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Material abstract

Author: Benjamin Peter Rigby

Title: Complexity and physical activity policy: considerations for theory and practice.

Background: Complex systems perspectives have been increasingly adopted to address physical inactivity. Within this, myriad policy actions are deemed important for supporting population physical activity and creating so-called 'active systems.' I argue that complexity and systems-thinking have, prior to this thesis, predominantly been applied uncritically and with insufficient consideration of the agents who influence, and are influenced by, the complexity of the physical activity policy environment. There is the need to connect different strands of research, specifically in relation to physical activity policy, evidence-informed Public Health, and complexity.

Aim: My research aimed to critically assess the understanding and application of complexity theories as a basis for evidence-informed physical activity policy efforts. Specifically, I sought to interrogate the suitability of complexity theories for influencing, developing and implementing physical activity policies; identify conditions that enable more effective complex systems approaches to physical activity policy and programmes; and in doing so, extend understanding concerning complexity theories and their application.

Theory and methods: Central to my theoretical position has been a reflexive process in which I have located myself within the wider physical activity and Public Health research landscape, and crucially the system I seek to change. This thesis is underpinned by a complex realist ontology, and epistemologically I draw on the

notion of different lenses of evidence about policy issues. Methodologically, I employed qualitative and action-orientated methods to explore individuals' agency and experiences of the physical activity policy system. My own observations and experiences are discussed through a theoretical pluralism.

Study 1: I explored the processes, values and experiences of physical activity policy-makers in UK national government, in relation to complexity, and how they sought to foster system change. I conducted 10 semi-structured interviews. Three overarching themes were constructed and emphasised that while the idea of complex systems permeated the physical activity sector, uncertainty as to the meaning of complexity and its implications may preclude its application in ways that enhance physical activity policies and programmes. I highlight problematic practices and identify potentially important mechanisms to support system change.

Study 2: This study was originally a preliminary component of an action research project that was curtailed by the SARS-Cov-2 pandemic. Through five in-depth semi-structured interviews, I examined how local partnerships can be used more effectively to improve the implementation of national physical activity policies. Specifically, I extended knowledge by providing a critical reflection on system leadership, demonstrating how it is enabled and strengthened, how it links to implementation, and how changes in systemic practices and cultures can be stimulated in the physical activity policy domain.

Study 3: This study responded to outstanding gaps in the evidence, in particular the ongoing uncertainty around the practical applications of complexity theories and systems perspectives. In-keeping with my intended action-orientated approach, I convened a workshop with 19 international experts (from research, policy and practice) to critically reflect on my previous research, drawing attention to

issues of conceptual purity and discord between the theory and practice of complexity in the physical activity policy domain. Thereafter, the workshop explored how to optimise the application of complex systems approaches to physical activity policy, by focusing on the action of knowledge mobilisers. Analysis led to the creation of four propositions for advancing complexity theories and systems-based approaches, which set out important considerations concerning the how, when, and why of applying these perspectives.

Concluding remarks: The general discussion is presented not as a line in the sand, but as both an advancement on previous thinking, and reflection on these and empirical contributions that remain a work in progress. Specifically, I set out current conceptualisations of complexity theories as they pertain to physical activity policy, and discuss considerations for future practice. I conclude by arguing that a reorientation of efforts across research, policy and practice toward agency, mobilisation and application of complex systems perspectives in physical activity policy settings will strengthen collective impact.

Complexity and physical activity policy: considerations for theory and practice.

Mr Benjamin Peter Rigby, M.A. FHEA.

Thesis submitted in partial fulfilment of the requirement for the degree Doctor of Philosophy (Ph.D.).

Department of Sociology.

University of Durham.

2022.

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List of abbreviations

B.A. (Hons.)	Batchelor of Arts (Honours)
CAROD	Centre for Academic, Researcher and Organisational Development
CECAN	The Centre for the Evaluation of Complexity Across the Nexus
Co-I	Co-investigator
CMO	Chief Medical Officer
CSJCA	Centre for Social Justice and Community Action
DCMS	Department for Culture, Media and Sport
DfT	Department for Transport
DHSC	Department of Health and Social Care
Dr	Doctor
e.g.	*Exempli gratia* (for example)
ESRC	Economic and Social Research Council
et al.	*Et alia* (and others)
etc.	*Et cetera* (and the rest)
FHEA	Fellow of the Higher Education Academy
HIV	Human immunodeficiency virus
HEPA	Health Enhancing Physical Activity
i.e.	*Id est* (that is)
M.A.	Master of Arts
MET	Metabolic equivalent
MRC	Medical Research Council
PgCert	Postgraduate Certificate
Ph.D.	Doctor of Philosophy
PHE	Public Health England
R.A.C.	Royal Automobile Club
RE-AIM	Reach, Efficacy, Adoption, Implementation, Maintenance Model
RIS	Research and Innovation Services
SRA	Social Research Association
UK	United Kingdom
UKSBM	United Kingdom Society for Behavioural Medicine
USA	United States of America

Declaration

- A manuscript on the findings presented in Chapter Four is published in the Health Research Policy and Systems journal (2022, 20, article number 59).
- A paper on the findings presented in Chapter Four has been accepted for oral presentation at the 11th HEPA Europe Conference, 31st August to 2nd September 2022, Nice, France.
- A paper on the findings in Chapter Six was orally presented at the UKSBM 2022 Conference (online), 30th March 2022.

Statement of copyright

The copyright of this thesis rests with the author. No quotation from it should be published without the author's prior written consent and information derived from it should be acknowledged.

Funding

This thesis and associated doctoral training programme was supported by an ESRC North East Doctoral Training Centre Ph.D. studentship (grant number: ES/J500082/1).

Acknowledgements

First and foremost, I wish to thank my supervisors, Dr Emily Oliver and Dr Caroline Dodd-Reynolds. Without their guidance, support, flexibility and patience, this project would not have come to fruition. I hope that this thesis bears the hallmarks of Emily's penchant for interesting new ideas, and Caroline's exacting eye for detail. In their own ways, they are great researchers and mentors. I am thankful that I have had the chance to know, learn from, and work alongside them both.

Second, I wish to thank all those who gave up their time to participate in my studies. This thesis represents their insights and ideas, as much as it does my own, having channelled these various perspectives through a scientific lens. Further, to all those who have offered advice or suggestions along the way, I thank you too.

Third, I am grateful for all of the opportunities that the North East Doctoral Training Centre (now Northern Ireland and North East Doctoral Training Partnership) has afforded me. I have been able to develop myself as an academic in ways that stretch far beyond this thesis. Without the financial support of the ESRC, I would not have been able to undertake postgraduate study and realise my ambition of doctoral training.

I must also thank Durham University, its Departments of Sport and Exercise Sciences and Sociology, as well as St. Cuthbert's Society (my college). The University has been a part of my life for a decade. From when I joined as an undergraduate in 2012, until now, I have been fortunate to live and work in an environment in which I have been most at home, and thus been able to give my best to my work. I am grateful to the University, its departments and colleges for their faith in me, and I hope that I have reciprocated this sufficiently. I truly hope that I can return some day.

And last, but by no means least, I want to thank my fellow postgraduate students alongside whom I have undertaken this process. Postgraduate study, particularly doctoral research, can be isolating at the best of times, let alone during a global pandemic and its associated social restrictions. To Hester, Sophie, Sarah, Verity, Alex, Rebekah and Amée, as well as those unnamed but not forgotten, I am indebted to you for your friendship and support. I have been proud to watch you develop and grow through this shared process of scholarship and self-discovery.

Dedication

To Alice

Chapter 1. Introduction

Physical inactivity is a profound global health issue (World Health Organization, 2018). It is associated with increased incidence of poor physical and mental health outcomes, as well as extensive economic and societal costs (Bull *et al.*, 2017; Ding *et al.*, 2016; Katzmarzyk *et al.*, 2022; World Health Organization, 2018). Approximately, 28% of adults and 81% of children aged 11 to 17 years across the globe are considered insufficiently active (Guthold *et al.*, 2018; Guthold *et al.*, 2020). However, the relative burden of inactivity is greatest among high-income countries, such as the United Kingdom (UK) (Katzmarzyk *et al.*, 2022). In the UK, the prevalence of physical inactivity among adults in England, Scotland, Wales and Northern Ireland is 39%, 54%, 53% and 46%, respectively (British Heart Foundation, 2017; Sport England, 2021a; Scottish Government, 2020; Welsh Government, 2020). Meanwhile, 55% of children and young people in England, 63% in Scotland, and 51% in Wales are also insufficiently active (National Assembly for Wales, 2019; Public Health Scotland, 2022; Sport England, 2021b). This issue is compounded by deep-rooted inequalities in physical activity participation that exist across many social strata, such as gender, age and ethnicity (Ball *et al.*, 2015; Hunter *et al.*, 2015; Rigby *et al.*, 2020a). Thus, many examinations of contemporary society explore how to optimally support population-level physical activity. The research set out in this thesis critiques one societal approach to inactivity, and explores the complex interactions between evidence, policy and practice in this health promotion domain. Specifically, it focuses on the increasing recognition that persistent physical inactivity is a key policy problem (Gelius *et al.*, 2020; Oldridge-Turner *et al.*, 2022; World Health Organization, 2018).

Despite considerable research interest, efforts to increase population physical activity levels remain challenging (Pratt *et al.*, 2020). Several reasons for this have been posited. For example, the World Health Organization (2018, p.6) suggested that progress *'has been slow, largely due to a lack of awareness and investment'.* However, in terms of awareness, it has been argued for the better part of three decades that physical activity is a *'best buy'* for public health (Morris, 1994, p.807). This indicates that alternatively, the Public Health community has suffered from a failure to design, resource (financial investment included) and implement effective solutions, at scale, which reflect the systemic drivers of population physical activity change (Pratt *et al.*, 2020). By exploring how we are (or are not) tackling inactivity, it will enable understanding of the specificities of physical activity promotion, but also how to promote health behaviour and overall health, more broadly.

In recent years, efforts have shifted toward the idea of a whole-systems approach, which recognises the need to address the upstream (*e.g.* policy actions) and downstream (*e.g.* individual approaches) determinants of physical activity through multiple policy solutions (Piggin, 2019; World Health Organization, 2018). However, the ongoing difficulty in increasing population activity levels raises several questions: i) how does policy seek to address inactivity; ii) what is actually meant by a systems-based perspective in this context, including the concepts and assumptions that underpin it; and iii) how and why may this approach be more, or less, effective? It is toward these, and related, questions my thesis tends, through an exploration of the UK physical activity policy context.

Having briefly set out my starting point, the remainder of this chapter contextualises the research presented in this thesis through more detailed discussions of concepts related to physical activity promotion. First, I briefly consider what is

meant by physical activity, and move on to explore physical activity in the Public Health research agenda. Within this, I highlight continued issues and possible solutions for progress. I conclude by detailing the aims of this doctoral research programme, before outlining the structure of the rest of this thesis.

1.1 What is physical activity?

Traditionally, it has been accepted that physical activity describes *'any bodily movement produced by the skeletal muscles that results in energy expenditure* (Caspersen *et al.*, 1985, p.126)*.'* While this seminal definition has been revised over time, for example to include the distinction that this energy expenditure is over and above that generated in a resting state (Bouchard *et al.*, 2012), it remains the authoritative perspective in the Public Health domain. Physical activity is related to, but distinct from, physical fitness. This latter concept refers to an ability to undertake daily activities, and is characterised by its different components (*e.g.* cardiovascular, morphological, muscular, motor and metabolic fitness) (Bouchard *et al.*, 2012). On the other hand, physical activity is usually categorised by its intensity (*e.g.* low, moderate or vigorous energy expenditure), or by domain (*e.g.* leisure-time or occupational physical activity). A second related concept is sedentary behaviour:

> Sedentary behaviour is defined as any waking behaviour [i.e. not including sleep] characterised by an energy expenditure ≤ 1.5 metabolic equivalents[1], such as sitting, reclining or lying down (World Health Organization, 2018, p.14).

It is important to note that sedentary behaviour is distinct from physical inactivity (Dempsey *et al.*, 2020). It is possible for people to be both active and sedentary, with long periods of time spent enacting each behaviour. Furthermore, there is some evidence to suggest that being active can help attenuate negative health outcomes

[1] *'One metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O^2 per kg body weight x min* (Jetté *et al.*, 1990)*.'*

associated with sedentary behaviour (Ekelund *et al.*, 2016). While my thesis is focused on physical activity, and attempts to promote it, it is important to make these terminological distinctions clear at the outset, as these related concepts are referred to by myself and participants. The definitions offered here are grounded in medical and physiological sciences – an issue to which I will return in relation to the physical activity and Public Health agenda more broadly. Recently, however, there have been attempts to think about physical activity more holistically.

Piggin (2020, no pagination) argued that existing definitions insufficiently considered the cerebral, social, political, and situational dimensions of physical activity, and proposed that:

> Physical activity involves people moving, acting and performing within culturally specific spaces and contexts, and influenced by a unique array of interests, emotions, ideas, instructions and relationships.

This definition has both positive and negative aspects. It rightly contests the predominance of the medicalised view of physical activity, offering a perspective grounded in social sciences, which has typically been missing from the physical activity policy domain (Kay, 2016). However, it seems to erase the idea of health altogether, and make assumptions about the relative importance of particular determinants of physical activity, through the omission of others that may be considered (*e.g.* see Bauman *et al.* (2012)). Nevertheless, it recognises that physical activity can be undertaken in many different ways, and can therefore include a myriad of specific activities, such as walking, cycling, sports, exercise, other forms of recreational activity (*e.g.* dance), or work-related activities such as gardening or housework (World Health Organization, 2018). This definition also encourages one to think about physical activity differently, and alludes to the complexities of the behaviour, and thus presumably also efforts to promote it.

1.2 Physical activity and the Public Health agenda

The benefit of physical activity for health was first reported in the 1950s (Morris *et al.*, 1953). This seminal research laid the foundations of an extensive and robust epidemiological evidence-base, which has developed rapidly since the 1990s. It is clear that physical inactivity is associated with increased risk of non-communicable disease (Katzmarzyk *et al.*, 2022; Lee *et al.*, 2012), while increasing activity levels can have a significant positive impact on health outcomes and reductions in the risk of premature mortality (Ekelund *et al.*, 2019; Warburton *et al.*, 2006). The potential for physical activity to ameliorate non-communicable disease, in particular, has given rise to the field of physical activity and Public Health, which is a site of substantial academic enquiry, and extensive promotion efforts through policy and practice. In this section of the introduction, I consider some of the beneficial outcomes of this agenda, which may make it appealing to policy-makers, and reflect on its remaining challenges.

1.2.1 The first success: identifying the benefits of physical activity

A key first success of the physical activity and Public Health agenda has been unequivocally evidencing the benefits of physical activity, both to health and society (World Health Organization, 2018). For a detailed discussion of these, the reader is directed to a wealth of research (Bull *et al.*, 2017; Ekelund *et al.*, 2016; Ekelund *et al.*, 2019; Lee *et al.*, 2012; Warburton, 2015; Warburton *et al.*, 2006; World Health Organization, 2018). However, I outline these benefits in brief.

Regular physical activity is associated with multiple physical and mental health benefits. In particular, it can prevent, or facilitate treatment of, non-communicable diseases such as breast and colon cancers, type II diabetes, and coronary heart disease (Lee *et al.*, 2012). It is also a protective factor for the

prevention of strokes, hypertension, osteoporosis, and overweight and obesity (Hill and Wyatt, 2005; Warburton *et al.*, 2010). In terms of mental and cognitive health, physical activity can potentially delay the onset of dementia (Livingston *et al.*, 2020), protect against depression and anxiety (Mammen and Faulkner, 2013; McDowell *et al.*, 2019), and improve overall well-being and quality of life (World Health Organization, 2018). While these health benefits are of particular interest to governments and other decision-making authorities, given their potential to reduce the burden on health services, the varied societal impacts of physical activity are also increasingly recognised.

Increased physical activity is associated with improved behaviour and attainment in educational settings (Michael *et al.*, 2015; Rasberry *et al.*, 2011). It can contribute to improved employment prospects, enhance community cohesion, and increase volunteer engagement (Department of Culture, Media and Sport, 2015). Physical activity also has a role to play in mitigating environmental and climate-related issues (*e.g.* through active transport) (Bernard *et al.*, 2021). Furthermore, physical activity has the potential to drive economic development and productivity, particularly in relation to hosting major sports events and contributing to the United Nation's (2015) Sustainable Development Agenda (Department of Culture, Media and Sport 2015; World Health Organization, 2018). In economic terms, physical inactivity costs the annual global economy $54 billion in healthcare, and a further $14 billion in lost productivity (Ding *et al.*, 2016), therefore the potential for return on investment in terms of savings is appealing to policy-makers. For example, in England, physical activity generates a return of £3.91 for every £1 invested, and the current overall contribution to the economy and society is approximately £85.5 billion (Sport England, 2020c).

1.2.2 The second success: establishing how much physical activity leads to health benefits

A second key achievement of the physical activity and Public Health agenda has been the establishment of recommendations about how much physical activity is important for health improvement. A robust evidence-base suggests that there is a dose-response relationship between physical activity and health outcomes, whereby further benefits are typically accrued as levels of physical activity increase (Warburton *et al.*, 2010). Recent evidence indicates that this dose-response relationship may be non-linear in mid-to-older aged adults (Ekelund *et al.*, 2019), and the potential for too much activity has also been considered (Warburton *et al.*, 2016). Nevertheless, it is generally accepted that the benefits of physical activity outweigh any potential risks, and that such benefits are most acute among individuals moving from a state of inactivity, to initiating some physical activity (Department of Health and Social Care, 2019). The relationship between physical activity and improved health outcomes is typically expressed in terms of time spent engaging in moderate-to-vigorous physical activities, as well as those that improve strength, balance and flexibility. Moderate-to-vigorous physical activities are those associated with an energy expenditure equal to, or above, 3.0 METs (Haskell *et al.*, 2007). It is beyond the scope of this thesis to discuss this evidence-base further. Of relevance, however, is how this evidence is packaged in public health policy.

The development of physical activity guidelines is a key strategy in physical activity promotion (World Health Organization, 2018). They exist to inform key stakeholders (*e.g.* decision-makers, health professionals, practitioners, and sometimes members of the public) about the volume, duration, frequency and types of physical activity required across the life-course to achieve health benefits (Rigby *et al.*, 2020b). Such guidelines have evolved over time, as the evidence-base has been

refined, and nations adopt different approaches. For example, recently there has been a shift toward 24-hour movement guidelines, particular for younger children (Draper *et al.*, 2020; Okely *et al.*, 2022; Tremblay, 2020). While the World Health Organization (2020) has produced global guidelines, again these differ slightly to those produced in the UK (Department of Health and Social Care, 2019). Table 1 summarises the UK guidelines, which are most relevant to the context of this study.

Table 1. Summary of the UK physical activity guidelines

	Population subgroups						
Component	**Early years (under 5s)**	**Children and young people (5 to 18 years)**	**Adults**	**Older adults**	**Disabled children and young people**	**Disabled adults**	**Pregnancy and postpartum**
Aerobic physical activity (moderate-to-vigorous)	180 mins per day	Average 60 mins per day each week	150 mins per week	150 mins per week	20 mins per day	150 mins per week	150 mins per week
Strength, balance and flexibility	-	Engage in a variety of activities to support these	At least twice per week	At least twice per week	2-3 times per week	At least twice per week	At least twice per week
Sedentary behaviour	Break up sedentary periods	Minimise	Minimise	Break up sedentary periods	-	Do not be still for too long	-
Other	30 mins tummy time per day for Under 1s	-	-	Some is better than none	-	-	Daily pelvic floor exercise (postpartum)

Adapted from Department of Health and Social Care (2019) and Smith *et al.* (2022).

1.2.3 The third success: understanding why some people are active, and others are not

A third success of the physical activity and Public Health agenda has been the wealth of correlates and determinants research, which has increased understanding of why people may be active or otherwise. A prominent paper by Bauman *et al.* (2012) highlighted that physical activity is determined by a range of socio-ecological conditions, including the economy, societal norms, urbanisation, and industrialisation. Furthermore, they identified that there are some consistent correlates of physical activity at an individual level, such as sex, age, health and previous activity levels. Nevertheless, people's activity is associated with a complex and often unique array of determinants. Research has identified at least 117 correlates of physical activity, which include 24 demographic and biological factors, 40 psychological factors, 13 behavioural factors, and 13 social factors (Choi *et al.*, 2017). There are likely to be many more.

The World Health Organization (2018) Global Action Plan considers determinants in terms of their so-called upstream and downstream influence. The former, associated with population-level approaches (*e.g.* policy), concerns the social, economic and environmental factors, while the latter refers to individually-centred perspectives. In order to better inform upstream measures, issues of causation and accuracy may arguably still warrant further attention (Bauman *et al.*, 2012; Choi *et al.*, 2017). Nevertheless, this wealth of research has provided insight on how to intervene to increase physical activity.

1.2.4 The fourth success: recognising what works to increase physical activity

The fourth and final success from the physical activity and Public Health agenda that I wish to raise, is the identification of strategies to increase physical activity. However, there are caveats attached. Knowledge of 'what works' in programmes designed to increase physical activity has advanced (Milton *et al.*, 2021; Public Health England, 2014b; World Health Organization, 2009). Many studies have been conducted with different types of interventions, in different settings, and among different population groups (Tuso, 2015). Some common conclusions indicate that multi-component programmes, which are adapted to local, cultural and environmental contexts are more successful (Public Health England, 2014b; World Health Organization, 2009). Furthermore, programmes that are underpinned by various behaviour change techniques are often more effective (Howlett *et al.*, 2018).

More recently, it has been argued that the evidence indicates that policy and investment are central to physical activity promotion. Milton *et al.* (2021) identified eight effective investments, which include whole-school programmes, active transport, active urban design, health care, public education (including mass media), sport and recreation for all, healthy workplaces, and community-wide programmes. Meanwhile, the World Health Organization (2018) recommended 20 policy actions that are universally applicable to support physical activity, which relate to creating active societies, environments, people, and systems. A systematic review determined that school-based and infrastructural policies are particularly effective (Gelius *et al.*, 2020). A whole-system approach (to which I will return) by policy-makers is encouraged (Milton *et al.*, 2021; World Health Organization, 2018). Despite this progress, however, efforts to increase physical activity have largely been effective

only in the short-term and on a small-scale (Howlett *et al.*, 2018; The Lancet Editors, 2021; Reis *et al.*, 2016).

Furthermore, inequalities in physical activity participation remain within and between countries and population groups (Ball, 2015; Rigby *et al.*, 2020a; World Health Organization, 2018). Consequently, the disparity in engagement between certain groups creates a damaging contribution to increased risk of disease and subsequent health inequalities (Marmot, 2010). To-date, existing physical activity programmes have often exacerbated inequalities (Hanson and Jones, 2017; Williams and Gibson, 2017). These persistent challenges of scale and inequalities indicate an inability to adequately address the complexities of physical activity promotion for population benefit.

Much of the aforementioned success in physical activity research has resulted from a strong tradition of epidemiological science, which is seen as a critical first step in informing the Public Health agenda (Brownson *et al.*, 2018). However, it has been argued that this approach has been perpetuated for reasons of convenience and feasibility, rather than scientific justification (Pratt *et al.*, 2020). It is possible, and a perspective that I endorse, that a juncture has been reached, whereby the agenda has progressed as far as it can without a significant shift in focus. There have been consistent calls for a new approach (Das and Horton, 2016; Hallal *et al.*, 2012; Pratt *et al.*, 2020), particularly to policy and implementation, to overcome the lack of further progress (Hallal and Pratt, 2020).

1.3. Persistent physical inactivity is a problem of policy

The importance of policy in physical activity promotion cannot be overstated, as it has the potential to address the material and social conditions that perpetuate ongoing inequalities, as well as shaping the research and funding landscape that may

enable longer-term and more scalable solutions to physical inactivity (World Organization, 2018). However, while potentially effective policy solutions, such as those discussed above, have been proposed (Gelius *et al.*, 2020; Milton *et al.*, 2021; World Organization, 2018), there remains a lack of concerted policy action in most cases (Das and Horton, 2016; The Lancet Editors, 2021; Sallis *et al.*, 2016). In this section, I develop the first half of the rationale for my doctoral research and argue that, in order to improve policy efforts, it is necessary to better understand evidence-informed policy, and the wicked nature of physical inactivity as a policy issue. First, however, I define two key terms, as I refer to them throughout this thesis, and briefly outline the current policy landscape.

1.3.1 What are policy and policy-making?

A first step in any study of policy is to define it (Cairney, 2012b). In general terms, it may be considered as *'a formal decision or plan of action adopted by an actor, be it an individual, organization, business, government, etc., in order to achieve a particular goal* (Richards and Smith, 2002, p.1)*.'* In terms of governments, it may refer to the total sum of their action. These actions and decisions may be formally recorded in written policies, but this need not be the case. Policy has many other definitions, from which several principles and considerations can be drawn. For example, explorations of policy should consider what is and is not done, or achieved, by policy-makers; who are the many policy-makers involved (not just elected officials and civil servants); and what are the aims and effects of the policies that they produce (Cairney, 2012b). In this way, policy is considered as a multi-dimensional construct, which emphasises its enormity and the intricate arrangement of actions and actors, within and beyond government settings.

Policy-making, therefore, is the process by which policy is produced, reproduced and changed (Cairney, 2012b). As with policy, there is no singular definition that adequately incorporates all of its aspects. Key concerns of policy-making include its highly specialised nature; the mutually beneficial relationship between power and ideas; the notions of stability and change, and why these occur; and that it is a continuous process (Cairney, 2012b). In many cases, policy-making is considered in relation to an increasingly crowded and multi-level space, whereby different actors are influential at different stages, and previous decisions set the agenda for future ones (Cairney *et al.*, 2019). Within this, therefore, policy-makers can include all those who have either a formal responsibility, or informal influence in, the formulation of policy. The increasingly diffused nature of physical activity policy-making has led to the idea of 'accidental' physical activity policy-makers, who come from beyond traditional health sectors, such as transport or environment agencies (McKinnon *et al.*, 2011; Rütten *et al.*, 2013).

1.3.2 The physical activity policy landscape

At a global level, there are essentially two notable policy responses, which have been initiated by the World Health Organization. First, a global action plan that details a suite of policy options that can be adopted and adapted in different countries (World Health Organization, 2018). This articulates the multi-sectoral nature of physical activity policy. Second, a set of global physical activity guidelines (World Health Organization, 2020). However, there remains a significant dearth of policy action and implementation (The Lancet Editors, 2021; Sallis *et al.*, 2016), which may in part be due to an inability to persuade policy-makers of the potential benefit of physical activity to reduce non-communicable diseases, compared to addressing other health issues such as tobacco use, alcohol consumption and HIV (Andersen *et*

al., 2016; The Lancet Editors, 2021). While this issue may have been exacerbated by the way the Global Burden of Disease risk factors are now assessed, meaning physical activity has been downgraded (Stamatakis *et al.*, 2021), it also suggests an imperfect understanding of how to influence physical activity policy, despite the weight of positive evidence concerning its effects discussed above. Therefore, it is important to learn about the policy process, and explore how physical activity policy may be better evidence-informed. To do this, the UK offers a useful test case for several reasons. First, the global policy landscape was closely informed by developments in UK policy (*e.g.* Public Health England (2014a)). Second, there are reported issues at the juncture between evidence, policy and practice (Oliver *et al.*, 2016a). Third, there may be greater progress toward the uptake of multisectoral approaches and cross-government collaboration (Milton *et al.*, 2019; Sharp *et al.*, 2022), which is not the case globally (The Lancet Editors, 2021).

Attempting to address inactivity in the UK, government and non-government organisations, across public, private and voluntary sectors have produced generalised policy and guidance documents for national implementation (Department of Health and Social Care, 2019; House of Lords Sport and Recreation Committee, 2021; Public Health England, 2014a; Sport England, 2021d). Such top-down measures reflect both the assumed predominant order of policy in the UK, which is characterised by rigid hierarchies and performance indicators (Cairney, 2012a), and the desire of central actors to provide clear policy goals and consistent messages (Matland, 1995). According to Milton and Bauman (2015), the UK approach has typically consisted of four such top-down policies, which have fluctuated in prominence and nature over time: i) producing evidence-based physical activity guidelines; ii) setting national goals; iii) introducing surveillance and monitoring

systems; and iv) supporting public education. While acknowledging the strength of physical activity guidelines, they identified numerous challenges related to goal-setting, subjective and inconsistent surveillance measures (*e.g.* changing between self report surveys, such as the Health Survey for England, Active People Survey and Active Lives Survey), and the reliance on commercial investment (*e.g.* sponsorship of parliamentary groups or physical activity programmes) (Stevinson *et al.*, 2015; Strain *et al.*, 2020). These factors are compounded by the additional challenge of devolved administrations (*i.e.* Scotland, Wales and Northern Ireland), which characterise the UK political and legal systems, as well as the lack of a systems-based perspective taken to physical activity policy.

While there is evidence of embedding physical activity across policy sectors (*e.g.* Public Health England, 2014b), there remains key government and non-government organisations in each of the UK's four nations that provide a top-down steer for physical activity policy. For example, the Department for Health and Social Care (2019) provide UK-wide public health physical activity guidelines, and clinical guidance is provided by the National Institute for Health and Care Excellence; the focus being on epidemiological arguments for physical activity. Meanwhile, the implementation, surveillance and funding of physical activity is typically devolved to the Office for Health Improvement and Disparities (known as Public Health England for the majority of the timeframe of this study) and Sport England, through to the county-level Active Partnerships Network, and local clinical and public health commissioning groups. Responsibility for physical activity is also devolved to equivalent Scottish, Welsh and Northern Irish government health departments, and their sport and activity delivery groups. However, the creation of Active Travel

England in 2020 is typical of the increasing emphasis placed on this policy sector across the UK.

The UK differs from other countries, for example Germany (Rütten *et al.*, 2018), as the respective administrations do not provide national-level guidelines for physical activity implementation. Policies and programmes are typically implemented in pockets of localised investment and commissioning, political engagement and innovation (*e.g.* Greater Manchester Moving or Sport England's Local Delivery Pilots). Despite an increase in policy rhetoric around multi-sectoral and systems-based approaches to physical activity (House of Lords Sport and Recreation Committee, 2021; Sport England, 2021d), the landscape remains somewhat disjointed and siloed. There is a lack of whole system planning and surveillance, which is being increasingly adopted in other countries, including Australia (Bellew *et al.*, 2022) and Ireland (Murphy *et al.*, 2021) through the implementation of the World Health Organization's (2018) *Global Action Plan for Physical Activity*. There are many sectors that have an important stake in physical activity (*e.g.* natural environment, urban planning and design, or commerce and media), but who are typically absent from the development and implementation of core physical activity policy.

A further characteristic of the current UK policy context is the lack of legislative action to address physical activity (*e.g.* developing new traffic laws, or legally incentivising local authorities to improve physical activity levels), although prominent exceptions such as the *Cycling and Walking Investment Strategy* exist (Department for Transport, 2022). This reflects a global missed opportunity to develop legal strategies that have the potential for system-wide impact (Nau *et al.*, 2021). Rather, the UK physical activity landscape is typified by a strong national-

level commitment to epidemiologically informed policy development, mixed implementation efforts, and a focus on delivery through certain sectors (*i.e.* health, sport and transport), which does not necessarily reflect the range of stakeholders engaged in local implementation and surveillance. In the following subsection of this chapter, I construct a critique of the manifestations of the existing UK physical activity policy landscape.

1.3.2.1 A critique of the UK physical activity policy context

Despite the perceived benefits of a national policy approach, this has not translated into meaningful change in population physical activity levels, or consistent changes in practice. There are several reasons for why this might be. First, policies have been developed with little consideration of social context and evidence on inequalities in physical activity (Kay, 2016). They have often been overly ambitious and confusing (Andersen and Jakicic, 2009; Haskell *et al.*, 2007), which has led to difficulties in translating policy into awareness among the public and key practitioners charged with implementation (Douglas *et al.*, 2006; Knox *et al.*, 2013). Furthermore, the simple answers that policy-makers have sought to a complex issue (*e.g.* nudging, and re-packing advice in terms of individual lifestyle choices made by so-called consumers of physical activity) are inappropriate to address the multiple determinants of physical activity (Kelly and Barker, 2016; Rütten *et al.*, 2013). While calls for innovative programmes with the potential to be scaled-up for population benefit have yielded little (Hanson and Jones, 2017), taken together, the above factors are likely to have resulted in increased inequalities, and mean that the policies adopted are in and of themselves ineffective, not solely the processes or implementation efforts, to which blame is typically apportioned (Hunter and Killoran, 2004).

It has also been argued that national policy has not necessarily addressed local implementation barriers, therefore reducing the likelihood that inactive people will access behaviour-change opportunities (Oliver *et al.*, 2016). Conflict between local intervention and national strategy is neither new nor uncommon in UK health policy (Exworthy *et al.*, 2002), yet the range of stakeholders, funders, and services involved further complicates understanding effective policy measures in the physical activity context. This diminishing influence of government and the need to collaborate and innovate across sectors (Oliver *et al.*, 2016a; Rütten *et al.*, 2013), is reflected in recent UK policy strategies (House of Lords Sport and Recreation Committee, 2021; Sport England, 2021d). By better understanding how this increasing interdependence in physical activity promotion is functioning, or not as the case may be, this can indicate the possibility, or otherwise, of ambitious new policy approaches (Piggin and Hart, 2017).

To offset issues of national policy, there has been growing appetite for evaluation and insight to inform physical activity best practice guidance (Public Health England, 2014b; Sport England, 2021d). Using evidence to inform policy and best practice from the bottom-up means local level actors assist policy creation and implementation to meet local needs (Matland, 1995). Despite frameworks designed to improve evaluation (*e.g.* Breckon *et al.* (2016); Cavill (2012); CECAN (2018)), these have been applied both sparingly and inconsistently, resulting in limited quality, comparability and transferability of evidence (Fynn *et al.*, 2020), thus inhibiting their use in policy and practice.

Increasing the amount and quality of scientific evidence does not guarantee its influence on the policy agenda, however, nor the implementation of policies that it informs (Cairney *et al.*, 2016; Exworthy *et al.*, 2002). Determining implementation

factors is crucial for scaling-up evidence from programmes into national policy (Public Health England, 2014a). However, with exceptions (Horodyska *et al.*, 2015; Howie and Stevick, 2014), and particularly in the UK context, there remains relatively little implementation research for physical activity policy (The Lancet Editors, 2021). Thus, policy-makers' and practitioners' attempts to transfer local success into wider contexts are constrained by a lack of critical information (Waters *et al.*, 2011). This, combined with the weak evidence-base has resulted in vague policies that are inherently conflicting and ambiguous.

Policy conflict, which arises when multiple organisations or sectors each see policy as being directly relevant to their own interest, despite holding incongruous views and remits (*e.g.* sport, health and transport sectors), directly affects the ease of policy implementation (Matland, 1995). Those who subscribe to top-down models of policy (*i.e.* the prevailing UK policy approach), try to minimise conflict with, for example, policy ambiguity, which refers to unclear policy goals and uncertain roles for organisations and other actors in implementation (Matland, 1995). Reflecting the norm in policy (Cairney and Oliver, 2017), Oliver *et al.* (2016a) argued that ambiguity exists in UK physical activity policy. Although encouraging wide-ranging interpretations and opportunities for experimental implementation, which is proposed to facilitate successful policy (Matland, 1995; Sanderson, 2009), it may be argued such approaches fail to consider barriers to implementation and subsequently local level activity engagement (Oliver *et al.*, 2016a). Failures of implementation are commonly found in the physical activity literature (Barrett *et al.*, 2013; Pratt *et al.*, 2020; Sallis *et al.*, 1998). That this is a common occurrence, both in physical activity and health policy research more broadly, is concerning given that such policies aim to disseminate research-derived best practice (Grimshaw *et al.*, 2012).

In sum, the physical activity policy landscape, both globally and in the UK, is characterised by consistent overarching policy proposals. However, due to insufficient or weak evidence, and inherent conflict and ambiguity that arises from the interdependent nature of policy-making, policy development and implementation are constrained. There appears to be confusion and inconsistent quality of practice within the physical activity sector as a result. This indicates a need to consider more effective solutions to informing policy amid uncertainty, conflict and ambiguity, as well as the type of evidence that is available. In doing so, policy efforts may be enhanced in ways that address persistent inequalities and issues of promoting physical activity at scale. The seemingly intractable nature of these problems, and the need for stronger collaborative responses driven from the bottom-up, are indicative of a wicked problem (Wistow *et al.*, 2015).

1.3.3 Physical inactivity is a wicked policy problem

According to Wistow *et al.* (2015, p.30), wicked problems:

> Are issues that are complex in terms of causal pathways, difficult to define and with no immediate solution, with one wicked problem often a symptom of another […] in calling these 'wicked' they contrast from 'tame problems' […] tame problems are not necessarily simple, since they can be very technically complicated. However, tame problems can be neatly categorised, and solutions are generally easy to identify or work out.

