FOSTERING BEHAVIOUR CHANGE FOR PANDEMIC PREVENTION AND CONTROL THROUGH PUBLIC SPACE DESIGNS IN HEFEI, CHINA

By

LIU JING

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

December 2022

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DEDICATION

I dedicate this work to:

Those who have a special and critical place in my heart, especially for my beloved family members.

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for degree of the Doctor of Philosophy

FOSTERING BEHAVIOUR CHANGE FOR PANDEMIC PREVENTION AND CONTROL THROUGH PUBLIC SPACE DESIGNS IN HEFEI, CHINA

By

LIU JING

December 2022

Chairman : TS. Khairul Manami Kamarudin, PhD
Faculty : Design and Architecture

Due to urbanisation and globalisation, pandemics and their devastating impacts have triggered an unprecedented crisis in all spheres of human society. Currently, people across the globe have suffered from several waves of the Coronavirus Disease 2019 (COVID-19) pandemic, so it is highly significant to develop public health solutions for pandemic prevention and control. In addition to antiviral medicines and vaccines, protective behaviours, such as face mask-wearing, hand hygiene, social distancing, and contact reduction can also limit the spread of viruses. Currently, authorities have launched policies and legislation to promote public behaviour change. However, many people in Hefei, China have difficulties adhering to performing the recommended protective behaviour during pandemics. One main reason is that current design interventions cannot play a role in prompting people's behaviour change for pandemic prevention and control. Hence, this study strives to develop a research framework and propose strategies to improve the current design interventions in public spaces, and finally provide support for people's pandemic-related behaviour change. The disadvantageous condition and successful pandemic prevention experience have made Hefei a fit laboratory for conducting pandemic-related research. Four studies were carried out to achieve the research objective. First, this study examined the existing pandemic situation in public spaces in Hefei, China. After that, the researcher identified seven key challenges and six design limitations of behaviour change during pandemics and then prioritized them through three Nominal Group Technique (NGT) discussions. Second, based on the literature review and user interview results (N=22), this study determined nine key factors influencing people's behaviour change. These key factors were categorized into four main aspects: perceptional factors (attitudes, subjective norms and perceived behaviour control, risk perceptions), social factors (knowledge and information dissemination, governmental regulations), physical factors (tools and facilities and surveillance), and sociocultural factor (cultural contexts). Third, this research developed a behaviour change framework that reveals people's behaviour change intention and formation process during pandemics. After that, the researcher carried out an empirical study (N=549) to quantify relationships among variables in the

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behaviour change framework and further improve it. A Structural Equation Modeling (SEM) approach was employed during this process. According to the above findings, the researcher forwarded a strategic public design framework to promote pandemic-related behaviour change. Finally, the frameworks were validated by an expert survey (N=5). Overall, this study explores the potential of integrating public health, behaviour science, and design science under a pandemic context, contributing to the knowledge of "design for behaviour change" and "design for pandemic prevention and control". The proposed research framework is an integration, extension and improvement of the previous behaviour theories, as well as implementation under a new context. Besides, this study provides valuable insights for different stakeholders, including designers, policymakers, and administrators in public spaces when dealing with pandemic situations.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

MEMUPUK PERUBAHAN TINGKAH LAKU UNTUK PENCEGAHAN DAN KAWALAN PANDEMIK MELALUI REKA BENTUK RUANG AWAM DI HEFEI, CHINA

Oleh

LIU JING

Disember 2022

Pengerusi : TS. Khairul Manami Kamarudin, PhD
Fakulti : Rekabentuk dan Senibina

Disebabkan oleh urbanisasi dan globalisasi, wabak penyakit dan kesan buruknya telah mencetuskan krisis yang tidak pernah berlaku sebelum ini dalam semua tahap masyarakat. Kini, manusia di seluruh dunia telah mengalami beberapa gelombang pandemik Penyakit Koronavirus 2019 (COVID-19), oleh itu, hal ini penting untuk membangunkan solusi kesihatan awam untuk pencegahan dan kawalan wabak. Selain ubat antivirus dan vaksin, langkah-langkah melindungi diri seperti memakai topeng muka, membersih tangan, mengamalkan penjarakkan sosial, dan pengurangan sentuhan juga boleh mengehadkan penyebaran virus. Mutakhir ini, pihak berkuasa telah melancarkan polisi dan perundangan untuk menggalakkan perubahan tingkah laku awam. Namun, ramai masyarakat di Hefei, China menghadapi kesukaran untuk mematuhi langkah-langkah perlindungan yang disyorkan sepanjang pandemik. Salah satu sebab utama ialah campurtangan reka bentuk sedia ada tidak dapat memainkan peranan dalam menggesa perubahan tingkah laku manusia untuk mengawal dan mengelak pandemik. Justeru, kajian ini berusaha membina satu rangka kerja penyelidikan dan mencadangkan strategi untuk menambahbaik campurtangan reka bentuk sedia ada untuk reka bentuk kawasan awam, dan akhirnya memberi bantuan kepada perubahan tingkah-laku manusia berkaitan pandemik. Keadaan yang merugikan dan pengalaman pencegahan wabak yang berjaya telah menjadikan Hefei sebagai makmal yang sesuai untuk menjalankan penyelidikan berkaitan pandemik. Empat kajian telah dijalankan untuk mencapai objektif kajian. Pertamanya, kajian ini mengkaji keadaan pandemik yang sedia ada di tempat awam di Hefei, China. Kemudian, penyelidik mengenal pasti tujuh cabaran utama dan enam batasan reka bentuk perubahan tingkah laku semasa pandemik dan kemudian mengutamakannya melalui tiga perbincangan Teknik Kumpulan Nominal (NGT). Kedua, berdasarkan kajian literatur dan hasil temu bual pengguna (N=22), kajian ini menentukan sembilan faktor utama yang mempengaruhi perubahan tingkah laku manusia. Faktor-faktor utama ini dikategorikan kepada empat aspek utama iaitu faktor persepsi (sikap, norma subjektif dan tanggapan kawalan tingkah laku, persepsi risiko), faktor sosial (penyebaran pengetahuan dan maklumat, peraturan dan undang-undang kerajaan), faktor fizikal (alat dan kemudahan serta pengawasan), dan faktor sosiobudaya

