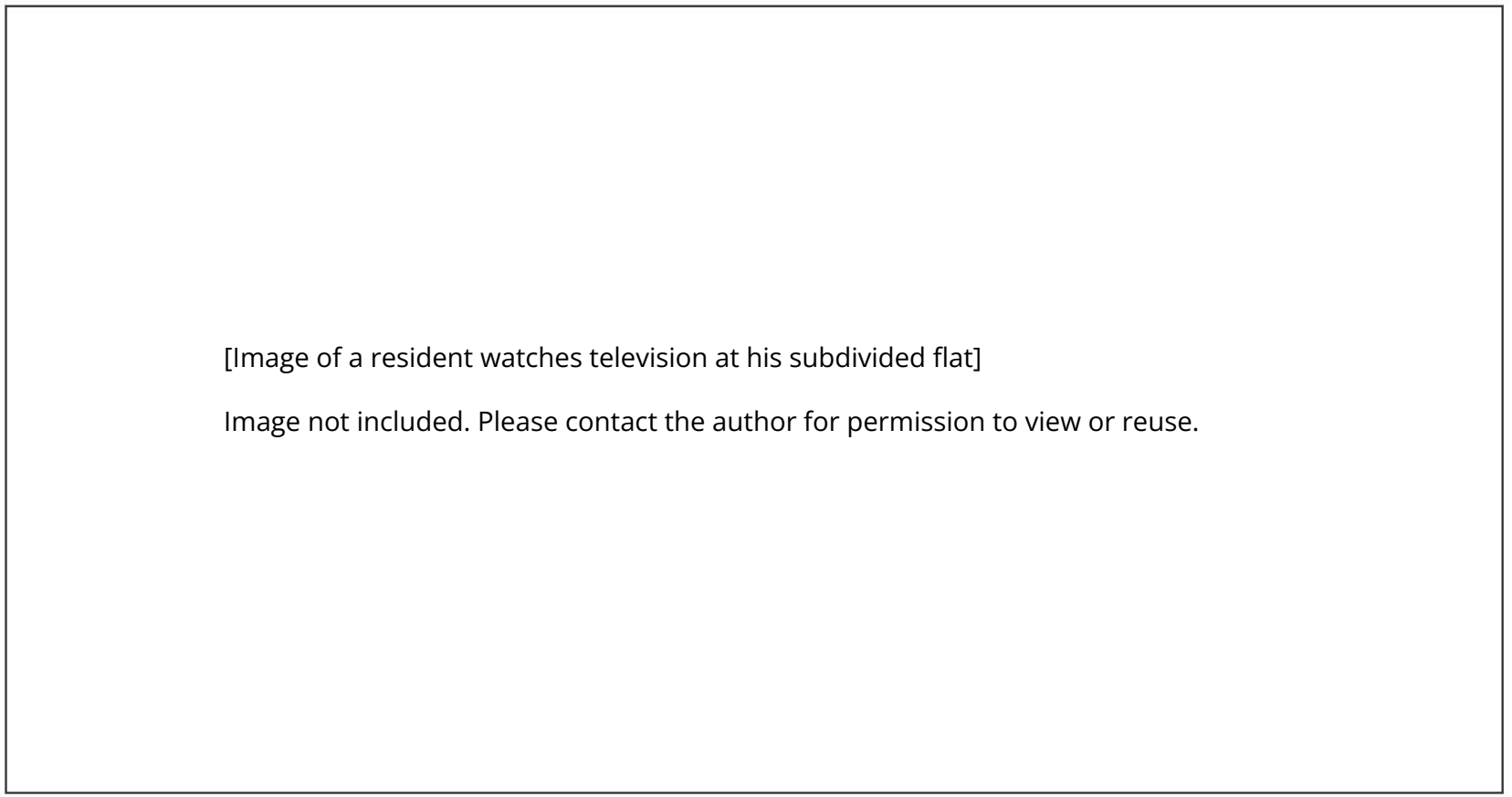
Research Field & Key References

Context

Dwelling conditions in Hong Kong are shaped by a complex interaction of public policy, severe land scarcity and persistent socioeconomic inequality. Recognised as one of the world's most densely populated urban centres (Lai, 2008), the city faces a significant deficit in affordable housing options. Many residents are housed in public estates, subdivided units, micro-apartments (Yau, 2012; Pumar, 2020) or 'coffin homes'. The scarcity of developable land and the high cost of property have produced housing models that prioritise spatial efficiency over comfort and well-being (Wong, 2015). The resulting dwelling conditions not only affect physical health but also contribute to psychological stress, family strain and social exclusion (Smart, 2006), highlighting the need for holistic, equity-focused housing strategies that address both spatial and social dimensions of urban life.

The following pages present visual and contextual documentation of two extreme dwelling conditions in Hong Kong: a subdivided apartment and a coffin home. Although not part of the sampled flats in this study, these examples provide critical insight into how housing adapts to severe spatial and economic constraints. Characterised by minimal space, limited privacy and improvised living arrangements, they illustrate how residents modify their environments to sustain everyday life.

Research Field & Key References



Research Field & Key References

Research Field & Key References

Significance

While previous studies of Hong Kong's public housing have explored various dimensions – including design challenges and sustainability considerations (Deng et al., 2016), spatial distribution and resident mobility within estates (Lui, 2011; Zheng et al., 2015) and the influence of housing design on residents' perceptions of domestic space (Rooney, 2001) – a critical gap remains in the literature.

To date, no research in Hong Kong or internationally has applied volumetric behaviour analysis to public housing with the explicit objective of evaluating its implications for public expenditure, operational effectiveness and housing policy.

This study aims to fill this gap by proposing an evidence-based framework that can inform and enhance the specification, planning and development of public housing in Hong Kong.

Research Field & Key References

In this context, housing models are understood not only as housing porotypes but also as socio-technical systems – design outcomes shaped by the everyday behaviours they accommodate while simultaneously constrained by economic pressures, political agendas, industrial production processes and temporal limitations (Heynen, 1999).

These interdependencies are crucial for understanding how space is conceptualised, produced and inhabited.

In addition, this study examines how industrialised approaches to housing development – particularly in the areas of construction and architectural design – have significantly restricted design diversity (Panero & Zelnick, 1979; Vesely, 2006).

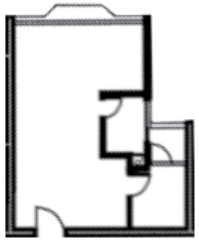
Standardisation and mass production, aimed at efficiency and scalability, have resulted in repetitive and homogenised flat layouts that limit adaptability to different household needs.

In Hong Kong, where housing production must respond to intense demand and limited land supply, these constraints are especially pronounced. As a result, flat designs often prioritise spatial efficiency over human-centred design, reducing opportunities for variation or contextual sensitivity.

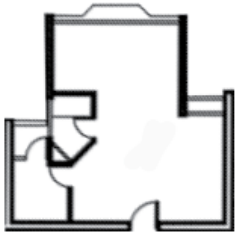
Research Field & Key References

Apartment Unit Types within Trident Block

[STANDARD]
Trident 1 - Unit
IFA area: 30.53 m2



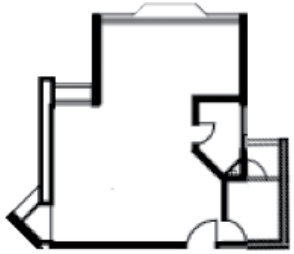
[STANDARD]
Trident Block - A
(T3,T4) Unit
IFA area: 35.41 m2



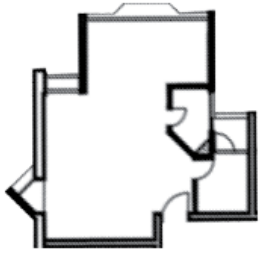
[STANDARD]
Trident Block - B
(T3,T4) Unit
IFA area: 40.32 m2

[STANDARD]
Trident Block - B (T2) Unit
IFA area: 36.02 m2

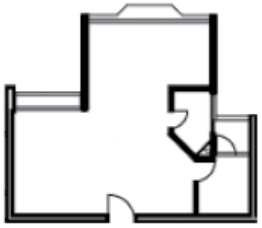
[STANDARD]
Trident Block - C (T2) Unit
IFA area: 45.04 m2



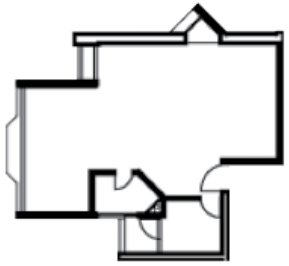
[STANDARD]
Trident Block - B1 (T3) Unit
IFA area: 48.49 m2



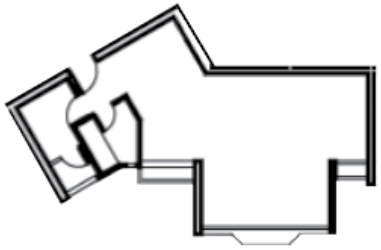
[STANDARD]
Trident Block - C (T3) Unit
IFA area: 46.94 m2



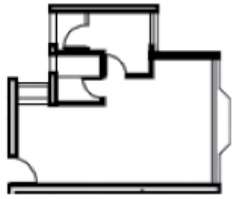
[STANDARD]
Trident Block - C1 (T3) Unit
IFA area: 46.12 m2



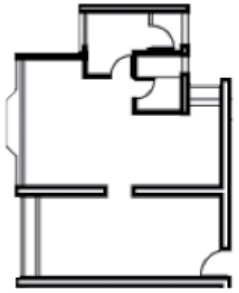
[STANDARD]
Trident Block - D (T3) Unit
IFA area: 52.47 m2



[STANDARD]
Trident Block - C (T4) Unit
IFA area: 53.94 m2



[STANDARD]
Trident Block - D (T4) Unit
IFA area: 36.5 m2



[STANDARD]
Trident Block - E (T4) Unit
IFA area: 57.93 m2

Research Field & Key References

This research goes beyond documenting housing conditions; it challenges the assumption that standardised housing models can adequately meet the needs of diverse residents. By linking the *model* – that is, the intended architectural design – with the *lived* – the everyday realities shaped by residents' behaviours, needs and preferences (Han, 2016; Lee, 2007) – the study examines how people live in Hong Kong's public housing.