While for the reasons set out above, physical inactivity seems to be a wicked problem, this framing of the policy issue has seldom been used in physical activity research (even if, anecdotally, it may be discussed this way in practice). Two reports from a decade ago, suggested that physical inactivity is a wicked problem in need of urgent attention (PLOS Medicine Editors, 2013; Signal *et al.*, 2013). However, neither of these papers explained why the issue is wicked *per se.* This was addressed in a recent paper, which explored physical inactivity as a wicked problem in Sub-

Saharan Africa (Onagbiye and Bester, 2022). The authors drew on Jonsson *et al.*'s (2021) ten properties for defining a wicked issue to demonstrate how physical inactivity is an issue that: i) has no absolute formula; ii) has no obvious end point; iii) has no definitively right or wrong solutions; iv) has no speedy solutions; v) has properties that make repeated trial and error solutions difficult; vi) has an unknown number of possible solutions; vii) is fundamentally unique; viii) has a difficulty rating that is proportional to the number of people who pass judgement on it; ix) is influenced by different views and plans; and x) means those who make decisions are accountable for the outcomes of strategies to address it (Onagbiye and Bester, 2022). As a result, it is evident why the evidence-base around physical activity is characterised by uncertainty and ambiguity.

Given the paucity of research in this area, it is unlikely that this explication of physical inactivity as a wicked problem is exhaustive. However, it highlighted that addressing the issue is far from simple. It is suggested that to tackle such problems, multiple innovative and multifaceted approaches are required (Onagbiye and Bester, 2022). This means transcending disciplinary boundaries and instigating finance, information systems, governance, leadership and partnerships across all relevant sectors (World Health Organization, 2018). How to achieve this within and through policy remains unclear.

Furthermore, Wistow *et al.* (2015) argued that the dimensions of wicked problems pose challenges to traditional ways of making and implementing policy, thus requiring greater emphasis on systems, and stakeholder and public engagement. While progress has been made on this in some areas (*e.g.* aligning sport and health agenda in England (Milton *et al.*, 2019); or connecting national and subnational policies in Wales (Sharp *et al.*, 2022)), this remains one of the most challenging

aspects of physical activity and public health promotion (Das and Horton, 2016; The Lancet Editors, 2021; McKinnon *et al.*, 2011). Therefore, in order to confront seemingly unsolvable issues, such as physical activity inequalities and how to scale programmes effectively, a new direction is required that reflects the wicked nature of inactivity, and re-examines the rationale for, and underlying assumptions of, evidence-informed public health policy. This requires a methodological programme that accounts for complex contexts and unknown causal structures, and the interaction of many actors (Wistow *et al.*, 2015), thus enabling evidence to be strengthened and packaged in ways that better reflect the circumstances in which policies are created and implemented (Cairney *et al.*, 2019; Rutter *et al.*, 2017; Sanderson, 2009). This leads us to consider complexity theories.

1.4 Persistent physical inactivity is a problem of complexity

Having made the case for a renewed examination of UK physical activity policy, here I set out the second half of the rationale for my thesis, namely the need to critically explore the application of complexity theories in health promotion. This research programme has coincided with calls for a complex systems model of evidence for Public Health (Rutter *et al.*, 2017), and there has been increased interest in this topic over recent years (Apostolopoulos *et al.*, 2019; Jebb *et al.*, 2021). This interest has also been reflected in social sciences and policy research, with developments in research methods, methodological perspectives (*e.g.* implications for realism as applied in this thesis – see Chapter Three), and how complexity can inform existing research practices (Barbrook-Johnson *et al.*, 2021).

Over the coming pages, I discuss how complexity theories are helpful for considering wicked policy issues, such as physical inactivity, and reflect on how they are currently applied in relation to the physical activity field. In doing so, I identify a

need for a new critical perspective on complexity, in order to maximise the potential of health promotion policy. First, however, I set out the key terms of reference.

1.4.1 What is complexity?

By its very nature, producing accurate and universally accepted definitions of complexity has proved challenging, and the concept remains somewhat ambiguous (Cairney, 2012a; Gerrits and Verweij, 2013; Holland, 2014b; Rescher, 1998; Waldrop, 1993). Essentially, complexity is an ontological perspective; it has been described as a frame of reference (Byrne and Callaghan, 2014). Therefore, to say that something is complex, is to make an argument about the nature of that domain, its properties and the relationships between them. Complexity opposes the classical Newtonian viewpoint, and as a starting point may be considered as the *'opposite of simplicity, i.e. complexity focuses on intricate causal patterns that progress non-linearly, making for a poorly predictable reality* (Gerrits and Verweij, 2013, p.168)*.'* However, complexity should therefore be considered as a dynamic concept with a continually evolving meaning, and thus efforts to generate a complete description of this reality are rendered impossible (Cilliers, 1998). This highlights the need to explore how people can make sense of, and meaningfully apply, complexity through research, policy and practice in different domains. Complexity theories provide the tools to consider the properties of a complex reality.

1.4.2 Complexity theories

Throughout this thesis, I deliberately refer to theories in the plural, as it more accurately reflects that complexity theory is not a single definitive concept, rather it is an assemblage of interrelated perspectives with shared characteristics (Castellani, 2021; Cochran-Smith, 2014). For example, I particularly draw on the methodological

programme of complex realism (Byrne, 1998; Byrne and Callaghan, 2014), and examine different applications of complexity theories to social policy (Cairney, 2012a; Cairney and Geyer, 2017; Gerrits, 2012; Teisman *et al.*, 2009). Complexity theories, therefore, encapsulate these different approaches to the complexity frame of reference, and furthermore include the methodological practices that emanate from it (*e.g.* complexity science and systems-thinking). While the existing applications of complexity theories and the methodological approach to this study are detailed in the next two chapters, here I reflect on the development of complexity theories and their shared properties.

In one form or another, complex phenomena have been the subject of enquiry for millennia. Modern conceptualisations, however, can be traced to the eighteenth century Scottish enlightenment, and the examination of order in market systems (Hayek, 1978). Throughout the nineteenth and first-half of the twentieth century, this learning was applied and expanded upon in economics and physics in particular. General systems-theories of thermodynamics, once abundant but now largely rejected, were the precursor for current complexity theories (Cilliers, 1998; Manson, 2001). The notions of holism and system interconnectedness were introduced to the scientific community in the 1960s (Von Bertalanffy, 1968). Further advancements in physics contributed the crucial ideas of emergence and self-organisation from dissipative systems (Prigogine and Stengers, 1984). Byrne (1998) and Cilliers (1998), among others, started to develop these ideas in a social science context.

Thus, complexity theories constitute an interdisciplinary approach, originating in the natural sciences (Wistow *et al.*, 2015), and foster a closer relationship between so-called hard and soft sciences. Complexity theories promote a worldview that combines learning from physics, chemistry, biology, economics,

anthropology, sociology and beyond (Cairney, 2012a; Mitchell, 2009). Central to this worldview is the idea of a complex system and its properties. This needs to be differentiated from simple and complicated systems.

A system is comprised of component parts that are arranged, connected and dependent on one another in such a way as to form a purposeful whole structure, guaranteeing the flow of information, energy or matter (Grabowski and Strzalka, 2008). Simple and complicated systems are differentiated by the number of component parts. However, their characteristics are essentially the same. Such systems are easy to define, they follow predictable patterns of behaviour, and have deterministic causal pathways (Grabowski and Strzalka, 2008). On the other hand, Barbrook-Johnson *et al.* (2020, p.316) summarised key characteristics of complex systems to include:

> Their adaptive and dynamic nature, feedback loops, multiple scales, thresholds for change, areas of high and low stability, and open or ill-defined boundaries that can span (socio-technical) domains or areas of expertise and responsibility. Such features result in systems characterised by tipping points, non-linearity, emergent properties, and unpredictability.

Table 2 defines each of these, and other select, key features. While the reader is reminded about what these concepts are at various points in the thesis, this table may be a useful glossary of terms to refer back to.

Table 2. Features of complex systems

Component	Definition
Adaptive	Components of the system can learn and evolve over time, changing the systems' behaviour in anticipation of, or response to, alterations in context and the introduction of new information (*e.g.* physical activity policies).
Boundaries	Boundaries exist at the junction between systems and their environment. However, they are not seen as perimeters that fix a system in a particular place, rather they are a functional component of a system, with enabling and communicative properties. They are continually created, maintained and degraded.
Dynamic	A dynamic system is one that changes its state over time. In complex systems this change is considered to be non-linear.
Emergence	The interaction of components in a system can lead to new and unexpected higher-level properties. These properties are considered to be emergent if they cannot be described, explained or predicted from the arrangement of original components.
Feedback	When a result or output of a process influences the input either directly or indirectly. These influences can both accelerate or inhibit change in systems.
Multiple scales	Agents or interactions in complex systems can operate at different levels. Thus, systems need to be explored from multiple perspectives at the same time.
Nested systems	Complex systems often have nested within them, and are themselves nested within, other complex systems.
Non-linearity	Non-linearity is the direct result of the mutual interdependence of components in a system. Causal structures and pathways are multiple, conjunctural and non-deterministic.
Openness	Systems interact with their environment, exchanging material, agents, information, energy, and capital.
Path dependency	Current and future states of the system depend on the historical sequence of events and actions that have previously occurred.
Tipping points and thresholds for change	Change in systems is often slow, particularly at first. However, this can gather momentum and the system can reach a point at which sudden and dramatic change occurs.

Self-organisation	Regularities or higher-level patterns can arise from the local interaction of autonomous lower-level components.
Stability	Complex systems may exhibit multiple stable states, which can change over time alongside contextual evolutions. Systems typically gravitate toward these stable states, and remain this way until significant agitation occurs. If, having reached a tipping point, systems often slide quickly into a new stabled state, making it difficult to revert back to the previous state.
Unpredictability	Complex systems are fundamentally unpredictable. The sheer scale of the interactions, information and causal processes make predictions impossible, and mean that our understanding of the system is only ever partial.

Adapted from Boehnert (2018); Byrne (1998); and Cilliers (2001).

Complexity theories, therefore, enable people to explain and explore complex phenomena, by providing the framework for understanding the properties, characteristics and behaviours of societies as complex systems (Eppel and Rhodes, 2017). They have also led to the development of complementary and intersecting methodological research traditions, such as complexity science and systems-thinking (Barbrook-Johnson *et al.*, 2021). Within the context of this thesis, these are considered part of the complexity theories framework. Nevertheless, they are referred to in literal terms at various stages of this project. According to McGill *et al.* (2021, p.2):

> Complexity science typically takes a dynamic system as its principal unit of analysis. Often, such research defines and models systems, using computer simulation, to draw conclusions about how systems might behave over time.
>
> Systems thinking is concerned with the structure of a system, understanding and defining its 'boundaries', and making sense of the relationships between 'agents' and the wider system. Many systems thinking approaches gain insight from the multiple perspectives of different stakeholders and facilitate stakeholders and evaluators in restructuring their individual and collective understanding of the system in question.

Combined, the overall framework of complexity theories, as set out in this chapter, is of significance to the study of physical activity policy. In particular, complexity theories are especially suited to the analysis of wicked problems (Klijn, 2008). Furthermore, complex systems and their features typify UK policy-making environments (Cairney *et al.*, 2019), and the issues to which policy responses are developed (Barbrook-Johnson *et al.*, 2020). I now briefly discuss why that is so.

1.4.3 Policy-making is complex

Policy-making is characterised by features of complex systems, such as feedback, emergence, and path dependency (Cairney, 2012a; Cairney and Geyer, 2017). These manifest in particular practices and processes. Policy-making is a

multi-centric endeavour, meaning that it is self-organising and takes places at different levels, power is diffused within and between these levels, and that outcomes seem to emerge from within the complex system (Cairney *et al.*, 2019).

Furthermore, complexity theories align well with policy process models (Cairney, 2012a). For example, bounded rationality, which refers to the inability of policy-makers to process all of the available information about a policy problem (Cairney *et al.*, 2019), reflects the impossibility of knowing a complex system in its entirety (Cilliers, 1998). Kingdon's (2003) multiple streams model, which proposes that policy change occurs at the opportune intersection of a problem, its potential solutions, and political motive, suggests that policy change is non-linear and that actors in this space have to adapt to a changing system. Punctuated equilibrium theory explains how, like complex systems (Barbrook-Johnson *et al.*, 2020), policy is often characterised by long periods of stability and only occasionally rapid bursts of change when sufficient attention is given to a particular problem (Baumgartner and Jones, 2010). Furthermore, collaborative partnerships also play a crucial role for governments trying to gain a semblance of control amid self-organising systems (Wistow *et al.*, 2015).

It has been argued that the real value of complexity theories in policy are three-fold. First, to help policy-makers understand the complexity of their environment and its implications (Cairney, 2012a). Second, to foster conversations about the benefits of bottom-up approaches to evidence-informed policy (Cairney, 2012a), and third, to bridge the gap in conversations between academics and policy-makers that better reflect the need for pragmatic responses to the complexity of policy-making and policy issues (Cairney and Geyer, 2017). The latter contributions of complexity theories to policy are particularly relevant to the study of physical

activity, given the aforementioned focus on collaboration (Milton *et al.*, 2019; Sharp *et al.*, 2022), difficulty in generating effective bottom-up approaches (Fynn *et al.*, 2020; Oliver *et al.*, 2016a), and the scant attention paid to theories of the policy process (Pogrmilovic *et al.*, 2018).

1.4.4 Physical activity and public health are complex

In Public Health, complexity can be used to describe a problem (such as physical inactivity), a programme or intervention that is designed to address a problem, or the context in which this proposed solution is embedded (Nobles *et al.*, 2022b). Often there is an interplay between all three of these dimensions (Moore *et al.*, 2019). Rutter *et al.* (2017, p.2602) argued that existing evidence in the Public Health field has not traditionally been suited to understanding and addressing such complexities, and proposed that:

> A complex systems model of public health conceptualises poor health and health inequalities as outcomes of a multitude of interdependent elements within a connected whole. These elements affect each other in sometimes subtle ways, with changes potentially reverberating throughout the system A complex systems approach uses a broad spectrum of methods to design, implement, and evaluate interventions for changing these systems to improve public health.

They called for a new approach, which considers the distinct properties of complex systems, such as those defined above and elsewhere (Bolton *et al.*, 2022). In the years since Rutter *et al*.'s (2017) call to action, which have mirrored the duration of my doctoral training, there has been a proliferation of research and practice that draws on complexity theories, and its associated research traditions, in the Public Health sector (Jebb *et al.*, 2021). In line with the above conceptualisation of public health, physical activity can be considered as complex (Buchan *et al.*, 2012; Sparling *et al.*, 2000).

There are four reasons for why physical activity is a complex health behaviour. First, participation in physical activity is influenced by multi-layered determinants that interact in a non-linear way (Buchan *et al.*, 2012), and this requires multiple simultaneous strategies to address them (Rütten *et al.*, 2013). Second, societies, as the context in which physical activity and efforts to promote it take place, are complex systems (Eppel and Rhodes, 2017). Third, the processes by which people change their behaviour do not occur in a deterministic or linear fashion (Resnicow and Page, 2008). Fourth, there is a high degree of political complexity in which numerous agents (*e.g.* people and organisations), sectors and ideas are required to enable change in population physical activity levels (Rütten *et al.*, 2013). However, despite the evident need for a complex systems perspective to physical inactivity, it has been suggested that the incumbent physical activity and public health policy context is not often based on such models of evidence (Jebb *et al.*, 2021; Kay, 2016; Rütten *et al.*, 2013).

1.4.4.1 Reasserting the case for a complexity informed model of evidence for physical activity policy

It is necessary to make the case for applying complexity theories to physical activity policy for two reasons. First, an evidence-base that has not adequately accounted for complexity. Second, issues with emerging practices in this domain.

Models of evidence that underpin responses to public health problems have largely been devised to explore questions of clinical effectiveness, rather than reflect the complexity of society and policy programmes (Rutter *et al.*, 2017). Individualistic, simple and linear reasoning has consistently informed physical activity policy (Downward, 2017; Kay, 2016; Piggin, 2019; Rütten *et al.*, 2013; Stubbs *et al.*, 2018). This means that policies are based on a hierarchy of evidence,

which prioritises certain scientific practices over others, and tend to promote downstream measures, such as individual behavioural interventions (Kay, 2016b; Williams and Fullagar, 2019). This has contributed to considerable success, as highlighted above. However, it is no longer appropriate if we want to move the system forward, and address some of its most stubborn challenges. It can be argued that traditionally, the evidence-base for physical activity is insensitive to complexity (Ball *et al.*, 2015; Hanson and Jones, 2017; Lewis *et al.*, 2017).

Reductionist perspectives (*i.e.* those that are linear and non-complex), which have continued to inform policy, are a key contributing factor to systemic inequalities (Byrne, 1998), which clearly persist in physical activity (Ball, 2015; Hunter and Tulley, 2015; Rigby *et al.*, 2020a; Williams and Gibson, 2017). This issue has been compounded by a common disregard for social sciences that are better able to consider social context, which is a critical feature of complexity theories (Byrne, 1998). Understanding social context is essential for addressing inequalities (Kay, 2016; Salway and Green, 2017), and scaling programmes for population benefit (Pawson and Tilley, 1997). Furthermore, the complex circumstances around physical activity behaviour change have not been well reflected in policy (Oliver *et al.*, 2016b). This raises the question about how complexity theories, which stand in opposition to traditional models of evidence, can influence the process and products of policy better, as well as how they compete for the attention of policy-makers among other forms of evidence.

Coinciding with developments in applying complexity to policy more broadly (Barbrook-Johnson *et al.*, 2021), there has recently been a move toward complexity theories in physical activity policy, most notably through the application of systems-thinking, whole-system approaches and systems mapping (Milton *et al.*, 2021; Nau *et*

al., 2019; Oldridge-Turner *et al.*, 2022; Rutter *et al.*, 2019; World Health Organization, 2018). The focus of this has primarily been to describe the structure of the system (*e.g.* through maps), evaluate systems-based programmes, or to highlight and foster the necessary collaborative policy efforts across the system to address complexity. A complex systems approach is put forward as a definitive policy response to inactivity (Piggin, 2019). Arguably, these approaches are being applied uncritically, and are done so at the expense of other claims and modes of enquiry that assess the complexities of the social world. For example, there is a need to explore the implications of whole-systems approaches to physical activity policy (Piggin, 2019), and examine how, or otherwise, complexity theories more broadly are operationalised or extended in effective policies and across policy domains. In particular, the predominant focus on structural aspects of complexity over agency in Public Health research (Sniehotta *et al.*, 2017) has been helpful in understanding components of complex systems, but indicates a need to explore the roles of key agents in influencing systems, as well as the reciprocal influence that complexity exerts over them. Further detail about these arguments is unpacked in the literature review of this thesis (see Chapter Two).

1.4.4.1.1 Identifying success in a complex systems approach to physical activity

Having reasserted the case for a complex systems approach to physical activity policy, albeit one underpinned by greater critical reflection, it is prudent to briefly consider the types of outcomes that may be deemed successes from this kind of approach, which build upon achievements of, and overcome the current impasse in, physical activity research. In many cases, adopting a systems approach means facilitating systems agents' efforts to define their own success criteria (Nobles *et al.*,

2022b). Nevertheless, there are several *'benchmarks'* (Martin *et al.*, 2020, p.324) that can be drawn from the applied physical activity and Public Health policy and practice literature, which may be broadly relevant to any systems-based programme (see Table 3).

Key objectives of systems approaches to physical activity do not necessarily include increasing traditionally espoused statistical measures of population physical activity prevalence, *per se*. Quantitative changes of this nature often take much longer to manifest (Stansfield *et al.*, 2020); changes in physical activity may otherwise be captured in softer ways, through the perceptions of stakeholders (Nobles *et al.*, 2022a). Therefore, efforts may be better focused on creating and reforming the systemic conditions that enable, rather than constrain, effective population physical activity promotion. The ten benchmarks as described in Table 3 are illustrative, rather than an exhaustive list of potential systems objectives.

Table 3. Benchmarks of successful complex systems approaches to physical activity

Benchmark	Description	Indicative resources
System understanding	The system should be understood in terms of its structure and agents, where influence lies and what the potential points for intervention may be. Systems-level programmes should be founded on a shared vision of the system, its context, underlying mechanisms and potential unintended consequences.	Hall *et al.* (2021); Skivington *et al.* (2021); Stanfield *et al.* (2020).
Trust	There should be demonstrable trust between stakeholders, particularly between local community members and professionals.	Bagnall *et al.* (2019); Speake *et al.* (2016).
Committed collaboration	Multi-sector and cross-level collaboration with new and broad-ranging agents is an important outcome of systems-based approaches, as it promotes co-benefits of strategic alignment. There should be evidence of long-term commitment, strong stakeholder relationships and ownership across parties.	Bagnall *et al.* (2019); Nobles *et al.* (2022ab); Martin *et al.* (2020).
Strong communities	Systems approaches can lead to stronger communities, which are more resilient and braver in their approach to creating change. Community capacity and proactivity can be increased.	Bagnall *et al.* (2019); Nobles *et al.* (2022b); Stanfield *et al.* (2020).
Knowledge creation	Systems approaches can lead to new ways of creating knowledge. This often incorporates embedded researchers and co-production, but also methodological development. There should be an expectation on raising research capacity and standards of evidence that provide data to meet the needs of the system agents.	Hall *et al.* (2021); Potts *et al.* (2020); Speake *et al.* (2016); World Health Organization (2018).
Bold leadership	There should be demonstrable distribution of leadership, with strong collective commitment.	Martin *et al.* (2020); Nobles *et al.* (2022a); Stanfield *et al.* (2020).
Policy reform	At a strategic level, systems approaches can lead to physical activity-related outcomes being embedded in new and existing policies, which may be accompanied by renewed system-wide surveillance efforts and political support.	Nobles *et al.* (2022a); Rutter *et al.* (2017); World Health Organization (2018).

Restructured funding	Systems approaches may lead to the development of new cross-sectoral funding streams allocated to support collaboration and complex systems approaches to physical activity. These should be underpinned by a commitment to sustained support for implementation efforts.	Nobles *et al.* (2022ab); Rutter *et al.* (2017); Speake *et al.* (2016); World Health Organization (2018).
Ripples of change	Those adopting systems approaches may expect to find that changes implemented in a particular area of the system cascade to other parts, without deliberate action or anticipation. Changes implemented may lead to new and unexpected changes elsewhere, but still contributing toward the common purpose of the original programme.	Maitland *et al.* (2021); Nobles *et al.* (2022ab).
Shift in mindset	At an individual-level, systems approaches may lead to a change in mindset among system agents. They may exhibit a demonstrable increase in systems-thinking, or perceive greater knowledge and awareness of the nature of their complex systems, as well as systems more broadly.	Martin *et al.* (2021); Nobles *et al.* (2022a).

1.4.5 Final remarks on complexity

Evidently, physical inactivity is a problem of complexity. In this section, I have outlined the relevance, and potential contribution, of complexity theories for understanding policy and physical activity. Complexity theories provide a useful analytical framework for understanding the nature of reality, policy systems and wicked problems, and the overlap between the application of complexity theories to social policy and physical activity make this an interesting test site for advancing knowledge of public health issues and complex models of evidence. These ideas are developed further in Chapter Three.

1.5 Summary and thesis aims

In this introduction, I have made the case that persistent physical inactivity, particularly in the UK, is a problem of both policy and complexity. On one hand, a weak evidence-base has led to an inherently conflicting and ambiguous policy environment. Collaborative efforts to address inactivity are reflective of a wicked policy issue, which suggests a need to understand complexity. On the other hand, while physical activity promotion is complex, the evidence-base has traditionally been insensitive to complexity, and recent advances may be applied uncritically and in ways that preclude their optimal use. Across these two dimensions, there is a lack of understanding in how evidence informs physical activity policy, and how to develop policies and practices that are based on the principles of complexity theories, not merely associated rhetoric.

The following programme of research draws these two problem dimensions together, and focuses enquiry at the nexus of physical activity policy and complexity. If the goal of physical activity system change is to be achieved in such a way that it

ameliorates inequalities and creates opportunities for people to be active at scale, this requires multiple robust policy efforts, and a shift in the evidence-base that increases knowledge of how to inform policy and implementation. Complexity theories are proposed to be one framework for supporting this endeavour.

In better understanding how physical activity is promoted, this supports efforts to identify evidence and strategies that may be applicable in supporting public health more broadly. Therefore, this thesis presents research that aims to critically assess the understanding and application of complexity theories as a basis for evidence-informed physical activity policy. Specifically, I seek to extend complexity theories to this policy domain; interrogate the suitability of these perspectives for influencing, developing and implementing physical activity policies; and identify conditions that enable more effective complex systems approaches to physical activity policy and programmes.

1.6 Structure of the thesis

Much of the above discussion, and the substantive arguments raised within, will be revisited at various points throughout this thesis. Through the following programme of research, I do not purport to be able to solve issues that have been engrained in the physical activity sector, and across Public Health more generally. However, I present a new way of thinking about complexity and physical activity policy, that in turn can help cast light on these issues, and thus hope to initiate a conversation about previously unconsidered aspects of these topics.

This thesis has four main components. First, this introduction and literature review contextualise the current study. Second, the theoretical and methodological approach is introduced. Third, a collection of three chapters presents the substantive

empirical findings of this research. These chapters are accompanied by extensive appendices, which the reader is encouraged to consider, especially in Chapter Seven where important complementary details are provided. Last, the thesis culminates in a general discussion and conclusions chapter.

Following this introduction, I provide a literature review that situates the current study in the existing bodies of work that are drawn together in my research. Specifically, these relate to: i) physical activity policy; ii) evidence-informed Public Health and policy; iii) complexity in Public Health and policy. This identifies gaps where my research adds significance and originality, particularly at the intersection of these domains.

Chapter Three focuses on the philosophical and methodological assumptions that underpin this Ph.D. project. It begins with a critical reflection of who I was as a researcher prior to engaging in this project. Thereafter I critically discuss the ontological and epistemological implications of a complex realist approach to scientific enquiry, and justify the selection of qualitative methods and analytical techniques. The chapter concludes with a final reflection on how this process has influenced my research outlook.

Chapter Four presents findings from my first empirical study, in which I interviewed physical activity policy-makers working in the UK government and related public organisations. This chapter addresses questions about the understanding and application of complexity in national government. I draw attention to how the concept, while ubiquitous, is shrouded in uncertainty. This leads to an unclaimed policy space. I identify practices and outcomes that have the potential to both support and inhibit physical activity system change, notably the ideas of policy as leadership, and detachment.

Chapter Five presents findings from my second empirical study, in which I interviewed local physical activity stakeholders about complexity, leadership and policy implementation. The purpose was to explore how local partnerships can be used more effectively to improve the implementation of national physical activity policies. The findings are presented in two parts. The first relates to leadership, the second to policy implementation. These are drawn together in a critical discussion about their symbiotic relationship. In this way, I identify new contextual factors that can support or inhibit physical activity policy efforts.

Chapter Six presents my final set of empirical findings. These were constructed from a workshop hosted with key physical activity, complexity and policy stakeholders, from varied academic, policy and practice backgrounds. In this chapter, I draw on the learning presented in chapters five and six to 'take-stock' of the evidence-base, and consider ways to mobilise and enhance the uptake of complex theories and systems perspectives in physical activity policy. Through a realist lens, and a focus on mobilisers of knowledge, I consider how, for whom, and in what circumstances these perspectives may be most usefully applied. I present four propositions that reflect the current state of complexity in physical activity policy, and key considerations for advancing this field.

My thesis culminates in a general discussion and conclusions chapter, which also includes the limitations of the research and recommendations for future exploration. In this chapter, I discuss my findings further in relation to existing literature, highlighting the significance of my contributions to knowledge. Based on this, I pose considerations for theory, practice and evidence-informed policy. Notably, I set out the current conceptualisations of complexity theories, as they pertain to physical activity policy. I conclude by encouraging a reorientation of effort

across research, policy and practice, toward agency, mobilisation and meaningful implementation of complexity theories and systems perspectives.

Chapter 2. Literature review

2.1 Introduction

The purpose of this chapter is to situate this thesis in an existing body of knowledge, by reviewing literature that is relevant to its research aims. However, what constitutes relevant in a novel research programme is naturally subjective, and therefore driven by my positionality and theoretical commitments as a researcher. Specifically, I am committed to understanding the social world as complex (Eppel and Rhodes, 2017), and making a change to the physical activity system. Nevertheless, the introduction highlighted three broad areas of research that warrant consideration: i) physical activity policy; ii) using evidence to inform Public Health policy; and iii) complexity in Public Health and policy. Here, I set out a critical discussion of these topics, and related sub-themes, drawing on a variety of sources to identify gaps in the literature. While there is considerable overlap between these subjects, I discuss each in turn to construct a narrative that demarcates clear lines for further enquiry. This review includes articles published up to, and including, March 2022.

In the first section, I argue that physical activity policy research has focused primarily on evaluating the formation and outcomes of specific policies, as well as identifying what kind of policies can be instrumental in supporting population physical activity. However, to-date, there remains a lack of understanding about *how* to develop and implement the proposed approaches in practice, particularly in relation complex systems. This raises questions about our understanding of physical activity policy processes, and how to influence them.

The second section of the literature review explores evidence-informed Public Health and policy, and is divided into two main parts. First, I discuss the

assumptions that have traditionally underpinned the evidence-based movement, arguing that these are detrimental to further progressing physical activity, and examine what influences the uptake of evidence to inform public health promotion. This includes a brief exploration of knowledge mobilisation. I then draw on the evidence informed policy literature to highlight that further research is needed to understand the nuances of evidence-use and complexity in the physical activity domain.

In the third section, I examine trends in complex systems research; first, in relation to Public Health, and second, in policy studies. Through this, I demonstrate how the emphasis on descriptive research in Public Health has precluded a focus on agency, which is particularly important in developing and implementing complex systems approaches to policy and practice. Policy research is considered, and highlights a need to explore how complexity theories can be useful, or otherwise, in specific policy domains, such as physical activity.

This chapter concludes by drawing connections across these three interrelated research streams. In particular, I discuss the importance of collaboration for physical activity policy, evidence-informed Public Health, and complex systems approaches to Public Health and policy. However, I propose that a lack of research attention at the intersection of these domains has, thus far, precluded further advances in knowledge, and the effective application of complexity theories for public health benefit. The arguments set out in the literature review point toward a complexity-informed methodological approach to explore how complexity theories may be used in physical activity policy.

2.2 Progress and pitfalls in physical activity policy research

Physical activity policies are increasingly prevalent on a global scale, with 92% of countries (n = 73) surveyed in one study having published written policies. Sixty-eight per cent of all policies were published in the five-year period leading up to 2020 (Pogrmilovic *et al.*, 2020). Despite the proliferation of policy in recent years, it is often argued that these are poorly formulated and implemented, and evidence of their effectiveness is unclear (Milton *et al.*, 2020; Pogrmilovic *et al.*, 2020; Pratt *et al.*, 2021; Schmid *et al.*, 2006). However, such arguments perhaps do not reflect progress that has been made in identifying the type and components of policies that are more likely to have a positive impact on physical activity promotion.

Schmid *et al.*'s (2006) framework for physical activity policy research represented a significant step in attempts to understand the scale (*e.g.* local and national), sectors (*e.g.* transport and schools) and aspects of policy (*e.g.* determinants and outcomes) that can influence physical activity. An important feature of this framework, which was designed to be applied in policy development, was its expanded definition of policy to include both formal and informal regulations, standards and norms. This contrasted an earlier definition by Bull *et al.* (2004, p.95) that suggested that physical activity policy is *'a formal statement that defines physical activity as a priority area […] and provides a framework for action',* and thus Schmid *et al.*'s (2006) definition better reflected the nuance of what constitutes policy (see Chapter One). However, the ultimate impact of this framework, while reasonably well cited, has been limited (Pogrmilovic *et al.*, 2018). Two notable exceptions are a pair of content analyses, one on 27 national physical policy documents that concluded closer attention to the principles of policy development were required (Daugbjerg *et al.*, 2009), and a second on European sport policies

suggested that the health and sport sectors can collaborate more effectively to promote physical activity (Christiansen *et al.*, 2014). Readers interested in the development of this latter area are directed to Milton *et al.* (2019). Despite a lack of direct application of the framework, I argue that its dimensions (*i.e.* scale, sectors and policy aspects) are reflected in more recent research developments.

Although, as suggested above and in the previous chapter, research that explores policy in its broadest sense is warranted, the current global research and policy landscape strongly reflects Bull *et al.*'s (2004) landmark definition (Pogrmilovic *et al.*, 2018), not least in the development and naming of the World Health Organization's (2018) Global Action Plan for Physical Activity. There is now a considerable body of literature that has examined formalised, and in particular national-level, policies, such as physical activity guidelines and national strategies (*e.g.* Bull *et al.* (2015); Ding *et al.* (2020); Kahlmeier *et al.* (2015); Milton and Bauman (2015); Milton *et al.* (2020); Pogrmilovic *et al.* (2018); Pogrmilovic *et al.* (2020); Rütten *et al.* (2018); Rutter *et al.* (2019)). These have typically focused on the development, content and perceived potential of these policies. Taking the World Health Organization Global Action Plan (2018) as a reference point, it is possible to highlight contemporary trends in physical activity policy research.

The World Health Global Action Plan (2018) proposes 20 evidence-based policy actions that are broadly categorised as creating active societies, active environments, active people, and active systems. Framed within a whole-systems approach to physical inactivity, these policy actions are proposed to address the interaction between the individual, social, community, environmental and political dimensions of this problem, through a focus on proportional universality (*i.e.* universal opportunities for activity, with resources targeted at those most in need; see

(Marmot, 2010)). I suggest that this Plan is, in part, both the product and producer of current interest in the effectiveness of different policy approaches to physical activity.

A recent systematic review of reviews identified 53 types of physical activity policies, across four broad categories: setting- and target-group specific (*e.g.* school-based); urban design, environment and transport; economic; and broad-ranging, which covered multiple perspectives (Gelius *et al.*, 2020). It concluded that school-based policies were effective, while some infrastructural policies (*e.g.* for cycling and walking) may be effective. However, there was inconclusive evidence to support other policy types. It was notable, however, that the two promising policy sectors were those in which there was the most comprehensive evidence-base available to review, suggesting a need to develop and evaluate policy initiatives elsewhere. Nevertheless, these findings contrasted the argument of Milton *et al.* (2021, p.625), who advocated for investment in a broader range of policy areas *'that work for physical activity,'* to also include health care, public education, sport and recreation, workplaces and community programmes. Similarly, Oldridge-Turner *et al.* (2022) recently developed the MOVING framework for promoting physical activity policy. Based on a thematic analysis of existing policy documents and an expert consultation process, they identified a range of policy actions that directly correspond with the four dimensions of the World Health Organization (2018) Global Action Plan.

Evidently, strong progress has been made, through physical activity research, to identify a range of potentially effective policy intervention options for public health promotion. Consistent with the World Health Organization (2018) Global Action Plan, both Milton *et al.* (2021) and Oldridge-Turner *et al.* (2022) recognised that cross-sectoral collaboration is key to operationalising such policies, and in

doing-so called for a whole-system approach. Such arguments are long-standing in research (Eyler *et al.*, 2010), and popular in policy, including in the UK (House of Lords Sport and Recreation Committee, 2021; Sport England, 2021d). However, despite being aware of the need for multiple policy actions across the system and strong collaboration, the lack of progress in turning this knowledge into meaningful action at a national- and local-level (Pratt *et al.*, 2020), possibly reflects that collaboration across policy sectors remains a particularly stubborn challenge (The Lancet Editors, 2021). Furthermore, it points toward insufficient knowledge of how best to implement policies for physical activity (Pogrmilovic *et al.*, 2020; Pratt *et al.*, 2021), including whole-systems approaches, as well as a general underappreciation of the policy process in this domain (Hudson *et al.*, 2019; Pogrmilovic *et al.*, 2018). There has been little research on how to develop collaborative systems-based approaches in practice. I now consider emerging literature pertaining to each of these issues.

2.2.1 Implementation

Implementation research has interested political scientists since the 1960s (Howie and Stevick, 2014).

> Policy implementation may be defined as translating policy goals into actions or integrating a policy within a setting or a system, or the actions aimed at maintaining the use and capacity of a policy (Lobczowska *et al.*, 2022, no pagination).

As a field of research, it is concerned with identifying the conditions that may support or inhibit implementation, as well as the mechanisms and processes that determine that implementation, and the subsequent effectiveness, or otherwise, of policies amid the complexity of the environment (Cairney *et al.*, 2019). The following section begins with a discussion of implementation research in relation to

physical activity, and then briefly draws on literature from policy studies more broadly to highlight key gaps in knowledge.

Two systematic reviews have assimilated what, to-date, has been the predominant focus of implementation research in physical activity policy. The first was an attempt to identify the critical implementation conditions that support optimal policy outcomes in real-world settings (Horodyska *et al.*, 2015). Using the RE-AIM framework (Glasgow *et al.*, 1999) to guide the analysis of previous systematic reviews, it identified 83 unique conditions, which included socio-cultural issues, satisfaction and feasibility, evaluation processes, leadership, advocacy, implementation training, expertise, cross-sectoral collaboration, community support, and government involvement, to name but a few that reflected other physical activity literature (Hatfield and Chomitz, 2015; Salvesen *et al.*, 2008). This list, which the authors claim may need revision with further research and meanwhile may support identification of the most successful policy actions (Horodyska *et al.*, 2015), contributed to a substantial existing, and continually growing, implementation conditions evidence-base (*e.g.* Barrett and Fudge (1981); Cerna (2013); Gornitzka *et al.* (2005); Hudson *et al.* (2019); Sutton and Levinson (2001); Sabatier and Mazmanian (1979); Weiss *et al.*, 2016)). In general, however, implementation conditions are not necessarily uniform across different policies or contexts in which they are to be implemented. Therefore, as Sabatier and Mazmanian (1979) proposed 43 years ago, it is necessary to find a set of conditions that enable a substantial departure from the policy status quo. In the current physical activity context that means trying to understand the conditions that support systems-based approaches to evolve in global, national and local environments.