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(konteks budaya). Ketiga, penyelidikan ini membangunkan rangka kerja perubahan tingkah laku yang menunjukkan niat perubahan tingkah laku dan proses pembentukan semasa pandemik. Selepas itu, pengkaji menjalankan kajian empirikal (N=549) untuk mengukur hubungan antara pemboleh ubah dalam rangka kerja perubahan tingkah laku dan seterusnya memperbaikinya. Pendekatan Pemodelan Persamaan Struktur (SEM) telah digunakan untuk proses ini. Berdasarkan penemuan di atas, penyelidik mengemukakan rangka kerja reka bentuk tempat awam yang strategik untuk menggalakkan perubahan tingkah laku berkaitan pandemik. Akhir sekali, rangka kerja tersebut disahkan oleh tinjauan pakar (N=5). Secara keseluruhan, penyelidikan ini meneroka potensi menghubungkait kesihatan awam, sains tingkahlaku, dan sains reka bentuk di bawah konteks pendemik, seterusnya menyumbang kepada pengetahuan tentang "Reka bentuk untuk perubahan tingkah laku" dan "Reka bentuk untuk pencegahan dan kawalan pandemik". Rangka kerja kajian yang dicadangkan adalah dari integrasi, pelanjutan dan penambahbaikan teori tingkah laku sebelumnya, serta perlaksanaan di bawah konteks baharu. Selain itu, kajian ini memberi pandangan berharga kepada pihak berkepentingan, termasuk pereka bentuk, penggubal dasar dan pentadbir di tempat awam apabila berhadapan dengan situasi pandemik.

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This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Khairul Manami binti Kamarudin, PhD
Senior Lecturer Ts.
Faculty of Design and Architecture
Universiti Putra Malaysia
(Chairman)

Rosalam bin Che Me, PhD
Senior Lecturer Ts.
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

Ruhaizin bin Sulaiman, PhD
Senior Lecturer
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 8 June 2023

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Signature: _____
Name of Chairman of Supervisory Committee: Ts. Dr. Khairul Manami Kamarudin

Signature: _____
Name of Member of Supervisory Committee: Ts. Dr. Rosalam Che Me

Signature: _____
Name of Member of Supervisory Committee: Dr. Ruhaizin bin Sulaiman

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TABLE OF CONTENTS

		Page
ABSTRACT		i
ABSTRAK		iii
ACKNOWLEDGEMENTS		v
APPROVAL		vi
DECLARATION		viii
LIST OF TABLES		xiv
LIST OF FIGURES		xv
LIST OF APPENDICES		xvii
LIST OF ABBREVIATIONS		xviii
CHAPTER		
1	**INTRODUCTION**	1
	1.1 Introduction	1
	1.2 Background	1
	1.3 Problem statement	5
	1.3.1 Challenging Behaviour Change during Pandemics	5
	1.3.2 Public Spaces in the Hefei Context	5
	1.3.3 The China Context	6
	1.3.4 Lack of Research on Designing for Behaviour Change during Pandemics	7
	1.4 Research Questions	8
	1.5 Research Objectives	8
	1.6 Research Scope	9
	1.7 Significance of Research	9
	1.8 Outline of Thesis	10
	1.9 Structure of Thesis	12
2	**LITERATURE REVIEW**	13
	2.1 Introduction	13
	2.2 The Definition of Terms	14
	2.2.1 Behaviour Change	14
	2.2.2 Pandemic	14
	2.2.3 The City of Hefei	15
	2.2.4 Public Space	15
	2.3 The Review of Pandemic	15
	2.3.1 The Origination of Pandemic	15
	2.3.2 Historical Pandemics	16
	2.4 Interventions for Pandemic Prevention and Control	17
	2.4.1 Public Service Platforms	17
	2.4.2 Social Control Measures	19
	2.4.3 Design and Practices during Pandemics	21
	2.5 Individual Behaviour Change during Pandemics	24
	2.5.1 Face Mask-wearing	25

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	2.5.2	Hand Hygiene	25
	2.5.3	Social Distancing	26
	2.5.4	Contact Reduction	26
2.6	Behaviour Change Theories and Models		27
	2.6.1	The Key Components of Behaviour Change	27
	2.6.2	The Overview of Behaviour Change Theories	28
2.7	The Comparison of Behaviour Change Theories		35
2.8	Theories of Designing for Behaviour Change		36
	2.8.1	Lilley's Model	37
	2.8.2	Lockton's Design with Intent Toolkit	38
	2.8.3	Defining the Process of Behaviour Change: The DECIDE Model	39
	2.8.4	The Behaviour Change Wheel	40
	2.8.5	Wang's framework: Message Framing Effects on Health Behaviour Change	41
2.9	Key factors influencing behaviour change during pandemics		42
	2.9.1	Attitudes	42
	2.9.2	Subjective Norms	43
	2.9.3	Perceived Behaviour Control	43
	2.9.4	Risk Perceptions	44
	2.9.5	Information and Knowledge Dissemination	45
	2.9.6	Cultural Contexts (Individualism/collectivism)	45
2.10	Conceptual Framework		46
2.11	Summary		47
	2.11.1	Insights from existing behaviour change models	48
	2.11.2	Insights from existing designing for behaviour change models	50
3	**METHODOLOGY**		52
3.1	Introduction		52
3.2	Research Paradigm		52
3.3	Research Methodology		53
3.4	Research Design Framework		55
3.5	Study One: Identification		56
	3.5.1	Observation	56
	3.5.2	NGT	58
3.6	Study Two: Research Framework Construction		60
	3.6.1	Thematic Analysis Method	60
	3.6.2	Research Site and Sample	61
	3.6.3	Data Collection and Analysis	61
3.7	Study Three: Research Framework Refinement		63
	3.7.1	Structural Equation Modeling (SEM)	63
	3.7.2	Measurement Items Construction and Questionnaire Design	63
	3.7.3	Research Site and Sampling	64
	3.7.4	Data Collection and Analysis	65
3.8	Research Framework Validation		66
3.9	Triangulation		66
3.10	The Summary of Chapter		67