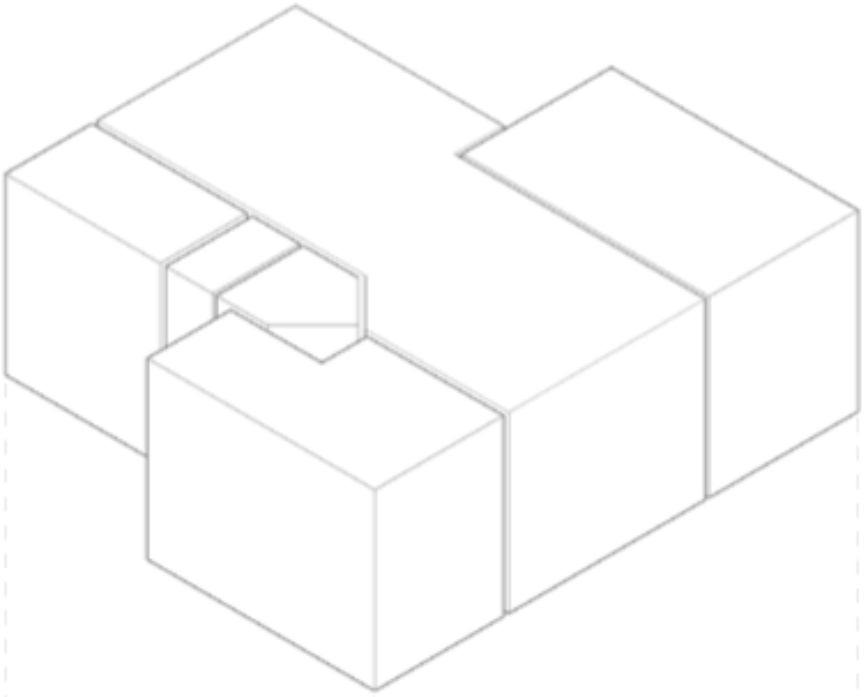
The evolving significance of personal possessions further illustrates how domestic spaces are interpreted and used in diverse ways, reflecting a wide range of everyday practices (Paavilainen et al., 2016).

These subtle yet meaningful adaptations – often imperceptible to external observers (Turner, 1972) – demonstrate how inhabitants continually reshape their living environments beyond the original design intentions (Blomberg, 2012; Madden, 2010), highlighting a persistent gap between standardised housing models and lived experience.

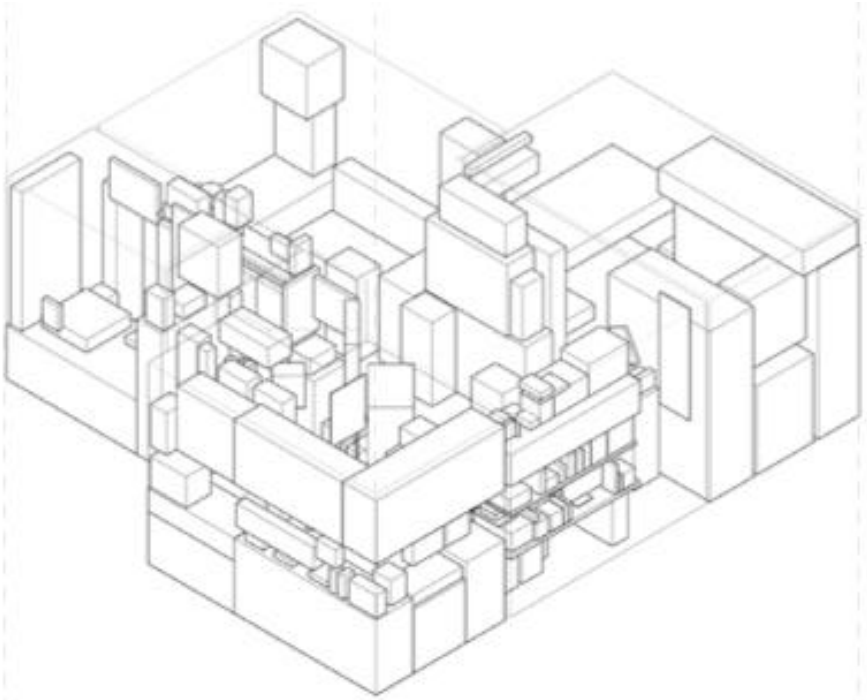
Grounded in the framework of behavioural analysis (Skinner, 1938) and established architectural methods, this research links behavioural traits to specific interior spaces. It employs behavioural categories alongside sentiment evaluation to capture the nuanced ways in which residents interact with their homes (Bernard & Ryan, 2010; Friese, 2012; Kuckartz, 2014; Panero & Zelnic, 1979).

Research Field & Key References

The model



The lived



Research Methods, Prototypes & Materials

A key contribution of this study is the development of a methodological framework that systematically links behavioural patterns with the physical characteristics of living spaces.

Unlike traditional behavioural studies, this approach grounds behavioural data in tangible spatial evidence, offering deeper insight into the interaction between design and inhabitant adaptations.

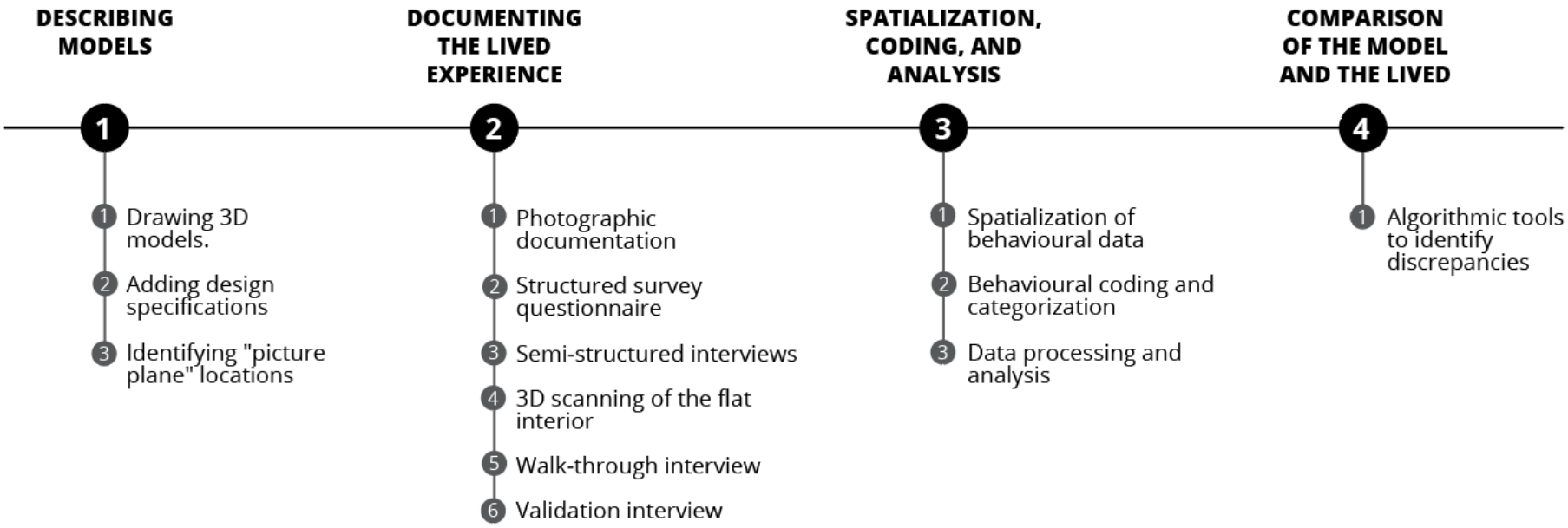
By integrating photographic coding, qualitative and quantitative behavioural analysis and advanced three-dimensional (3D) scanning with geocaching technology, this study introduces a replicable and flexible methodology for documenting, analysing and visualising inhabitant behaviours within domestic spaces.

Research Methods

1. Photographic coding (Chapman et al., 2017) is employed as a systematic method to visually and physically connect qualitative and quantitative data to the living space through photographic evidence.
2. 3D scanning with geocaching technology is conducted using the Leica BLK2Go laser scanner, which captures a comprehensive 3D digital model of the living environment. This scanner integrates high-resolution, geocached photography, enabling behaviours and physical adaptations to be mapped to their exact spatial locations.
3. Triangulation with interviews – including personal questionnaires and walk-through interviews – enhances validity by cross-referencing self-reported behaviours and inhabitant perspectives with the documented spatial adaptations.

Research Methods, Prototypes & Materials

The **research process** consists of four key steps, as illustrated in the workflow diagram below and described in detail in the following pages.