The second systematic review (Lobczowska *et al.*, 2022) examined the use of implementation frameworks, for example RE-AIM (Glasgow *et al.*, 1999), the theoretical domains framework (Atkins *et al.*, 2017), and the normalisation process model (May and Finch, 2009), that are designed to assist their users to focus on the ways in which policies are put into action. The findings of this review indicated that such frameworks typically have two or three aims, specifically, to combine the processes, determinants or evaluation of implementation, across different levels (*e.g.* individual and community). Crucially, however, complex systems were accounted for in only 8 out of 38 frameworks reviewed, and components related to inequalities were present in just 17 (Lobczowska *et al.*, 2022). This is particularly problematic for physical activity, where systems-based approaches to policy are advocated, and deep-rooted inequalities persist. However, while these many frameworks may assist researchers and policy-makers alike in understanding the proposed process, determinants and evaluation strategy for implementation (Nilsen, 2015; Tabak *et al.*, 2012), there has been little empirical evidence of their application in practice (Rigby *et al.*, 2020b).

The two systematic reviews highlighted above are characteristic of the descriptive nature of physical activity policy research to-date. While this has been important for understanding the complexity and context of implementation, few attempts have been made to understand and theorise about why certain implementation conditions are more effective, and how they are created in practice amid a complex policy environment. However, there are promising exceptions. For example, one report compiled in the grey-literature focused at national-level policy-making, while a second paper examined local implementation. I introduce these here.

Bellew *et al.* (2020) edited a strategic 'how-to' guide for policy-makers that explained how to develop and implement systems-based approaches to physical activity. Central to this approach were three pillars (*i.e.* governance, leadership, and knowledge mobilisation) that were said to underpin a systems-based approach (Nau *et al.*, 2020). In particular, the authors argued that the ideas of enabling leadership (*i.e.* bridging the gap between new ideas and formalised actions), governance structures that allow leadership to flourish (*e.g.* through establishing and brokering relationships, and disseminating knowledge); and discerning what, why and by whom knowledge is mobilised is key. However, there remains a need to empirically explore how some of these constructs are enacted, if at all, in practice.

On the other hand, Rigby *et al.* (2020b) examined how, through the organic growth of localised physical activity partnerships, it is possible to address and embrace the complexities of policy implementation, by creating space to bring different rationalities together (*i.e.* the different ways in which people conceptualise and use evidence), fostering inclusive leadership, and ensuring structural engagement in a clear system-wide vision. This study:

> Extends the knowledge-base by providing a local and practical perspective on stimulating a whole-system approach amid the competing policies and priorities of various stakeholder groups, who discussed difficulties in attaining and evaluating holistic intervention. While the importance of [national] policy was recognised, there is need to explore a systems approach built on structures and policies, together with tailor-made programmes to suit specific contexts in which people live. Understanding these local contexts, and the people who operate within and across them, will help both [policy] implementation and utilisation (Rigby *et al.*, 2020b, pp.10-11).

A key implication of these findings, as well as those above, is the need to further examine the role of agency in developing responses to complex policy systems. Furthermore, as this was a case study, given the complexity of policy (Cairney *et al.*, 2019), how learning may be transferred between contexts is as yet unknown. A move

toward a more theoretical understanding of physical activity policy implementation demands: i) that both policies and practices of system agents are considered in tandem; ii) implementing agents are considered as learners, thus able to adapt to complexity and provide insight into their experiences (Howie and Stevick, 2014; Rigby *et al.*, 2020b); and iii) a fuller appreciation of critical arguments from the social policy field.

Early policy implementation science was bound by a strict success versus failure dichotomy (Howie and Stevick, 2014). However, more recently, it has been suggested that the effectiveness of implementation is defined differently among different stakeholders. This can include compliance with instruction, accountability, goal achievement, or an affective reaction to a policy and its associated programmes (Matland, 1995). In Chapter One, I proposed that the physical activity policy environment is characterised by conflict and ambiguity. Matland (1995) argued that amid such circumstances, collaborative strength and context are key drivers of implementation. In an increasingly complex environment (Cairney *et al.*, 2019), ambiguity may present an opportunity to energise collaboration, as the effectiveness of policy implementation extends beyond policy-makers' cognitive limitations or lack of resources, and relates as much to the alignment of problems, solutions, resources and knowledge at a local-level Cairney (2012b). This requires a lateral and cross-cutting perspective on policy, that prioritises neither the top, nor the bottom (Rigby *et al.*, 2020b). To-date, however, I suggest physical activity policy research has been pre-occupied with outdated notions of policy success (*i.e.* 'what works') and, as is the norm amid ambiguity (Cairney, 2012b), retained a centralised view of policy and policy-making that is no longer grounded in policy theory, which has

influenced particular modes (*e.g.* document analyses) and foci (*e.g.* policy sectors) of enquiry.

2.2.2 Policy theory

The second pitfall in physical activity policy research thus far has been the lack of attention paid to policy theories, particularly in relation to the policy process (Pogrmilovic *et al.*, 2018). I suggest that this is exemplified in recent ambitious calls for multiple and simultaneous policy actions (Milton *et al.*, 2021; Oldridge-Turner *et al.*, 2022; World Health Organization, 2018), without a clear understanding of how to generate the necessary collaboration (The Lancet Editors, 2021), or any serious consideration of how to navigate the complexities of the policy environment or facilitate policy change.

In the previous chapter, I introduced three key theories of the policy process that align well with the tenets of complexity theories. These were: multiple streams analysis – the coupling of problems, policies and politics in the creation of policy windows, whereby carefully crafted policy solutions can be tabled by so-called entrepreneurs at opportune moments (Kingdon, 2003); punctuated equilibrium theory – policy is typically characterised by stability and extreme incremental change, although where sufficient attention is paid toward a particular policy area, rapid and dramatic change may occur at the expense of change elsewhere (Baumgartner and Jones, 2010); and relatedly, bounded rationality theory – policy-makers can only attend to a limited number of signals at any one time, therefore they must prioritise certain forms of evidence over others, and employ a number of rational (*i.e.* empirical) and irrational (*i.e.* normative) decision-making shortcuts, which can reinforce incrementalism (Cairney, 2012b). Each of these theories explains the policy

process in different ways and will be useful to consider aspects of complexity. Given the need to develop stronger collaborative approaches to physical activity policy (The Lancet Editors, 2021; Milton *et al.*, 2021), the advocacy coalition framework presents another potentially useful perspective to this area of enquiry.

The advocacy coalition framework posits that policy is made by coalitions of people, who operate in various positions and at various levels, who share a belief system and demonstrate significant coordinated activity over time (Sabatier, 1988). This perspective explains how, amid complexity and ambiguity, different policies may be processed in different ways. Some may concern public and politicised issues, while other policies may be processed in a technical and routine manner in more private spheres. Nevertheless, these coalitions operate slowly, and it can take upward of a decade for discernible outcomes to manifest from decisions (Cairney, 2012b). Other key features of this perspective are that coalitions compete with each other in subsystems (*i.e.* issue-specific networks) to dominate a policy-making space, and that coalitions learn lessons about policy through implementation, which are filtered through their entrenched belief systems (Sabatier, 1988). Difficulties in implementation research in physical activity may either preclude such learning, or present a significant impediment to challenging the prevailing belief system. This is particularly pertinent when the adoption of newer systems-based perspectives are advocated.

The purpose of this thesis is not to extend, or directly contest, these theories *per se.* Nor is it to conduct a policy analysis with these constituting my overarching framework. Those seeking a comprehensive analysis of theories of the policy process are directed to Weible and Sabatier (2018). My interests here are to critique the application of complexity theories. It is my proposal that by drawing on these various

perspectives, which have particular relevance to physical activity promotion (Racine *et al.*, 2022; Rütten *et al.*, 2013), at the appropriate times, these lenses can help elucidate knowledge about physical activity policy and complex systems (and by extension health promotion) in a manner that has seldom been applied in this field of research (Pogrmilovic *et al.*, 2018; Racine *et al.*, 2022; Schmid *et al.*, 2006; Rütten *et al.*, 2013).

There is, however, emerging research that primarily focuses on multiple streams analysis. This is notable as, compared to other policy theories, empirical applications of this approach had, until recently, largely been restricted to case studies of North American policy-making (Cairney and Jones, 2016). Multiple streams analysis has been used in two broad contexts. First, the analysis of specific physical activity policies (Hämäläinen *et al.*, 2016b; Milton and Grix, 2015; Piggin and Hart, 2017; Racine *et al.*, 2022). Second, to explore the relationship between research and policy (Hämäläinen *et al.*, 2015; Pratt *et al.*, 2015). Milton and Grix (2015) and Racine *et al.* (2022) both identified mechanisms by which policy windows have been opened. Specifically, by embedding physical activity solutions in other problem streams (Racine *et al.*, 2022), and seizing an opportune moment in the build-up to a major global sporting event to agitate the political stream and align cross-sectoral support for walking policy in the UK (Milton and Grix, 2015). Through analyses of policies to address physical activity inequalities, and the actions of an All Party Committee in UK government, respectively, Hämäläinen *et al.* (2016b) and Piggin and Hart (2017) argued that greater attention should be given to the policy process to improve the outcomes of policy entrepreneurship, in particular the balance between radical and conservative policy solutions. This relates to the complex way in which research and other forms of evidence influence policy, in

which it is suggested that collaborative brokering of relationships is required (Hämäläinen *et al.*, 2015; Pratt *et al.*, 2015).

The potential benefit of a multiple streams perspective to physical activity research in particular, is that this approach assumes ambiguity shrouds policy situations (Weible and Sabatier, 2018). Applying this allows the exploration of links between central government policy directives and local agency activities. Thus, continued consideration of physical activity policy from this perspective, alongside other policy theories as applicable, may enable a more cross-cutting examination of its processes.

2.2.3 Furthering progress in physical activity policy research

A full understanding of policy developments can take many years or decades (Howlett and Cashore, 2009). While tools have been developed to expedite this process (*e.g.* Pogrmilovic *et al.* (2019)), the field of physical activity policy research is still very much in its infancy, having primarily developed since the turn of the Millennium. This nascence is highlighted further given the recent turn toward systems-based approaches (World Health Organization, 2018). This thesis, therefore, is among the first attempts to explore physical activity policy from a complexity theories perspective.

In this section of the literature review, I have argued that physical activity policy research has largely focused on identifying components of, and sectors related to, policy. However, notwithstanding the relatively short timeframe over which this has been conducted, progress has stalled due to a lack of attention to implementation and policy theory. As Gelius *et al.* (2020) assert, it is necessary to critically re-examine the approach to physical activity policy. A new approach needs to be

informed by policy theory, consider different levels of policy-making and implementation, and closely focus on issues of collaboration and the actions of policy stakeholders (*e.g.* what policies are pursued, what information is prioritised, and how are people encouraged to work, or change their practice?). Furthermore, broader definitions of policy and policy-making, as set out in Chapter One, facilitate this renewed focus. Better understanding the processes of how physical activity policy is developed and practised can facilitate knowledge about how best to inform that policy. Next, I review literature related to the use of different types of evidence in policy and practice.

2.3 Using evidence to inform Public Health and policy

Evidence-based Public Health is the judicious application of scientific reasoning, data and theory to the development, implementation and evaluation of effective policies and programmes designed to improve population health (Brownson *et al.*, 2018). In this way, the idea of evidence-based Public Health is appealing, as it points toward a rigorous approach that is underpinned by research. Furthermore, it is proposed that if fostered effectively, it may lead to numerous direct and indirect benefits (Brownson *et al.*, 2009b). For example, increased access to, and higher quality, information about 'what works'; a higher likelihood of effective implementation; enhanced productivity; and more efficient use of resources. However, there is considerable debate about the possibility, potential and processes of evidence-based Public Health, particularly in relation to policy (Brownson *et al.*, 2018; Cairney, 2016; Cairney and Oliver, 2017; Kelly *et al.*, 2010; Smith, 2013). In this section, I draw on a variety of literature to consider questions such as, where has this approach come from; what constitutes evidence; and what factors influence the

likelihood of its adoption and translation? I begin with a general discussion of the Public Health literature, before focusing on policy given its relevance to this study. In doing so, I pose some key aspects that warrant further consideration in shifting toward a complex systems model of evidence to physical activity policy, and Public Health more broadly.

2.3.1 Evidence-based medicine is the backdrop to evidence-informed Public Health

Evidence-based medicine was an approach established in the early 1990s (Guyatt *et al.*, 1992). It was conceived as an antidote to medical practice based on individual and collective clinical experience, and to ensure that medical decisions were based on the best available clinical evidence. This approach has two fundamental principles: first, that evidence is selected based on a hierarchy of methods; and second, to use evidence to directly persuade practitioners to abandon 'bad practice' (Cairney and Oliver, 2017). The hierarchy of evidence is a framework that ranks different forms of scientific research according to how well they assess the question of clinical effectiveness (Brownson *et al.*, 2009b). Thus the 'best' evidence at the top of the hierarchy is derived from research methods that prioritise internal validity (*i.e.* meta-analyses and randomised controlled trials), while at the bottom are qualitative case reports and anecdotal evidence. The strict adherence to this approach has had undoubted positive impacts on clinical practice, particularly in relation to the use of pharmaceutical treatment and certain clinical guidelines (Kelly *et al.*, 2010). However, in Public Health, its influence has been challenged, not least due to its incompatibility with complexity, as I alluded to in the previous chapter.

Before discussing the problems of the evidence-based medicine approach to Public Health, it is worth reiterating that examining questions of effectiveness is a

critical first step of informing the Public Health agenda (Brownson *et al.*, 2018; Chaloupka and Johnston, 2007). In physical activity, therefore, the rapid expansion of research, at the aggregate level (Rosen *et al.*, 2006), has identified its epidemiological and aetiological importance (see Chapter One). Thus, determining how to increase physical activity is now a key Public Health priority. It is the continued prioritisation of the evidence-based mantra, however, that is problematic.

Research methods that occupy elevated positions in the hierarchy of evidence (*i.e.* randomised controlled trials and systematic reviews that prioritise this form of research, such as meta-analyses) are premised on linear causal models (Rutter *et al.*, 2017). These explain phenomena in terms of parameters, and seek to generate universal laws that state how said phenomena change, if parameter values are altered (Byrne and Callaghan, 2014). Each causal condition is typically perceived to have an independent and additive effect on the outcome. While statistical techniques, such as multi-level modelling, enable the moderating effects of interaction variables to be explored, these remain based on simple causation and linear probabilistic reasoning, and do not capture complexity as conceptualised in this study (Byrne, 2011). Such reductionist logic breaks down outside of clinical settings, where complex societal systems exhibit conjunctural and multiple causal pathways (Byrne, 2011) – see Chapter Three, and Byrne and Uprichard (2012), for a full explanation of these properties. Furthermore, this approach to evidence prevents policy-makers from exploring the *'complex, context-dependent and value-laden way in which competing options are negotiated by individuals and interest groups* (Byrne, 2011, p.47)*.'*

The prolonged commitment to reductionist values in social and Public Health research has polarised society (Byrne, 1998). It may also reinforce the inverse evidence law by which approaches most likely to influence population health

outcomes (*e.g.* policy or environmental change) are least valued in a hierarchy of evidence (Brownson *et al.*, 2009b; Rutter *et al.*, 2017). A systems-based approach to Public Health and policy, as is increasingly advocated (Rutter *et al.*, 2017; World Health Organization, 2018), stands in direct opposition to such linear and hierarchical perspectives. The effect of its absence (Rutter *et al.*, 2017) however, may be observed, for example, in continued physical activity inequalities (Ball, 2015; Rigby *et al.*, 2020a).

A second issue of the evidence-based medicine approach to Public Health, and social research more broadly, is that it has prevented research findings from being transferred to wider predictive contexts (Byrne and Callaghan, 2014; Kelly *et al.*, 2010). The prioritisation of methods that emphasise internal validity, over external validity, has resulted in a situation whereby there is a longstanding dearth of information about implementation and contextual factors at multiple levels of analysis (Brownson *et al.*, 2009b; Kelly *et al.*, 2010). Again, this reflects issues of scaling physical activity programmes (Lane *et al.*, 2021), and represents an important aspect of what a complex systems model of Public Health evidence aspires to address (Rutter *et al.*, 2017).

While proponents of the complex systems perspective have rightly critiqued the evidence-based movement in Public Health (Rutter *et al.*, 2017), they have perhaps reflected less on the distinctive nature of evidence-based Public Health, as opposed to medicine. Brownson *et al.* (2009b) argued that in Public Health, while the hierarchy of evidence remained, there was a broader range of methods used in research. Furthermore, Public Health typically focuses on programmes of multiple strategies rather than singular interventions, thus multiple disciplinary perspectives are drawn together to address common problems. These earlier conceptualisations of

evidence-based Public Health proposed that decision-making should be informed by the intersection of the best available evidence, resources (including practitioner expertise), and population characteristics and needs, which come together in specific contexts (Brownson *et al.*, 2009b).

However, it has been shown that context in particular has been poorly considered in Public Health research, and that an alternative approach is required. For example, realist methods (*e.g.* Pawson and Tilley (1997)) have grown in popularity and hold promise given their ability to explore context and how it interacts with mechanisms to produce certain outcomes, as well as through giving equal credence to traditionally discarded methods (Kelly and Barker, 2016), such as qualitative research.

The aspiration of informing policy and practice is not new, nor should it be controversial (Boaz and Davies, 2019). However, as evidenced by the persistent challenges in physical activity promotion, it suggests that there is uncertainty about how to steer this toward complexity theories and complex models of evidence. This requires a closer examination of what constitutes evidence, and how it is mobilised from research into policy and practice.

2.3.2 What is evidence?

Consistent with other dimensions of this thesis, there are multiple ways in which evidence can be conceptualised (Rychetnik *et al.*, 2004). For example, there are empirical perspectives, such as the *'available body of facts or information indicating whether a belief or proposition is true or valid* (Brownson *et al.*, 2009b, p.177).' However, this would propose that normative information (*e.g.* beliefs and values) is the object of scrutiny, rather than constituting a form of evidence in and of

itself. Alternatively, in broader terms, evidence may be considered as pieces of knowledge about a problem (Bowen and Zwi, 2005). In both cases, note the absence of the terms research or science. In this context, the notion of a hierarchy of evidence seems misguided at best. Scientific, or research-based, evidence is but one form of information that can inform policy approaches to wicked problems (Head, 2008), such as physical inactivity. The definition and relative value of any given type of evidence is often unique to its creators and users (Brownson *et al.*, 2009b). Thus, it is pertinent to explore these aspects in new contexts.

Evidence about public health problems is drawn from various sources. These include scientific research, political know-how, implementation feedback, beliefs, values, competencies and lived experience (Bowen and Zwi, 2005; Head, 2008). Therefore, it is within and through this diverse range of information sources that ideas about complex systems must compete for acceptance amid myriad other perspectives on policy problems. Smith (2013) proposed that the presence of these different ideas are central to policy, and that examinations of evidence-informed policy in Public Health should focus on how they interact and change. To date, I argue, there has been little consideration of how evidence from complexity theories and systems-based approaches interact with other forms of information about physical activity. This warrants consideration in policy-making and implementation contexts. Furthermore, it may be prudent to extend Smith's (2013) concept from an analysis of policy to an analysis of scholarly practices, to understand how complexity theories interact with, complement or challenge other research ideas, theories and perspectives. In both cases, the complexity of physical activity and its surrounding policy environment (Cairney *et al.*, 2019; Oldridge-Turner *et al.*, 2022) encourages evidence to be considered in the broadest terms, and an examination of how certain

types of evidence are mobilised and translated into policy at the expense of others. This includes scientific knowledge of complexity theories.

2.3.3 Translating and mobilising research knowledge (the Public Health perspective)

Knowledge translation and mobilisation are terms that are often used synonymously in research, albeit to different degrees across sectors and disciplines (Barwick *et al.*, 2014). For example, knowledge translation is common in implementation science (Barwick *et al.*, 2014), with which there is a considerable degree of overlap in theories and models (Nilsen, 2015). Other related terms include knowledge exchange and knowledge transfer, but each of these four concepts broadly refers to how knowledge of a phenomenon transcends boundaries between research, policy and practice, and I suggest may equally be applied to communities, systems and societies. Specifically, however, knowledge translation can be defined as the strategies, systems and research practices that are designed to improve the application of all research evidence in policy and practice, whereby the aim is to often achieve equivalence rather than literal translation (Rychetnik *et al.*, 2012). Mobilisation, on the other hand, is concerned with the processes of how knowledge moves between different contexts (Haynes *et al.*, 2020). While these are inherently entwined, I argue that maintaining the distinction between what (*i.e.* the product for translation and application), and how (*i.e.* the processes of mobilisation), knowledge crosses boundaries is useful.

Public Health knowledge translation and mobilisation is notoriously challenging (van der Graaf *et al.*, 2020). Estimates a decade ago suggested that the average time-lag between production of research evidence and its application in practice was 17 years (Morris *et al.*, 2011). Nevertheless, with the development of

various frameworks to support knowledge translation and mobilisation, some were optimistic that the gap between research and practice could be reduced (Nilsen, 2015). However, Rigby *et al.* (2020b, p.10) identified how similar obstacles to whole-system physical activity policy efforts persist:

> A particularly stubborn challenge is the mismatch between the time taken to conduct research and the immediacy with which evidence is needed in policy and practice. Policy-makers and practitioners often need to make quick decisions in rapidly changing environments, yet evidence on which to inform decisions about how best to increase physical activity engagement is not always readily available. Our findings revealed that stakeholders believe that ensuring physical activity becomes a well-resourced local priority will not speed up the research process. This and many other challenges identified by stakeholders have persistently been raised in the physical activity literature. This will likely continue despite progress in translational research, a problem which is indicative of the wicked nature of these issues and the need to understand and manage their complexity.

Despite such difficulties, there are some notable themes in the knowledge translation and mobilisation literature that may be useful for addressing this complexity.

Davies *et al.* (2015) reviewed different models of knowledge mobilisation and identified several archetypal mobilisation activities – knowledge production, brokerage, intermediation, advocacy and research; fostering networks; and advancing knowledge mobilisation. Considering the existing physical activity policy literature discussed above, it can be argued that thus far, complex systems approaches to physical activity policy have perhaps focused primarily on production and advocacy (Milton *et al.*, 2021; Oldridge-Turner *et al.*, 2022; World Health Organization, 2018); and to a lesser degree, fostering networks (Rigby *et al.*, 2020b; Rütten *et al.*, 2019). Recently, Haynes *et al.* (2020) applied systems-thinking to explore the different mobilisation archetypes in Public Health, which they argued had typically been considered in linear terms. The authors determined that each of these archetypes could be considered in terms of complex systems, but that there was need for greater

clarity on what is meant by systems-thinking, and new methods to track mobilisation across systems. While an interesting development pertinent to the current study, as yet there is no research that examines complexity theories themselves, and how collaboration, power structures and adaptive learning (Haynes *et al.*, 2020) affect their mobilisation in Public Health. Of particular interest is the need to consider the advancing knowledge mobilisation archetype (Davies *et al.*, 2015), which to-date seems to have received minimal attention.

According to Holmes *et al.* (2017), mobilising knowledge in complex systems, such as those relating to physical activity and policy, involves working with complexity, rather than against it. This includes co-producing knowledge, establishing shared goals, enabling leadership, and ensuring the availability of resources (Holmes *et al.*, 2017). Such integrated knowledge-to-action activities, whereby researchers, policy-makers and practitioners combine to embrace complexity and foster systems-based approaches, are shown to be promising in physical activity policy settings (Rigby *et al.*, 2020b; Rütten *et al.*, 2019). In attempting to explore the mobilisation of complexity theories across complex systems, this suggests a need for research methodologies in which researchers are embedded in systems alongside other policy stakeholders. Furthermore, it reflects calls for a greater emphasis on understanding policy-making in Public Health, and action-orientated approaches to knowledge mobilisation research (van der Graaf *et al.*, 2020).

Although there is a substantial physical activity evidence-base, this has, as yet, had limited impact on policy (Lee *et al.*, 2021). Furthermore, there is little discernible evidence that, despite considerable advocacy, complexity theories underpin Public Health policy (Jebb *et al.*, 2021). While acknowledging the

continued difficulties in translating and mobilising research, it is necessary to try to establish why, and what can be done to address any barriers that exist. In particular, an emphasis on the knowledge mobilisers, their actions, beliefs and ethos are important (van der Graaf *et al.*, 2020; Ward, 2017). To facilitate a movement toward a complex model of Public Health evidence, there also needs to be a greater appreciation of the policy environment in which evidence translation is desired.

2.3.4 Lessons and opportunities in policy research

Factors affecting the extent to which evidence may influence policy have been reviewed extensively (Bowen and Zwi, 2005; Brownson *et al.*, 2009a; Cairney, 2016; Cairney and Oliver, 2017; Masood *et al.*, 2020; Smith, 2013). In this next subsection I highlight some key arguments from policy studies, alongside examples specifically related to Public Health and physical activity policy, which are important for the context of the current study.

The idea of evidence-based policy-making gained prominence in the UK at the start of successive New Labour Governments (1997 to 2010), whose mantra of 'what counts, is what works' was central to their modernising agenda (Perkins *et al.*, 2010). In practice, however, this did not result in a technocratic government whose only interest was scientific evidence of effectiveness, and other key policy influences remained (Wells, 2007). For example, one report indicated that rigorous scientific evidence ranked bottom among policy-makers' perceptions of good policy-making (Hallsworth *et al.*, 2011). Furthermore, the notion of evidence-based policy is contested and differs in meaning across policy and research domains (Cairney, 2016; Wells, 2007). Today, the concept is challenged by economic pressures and the rise of post-truth politics (Wellstead *et al.*, 2018). This contestation and post-truth politics

have been felt keenly during the SARS-Cov-2 pandemic (Lancaster *et al.*, 2020; Parmet and Paul, 2020).

The urgency of the SARS-Cov-2 pandemic highlighted longstanding debates about the supply of research, which has previously be characterised as untimely, weak, out of touch with local intuition, or inappropriately framed (Rutter, 2012). Furthermore, before the pandemic, concerns were also raised about the ethical implications of experimentation, the potential for political risk, data protection, and the lack of evidence transferability across both government departments and different policy problems (Rutter, 2012). These are all supply side issues. On the other hand, demand-side arguments indicated that policy-makers are often driven by values, not outcomes (Cairney, 2016), and that organisations may not foster a culture and competence, nor receive incentive for, rigorous evidence-based policy-making (Rutter, 2012). There is a need to consider how such issues may be addressed, and to what end. However, any strategies identified will remain futile unless attention moves from the supply and demand of evidence itself, toward an examination of the broad actions of policy agents, and accounts for the policy process, and the multi-level and multi-centric nature of policy making systems (Cairney, 2016; Cairney *et al.*, 2019; Piggin and Hart, 2017).

In Chapter One, and section 2.2.2 of the literature review, I introduced several theories of the policy process. Again, these are useful for making sense of how evidence may inform policy. Nevertheless, a brief extension to some of these ideas here is necessary to emphasise their relevance to my thesis, and reiterate the importance of understanding the complexities of evidence-informed policy-making, which is neither linear nor cyclical (Brownson *et al.*, 2018). In this context, the concept of bounded rationality is a common departure point (Cairney, 2016).

To reiterate, bounded rationality means that policy-makers cannot gather and process all evidence pertinent to a problem (Cairney, 2012b). Their rational decision-making is inhibited by an infinite number of policy signals, cognitive limitations, and time-demands. Consequently, emotions, beliefs, habits and familiar reference points all facilitate quick decision-making (Cairney, 2016). Brownson *et al.* (2009a) argued that these other influences interact with scientific evidence in a series of feedback loops, which determine the framing, content, dissemination and perceived outcomes of Public Health policy. In this way, using evidence derived from research is only ever one legitimate approach to policy. Scientific advice, personal and public values, pragmatism, and democratic processes are all important factors (Bowen and Zwi, 2005; Cairney, 2016; Rutter, 2012). Thus, the distinction between evidence-informed (*i.e.* the reality of policy-making) and evidence-based (*i.e.* an aspirational perspective) is apt, and I have purposely adopted these terms at particular times to reflect the state being discussed. Nevertheless, one should not be dismissive of these apparent irrationalities, rather try to understand them, and the heuristics policy-makers use to make sense of their unpredictable environment.

It is proposed that a useful way to approach evidence-informed policy-making is to consider how ambiguity about policy problems may be reduced (Cairney and Oliver, 2017; Wellstead *et al.*, 2018). In these circumstances, and similar to issues in Public Health more broadly, adherence to hierarchies of evidence is inappropriate (Brownson *et al.*, 2018; Cairney and Oliver, 2017). Rather this endeavour involves substantial and carefully-crafted collaborative effort to target both rational and irrational decision-making strategies, as set out above (Cairney and Oliver, 2017; Smith and Stewart, 2014), and attention to the mechanisms that underpin the use of evidence (Wellstead *et al.*, 2018). While complexity theories

denounce the hierarchy of evidence, such approaches are being advocated strongly in Public Health research as a plausible solution to key issues (Oldridge-Turner *et al.*, 2022; Rutter *et al.*, 2017), at the possible expense of alternative forms of evidence and information (Piggin, 2019). Thus, this reinforces the importance of exploring their application in novel domains, such as physical activity policy.

Similar findings to those already discussed in this subsection of the literature review were reflected in two recent studies that specifically focused on Public Health policy (Masood *et al.*, 2020; Newson *et al.*, 2021). These studies identified a range of contextual barriers and facilitators to research-use, which included organisational factors, funding and incentives, individual dispositions, and social factors. In relation to physical activity, specifically, an emerging body of literature has focused on collaborating and communicating with policy-makers. Proposed strategies include creating a compelling and emotional narrative that demonstrate the political and moral value of research (Stamatakis *et al.*, 2010), creating interdisciplinary coalitions (Giles-Corti *et al.*, 2015; Hämäläinen *et al.*, 2015; McKinnon *et al.*, 2011), and crucially, developing a more flexible understanding of the complexities of the problems, and the domains that knowledge is to transcend (Pratt *et al.*, 2015). While exploring how systems-based research is packaged and mobilised, it is toward this latter endeavour that my study contributes most significantly.

2.3.5 Supporting the uptake of complexity theories in physical activity policy

In this section, I have considered key arguments among existing literature related to evidence-informed Public Health policy, as one of three key bodies of knowledge in which my thesis is situated. In sum, I have demonstrated that while aspiring to evidence-informed Public Health policy is a worthwhile endeavour, the

nature of evidence and context are important considerations. Furthermore, it is important to understand the actions of those who mobilise and receive research evidence. There are numerous barriers and facilitators to the uptake of evidence in policy, which is limited by bounded rationality and an array of decision-making shortcuts. Richer, or more abundant evidence is no guarantee that it will be used to inform policy, and efforts to better understand the conditions and circumstances (*e.g.* ambiguity and complexity) in the policy environment are necessary. These factors all have important implications for the understanding and application of complexity theories and systems-based models of evidence in physical activity policy, and have thus far received limited or no scholarly attention in this domain.

In moving toward a complex systems model of evidence for Public Health, it is necessary to consider how policy-makers receive, adapt and adopt evidence, and how organisational and political factors constrain or facilitate these processes. Importantly, the values and interests of those influencing responses to the evidence or policy problem also warrant examination. This presupposes an approach to research that directly engages policy stakeholders in a dialogue about their experiences, and accounts for the many forms of evidence that can influence policy for wicked problems.

It is as yet unclear to what extent complexity theories can, or should, influence physical activity policy, amid a congested policy-making space. Nevertheless, it is proposed that they may offer other insight into the complexity of the policy environment, and the necessary collaborative activities that complex systems approaches to Public Health entail.

2.4 Understanding complexity in Public Health and policy

In the previous chapter, I explained how both physical activity and policy processes are complex phenomena, and that the application of complexity theories and systems-based approaches are gaining prominence in Public Health research and practice (Apostolopoulos *et al.*, 2019; Jebb *et al.*, 2021). However, while interest has increased in recent years, this field has been subject to scholarly enquiry for two decades or more. For example, among early applications of this perspective were two pivotal papers that introduced key concepts of complex adaptive systems and holistic approaches to health, albeit with a more clinical focus (Plsek and Greenhalgh, 2001; Wilson *et al.*, 2001). Building on these ideas, Leischow *et al.* (2008) advocated systems-thinking as a rubric for understanding and changing the societal structures and functions that create the complexity of Public Health systems, and suggested that key areas for development included the application of systems methods, fostering network relationships, building system capacity, and encouraging transformation to a system culture. A systematic review of system science and systems-thinking for public health proposed that the research landscape was most heavily populated by position pieces that advocated the potential of such approaches, while analytic, benchmarking and systems modelling publications were present in decreasing quantities (Carey *et al.*, 2015). Most recently, it was suggested advocacy remains strong and evaluative approaches had progressed, but further effort is required to advance from rhetoric toward Public Health policies and programmes that are underpinned by complex-systems perspectives (Jebb *et al.*, 2021).

Therefore, it is within this historical perspective that I review literature related to complexity in Public Health and policy. In this penultimate section, I examine three prominent trends in Public Health and physical activity research, and

draw on policy studies to critique the evidence-base, thus highlighting gaps in knowledge that warrant further enquiry. First, I discuss how a focus on structural perspectives to complexity has thus far precluded consideration of agency. Second, I explore the implications of the many frameworks that have been developed for systems-based research. Third, I consider methodological and theoretical developments. Thereafter, the section concludes with a more general discussion of the implications for, and application of, complexity theories in policy studies.

2.4.1 Structure and agency

It has been argued that complex systems approaches in Public Health have traditionally focused on structural aspects of complexity, rather than issues of agency (Sniehotta *et al.*, 2017). This emphasis is exemplified in particular research practices, which to their credit seek to understand the way in which systems are characterised by many component parts (Grabowski and Strzalka, 2008). The following is an illustrative example.

The emergence of systems-mapping has generated much interest in the physical activity and Public Health field (Bellew *et al.*, 2020; Cavill *et al.*, 2020; Murphy *et al.*, 2021; Nobles *et al.*, 2022b; Rutter *et al.*, 2019; World Health Organization, 2018). The purpose of systems mapping is to create a visual representation of a system's structure, by illustrating its components and the causal connections between these (Wilkinson *et al.*, 2021). A key benefit of this approach, demonstrated in physical activity research, is that it enables stakeholders to conceptualise complexity, and understand what a system comprises and how they as agents in the system are related to its various components (Cavill *et al.*, 2020). Furthermore, systems mapping is a useful tool in identifying potential leverage

points, whereby policies or programmes can have the most substantial impact on public health (Maitland *et al.*, 2021; Signal *et al.*, 2013). This method has also been used in evaluation of systems programmes (Nobles *et al.*, 2022b). A recent application was among the first to apply this approach to physical activity policy-making, in order to develop a causal loop diagram of the system driving physical activity in the Caribbean, and adapt the World Health Organization (2018) Global Action Plan to local contexts (Guariguata *et al.*, 2021). However, such approaches are typically descriptive and are indicative of potential issues in complexity research.

While a necessary step in being able to understand what a system is, its context and boundaries, and in some cases how it behaves (*e.g.* through particular kinds of dynamic modelling; see Apostolopoulos *et al.* (2019)), the fixation on system structures does little to advance knowledge of how and why more effective systems-based approaches to policy and practice are produced, or otherwise. Research on complexity theories in policy suggested that an emphasis on structural components of complexity are typically associated with an overly deterministic view of systems (Cairney, 2012a). Thus, this has precluded knowledge of how agents conceive of, and act amid, complexity's emergent properties, as well as how systems change as a result of the actions of people, organisations and other agents (Cairney, 2012a; Sniehotta *et al.*, 2017; Teisman *et al.*, 2009). While systems are characterised by self-organising properties, self-referential agents play a key role in creating knowledge of a system and shaping its behaviour (Cairney, 2012a; Teisman and Klijn, 2008).

It is possible, therefore, to explore interpretative accounts of complexity if the aim is to understand how policy agents interpret, adapt to and influence their decision-making environment (Cairney, 2012a). Critics of complexity theories have

questioned the appropriateness of applying these perspectives to social systems, given that they are ultimately derived from the study of natural phenomena, and claim this to be an attempt to maintain a positivist hegemony (see Tosey (2002); Gerrits (2012); Cairney (2012a)). However, research that focuses on agency and complexity has important contributions to make in both policy and Public Health domains (Byrne, 1998; Byrne and Callaghan, 2014; Cairney, 2012a; Sniehotta *et al.*, 2017). In particular, a renewed focus on agency has the potential to address persistent inequalities, if complexity theories are incorporated alongside broader critical perspectives on social life, for example theories from sociology, psychology and policy (Salway and Green, 2017; Sniehotta *et al.*, 2017). For example, this approach can highlight key system elements that generate such inequalities, and increase understanding of how deliberate actions of agents on the ground influence both expected and unanticipated events, as these actions spread across the system.