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4	**RESULTS AND FINDINGS**		68
	4.1	Introduction	68
	4.2	Findings of Study One	68
		4.2.1 The Existing Situation of Behaviour Change during Pandemics	68
		4.2.2 Background of Informants in NGT Discussion	77
		4.2.3 Key Challenges of Behaviour Change during Pandemics	78
		4.2.4 Limitations of Current Designs for Behaviour Change during Pandemics	80
		4.2.5 The Summary of NGT Discussion	82
	4.3	The Finding of Study Two	82
		4.3.1 Background of Informants in User Interview	82
		4.3.2 Key Factors Derived from Interview	84
		4.3.3 The Behaviour Change Framework Development	93
		4.3.4 The Design Role in Promoting Individual Behaviour Change during Pandemics	97
		4.3.5 The Summary of Study Two	102
	4.4	Findings of Study Three	102
		4.4.1 Questionnaire Design and Sampling	102
		4.4.2 Background of Informants in Questionnaire Survey	105
		4.4.3 Preliminary Analysis	106
		4.4.4 Measurement Model	108
		4.4.5 Structural model Analysis	111
		4.4.6 Summary of Study Three	112
	4.5	The Summary of Chapter	112
5	**DISCUSSION OF FINDINGS**		113
	5.1	Introduction	113
	5.2	The Proposed Behaviour Change Framework	113
	5.3	The Proposed Strategic Public Design Framework	117
		5.3.1 Achieve Automatic Surveillance in a Broad Coverage	118
		5.3.2 Develop New Interactive Modes to Reduce Behaviour Change Difficulties	119
		5.3.3 Improve Behaviour Change Experience	119
		5.3.4 Take Advantage of Cultural Context in Publicity	120
		5.3.5 Focus on Needs of Diverse User Groups	120
		5.3.6 Design for Emotional Regulation to Address Pandemic Fatigue	121
	5.4	The Validation of Research Framework	121
		5.4.1 The Informants and Validation Process	121
		5.4.2 The Result of Validation	122
	5.5	The comparison study to the two finalised frameworks	125
6	**CONCLUSION**		128
	6.1	Introduction	128
	6.2	The Review of Research Questions	128

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6.2.1 What is the Existing Situation of Behaviour Change during Pandemics in Public Spaces in Hefei, China 128
6.2.2 What are the Key Factors Influencing People's Behaviour Change during Pandemics 129
6.2.3 How to Develop a Research Framework to Promote Individual Behaviour Change during Pandemics 130
6.2.4 How to Validate the Effectiveness of the Research Framework Forwarded in the Current Study 131
6.3 Implications 131
6.3.1 Theoretical Implications 131
6.3.2 Practical Implications 132
6.3.3 Policymaking Implications 132
6.4 Knowledge Contributions 133
6.5 Limitations and Recommendations for Future Research 133

REFERENCES 135
APPENDICES 158
BIODATA OF STUDENT 183
LIST OF PUBLICATIONS 184

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LIST OF TABLES

Table		Page
2.1	Some major pandemics since the 20th century	17
2.2	Core components of behaviour change	27
2.3	The comparison of various behaviour change theories	36
3.1	The comparison between participant observation and non-participant observation	57
3.2	Qualitative descriptions for Cronbach Alpha (α) values	66
4.1	Demographic profile of participants in NGT discussion	77
4.2	People's perceived challenges for behaviour change during pandemics	78
4.3	Limitations of current design interventions for behaviour change during pandemics	81
4.4	Demographic profile of informants in the interview	83
4.5	Latent variables and measurement items	103
4.6	Demographic information of participants	105
4.7	Results of reliability analysis	106
4.8	SPSS output for KMO and Bartlett's Test	107
4.9	SPSS output for Rotated Factor Matrix	107
4.10	Reliability and unidimensionality	108
4.11	Correlation matrix of the measurements	110
4.12	Goodness-of-fit of model	110
4.13	The results of path analysis	111
4.14	The results of Moderating Effect testing	112
5.1	Personal information of experts in the validation process	122

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LIST OF FIGURES

Figure		Page
1.1	A press conference launched by the Chinese government to elaborate on DCZS	4
1.2	The dynamic COVID-zero strategy in the normalisation stage of pandemic prevention	5
1.3	Structure of thesis	12
2.1	The literature review construct	13
2.2	The interface of China government website	19
2.3	Graphic design for indigenous communities in Choco, Colombia to promote behaviour change during COVID-19	23
2.4	Cognitive process of protection motivation theory	29
2.5	The Theory of Planned Behaviour (TPB) model	30
2.6	The Social Cognitive Theory	31
2.7	Diffusion of Innovation Adopter Categories	33
2.8	Conceptual framework of DOI model.	33
2.9	The Health Belief Model	35
2.10	Lilley's model for behaviour change	37
2.11	Lockton's design toolkits for behaviour change	38
2.12	The DECIDE model	39
2.13	Behaviour Change Wheel	40
2.14	Message Framing Effects on Health Behaviour Change in Different Stages	41
2.15	Conceptual framework	47
3.1	Exploratory sequential research design	54
3.2	Research design framework	55
3.3	Five steps of NGT discussion	60
3.4	Six procedures of thematic analysis	62