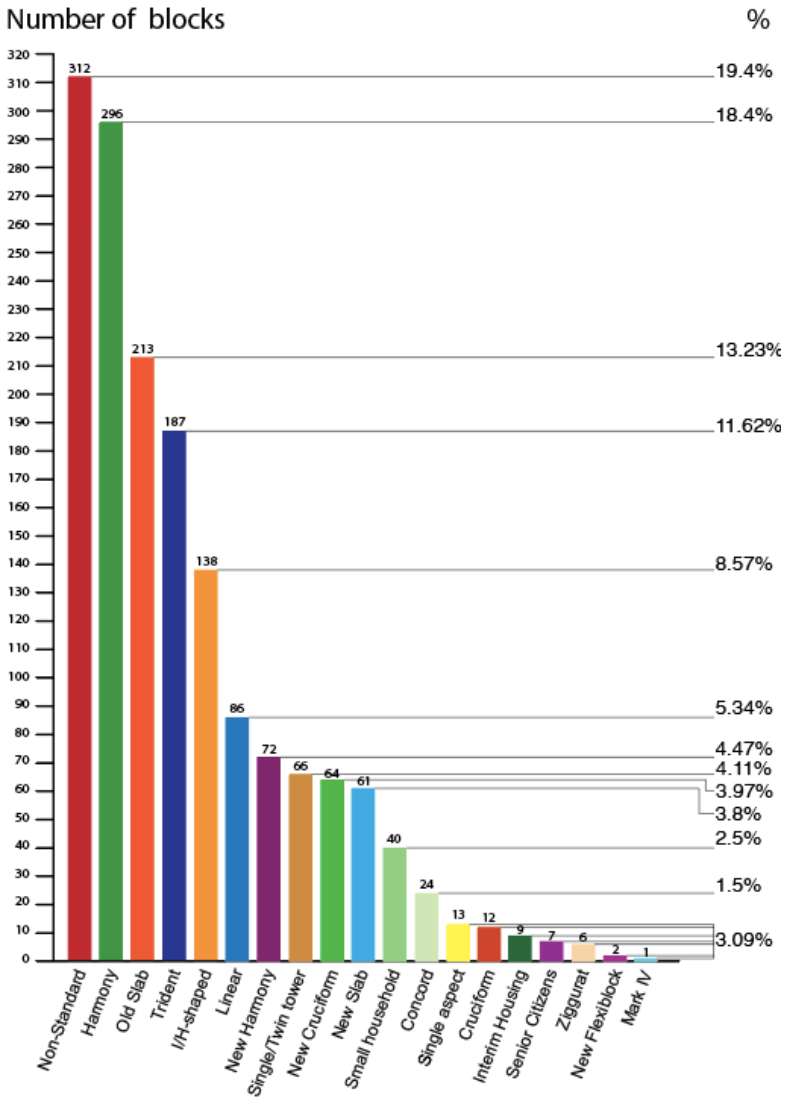
Workflow diagram with the four research steps.

Research Methods, Prototypes & Materials

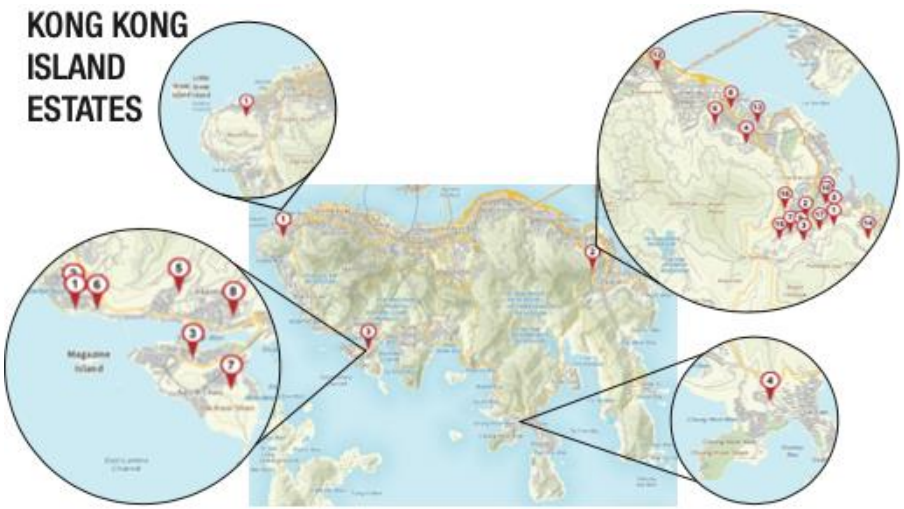
Part 1: Describing the Models

Part 1 of the study investigated the historical development of public housing in Hong Kong, tracing its evolution over the past seven decades. Since its establishment, the Hong Kong Housing Authority has served as the main body responsible for this development, introducing 36 standardised block types, each offering a range of flat designs (Shen, 1986).

The research involved a detailed analysis of existing public housing estates across Hong Kong Island, Kowloon and the New Territories. For each area, a comparative table was produced to record key information, including the type of estate, block type, year of intake, number of blocks and flat sizes, as shown in the following pages. Based on these data, a bar chart was used to visualise the most frequently constructed block types (see right), highlighting the five dominant forms across Hong Kong's public housing landscape: non-standard blocks (19.4% of total constructions), harmony blocks (18.4%), old slab blocks (13.23%), trident blocks (11.62%) and I/H-shaped blocks (8.57%). Given their prevalence, sample flats were selected by the researchers exclusively from these five block types to ensure representativeness and relevance in the analysis.



Research Methods, Prototypes & Materials



AREA	ESTATE NAME	TYPE OF ESTATE	YEAR OF INTAKE	TYPES OF BLOCKS	NO. OF BLOCKS	FLAT SIZE (m^2)
1 Central/ Western	Sai Wan	PRH	1958	Old slab	5	35.5 - 56.3
2 Eastern	Chai Wan	PRH	2010	Non-standard	2	17.91 - 40.58
	Wah Ha	PRH	2016	Non-standard	1	17.66 - 38.08
	Lin Tsui	PRH	2018	Non-standard	1	14.05 - 35.12
	Yiu Tung	PRH	1994	Harmony 1, 3A, 3B, 3C	11	11.8 - 52.3
	Yue Wan	PRH	1977, 2020	Old Slab, Non-standard	4 1 — 5	14.01 - 56.2
	Hing Tung	PRH	1996	Harmony 1	4	11.8 - 43.3
	Hing Wah 2	PRH	1976	Old slab	7	22.7 - 42.2
	Hong Tung	PRH	1998	Small Household	1	17.6 - 49.8
	Hing Wah 1	PRH	1999	Harmony 1	3	16.3 - 49.0
	Tsui Lok	PRH	1999	Small Household	1	22.9 - 60.1
	Tsui Wan	PRH	1988	Trident 4	4	19.3 - 55.6
	Model Housing	PRH	1954	Old Slab	6	13.8 - 62.4
	Oi Tung	PRH	2001	Harmony 1, Small Household Non-Standard	3 2 1 — 6	16.3 - 43.3
	Siu Sai Wan	PRH	1990	Harmony 1, Linear 1, Trident 4	3 2 1 — 12	11.3 - 50.5
	Fung Wah	TPS	1991	Trident 4	2	34.7 - 66.6
	Hing Man	PRH	1982	Cruciform	3	24.7 - 51.4
	Wan Tsui	PRH	1979	Double H, Old Slab, Single H, Small Household	4 4 2 1 — 11	22.5 - 58.1
3 Southern	Wah Fu 1	PRH	1967	Old Slab	12	28.3 - 36.5
	Wah Fu 2	PRH	1970	Twin Tower	6	33.1 - 39.9
	Ap Lei Chau	PRH	1980	Double H, Old Slab, Triple H	2 4 2 — 8	23.13 - 67.91
	Ma Hang	PRH	1993	Harmony Rural	5	17.0 - 52.5
	Tin Wan	PRH	1997	Harmony 1, Non-standard	5	12.3 - 49.0
	Wah Kwa	TPS	1990	Small Household, Trident 4	4 1 — 6	19.3 - 55.6
	Lei Tung	TPS	1987	Trident 1 and 2	8	26.7 - 45.5
	Shek Pai Wan	PRH	2006	New Harmony I, Small Household, New Flexiblock	5 1 2 — 8	17.8 - 53.7

This page presents a regional overview of public housing estates on Hong Kong Island, facilitating the refinement of the broader typological study by helping to identify and focus on the five most representative block types out of the original 36.

Research Methods, Prototypes & Materials

REGION	AREA	ESTATES	BLOCKS
HONG KONG ISLAND	1 Central & Western	1	5
	2 Eastern	17	80
	3 Southern	8	58
	Subtotal	**26**	**143**
KOWLOON	4 Sham Shui Po	19	153
	5 Kowloon City	7	47
	6 Wong Tai Sin	22	181
	7 Kwun Tong	34	242
	8 Yau Tsim Mong	1	5
	Subtotal	**83**	**628**
NEW TERRITORIES	9 Tai Po	8	44
	10 Yuen Long	18	132
	11 Tuen Mun	16	101
	12 Tsuen Wan	6	39
	13 Kwai Tsing	25	183
	14 Sha Tin	22	147
	15 Sai Kung	10	58
	16 Islands	10	70
	17 North	13	64
	Subtotal	**119**	**838**
	TOTAL	**228**	**1,609**

The figure above presents 1609 blocks across 228 public housing estates distributed throughout Hong Kong's three main regions: Hong Kong Island, Kowloon and the New Territories. This table was developed as part of the regional analysis, enabling the researchers to accurately identify the block types constructed in each area. This information was essential for determining the most commonly built block types and, consequently, selecting those to be included in the sample for further analysis.

Research Methods, Prototypes & Materials

Part 1: Describing the Models

Following the public housing mapping, the researchers gathered design documentation from the flats within the five selected block types.

Sources for these documents included publicly accessible materials from the Housing Department's website, supplementary records from the Architectural Services Department, relevant academic studies and historical archives.

Using these documents, the researchers recreated each flat type as a three-dimensional digital model (see p. 32). These models were based on the original design plans and helped identify key architectural and spatial features.

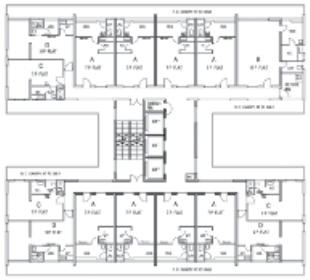
Within each model, specific viewpoints were chosen to show how the flats were originally designed to function – highlighting layout, movement and how people are expected to use the space.

The researchers then marked and categorised interior elements – such as built-in storage, doorways and fixed furniture – that support or guide daily activities. This produced the first dataset of the study, offering insight into how the original housing designs considered residents' everyday behaviours and needs.