In this context, therefore, there needs to be a clearer understanding of how agents shape, and are shaped by, complex systems. Specifically, there is insufficient knowledge to-date about how this informs systems-based approaches to physical activity policy. While this has received fleeting attention, as discussed in Chapter One and in this literature review (*e.g.* Nau *et al.* (2020)), it is important to explore these ideas in new contexts, and with closer regard for a range of conceptual ideas from social and political sciences.

2.4.2 Applying complexity in research and practice

The second trend in Public Health research that I consider relates to the increasing amount of guidance that has been produced to support the development and evaluation of systems-based approaches. A systematic review of systems-

thinking and complexity ideas in health concluded that a majority of research at that time was conceptual, and that further study about the practical application of these perspectives was needed (Rusoja *et al.*, 2018). Yet, a similar argument was made in a recent report (Jebb *et al.*, 2021). Nevertheless, there has been a proliferation of frameworks that are designed to increase the prevalence and quality of complex systems-based research in Public Health. Broadly, these fit into one of two categories.

The first category comprises guidance on developing general systems-based approaches (*e.g.* Egan *et al.* (2019); Public Health England (2019)), and more specific complexity-informed interventions and programmes. For example, recent additions to the literature include frameworks for developing complex interventions (Skivington *et al.*, 2021); identifying where and how to intervene across 12 levels of the Public Health system (Bolton *et al.*, 2022); and creating whole-systems approaches to physical activity policy (Bellew *et al.*, 2020). The second category relates to evaluation, for which several further frameworks have been developed in recent years (*e.g.* McGill *et al.* (2021); Pinzon *et al.* (2022); Skivington *et al.* (2021)). These have coincided with a growing interest in complexity-informed evaluation in the policy domain (Barbrook-Johnson *et al.*, 2021).

Such guidance and frameworks are important for creating the intellectual foundation for the advancement of complexity theories and systems-based approaches in Public Health (Jebb *et al.*, 2021). They are often well received by research and practice communities alike, are highly cited works, and if used appropriately can support skill and capacity developments by making these perspectives available to a wider audience (McGill *et al.*, 2021). In time, it is proposed that they may lead to more policy-relevant research that responds to the

complexity of this environment (Jebb *et al.*, 2021). However, similar to the models for implementation and knowledge mobilisation discussed above, these frameworks are highly prescriptive, which is somewhat counterintuitive to the flexibility required to navigate complexity's emergent form, and there is a lack of empirical studies that illustrate the practical application of such models. Jebb *et al.* (2021, p.12) note:

> [These] systems-based approaches have emerged from multiple directions […] this work tends to require significant expertise and uses unfamiliar terminology, and as such has not become widespread or embedded in public health policy or practice.

This indicates a need to explore how complex systems are understood in policy settings, and how principles from complexity theories and systems-based research are translated, or otherwise, into meaningful practices. Again, we can turn to policy studies for insight.

In the previous chapter, I highlighted how complexity has a dynamic meaning that alters over time, and across contexts. While complexity is a significant characteristic of policy (Cairney *et al.*, 2019), its properties do not necessarily form part of the vernacular. Research indicated that policy-makers and evaluators often discuss complexity in a metaphorical or analogical sense, rather than with direct reference to tenets of complexity theories (Cairney, 2012a; Barbrook-Johnson *et al.*, 2020). Policy agents often create their own sense of what complexity is, and how to behave in the system they perceive (Teisman and Klijn, 2008). People will typically respond, adapt and innovate amid the dynamism and uncontrollable circumstances of complex policy settings (Cairney, 2012a; Room, 2011).

Cairney (2012a, 2015) and Cairney and Geyer (2017) have theorised considerably about the contribution of complexity theories in social policy. They argued that one of its most valuable contributions is to bridge the gap between

academic and policy-makers, by fostering conversations about the implications of complexity, both for research and practice. Furthermore, Cairney (2012a) proposed that developing toolkits (*e.g.* Room (2011)) to understand the policy landscape and complexity in more literal terms, as applied to day-to-day experiences, can reinforce the importance of practices that acknowledge the multi-centric nature of policy.

Complexity means that one-size does not fit all (Cairney, 2012a). Furthermore, being able to apply its concepts, presupposes knowledge of it. In this way, I argue that prescriptive research frameworks may only advance knowledge and practice so far. There is a pertinent need to explore complexity's dynamic meaning in new contexts, for example physical activity policy. In particular, deciphering how tenets of complexity theories manifest in this domain is important, so that they may be translated into strategies that enable research to engage with policy-makers and implementers in a way that meaningfully reflects their day-to-day experiences (Byrne and Callaghan, 2014; Cairney, 2012a). This prospect leads me to a third trend in Public Health research.

2.4.3 Methods and theory

Although having just noted that conceptual research is particularly common in Public Health (Jebb *et al.*, 2021; Rusoja *et al.*, 2018), and that there is a need for knowledge of how to meaningfully apply complexity theories, this should not preclude further theoretical development. Indeed, theory has the potential to inform action upon which systems change (Byrne, 2011), and much of the aforementioned conceptual research advocates for systems-based perspectives, rather than examining how complexity theories themselves can be enhanced. In this context, I briefly

explore research method development, juxtaposed with a lack of theoretical evolution, in Public Health.

As alluded to through the discussion of systems mapping in relation to physical activity, research method development in the Public Health field has been considerable. These include, for example, applications of agent-based modelling (Tracy *et al.*, 2018), system dynamics (Apostolopoulos *et al.*, 2019), social network analysis (Valente and Pitts, 2017), and cybernetics (Hassannezhad *et al.*, 2021), among others. Alongside these, existing research methods and tools, with which Public Health is more familiar, can be used within a systems-framing (McGill *et al.*, 2021; Shiell and Riley, 2017). Often these methods are participatory in nature and foster interdisciplinarity to ensure the diverse range of interests in the system are represented in research (Jebb *et al.*, 2021). However, there is an apparent tension between the barriers to the use of these methods (*i.e.* lack of interest or expertise; see Jebb *et al.* (2021)), and the need to further develop new methodological approaches to deepen collective understanding of complex systems and how they shape public health (McGill *et al.*, 2021). Such developments are beyond the scope of this thesis, where my persuasions are more theoretically inclined. However, this description was necessary to highlight the extent of scholarly investment in research methods development, in juxtaposition with the relative inattention to advancing complexity theories in Public Health. In particular, this concept has not been explored in relation to physical activity policy.

Reasons for the relative lack of theoretical development in this field could be several. For example, it may reflect that there are multiple perspectives on complexity theories and therefore progress is difficult to locate within the overarching frame of reference. Or perhaps, that this is still conceptually new to

many people in Public Health (Jebb *et al.*, 2021), energies are directed toward understanding complexity theories' current manifestations, as opposed to refining them. It may also be as a result of an eagerness among policy agents and researchers alike to apply these concepts in response to pressing policy problems (Barbrook-Johnson *et al.*, 2021). Alternatively, it may be due to concerns regarding conceptual purity.

Conceptual purity is the idea that a theory or theoretical construct should be used with reference to its original incarnation, whereby tenets of a theory retain their meaning and descriptive capacity irrespective of the context in which they are applied (Gerrits, 2012). This argument has been previously made about the application of complexity theories (Kerr, 2002; Rosenhead, 1998; Tosey, 2002). However, Gerrits (2012) argued that the development of complexity theories in policy contexts is worthwhile, provided it develops in ways that retains its explanatory powers. Given the paucity of research related to complexity theories and physical activity policy, there is a need to explore potential theoretical developments in this domain, which may advance knowledge of complex systems and actions of agents within them (Eppel and Rhodes, 2017).

2.4.4 Enhancing knowledge of complexity in physical activity policy

In this section of the literature review, I have posed three arguments about the state of complex systems research in the physical activity and Public Health field. Using learning from policy studies, I have highlighted gaps in knowledge that warrant further investigation in relation to physical activity policy. First, a need to focus on agency in complex systems. Second, the importance of how these complex systems perspectives are applied in practice. Third, the opportunity for domain-

specific development of complexity theories. Across each of these aspects, a move from descriptive to critical explanations of phenomena are required.

The Public Health and complexity field continues to move at a pace (Jebb *et al.*, 2021; McGill *et al.*, 2021), and scholars and practitioners of physical activity and policy are following suit (Barbrook-Johnson *et al.*, 2021; Oldridge-Turner *et al.*, 2022). Thus, what has preceded represents a selective discussion of key trends in the literature that are pertinent to the current purpose of enquiry, and suggest a cause for pause and reflection. Throughout this thesis I draw on various conceptualisations and applications of complexity theories, which are critiqued extensively here and in other chapters.

Complexity theories suggest that policy systems are co-evolving and self-organising entities (Gerrits, 2012; Teisman and Klijn, 2008). Amid such circumstances, policy-makers need to be realistic and pragmatic in their endeavours (Sanderson, 2009). They should work with, and not resist, complexity wherever possible (Gerrits, 2012). These theoretical perspectives also present an opportunity to connect researchers and policy stakeholders in a productive and educational dialogue about pragmatic responses to complexity (Cairney, 2015; Cairney and Geyer, 2017; Eppel and Rhodes, 2017). To enhance knowledge of complexity in physical activity policy therefore, it is necessary to appreciate the complexity of the policy environment, engage in a dialogue with policy-makers and other agents, and, while remaining pragmatic, embrace complexity.

2.5 Connecting the research agenda

So far in the literature review, I have set out and critiqued the evidence-base surrounding three interrelated topics, selected due to their particular relevance to the

current study: i) physical activity policy research; ii) evidence-informed Public Health and policy; and iii) understanding complexity across these research domains. In this final section of the chapter, I draw these research streams together. I begin by discussing a key overarching theme that transcends these domains, and then situate the current thesis among the existing body of research. I conclude by offering final remarks about the particular knowledge gaps that this thesis addresses, and implications of this for the rest of this research programme.

2.5.1 Collaboration and innovation

A cross-cutting feature of the three literature-bases that have been discussed in this chapter is the importance of strong collaboration and innovation to address complexity. This is the case for physical activity promotion (The Lancet Editors, 2021; Milton *et al.*, 2021), knowledge mobilisation and evidence-informed Public Health (Cairney and Oliver, 2017; Rigby *et al.*, 2020b; Rütten *et al.*, 2019), and complex systems-based perspectives to policy (Cairney and Geyer, 2017; World Health Organization, 2018). However, despite their significance, harnessing these constructs has presented a longstanding challenge in practice (Hunter and Killoran, 2004; The Lancet Editors, 2021). Here, I raise three brief considerations that have significance to studies of complexity theories and policy.

First, in order to address wicked policy problems (*e.g.* persistent inequalities), policy-makers cannot act alone (Cairney, 2012a), and therefore should generate conditions for collaboration and innovation to enable effective co-evolution and new adaptations to unpredictable circumstances (Mannell *et al.*, 2018; Kovacs, 2016; Room, 2011). This can include strategies to increase willingness, opportunity and capacity for collaboration, while reducing barriers to this mode of practice through

clear policy goals and knowledge sharing activities (Patanakul and Pinto, 2014). In particular, this emphasises the need to reject top-down control, and facilitate experimental policy learning through local implementation and evaluation (Cairney, 2012a). However, given the ever increasing weight of interdependence (McKinnon *et al.*, 2011; Milton *et al.*, 2019), the proposed conflict and ambiguity that arises from this (Oliver *et al.*, 2016b), and the ongoing travails of implementation (Pratt *et al.*, 2020) that characterise the physical activity policy context (including in the UK), it is pertinent to examine these features more closely. Critically, while reliant on other levels of the system, the national policy sector above others has the potential to set the conditions that can foster or inhibit collaboration (Cairney, 2012a; Mannell *et al.*, 2018). It is necessary to understand how policy-makers collaborate, with whom and how, as well as how collaborative practices, power and influence are created and distributed across the system among other physical activity stakeholders (Rütten *et al.*, 2013).

Second, despite knowledge of the growing interdependence of stakeholders in promoting physical activity, this has not necessarily led to effective multi-sectoral and cross-government collaboration within and between systems (Das and Horton, 2016; The Lancet Editors, 2021). Myriad policy actions are required to effect change in population behaviour (Oldridge-Turner *et al.*, 2022; World Health Organization, 2018), but as yet, it is unclear how the various component domains of a whole-system approach are brought together, or to what ends. Boundary spanners are individuals or organisations that facilitate learning and exchange of knowledge in different contexts within complex systems (Bednarek *et al.*, 2018). By better understanding who or what connects the physical activity system, and how, it may be

possible to more effectively prioritise resources and target knowledge mobilisation strategies to advance complexity theories and systems-based perspectives.

Third, and briefly, opportunities for innovation and creativity often emerge in complex policy systems, meaning that they arise unpredictably (Kovacs, 2016). McKinnon *et al.* (2011) demonstrated that working alongside physical activity policy-makers to educate and promote innovative approaches to policy design, implementation and evaluation is effective for producing policy change. However, given complex systems continually evolve, it is pertinent to re-examine how learning, adaptation and innovation occur within systems, and how these processes are designed to foster similar outcomes elsewhere (Flanagan and Uyarra, 2016). System change is a strategic goal of physical activity advocates, and policy is a proposed mechanism by which this occurs (World Health Organization, 2018). Developing a new approach to physical activity (Das and Horton, 2016; Hallal *et al.*, 2012; Pratt *et al.*, 2020) suggests the need for innovative research, policy and practice that can understand and help initiate the desired outcomes. To date, however, there has been limited enquiry as to how agents in the physical activity policy system foster innovation and change.

The benefit of collaboration amid complexity in Public Health is undoubted (Such *et al.*, 2022). Nevertheless, harnessing its potential in physical activity promotion is challenging (The Lancet Editors, 2021). In order to effect change in this regard, it is necessary to understand the complexity of the policy environment, and its processes and influences (Cairney, 2012a; Cairney *et al.*, 2019; Giles-Corti *et al.*, 2015; Piggin and Hart, 2017). Again, this points toward the potential utility of interpretive or action-orientated modes of enquiry. However, to date, research of this kind has been scarce. I propose that this situation emanates from a lack of focused

enquiry at the point at which the domains of complexity theories, physical activity and Public Health, and evidence-informed policy intersect.

2.5.2 Concluding remarks: the convergence of physical activity, evidence-use and complexity theories

To my knowledge, with a few exceptions, there is little research that has examined the combined implications of complexity theories (*i.e.* the methodological tenets and practices set out in Chapter One) with the study of evidence-informed policy, and Public Health. Two publications by Geyer (2012) and Portela *et al.* (2019) were similar in that they each presented a methodological framework. The former presented a tool that enabled policy-agents to visualise the trajectory of health policy over time. The latter related to the development of a framework for incorporating a complexity perspective in systematic reviews used to inform public health guidance. While Geyer's (2012) paper reinforced the utility of tools that enable policy agents to draw on their intuitive and context-specific experiences of complexity, as highlighted, there is a need to produce research that complements frameworks, by empirically exploring how complexity theories are understood, and applied through the actions of policy stakeholders. A third piece of research determined that a pragmatist approach to complexity may provide an alternative way to conceptualise the relationship between scientific knowledge and decision-making (Ansell and Geyer, 2017). Again, however, this was a conceptual piece, which was illustrated with a brief evidence-based drugs policy case study. Thus, there is to date a lack of empirical research about how complexity theories, evidence-informed policy, and Public Health come together, especially in relation to physical activity, despite the proliferation of systems-based perspectives (Jebb *et al.*, 2021; World Health Organization, 2018). My thesis initiates examination of this knowledge gap.

To conclude, much of the literature and ideas discussed in this chapter are explored further in the introductions to my empirical studies (see Chapters Four-to-Six), and are revisited in the general discussion (see Chapter Seven). Furthermore, an in-depth discussion of the complexity frame of reference adopted in this study is provided in the next chapter (Chapter Three).

I have highlighted a particular need to critically explore the concept of agency, and how policy agents can influence, or be influenced by, the physical activity system, as well as illustrated the importance of examining the policy system at different levels. The prominence of national policies in existing physical activity scholarship and practice (Milton *et al.*, 2020; Milton *et al.*, 2021; Rutter *et al.*, 2019; World Health Organization, 2018), as well as their potential to: i) shape the conditions that perpetuate issues such as inequalities; ii) facilitate or constrain local action; and iii) change systems more broadly (Byrne, 2011; Cairney, 2012a; World Health Organization, 2018), suggests that this level is a worthwhile departure point for the research featured in this thesis. Nevertheless, continued challenges of implementation (Pratt *et al.*, 2020) indicate that localised perspectives are also important. This alludes to the notion that the study of complex phenomena (including physical activity and policy-making, as set out in the introduction chapter) benefits from multiple *'entry points'* (Byrne and Callaghan, 2014; Jessop *et al.*, 2008, p.392; Moulaert *et al.*, 2022).

Due to their open and nested nature, the boundaries within and between systems are fuzzy and overlapping (Wistow *et al.*, 2015). Therefore, the decision about how to bound the study of any given system is open to interpretation and contest. Jessop *et al.* (2008) proposed a framework that may provide the lexicon to describe limits placed on a particular study, by highlighting entry points across

socialspatial dimensions (*i.e.* investigation by combinations of territory, place, scale and networks). It also enables a broader understanding of complex phenomena by encouraging reflection on the interactions between these domains; each dimension can be considered in and of itself, as a causal mechanism that influences other dimensions, or as the product of the causal mechanisms imparted by other dimensions (Jessop *et al.*, 2008). For example, the study set out in this thesis examines the physical activity policy system from a multi-dimensional perspective, which extends beyond a simple national- and local-level dichotomy. It considers interactions between territory and place (distinct places), territory and scale (multilevel government), and place and networks (local governance and partnerships), as well as nested hierarchies of scale. These represent just a few of the possible dimensions from which the system of interest may be approached.

To further illustrate the boundaries set around this study, Figure 1 presents a systems map, which is adapted from recent illustrations of the physical activity policy system (Bellew *et al.*, 2022; Rutter *et al.*, 2019; World Health Organization, 2018). This map shows how the policy-orientated entry points and scalar levels selected for this doctoral research fit within the wider physical activity system, and demonstrates how agents in the system who participated may have more or less jurisdiction and influence over certain other factors in the system. While not intended to be an exhaustive systems map, this provides a useful heuristic device to ground, bound and contextualise this study.

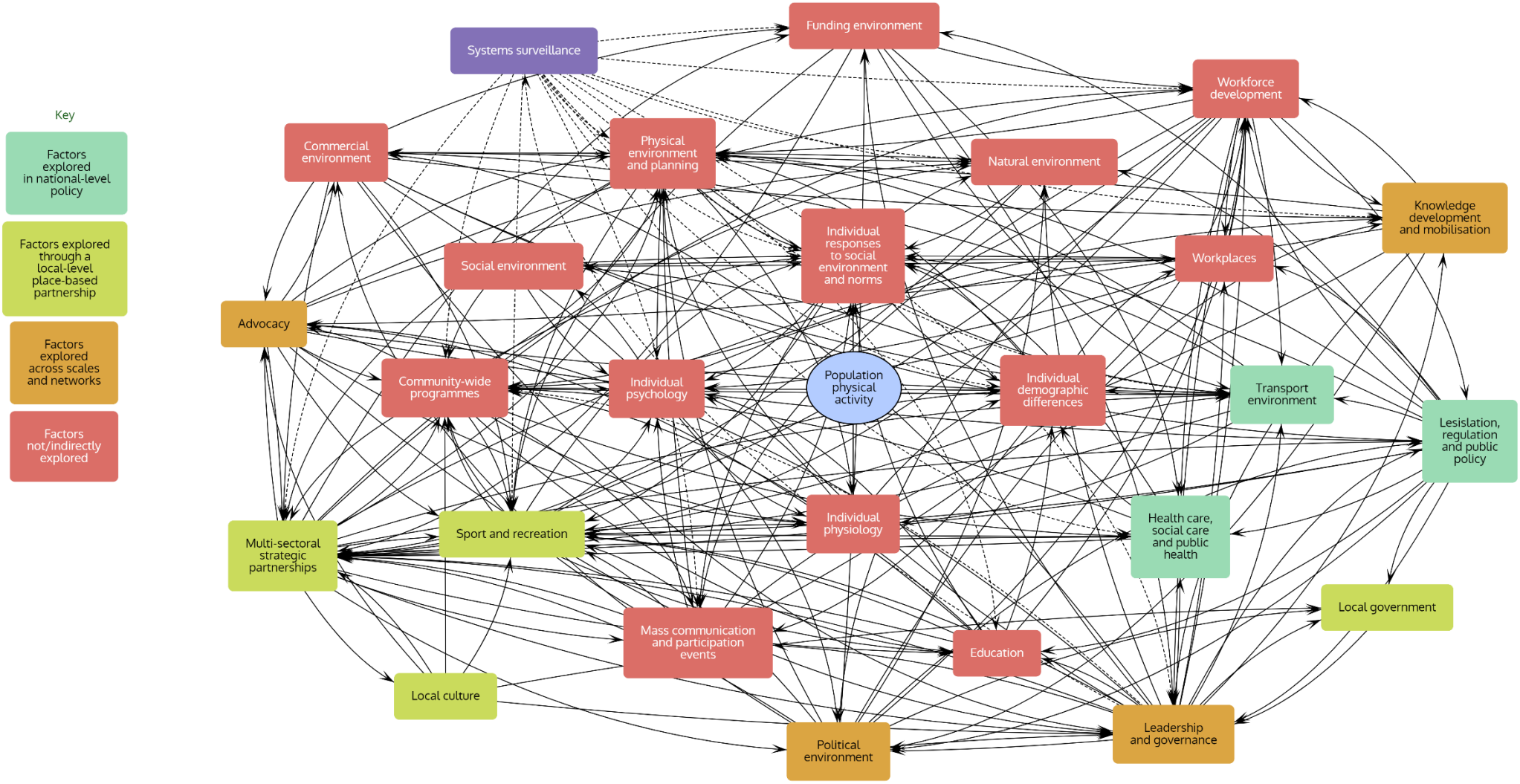


Figure 1. Systems map illustrating the entry points and scalar levels incorporated in this study (adapted from Bellew *et al.*, 2022; Rutter *et al.*, 2019; World Health Organization, 2018).

I argue that, in the context of this study's aim to critically assess the understanding and application of complexity theories as a basis for evidence-informed physical activity policy, and being cognisant of the need for a multi-dimensional approach to the study's entry points, knowledge gaps in the existing literature indicate three overarching questions that warrant scholarly enquiry, which guide this thesis:

1) How is complexity understood and navigated in the physical activity policy system?
2) How are effective systems-based approaches to implementing physical activity policies generated?
3) How are complexity theories and systems-based perspectives optimally applied to, and through, physical activity policy?

Knowledge of these concepts can support a move beyond rhetoric, to more contextually-relevant applications of complexity theories and systems-based approaches to physical activity policy, and health promotion more broadly, through the identification of actionable considerations for theory, practice and policy. In turn, this can contribute toward understanding of how to address persistent wicked health problems.

My review of existing literature also concludes that these lines of enquiry demand an interpretive methodological programme that embraces complexity and positions the researcher to be able to engage with the policy system and its agents, access various types of knowledge, and learn from others' experiences of the complexity of their respective domains and endeavours. The following chapter sets out the theoretical and methodological position that underpins this thesis.

Chapter 3. Theoretical and methodological position

3.1 Introduction

This chapter sets out the theoretical position that underpins my thesis and justifies the methodological decisions that I made, which in turn guided the process and product of my research (Smith, 2018). It is the reference point against which my findings, conclusions and recommendations sit. This project has been an exercise in finding my position as a researcher among the predominant paradigms of physical activity and Public Health research, and crucially how I consider myself part of the system I am obliged to try to improve (Luyckx *et al.*, 2017). Therefore, the following narrative presents a critical and reflexive account of the decisions and assumptions that shaped both my research and person.

The chapter is structured around the major theoretical and methodological considerations that were made during the research process. First, my ontological and then epistemological assumptions. Second, the selection of methods and subsequent analytical approach. These sections are bookended by a reflection on how my formative research experiences influenced my approach to this Ph.D., and how through the process of doctoral training I have found my philosophy (Baldwin *et al.*, 2014).

To provide a brief overview of the discussion that follows: Having made the case in the previous chapters for greater critical examination of complexity theories and systems-thinking as applied to physical activity policy, here I critique different theoretical perspectives within the complexity frame of reference (Byrne, 2009b). I adopt a complex realist ontological position, which repudiates relativist perspectives on complexity (Byrne, 1998; Byrne and Callaghan, 2014). In terms of epistemology, I draw on the notion of different lenses of evidence about policy issues (Head, 2008),

which meld throughout the research process to enable the development of emerging middle-range theories (Merton, 1968) about how physical activity and public health promotion may be optimised. These perspectives emphasise the importance of action in constructing social reality (Byrne, 1998).

In seeking to understand and influence change in the physical activity policy system, I required methods that enabled both interpretation and engagement (Byrne, 2011). To this end, I justify the employment of qualitative and action-orientated methods that enabled me to explore individuals' agency and experience. I also present a critique of recent developments in thematic analysis, and explain how my own observations are discussed through a pragmatic approach and a theoretical pluralism. This chapter concludes with some final reflections on how I currently position myself as a researcher, following a doctoral process that has shifted my thinking from the conceptual to the empirical, and from the theoretical to the applied.

3.2 Who was I? Formative research experiences

In my opening chapters, I argued that new perspectives grounded in critical expositions of complexity theories may be needed to change the system and overcome the apparent impasse in physical activity promotion. According to Byrne (2009a, 2011), agency provides the foundation for system change. Therefore, it must be incumbent on researchers to consider what their role is in influencing such outcomes. However, having embarked on postgraduate study, I initially found this reflexivity challenging as I felt obliged, but struggled, to identify with a particular academic discipline. This was despite the predominant epidemiological and behavioural persuasions for which physical activity research was renowned (Reis *et al.*, 2016). While I did not see myself as a Public Health scientist, neither did I feel

like a sociologist. My world view contrasted with, and challenged that of colleagues, peers and other contemporary thinkers in these fields. At times this was difficult as an early career researcher trying to align myself with the institutional practices and values of a university's departments. On reflection, my formative experiences at university and in practice may have contributed to this sense of feeling lost.

As a first-year undergraduate I took a module entitled *Introduction to Physical Activity*, and my interest in studying physical activity and Public Health grew from that point. However, alongside this I progressed to read modules in sociology, physiology, psychology, human development and social policy. Thus, my background was inherently multi-disciplinary. Between undergraduate and postgraduate study, I spent a year working in sport development. This meant I gained a unique insight and ability to consider physical activity from both a broad theoretical perspective, and one grounded in the reality of everyday practice. The benefit of these combined experiences only came apparent as my postgraduate studies progressed. I unpack these benefits as the chapter continues.

During my Master's degree, I was introduced to the work of David Byrne, and specifically his interpretation of complex realism (Byrne, 1998). This represented a threshold concept (Meyer and Land, 2003), an encounter with a world view that, once I had come to terms with it, fundamentally changed the way I understood physical activity and Public Health policy as phenomena in complex systems. I was persuaded of the assumption that *'society is a complex, self-organising system. Since we are part of this system – we can actually never stand outside it* (Cilliers, 1998), p.138)*.'* Ethically and morally, this perspective had a strong bearing on the development of my research and the selection of methods.

As somebody investigating a system that I simultaneously sought to change, I had to position myself as a constituent element of the system (Byrne, 2009a). That is, it was not merely sufficient to interrogate the research problem from an external perspective, rather I recognised that my actions had the potential to shape and be shaped by the complex issues under examination. I levelled this critique of one's position in relation to the system to myself and my research participants equally. The process by which I settled on the principle of my alignment to the system, rather than to disciplinary fields, was, not unlike complexity, a non-linear process characterised by interactions and feedback. The remainder of this chapter sets out how, in theory, I adhered to this principle.

3.3 Ontological perspective: complex realism

The ontological position adopted in this thesis contends that it is necessary to first consider the nature of reality in order for it to be knowable (Bhaskar, 2008). That is, in a social context, our knowledge of society is contingent on the underlying properties that society possesses. It is therefore impossible for me to recognise my position and influence in the system without first contemplating how the reality of society is organised. Having made the case for adopting a complexity frame of reference to understand and address population health issues, specifically physical activity policy, this is reflected by my research being underpinned by an ontological perspective that expounds the primacy of society's complexity, namely complex realism (Byrne, 1998; Reed and Harvey, 1992; Williams and Dyer, 2017). Here I introduce this perspective and consider its critiques.

Complex realism as an ontological position was introduced to the social sciences by Reed and Harvey (1992), and developed extensively through the work of

Byrne, upon which I draw most substantially (Byrne, 1998, 2005, 2009a, 2011; Byrne and Callaghan, 2014). While this perspective is concerned with causal theories, it primarily offers a framework for understanding society's properties (Byrne and Callaghan, 2014). It does this by synthesising the philosophical ontology of critical realism (Bhaskar, 2008), with the scientific ontology of general complexity (Byrne and Callaghan, 2014; Morin, 2006).

Critical (or transcendental) realism denounces positivist approaches for disregarding the possibility of hypothetical entities existing beyond people's direct observation, yet maintains that reality exists beyond people's conscience and that assumptions about its nature presuppose knowledge of it (Bhaskar, 2008; Bhaskar and Hartwig, 2010). It contends that there are three levels for causal understanding. First, the real, which are deep generative mechanisms that contingently constitute the world. Second, the actual, which are events and structures that occur when mechanisms activate and interact with context. Third, the empirical, which is the knowledge constructed about the real and the actual (Bhaskar, 2008). In this way, observations are of real entities produced through complex and contingent mechanisms (*i.e.* those mechanisms that interact with context), that in themselves are not necessarily directly accessible to people's experience (Bhaskar, 2008; Byrne, 2002). I return to this latter level later in the chapter when I discuss epistemological considerations.

Having outlined the essential realist tenets of the ontological perspective, I now turn to the issue of the complex. Here, Bhaskar's idea that natural and social reality should be understood as an open stratified system of objects with causal powers (Morton, 2006), is clearly aligned with the concept of general complexity and

the nature of complex open systems (Morin, 2006; Reed and Harvey, 1992). However, it is necessary to first briefly distinguish this from restricted complexity.

Restricted complexity contends that it is possible to understand complex systems as the outcome of interactions between simple elements based on rules of action (Byrne, 2011; Morin, 2006). It is predicated on micro-interactions and dismisses notions of structure and the social. This is at odds with critical realism, which holds structure as providing the material causes upon which people's actions are founded (Bhaskar, 2008). On the other hand, general complexity, of which complex realism is concerned, is a systems theory dealing with complex systems (Byrne, 2011).

The social world comprises complex open systems that are nested within, and have nested within themselves, other open systems (Byrne, 2005). Their critical defining characteristic is emergence, meaning their properties cannot be directly predicted from their constituent elements (Rutter *et al.,* 2017). Crucially, openness means that systems acquire structure through dynamic interactions in which they internalise component parts of the whole-system, sub-systems, other systems, and the environment (Byrne, 2002; Gerrits and Verweij, 2013). Complex realism therefore assumes that reality is the result of conjunctural causation whereby mechanisms activate one another in combinations (Byrne, 2002). However, systems' dynamic and emergent nature means that explanations of reality are only ever temporal and local, thus contingent (see Bhaskar) upon history, path dependency (*i.e.* having causal potential), context and crucially the interaction of agency with this context (Byrne, 2005; Byrne, 2011; Wistow *et al.*, 2015).

The effect of change and causation in complex systems is understood in terms of their trajectories, that is their position in space and time (Byrne and Uprichard,

2012). These trajectories are not fixed (Gerrits and Verweij, 2013), as interacting generative mechanisms in specific contexts, at the level of the real, mean that the future contains multiple possible system states, some more plausible than others. Which occurs depends on historical events and chance occurrences. Crucially, however, that system trajectories are contingent on these events means that systems must be considered as time-asymmetrical, and thus the Newtonian notion of time-reversibility is dispelled (Byrne, 2011; Byrne and Uprichard, 2012). Social reality is in a constant constructive state of production and reproduction, and people's actions have an important role in this through the way they engage with and understand its nature (Byrne, 2011). To put it simply, at its heart, critical social research is about changing systems (Bhaskar, 2008; Byrne, 2011).

So far, I have explained how the tenets of critical realism and general complexity combine to form a complex realist theory of ontology, which depicts a real social world that is characterised by open complex systems, with deep causal mechanisms, and contingent and emergent properties. Systems change over time through processes of interaction and action. Further important attributes of complex systems include feedback (*i.e.* the situation in which system change is reinforced or balanced) and adaptation (*i.e.* adjustments in behaviour in response to changes in the systems) (Rutter *et al.*, 2017). Combined, these attributes of social systems mean that there is the possibility of change, and that they are theoretically speaking both open to researchers such as myself, and that the information that my research generates will feed into the system. I will return to the implications of these features later in the chapter, but for a fuller explanation of complex realism, the reader is directed to Byrne (1998) and Byrne and Callaghan (2014). However, I now turn my attention to

the applications of complex realism and defending this position in light of its critiques.

3.3.1 Applications and critiques of complex realism

Complex realism is but one approach in a much broader realist research paradigm, each with its nuances and distinctive features (see Sayer (1999)). Compared to other realist positions, complex realism has perhaps been applied more sparingly, and much work has concentrated on developing the approach methodologically (*e.g.* Byrne (1998, 2002, 2005, 2009a) and Byrne and Uprichard (2012)). Its limited impact on empirical research was noted by Williams and Dyer (2017). While, as articulated above, this perspective offers a useful framework for understanding the social world, this is perhaps not too surprising. Having both taught and studied complex realism, I acknowledge it is not necessarily intuitive. Furthermore, it opposes a predominant paradigm of contemporary sociological scholarship (see below).

Williams' (2020) thinking on complex realism draws heavily on the work of Byrne and other complexity social scientists (*e.g.* Castellani, Uprichard and Gerrits). Their approach differs, however. Recognising that measurement and quantification are essential components of understanding complex systems, Williams and Dyer (2017) set-up a theoretical programme based on an ontology of probability to explore the risks of self-harm in prisoners. While compatible with the approach set out here, not least preserving the importance of temporality and contingency, it would be remiss to take this approach as the definitive argument for a theory of complex realism, as it does little to advance the qualitative and interpretative approaches that are necessary to understand and change complex systems (Byrne, 2011). In the

context of an unexplored domain such as physical activity policy, the quantitative programme that Williams and Dyer (2017) point toward is perhaps less valuable. Moreover, I remain unpersuaded that probability (see Williams (2020)), rather than emergent systems, is the defining feature of complex realism.

Despite the assertion that there has been little empirical research, there are numerous examples of this perspective underpinning research in relation to health inequalities (Wistow *et al.*, 2015), public policy and administration (Gerrits, 2012; Gerrits, 2008; Haynes, 2003; Teisman *et al.*, 2009), nursing (Clark *et al.*, 2008), and climate change (Byrne, 2021), among others. To my knowledge, however, this thesis presents the first attempt to conceptualise the issue of physical inactivity from a complex realist perspective.

The most extensive critique of complex realism, specifically the approach set out by Byrne (1998, 2009a) and Byrne and Callaghan (2014), claimed four theoretical inconsistencies evident in Byrne's understanding and application of Bhaskar's critical realism (Holland, 2014a). That Holland (2014a) does not reference Morin (2006)'s general complexity as an essential component of the complex realist position suggests that either the author did not take exception to this aspect, or has themselves an incomplete understanding of theoretical tenets of the position they critique. This alone is cause to regard one of Holland's critiques with caution, in which they argue Byrne considers complexity to the be the emergent property of reality (Holland, 2014a). On the contrary, while Byrne (2011) claims that emergence is the essential characteristic of complex systems, it is the complex nature of reality (*i.e.* the interactions between deep generative mechanisms and context) from which emergent properties arise, not the other way round. Nevertheless, I will address each of the remaining purported inconsistencies in turn.

First, Byrne is accused of having an ambivalence toward simplification, choosing to see the real, actual and empirical as distinct and not overlapping (Holland, 2014a). While I address the necessity of simplification later in the chapter, Byrne (2002) fully acknowledges the layered nature of reality by asserting that at the empirical level, the real may not remain directly accessible. In this way, the levels remain in explicit dialogue through observation and inference. One is always considering the real by the very nature of observing the actual, whether obscured from view or not.

Second, Holland (2014a) criticises Byrne for treating traces (*i.e.* abstract but real remnants of system change (Byrne and Uprichard, 2012) – see epistemological considerations) as different to variables, and claims that they are in fact synonymous. Traces, however, are distinct from variables in that they, like we as investigators, cannot be separated from the systems of interest and only describe systems in terms of attributes that have no reality beyond the system (Byrne, 2002). Variables on the other hand are constituted outside of and introduced to the system, for example the administration of new medicines (Byrne and Uprichard, 2012). We may further consider traces as measuring changes of kind (*i.e.* shifts in the system state), and variables as measuring changes in degree. In a critical social scientific perspective, the former is the priority focus (Byrne, 2011). Holland's (2014a) final criticism of Byrne concerns post-disciplinarity and warrants explicit consideration in light of its importance to my work.