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3.5	Research framework validation steps	65
4.1	The smart detection doors in railway stations	69
4.2	The smart detection doors in a hospital	69
4.3	Publicity poster in a governmental administration hall (left) and highway station (right)	70
4.4	Publicity board hand hygiene in a governmental administration department	70
4.5	The user interface of the “Tencent News” APP	71
4.6	Self-service handwashing devices and hand sanitiser	72
4.7	Social distancing signs and clapboard on seats and ground	73
4.8	ace masks vending machine (left) and QR code signs and thermo-detectors (right)	73
4.9	Takeaway storage and pickup cabinets	74
4.10	People’s behaviour change in a hospital	76
4.11	Key factors influencing people’s behaviour change during pandemics	93
4.12	Hypothetical behaviour change framework	96
5.1	The proposed behaviour change framework	114
5.2	Strategic public design framework	118
5.3	The applicability of research framework and design strategy	123
5.4	The applicability of research framework and design strategy	124
5.5	The applicability of research framework and design strategy	124
5.6	The final version of behaviour change framework	126
5.7	The final version of strategic public design framework	127

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LIST OF APPENDICES

Appendix		Page
A1	Questions for NGT Discussion	158
A2	NGT Discussion Scenes	159
B1	Interview Consent for Participation in Study 2 (English Version)	160
B2	User Interview Protocols (English Version)	161
B3	Themes and Codes of Interview Data	162
B4	Sample of Transcript in Interview (Translated from Chinese)	164
C	The Questionnaire in Study 3 (English Version)	167
D	Expert Validation Survey for Research Framework	175

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LIST OF ABBREVIATIONS

COVID-19	Coronavirus disease 2019
WHO	World Health Organization
CDC	Center for Disease Control and Prevention
DCZS	Dynamic COVID-Zero Strategy
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
SCT	Social Cognitive Theory
DOI	Diffusion of innovation theory
HBM	Health Belief Model
PMT	Protection Motivation Theory
NGT	Nominal group technique
CFA	Confirmatory factor analysis
SEM	Structural equation modelling
CB-SEM	Covariance-based Structural Equation Modeling
PLS-SEM	Partial Least Squares Structural Equation Modeling
EFA	Exploratory factor analysis

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter illustrates the research background and problem statement, which are the impetus for the study. First, we briefly demonstrated pandemic situations and their impacts, the significance of behavioural change during pandemics, and the integration of design science and behavioural change under a global pandemic background. After that, three research problems were posed accordingly, including the challenge of behaviour change during pandemics, a lack of research and exploration of this issue, and the existing problems in the China and Hefei contexts.

Additionally, this chapter demonstrates the research questions, objectives, and scope, thus establishing the main research direction of this research. The research significance is subsequently illustrated, including theoretical and practical facets. The final section includes the structure and outline of this thesis at the end of this chapter, from which readers can have a basic understanding of the whole study.

1.2 Background

Since the 19th century, pathogenic viral outbreaks have resulted in complex transmission among humans and other species, posing grave threats to public health and safety (Goyal & Gupta, 2020; Reperant & Osterhaus, 2017). This process escalates due to various anthropogenic activities and their impacts, including extreme forms of predatory behaviour, warfare, colonisation, travel, agriculture, habitat fragmentation, urbanisation, and industrialisation (Piret & Boivin, 2021). Over the past decades, humans have experienced much suffering from various pandemics, such as Middle East respiratory syndrome coronavirus (MERS-CoV), hemorrhagic fever viruses (Lassa, Ebola), severe acute respiratory syndrome coronavirus (SARS-CoV), and the 2009 H1N1 Pandemic (H1N1pdm09 virus) (Reperant & Osterhaus, 2017; Weber et al., 2016; De Groot et al., 2013; Khanna et al. 2009). These pandemics have left significant and devastating influences on various facets of human society, including economic, financial, social, and environmental, regarding devastating influences (Goyal & Gupta, 2020). The recent COVID-19 pandemic triggered a global catastrophe that dramatically undermined social security and economies (Sharma et al., 2020). Unfortunately, although humans have overcome many past pandemics in different ways, they may face another pandemic soon, and its time and pathogen are unpredictable (Piret & Boivin, 2021). Thus, developing public health solutions for pandemic prevention and control in modern society is pivotal.

When a pandemic occurs, there is often a prolonged and uncertain period before massive vaccination and the successful development of antiviral medicines (Liu et al., 2021). During this period, non-pharmaceutical interventions can act as an effective treatment for containing the spread of viruses (Kamran & Naeim, 2021; Betsch, 2020; Wilder-

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Smith & Freedman, 2020; Bavel et al., 2020). During the COVID-19 pandemic, people worldwide were required to follow strict control measures as suggested by the World Health Organisation (WHO) to mitigate the spread of the virus. These social control measures included quarantine, tracing, social distancing, isolation, etc. (Perra, 2021; Vardoulakis et al., 2020). In this regard, non-pharmaceutical interventions were accompanied by rapid and large-scale individual behaviour change.

Behaviour change can often play a critical role in pandemic prevention and control (Michie & West, 2021; Arden & Chilcot, 2020). One primary reason is that pandemics and human behaviour are often intertwined (Perra, 2021). On the one hand, human behaviour and interactions can drive and accelerate the spread of pandemics. On the other hand, pandemic situations can result in public behaviour change. Bavel et al. (2020) highlighted that behavioural sciences could provide valuable insights for containing pandemics and their impacts. Similarly, Betsch (2020) and Rusou and Diamant (2022) also emphasised that the current COVID-19 pandemic could be contained through large-scale and rapid behaviour change.

On the other hand, practical situations can also reveal the association between individuals' behavioural change and pandemic prevention. At the time of this writing, COVID-19 is out of control in many parts of the world, and most people have suffered from several grave waves of the pandemic. One explanation is that many people fail to adhere to behaviour change rules and perform the recommended protective behaviours (Chan et al., 2021). In contrast, the spread of COVID-19 has been widely restricted in China, despite some disadvantaged factors in containing pandemics, such as population density and high population mobility. Some studies attributed this extraordinary success to people's strict compliance with behaviour change rules (Olufadewa et al., 2021; Xu et al., 2020). Also, Ammar et al.'s (2020) research suggested that more changes in public behaviours were significantly associated with lower COVID-19 fatality rates at the country level. In that regard, behaviour change during pandemics is critical and worthy of exploration for researchers.