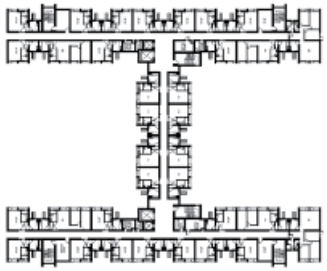
Research Methods, Prototypes & Materials

1973-1982
First Generation blocks

H-SHAPED BLOCK



OLD SLAB



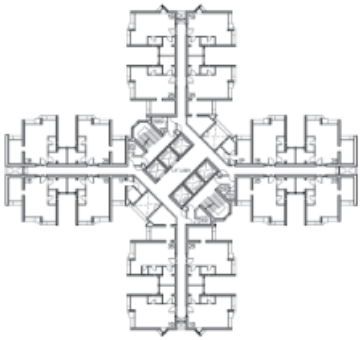
OLD SLAB

1986-1992
Second Generation blocks

TRIDENT

1992-2003
Third Generation blocks

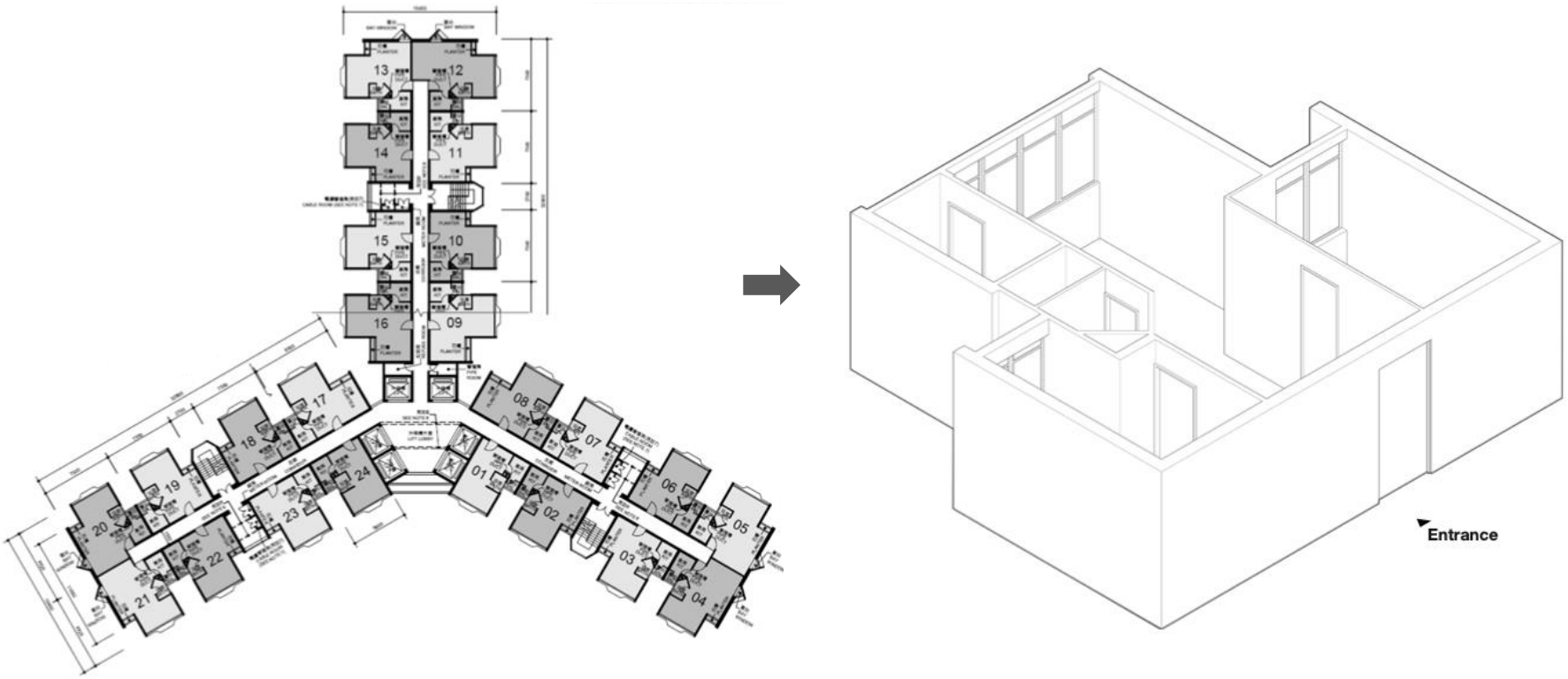
HARMONY



2012–present
Fifth Generation blocks

NON-STANDARD

Research Methods, Prototypes & Materials



This figure illustrates an example of the ‘describing the model’ process. The layout plan on the left, depicting Flat Type C1 in Tung Yuen House in Chuk Yuen (North) Estate – classified as a Trident 3 block type – was sourced from the Housing Department website. This plan was then translated into a 3D digital model, shown on the right.

Research Methods, Prototypes & Materials

Part 2: Documenting the Lived Experience

Part 2 aimed to understand residents' lived experiences within their housing environments by collecting both quantitative and qualitative behavioural data. This involved site visits to 20 participant flats, where the researchers followed a structured data collection process, comprising the following steps:

1. Photographic documentation was conducted for each flat in its occupied state, capturing interior layouts, furnishings, personal belongings and overall spatial organisation. An example from one of the case studies (Case PHTR1) is presented on the following page. This set of images illustrates the living conditions within a flat located in a Trident block – one of the five block types selected for in-depth analysis.

2. Semi-structured interviews were conducted to explore residents' daily routines, spatial needs and adaptations within the home. This format enabled the collection of detailed, open-ended responses. The interview guide can be accessed at https://ira.lib.polyu.edu.hk/bitstream/10397/115335/1/Consent_form_Fieldwork_procedure_Aug2023%20.pdf, (pp. 1–7).

3. 3D scanning was used to document the physical conditions of each flat interior (see p. 35). This process was complemented by a walk-through interview, during which participants guided the researchers through their living spaces and described how they interacted with and adapted them. This method provided contextual insights into observed behavioural patterns. The walk-through interview guide is available at https://ira.lib.polyu.edu.hk/bitstream/10397/115335/1/Consent_form_Fieldwork_procedure_Aug2023%20.pdf, (pp. 7-14).

Research Methods, Prototypes & Materials

Part 2: Documenting the Lived Experience

4. A validation interview was conducted in which participants reviewed the documented data and preliminary findings to confirm their accuracy and ensure they reflected their lived experiences. This step also provided an opportunity for researchers to address any gaps in the data and to reaffirm informed consent from the participants

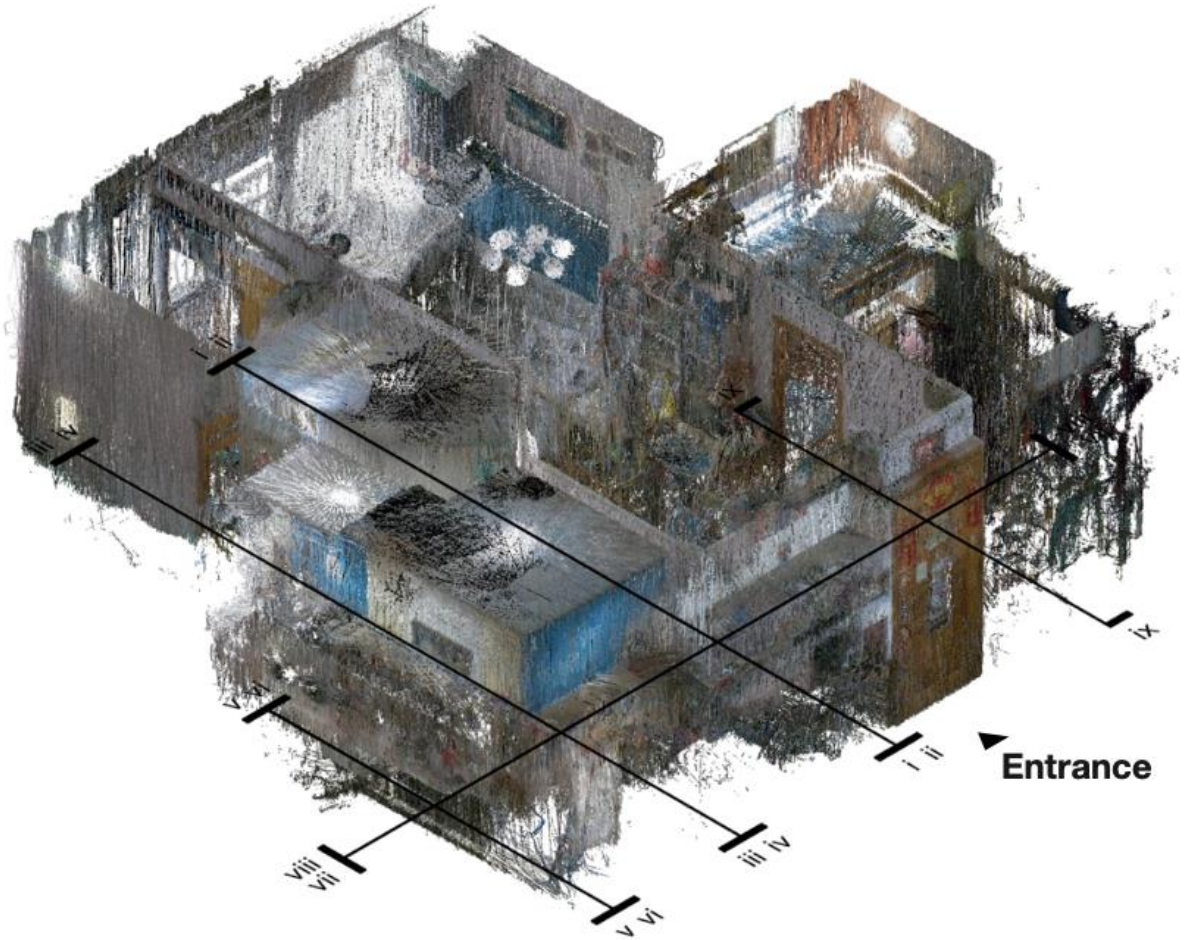
Research Methods, Prototypes & Materials

The figure above presents an excerpt from the photographic documentation of Flat Case PHTR1, one of the selected units situated within a Trident block – one of the five dominant block types identified in this study. All photographs correspond to the same flat and were captured during the data collection phase to document the space in its occupied state. This consistent visual record enabled the researchers to observe and analyse how interior spatial arrangements – such as furniture placement, storage solutions and circulation patterns – interact with and accommodate residents' everyday behaviours. By systematically identifying and mapping these spatial adaptations, the research linked specific volumetric features of the flat to lived practices, revealing how design is negotiated, personalised or constrained under real-life conditions.