3.3.2 A key consideration: post-disciplinarity

To Holland's (2014a) credit, in my view, they appropriately highlight that Byrne's implied focus on post-disciplinarity might be refined. However, my

assertion does not stem, as Holland argues, from a conflation of positivism and interpretivism to the extent that it is possible to claim that applied social research is not undertaken in any discipline- or field-specific manner (Byrne, 2011). Instead, I argue, and have done so extensively in the opening chapters of this thesis, that the field of physical activity research does continue, in many cases, to be identifiable by particular practices. This does not mean, however, that as clear fields exist, contrary to Byrne's view, it is necessary to say that those operating in these fields are disciplined so as to contribute only to the perpetuation of those fields, for example through scholarly publication in disciplinary journals (Holland, 2014a).

Holland is correct in their view that research takes place in a context of underlying social structures that have the potential to perpetuate disciplinary practices. Nevertheless, to claim that Byrne conceptualised post-disciplinarity as a denial of the distinction between pure and applied social sciences (Holland, 2014a) is inaccurate. Byrne (2011) simply makes the case that various methodological perspectives can contribute to research in any given field. This argument can be extended by saying that in order to change complex systems, these various perspectives are not only possible, rather they are essential. It is not a case of depreciating the value of various fields of research and their traditional methodological perspectives, rather arguing that the products and practices of these fields must unify in a systemic fashion to contribute to our understanding of, and influence on complex phenomena. Researchers cannot be constrained in their practices by their nominal classifications within a field (Byrne, 2011; Clark *et al.*, 2008). My inter-disciplinary background is, therefore, not a burden but a unique toolset to enable me to consider the complexities of physical activity policy.

Complexity acts as the framework that unifies perspectives from across different sciences, such as quantitative and qualitative paradigms, relativism and hard realism, analysis and holism (Byrne and Callaghan, 2014). Within this, there are numerous approaches one can take. I adopted a complex realist perspective, but it would be remiss to not briefly consider an alternative perspective on complexity, postmodernism.

3.3.3 Post-modernist perspective on complexity

The post-modernist complexity agenda sits in opposition to, and is largely renounced by advocates of, the complex realist perspective (Byrne, 1998, 2011; Byrne and Callaghan, 2014; Williams, 2020). Central to the post-modernist approach is the relativist position that social reality does not exist beyond people's knowledge. Furthermore, it denies the possibility of truthful explanatory narratives, as any account bears credence since it is constructed by the maker of said account without reference to reality (Byrne, 2011). This perspective, therefore, equates complexity with the openness of people's interpretation, not material cause (Byrne and Callaghan, 2014). It would render one's understanding of systems as complicated, rather than complex, and would be akin to Morin's (2006) programme of restricted complexity (see earlier discussion).

A detailed account of complexity and postmodernism can be obtained by reading both Cilliers' (1998) seminal text, and Byrne's (1998) and Byrne and Callaghan's (2014) critique. However, the distinction between the approach adopted here and that which follows a rigid post-modernist perspective can be summarised in Pawson and Tilley's (1997) explanation of hermeneutics *I* and *I*. Hermeneutics *II* contends that there are no factual accounts of the social world, and that we cannot

move beyond mere beliefs (Pawson and Tilley, 1997). It argues that there is an incommensurability between the structure of language and structure of reality in particular. This renders it impossible to understand people's social systems and how they change (Byrne and Callaghan, 2014). Every claim, description or explanation carries assumptions of the individuals who make them. The recycling of individual preferences, theories and values does nothing to move toward consensus of how reality can be understood (Pawson and Tilley, 1997).

On the other hand, hermeneutics *I* better reflects the approach to complexity adopted by Cilliers (1998), for whom language was itself a complex system. Cilliers' linguistic turn, was, however, softer than that demonstrated by proponents of hermeneutics *II.* The hermeneutics *I* approach permits interpretivist and qualitative modes of social research, while maintaining the possibility of generating representations of reality, something Cilliers (1998) recognised as crucial to developing causal explanations, which are essential for working and acting amid complex systems (Byrne, 2011).

Throughout my research, I espouse the tenets of complex realism over post-modernist approaches to complexity, as a framework for understanding the physical activity policy system. For example, later in this chapter I critique recent developments in thematic analysis for their post-modernist turn. I understand that my observations and experiences are representations of a reality, rather than claiming these to be real in and of themselves on the basis that I constructed them. It is to observations and issues of social-construction to which I turn next, in my explanation of epistemological considerations.

3.4 Epistemological considerations

While epistemology is necessarily subordinate to ontology (Bhaskar, 2008; Byrne, 2011), adopting a complex realist perspective presents several epistemological considerations and opportunities. I begin this sub-section by explaining the implications of complex realism for knowledge. I then detail how I adopted a multiple-lens approach to constructing knowledge and theories about the systems of interest.

3.4.1 Epistemological implications of complex realist ontology

To change systems, it is necessary to understand causal mechanisms. In order to construct knowledge of these real causal mechanisms that, through interaction with context, generate actual events, I endorse the view that it is necessary to dismiss the primacy of traditional hierarchies of evidence (Byrne, 2011; Wistow *et al.*, 2015), such as those commonly adhered to in physical activity research. Rather it is beneficial to consider the social as a series of cases, which are in themselves complex systems (Byrne and Uprichard, 2012). These cases are objects, processes or conventions that exist in the social world and transcend mere units of analysis. They are found, or at least inferred through the traces left behind as systems move through space and time, not constructed (Byrne and Uprichard, 2012; Ragin and Becker, 2003). Through these inferences and observations knowledge of complex systems and how they change is constructed (Byrne and Callaghan, 2014; Byrne and Uprichard, 2012). Focusing on cases and traces acknowledges that it is impossible to measure a system in its entirety, rather it is necessary to measure or qualify aspects of it to build a picture of individual case trajectories (*e.g.* focusing on policy amid the wider physical activity system). As traces are inextricably tied to the case and have

no separate causal existence beyond the system, cases are considered real and non-decomposable (Byrne and Uprichard, 2012).

The non-decomposable and contingent nature of reality leads to a further consideration for knowing the complex. That is, reality must be compressed in order to facilitate knowledge of it (Byrne, 2011). This means that some characteristics of reality are inevitably lost, rendering complete models of complex systems impossible (Byrne, 2009a, 2011). This partial understanding is exacerbated by conjunctural causation and the way in which causal mechanisms are inferred by observations of the resultant events at the level of the actual (Bhaskar, 2008; Gerrits and Verweij, 2013). Reality is typically obscured by contextual factors (Byrne, 2002). Therefore, simplification is always necessary, but done so through processes of engagement as a constituent part of the system, constructing and reconstructing the social while giving voice to reality (Byrne, 2011).

3.4.2 Social constructionism

Prior to the post-modernist turn and the insurgence relativism, social constructionism was a programme concerned with the distinctiveness of social and physical reality (Byrne, 1998). The former was considered to be constructed through people's actions, intentional or otherwise. In this way, social constructionism characterised people as vessels of critical knowledge, but more importantly as reflexive understanding actors, as doers of social research and proponents of societal change (Byrne, 1998). The epistemological implication of this is the necessary emphasis on interpretivism, whereby people's actions are considered in relation to their own understanding of them. As people, researchers included, are constituent parts of the system, their actions shape and are shaped by said systems (Byrne,

2011). Aligned with this perspective, in the current programme of research, I was able to generate knowledge of the physical activity policy system by adopting methods that enabled reflection on, and opportunities to create, such actions.

In particular, the ontological and epistemological considerations discussed suggest a programme of research that aligns with Pawson and Tilley's (1997) hermeneutics *I* perspective is a necessary first step in trying to understand and change the physical activity policy system. These perspectives provide the conceptual and practical tools for undertaking such research (Maxwell, 2012), notably those most commonly associated with qualitative methodologies, which through carefully constructed narratives can give the basis for a later quantitative exposition of causality (Byrne, 2011). Consistent with a complex realist perspective (Byrne, 2011; Byrne and Callaghan, 2014), I do not claim that qualitative research is superior, or *vice versa.* Rather it presents the opportunity for a dialogical exchange that, within the context of our current understanding of the physical activity policy, may better enable knowledge of how to change it.

3.4.2.1 Praxis

Praxis is the act of reflexively engaging with and acting on theories, ideas and practices in order to change the social world (Byrne, 2011; Freire, 1996). Within this, action is predicated on a moral obligation among those who hold knowledge (Byrne, 2011). In this way, it compels researchers to engage in methods that actively apply social scientific knowledge. I did this by acknowledging and adopting Freire's (1996) dialogical pedagogy, which asserts that all forms of knowledge are incomplete, be that of the researcher or that which is held by other agents in the system of interest. The dialogue between others and I who live and work in the physical activity policy

system lead toward a unification of knowledges that form the basis of for future action (Byrne and Callaghan, 2014). In practice, this was achieved by applying Head's (2008) three lenses of evidence-based policy.

3.4.3 Constructing knowledge through multiple lenses

Head (2008) understood that to better appreciate complex policy issues, such as inactivity, and how policy-makers respond to them, it is necessary to consider a relational approach between three different types of evidence that inform policy. First, scientific (research-based) knowledge that encompasses multifarious methodological approaches to the systematic analysis of a policy problem, which is seldom uniformly defined among scholars. Constructors of this knowledge have traditionally proclaimed its supremacy over other forms, and have developed a hierarchical typology by which to grade different sub-sets of this knowledge (Head, 2008). In relation to physical activity policy, three prominent types of scientific knowledge have been identified: evidence linking physical activity to health outcomes; evidence linking interventions to physical activity behaviour; and evidence linking policy-making to interventions (Rütten *et al.*, 2016). The second form of knowledge is political know-how, which concerns contextual judgements about what is possible and desirable. Use of this knowledge is often partisan and may at times be immutable, irrespective of the scientific evidence-base. Third, practical implementation knowledge represents the collective wisdom of those professionals who manage and implement programmes in complex systems through communities of practice. This form of knowledge often develops in line with professional sectors (Head, 2008). In itself, this may be problematic in the context of complex systems if

this leads to siloed practices. Across each of these knowledge domains values, emotions and interests also structure policy debates (Head, 2022).

Byrne (2011) suggested that Head's (2008) work represents a useful heuristic, but that in practice the three different forms of knowledge are inherently interlinked given that scientific knowledge ultimately informs the education and practice of both practitioners and policy professionals, and that there is a political dimension to the construction of scientific knowledge (this is discussed in relation to my research in Chapter Six). Nevertheless, I applied Head's (2008) typology in explicit terms as a means to make sense of the empirical level of reality.

I justify and discuss the methodological implications of the chosen research methods later in this chapter. However, through qualitative interviews and an action-orientated workshop, I was in dialogue with those who had a range of scientific, and in particular practical and political knowledges. These research methods may, as a deliberately constructed attempt on my part, be considered actual events in the system that I partially constituted, which were designed to enable participants to understand their experiences and actions relevant to other events. I then chose to observe and present participants' views through a complex realist scientific lens to attempt to elicit the most salient knowledge. In this way, all forms of knowledge about the physical activity policy system melded together to construct a single narrative, which is based on a collective interpretation and reinterpretation of the nature of reality. Therefore, knowledge about this system and how to change it is fundamentally influenced by my methodological choices.

Alongside the application of multiple lenses as a way of conceptualising the empirical beyond a typology of evidence, it was also necessary to discuss findings in relation to different theoretical perspectives. To reiterate, complexity is not a single

definitive concept, rather it is an assemblage of interrelated perspectives with shared characteristics (Cochran-Smith, 2014). While throughout this thesis I draw on the complexity frame of reference, this was not always sufficient to understand the implications of observations made. In-keeping with the post-disciplinary perspective of complex realism (Byrne and Callaghan, 2014), I drew upon my broad and varied research experiences in sociology, social policy, psychology, Public Health and beyond, to construct actionable theories based on the collective understanding of experiences, as well as the actions of participants and myself as the researcher. Williams (2020) described this as the complex realist manifestation of Popper's third world of knowledge (*i.e.* abstract conceptualisations of the ontological reality). Next, I summarise the concept of middle-range theory, as a vehicle to communicate knowledge that is constructed of the social world.

3.4.4 Middle-range theory

Middle-range theories are an attempt to bridge grand narrative theories that seek to explain the social in its entirety, and micro theories that are contextually fixed explanations of observed phenomena (Merton, 1968). Their purpose is to present generic propositions about the social world, which can be empirically tested in alternative contexts (Boudon, 1991). This has important implications for a complex realist position, whereby knowledge is deemed spatially and temporally located. It enables one to consider the possibilities within a given context in relation to the conjunctural causal processes, and then empirically test these possibilities elsewhere (Byrne and Callaghan, 2014; Williams, 2020). This necessitates a reflexive process of knowledge generation, thus reinforcing the importance of praxis and dialogue with which I engaged during this research. I have constructed several theoretical

propositions for actions that may result in meaningful systemic changes, which warrant further exploration.

The nature of middle-range theories as a vehicle for transferring knowledge between complex contexts is promising, given difficulties in scaling-up physical activity programmes (Lewis *et al.*, 2017). However, they also present further methodological considerations specific to my research, namely generalisability in qualitative research.

Qualitative research conducted from a realist perspective has the potential to uncover contextual factors and mechanisms not knowable through other methods (Fletcher, 2017). This renders statistical generalisability irrelevant, and the possibility of generalisability from qualitative research more broadly has been the subject of considerable critique. In the physical activity context, this has been most extensively researched by Smith (2018), however, some of their ideas are aligned with a relativist position. For example, Smith's (2018) notion of transferability is underpinned by the assumption of multiple realities and contends that a theory is transferable if it is adopted irrespective of whether the two contexts are congruent. In a complex realist approach, context cannot be ignored, thus the notion of trustworthy qualitative research, which includes an alternative measure of transferability, is more fitting (Lincoln and Guba, 1985). In my research, this included following-up with participants to ensure that findings were a credible representation of our collective views (Timmermans, 2013). Testing middle-range theories is a way of establishing the congruence of different contexts, thus the possibility of similar generative mechanisms determining the state of reality.

Conversely, analytical generalisability is the generalisation of theories, rather than contexts (Smith, 2018), and thus is compatible with the approach taken to this

thesis. I frequently generalised my findings to established theories of complexity, but also constructed and refined new theories throughout my studies. Moreover, through a range of methodological perspectives I produced new understandings of complex systems, as applied to the physical activity policy context. These perspectives will now be justified further.

3.5 Methods

This research used two methods of data collection. First, semi-structured qualitative interviews, and second, an online workshop. Their purpose was to elicit understanding of, and then stimulate engagement with, the complexity of physical activity policy. In this way, my research began with a strong conceptual focus that, through a process of dialogue and learning alongside other system agents, shifted toward an applied angle. While the methods sections of Chapters Four-to-Six detail how each method was practically applied in the respective studies, here I reflect on broader methodological considerations. I also include a brief justification for my intended action research project that was curtailed by the SARS-Cov-2 pandemic, which strongly influenced my choice of using workshopping as a research method.

3.5.1 Elite interviews

I adopted a qualitative semi-structured interview design for study one to construct an account of policy-makers' reflexive experiences and knowledge of complexity in the physical activity policy domain. In a complex realist framework, this had two-fold benefit. First, it was impossible to acquire a complete quantitative understanding of the complex phenomena of investigation (Byrne, 2011). Second, it opened a dialogue between me and other agents in the system, enabling the collective construction of knowledge that may provide the foundations for future change

(Byrne, 1998, 2009a). At this stage, my research was predominantly conceptual, although I used the same method at the start of my intended action research project (see Chapter Five), as my thinking progressed to more practically-orientated questions. Nevertheless, the implications of using this method were similar in both instances, whereby I was interviewing *elite* individuals (*i.e.* those positioned in senior roles toward the top of hierarchical systems of perceived power and decision-making authority (Jupp, 2006)).

Qualitative interviews produced rich data that contextualised behaviour in a manner meaningful to policy-makers (Lincoln and Guba, 1985; Stuckey, 2013). Furthermore, the dialogical construction of these individual accounts enabled closer representation of the reality of the complexities of physical activity promotion, as interpreted by those charged with producing and implementing policy (Patton, 2015). In this manner, findings have a greater potential to influence subsequent action (Seidman, 2013). While maintaining sufficient flexibility to allow participants to express their understanding and experience of events and behaviours, semi-structured interviews allowed for replicability and focus on the pre-determined research questions (Bryman, 2016). This was important, as it facilitated comparison between cases to establish salient qualitative differences between policy-makers' and practitioners' understanding, philosophies and practices (Byrne, 1998). Furthermore, while recognising the influence of political knowledge (Head, 2008), establishing an interview schedule helped me maintain a sense of political neutrality, which was necessary in building trust among politicians and civil servants in particular. Given that knowledge of complex systems is temporally-bound (Byrne, 1998), this approach also permits others to trace the system's trajectory in future studies.

More specifically, interviewing policy elites is increasingly recognised as important for generating information pertaining to the processes and networks associated with research-informed policy, through dialogue with those operating closest to the issues of interest (Boucher, 2017; Lancaster, 2017). The evidence-base for elite interviewing primarily offers practical advice for conducting interviews, which was drawn largely from experience (Berry, 2002; Burnham *et al.*, 2008; Cunningham-Sabot, 1999; Lilleker, 2003). I too have learned much, for example, how hand-written letters are an effective way to recruit senior policy-makers. Alternatively, it comprises a series of critical reflections on power dynamics between the interviewer and participants (Boucher, 2017; Harvey, 2011; Lancaster, 2017). It is to the issue of power I dedicate most of the remaining discussion, which I suggest is sometimes imperfectly conceptualised in policy-related interviews.

Elites are typically considered to constitute a minority of people, and this was evident through the small pool of potential participants for my research. They are either positioned toward the top of organisational structures, or have particular strategic influence and authority (Boucher, 2017). In both scenarios they are deemed to hold power, which may influence the interviewer or the interview process. However, power is not a real property in and of itself, it is a contextually-dependent quality bestowed on something or someone who then brings about, or in some cases prevents, something from occurring (Sayer, 2012). While I have already disassociated with the post-modernist position, the argument that power should not be seen as fixed before an interview begins, and that there is no guarantee that one's power can be transferred to alternative contexts (*e.g.* a research interview) seems reasonable (Smith, 2006). For power to be exorcised in an interview, there also needs to be a susceptibility of one party to be influenced, and the existence of causal

powers among other objects or people (Sayer, 2012). Therefore, it seems inadequate to start from the position that elite interviews take place between a less powerful interviewer and more powerful participant. While the participant may have strategic influence in the context of their organisation or role, this power may be rendered inactive in the context of an interview. On reflection, this is perhaps why I experienced few issues in trying to set-up or conduct the interviews. Although it is necessary to accept the possibility that those causal powers existed, but were not observed empirically (Bhaskar, 2008). Alternatively, the researcher could be seen to also hold power in terms of a degree of control over the conduct of the interview, holding more information about its content, and what happens to the information that is shared.

An important aspect of conducting elite interviews was how I positioned myself within the system of interest. Over the course of my doctoral training programme, I worked hard to make myself known in the physical activity policy niche. I actively engaged with the workings of the system and its reciprocal learning processes in ways that included networking, undertaking a policy internship at Public Health England, responding to evidence-calls and being engaged on social media. These activities contributed to the sense among policy professionals and practitioners that I was invested in the system, and that my presence as a researcher seeking to engage others in research that would benefit the system more widely was natural (Lancaster, 2017). In turn this enabled me to feel comfortable in the research space, which is something more typically considered in relation to the participants (Doody and Noonan, 2013; Whiting, 2008). I did not consider these individuals elite *per se*, and chose not to label them as such in the write-up of my studies. Instead I allowed participants to provide job descriptions that reflected differing contexts without

power-related assumptions (Lancaster, 2017). Furthermore, this relationship aided the necessary trust required to navigate issues of confidentiality and privacy sought by elites for themselves, and the organisations and institutions they represent (Lancaster, 2017). The barriers I faced were only practical constraints of people's work schedules and later the effects of the SARS-Cov-2 pandemic.

Last, some proponents of elite interviews suggested that they are an inappropriate way of considering the truth, as they lead to a subjective analysis of particular situations (Boucher, 2017). However, in line with the ontological position of this thesis, analyses should be considered as empirical experiences of an objective reality, as perceived by the participants and researcher, which move toward a consensual construction of the truth through a process of dialogue. My research is less concerned with issues of reliability and validity that seem to be a low hanging fruit for critics of elite interviews (Berry, 2002). Instead, the emphasis is on the co-construction of knowledge that acknowledges the mutual contribution of both researcher and participant as equal, with the aim of understanding the system, so as to act upon this knowledge.

3.5.2 Action research

It was my original intention to conduct an action research project following the completion of study one. The findings of that study highlighted a need for a greater understanding of practical implementation knowledge of complex systems approaches to physical activity policy. In this way, my first study advanced my thinking from what was a very conceptual position, to a more applied one, which I sought to explore in study two. Unfortunately, while I had initiated an action research project that aimed to map systems leadership for policy implementation in a local

context, this project was curtailed soon after it began by the SARS-Cov-2 pandemic. It was designed to specifically examine the implementation of the newly issued UK physical activity guidelines (Department of Health and Social Care, 2019). Nevertheless, it is important to reflect on the rationale for conducting action research, which later informed the use of workshopping as a research method.

Action research is the process of critical reflection on practice (Clark *et al.*, 2020). Wholly compatible with a complex realist position, most appropriately in the tradition of hermeneutics *I* (Byrne, 2011), it concerns finding ways of supporting people in becoming aware of how they learn and use their knowledge, alongside others, to encourage positive change (Bradbury, 2015). Action research brings together different views on the causes of and solutions for complex public health problems (Matheson *et al.*, 2018). An alternative approach would have been to conduct applied consultancy-style research on the behalf of policy-makers from an external standpoint. However, action research was preferable because I am a constituent part of the system, and it was necessary to engage with agents in their own environments and draw on their accounts of the challenges they face (Cilliers, 1998; Gerrits, 2012). Nevertheless, this ethical consideration of positionality continues to be overlooked. For example, a recent systems dynamics and participatory action research approach taken to the study of childhood overweight and obesity aimed *'to understand the system both from an outside (academic researcher) and inside (adolescent/family/stakeholder) perspective* (Waterlander *et al.*, 2020, p.7)*.'* I argue, this represents a false dichotomy.

Some action research advocates would criticise this approach, claiming researchers inevitably impart their views on others (Carr and Kemmis, 2005; Reason and Rowan, 1981). This is correct, however in a complex realist approach, this is

unproblematic, in fact it is necessary as I am obliged to act on my knowledge (Byrne, 2011) of the complexities of physical activity promotion. Through the processes of dialogue, views and experiences are focused through multiple lenses in a way that prioritises neither the researcher, nor those in the field of investigation (Byrne, 2011; Freire, 1996; Head, 2008). It acknowledges the mutually beneficial skills and knowledge from which new knowledge emerges (Byrne and Callaghan, 2014), and can be put into action to increase population physical activity (Rütten *et al.*, 2019).

Exploring complex phenomena through action research requires an emergent design in which participants may come and go. As such, only tentative commitment to the likely research methods were made (Burns, 2015). The design, methods and indicators of change were to be developed and finalised in collaboration with the participating group based on their requirements. It was likely therefore that a suite of methods (*e.g.* interviews, observations, diaries and systems mapping) would have been employed and analyses would have been discussed in relation to multiple theoretical perspectives (Burns, 2015; Clark *et al.*, 2020). The commitment to a complex realist approach meant that determining how to influence change would have been the primary focus (Burns, 2015; Byrne, 2011). Moreover, it would have been necessary to consider how to give a voice to all competing interests, while admitting that not all voices contribute toward the construction of a truthful narrative about system change. Conflicting views are inevitable, but do not need be the source of the narrative (Byrne, 2011).

By necessarily convening with makers and users of physical activity policy (Piggin and Hart, 2017), action research conducted well had the potential to facilitate an outcome driven pragmatism addressing policy ambiguity and thus also the challenge of adopting complex systems approaches to physical activity policy

(Byrne, 2011; Cairney *et al.*, 2016). In this context, pragmatism refers to the extent that theories and knowledge are evaluated on the basis of their practical use (Greenwood and Levin, 2007). Combined with a complex realist perspective, this would have enabled the project to respond to emergent processes and findings, facilitate the promulgation of leadership and in turn systemic culture change (Burns, 2015; Molineux, 2018), as well as seek causal explanations that underpinned the observed changes. However, this was not possible, and the project ceased at the onset of the SARS-Cov-2 pandemic after a series of preliminary interviews with key strategic decision-makers (see Chapter Five).

Nevertheless, having navigated the initial travails of the pandemic, this formative work impressed on me the importance of conducting a study in the spirit of an action-orientated approach. At its heart it needed to incorporate the central concepts of action research, which included engagement, dialogical learning and thinking about outcomes in terms of system transformation. To this end, I elected to host a workshop.

3.5.3 Workshopping

Like so many researchers, and notably doctoral students, the SARS-Cov-2 pandemic forced my research into an online space. While I had some experience of teaching remotely, this presented an opportunity to learn new ways of collaborating (Shamsuddin *et al.*, 2021). I held a half-day online workshop, using the Zoom video-conferencing platform, with 19 stakeholders whose backgrounds spanned complexity, physical activity and policy domains to collect data in my third study (see Chapter Six). While interactive workshops are a well-documented knowledge exchange activity (*e.g.* Cree *et al.* (2016); Rushmer *et al.* (2014)), the methodological

literature on their use as a data collection tool is still emerging. In particular, the use of online workshops for data collection had only been fleetingly considered at the time I was conducting my research (Ørngreen and Levinsen, 2017). In this section, I reflect on new and emerging literature to explain my use of workshops as both a knowledge exchange activity and a data collection method.

Participatory and collegiate activities, such as workshops, are important for generating solutions for complex systems issues (Burns, 2015; Kornevs, 2019). Workshops differ to focus groups in that the former is interactive and participatory in nature (Ørngreen and Levinsen, 2017). Through my workshop, I brought together different forms of practical, political and scientific knowledge held across communities of practice (Head, 2008). The aim was to construct knowledge about the understanding of complex systems approaches, and how to mobilise this understanding to stimulate a systemic benefit. The workshop had three parts.

The purpose of the first part of the workshop was to disseminate and reflect on findings generated during studies one and two (see Chapters Four and Five, respectively). As a useful way to communicate summaries of diverse materials (Rushmer *et al.*, 2014), formal presentations of the research were given to the participants in the form of a pre-recorded video distributed prior to the session, and through a brief slideshow at the start of the workshop. The rationale for the pre-recorded video was taken from my experience as a Fellow of the Higher Education Academy, and the benefit of flipping sessions in virtual learning environments (Parker, 2015). This freed-up valuable time for workshop discussions and greater engagement with the data, which helped mitigate some of the difficulties of engaging people online, not least due to Zoom fatigue (Shamsuddin *et al.*, 2021). The latter

parts of the workshop were designed to collect new data about the research topic (Ørngreen and Levinsen, 2017).

Partially in response to the SARS-Cov-2 pandemic, literature on the use of workshops for research purposes is gaining prominence. This is typically focused on public engagement activities (Razzouk and Shute, 2012; Tobin *et al.*, 2020), or on the methodological possibilities of workshopping (Ørngreen and Levinsen, 2017). Ørngreen and Levinsen (2017) argued that there are three distinct foci for workshops as a research methodology. First, to achieve a goal. Second, to view the workshop as a practice in which itself as a form and outcome is investigated. Third, as a way to generate new research data. I argue, however, that these should not be considered mutually exclusive purposes in the way that they are typically portrayed (Ørngreen and Levinsen, 2017; Shamsuddin *et al.*, 2021). While seeking to collect new data, the nature of my research objectives meant that I sought to produce theoretically-grounded recommendations about advancing complex systems approaches to physical activity policy. This was a goal. Likewise, constructing knowledge through a dialogical process, whereby the researcher and participants share the same platform as constituent elements of the system, means that the workshop and its associated practices are intrinsically tied to the research findings. Therefore, I suggest that at least within the complex realist approach adopted here, and in the tradition of hermeneutics *I*, these purposes should be considered not only synergistic, but collectively necessary to produce sound knowledge upon which action may be taken.

A recent publication outlined a series of challenges and opportunities in online workshopping as a data collection method (Shamsuddin *et al.*, 2021). These included practical aspects (*e.g.* time-saving and the need for broadband internet), pros and cons of recording, the likelihood of needing to engage smaller groups to

stimulate interaction and manage the process, and opportunities for developing and benefitting from rapport. Another key aspect that warrants further consideration is the facilitation of online workshops, which requires alternative skills, actions and forms of communication to in-person workshops (Razzouk and Shute, 2012; Shamsuddin *et al.*, 2021).

In my workshop, facilitation was performed by me and two of the participants with whom I had established a prior relationship. The term perform is important here, as I was not delivering a workshop as an outsider for the benefit of an external body. Rather this reflects that the workshop itself was a construct of our actions, thus a process of independent intellectual value (Ørngreen and Levinsen, 2017). I found that having three facilitators allowed for a manageable workshop with this number of participants. However, within the dialogical approach adopted, where everybody teaches and everybody learns (Byrne, 2011), all three of us were actively engaged in the workshop activities as co-participants. In this way, no views were privileged, and everybody was involved in a process of knowledge (re)construction. Furthermore, it reinforced my position, and that of everyone else, as part of the system. As is common in online workshops (Shamsuddin *et al.*, 2021), I used whiteboard technology to frame the activities and support participant engagement.

Digital whiteboards give workshops structure and aid collaboration through illustrative means (Bower, 2015). Many different whiteboard products exist, although, to date, research has not considered their respective effectiveness in data collection workshops. I opted to use Padlet for pragmatic reasons (see Appendix 1). On reflection, one beneficial aspect of my approach was to pre-populate the boards with a series of resources participants could use to prompt further discussion by clicking the relevant hyperlinks. Furthermore, I found it useful to link the boards of

different breakout groups so that participants felt connected to everybody else, while working with a subgroup of participants. Again, this served to emphasise the collective and dialogical nature of the learning process. Data collected on Padlet boards were supplemented by field notes, chat box responses and a transcript, which enriched the data and contributed to the methodological rigour of this study (Shamsuddin *et al.*, 2021) by ensuring a credible representation of the perceived reality was constructed. While here I have offered some reflections on the methodological benefits of digital whiteboards, this remains an under researched topic (Shamsuddin *et al.*, 2021).

Overall, this workshop presented a case study example of an effective way to construct useful knowledge with diverse stakeholders, which drew upon elements of action and translational research to facilitate the mobilisation of complex systems approaches to physical activity policy (Byrne, 2011; Rütten *et al.*, 2019). Having discussed the theoretical implications of the methods adopted for this research, I will finally discuss my analytical approach.

3.6 Thematic analyses

In the penultimate section of this chapter, I will justify the selection of thematic analysis as a tool by which knowledge of complex phenomena is constructed. I provide a brief introduction to the analytical technique and juxtapose my approach against recent developments in the predominant thematic analysis literature, particularly in relation to sport and exercise sciences, which I argue are incompatible with the approach I adopted.

There are numerous ways to analyse qualitative data, including phenomenological, framework, and discourse approaches (Braun and Clarke, 2013).

However, these are often grounded in post-modernist traditions of qualitative research and are therefore incompatible with the complex realist perspective adopted here. Alternatively, I employed pragmatic variants of thematic analysis for this research (Braun and Clarke, 2006).

Thematic analysis is a technique used in qualitative research to organise textual data and construct a framework of coherent categories that reflect recurring and salient themes, which answer the research questions (Braun and Clarke, 2006; Buetow, 2010). It is used in various ways. The most significant attempt to demarcate the practice of thematic analysis was by Braun and Clarke (2006). The authors recognised that the field lacked definition, and sought to consolidate their experiences and understanding of this analytical approach to support others to use it more effectively. In short, accompanied by numerous illustrative examples, they proposed a six-step process for conducting a thematic analysis: 1) data familiarisation; 2) generating initial codes; 3) searching for themes; 4) reviewing themes; 5) defining and naming themes; and 6) producing the report (Braun and Clarke, 2006). Furthermore, they outlined the decisions researchers need to make about types of (*e.g.* semantic or latent), and approaches to (*e.g.* inductive and deductive), coding. While these stages should not necessarily be considered a linear process, nor the decisions a clear dichotomy (Braun and Clarke, 2019), they provide a useful heuristic for those employing this technique, especially those new to qualitative analysis (Braun and Clarke, 2013). In essence, Braun and Clarke (2006) developed a toolkit for managing thematic analyses that was accessible to researchers of all traditions, given their assertion that the approach was not tied to any particular methodological or theoretical position. This was an important factor for me in adopting this approach.

However, recently there has been a significant turn in how thematic analysis is conceptualised among its ardent proponents (Braun and Clarke, 2019). Braun and Clarke (2019, p.591) introduced the concept of reflexive thematic analysis as an antidote to the *'sloppy mishmash of theories, methods and techniques'* applied to thematic analyses in sport, exercise and physical activity research. Note here the normative judgement made by the authors in relation to theory in particular. What was once a theoretically neutral domain has been deliberately and, in my view, erroneously theorised.

Braun and Clarke's (2019) central argument was that those using thematic analysis tended to espouse the primacy of technical procedure over researcher subjectivity and reflexivity, which the authors now deemed the cornerstone of quality thematic analysis. In itself, this is not problematic and there is much to agree with about their views on enhancing the practice and product of research. Thematic analysis is rightly characterised as the iterative construction of themes through a willing and critical engagement with, and interpretation of, the data. Themes should not be thought of as having emerged from the data (Braun *et al.*, 2016). I also agree that the researcher must knowingly and transparently consider the philosophical and theoretical assumptions that inform their use of thematic analysis (Braun and Clarke, 2019). Reflexivity is an essential component of social research; indeed, this chapter is an exercise in reflexivity. Where our positions differ, however, is in how we conceptualise the role of the researcher in knowledge construction. Braun and Clark (2019, p.591) outline their position thus:

> For us, qualitative research is about meaning and meaning-making, and viewing these as always context-bound, positioned and situated, and qualitative data analysis is about telling 'stories', about interpreting, and creating, not discovering and finding the 'truth' that is either 'out there' and findable from, or buried deep within, the data.

> We see *our* [emphasis added] approach mashed-up with other thematic analysis approaches that differ profoundly in terms of procedure and underlying philosophy, typically without any discussion or acknowledgement of the differences.

Evidently, Braun and Clarke's position is now firmly in the post-modernist camp, so much so that I argue that reflexive thematic analysis represents a new method entirely rather than, as the authors implied above, a natural extension of *their* original approach (Braun and Clarke, 2006). Central to my complex realist position is the construction of a truthful narrative by exploring data through different lenses. The philosophical partiality and theoretical rigidity of reflexive thematic analysis (Braun and Clarke, 2019) renders it obsolete in the context of my research. On the other hand, the benefit of their original toolkit was its flexibility to incorporate theoretical perspectives as necessary to understand the phenomena of investigation. Today, Braun and Clarke (2019) challenge users of thematic analysis to locate their approach in juxtaposition with the reflexive technique. Here I pick up that gauntlet.

Complex issues, such as policy-making or tackling physical inactivity, can only be understood if their reality is simplified and studied from multiple perspectives (Byrne, 2011; Wistow *et al.*, 2015). Given the applied focus of complex realist research, I combined the hermeneutic *I* approach to language of Cilliers (1998) and Pawson and Tilley (1997) in a *traditional* thematic analysis (Braun and Clarke, 2006). Through the continual reflection and learning that accompanies the doctoral training process, I also decided to incorporate a more explicit critical realist approach in my thematic analysis for study three (see Chapter Six), whereby data were considered in relation to dispositions, inferences and empirical manifestations (Wiltshire and Ronkainen, 2021). Thus, the theoretical flexibility of thematic

analysis meant that it was compatible with a complex realist perspective. Organising data into salient themes had several advantages for my research.

First, themes were a simplified representation of the reality of complex phenomena. For example, making and implementing physical activity policy is often an uncertain and ambiguous process (Oliver *et al.*, 2016a). Complex issues require unbounded resource, time and scope of enquiry to address them (Chapman, 2004). Therefore, themes represented a generally agreed framework that characterised social systems and how they may be understood, and from which action may be generated. As opposed to reductionist approaches (Chapman, 2004), this method simplified the reality of the systems of interest by increasing abstraction from the rich detail of how individuals understand and act amid complexity, to a collective view that was focused through multiple lenses. This enabled the construction of middle-range theories that remained contextually-located but amenable to testing and action elsewhere (Byrne and Callaghan, 2014; Williams, 2020).

Second, thematic analysis facilitated the relational approach required to consider unbounded issues (Head, 2008). It was a natural extension of the multiple lenses epistemological approach that emphasised, but did not prioritise, the views of diverse stakeholders. Thematic analysis represented a systematic scientific lens that highlighted the political know-how and practical implementation knowledge of participants. In this way a collective narrative was constructed, as I made observations of the way actual events and experiences manifested in my data (Byrne, 2011; Head, 2008; Wiltshire and Ronkainen, 2021).

Third, thematic analysis helped to highlight cases and the qualitative differences between how complexity is understood, and therefore approaches to action (Byrne, 1998; Byrne and Uprichard, 2012). These existed both within and

across themes, the interconnections between which were a vital consideration (Chapman, 2004). Of particular interest were the kinds of behaviours and events that reinforced or inhibited system change, and it was necessary to try to infer their underlying mechanisms. In doing so, it was important to consider what agents in this policy domain made explicit and also disregarded in their discussion of complexity. Language was a key component of this.