Scholars have widely explored and researched individuals' behavioural changes and their determinants during pandemics. In 1919, a paper published in *Science Magazine* revealed the association between public behaviour change and the 1918 Spain flu. It demonstrated several obstacles that prevented public behaviour change (Soper, 1919). Rimal and Real (2003) proposed that access to knowledge and information can influence people's perception of risk and motivate them to perform the recommended behaviour during pandemic situations. In 2010, Bish & Michie (2010) conducted a scoping review and found that several demographic factors and personal beliefs on the effectiveness of the recommended behaviour determined behavioural change. Recently, this topic has become more popular due to the profound impact of COVID-19. For instance, Betsch (2020) argued that large-scale and rapid behavioural change could contribute to limiting the unfolding COVID-19 pandemic. She then posed insights into the factors influencing people's behaviour, such as perceived threats, protective and preparedness behaviours, public trust, knowledge and misinformation.

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Moreover, Bavel et al. (2020) emphasised that social and behavioural sciences could be used to help citizens perform the recommended behaviour for pandemic prevention. They then illustrated various factors behind the public's behaviour change, including political, social, cultural, and perceptional aspects. Ammar et al. (2020) mentioned that individuals' stresses and worries could also directly impact their behaviour change implementations and adoption of protective measures during a pandemic. Additionally, pandemic fatigue, described as an increasing attitude of apathy or resistance during pandemics, can be a non-negligible issue that decreases people's behaviour change intentions (Crane et al., 2021).

Design researchers should assume responsibility for prompting people's behaviour change during pandemics (Clune, 2010). In design fields, the concept of "design for behaviour change" was developed to describe the link between design and human behaviour, referring to using design approaches to alter human behaviour purposely and encourage desirable practices (Cash et al., 2017; Niedderer et al., 2014). This concept dates back to Herbert Simon's (1969) early understanding of design, which is acknowledged as the capacity to create change by "devising courses of action to change existing situations into preferred ones." Following this, Don Norman coined the term "behavioural design" concerning product design in the 1980s. Nowadays, design approaches entail motivating behaviour or persuasion to draw users' attention and prompt them to do something (Niedderer et al., 2014). As Wendel (2020) described in this book "Designing for Behaviour Change", there are currently numerous tools in the design community, from user-centered design to design thinking, which can be applied to steer and guide people's behaviour change. Lilley (2009) mentioned that designers are able to shape and influence human behaviour intentionally. Tromp et al. (2011) stated that the strength of design as a deliberate means to change behaviour had garnered growing interest, especially in sustainable design fields. Thus, this research strives to facilitate individuals' behaviour change during pandemics by integrating design and behaviour sciences knowledge.

This study was conducted under a normalisation stage of the pandemic prevention context in China. In 2021, the Chinese government developed a "Dynamic COVID-Zero Strategy" (DCZS) to contain the highly contagious "Delta variant" virus. Figure 1.1 demonstrates a press conference launched by the Chinese government, during which National Health Commission members elaborated on DCZS to the public. DCZS is a conclusion of the Chinese experience in coping with COVID-19 in the post-pandemic era, aiming to limit the spread of viruses at a higher level, at a lower cost, and in a shorter period (Ding and Zhang, 2022; Liu et al., 2022; Zhou et al., 2021). Based on big data technology and large-scale nucleic acid testing, public health agencies can rapidly find, control, and cure infected people within a specific geographic area (Liu et al., 2022; Liang et al., 2022). During the post-pandemic era, DCZS is a practical and necessary approach to keeping a balance between public health, social security, economies and people's normal lives (Liu et al., 2022).

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Figure 1.1 : A press conference launched by the Chinese government to elaborate on DCZS
(Source : http://www.gov.cn/xinwen/2022-04/29/content_5688078.htm)

According to Liu et al. (2022), there are three pillars in the framework of DCZS: control the source of infection, cut off the transmission routes, and protect susceptible populations; see figure 1.2. In this case, individual behavioural change is a critical component in China's DCZS framework. Compared with other control measures of DCZS, it shows more advantages in some aspects. First, it costs less human and material resources than massive nucleic acid testing. Additionally, people can play a more active role in individual-level behaviour change than in passive compliance with governmental interventions (Liu et al., 2022). During the normalisation of the pandemic prevention period, China's Center for Disease Control and Prevention (CDC) also launched similar behavioural change guidelines to contain the pandemic. The guidelines include wearing face masks, properly washing hands, avoiding touching eyes, nose, and mouth with unwashed hands, reducing contacts, and maintaining social distancing (Wu & Shen, 2021). Based on the above illustration, it is worthwhile to explore the behaviour change situation in China's post-pandemic context.

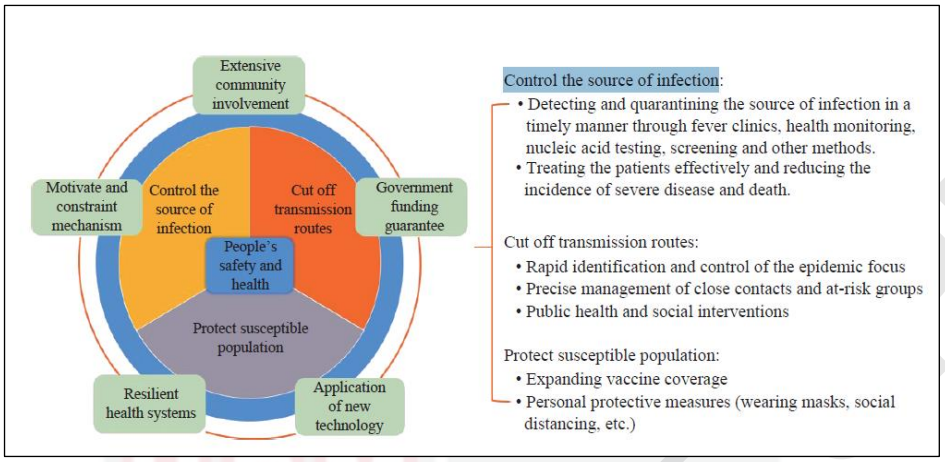

Figure 1.2 : The dynamic COVID-zero strategy in the normalisation stage of pandemic prevention
(Source : Liu et al., 2022)