Research Methods, Prototypes & Materials

A1-4: Living Room
B1-2: Kitchen
C1: Bedroom
D1-5: Living Room 2
E1: Bedroom 2

3D LiDAR Data 1:40



The figure above presents a 3D scan of Flat Case PHTR1, the same flat exemplified through photographic documentation on the previous page. This scan captures the spatial configuration and volumetric features of the flat with high accuracy, enabling a detailed visualisation of its interior in its occupied state. By translating the physical environment into a digital model, the 3D scan allows researchers to assess spatial dimensions, furniture arrangements, circulation flows and inhabitant modifications with precision. This digital reconstruction serves not only as a record of the flat's architectural characteristics but also as a tool for analysing how space is navigated and appropriated in daily life.

Research Methods, Prototypes & Materials

Part 2: Documenting the Lived Experience

The aforementioned methodological process led to the construction of a spatialised dataset documenting and interpreting inhabitant behaviours within public housing flats in Hong Kong.

This dataset synthesises multiple forms of qualitative and visual data, including photographic records of occupied interiors, residents' narrative accounts and information obtained through semi-structured and walk-through interviews.

These multiple data layers provide a nuanced and situated understanding of how domestic spaces are navigated, adapted and inhabited in everyday life. By integrating subjective experiences with spatial observations, the dataset moves beyond schematic or idealised representations of housing design to capture the complexity of lived environments.

The findings generated through this process inform the creation of detailed digital models that more accurately reflect real conditions – highlighting the discrepancies between as-designed intentions and as-lived spatial realities.

This comprehensive and embodied approach established the foundation for the next phase of the research: the spatialisation, behavioural coding and analytical interpretation of the collected data.

Research Methods, Prototypes & Materials

Part 3: Spatialisation, Coding and Analysis

Part 3 of the study focused on analysing data collected from the sample public housing flats in Part 2, with two central aims: (1) to spatialise behavioural data and (2) systematically code and categorise observed inhabitant behaviours.

The spatialisation process involved a structured, two-step methodology. In the first step, researchers developed simplified three-dimensional (3D) digital models of each sampled flat using raw data captured through 3D scanning.

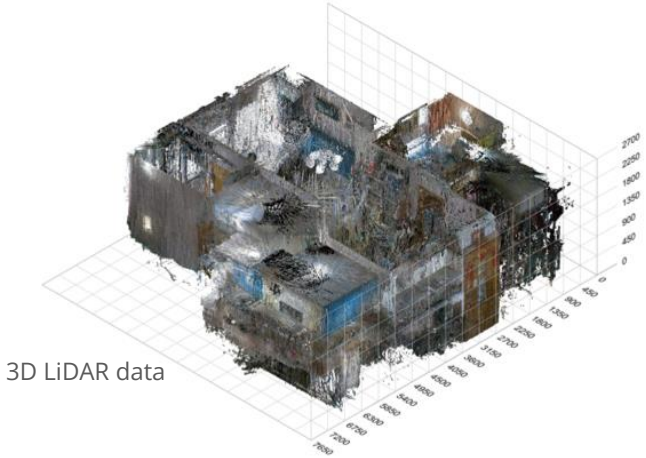
These point cloud data were processed and rationalised to generate clear architectural geometries. Physical components within each flat were then classified into three key categories (see p. 42): fixed furnishings, such as built-in cabinets and plumbing fixtures; movable furnishings, such as tables, beds and wardrobes; and smaller movable objects, including household items and personal belongings. These classifications enabled a more precise interpretation of how spatial configurations support or restrict different types of activities and behaviours.

In the second step, behavioural data were spatially mapped onto these models by integrating findings from a variety of sources, including survey responses, walk-through interviews, detailed room-by-room observations and photographic documentation.

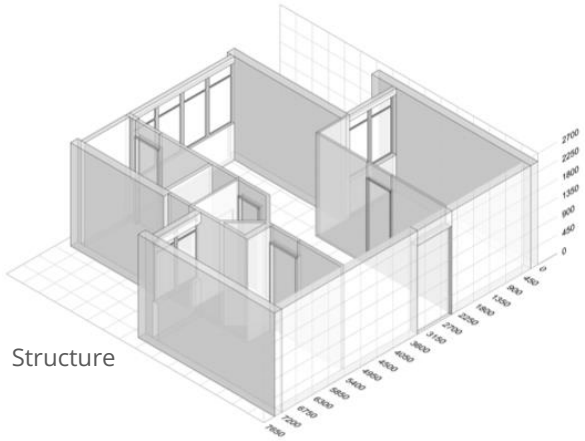
This process allowed the research team to identify and visualise the specific locations in which everyday behaviours occurred within each dwelling. By embedding behavioural data into the architectural models, the research created a spatialised record of domestic practices, offering insights into how residents engage with, modify and personalise their living environments within the constraints of standardised public housing design.

The outcome is a multi-layered dataset that not only reflects the physical space but also encapsulates the lived experiences embedded within it.

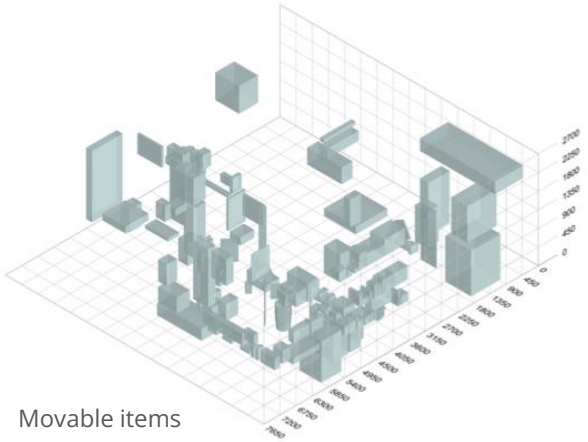
Research Methods, Prototypes & Materials



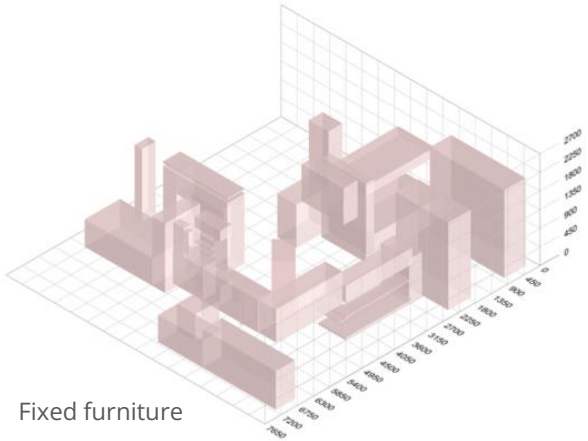
3D LiDAR data



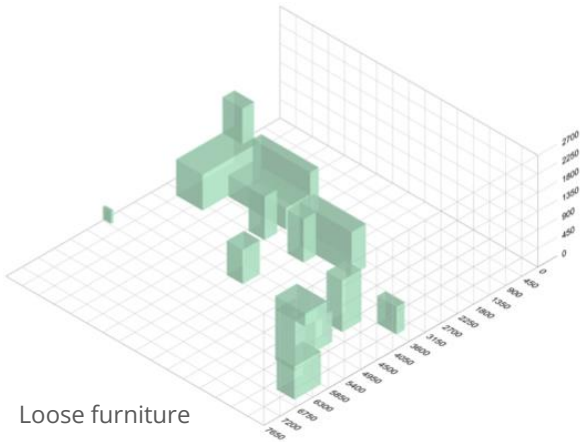
Structure



Movable items



Fixed furniture



Loose furniture

The 3D digital model of Flat Case PHTR1, as presented above, provides a detailed visual representation of the spatial configuration and interior organisation of the dwelling. This model illustrates the precise distribution and arrangement of physical elements within the flat, including fixed furniture, movable furnishings and loose furniture.