Several proponents of thematic analysis argue that it cannot make claims about language, instead propose alternative methods such as those highlighted at the start of this chapter subsection (Braun and Clarke, 2006; Nowell *et al.*, 2017). However, if one considers thematic analysis to be an extended relational process of constructing knowledge of complex phenomena, as articulated here, this could be considered to reflect the hermeneutic perspective, which I discussed in detail above. Incorporating a hermeneutic view into a thematic analysis had two-fold benefit.

First, it allowed for language to be explored, which illustrates something different about how complex phenomena are understood (Thirsk and Clark, 2017). Second, hermeneutics recognises that all participants had a view about the research topic, but that this view can be reconciled toward a consensus as knowledge of it changes. The relational approach meant that this understanding was constructed alongside, rather than biased by, the scientific perspective. It did however acknowledge that some views are more useful than other in creating knowledge about complexity (Thirsk and Clark, 2017). This reflected the complex realist position set out earlier in which the search for an objective, causal reality means some views are inherently more accurate than others (Bhaskar, 2008; Byrne, 2011). Furthermore, within the adopted philosophical framework, language was considered

to be a causal mechanism, knowledge of which was not a precondition for its use (Bhaskar, 2008).

In sum, the pragmatic and theoretically flexible approach to thematic analysis that I adopted in this research may not satisfy the scrutiny of the method's key advocates. However, I have constructed an approach to observing the complex social world that advances knowledge of it. The findings present a strong claim about reality in a given context and time, although this claim will only ever be partial due to the nature of complexity. As Williams (2020) contended, all explanations are fallible and should be open to contest. The methodological approach adopted has allowed me to generate middle-range theories that point toward actions to change the physical activity policy system. These theories warrant further testing to reinforce, develop and increase certainty about these claims.

3.7 A note about ethics

In this chapter, I have expressed my conviction for the ethical necessity of seeing myself as a constituent part of the physical activity policy system. Each of the studies presented in this thesis received Durham University Ethics Committee approval; the details of practical matters (*e.g.* informed consent and sense-checking of data) are provided in the methods sections of Chapters Four-to-Six, and their associated appendices. However, there are conceptual issues that warrant further discussion, particularly related to matters of confidentiality and anonymity of participants. Given the nature of systems-based research, and not least due to the emergent properties of complex policy systems (Cairney *et al.*, 2019), it is often difficult to decipher which elements of a system are contributing most substantially

to the research findings. Here, I defend my rationale for protecting anonymity and political sensitivity despite the potential to compound these uncertainties.

Silva *et al.* (2018) presented one of the few expositions of ethics for systems-based approaches in public health. They concluded that key dimensions of ethical practice included: i) defining the boundaries of the system of interest (*e.g.* see Figure 1); ii) being explicit about whose perspectives and interests matter; and iii) accounting for the interconnected nature of individuals and their relationships with their environments. Thus, being able to identify key stakeholders and their contributions seems important for each of these endeavours. However, common, and often mandatory, research practices, such as protecting the anonymity of participants as one way to provide confidentiality (Lancaster, 2017), may leave researchers in a conflicted state (Lillie and Ayling, 2021), whereby commitment to one ethical practice inhibits attempts to initiate or sustain others. This is potentially compounded by further implications of anonymity in studying elite groups.

Preserving anonymity stands somewhat athwart to the commitment to public accountability that many elite research participants are expected to uphold (*e.g.* policy-makers and politicians). This approach may protect participants' status and power, by significantly reducing the possibility of redressing any problematic power structures (Lillie and Ayling, 2021). Furthermore, anonymity typically reduces the richness of qualitative accounts, and impedes cross-case analyses in elite research (Lancaster, 2017). In the context of this study, while possible, this means increased difficulty for readers of the research to understand the behaviour of systems agents, identify where to target efforts to promote systems change, or understand how the accounts of different sectors interrelate to construct an overall system narrative. The onus is very much on me, therefore, as a researcher within the system to articulate

my experience and understanding of these dimensions through a scientific lens. Moreover, decisions about anonymity are complex, and determined through an emergent and relational approach to the participants and the data (Lancaster, 2017). I made decisions about what information to share and how (Burns, 2007); on balance, I determined an anonymous approach may potentially benefit longer-term advances of systems-based research in the physical activity policy domain.

Developing effective complex systems-informed approaches to physical activity policy will rely on the engagement of diverse stakeholders, including those who hold decision-making power (*e.g.* government and civil service personnel). I argue that preserving anonymity at this emerging stage of our system's endeavours may hold three key benefits.

First, it is necessary to initiate and sustain research involvement among new groups of participants. In this study, I brokered access to several groups who have seldom previously been represented in physical activity policy research. Ensuring that such participants feel as though they are treated equally to others (including on matters of confidentiality and anonymity) is an important means of developing trust (Lillie and Ayling, 2021), and therefore preserving involvement of key decision-makers in the long-term. Second, systems change can be impeded by information that is withheld by participants (Burns, 2007), and the protection of anonymity may encourage people to share their views, including on sensitive information, without fear of recourse (Lillie and Ayling, 2021). Third, and as discussed, progress on complex social issues must be informed by a consensual, truthful narrative (Byrne, 2011), thus creating the space for the exchange of different knowledge types, which are to be focused through multiple-lenses, enables the creation of the collective system view, rather than prioritising any individualised perspective, and dampens the

negative effects of anonymity. These factors may help ensure the voices that matter stay engaged, and work with the research community and wider system stakeholders, to generate sustainable system change, while also preserving the institutional ethics requirements of academic research.

3.8 Concluding remarks: who am I now?

In this chapter, I have set out a reflexive account of how my approach to research may help shape and has been shaped by the complex system of interest. I have made the case for adopting a complex realist ontological perspective that is a framework for understanding complex reality, which is complemented by an epistemological approached grounded in traditional notions of social constructionism, praxis and a relational approach to knowledge generation. The purpose of this was to construct middle-range theories about the physical activity system and how it may be changed. To achieve this, I justified the selection of qualitative research methods and a theoretically flexible approach to thematic analysis. I wholeheartedly agree that theory has the potential to inform action (Byrne, 2011). I engage with it extensively, both in this chapter and throughout my thesis.

Crucially, however, this reflexive account is very personal. It provides a narrative for how I have come to position myself as a researcher. It may appear to the reader that this project does not lend itself well to one particular discipline or another (*e.g.* physical activity and Public Health sciences, sociology, or public administration). This is quite deliberate. For too long, physical activity research has been wedded to particular disciplinary perspectives. My background and doctoral training lent themselves to exploring the issue of complexity and physical activity policy from a unique angle, drawing on a wealth of literature and methodological

reasoning. While the reader may not experience a deep exposition of a given topic, each theoretical or disciplinary application is considered carefully for its pragmatic value to illuminate the current research. In this sense, while continuing to learn and evolve, I position myself as somewhat post-disciplinary, using existing knowledge related to physical activity, Public Health and social policy, but exhibiting the dexterity to draw insight from beyond the paradigmatic boundaries associated with these research fields.

More important than that, however, is that I consider my position not in relation to any disciplinary field, rather to the system that I seek to know and change. This conceptual shift is fundamental to everything that I sought to do during my Ph.D. It represents the standard by which I judged myself and my participants. It is my research philosophy (Baldwin *et al.*, 2014).

Over the coming chapters, I set out how I put this philosophy into practice through a series of three qualitative and action-orientated studies. These reflect a shift in approach from the conceptual to the increasingly applied.

Chapter 4. Complexity and physical activity – how is it understood by, and how does it influence, national policy-makers?

4.1 Introduction

In the preceding chapters, I highlighted the persistent nature of physical inactivity, both globally and in the UK (Department of Health Care, 2019; Guthold *et al.*, 2018; Guthold *et al.*, 2020; Sport England, 2021a). In response, and aligned with developments in Public Health (Jebb *et al.*, 2021; Rutter *et al.*, 2017) and applied policy studies (Barbrook-Johnson *et al.*, 2021) more broadly, there has been increased interest in complex systems approaches to physical activity promotion through policy (Rutter *et al.*, 2019; World Health Organization, 2018). However, I argue that despite the proliferation of complexity-based ideas, this perspective shift has been underwhelming, and as yet has failed to translate into effective policy action and thus changes in population activity levels.

The research presented in this chapter aims to understand why this may be, by focusing on how complexity is understood at the critical national-level among physical activity policy-makers in the UK, and how this understanding influences their work and broader efforts to promote physical activity. In particular, I present a critique using the core tenets of complexity theories (Byrne, 1998; Byrne and Callaghan, 2014; Cairney, 2012a; Teisman and Klijn, 2008) to consider its comprehension and operationalisation 'in the field' of physical activity policy-making. Through the research process, I reinterpret policy-makers' experiences to generate actionable theories about how agents of complex systems make sense of, and navigate complexity more broadly.

4.1.1 How do policy-makers understand complexity?

Complexity in policy-making is poorly defined (Cairney, 2012a). This can make it difficult to put its concepts into practice. In order for people to do so, they must first develop an understanding of complexity. Thus, it is necessary to explore how this concept is understood in the physical activity policy context, and how this is transmitted more broadly in Public Health and policy.

Previous research has suggested that people have limited cognitive capacity and reasoning with which to understand complexity (Halford *et al.*, 1998). It is proposed that the people's working memories can only process so much information at a given time. Furthermore, there are also structural barriers to developing an understanding of systems, whereby emergent properties and contextual features obscure observations of them (Byrne, 1998). Knowledge of complexity and systems is always partial, transitive and fallible (Bhaskar, 2008; Byrne, 1998; Byrne, 2011). Thus, uncertainty is an inevitable feature of complex systems. This inevitability raises two import questions.

The first question relates to what extent complexity is understood in any given context. Suh (2005) argued that people typically have an intuitive understanding of complexity in their own field. For example, policy-makers recognise their work is multi-centric, or cite the multi-sectoral nature of physical activity promotion (Grant and Hood, 2017; Pratt *et al.*, 2015). However, this understanding is seldom literal (*i.e.* reflecting principles of complexity theories as reported in scientific terms (Anzola *et al.*, 2017)), nor usually accounts for how complexity is perceived in alternative fields (Heywood *et al.*, 2010; Teisman and Klijn, 2008). Recent research in exploring food-energy-water-environment policy evaluation exemplified this (Barbrook-Johnson *et al.*, 2020). In practice, complexity

derived not from scientific theories but from issues of scale, unpredictability and context. The authors concluded that pragmatic framing and communication of complexity were key to support evaluation. However, they elected not *'to "judge" participants' views against academic definition and debates* (Barbrook-Johnson *et al.*, 2020, p.317)*.'* While important to understand how complexity is experienced in given settings, without reference to theoretical constructs it precludes the advancement of said concepts for broader application in alternative domains. It will be important to reflect more closely on the relationship between academic principles and policy-makers' views, to advance complexity theories to be relevant for physical activity and health promotion more generally.

The second question relates to how understanding of complexity may be more broadly transmitted. Policy-makers learn about and discuss complexity through narratives (Peterson and Jones, 2016) and metaphors (both verbal and visual), which derive from numerous scientific disciplines (Cairney, 2012a; Gerrits, 2012). These observations reflect previous work in other fields (Aita *et al.*, 2003). Such approaches to learning and discussion generate various meanings associated with complexity theories. While fluid meanings of complexity may create an initial sense of cooperation and enthusiasm for cross-sectoral approaches among policy-makers (*i.e.* seemingly 'singing from the same hymn sheet'), this positivity may subside due to the misapplication of terminology or tools associated with complexity in new contexts (Cairney, 2012a; Kernick, 2006).

It is necessary to understand how policy-makers have experienced the fluidity of complexity, and to what extent being engaged in the process of constructing multiple meanings creates certainty and common ground, or otherwise, for the application of terminology and tools that are associated with complexity in physical

activity policy efforts. Furthermore, no research has been found that has examined how in practice the understanding of complexity may differ or be reconciled across government departments in relation to a specific policy problem. This is a particularly important consideration for physical activity policy-making. Increasingly, responsibility for physical activity promotion falls upon partnerships beyond traditional health sectors (McKinnon *et al.*, 2011; Milton *et al.*, 2019). No studies have been found that explore how policy-makers understand complexity and interpret this in relation to physical inactivity. Such a lack of empirical understanding precludes the development of theories about how understanding then influences people's actions within this domain.

4.1.2 How do policy-makers navigate complexity?

A small but significant body of research has demonstrated complexity's influence on policy-makers' actions and their ability to reflect on these (Cairney, 2012a; Cairney and Geyer, 2017; Cairney *et al.*, 2019). Through the aforementioned fluidity of meaning, it is proposed that people create their own perceptions about complex systems and how to behave in them. Often this behaviour amounts to mere survival (Teisman and Klijn, 2008). People may feel exhausted, out of control or unable to address the problems that they face alone (Room, 2011; Sterman, 1994). Typically, they are compelled to simplify their environment (Byrne, 2011; Thrift, 1999). It is proposed that policy-makers may employ three different strategies to move from a position of survival to one of meaningful action in complex systems. Drawing on research from sociology, psychology, policy and business studies each is briefly discussed in turn here.

First, policy-makers should harbour realistic expectations about the aims and impact of policies (Cairney, 2012a). They only ever have a partial understanding of problems and their responses to them (Byrne, 1998). Policy-makers' bounded rationality means that they use heuristics to guide decision-making and tend toward positive policy signals (Cairney, 2012b; Gerrits, 2012). Failure to recognise these factors, however, can lead to confirmation bias that inflates confidence in policy efforts, and an assumption of simple causality (Sterman, 2006). Modest expectations about solving social problems implies recognition of an incomplete understanding of its causal mechanisms and processes, and can facilitate experimental policy-making (Sanderson, 2009). Consequently, it is necessary to establish what policy-makers feel they can achieve in physical activity promotion, and the signals they prioritise to do so.

A second important strategy is for policy-makers to adopt longer-term perspectives. This allows for patterns in outcomes to emerge, which in turn uncover opportunities for innovation and creativity (Snowden and Boone, 2007). Acknowledging that policy outcomes are unpredictable and unevenly distributed, policy-makers rely on experimental local implementation and evaluation (Cairney, 2012a; Sanderson, 2009). Adapting to these outcomes requires considerable multi-sectoral collaboration and a normative approach that rejects top-down control (Kovacs, 2016; Room, 2011). However, numerous features of complex policy-making systems may inhibit these approaches.

First, the UK policy domain is organised in a way that perpetuates top-down control (Cairney, 2012a). Second, policy change can be costly, both politically and financially, thus is never considered lightly by policy-makers (Cairney, 2012b), who may act cautiously when they perceive the environment to be too complex (Room,

2011). Third, regarding information gathering about issues of interest, policy-makers may feel disengaged from the local systems where evidence is produced (Langlois *et al.*, 2016), or display preference for linear models of evidence (Grant and Hood, 2017; Sterman, 2006). These models assume the notion of simple and additive causation (commonly associated with statistical regression), measuring and describing variables and the relationship between them in terms of outcomes specified as a variable dependent on others. Last, even in systems that exhibit change, learning is naturally slowed by complexity (Sterman, 2006), and due to self-organisation, systems often revert back to their original state (Bovaird, 2008; Klijn, 2008). These factors render policy-makers' actions difficult.

As a final strategy for navigating complexity, people should act in the best interest of systems (Sterman, 1994). However, previous observations indicated that such actions do not always prevail among policy-makers. Policy-makers may display self-referential behaviours to advance their own ambitions, while simultaneously deflecting the attention on to other individuals when undesired policy outcomes arise (Teisman and Klijn, 2008). They may also act defensively in order to save face, assert their dominance and avoid testing ideas publicly as their perceptions of control diminish (Doerner, 1980; Sterman, 1994). Furthermore, where innovative solutions are scarce, systems may become stifled through interventions that prioritise the provision of goods and services (Room, 2011). It is worth establishing to what extent these strategies are employed, or otherwise, in the physical activity policy context, and how differences between theoretical and practical understandings of complexity manifest. These considerations have not been the topic of previous academic enquiry.

4.1.3 The present research: responding to issues in UK physical activity policy

Efforts in the UK to address complexity in physical activity promotion may have been hindered by an overemphasis on natural science-orientated evidence to inform policies, which are often ambiguous or packaged in marketised terms (Kay, 2016; Milton *et al.*, 2019; Oliver *et al.*, 2016). Thus, traditionally, practices in the UK physical activity policy system may not be consistent with those identified above as being conducive to more effective navigation of complexity. However, much of the nascent understanding of how complexity may influence policy-makers' actions in this area has been largely conceptual or anecdotal. There lacks critical reflection on how principles of complexity theories that underpin the growing movement toward systems-thinking in health promotion are understood and navigated in policy-making. This precludes theories about how understanding influences cross-government approaches to Public Health.

Furthermore, the lack of domain-specific knowledge relating to physical activity warrants examination. Physical activity is a particularly interesting context for operationalising complexity principles for several reasons. First, the issue and its influencing system are cross-sectoral with poorly defined boundaries. Despite insufficient government strategies that reach beyond health sectors (Das and Horton, 2016), the broader interdependence emanating from formal and informal partnerships required to tackle inactivity is creating 'accidental' physical activity policy-makers (McKinnon *et al.*, 2011; Rütten *et al.*, 2013). Second, inactivity is a long-standing issue that has proved challenging to impact. Third, the SARS-Cov-2 pandemic has had a significantly negative impact on UK population physical activity, with an estimated 3 million fewer adults classified as active in November 2020 compared to

12 months previous (Robinson *et al.*, 2021; Sport England, 2021b). However, amid a renewed UK policy emphasis and heightened awareness of physical activity's benefits, a critical window for change may be opened (Guardian News, 2020; Sport England, 2020b; UK Active, 2020). Consequently, and building on emerging works, this research explored the processes, values and experiences of physical activity policy-makers, and how they collaborated and with whom to foster positive system change.

Designed to address the aforementioned gaps in knowledge and the challenges outlined above, three central research questions were posed: i) what do national-level physical activity policy-makers understand about complexity; ii) how do they interpret this understanding within the context of the physical inactivity policy problem; and iii) how does this interpretation influence the policy-makers' working philosophy and practice? These questions demanded a research design that captures the essence of how people understand the social world as the basis for their actions.

4.2 Methods

4.2.1 Philosophical assumptions

I have provided a detailed exposition of my philosophical assumptions in the previous theoretical framework and methodology chapter. Congruent with these assumptions, the present study was underpinned by a complex realist perspective (*i.e.* an ontological position that posits society comprises open and nested interacting systems, with objective properties and causal mechanisms that generate specific events and experiences (Byrne and Callaghan, 2014)). I gained an understanding of these events and experiences through multiple lenses, which included the

participant's empirical observations of the systems in which they operate, and through the scientific perspective brought to the research and analysis. The complex realist perspective orientated my examination of the data to construct a truthful narrative from among varies cases, through which mechanisms were inferred and observations were explained with reference to key features of complexity theories.

4.2.2 Study setting

Data were collected between July and October 2018. Participants were drawn from various settings: parliament, government departments, a non-departmental public body, a higher education institution and a political party. All organisations were based in London, UK, except a single East of England university and a Northern Ireland Executive body.

4.2.3 Study design

This study has been designed and reported with reference to Durham University Ethics Committee policies and the COREQ checklist for qualitative research (Tong *et al.*, 2007), see Appendices 2-4. Data were collected using one-off semi-structured one-to-one interviews that were conducted face-to-face in a private office (n = 1) and by telephone (n = 9), whereby participants were either at home or in an office. Telephone interviews produce comparable data to face-to-face methods and facilitate participation among those from various backgrounds that are otherwise hard to reach (Trier-Bieniek, 2012), and applicable in this situation given scheduling challenges for participants.

The interview guide was developed with reference to literature on complexity, policy-making and physical activity promotion in order to elicit responses that were relevant to the research questions (see Appendix 5). The guide

was reviewed by a personal contact in the civil service (who was not a participant in this study) to assess its accessibility to policy-makers. It was then formally piloted with three individuals who took no further part in the study. As a result of these processes, the guide's structure and language were adjusted to be more accessible to policy-makers working in this domain. Throughout the project, I continued to change the guide iteratively to reflect my knowledge of how policy-makers were discussing certain concepts and how particular information was best accessed.

4.2.4 Recruitment

Participants were initially recruited using purposive sampling. Policy documents (*e.g. Everybody Active, Every Day)* and organisation websites (*e.g.* UK parliament) were reviewed to identify policy-makers whose possible remit included physical activity. These individuals were invited to participate by email, letter or social media, and had direct contact with me at all times. These brief invitations outlined who I am, why I was undertaking the study and what participation entailed. They were accompanied by a detailed participant information sheet. To maximise recruitment, the following strategy was employed: i) an initial invitation was sent; ii) a two-week follow-up was sent if no reply had been received; iii) a second and final follow-up was sent after five-weeks. As the study progressed, a snowball strategy was adopted (Atkinson and Flint, 2001), whereby interviewees suggested further possible participants. These were approached using the same strategy outlined above. Data saturation (Mason, 2010) was not a necessary consideration in this project, which targeted a niche group of individuals' experiences. Recruitment ceased when attempts to engage the identified individuals were exhausted.

Overall, 38 individuals were invited to participate. Ten offered no response. Sixteen declined interviews. Two agreed to participate but ultimately did not return consent forms and therefore no interviews were arranged. Where reasons for non-participation were offered, one individual had changed job role, one felt that their work's remit did not sufficiently encompass physical activity, and all others cited a lack of time. Given the important role that the following play in promoting physical activity, the lack of representation from the education, sport and environment sectors was notable (despite contacting and opening dialogues with the Departments for Education; Media, Culture and Sport; and Environment, Fisheries and Rural Affairs, respectively).

4.2.5 Participants

Recruitment resulted in a sample of 10 policy-makers, who at the time of interview were working across six sectors. Some personal characteristics of the participants are shown in Table 4. Additional characteristics have been withheld to maintain anonymity of this niche group.

Table 4. Participant characteristics (n = 10)

Descriptor	**Sex**	**Time in role (months)**	**Physical activity levels (mins/wk)**
Civil servant 1	Male	15	≥ 150
Civil servant 2	Male	13	30-149
Civil servant 3	Female	60	≥ 150
Civil servant 4	Male	45	≥ 150
Civil servant 5	Male	156	30-149
Policy advisor 1	Male	48	≥ 150
Policy advisor 2	Male	60	30-149
Politician 1	Male	24	Not reported
Politician 2	Male	242	≥ 150
Politician 3	Female	18	Not reported

Participants were given the opportunity to withhold any personal information and were invited to suggest a broad job role descriptor that would be used as their pseudonym. Their choices included ‘civil servant’, ‘policy advisor’, or ‘politician’. The majority of participants were male (8 of 10). While most of those identified and approached were also male (24 of 38), and despite the fact that there were two females who initially agreed to, but ultimately did not, participate, it is possible that my position as a male researcher may have contributed to an overrepresentation of male participants.

4.2.6 Procedure

Participants were made aware from the point of first contact that I would be conducting the interviews. At this time, I was a full-time PhD candidate in the Department of Sociology at Durham University. I had already obtained considerable qualitative research experience and postgraduate-level training, including a Master’s degree in *Social Research Methods (Social Policy)*, a UKRI approved core doctoral training module in *Qualitative Methods in Social Science*, and an *Introduction to Qualitative Interviewing* course from the University of Surrey.

Given the nature of the participants it was not necessarily feasible to establish close relationships prior to the interviews. The degree of initial correspondence varied between days and months but was typically limited to securing an interview and handling minor project-related queries. My default position was not to share the interview guide ahead of time, so as to avoid scripted answers. However, three participants took up the option to receive a prior copy (one stated that they had prepared answers with colleagues). Written informed consent was provided by all participants. At the start of each interview, I reminded them why the research was

necessary, outlined my assumptions and interests in this topic, and answered any queries before obtaining final verbal consent.

Each interview was audio-recorded. I began by initiating a general conversation with participants, which extended beyond the interview guide, to help build rapport. Thereafter, the interview guide was used to facilitate discussion. Topics included in the guide were: challenges in promoting physical activity; challenges in developing cross-sector collaboration; the ideas of complexity and whole systems; and the role of academic research in policy development. Throughout, I took notes to inform follow-up questions, as well as feed into subsequent interviews and analyses. During telephone interviews I remained attentive to changes in participants' intonation so as not to miss important cues that may otherwise be easier to recognise in face-to-face interviews.

On average, interviews lasted 35 minutes, and ranged between 17 and 69 minutes. This was a function of the difficulties in accessing policy élites for interviews (Trier-Bieniek, 2012), but is nonetheless indicative of their engagement with the research environment. In this context engagement was deemed meaningful and offered sufficient data to examine the salient patterns across a collated data corpus. No third parties were present during the face-to-face interview. During one telephone interview background noise indicated that there were other people in the workplace. This was not audible in any further cases; several participants explicitly indicated that they were in a private office.

At the end of the interview, participants were afforded the opportunity to ask any questions. At times this prompted further conversation and data collection. Thereafter, participants were debriefed about how the interview data was going to be used, as well as their continued involvement in the project. All audio recordings were

transcribed verbatim, at which point all identifying information for individuals and some organisations was removed. Participants each received a copy of their interview transcript and were invited to comment (two returned minor corrections), as well as monthly update emails throughout data collection and analysis.

4.2.7 Data analysis

I analysed the data using an inductive thematic approach (Braun and Clarke, 2006) to identify salient patterns across the data transcripts without the restriction of a predetermined coding framework. QSR NVivo 10 software was used to store data and facilitate this process. First, I immersed myself in the transcripts before coding line-by-line to generate initial codes (both semantic and latent). Codes were consolidated through an iterative process into a final coding framework, containing 26 free codes (*i.e.* not using a hierarchical tree), which was used to recode the data. Codes were then collated into candidate themes and all data relevant to these was collated. Candidate themes were discussed among myself and my supervisors, and subsequently reviewed against the transcripts before further combining and refinement. This led to the generation of three overarching themes and seven lower-order themes. Furthermore, diverse cases were identified and incorporated in the following results. A draft copy of the findings was sent to participants for comment, five of whom took up this offer. Their comments were considered and incorporated into the analysis as appropriate.

4.3 Findings

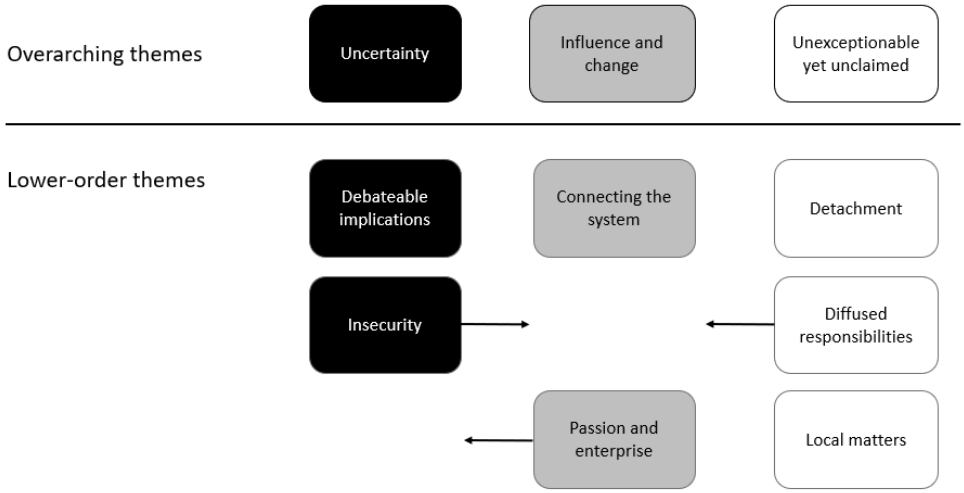
4.3.1 Overview

It is difficult to make sense of complex policy issues and the multi-centric nature of policy-making[2] (Cairney *et al.*, 2019). Unsurprisingly, therefore, the policy-makers who participated in this project discussed the issues of physical inactivity and complexity both directly and indirectly during the interviews. Through the research process, these accounts were interwoven with a scientific perspective (Head, 2008; Parsons, 2004). The following analysis is characterised by the struggles and deliberations that have led policy-makers' to question their place in systems, their ownership of complexity and policy problems, as well as the implications they draw from these perceptions. Their understanding of complexity was classified as uncertain and unexceptionable. This understanding affected policy-makers' perceptions of both their own and collective influence in systems (see Figure 2).

Collectively, the apparent 'uncertainty' with which policy-makers discussed complexity presented in two ways. First, through their varied and inconsistent attempts to define it. Second, through the extent to which they perceived complexity has implications for their work concerning physical inactivity and broader attempts to address public health issues. Generally, policy-makers acknowledged that *'to some extent almost every aspect of public policy is complex.'* This assertion echoes the common framing of public health issues (Carey *et al.*, 2015). Similarities drawn between physical inactivity and other issues (*e.g.* obesity and type II diabetes) ultimately led policy-makers to disassociate themselves from the complex issue and

[2] A collective term that indicates policy-making is in itself complex and occurs at multiple levels. The authority of different policy-making centres overlap. Centres may work collaboratively, or at times, in competition.

left them somewhat unable to identify their individual and collective roles and responsibilities, as well as those of others operating throughout the system. They sought leadership and other mechanisms to connect the system. Bisecting the technical uncertainty however is a clarity of mood. Policy-makers are passionate and yearning. They strive for solutions to the persistent systemic challenges that have thus far inhibited population-level change in physical activity participation.



Legend: Items displayed in black represent complexity and uncertainty, grey represents the policy-making environment around physical activity, and white represents possible solutions to issues faced by the physical activity sector. Arrows indicate a tentative relationship between items and a *neighbouring overarching theme.*

Figure 2. Thematic hierarchy showing overarching themes and lower order themes.

Figure 2 depicts an overview of the three overarching themes and seven associated lower-order themes, which were constructed from the data. Furthermore, it demonstrates the relationships between these. The overarching theme 'uncertainty' reflects the cognitions of policy-makers, in terms of both their capacity to understand complexity as individuals, as well as the application of the concept.

'Unexceptionable yet unclaimed' captures the complexities of physical inactivity and the policy-making environment, as perceived by the policy-makers. 'Influence and

change' is a theme that discusses factors that may influence systemic change in promoting physical activity. These themes are now discussed in turn.

4.3.2 Overarching Theme 1: Uncertainty

Not without exception, most policy-makers expressed at least some awareness of complexity and whole systems. For example, Civil Servant 2 admitted: *'I am not an expert in them, but I think that I have kind of a crude understanding.'* Nevertheless, there remained uncertainty about these concepts, which became evident as policy-makers unpacked their understanding of them. In part, this lack of clarity resulted from how notions of complexity are transmitted between and learned about in different areas of government.

Policy-makers understood complexity in various and inconsistent ways. The lack of collective understanding was highlighted by the provision of 12 different characterisations of the concept, which were as follows: the absence of simple solutions, different contexts, holism, logic models, long-term processes, moving at scale, multi-faceted, multi-level, thinking in the round, vested interests, a web of integration, and whole systems. Many of these reflect common academic principles, for example those proposed by Rutter *et al.* (2017), and are demonstrated further in the following quotations: *'It is multi-dimensional, there are lots of different factors in that people behave differently* **(Politician 1)***.' 'Testing and refining ideas in different kinds of environments* **(Civil Servant 1)***.' 'There's a spreading of onion rings around us that influence [physical activity], and a whole system approach is about addressing all of the onion rings* **(Policy Advisor 1)***.'* In particular, the logic informing this latter comment alludes to how policy-makers make sense of complexity.

For the most part, complexity is ill-defined and policy-makers rely on metaphors in the absence of a common language (Cairney, 2012a). These were drawn on by the participants. Civil Servant 5 commented humorously: *'You mentioned the Foresight [report] and you've seen that mind map, it's like spaghetti junction.'* In terms of policy action, others acknowledged *'there's no one silver bullet* **(Policy Advisor 1)***'* and *'that actually [what it is that] you need, some people describe it as a smörgåsbord of options* **(Policy Advisor 2)***.'*

Promisingly, some policy-makers described the importance of sharing ideas and understanding, which propagate through cross-government and cross-sector interactions. In time, this may facilitate consensus and adoption of an elusive common language, perhaps through micro-emergent means (Byrne and Callaghan, 2014):

> **Civil Servant 4:** A whole systems approach is certainly the language of my colleagues over in the Department of Health and Social Care and Public Health England. They certainly talk about and [are] thinking about it now actually. We had a recent session with Sport England. They were talking in that language as well […] I was saying about going out there and having conversations […] through conversations with DHSC, that's certainly their language, which has helped me understand it as well.

Contrastingly, however, some policy-makers appeared to distance themselves from these concepts. Complexity was considered a *'scientific word […] a more mathematical word,'* its use exemplifying *'a tendency to over apply academic practices [to public policy], because it's what we like to do.'* While language and ideas relating to complexity do permeate physical activity policy, some resistance remains.

The examples given above highlight that complexity is often seen as somebody else's domain, irrespective of whether policy-makers distanced themselves from it or not. It is seldom acknowledged by policy-makers to be their

own language or concept. The way in which participants discussed how complexity was learned about through shared experiences and practices, yet nobody claimed ownership over the complexity, reflects how the meaning of complexity continues to evolve from different scientific, political and practice-orientated perspectives (Gerrits, 2012; Head, 2008). While its fluid meaning may be broadly appealing to policy-makers looking for evidence of collaborative working, inconsistency can lead to misapplication, scepticism and uncertainty about issues of common interest (Cairney, 2012a; Kernick, 2006). Indeed, policy-makers displayed their insecurities about the concept, as well as debated its implications.

4.3.2.1 Insecurity – subtheme 1.1

'Insecurity' captures a construction of policy-makers' struggles to come to terms with the meaning of complexity for themselves as individuals. Discussion of this was characterised by uncertainty and a lack of confidence. For example, Civil Servant 3 commented, *'actually it doesn't mean anything to me, again I've been thinking about this.'* Such consideration supports research that has demonstrated policy-makers are active and reflexive recipients of ideas and concepts (Langlois *et al.*, 2016), but in this case suggests a struggle to identify how complexity works for them. Talking about novel ideas, Civil Servant 4 reflected:

> They were talking in that [complexity] language […] and you might not entirely know what someone's talking about, but you ask the question, you go "I'm sorry, what did you mean"?

This extract demonstrates a willingness to learn, suggesting policy-makers appraise their knowledge and skills in the context of predominant discourse and reasoning. It further emphasises their aforementioned interactions, through which they encounter and influence one another's conceptual considerations. Adopting

'evidence, theories and ideas, [and] testing and refining those ideas in different kinds of environments' is central to policy-makers' passionate attempts to advance physical activity promotion. This alludes to the observation that policy-makers are resourceful and entrepreneurial. Without confidence and clarity however, it may be difficult to implement new ideas.

It was evident that many policy-makers were uneasy with notions of complexity. They often spoke in hesitant or speculative terms. For example, Policy Advisor 2 surmised, *'I think what it is, is recognising these, what some people disclose, wicked issues.'* The general lack of confidence was summed up by Civil Servant 2 after a long pause for thought:

> Oh, blimey now you're testing me, erm, I *think* a whole system approach, it would be a way of looking at things in a holistic way, erm [emphasis added].

Despite this hesitation, such definitions are, at least in part, aligned with theoretical models of complexity that may be applied to the practice of addressing policy problems. Physical inactivity is a wicked issue (Onagbiye and Bester, 2022; Signal *et al.*, 2013), although it is seldom characterised this way in the academic literature. Wicked issues are those that have no immediate solution, are symptomatic of other problems, have complex causal determinants and are difficult to define (Wistow *et al.*, 2015). Complexity theory offers a suitable framework for understanding these (Teisman and Klijn, 2008). The notion of holism, on the other hand, is indicative of the possible pitfalls that policy-makers may encounter without the confidence to interpret and apply complexity theories appropriately. *'Complexity is not holism but there is a necessary holistic element in it* (Byrne and Callaghan, 2014, p.182)*.'* '*Looking at things in a holistic way'* typically implies reducing something to its

whole and overlooks the interactions and organisation between systems, as well as of their constituent parts (Byrne, 1998).

If left unaddressed policy-makers' lack of confidence in understanding and applying concepts consistently may inhibit the physical activity sector's ability to move further toward complex and whole system approaches. The prevalence of 'insecurity' among participants may reflect policy-makers' general discomfort at new ways of working (Bullock *et al.*, 2001). However, in the current data, this account did not necessarily characterise an environment in which traditional approaches are perpetuated. Rather, this was encapsulated by the outwardly 'debatable implications' of complexity in policy-making environments.

4.3.2.2 Debateable implications – subtheme 1.2

Policy-makers offered conflicting views about the utility of complexity as a concept. Some believe that it is *'absolutely'* useful, because *'if you're really trying to achieve something substantive, you do have to look at how the thing works as a whole.'* It enabled policy-makers to *'talk about [a] whole system approach,'* in recognition *'that there are very few things where we have a silver bullet, a single solution.'* Despite Policy Advisor 1 stating with confidence that *'I think there is a shared view [about complexity] that we have to use a whole system approach,'* policy-makers recognised its limitations and questioned whether existing systems can accommodate it:

> **Politician 3:** I'm clear with the aspiration, I'm not sure how well it works. I think if you can get a whole systems approach to politics in general you see a lot of our societal and fiscal problems ironed out. So, whether it's a good thing to do is not really controversial, of course it is […] the question is, how realistically do you get our departmental system to think in a whole system way? […] particularly in a political system that is very short-termist [sic].