1.3 Problem statement

1.3.1 Challenging Behaviour Change during Pandemics

Although researchers have realised the significance and necessity of protective behaviours during pandemics, achieving genuine and massive behaviour change is still challenging. During the COVID-19 pandemic, people in many parts of the world still fail to adhere to protective behaviour, which may be attributed to various causes (Chan et al., 2021). On the one hand, law enforcement cannot make efforts for behaviour promotion since it is challenging to achieve surveillance of large geographical areas and populations. On the other hand, people's adherence to preventive strategies may be undermined by contextual factors such as cultures, lifestyles, and living circumstances (Chan et al., 2021). A century ago, Soper (1919) emphasised several factors that led to unwillingness and failure of behaviour change in his paper during the Spanish flu. First, people do not clearly recognise the risk they face. Second, social control measures, such as isolation and social distancing, go against human nature. Third, people may unconsciously act as a danger to themselves or others (Bavel et al., 2020). During the long-lasting pandemic period, pandemic-fatigue may emerge and serve as an unresolved adversity that destroys people's willingness to change their behaviour (World Health Organization, 2020).

1.3.2 Public Spaces in the Hefei Context

In the current study, public spaces are classified as indoor areas that deliver services to urban dwellers. These places are an indispensable part of people's daily life, assuming responsibility for accommodation, recreation, transportation, and communication.

During pandemics, there is an urgent need for re-designing public spaces, primarily due to two causes. On the one hand, current public spaces cannot provide appropriate support for people's behaviour change. On the other hand, public spaces often have a large population density and high population mobility. If people are unwilling to follow behaviour change regulations, these public spaces may become sites where viruses spread quickly among people. Thus, there is an urgent need to design public spaces to facilitate individual behavioural change during pandemics.

At the time of this writing, Hefei had undergone a normalised pandemic prevention situation. This means that people who enter public spaces are required to perform a series of protective behaviours (e.g., mask-wearing, hand hygiene, social distancing) to limit the spread of COVID-19. As long-term and large-scale behaviour change is challenging, the Hefei government has enacted policies and imposed interventions to achieve this goal. These control measures fall into several aspects: First, policymakers launched large campaigns to disseminate knowledge of pandemic-related behaviour to improve people's awareness of behaviour change. Second, occupations and positions were set to check and monitor people's behaviour in public spaces. Third, public facilities and products were designed to support or guide people's behavioural change. However, going through the literature reviews, it can be found that rare studies have been carried out to explore the current behaviour change situations in public spaces in Hefei. Hence, it is still unclear whether these interventions play an effective role in promoting behaviour change during pandemics.

1.3.3 The China Context

China has successfully contained several waves of the COVID-19 pandemic, but there is still a long way to achieve final victory. Several disadvantageous conditions may hinder China's pandemic prevention. First, many people from other countries enter China daily, some of whom may become imported cases. In effect, imported cases have accounted for a significant proportion of infectious patients in China since March 2020. As He et al. (2022) pointed out, imported cases of viruses were a major obstacle to pandemic prevention during the post-pandemic period. Second, pathogenic viruses can be attached to imported goods. Hence, people engaging in cross-border trades, such as dockers, airport workers, and cold-chain food logistics workers, can easily be infected by viruses (Han & Liu, 2021). As the second-largest economy, China depends heavily on foreign trade, which may increase contact transmission risk (Zhang et al., 2017). Third, there are many densely populated urban areas in China where viruses can quickly transmit through various approaches. China's large, unevenly distributed population concentrates mainly in large cities and coastal regions. According to a recent government report, until 2019, China had 20 cities with over 4 million people (National Bureau of Statistics, 2020). In addition, Ding and Zhang also listed three challenges for pandemic prevention in China: repeated pandemic waves, increased downward pressure on the economy and social exhaustion (Ding and Zhang, 2022).

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1.3.4 Lack of Research on Designing for Behaviour Change during Pandemics

Since a global pandemic can undermine public security, economies, and social order at an alarming speed, research related to pandemics is usually topical. Scholars from various fields have contributed their knowledge to pandemic prevention and control, including design research. During pandemics, designers have phenomenal opportunities to exercise ingenious design in many avenues, including isolation and disinfecting materials and equipment, medical equipment and service, treatment planning, surveillance, data analysis, forecasting, and more (Reich, 2020). Similarly, Lai et al. (2020) stated that the current pandemic has raised questions about designing public spaces, providing phenomenal opportunities to rethink/redesign them to keep people safe. In product design fields, Liu et al. (2021) attempted to improve or redesign the current urban furniture for pandemic prevention and control. Thomas et al.'s (2021) and Whitelaw et al.'s (2020) research illustrated various digital health solutions during pandemics, such as inspection, diagnosis, transportation, and isolation. In graphic design, Borzenkova et al. (2021) integrated cultural and gamified elements into poster designs for pandemic-related information dissemination. Regarding the urban design field, Sharifi & Khavarian-Garmsir (2020) summarised four main themes for pandemic-related research during the current COVID-19 pandemic, including environmental quality, socio-economic impacts, management and governance, and transportation, and urban design. Most existing design studies concentrate on developing and producing critical products with complete functionality and usability to cope with pandemics. However, few studies consider how to promote individual behaviour change during pandemics through design interventions.