Research Methods, Prototypes & Materials

Part 3: Spatialisation, Coding and Analysis

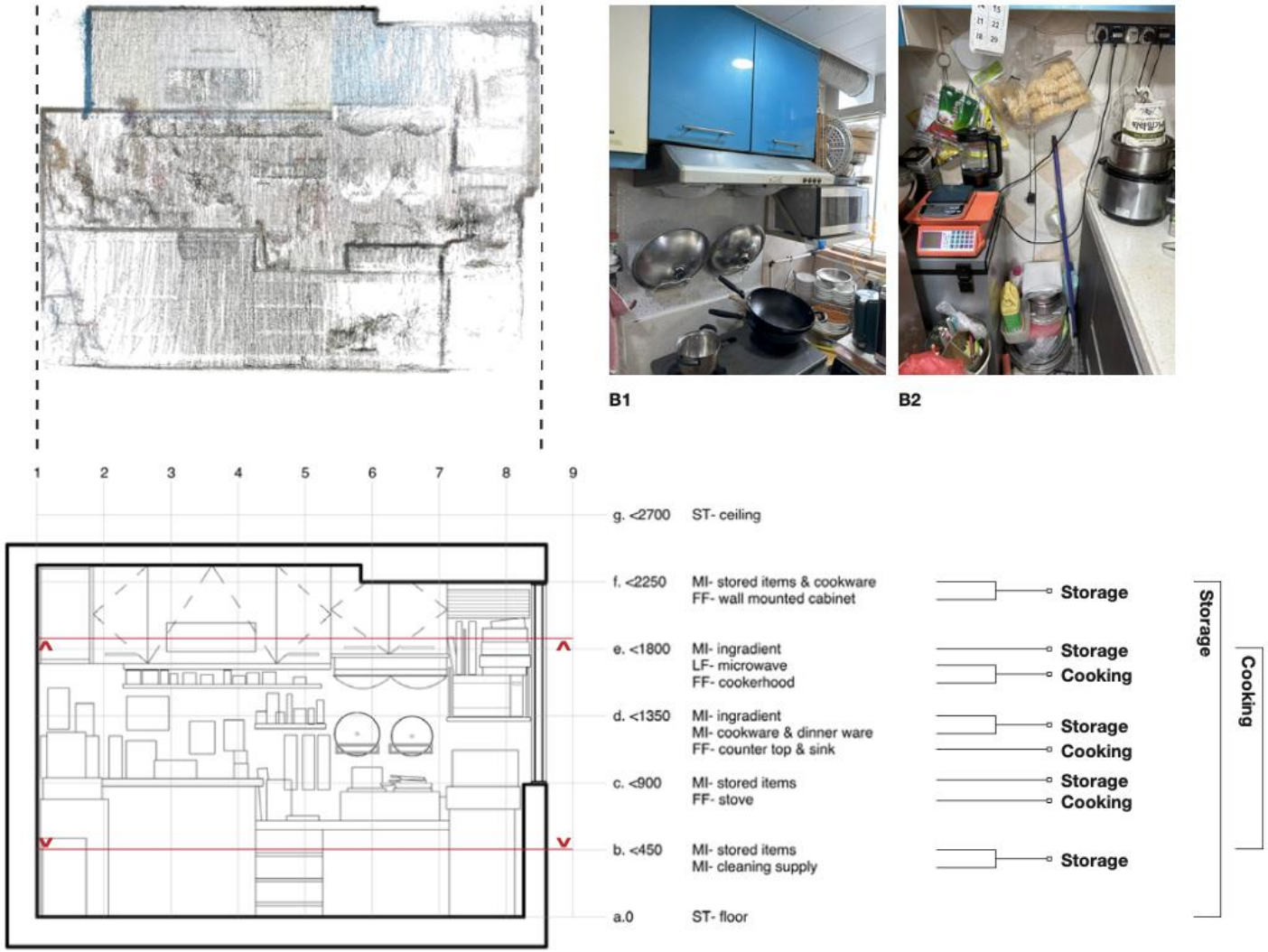
The behavioural coding and categorisation process was conducted through a systematic analysis of photographic documentation and interview transcripts collected during fieldwork.

These qualitative data were meticulously examined to identify patterns of inhabitant behaviour within the domestic space. Each observed behaviour – whether inferred from images or described by participants – was coded and classified into a set of predefined thematic categories, such as storage strategies, spatial adaptation and circulation patterns, and evaluative categories, such as positive, neutral or negative sentiment.

The behavioural instances were then embedded within the corresponding three-dimensional digital models as descriptive metadata, enabling a spatialised representation of everyday practices. Each entry in the dataset was linked to a precise physical location within the flat, its corresponding behavioural theme, any spatial or ergonomic constraints influencing the behaviour and an evaluation of user sentiment associated with that practice.

This coding framework not only allowed for detailed spatial-behavioural analysis but also supported the development of evidence-based insights into how design influences the lived experience in compact housing environments. The following page illustrates this process.

Research Methods, Prototypes & Materials



The figure above illustrates the behavioural coding and categorisation process for Case PHTR1 by spatially mapping inhabitant actions onto the interior layout.

Research Methods, Prototypes & Materials

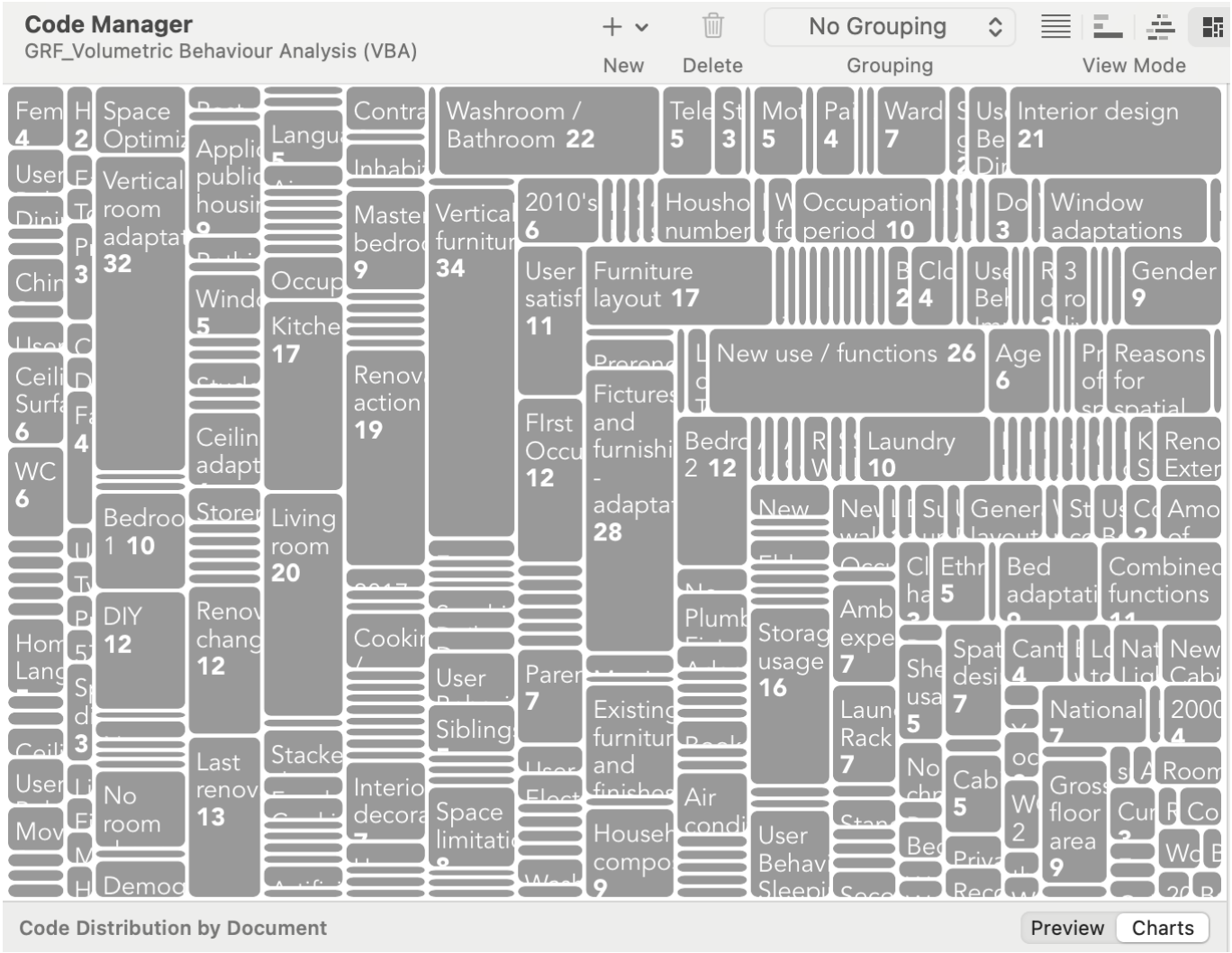
Part 3: Spatialisation, Coding and Analysis

To enable comprehensive interpretation, spatialised behavioural data were prepared for both quantitative and qualitative analysis.

For the quantitative component, the researchers conducted an analysis of variance to identify statistically significant trends and variations in inhabitant behaviour across different spatial configurations. In parallel, qualitative data were coded and analysed using ATLAS.ti to uncover recurring patterns, thematic relationships and contextual nuances between behaviours and their associated spatial conditions.

This integrated approach – combining spatial, statistical and narrative data – is defined as *volumetric behaviour analysis*, a method designed to bridge design intention and lived experience by examining how domestic space is shaped and adapted through everyday practices.

Research Methods, Prototypes & Materials



An excerpt from ATLAS.ti is presented above, illustrating the coding process used to identify patterns, thematic relationships and contextual insights linking inhabitant behaviours to specific spatial conditions.

Research Methods, Prototypes & Materials

Part 4: Comparison of the Model and the Lived

In Part 4, algorithmic analysis was employed to identify spatial zones within the sampled flats that demonstrated either a high density of inhabitant behaviours or notable divergences between the intended design and the actual lived experience.

The algorithm processed spatialised behavioural data at defined resolutions, enabling researchers to visualise the frequency, clustering and distribution of behaviours across various interior zones.

This analytical approach facilitated the identification of critical areas – such as zones of congestion, underutilised spaces or sites of behavioural adaptation – that can inform design refinement and resource allocation.

When scaled to larger datasets, this method holds potential for generating evidence-based recommendations to enhance housing design, improve user satisfaction and support cost-effective decision-making.

This analysis informed the following section: *Research Outcomes, Findings and Further Research*.

Above: Workflow diagram with the four research steps.

Research Outcomes, Findings & Further Research

GRF Project Outcomes

The GRF project results have been disseminated through three journal articles, three conference papers and various presentations.

Additional outcomes include point cloud files of 20 public housing flats, published in the *Mendeley Data Repository* for digital conservation, research and public study.

Each point cloud is a downloadable, fully three-dimensional record of one public housing flat (see turntable video demonstration here).

Links by case number:

1PHTR1, 3PHNS1, 4PHHA1, 5PHOS2, 6PHHA2, 7PHPS1, 8PHHA3S, 9PHNS2, 10PHHA4, 11PHHA5H, 12PHOS3T, 13PHOC1R, 14PHTT1B, 15PHTT2H, 16PHCO1R, 17PHNS3T, 19PHNS4B, 20PHSH1R, 21PHHA6T – Case 18 failed.