> **Policy Advisor 1:** So, there's a tension of, you know, whole system approach doesn't always go hand in hand with altruism […] you've got to have a kind of an agnostic budget […] we're still a very long way from that, even in some of the most devolved authorities.
>
> **Civil Servant 5:** The whole systems approach is a nice idea in principle. In theory, it's perhaps slightly harder to achieve because of the complexity of it.

Such comments provide examples where a lack of confidence is not situated in the individual, rather it is expressed toward the conditions in which they work. The traditional operations of government, such as short-term policy goals, are a commonly cited barrier to policy-makers' attempts to bring about change (Bullock *et al.*, 2001). As Policy Advisor 2 explained, complex approaches do not fit neatly into the short-term dynamism of government: *'One of the challenges is about people having confidence and willingness to sign-up for the long-term.'* This feeling was echoed by many participants. It suggests scepticism about the system's ability to accommodate complex approaches, but also for policy-makers to individually have the strength of conviction to advocate for, and bring about, substantive change when immediate rewards are unlikely.

Contrary to the positive and undecided views raised, some policy-makers constructed complexity to be a negative concept with little utility. For instance, Politician 1 explained how they were *'just a bit sceptical, it feels like a cop-out.'* Elaborating further: *'the whole system has to matter but what does that add that any other analysis doesn't add?'* Indeed, complexity was described by Civil Servant 3 as an inappropriate framing of social problems: *'I think complexity doesn't really mean much. I would much rather we used the word complicated.'* Such beliefs may highlight aforementioned difficulties in applying complexity given its disparate meaning among policy-makers (Cairney, 2012a). Further than this, however, the framing of issues as complicated may fail to recognise the emergent and interacting

nature of complex systems in which problems are situated. In this way, policy-makers may consider that there is a predictable or 'correct' way to solve physical inactivity. It also suggests some consider complexity in the restricted sense (Byrne and Callaghan, 2014). This has important ramifications for how policy-makers may consider their place in relation to an issue like physical inactivity.

In sum, therefore, although individually policy-makers understand many important features of complexity, individual and collective 'uncertainty' constructed as 'insecurity' and 'debateable implications' undermine the development of consensus and wholehearted commitment. Complexity remains contested, both in terms of its meaning and utility. It is seldom understood in depth, nor with consideration of how others outside of one's immediate environment understand it (Heywood *et al.*, 2010; Teisman and Klijn, 2008). This has important implications for exploring the concept in relation to specific issues, such as physical inactivity, where increasingly policy-makers have varied, non-specialist backgrounds (McKinnon *et al.*, 2011).

4.3.3 Overarching Theme 2: Physical inactivity is an unexceptionable yet unclaimed policy issue

When seeking to understand how complexity is understood and applied in relation to physical inactivity, an overarching theme was constructed to capture the belief among policy-makers that physical inactivity is not a unique public health issue. However, given the apparent similarities between physical inactivity and other problems, consequent actions ultimately gave rise to a sense of detachment from the complexity of both the issue and the policy environment. Policy-makers became external observers who, at times, interacted with physical activity but seldom owned it.

Physical inactivity was deemed comparable to other issues with examples given including obesity and type II diabetes. Similarities were drawn along three lines: i) its complexity; ii) its determinants; and iii) the steps required to address it. For example, Civil Servant 1 commented that they: *'do agree with that statement, it is a complex problem. It's not uniquely complex. I think all lifestyle interventions can be complex.'* To perceive physical inactivity as similar to other public health problems may seem beneficial, if one concludes that this facilitates the transfer of knowledge and programmes required to address it. Unlike these other problems however, physical inactivity may, without motivated and accountable individuals, lack the necessary political capital to advance the cause, as two politicians explained:

> **Politician 1:** Physical activity promotion, it's about doing a lot of the small things and that makes it sort of less sexy […] having a policy proposal that says everybody should do a bit more isn't very exciting.
>
> **Politician 2:** You do have a Public Health minister, and it sits to me very comfortably in that portfolio. Particularly, if you've got a minister who wants to make a mark. I think this could be potentially a great way to do it.

It was felt by some that the issue was *'not taken seriously.'* It ultimately came down to *'that same problem of announceability [sic].'* The issue was seen as *'uncontentious.'* This has clear implications for how physical inactivity is framed. It was often considered in relation to other problems.

Currently, policy-makers seem to search for more contestable policy issues through which the cause of physical inactivity may be considered, which in itself may be problematic given a focus on outcome over causal determinants. For example, Politician 2 suggested: *'I still think obesity is the best bet.'* Civil Servant 5 explained further:

> I work in a policy branch which is responsible for obesity prevention […] so in other words to include both physical activity and a healthy diet in one strategy […] and to be honest the funding for obesity was a good hook to

> hang, you know, that was where the funding was going to be pumped through to obesity because [the] nation's obesity has really grown.

While this recognises benefits of a cross-sectoral approach to Public Health (Teutsch and Fielding, 2013), it may also exacerbate three issues. First, it may obscure the severity of physical inactivity, perhaps to the point where it loses place in policy debate altogether. Second, by encapsulating it in other issues, it may mean policy-makers become further removed from the issue. Lastly, it adds to the complexity of the policy-making environment by increasing the range of stakeholders. Nevertheless, in localised circumstances it may have the potential to open policy windows (Racine *et al.*, 2022).

A similarity to other issues was portrayed in the way policy-makers constructed physical inactivity as a multi-level problem with many influencing factors. There *'isn't a single solution'* and *'no bit of the sector will be the solution on its own.'* Once more through metaphor, Civil Servant 3 commented that the collection of determinants is *'in itself like a Russian doll isn't it? A doll, within a doll, within a doll.'* However, they go on to suggest how physical inactivity may differ:

> I think what makes it complicated is because there are so many things that have to happen. It doesn't fit into the kind of typical transtheoretical stage model, because it's not like if you're a smoker, you clearly define yourself as a smoker or non-smoker. But you can't say that you're a physical activity activator or not activator, because in a way everybody does physical activity, the question is how much do you do? That's the issue. So, actually, I am probably going to get shot for this, but when people say there are people who are just physically inactive, well everybody's active, the question is how inactive or how active are you. That is the equation we are talking about. If we're trying to say we want you to be less inactive, there are lots of things that need to happen before you can be less active or more active.

Nevertheless, the predominant view is there is a requirement to *'think of this both at the individual level […] and the societal level,'* as Policy Advisor 1 elaborated:

> How does that get addressed and is that local policy? Is it national policy? What are the drivers and influences? So, you very quickly start to realise that every day decisions are influenced consciously and unconsciously by family, community, society, government and, in some senses, international context as well.

These sentiments reflect an appreciation of one way in which physical inactivity should be considered a complex problem. Engagement in physical activity is determined by many interacting causal factors, which necessitate multiple intervention strategies to support behaviour change (Buchan *et al.*, 2012; Rütten *et al.*, 2013). While the extent to which policy-makers understood the importance of interaction remains unclear, they evidently realised the interdependent nature of their endeavours.

4.3.3.1 Diffused responsibilities - subtheme 2.1

Interdependence and the consequent systems-thinking was a major premise on which physical inactivity was considered similar to other issues. In support of this argument, policy-makers cited their experiences of multi-centric policy-making and governance, cross-sector working, and the need to reconcile disparate stakeholder views. Working this way is not without difficulty, however.

The diversity of agents means many voices need to be considered. These do not always align. For example, Civil Servant 2 reflected on members of an active travel stakeholder advisory group:

> The R.A.C. Foundation, they represent the interests of the motorists and sometimes of course the interest of motorists align with the interests of cyclists but not always, so it's quite good to have a different voice.

Furthermore, as two politicians explained it may be hard to ensure that responsibility is maintained through collaboration and whole systems approaches:

> **Politician 2:** It's just my experience, getting departments to work together is easy in principle, it's the practice of how do you get them to sign-up to

> something that is cohesive, that commits themselves and the people they are responsible for down locally.
>
> **Politician 3:** How do you devise in an age of ever increasing accountability, in terms of measuring processes, not necessarily outcomes, or even if you do measure outcomes, very specific outcomes, because people want specific accountability for specific funding streams. How on earth do you get a whole system approach and maintain the kinds of accountability that we have grown accustomed too?

Nevertheless, while *'trying to […] get these other bodies and organisations to work in the same fashion is a challenge to say the least,'* policy-makers perceived cross-sector interdependence as a positive construct. It is an important feature of working toward policy goals. For example, Policy Advisor 1 acknowledged: *'while it has taken us a long time [to initiate collaboration], it does well for us to be able to cross-pollinate between different modalities and different bits of the sector.'* In particular, it holds importance for the increased emphasis on devolution and democratic renewal (South *et al.*, 2018), as well as responsibility for the enactment and implementation of physical activity policy. That is, the more policy-making and enactment is devolved, it will be increasingly challenging to steer all parties toward common goals.

Government influence is diminishing under the weight of interdependency from formal and informal partnerships required to address physical inactivity, creating unexpected policy-makers (McKinnon *et al.*, 2011; Rütten *et al.*, 2013). This became evident when participants were asked about developing national policies that were intended to be implemented across a variety of places and contexts. Policy-making was not considered to be the reserve of Westminster, rather, it was discussed it terms of an intricate network of agents and institutions that reached beyond a narrow government remit:

> **Policy Advisor 1:** The UK, compared internationally, is one of the few governments that has achieved a web of integration into policy which goes beyond having a sport strategy […] Part of the reason I think we have achieved what we've achieved is that through the last four-to-five years, Sport England and Public Health England have been continually working in hand together, to beat the drum and working with partners like UK Active, the Richmond Group of Charities, the sport and leisure industry.
>
> **Civil Servant 5:** It's all about working with a range of partners and perhaps trying to pool budgets and resources […] obviously we're working with partners and stakeholders, and it is wider than just departments because it's the community and voluntary sectors, the non-statutory bodies and so on, that are perhaps closer, more on the ground to the communities, so they can have a huge influence.

Systems-thinking has therefore become integral to national policy-makers' working practice, even if, perhaps, they do not all perceive it this way individually. In particular, policy-makers *'recognised that decisions on these things [i.e. physical activity promotion] are devolved down to local authorities.'* Understanding local systems is crucial, therefore.

4.3.3.2 Local matters – subtheme 2.2

Policy-makers deemed an engaged local system to be pivotal in the development and implementation of physical activity policy, as Politician 2 highlighted:

> If you were to read a Public Health director's report, it's pretty clear that if you were going to take action on some the main health issues facing the community, you can't do it alone. The question is how to, just as in central government, how do you deliver that locally and how do you create enthusiasm for it?

Complexity dictates that one size does not fit all and policy should enable local and contextual responses (Cairney, 2012a). Civil Servant 4 explained one important element of this:

> A key playing area about how effective policy is, you can set a national strategy but unless you've got local bodies […] it's kind of how they apply that locally.

This local governance was believed to provide the necessary flexibility to respond to contextual complexities, again highlighting resourcefulness and entrepreneurism as key facets of physical activity promotion:

> **Civil Servant 4:** The final years of New Labour […] we're light years away from that approach, which is very top-down. Now it's much more over to you to decide how to do it […] so you've got a lot of experimental stuff there […] they've got a lot of resources and people who tend to work there as a result tend to be quite ambitious.

Previous research has demonstrated that policy-makers may feel frustrated where national policy fails in local contexts (Cairney, 2012b). However, more recent departure from solely top-down approaches may help explain why policy-makers in this study often felt differently. Rather, with one exception among participants notwithstanding, Civil Servant 2 explained:

> I don't think there's a sense of frustration or anger when local authorities aren't promoting active travel as much as the government would like. I think that we recognise we live in a democracy and local authorities are accountable to their local populations […] if a particular city decides not to invest in any cycling and walking infrastructure, that's very much a matter of local choice […] we can't force local authorities to do things that are consistent with the national strategy.

In fact, there was a certain degree of sympathy toward local agents, in recognition that *'sometimes it's quite a lonely place.'* Civil Servant 4 commented:

> If you're working for a district authority or even a county council and you've got to deliver all of this cycling and walking stuff, and there's all this other stuff as well, and you've got to speak to your Public Health people, you've got to speak to your air quality people and you're just one person in a role, you're a bit like "where do I even start and I haven't got the resources to do that."

There is a sense however, that while observing the national picture, policy-makers recognise and even demonstrate the existence of complexity in physical activity and policy-making, they may have limited capacity to comprehend the complexities of more localised systems. The importance of understanding and

supporting the local context cannot be underestimated if the effectiveness of national policies is to increase. Although 'w*e do have national programmes that are either tested at one local level or a couple of local levels,'* more concerted effort to bridge the gap between national and local policy efforts may be required to support implementation, which is necessarily localised (Hudson *et al.*, 2019). Government policies cannot be left to drift, as Civil Servant 3 admitted was the case with the 2011 physical activity guidelines (Department of Health, 2011):

> We did not have an implementation plan, and the reason we did not have an implementation plan was because shortly after the report is launched, we had a change of government, and everything came to a halt. To be honest people forgot about it. So, they forgot to implement, to carry out the implementation. So, although the guidelines were there, there was no implementation plan, hence, there were no messages or messaging.

Policy Advisor 1 acknowledged:

> This isn't unique to physical activity, it was an OECD report on mental health, which had a similar finding […] the UK writes a beautiful document, really well planned out framework, but then they sit on a shelf. The challenge is moving beyond just writing to then implementing it.

One way in which policy-makers may attempt to bridge the implementation gap between national policy and local delivery, thus promoting a consistent narrative, is by drawing upon different forms of evidence, beyond academic research. This point is encapsulated in the further subtheme 'evidence and implementation.'

4.3.3.2.1 Evidence and implementation – subtheme 2.2.1

Policy-makers receive vast quantities of information, and it is known that people have bounded rationality (Cairney and Oliver, 2017). Consequently, Civil Servant 4 suggested that *'you don't have time to delve into the complexity'* of it all. There was an expectation on researchers to have done this. Two policy-makers admitted that sometimes they had to *'take a hunch* **(Civil Servant 3)***,'* or if

necessary, *'you make the policy then you go and find the evidence* **(Politician 2)***.'* It is important to also note the strong normative dimension to physical activity policy-making, as Politician 3 commented:

> I worked on his proposal for trialling non-contact boxing in prisons with violent offenders. This is a good example, it's a really good test case. The evidence and the statistics from reputable university psychologists, the evidence was there. The reason it got quashed was because I know he [the minister] had tremendous trouble changing the prejudices of civil servants who just felt that, in inverted commas, "teaching violent people to hit was going to be bad" […] and so their natural, understandable prejudices against the idea made the whole system very resistant.

In this context, the participant discussed policy-makers' stereotypical views of certain types of physical activity and its participants.

Knowledge is focused through different lenses, each providing important evidence on complex policy issues (Head, 2008; Head, 2022). Most policy-makers seemed to be *'very committed to evidence-based policy-making.'* However, it is not always clear how different forms of evidence intersect:

> **Civil Servant 1:** We have to look at whether or not the pragmatic delivery of physical activity informs academic research or does academic research then inform what we should be doing? I'm not quite sure if we've got that right […] why can't we look at it the other way round and say, research questions would be very much designed on the challenges we are facing in the local practical system? And they should then go and be answered by the research.

Civil Servant 5 acknowledged:

> Sometimes the knowledge translation from academic to practical implementation can be difficult, because sometimes academics and researchers are, where a lot of it's theory and trying to put that into practice, can take quite some time, and ensuring that you're trying to reflect what the academic people were hoping to do can be a challenge.

Beyond academic research , policy-makers may rely on political know-how (Head, 2008). For example, Policy Advisor 1 outlined amendments they received from a sitting minister to a policy document that they were drafting:

> "So, what I've tried to do is help you write in a language that if I was just a constituent MP, I would read this information and understand what you're trying to do" […] it went out with a letter to the MPs and it's that energy I think we've been able to harness and capture which does make this quite different.

Furthermore, policy-makers are increasingly engaged with downstream agents to elicit knowledge of implementation in practice (Head, 2008). Civil Servant 1 commented that *'the implementation review that we do every year, that's very much based on local implementation.'* Although policy-makers may spend *'quite a few days staring at consultation responses, with all manner of some helpful, some less helpful suggestions,' 'good old fashioned co-production and consultation of actually asking people on the ground what works well, is still pretty unique and beneficial.'* It is about sharing best practice. This suggests that in order to make sense of complexity, science from across the hierarchy of evidence is necessary but not sufficient. It is important to consider other types of evidence about influencing policy and politics, and delivering and evaluating programmes.

Reflecting previous research (Kovacs, 2016; Room, 2011), diverse knowledge is thought to enable co-evolution and adaptation to unpredictable policy outcomes, which often arise as national policies are adopted and adapted to local contexts. This was demonstrated clearly in relation to Public Health England's (2014) *Everybody Active, Every Day* evidence-based framework, co-produced with both national and local stakeholders to help implement the UK Chief Medical Officers' guidelines on physical activity (Department of Health, 2011). However, as Policy Advisor 2 cautioned:

> There's been suggestions that that's been detrimental to increasing physical activity with disabled people, or potentially detrimental. So, we commissioned an evidence review […] as part of that work they co-produced with over 300 disabled people and disabilities groups.

These findings demonstrate a willingness among policy-makers to seek and adopt alternative forms of evidence in their attempts to address the complexities of physical inactivity and better understand how their work intersects with more localised systems. While policy-makers believed a *'more balanced view'* that reflects different stakeholders to be beneficial, progress on complex social issues must be informed by a consensual, truthful narrative, which means some information may necessarily be discarded (Byrne, 2011). However, this may be complicated where physical inactivity is concerned, given the diversity of views and agents present.

Policy-makers acknowledged that *'there's always more that you can do.*' However, it is increasingly common for them to recognise political complexities and the need for cross-sector engagement (Grant and Hood, 2017; Pratt *et al.*, 2015). The need for more locally determined approaches and an appreciation of the complexity of local systems have important implications for national policy development and wide-spread implementation. National policy-makers seem to recognise their roles within their immediate environment. However, with the *'move towards place-based thinking'*, localised evidence production and *'building a really much stronger sense of mutual aid'* downstream, national policy-makers' position in the system may appear uncertain and somewhat detached.

4.3.3.3 Detachment – subtheme 2.3

In addition to the tensions between national and local contexts, it is necessary to consider the broader context in which national policy-makers operate. The participants had varied work programmes, including the *'standard civil service, business as usual.'* Alongside this, policy-makers wrestled with the *'challenge of economic and social change,*' competing priorities, the nuances of political process and even biases of fellow policy-makers:

> **Civil Servant 2:** [Some] departments are generally worried about much bigger things if you like, from their perspective, particularly with Brexit, the dreaded B-word. You know a lot of the government's attention at the moment is inevitably focused on Brexit.
>
> **Civil Servant 5:** I guess short-termism if that's a word. Ministers are only here for usually as long as they're voted in. So, they, the ministers, tend to look at the short-term rather as opposed to the long-term view, as do civil servants in some regard. And of course, we answer to minsters. We have to follow their lead.
>
> **Politician 2:** To be honest it's a secondary issue […] you know the Department of Health's main concern is dealing with the pressures in the system. I wouldn't expect there to be much capacity on this.
>
> **Politician 3:** I also think people who are attracted to Public Health are people very attracted to evidence-based stuff. It is a good thing, but it means they may not be so focused on action.

Ultimately, policy-makers felt they *'do our best but there are [many] departments […] and it is difficult to coordinate.'* These departments have to *'divert an awful lot of time to thinking about big questions,*' so the world of physical activity can *'often feel a little remote as a department priority.'* These organisational complexities, emanating from policy that can *'fit between numerous government departments'* and sectors beyond government, mean that the issue may *'end up falling between the gaps.'* In complexity theory terms, lost amid fuzzy boundaries. In this context, it is easy to see why physical activity is not afforded the priority that its proponents often implore (Das and Horton, 2016). However, the current dataset suggests something more, a disassociation from being part of the complexity.

Physical inactivity was constructed by policy-makers as a detached issue. Specifically, they did not perceive themselves as part of the complexity. Rather they portrayed a view that they operated in a separate system that at times intervened with, and then withdrew from, addressing physical inactivity. Civil Servant 5 commented:

> Just to clarify, as the department we set policy and strategy, we don't really cover as much physical activity as we'd have liked […] we as policy-makers don't get involved at that level, a lot of it is left to [those] who implement the policies, so they are the people who really help steer the direction of work.

Policy Advisor 1 went further, suggesting that it may one day be possible for policy-makers to disregard physical activity altogether:

> We still haven't reached a tipping point that now, we can walk away and it's job done, it's [the solution] gonna be there forever.

Physical inactivity was perceived to be *'everyone's business but nobody's responsibility.'* This was reflected in the way the issue was *'frankly marginalised'* and passed between agents and institutions, as Politician 2 intimated:

> If we regard this as a Public Health activity, the responsibility has been transferred to local government, so I would push it back to the director of Public Health and the health and wellbeing boards.

This may be indicative of several things. First, policy-makers' attempts to simplify their environment, as has been demonstrated to be a common reaction to complexity (Thrift, 1999). Second, one may accuse policy-makers of taking such actions so as to absolve themselves of responsibility for the issue (Carlisle, 2001). Alternatively, this may be viewed as a variation on the tragedy of the commons concept (Hardin, 1968) that occurs when a policy area impacts on numerous government departments but is not aligned to one. However, it appears as likely that policy-makers are struggling to understand how the constituent parts of the system interact, while concurrently being unable to delineate the boundaries between different systems and the further interactions that occur at these junctures. This is leading to a *'perceived lack of coordination'* among somewhat disparate groups of agents whose roles are not always immediately clear to them. Policy Advisor 1 commented on these difficulties for those who feel they '*still need a slice of the pie to succeed:'*

> One of the challenges of a whole system approach is it requires you to be able to step back and go "actually, the best person to do this sits over there in a different sector and is not me."

Policy Advisor 2 emphasised the importance of relevant stakeholder-led strategies to *'recognise their role in creating a more physically active population.'*

The absence of clear role identities and the construction of physical inactivity as a detached issue has several important implications. First, some system-wide identity is important to motivate agents toward key goals (Bothma *et al.*, 2015). Second, by divorcing themselves from the issue and its complexity, wittingly or otherwise, policy-makers are imposing significant barriers to achieving policy goals, as one cannot stand outside a system they seek to change (Cilliers, 1998). The ramifications of detachment run further, however. By characterising physical inactivity as a discrete entity that can be viewed separately from the structural properties and causal mechanisms of the system by which the problem is generated, this reifies and legitimises a particular conceptualisation of physical activity, in this instance as a form of technology (in the sociological sense of the word; American Sociological Association (2020)), and therefore its subsequent use among policy-makers. In sum, physical inactivity is seen as 'unexceptionable and unclaimed,' *'no one government department owns it, there is uncertain leadership and very uncertain commitment.'* If we are to advance physical activity policy-making and implementation, it is necessary to support policy-makers in understanding their roles and perceptions of agency within the systems in which they operate.

4.3.4 Overarching Theme 3: Influence and change

A final overarching theme was constructed to characterise how policy-makers' perceptions of complexity and physical inactivity affects their work.

‘Influence and change’ captures the varied degrees of control felt by policy-makers in their attempts to progress physical activity promotion. Faced with enduring barriers and common, yet potentially detrimental, reactions to complexity, policy-makers explored and articulated possible solutions. There was an imperative to connect the policy environment and ensure suitable leadership. Of particular note was the emphasis policy-makers put on people’s behaviour, as well as a collective desire and enterprise.

Policy-makers articulated a raft of systemic challenges in promoting physical activity. These included the scaling of initiatives, financial constraints, sustainability, environmental influences, behavioural antecedents, inconsistent messaging, and modern living:

> **Civil Servant 5:** Scaling up the research projects can be a particular challenge because of the cost and so on, again we have to prioritise how much work we can do within a limited budget [...] intrinsic and extrinsic motivation, I think we’ve talked about those.
>
> **Civil Servant 3:** So, there are things that can be replicated for physical activity, and I suspect that you can only do that if the infrastructures are there.
>
> **Civil Servant 1:** Other things are may be messaging to the public. So, I think sometimes messages are helpful. It’s important for us to have evidence-based messaging. However, the public either have messages thrown at them and it’s very difficult to understand how they’re received or how they’re interpreted.
>
> **Policy Advisor 1:** It is just amazing the zeitgeist of experience enabled by technology. And as I say, the next iteration for me, I think of, it’s experience enabled by technology controlled by the user […] things that are going on around climate change […] will hit high income countries as badly as it hits low income countries. That will drive us back to locality living.

There was a sense that complexity affected policymakers’ capacity and sense of influence in response to such issues. Perceptions of influence differed quite significantly between policy-makers. Some believed that they had considerable voice and impact:

> **Civil Servant 1:** A lot of our work informs what went into the [World Health Organization] Global Action Plan. For example, you'll see there's [sic] four key strategic objectives and they are almost identical to our own.

It seemed apparent that claims centred on being able to produce meaningful change in policy or practice were accompanied by feelings of control, empowerment and confidence. This was encapsulated in policy-makers' use of language [emphases added]:

> **Civil Servant 1:** *We're an organisation that make the decisions and offer advice and guidance* to colleagues and other organisations out there already, the health and other government departments, with regards to policy direction and policy design. And advice to ministers, politicians regarding, I guess, healthy lifestyles integration into thinks like NHS England […] *we support* the changing health care professionals around physical activity.

> **Policy Advisor 1:** *Are we delivering?* It is making change? And the latest evaluation [of our policy], which was looking specifically at was it influencing local government and policy? And the feedback was *yes, it has fundamentally changed* the way people are commissioning around physical activity and the way that they're thinking about it more in a whole system way than they were before.

> **Civil Servant 2:** So certainly, the statutory strategy has made a big difference because *it gives us a real mandate to act*. It helps us when negotiating with other government departments certainly.

While these findings reinforce the importance of agency to underpin system change (Byrne, 2009b), it is unclear how substantial perceived influence arises. The following offer three plausible explanations. First, non-departmental government organisations may experience greater autonomy than government departments (Wettenhall, 2005). Second, statutory instruments compel departments to act. Third, as Policy Advisor 1 emphasised, it may result from the individuals involved:

> It's difficult 'cause otherwise I end up sounding very egotistical. But I think it has a lot to do with personality. So, what you had was [a] senior clinician who wasn't a single top person and therefore I could jump across and use the network I had for other areas to find synergies and opportunities.

However, there were several policy-makers who questioned their influence in the system, both in terms of policy development and addressing the issue of physical inactivity:

> **Civil Servant 2:** One of your key challenges that not all of the policy levers are held by central government.
>
> **Civil Servant 3:** We've tried everything. So, we've tried the carrots; we've tried the sticks. We've tried like the sort of subtle push. We've tried everything, but we haven't [succeeded], the prevalence [of physical activity] has remained stubbornly the same.

These feelings were often captured in language with subordinate connotations. For example, Civil Servant 1 believed that it was incumbent on ministers to *'agree very defined actions for us to take forward together.'* This comment is indicative of a key view held by many policy-makers. They looked to others to connect the system and take the lead. This was exemplified by Politician 2's query: *'where's the kind of leadership that actually says "right, this is something we're going to go for"?'* This perceived lack of influence may partially explain existing and potentially detrimental working practices amid complexity.

Specifically, these findings reinforce a nascent body of knowledge that proposes policy-makers do not always act in the best interests of systems when faced with complexity. While they are encouraged to take long-term perspectives (Snowden and Boone, 2007), *'governments come and go, the way they operate [is] why it all comes and goes,'* leaving policy-makers to reflect on the likelihood of short-term approaches: *'your five year political cycle is your longest unit of time you'll be dealing with, and if you're looking at a whole system approach, that unit of time is nothing.'* Furthermore, policy-makers may adopt a rhetoric and prioritise interventions that emphasise the provision of goods and services (Room, 2011). Two policy-makers articulated their views on persistent physical inactivity:

> **Civil Servant 3:** I think it's selling a product to people who do not want it. I think we've been trying to sell this product for the past twenty or thirty years […] it's very hard, you know, you appreciate that many people find physical activity a very difficult to grasp kind of product. They're not sure they can afford to buy it because it's just so hard.
>
> **Politician 1:** There is also a sense that there are organisations that are very keen on pushing bales of their own product. So, there's a bit of tension there. There's [sic] over-claims for physical activity, as well as massive under-claims.

Last, while trying to survive amid complexity, policy-makers may display self-referential behaviours, by giving credit to themselves where due (*e.g.* Policy Advisor 1 who felt their efforts had created synergies and opportunities for physical activity promotion), but pointing out others where shortcomings present themselves (*e.g.* when discussing the perceived disconnection between sport and health sectors, Politician 2 suggested ,*'I'm not sure Public Health like sports very much […] sports people are very blinkered, siloed'*) (Teisman and Klijn, 2008). As these examples show, these qualities have been demonstrated at times among this sample of policy-makers and contribute to a wider sense of acting in their own interests. Given the perceived lack of influence, short-termism and the prioritisation of departmental and ministerial priorities, it is perhaps easy to see why *'this silo thing is quite normal.'* However, policy-makers recognised that these behaviours are not necessarily beneficial and articulated a solution-focused mind-set toward connecting the system.

4.3.4.1 Connecting the system – subtheme 3.1

Policy-makers discussed the importance of connecting the system and bringing people together to address physical inactivity. While Politician 2 questioned why *'there's no effective lobby and there's no all-party group, and so you see a very dissipated effort,'* Civil Servant 4 offered examples of where advocacy coalitions and policy entrepreneurs had been used to good effect:

> Round about 2014-15 as the Infrastructure Bill was going through parliament, there was a lot of lobbying from groups like Cycling UK and Sustrans […] so I think it was a lot of lobbying by those organisations and other cycling groups that led to the Infrastructure Bill being amended as it went through parliament […] the Cycling and Walking Investment Strategy wasn't in the first version of the bill […] it's a credit to them that they managed to influence legislation in that way.
>
> There might not be anything at that moment in time that you can develop together, you still keep in touch because it could change, and you know it does change, and then all of a sudden you sort of make the most of that opportunity.

However, without a consistent alliance of agents, or a specific issue against which to advocate change, policy-makers may turn to other approaches to bring people together.

Given the diffuse responsibility for physical inactivity, its seemingly unclaimed nature, and the way in which policy-makers construct physical inactivity as a detached technology, the issue was used in attempts to extract people from their silos. In this way physical activity, rather than any particular people or organisations, acted, in complexity theory terms, as a 'boundary spanner,' as one civil servant and a policy advisor suggested:

> **Civil Servant 1:** Whether or not that's as simple as, I dunno [sic], inputting physical activity into commissioning contracts with other government departments and that kind of stuff. So where would you look at really embedding physical activity into key systems.
>
> **Policy Advisor 1:** I tried to weave physical activity into every bit of policy I could find because, you know, at the end of the day, no bugger has got the patience to come back and unpick it. But the counter argument to that is that it is woven too tightly it becomes invisible and so there's a kind of balancing act as we move forward.

As Piggin (2019) explained, it is common for policy-makers and practitioners alike to deploy physical activity as a tool in different forms, in different spaces, and for different reasons. These actions are inherently political. This raises critical questions about how we consider physical activity. It is not a single thing, or related

to one thing more than others. Embedding physical activity as technological resource across policy and practice does not appear to galvanise the agents, however, as the challenges of interdependence between parts of the policy system seemingly persist. Policy-makers alluded to three key mechanisms that may better connect the system: relationship building, financial support and political leverage:

> **Civil Servant 3:** I have very good working relationships with other government departments and in fact we meet up every quarter for a catch-up […] surprisingly we all do get on extremely well because we've known each other for a long time, so that makes working much easier.
>
> **Civil Servant 1:** So obviously more investment into physical activity would be beneficial. It would allow us to be more innovative, test new things.
>
> **Policy Advisor 1:** One of things we did was we got agreement, or she [the minister] did actually, and it was her that did it personally, is we got agreement from The Speaker's office for her to write to every MP in parliament. Now that's quite unusual. It doesn't happen very often. As I say, you have to get permission from The Speaker.

Although through discussion policy-makers suggested these key mechanisms, there was a further feature which they were most vocal about. The need for leadership, captured in a further subtheme, to cut across complexity and the intricacies of physical activity promotion discussed here.

4.3.4.1.1 Leadership – subtheme 3.1.1

There were two key forms of leadership evident in the dataset. The first was policy as leadership. In its broadest sense, policy may refer to decisions or actions adopted by agents to achieve particular goals (Richards and Smith, 2002). Some policy-makers felt their efforts in these regards had the potential *'to pull people together.'* For example, Politician 2 suggested for *'a central government initiative on physical exercise […] the only way to get government departments to work together is if you force them to.'* Policy Advisor 1 offered further thoughts:

> What we've got is the ability to convene and the ability to be technical experts and advisors. You know, it's pretty unique actually and it has created that kind of glue at a national level, which has supported and enabled the glue at a local level […] we can play that brokerage across the system […] in this bringing people together in neutral territory.

Others felt that it was important to *'look at some of the community leadership models'* and create things like *'leadership academies in physical activity.'* Above all else however, leadership was considered in the context of *'how to use people to open up the sector.'*

The importance of having the right people at the right times, in the appropriate circumstances was evident. Some policy-makers felt *'it was very minister dependent,'* or at least leadership was required *'at a very senior level and then that will filter down.'* The NHS and national leaders in the health department were two cited examples. Policy Advisor 1 passionately emphasised the need to:

> Strengthen the reliance on individuals in key positions to move the agenda forward, it is one of the most fundamental steps when addressing complexity. Having a couple of people in aligned agencies can significantly move forward the agenda.

Alternatively, there was recognition that *'policy leads change'* and that local leaders were needed too, as a politician and civil servant observed:

> **Politician 2:** Basically, you need someone to gee people up and then you need local campaigns, because this is all mostly going to be done locally.
>
> **Civil Servant 2:** We have a number of new mayors in cities like Manchester and Birmingham, who are responsible for lot of key transport decisions in their areas. And frankly, some of them are doing a really good job. I mean, Andy Burnham in Manchester, for example, particularly helped by his active travel commissioner, Chris Boardman[3], has really been prioritising investment in active travel.

[3] Chris Boardman has stepped-down from this role since the research was conducted.

Further examination of the data highlights two key features of leaders in the context of physical activity promotion, which characterise the policy-makers who participated in this study.

4.3.4.2 Passion and enterprise – subtheme 3.2

One way in which diminished perceptions of control amid complexity may affect policy-makers is to increase their defensiveness. This may save face, assert dominance, or importantly preclude the testing of new ideas in public (Doerner, 1980; Sterman, 1994). However, to the contrary, policy-makers in this study were open to experimentation and novel ideas, as the following quotations demonstrate:

> **Civil Servant 4:** And of course, you know, the policy solutions to that are so different to those that have been historic, which have been "Oh yeah, well let's just improve the roads and they'll be nicer to cycle on." Well actually, what happens if you don't want to cycle on the road […] what's the role of e-bikes and stuff like this as well?
>
> **Civil Servant 4:** We pay out grants to local authorities. We had our eight Cycle Ambition Cities, who were, if you like, specially selected to sort of pilot some innovative and exciting cycling and walking measures.
>
> **Policy Advisor 2:** Certainly, what we know, certainly in physical activity for example, there's been loads of great little initiatives over the years. In terms of do they have any impact on population physical activity levels, it doesn't seem so. So, there is the need for this [whole systems] approach.

This willingness to adapt, evaluate and change is important for policy-makers seeking to navigate complexity (Sanderson, 2009). Further, however, it is indicative of the sample's strength of desire, as they strive to progress physical activity promotion. Most participants were somewhat active themselves (see Table 4). Consequently, their evident passion may have been driven, at least in part, by their personal experiences, which places the participants in what Politician 3 described as the category of *'people who get it'.* Nevertheless, throughout their discussions, policy-makers expressed their *'hope we can [improve physical activity prevalence]'*

and strategies in terms of *'physical activity, I'd love to see.'* For example, Civil Servant 2 reflected on their ambition to reach out to local bodies and embed effective physical activity policy programmes across the country:

> I think that there's obviously a hope that by sharing best practice and particularly by sharing schemes that have been successful [we can increase physical activity].

4.3.5 Summary of findings

The key findings of this study can be summarised as follows: complexity is perceived by national physical activity policy-makers in different ways. While language relating to the concept is seemingly wide-spread, its meaning and implications are still contested. As such, how to use language and models of complexity is not fully understood. Physical inactivity is constructed to be an 'unexceptionable yet unclaimed' issue. In order to address it, many policy-makers consider whole systems approaches. Nevertheless, policy-makers embodied a sense of detachment from its complexity. The interconnected nature of physical activity promotion has important implications for evidence use, local implementation and mechanisms by which to bring people together. Leaders are deemed pivotal in this endeavour. Key characteristics of such leaders include passion and enterprise.

4.4 Discussion

Engaging policy-makers in discussion about complexity is important for two reasons. First, it helps policy-makers to understand the concept of complexity and how it affects their work (Cairney, 2012a). Second, it enables researchers to reinterpret these understandings to develop theories about how agents make sense of, and respond to, the complexity of systems in which they live and operate (Salway and Green, 2017; Teisman *et al.*, 2009). This study aimed to accomplish these

outcomes in the novel context of national-level physical activity policy-making across different government sectors in the UK.