On the other hand, the concept of "design for behaviour change" has been growingly popular in design sciences and has been explored by many design researchers. Niedderer (2013) summarised four main areas where design approaches were employed to guide intentional behaviour change: sustainability, crime prevention, health promotion (usually based on wearable devices), and safety design. Fogg (2002) proposed "persuasive technology" to change individual attitudes and behaviours based on interactive technology. This approach attempts to understand human behaviours and communication and then designs an interactive system to achieve the expected results. Lilley (2009) proposed three roles that design can play in promoting sustainable behaviour change: guiding change via eco-feedback, maintaining change via behaviour steering, and encouraging transformation via persuasive technology. Lockton et al. (2008) forwarded the concept of "design with intent behaviour," during which a system, including physical products, environments, computer networks, and user interactions, is used to guide, regulate or shape human behaviour. He then developed a design toolkit to utilise product and system design to change user behaviours from six different lenses (Lockton et al., 2010). Aunger and Curtis (2016) developed a behaviour change design (BCD) approach that encompasses both the theoretical level (a theory of change for behaviour) and the practical level (design and evaluating interventions). Mummah et al. (2016) forwarded an IDEAS design framework to provide practical guidance regarding behaviour strategy generation. Xiao (2017) strived to impose design interventions to promote waste recycling behaviour in densely populated urban areas in Hong Kong. Sharma (2018) deemed that designers should also consider those contextual factors impacting human behaviour change, in addition to specific products and interactive systems. However, few studies have explored "design for behaviour change" during a

global pandemic.

In behaviour sciences, researchers have investigated individuals' behaviour change during pandemics and their influential factors. For instance, Bish and Michie's (2010) conducted a scoping literature review and found several demographic factors affecting individuals' behaviour adoption during pandemics, including age, gender, educational level, and race. Similarly, Galasso et al. (2020) also noted that gender differences could result in discrepancies in people's behaviour modifications during pandemics. Coifman et al.'s (2021) research suggested human emotions, such as fear and worry, could indirectly drive individuals' behaviour engagement during the COVID-19 pandemic. However, few studies are dedicated to constructing a research framework that reveals individuals' behaviour formation process during pandemics, especially in China's context. Additionally, despite some knowledge and experience of behaviour change learned from previous pandemics, many variables in the current pandemic need to be reassessed, such as viruses' features, people's access to information, and social media development (Betsch, 2020).

1.4 Research Questions

Main research question: How to foster individual behaviour change during pandemics through designing for public spaces in Hefei, China.

Sub-research questions:

RQ1: What is the existing situation of behaviour change for pandemic prevention and control in public spaces in Hefei, China?

RQ2: What are the key factors influencing people's behaviour change during pandemics?

RQ3: How to develop a research framework to promote individual behaviour change during pandemics?

RQ4: How to validate the effectiveness of the research framework forwarded in the current study.

1.5 Research Objectives

Main research objectives: To develop a research framework to promote individual behaviour change during pandemics for public spaces in Hefei, China.

Sub-research objectives:

RO1: To understand people's perception of the pandemic situation and identify key challenges and design limitations for behaviour change.

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RO2: To determine the key factors influencing people's behaviour change during pandemics.

RO3：To develop a research framework to promote individual behaviour change during pandemics.

RQ4: To validate the effectiveness of the research framework forwarded in the current study.

1.6 Research Scope

This study attempts to develop a research framework to facilitate individual behaviour change during pandemics in public spaces in Hefei, China. To begin with, it presents the definition of pandemics, several pandemics recorded in human history, policies, and public health interventions, especially for the existing pandemic situation. The recommended behaviour change for pandemic prevention and control is discussed. It then provides an overview of several prestigious behaviour change models, followed by a preliminary conceptual framework for behaviour change during pandemics. After that, three studies were conducted to answer research questions and achieve the research objectives. The first study explored how people felt about the existing pandemic situations and attempted to identify people's perceived challenges and design limitations for behaviour change. In the second study, the researcher tried to determine key factors influencing behaviour change during pandemics and reveal the relationship among these factors. Then a behavioural change framework for pandemic prevention and control was constructed by clarifying people's behavioural change intention and formation processes. In the third study, the researcher refined the proposed behavioural change framework based on empirical research. Subsequently, the researcher discussed research findings and proposed design strategies to prompt pandemic-related behaviour change in public spaces, followed by an expert survey for validation. Finally, the research implementations, knowledge contribution, and limitations were summarised.

1.7 Significance of Research

This study is an important endeavour to promote individuals' behaviour change during pandemics in public spaces in Hefei by integrating design and behavioural sciences knowledge. It aims to provide people with a feasible solution when public health crises emerge. First, this research identified people's perceived challenges and design limitations of behaviour change during pandemics. Then it determined the key factors that impacted people's behaviour change during pandemics and developed a research framework by comprehending people's behaviour mechanisms. Based on these theoretical achievements, the researcher proposed design strategies to prompt the pandemic-related behaviour change. Hence, this study can provide a new perspective on pandemic prevention and control in densely populated urban areas. The primary significance of this thesis is described as follows:

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First, our research findings can help people perform the recommended behaviour and adapt to new behaviour patterns during a pandemic. Generally, when a pandemic emerges, authorities will adopt non-pharmaceutical interventions to contain the spread of viruses (Betsch, 2020; Wilder-Smith & Freedman, 2020). These non-pharmaceutical interventions, known as social control measures, often require a large-scale and rapid behavioural change in the general public, including face mask-wearing, hand hygiene, social distancing, and contact reduction. In that regard, this study can contribute to controlling the spread of viruses, thereby minimising the destructive impacts of pandemics.

Besides, our research can help people prepare for the next pandemic in the near future. In modern society, globalisation and industrialisation have raised population mobility, making it easier for viruses to transmit across the globe. Humans have suffered from several pandemics over the past few decades. Although many past pandemics were overcome, humans may face another unpredictable pandemic shortly (Piret & Boivin, 2021). Hence, making preparations for future pandemics is necessary and valuable.