A

Mendeley Data

Volumetric Behaviour Analysis (VBA) - 1PHTR1

Published: 15 July 2024 | Version 2 | DOI: 10.17632/vrxnh3dzv5.2
Contributors: Gerhard Bruyns, Daniel Elkin

Description

This data package comprises a point cloud file obtained using a LiDAR scan of a public high-rise building in Hong Kong. The research project record designates this flat interior as "Case PHTR1". The data scan was conducted through a 12-minute walk-through of the high-rise apartment using a Leica-brand BLK2Go model 3D environment scanner.
The scan provides a detailed description of the layout and arrangement of furniture within the interior of the public high-rise apartment. The data accurately depicts the physical state of the house, enabling the interpretation of the scan to describe the housing conditions of super-tall and super-dense housing units, including their spatial utilisation and user contents. Access to the data is granted only after a one-year period of restriction to ensure the protection of individuals' personal information. The data is provided with the purpose of future research examining housing behaviour in connection to spatial use.

B

Research Outcomes, Findings & Further Research

GRF Project Outcomes

The GRF project results have been disseminated through three journal articles, three conference papers and various presentations.

Additional outcomes include first round interview files of 20 public housing flats, published in the ***Mendeley Data Repository*** for digital conservation, research and public study.

Each semi-structured interview is a downloadable, interview record of one public housing flat (as per screenshot, shown here).

Links by case number:

1PHTR1, 3PHNS1, 4PHHA1, 5PHOS2, 6PHHA2, 7PHPS1, 8PHHA3S, 9PHNS2, 10PHHA4, 11PHHA5H, 12PHOS3T, 13PHOC1R, 14PHTT1B, 15PHTT2H, 16PHCO1R, 17PHNS3T, 19PHNS4B, 20PHSH1R, 21PHHA6T – Case 18 failed.

A

B


Case 1PHTR1

Interviewer 1
Interviewee

Anonymized Version

Interviewer Interviewee

Interviewer: 首先，請問你叫什麼名字？First of all, what is your name?

Interviewee: ---，叫---可以 Interviewee, you can also call me Interviewee.

Interviewer: 請問你今年幾歲 How old are you?

Interviewee: 36

Interviewer: 性別係男，國籍就係 Gender is male, Nationality?

Interviewee: 中國香港 Hong Kong Chinese

Interviewer: 你嘅種族就是中國人 Your ethnicity, Chinese

Interviewer: 你的母語會是 Your mother language

Interviewee: 廣東話 Cantonese

Interviewer: 只有廣東話？Only Cantonese?

Interviewee: 對 Correct

Interviewer: 你的職業是 What is your occupation?

Interviewee: PolyU 社工 Social worker in PolyU

Interviewer: 關係就剛剛有提及，爸爸媽媽和家姐 We talked about household members - father, mother, and sister.

下一個部份是關於你這個房子的使用 We will talk about the usage of your house.

請問你而家喺度住咗幾耐? How long have you lived here?

Interviewee: 很久，應該超過 30 年 We live here for a long time, should be over 30 years

Interviewer: 記得是哪一年搬入嚟住的嗎 Do you remember which year did you move in?

Interviewee: 不記得，應該大廈落成就搬進來住，當時我很細 Not exactly. We should live here since the building completed. I was very small during that time.

Interviewer: 那麼是第一批 So you are the first occupant.

你是如何申請住公屋 How do you apply for public housing?

Interviewee: 我不清楚，是父母當年申請， 30 年前，聽父母說，當年有派不同位置給他們，這是第二個選擇，那麼他們就選擇了這裏，I am not clear about this. It should be my parents who applied it 30 years ago. According to my parents we have been allocated another location and this was the second choice. And they chose here.

Interviewer: 那麼你搬入嚟住之前，知不知道有冇其他人住過? Do you know if anyone live here before?

Interviewee: 沒有，我們是第一批，一落成便進來了 No, we are the first ones who live here. We moved in once the building completed.

Research Outcomes, Findings & Further Research

Research Outcomes

As part of the long-term outcomes, the team is developing a digital housing archive to serve as a resource for both academic and policy-related enquiries.

From the outset, the research team has maintained engagement with the Hong Kong Housing Authority and the Urban Renewal Authority, which will receive a full presentation of the findings and outcomes. Additionally, discussions have taken place with building information modelling software developers to explore the potential influence of this research on future housing design and planning strategies.

The team is also exploring interdisciplinary collaboration by presenting aspects of the study – particularly those focused on cluttered versus uncluttered living environments – to psychologists, with the aim of investigating potential correlations between spatial conditions and psychological well-being.

Research Outcomes, Findings & Further Research

Exhibition: Volumetric Dwelling: Accessing Behaviour Space and Design

Exhibition

Share | Add to Calendar

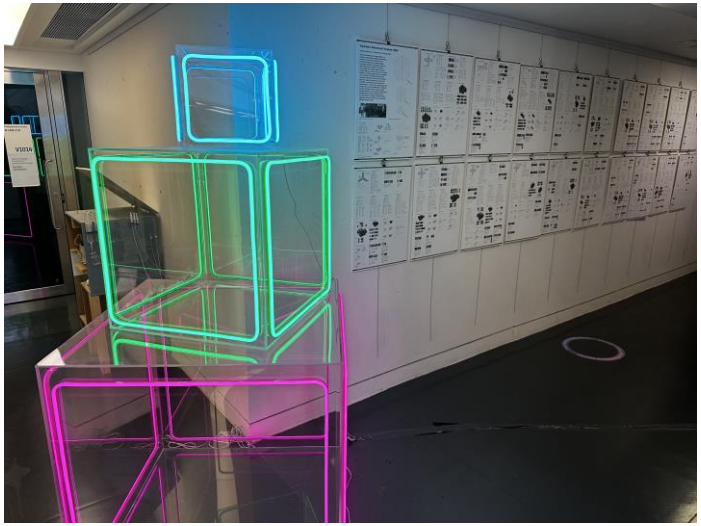
Date
06 Jun - 08 Aug 2025

Organiser
PolyU Design

Time
11:00 - 20:00

Venue
10/F, Block V, PolyU

Map



Summary

Volumetric Dwelling investigates how volumetric and behavioural studies of domestic interiors can inform public housing design in Hong Kong. Recognizing that standardized housing models, shaped by policy and technology, often limit inhabitants' ability to personalize their living spaces, the research compares the "model" (as-designed) and "lived" (as-occupied) conditions in high-rise public housing. By analyzing both quantitative volumetric data and qualitative behavioural adaptations, the study aims to reveal how residents use furniture and fittings to modify their environments, potentially reducing usable space and affecting quality of life. The research involves digital modelling, photographic documentation, surveys, and interviews across 20 diverse public housing flats. Through Volumetric Behaviour Analysis (VBA), the project seeks correlations between spatial changes and behavioural patterns, providing valuable anthropological records and innovative methods for housing science. Ultimately, the findings aim to inform more responsive and effective public housing design, enhancing residents' satisfaction and well-being.

Research Outcomes, Findings & Further Research

POLYU DES'GN

Quick Access

THE HONG KONG POLYTECHNIC UNIVERSITY 香港理工大學

School Study People Students Alumni Knowledge Transfer and Collaboration Research News and Events

Home > News and Events > Events >

2025 Design Research Impact and Global Insights Colloquia Cum Exhibition

Event Seminar Conference & Seminar Exhibition

Share | Add to Calendar | Register Now

Date
25 Aug - 31 Oct 2025

Organiser
PolyU Design & PolyU SFT

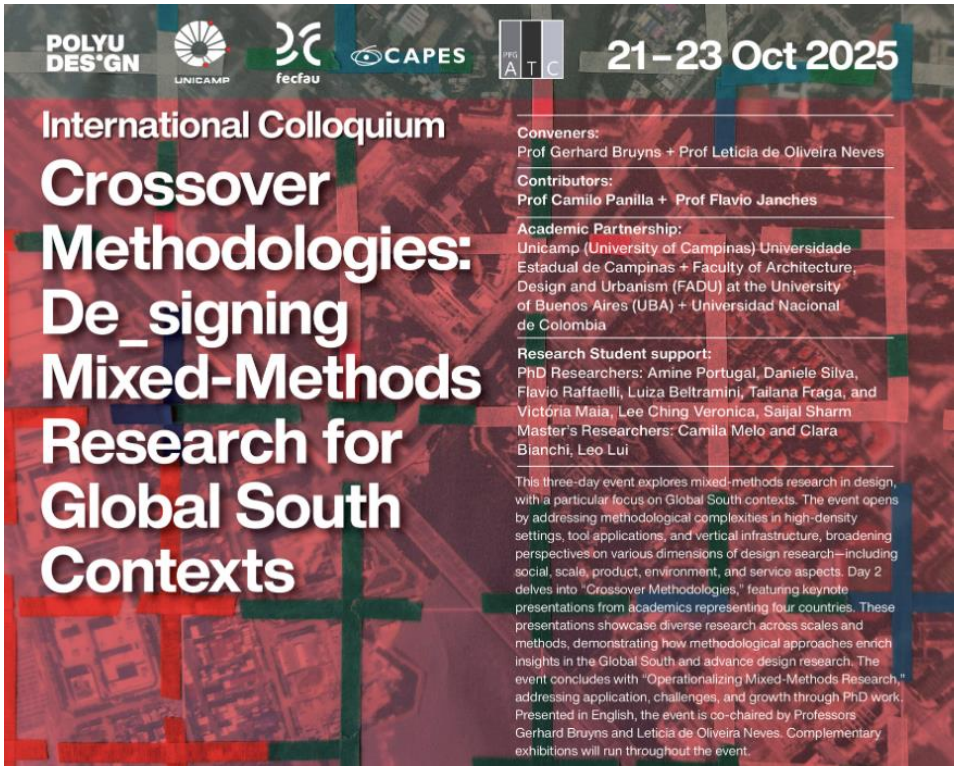
Time
10:00 - 18:00

Venue

Speaker
Moderator, Panel Discussion Chair: Prof. Yan Tina LUXIMON
Prof. Kun Pyo LEE
Prof. Peter HASDELL
Prof. Kit YICK
Dr Markus WERNLI
Dr Aria YANG

Posture Correction Gridle on Adolescents with Early Scoliosis
House of Dreams: Designing Circularity
Habibi Community Centre: Placemaking and Community Resilience
Volumetric Behavioural Analysis (VBA) of Hong Kong Public Housing Flats, Space, Behaviour, and Design
Boat People Housing Culture: An In-depth Case Study of Tai O Village
The South China Sea Monument
Ghost Islands as Ecological Intervention
The Development of a Gamified Interactive XR Structure to Enhance the Participation of Recycling

Research Outcomes, Findings & Further Research



Research Outcomes, Findings & Further Research

[Video]

Original screen capture removed for copyright reasons. Please refer to the link provided.