Second, this study can provide novel insights for policymakers, public-space administrators, and designers when dealing with pandemic situations. Based on the theoretical proposals, policymakers can enact more effective policies and regulations; administrators can gain an in-depth understanding of how to organise, coordinate, manage, and control citizens in public spaces; and designers can improve or re-design public facilities, tools, wearable devices, public environments, and smartphone applications to facilitate individual behaviour change during pandemics.

Third, the research outcomes in this study can be applied to other common infectious diseases in human society. Droplets and contact can transmit the current COVID-19 pandemic, so research on COVID-19 can be referred to those contagious diseases with similar transmission methods, such as flu and tuberculosis.

1.8 Outline of Thesis

This study is categorised into the following sections:

Chapter one: Chapter one is an overview of the whole research. It presents research backgrounds and introduces research problems. This chapter can give readers a precise and fast understanding of the research topic. The introduction, problem statement, research questions, research objectives, significance of the research, research framework, and outline are outlined in this chapter.

Chapter two: Chapter two is the literature review section. It begins with a review of several of the most influential pandemics in human history. Next, the development of policies, practices, and facilities for pandemic prevention and control is examined. After that, it discusses several classic models and theories for behaviour change from previous studies, providing a theoretical basis for the following research design. Finally, a preliminary conceptual framework was constructed.

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Chapter three: Chapter three describes the research methods employed in this study. It starts with a research design framework that describes the whole research process. Then, detailed data collection and analysis methods are represented. The study's validity and reliability is discussed in this chapter's final section.

Chapter four: Chapter four demonstrates research findings derived from three studies. The first study examined the existing situation of behaviour change during pandemics in public spaces in Hefei, China. The researcher identified people's perceived challenges and design limitations of behavioural change in the current pandemic. The second study determined the key factors influencing people's behavioural change during pandemics and developed a research framework revealing behaviour intention and formation process. The third study shows the structural relationships among variables in the behaviour change framework through empirical research and further improves it.

Chapter five: Chapter five discusses the research findings of this study. It then develops public design strategies used to guide practical designs for pandemic-related behaviour change in public spaces in China. After that, an expert survey was conducted to validate the research framework.

Chapter six: This chapter answers four research questions, concludes the whole study, and sheds light on research implications, knowledge contributions, limitations, and recommendations for future studies.

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1.9 Structure of Thesis

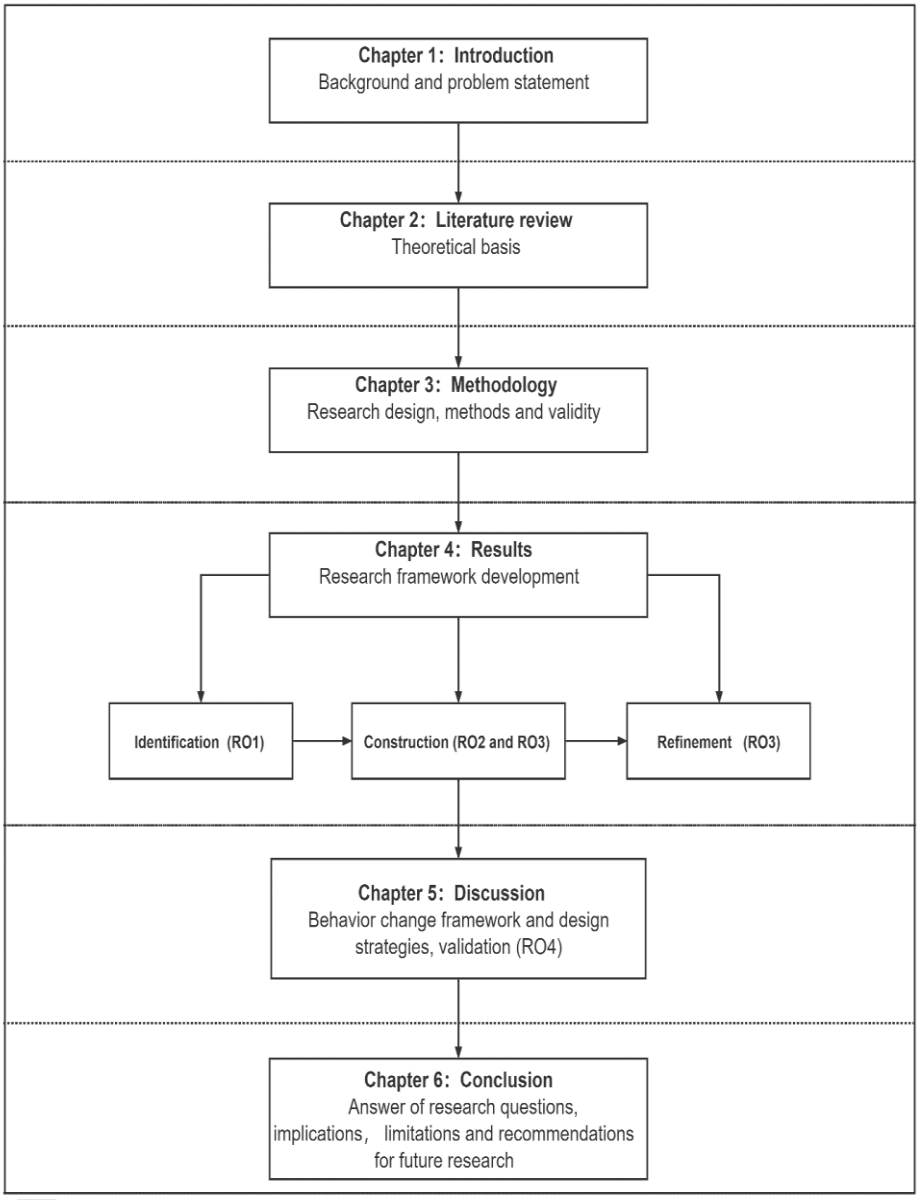

Figure 1.3 : Structure of thesis

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