Re-Politicizing the urban: Commoning technicities in Hong Kong's Umbrella Movement

Research Outcomes, Findings & Further Research

Findings

While data analysis is ongoing, the preliminary findings indicate two emerging trends. First, there appears to be a relationship between highly cluttered domestic environments and certain behavioural patterns, indicating that spatial conditions may influence residents' moods, habits and psychological responses.

Second, contrary to conventional assumptions, many residents do not express concern about clutter levels. Their spatial organisation practices seem to arise from habit or necessity rather than from intentional preferences for order or disorder.

Research Outcomes, Findings & Further Research

Future Research

For further research, Gerhard Bruyns is continuing to seek funding to extend this methodological framework to the analysis of common areas within public housing estates – referred to as common shared facilities.

This next phase aims to investigate how shared spaces shape social behaviours, spatial attitudes and practices of commoning, thereby linking individual domestic environments to broader urban and communal dynamics.

Research Dissemination

Website

Year	Type of dissemination
2025	Website for public access *https://www.morpho.work/*

Research Dissemination

Colloquium & Symposium

Year	Types of dissemination
2023	Colloquium *Colloquium on Human and Spatial Cognition [HSC] for Human Centric Design* *The School of Design, PolyU, Hong Kong SAR* *https://www.polyu.edu.hk/sd/news-and-events/events/2023/6/1-colloquium-on-hsc/?sc_lang=en*
2025	School Lecture *Digital Design Techniques* *School of Design and the Built Environment, Faculty of Arts and Design* *University of Canberra*
	Design Research Symposium *UNICAMP University, Brazil (to be held October 21–24)* *https://www.fecfau.unicamp.br/pos/*

Research Dissemination

Book Launch & Exhibition

Year	Types of dissemination
2023	Book launch *Re-Politicizing the Urban: Commoning Technicities in Hong Kong's Umbrella Movement* *Online: Architecture, Urban Space & Politics YouTube Channel* *https://www.youtube.com/watch?v=J5jf9hdox4Y*
2025	Exhibition : *Volumetric Dwelling: Accessing Behaviour Space and Design* *The School of Design, PolyU. June 6 – August 8, 2025* *https://www.polyu.edu.hk/sd/news-and-events/events/2025/6/6-volumetric-dwelling/?sc_lang=en*
2025	Exhibition: *Design Research Impact and Global Insights Colloquia Cum Exhibition* *The School of Design, PolyU. August 25 – October 31, 2025* *https://www.polyu.edu.hk/sd/news-and-events/events/2025/8/25-2025-design-research-impact-and-global-insights-colloquia-cum-exhibition/?sc_lang=en*

References

1) Aureli, P. V. (2011). *The possibility of an absolute architecture*. Cambridge, Mass: MIT Press.

2) Blomberg, J., & Burrell, M. (2012). An Ethnographic Approach to Design. In J. A. Jacko (Ed.), Human Computer Interaction Handbook (3rd ed., Vol. 1, pp. 1025–1051). Routledge. https://doi.org/10.1201/b11963-ch-45

3) Bruyns, G. (2018). Tactical interiority; Hong Kong's "lived" interiors as praxis for tactical living in High-Density landscapes. Interiors : design, architecture, culture, 9(3), 346-371. https://doi.org/10.1080/20419112.2019.1642571

4) Bruyns, G. (2016). Model and the lived, beyond the 60m2 mean : an investigation into Hong Kong's domestic models and its 'Square Foot Society.

5) Bruyns, G., & Lee, V. (2016). *The interpolated Hongs*. (BA (Hons) Environment & Interior Design graduation research and design project). The Hong Kong Polytechnic University, Hong Kong.

6) Chapman, M. V., Wu, S., & Zhu, M. (2017). What is a picture worth? A primer for coding and interpreting photographic data. *Qualitative Social Work : QSW : Research and Practice*, *16*(6), 810–824. https://doi.org/10.1177/1473325016650513

7) Clark, W. A. V., Gibb, K., & Clapham, D. (2012). *The SAGE handbook of housing studies*. SAGE.

8) Deng, Y., Chan, E. H. W., & Poon, S. W. (2016). Challenge-driven design for public housing : The case of Hong Kong. *Frontiers of Architectural Research*, *5*(2), 213–224. https://doi.org/10.1016/j.foar.2016.05.001

9) Dewolf, C. (2016, December 15). The Vertical City Part II: Why half of Hong Kong lives in public housing. ***ZolimaCityMag.*** https://zolimacitymag.com/the-vertical-city-part-ii-why-half-of-hong-kong-lives-in-public-housing/

References

10) Gottlieb, B., & Hang, K. (2011). *Hong Kong's poorest living in 'coffin homes.'* CNN Online. http://edition.cnn.com/2011/WORLD/asiapcf/07/25/hongkong.coffin.homes/

11) Han, F., Shin, K., & Chow, D. (2016). User-centred design approach for hydrotherapy wetsuit. International journal of fashion design, technology and education, 9(1), 16-22. doi: 10.1080/17543266.2015.1103785

12) Harvey, D. (2012). *Rebel cities: From the right to the city to the urban revolution*. London: Verso.

13) Hei, C.L. (2025, February 13). Why some Hong Kongers live in homes smaller than a parking space, by the number. *AP News.* https://apnews.com/article/hong-kong-subdivided-flats-numbers-21b31a68ab38cd148581b02dd87dd9e9

14) Heynen, H. (1999). *Architecture and modernity: A critique*. Cambridge, Mass: MIT Press.

15) Hong Kong Housing Authority. (2024, March, 31). *Annual report & financial statements 2023/24. Housing for millions building for bliss*. https://www.housingauthority.gov.hk/mini-site/haar2324/common/pdf/01-Key-Figures.pdf

16) Huang, R. (2021). Informal housing in global cities: case studies on Hong Kong, New York City and Toronto. Toronto Metropolitan University. Thesis. https://doi.org/10.32920/ryerson.14661021.v1

17) Hui, E. C. M. (2001). Measuring Affordability in Public Housing from Economic Principles: Case Study of Hong Kong. *Journal of Urban Planning and Development*, *127*(1), 34–49. https://doi.org/10.1061/(ASCE)0733-9488(2001)127:1(34)

18) Lai, L. W. (2000). *Planning Buildings for a High-Rise Environment in Hong Kong: A Review of Building Appeal Decisions* (1st ed.). Hong Kong University Press. https://doi.org/10.1515/9789882202436

19) Lathouri, M. (2019). Imagining the space in-between: The elaboration of a method. Arhitektura, Raziskave, 173–268.

References

20) Lee, Y. (2007). *Design participation tactics: Involving people in the design of their built environment*. Hong Kong: Hong Kong Polytechnic University .

21) Lui, H., & Suen W. (2011). The effects of public housing on internal mobility in Hong Kong. Journal of Housing Economics, 20(1). doi: 10.1016/j.jhe.2010.11.001

22) Madden, R. (2010). *Being ethnographic: A guide to the theory and practice of ethnography*. London: SAGE.

23) Madden, D. J., & Marcuse, P. (2016). *In defense of housing: The politics of crisis*. London: Verso.

24) Marshall–Baker A. (2000). Reformulating interior design in the year 2000. Proceedings of Interior Design Educators Council Conference, 87–88.

25) Paavilainen, H., Ahde-Deal, P., & Koskinen, I. (2017). Dwelling with design. The Design Journal, 20(1), 13-27. doi: 10.1080/14606925.2016.1223783

26) Panero, J., & Zelnik, M. (1979). Human dimension and interior space: A source book of design reference standards. London: Architectural Press.

27) Saysching. (2025). Hong Kong: Montane Mansion at Quarry Bay. ***Saysching.*** https://saysching.com/2017/11/15/quarry-bay/

28) Shen, Q. (1986). *Low-Income public housing in Hong Kong and Singapore, 1950–1980: A comparative analysis*. (MA thesis). The University of British Columbia.

29) Skinner, B. F. (1938). *The behavior of organisms: an experimental analysis*. Appleton-Century.

References

30) Smart, A. (2006). *The Shek Kip Mei myth : squatters, fires and colonial rule in Hong Kong, 1950-1963*. Hong Kong University Press.

31) Turner, J. (1972). *Freedom to build: Dweller control of the housing process* (R. Fichter Ed.). New York: Collier- Macmillan.

32) Vesely, D. (2016). Between architecture and the city. In (pp. 151–166).

33) Wong, Y. C. R. (2015). *Hong Kong Land for Hong Kong People: Fixing the Failures of Our Housing Policy* (1st ed.). Hong Kong University Press. https://doi.org/10.1515/9789888313044

34) Yi, B. (2018). From “cardboard nannies” to “fruit money”: Fast-paced Hong Kong slow to adapt to its elderly. https://news.trust.org/item/20181031005809-3mnfe/

35) Zheng, W., Shen, G., Wang, H., & Lombardi, P. (2015). Critical issues in spatial distribution of public housing estates and their implications on urban renewal in Hong Kong. *Smart and Sustainable Built Environment*, *4*(2), 172–187. https://doi.org/10.1108/SASBE-09-2014-0047