The findings provide insight into the contested meaning and implications of complexity, both specific to physical activity promotion and policy implementation, as well as transcending this context. While language and models of complexity permeate policy discussions about physical activity, how to apply them consistently does not. The competing experiences and dissonance among policy-makers portrayed in these findings contrasts the definitive approaches as being the way forward made by many leading physical activity literatures (Piggin, 2019). At times complexities are acknowledged, but at others they are seemingly ignored in favour of straightforward and grand generalisations of physical activity promotion.

The data reinforce previous work concerning policy-makers' reflexive engagement with evidence from various sources (Head, 2008); the evolution of complexity's meaning, which is influenced and promulgated by metaphors (Cairney, 2012a; Gerrits, 2012); some of the anticipated responses by policy-makers to complexity (Carlisle, 2001; Room, 2011; Thrift, 1999); and the increased emphasis on co-evolution and adaptation of policies in local settings (Kovacs, 2016; Room, 2011).

Additionally, this study extends theory and practice in important ways. First, new insight is provided concerning policy-makers' uncertainty in understanding and applying complexity theories to physical activity promotion; how physical activity is conceptualised and responded to as a policy problem; and the mechanisms by which systemic change may be stimulated. Second, notions of complexity's conceptual purity and the perceived irrationality of policy-makers' decision-making are challenged. These core findings relating to complexity theories, decision-making and

policy-making are discussed in turn below. This section concludes with a discussion of the study's limitations and directions for future research.

4.4.1 Core findings: Complexity theories

Considering the key overarching theme of 'uncertainty', and its lower order themes, in the context of existing complexity literature, the theoretical contribution of the results becomes clear. In their discussion of complexity theory in political science and public policy, Cairney (2012a) recognised that policy-makers had yet to establish a shared language of complexity amid conceptualisations drawn from various disciplines. The current findings reinforced this observation and the importance of metaphors in the absence of a common dialogue. In realist terms, language is a mechanism (Bhaskar, 2008). It demonstrates differences in how complexity is understood, and importantly enables this understanding to shift beyond what is commonly and explicitly discussed (Thirsk and Clark, 2017).

This study extends on this body of knowledge by providing insight into the organic, dynamic and potentially emergent way in which a shared understanding may develop. The importance of creating space for the exchange of ideas through social interaction and communities of practice is highlighted. This may also enable policy-makers to identify their roles and in turn address issues around ownership. However, participant responses suggest that this understanding cannot be engineered, and that it evolves over time. It may in itself be, to some extent, a product of emergence (Deacon, 2007). Given that meaning associated with complexity continually develops and is contextually determined, this discredits previous notions of conceptual purity (Kerr, 2002; Rosenhead, 1998; Tosey, 2002). The current findings uncover the increasing, if inconsistent, way in which complexity theories' principles

are interpreted and perceived in the context of physical activity policy. However, similar to recent concerns raised by Salway and Green (2017), the complexity knowledge-to-implementation gap identified in this study must be addressed to better inform Public Health decision-making. Complexity theories alone are unlikely to be sufficient in this endeavour. The limitations of whole systems approaches need to be further explored (Piggin, 2019).

4.4.2 Core findings: Decision-making

There is a well-established view that people draw on both rational or irrational skills and aptitudes in decision-making (Simon, 1993). Research in evidence-informed policy-making has determined that amid complexity, policy-makers tend toward irrationality (emotions, beliefs, habits and familiarity with information) to facilitate prompt decisions (Cairney, 2016; Cairney and Oliver, 2017). However, participants' responses demonstrate that rational processes may supersede irrationality wherever possible, rather than what has been portrayed in this aforementioned previous literature as almost a preconditioned reliance on the latter among policy-makers. While notions of bounded rationality were evident, policy-makers may first consider rational decision-making shortcuts, whereby evidence-based, goal-orientated responses to problems are prioritised despite the inherent complexity of these issues and the associated policy-making environment.

In addition to considering the current findings within the context of rationality, it is also prudent to examine them in the context of decision-making frameworks, of which there are many published – for examples, see Morgan *et al*. (2018). In their adapted model of decision-making, Dobal *et al.* (2017) identified information, values and preferences as important components that interact with each

other and the contextual environment to influence decisions. While typically applied to individual behavioural decisions, this model affords insight into how participants addressed physical inactivity, both individually and collectively. Furthermore, framing policy-makers' problem solving in this way invites consideration of complementary theories of decision-making in Public Health and policy studies.

This study's findings show that as a result of diffused responsibilities in particular, decision-making in the context of physical activity promotion is largely an interdependent task. Participants obtained information from various sources, including research evidence, theories and general ideas relevant to their decisions. This finding relates to dimensions of participative decision-making, especially in terms of providing possible solutions to problems (Black and Gregersen, 1997). The degree to which participants open-up the process to new ideas and agents, and how they seek to balance different interests, is an important strategy for complex decision-making (Klijn and Teisman, 1997). However, there are remaining issues, not least due to the added complexity each stakeholder brings. Related to this, the theme about detachment raises important considerations. Drawing on need theories of motivation (*e.g.* Deci *et al.* (2017); Maslow (1954)), it is not implausible to suggest that successful participative decision-making may rely on a sense of belonging. Given participants' detachment from both complexity and the issue of physical inactivity, it is unclear to what extent this is desired or necessary. This paper suggests some key mechanisms that may bring the system together. Further understanding about the importance of generating a collective identity is warranted.

Furthermore, the enduring gap between researchers and decision-makers is a significant barrier to the use of evidence in Public Health (Brownson *et al.*, 1999). The participants acknowledged that more can be done to address this issue. Their

reflection on navigating the complexity of physical inactivity emphasises the lack of available tools and processes at policy-makers' disposal, which Brownson *et al.* (1999) deemed necessary for evidence-based decisions. There is a need to generate evidence and accompanying tools which are both efficient to use and sensitive to complexity. This may help negate time pressures and increased ambiguity (both factors that are known to increase irrational decision-making (Maqsood *et al.*, 2004)) about what the evidence demonstrates is important for physical activity promotion and who ought to respond to this evidence, as experienced by this study's participants.

The notion of preference, as conceptualised by Dobal *et al.* (2017), did not feature as strongly in the current findings. One postulates that this may be due, in part, to the value-based dimension evident here, namely a culture of passion and enterprise. The issue of physical inactivity is considered to be intractable, and participants acknowledged policy efforts to increase population physical activity prevalence have produced mixed results. The willingness of participants to take a pragmatic, experimental and pluralistic approach to new solutions suggests similarities to previous recommendations for decision-making where programme failure is commonplace (Pawson and Tilley, 1997). However, at times, this culture appears at odds with the contextual environment, which is characterised by the common barriers to Public Health decision-making of financial sustainability, short-termism, competing pressures and insufficient leadership (Brownson *et al.*, 1999; Orton *et al.*, 2011).

Key personnel are a critical influence in Public Health decision-making (Orton *et al.*, 2011). The conceptualisation of leadership within the current study extends Orton *et al.*'s (2011) observations by highlighting the role of individuals in

key positions to shift and advocate for particular policy agenda. Working with allied individuals across organisations was deemed pivotal in addressing complexity. It may be argued that this approach was used to considerable effect in the UK between 2013 and 2016 when the nation's key policy documents *Everybody Active, Every Day* (Public Health England, 2014a), *Sporting Futures* (Department of Culture, Media and Sport, 2015), and *Towards an Active Nation* (Sport England, 2016), were all strategically aligned and subsequently influenced the development of the World Health Organization's (2018) *Global Action Plan on Physical Activity*.

Previous research has focused on the importance of individuals in making common-sense and expert judgements, or as evidence filters (Orton *et al.*, 2011). Furthermore, theoretical advances in complex environments propose more diffused models of leadership (Johannessen, 2009). In some cases, power and leadership roles may become so diffuse and subtle, that it becomes difficult to recognise them and therefore inhibits policy-makers' attempts to identify who and what constitute necessary components of policy change in response to changing environments. This may contribute to the participants' sense of absent leadership. While they recognised the importance of system-wide leadership, the findings suggest a desire among policy-makers for visible leaders within a top-down framework, which is in tension with reflections on local drivers of change. This places an emphasis on the role of government and other key organisations in policy-making.

4.4.3 Core findings: Policy-making

When analysing policy-making, it is important to consider what policy means in specific circumstances, as well as the decisions and actions adopted to achieve particular outcomes (Heikkila and Cairney, 2018; Richards and Smith, 2002). The

current study provides insight in the context of physical activity. Physical activity policy-makers are both the small teams of individuals embedded within departments, as well as an increasing number of agents outside government. The findings demonstrate how attempts are made to foster a joined-up response to physical inactivity. The physical inactivity problem is used as a tool by policy-makers to break-down silos, and it has been weaved into numerous policies across different sectors. In this manner, a focus on physical inactivity becomes policy in itself. It represents a strategy employed through the wilful act of policy-makers to compel others to recognise the interconnected nature of the issue and entice them into collaborative efforts to address it. Thus, this policy acquires a semblance of the system-connecting leadership that policy-makers seek.

No previous research has been found that considers leadership in this context, rather it has typically explored the collaborative behaviours and competences of key individuals who are considered boundary spanners (Bednarek *et al.*, 2018; Williams, 2002). While the current study reinforces that this concept is evident in practice, it also highlights the possible importance of institutions and structures (*e.g.* implementation frameworks or legislated targets) as mechanisms for connecting systems in particular circumstances (*e.g.* generating initial buy-in where individuals' remits are uncertain, or where physical activity promotion is not considered as part of organisations' everyday business). However, it is unclear to what extent this may ever lead to sustained or meaningful changes in culture or practice, given the short-term nature of policy and politics that participants acknowledged.

Furthermore, findings directly relate to elements expressed in different theories of the policy process (Kingdon, 2003; Jones and Mortensen, 2018; Sabatier, 2007). In these theories, policy change can be associated with short, intense periods

following extended stability, key agents compiling policy alternatives to be tabled at critical time points, as well as groups of people with shared belief systems who display a degree of coordinated activity over time. All identify the potentially drawn-out process of policy change and the importance of solution advocates in generating it. Within the current study, participants acknowledged that policy changes that lead to increased physical activity prevalence will take time. Consultation, lobbying through networks, and fostering strong working relationships with regular interaction between agents were seen as ways to effect quicker policy change, as well as prepare responses for opportune moments that may arise. In sum, this study extends upon previous theories by highlighting approaches that may influence policy within a physical activity context. This specificity will help physical activity advocates to engage with policy-makers and policy-making itself.

4.4.4 Limitations and areas for future research

A first limitation of this study is that it did not include participants from all government departments with a physical activity-related remit. While extensive recruitment efforts were made, absent voices include sport, education and environment ministries. Despite these notable absences, this study still engaged a wide variety of policy-makers. Views of policy-makers in these additional fields warrant further examination, as they have particularly strong influence in this policy area and their experiences may differ.

Second, this study also did not consider how experiences may vary between organisations and job roles. Specifically, the exhaustive sample did not include sufficient participants with contrasting characteristics to make reasonable distinctions of this type. Future comparative analyses may expose notable political-, ideological-

or power-related dimensions related to the development and implementation of physical activity policy.

Finally, it is important to note that complex systems are constantly evolving (Byrne, 1998). It is only possible to generate a snapshot of their state at a given point in time through cross-sectional research. Therefore, it will be prudent to conduct further work to be able to chart the evolution of physical activity policy systems, noting also how the policy-makers' actions change over time.

4.5 Conclusion

As far as is known, this initial study was the first to examine how national policy-makers navigate complexity in relation to their environment and while addressing the problem of physical inactivity. It has shown that the concepts of complexity theories and whole systems are permeating the sector. However, their meaning and implications are contested. Consequently, this uncertainty may preclude their application in ways that enhance physical activity policies and programmes.

Furthermore, this study has demonstrated how policy-makers seem to construct a sense of detachment from complexity and physical inactivity. This is associated with an increased emphasis on participative decision-making, localised responses and diffused responsibility among policy-makers and practitioners working to promote physical activity. This previously unobserved construct of detachment raises important questions about ownership and accountability among policy-makers, as well as their ethical and practical capacities to bring about change. It also emphasises the need to consider the local systems in which national policies are adopted, adapted and implemented.

In particular, this study has uncovered the possible importance, and absence, of leadership and other mechanisms that may connect and shape systems. Consideration of these mechanisms may enable stakeholders from across the system to be brought together in ways that stimulate meaningful changes in culture and practice, enhancing the prospect of effective physical activity promotion.

To this end, it is necessary to create and test ways to facilitate: i) the emergence of leadership for connecting the physical activity sector; ii) the practical application of systems-thinking; and iii) system-wide change in the development and implementation of physical activity policies. As has been made apparent in the findings, local systems are particularly important to consider when researching complexity and policy, as they have increasing responsibility for health promotion and are looked to by national policy-makers for examples of system-galvanising leadership. The following chapter reports on a subsequent research project that aimed to explore how local partnerships can be used more effectively to improve the implementation of national physical activity guidelines, with an emphasis on leadership and system change.

Chapter 5. Leadership and policy implementation in local physical activity systems

5.1 Background

As I have argued, physical inactivity is an enduring global health problem, including in the UK (Department of Health and Social Care, 2019; Guthold *et al.*, 2018; Guthold *et al.*, 2020; Sport England, 2021a). This issue, including concomitant inequalities and economic challenges, was exacerbated by the onset of the SARS-Cov-2 pandemic, which had a significant and disruptive effect on physical activity promotion in the UK (Sport England, 2020b). The start of the pandemic coincided with this study.

To address the complexity of inactivity and increase rates of population physical activity, there has been growing interest in systems-based approaches that incorporate a suite of policy solutions (Rutter *et al.*, 2019; World Health Organization, 2018). Cross-sector collaboration is fundamental to these, and partnerships are considered integral to physical activity promotion (Matsudo, 2012; Milton *et al.*, 2021; World Health Organization, 2018). However, the implications of promoting systems-based approaches warrant further investigation (Piggin, 2019).

The uncertainty around complex systems approaches to physical activity was reflected in the findings from interviews with UK government policy-makers that were conducted during my first study (see Chapter Four). In particular, policy-makers emphasised three key considerations for local systems in supporting population physical activity promotion. First, to address complexity. Second, to support policy implementation. Third, to foster leadership that connects stakeholders in meaningful and productive ways. Nevertheless, enabling stakeholders of local

systems to offer such leadership is considered one of the most enduring and complex challenges in health policy implementation (Gilson, 2016).

5.1.1 Policy implementation: key issues

To-date, examination of physical activity policy implementation has been limited (The Lancet Editors, 2021). The reader is reminded of, and directed to, the review of existing implementation research in section 2.2.1 of my earlier literature review chapter.

There are several potential issues that may preclude more effective implementation of physical activity policy. These include: i) insufficient evidence about the effect of policy-making on physical activity programmes (Rütten *et al.*, 2016); ii) national policies that do not account for the conflict, ambiguity and barriers present in local settings (Oliver *et al.*, 2016a); iii) procedural constraints such as population size, resources and human capital, and insufficient evaluation measures (Barnidge *et al.*, 2013; Howie and Stevick, 2014); and iv) difficulties demonstrating the benefits of non-health-focused policies, which support physical activity, on health outcomes (Barnidge *et al.*, 2013).

While it is necessary to understand the complex factors and contexts that influence physical activity policy implementation (Rigby *et al.*, 2020b), existing research has predominantly been descriptive (*e.g.* through document analyses and systematic reviews), or highly contextualised (*e.g.* case studies). There has been little attempt at theory development to ascertain how observed implementation conditions arise, or how learning may be transferred between contexts. To move toward a more theoretical understanding of physical activity policy implementation, it will be necessary to consider policies and practices of the system agents in tandem, as well

as viewing implementers as learners (Howie and Stevick, 2014; Rigby *et al.*, 2020b). This mandates a methodology that can access people's experiences as leaders, and of being led, in policy implementation contexts.

5.1.2 Systems leadership

Traditional notions of leadership are founded on top-down models and bureaucratic paradigms (Uhl-Bien *et al.*, 2007). However, consistent evidence has suggested that in systems, leadership is a *'complex dynamic process that emerges in the interactive "spaces between" people and ideas'* (Lichtenstein *et al.*, 2006, p.2). Rather than directive management, leadership encompasses a collection of processes and skills, which are distributed throughout the system at all levels. These include enabling, innovation, learning and adaptability (Lichtenstein and Plowman, 2009; Lichtenstein *et al.*, 2006; Uhl-Bien *et al.*, 2007). This systems perspective prioritises collective leadership borne out of contextually-bound interactions across all organisational levels and boundaries. It largely discounts the role of specific leaders *per se*. As such, this contrasts findings from my previous study (Chapter Four) in which national policy-makers considered leaders and leadership more equally. There is still debate about whether system leadership can be taught or if it develops naturally through experience (King's Fund, 2015).

Leadership is an important antecedent of system change that involves embedding shared decision-making, energy, commitment and an understanding of how open systems operate (Onyx and Leonard, 2011). Furthermore, Lichtenstein and Plowman (2009) argued that effective system leadership embraces uncertainty, creates controversy, provides sense-giving, integrates local constraints (*e.g.* culture and values) and encourages novelty and experimentation. In contrast to previous

research that has suggested that UK physical activity policy may inhibit these latter features, my interviews with national policy-makers suggested that those individuals were entrepreneurial, resourceful and willing to try new things.

Regarding physical activity, the concept of system leadership has emerged more recently through policy guidance and large-scale programmes (*e.g.* Greater Sport (date unknown); Sport England (date unknown); World Health Organization (2018)). According to the World Health Organization (2018), strong and visible national leadership is required to create a vision for physical activity promotion. This was supported by the views of national policy-makers interviewed in my previous study. However, they also sought examples of local leadership, which reflects an expectation of local agents to cooperate and evenly share the burden as leaders (Lasker and Weiss, 2003). In contrast to much systems leadership literature, national policy-makers espoused the value of specific individuals. The relative role for individuals and collective leadership remains unclear.

The notion of distributed leadership is, however, more prevalent in physical activity literatures, and is commonly discussed with reference to partnerships (Matsudo, 2012; Milton *et al.*, 2019; Parent and Harvey, 2009). Alexander *et al.* (2001) argued that partnership leadership is in itself a distinct concept. In this context, it is proposed that leadership is influenced by reputation and credibility, as well as institutional and personal commitment to the partnership and its goals (Matsudo, 2012). Several leadership qualities that increase the effectiveness of cross-sectoral partnerships have been demonstrated. These include conflict resolution, power balancing, shared responsibility, common language, trust, and respect for different perspectives (Hämäläinen *et al.*, 2016a; Parent and Harvey, 2009; Weiss *et*

al., 2002). However, in practice these characteristics are difficult to foster (Lasker and Weiss, 2003).

Given the calls for system change to address persistent physical inactivity, it is pertinent to explore ways in which leadership is enabled. To date, much leadership literature in relation to physical activity has been practitioner-orientated and provided examples of best-practice (*e.g.* Matsudo (2012); Gates *et al.* (2018)). There has been little theorising about the mechanisms that enable these characteristics and practices to occur, nor how best to foster the complex networks and interactions that are considered to be important antecedents. Furthermore, there is need to explore some of the discrepancies highlighted in previous research and my earlier observations.

Across both policy implementation and leadership, the direct application of systems-thinking has seemingly created an environment whereby desirable characteristics and practices are understood, but the processes by which these are attained remain elusive. This is comparable to the application of complexity theories in policy-making, as examined in study one. There has been a general lack of theorising about how implementation and leadership can be enhanced. While the latter is considered important for implementation (Hatfield and Chomitz, 2015), little research has examined how these concepts are interrelated, especially with regard to national policies being implemented in local systems.

To this end, the aim of this research was to begin to explore how local partnerships can be used more effectively to improve the implementation of national physical activity policies. Specifically, it focused on system leadership of physical activity promotion, what it looks like and how it is enabled and strengthened, as well as how changes in systemic practices and cultures can be stimulated.

5.2 Methods

This chapter is reported according to COREQ criteria for qualitative research (Tong *et al.*, 2007). Ethical approval was granted by Durham University Ethics Committee. See Appendices 6-8.

5.2.1 Philosophical assumptions

The assumptions of this study adhere to the complex realist philosophy that underpins the thesis (Byrne, 2011). However, to the extent that I sought theory and knowledge on the basis of their practical use, the study also takes a pragmatist stance (Greenwood and Levin, 2007).

5.2.2 Study design

A qualitative case-study design was applied using semi-structured interviews that were conducted using videoconferencing platforms due to the SARS-Cov-2 pandemic. Videoconferencing is a viable data collection tool that participants may prefer, compared to other traditional interview forms (*e.g.* in-person or telephone), due to its convenience, simplicity and rapport-supporting interface (Archibald *et al.*, 2019). The interviews were one-off and one-to-one.

An interview guide was developed with reference to the findings of interviews with national physical activity policy-makers (see previous chapter), as well as literatures on leadership, policy implementation and systems-thinking (see Appendix 9). Although not piloted, the guide was changed iteratively between interviews to better reflect participants' understanding of the questions and elicit more pertinent responses.

5.2.3 Participants and setting

Participants were purposively recruited from the committee of a partnership based in Northeast England, whose aim was to increase countywide physical activity levels. The proposed project was initially raised at a scheduled committee meeting on my behalf by a personal contact. I conducted further consultation with a subgroup of the committee to discuss the partnership's involvement. Thereafter, participants were invited by email and all subsequent contact was directly with me. Invitations were accompanied by a participant information sheet. The following strategy was used to maximise recruitment: i) an initial invitation was sent; ii) a two-week follow-up was sent if no reply had been received; iii) a second and final follow-up was sent after five-weeks. Recruitment ceased when attempts to engage the identified individuals were exhausted. Data saturation (Mason, 2010) was not a necessary consideration given participants were recruited from a specific committee, and thus sampling was naturally restricted by circumstance.

Overall, nine individuals were invited to participate. Three offered no response and one declined interview, citing lack of time. Those who agreed to participate were emailed a consent form. Once signed and returned, an interview was arranged to suit the participants' choice of time and medium. Data were collected between April and June 2020 via Zoom and Microsoft Teams videoconference platforms. Participants and I were in our respective homes. No third parties were present.

5.2.4 Procedure

Participants were made aware from the outset that I would conduct the interviews, and I already had a professional relationship with them due to previous

work with the partnership, as well as through preliminary project meetings. While participants were aware of the topics, the interview guide was not shared beforehand to avoid scripted answers. At the start of each interview, I reminded participants of the research's purpose, outlined my assumptions and interests, and answered any queries before obtaining final verbal consent.

Each interview was audio-recorded. The guide was used to facilitate discussion. Topics included in the guide included physical activity and place, leadership, and putting national policies into practice in local systems. Throughout, I took notes to inform follow-up questions, as well as to inform subsequent interviews and analyses. On average, interviews lasted 52 minutes and ranged between 44 and 59 minutes.

After each interview, participants were afforded the opportunity to provide additional comment or ask any questions. This sometimes prompted further conversation and data collection. Thereafter, participants were debriefed about how the interview data was to be used, as well as their continued involvement in the project. All audio recordings were transcribed using intelligent verbatim transcription (Bucholtz, 2000), during which identifying information for individuals and some organisations was removed. Participants each received a copy of their interview transcript and were invited to comment (two returned minor comments).

5.2.5 Data analysis

Data analyses were two-fold. The following pragmatic approach enabled the production of useful knowledge that the participating partnership could action; enabled the integration of different lenses of knowledge through the analytical

process; and allowed for the relationship between leadership and implementation to be explored.

First, an inductive thematic analysis was conducted (Braun and Clarke, 2006) to identify key patterns across the data, without being limited by a predetermined coding framework. QSR NVivo 12 software was used to store data and facilitate this process. First, I immersed myself in the transcripts and generated initial semantic codes. These codes were then organised into candidate themes, which were reviewed against the coded data extracts and then against the entire dataset. These were then refined and combined into three main themes and three subthemes, which were named at this point.

The second analysis phase involved deductively coding the entire data set for policy implementation conditions that may have supported or hindered the partnership's efforts to translate national policy into local actions. This was done with reference to literatures on implementation and physical activity policy (Gornitzka *et al.*, 2005; Horodyska *et al.*, 2015; Matland, 1995; Sabatier and Mazmanian, 1979; Salvesen *et al.*, 2008). Once coded, each data extract was further categorised by sentiment (*i.e.* positive, negative or neutral). This approach incorporated a scientific lens, alongside the practical knowledge already gleaned, to help inform recommendations for the partnership about their policy implementation environment, and identify areas of good practice and opportunities for change.

5.3 Findings

Five partnership committee members participated in interviews. Table 5 displays their characteristics.

Table 5. Participant characteristics (n = 5)

Participant ID	Age (years)	Sex	Ethnicity	Time in current role (months)
1	49	Female	White British	13
2	70	Female	White British	48
3	34	Male	Mixed (White/Black Caribbean)	60
4	-	-	-	-
5	58	Male	White British	30

Participants had the opportunity to withhold personal information. Despite two follow-up emails, Participant 4 did not provide their details. While small, the sample had a variety of participants by age, sex, time in current role and job sector. Participants were drawn from the local authority, Public Health, and sport and physical activity development sectors.

5.3.1 Part 1: Leadership in local physical activity systems

The analysis process resulted in the development of three overarching themes and three subthemes. The main themes were termed *creating connections*, *producing and responding to change,* and *driving the vision* (see Figure 3). Each is discussed in turn below.

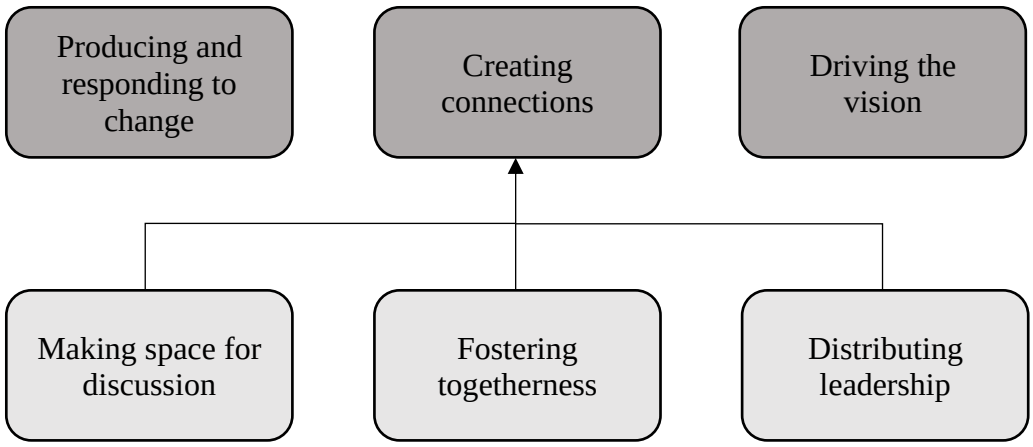


Figure 3. Final thematic map, showing three main themes and three subthemes.

5.3.1.1 Creating connections

Perhaps unsurprisingly given the partnership setting, participants emphasised the perceived importance of creating and utilising *connections* to lead the local physical activity system. This encompassed the bringing together of people, ideas, policies and programmes, and the subsequent distribution of leadership, consensus and learning. The connections were based on *'understanding the wider element of the system and how that all works together'* ***[P4]*** and being able to provide oversight for the range of agents who are active within it. Typifying most participants' views, Participant 2 commented:

> Leadership is about being able to have a wider perspective than the people you are dealing with, to be able to bring the things together that you can link, to make something better and more meaningful […] to me that's where the big value is, and there's quite a few people I know that can do that, who will make connections, really worthwhile connections […] I think it's about being able to have oversight.

Within this theme, which suggests the importance of the breadth of perspectives, the three subthemes of *making space for discussion, distributing leadership,* and *fostering togetherness* provide insight into what participants thought effective local leadership may look like, how it may be developed, and how the implementation of national physical activity policies may be enhanced in local systems.

5.3.1.1.1 Making space for discussion

A perceived key element of system leadership was creating space for the exchange of ideas and talking about physical activity in order to reach decisions about how local partners should act. The formal structures of the partnership acted as a *'forum to which information can be shared and given'* ***[P1].*** Leischow *et al.* (2008) have highlighted the importance of such structures for the integrated exchange of

information and knowledge, both explicit and tacit, in Public Health systems. Participants particularly appreciated the opportunity to have conversations with individuals and organisations beyond the traditional sport and physical activity sector:

> This group was the first time really it had some of the other partners who could benefit from the outcomes of sport and physical activity, but maybe weren't interested in the provision of sport and physical activity **[Participant 3]**.

It was considered to be *'very unusual to get different organisations round the table talking about physical activity **[P2]**.'*

Given the breadth of involvement among agents from different sectors, clear communication was critical for ensuring everyone understood local systems, priorities and actions. However, some participants perceived this to be *'one of the challenges of this [whole systems] approach **[P5]**,'* whereby it requires *'a differentiated approach, differentiated messaging and clear language, 'cause* [sic] *not everybody involved in the system is a professional **[P5]**.'* Participant 4 explained how *'people weren't aware of what the culture, sport and tourism offer already was.'* The importance of democratic communication for leadership in this context was summed up by Participant 1:

> One of the leadership qualities that would happen from this transition is identifying what those communication routes are, but also testing whether or not the people who are represented are actually feeling represented, and they're receiving a two-way communication.

Discussion was also viewed as important for the communication of national policy messages, which could then be contextualised and disseminated among stakeholders. In terms of national policies where this had been helpful, Participant 3 provided the example of *'how we can educate people on the messages around the Chief Medical Officer guidance',* which Participant 2 felt was '*not always as clear as*

it could be.' The space to discuss and debate such national policies was thought to be a key first step to local implementation. The following examples echo previously researched dissemination and communication strategies (Grimshaw *et al.*, 2012; Weiss *et al.*, 2016):

> I was developing, with Public Health colleagues, a workshop that we were going to take to the new committee that was around: what was the latest policy guidance? What were the national policies? What were the national priorities? What were the local priorities? **[Participant 4]**.

> We did have a lot of discussions when we were putting the framework together about what measure can we have in place in order to show that we are implementing this policy **[Participant 2]**.

In sum, creating space for and allowing discussion was considered to be key to receiving policy and approaching its implementation, as well as a feature of effective systems leadership. It enabled partners to bring *'all those non-leisure characteristics to look at leisure and creative opportunities **[P4]**.'* Furthermore, it ensured partners can offer *'a totally different perspective on things […] have somebody to ask the daft questions, who could challenge without having an ulterior motive **[P2]**.'* This may be important if agents in local health promotion systems are to bring about effective changes to policy, practice and population health outcomes.

5.3.1.1.2 Distributing leadership

Distributed leadership is a well-established notion in systems-thinking (Lichtenstein *et al.*, 2006). However, Participant 5 suggested that, in their experience, promoting this view in relation to physical activity has not necessarily been straightforward:

> One of the things we've tried to engender is that leadership is distributed across the system because it is not really possible, generally I would say, for key individuals to have a whole systematic impact […] and that can be particularly difficult, I guess if you're working in a quite hierarchical organisation, if the way you see yourself is not as a leader.

This approach might have been predicted by the physical activity partnership literature. Leaders cannot cover all aspects of wide-scale physical activity promotion alone (Matsudo, 2012). It was evident in this data set that a key leadership quality was to be able to overcome these barriers and support the distribution of leadership more widely. Participants suggested various ways in which this might be achieved.

A first key strategy for distributing leadership was to provide clear roles for partners and stakeholders, ensuring accountability, and where relevant, supporting implementation:

> It's something where new guidance would come out and the discussion would be how does that impact on all the partners, and how do they see their role, and it's about taking a systems-wide approach, rather than getting new guidance and scurrying away **[Participant 4]**.

> I think that it's just the fact that we've all bought into the same priorities and agree the same targets for the county as a whole, then underneath that it's identifying the roles and responsibility of who's going to be accountable for delivering those [**Participant 1]**.

In the quote above, a systems-wide approach is used to refer to one that involves all, or at least as many as possible, partners within the system.

A second strategy involved *'supporting, encouraging and explaining that actually the way people operate and what they do, they are actually being leaders in the system **[P5]**.'* The appointment of an independent partnership chair helped demonstrate that no one party was in charge. Accepting that all those promoting physical activity are integral in leading the system aids the distribution of leadership because *'[leadership] just happens, the understanding of how you do it evolves over time **[P2]**.' 'People could see how they were advocating and influencing, and mirror those behaviours. It [the partnership] was a strong group trying to make a difference*

***[P5]**.'* This suggests the possibility of leadership being socially learned (Decker, 1986).

5.3.1.1.3 Fostering togetherness

The final subtheme encapsulates perceptions among participants that systems work more effectively when people are brought together in meaningful relationships with shared goals, allowing partnerships to better address local needs and ensure that support is felt among local communities.

Initially the partnership worked because *'people could see the need for a group, some sort of entity, and that's why it was successful in bringing people together **[P1]**.'* By *'broadening the scope of those who are involved in the local landscape **[P5]**'*, it has resulted in more effective leadership. The *'much closer relationship with Public Health **[P3]**'* has resulted in *'quite a significant community-based programme in terms of sport and physical activity **[P3]**.'*

Participant 1 held the view that for county residents *'it doesn't matter who is delivering. They just need to know they've got someone who responds to their needs.'* Yet Participant 3 suggested that this was something the partnership had not always got right:

> There wasn't for me enough focus on that [*i.e.* community needs] and I think equally what needs to happen going forward is, there needs to be priorities to be agreed and an acceptance that we can't do everything for everyone at the same time, so we either need to focus our priorities or have a longer-term plan that addresses the different priorities but over a period of time, so that we can really focus on what's really important to [the county].

Possibly, facilitating a sense of togetherness *'means people need to be prepared to compromise, give a little and realise that you won't always get everything that you want out of a relationship **[P5]**.'* It may be necessary to align policies and practices, as well as to *'manage different agendas [...] if we've agreed to*

a process, it's sticking to that […] we can't go off-piste otherwise we break that route into creating stronger leadership ***[P1]****.'* Furthermore, it may be possible to use policy tools such as frameworks and *'have some robust data to back things up, because that's where we need things to come nationally saying that is the benefit of being active, rather than us just lobby it locally* ***[P3]****.'* It may be possible, therefore, that national policy has a role in convincing local domains to act on physical activity.

A final strategy to promote togetherness and support local communities was to work within, not against, existing structures and provision:

> One of the things I was very keen to do with that was to maintain those networks, and to really have strong partnership links, and really try as hard as possible. And this is a little bit about how I was trying to build the team in the first place, and the structure of how we were going to do it was to link in as much as possible with existing partners and existing organisations **[Participant 4]**.

While this suggests that it may not always be necessary to create new opportunities for physical activity promotion, participants all expressed the need to do things differently. Notions of change are evident throughout the *creating connections* theme.

5.3.1.2 Addressing change

There has been little improvement in the prevalence of adults meeting aerobic physical activity guidelines in England between 2012 (67% men, 58% women) and 2019 (65% men, 61% women) (British Heart Foundation, 2015; Sport England, 2020a), the latter year being the most recent dataset at the time of this study[4]. There was a consensus among participants that *'our approach had been effective in engaging those who were already active […] but hadn't really enabled at a large*

[4] Latest figures show a decline between 2019 and 2021, whereby 62% of men and 60% of women currently meet the recommended aerobic activity levels (Sport England, 2021a).

*scale, on a consistent basis, to get the inactive active **[P5]**.'* In terms of implementing policy, participants' experiences suggested the need to identify which elements of the system are currently ineffective and in need of reconsideration. At times, largely due to capacity, the partnership *'weren't in the position **[P1]**'* to translate policy into local action, but *'the mechanism is in place now so we can address that process **[P1]**.'* Consequently, the ability to approach and support ideas of change in local systems and ways of working in them, in response to enduring physical activity trends, and new policies and local expectations, was considered to be key to effective leadership.

Although perhaps prompted by ongoing developments in local organisational structures, participants felt that *'it can't carry on the way it has **[P3]**'* and cited examples of changes that they had experienced. In particular, these related to the partnership's members and its links with local health and wellbeing systems:

> Public Health probably were in the same boat about the [partnership committee], where it wasn't serving a purpose for them. So, I've worked closely with them to identify what would work, they've been one of the biggest supporters, but also one of the catalysts of the change because the [new] committee will then be accountable to the Health and Wellbeing Board […] Those agendas will be informed by local work, but the partnership will [also] support the delivery of the local work against all of those common priorities **[Participant 4]**.

More broadly, Participant 5 acknowledged that their organisation *'didn't work as we might have done with a range of partners with whom we're now trying to work with. We're trying to at least increase the scope of how we view the local physical activity system.'* However, enacting systems-thinking remains a challenge:

> Do I think the physical activity sector tends to think of itself in isolation and not part of the system? I do think that a lot of the time there is a lot of thought, time and resource put into structured physical activity, when there is a great need particularly in terms of people in relation to inequalities, we need to be very mindful of the wider system and the unstructured offer, and how that can either help or hinder **[Participant 4]**.

> I guess similar, as in all things, systems working is the same […] for quite a number of people and organisations, systems-thinking is new, and ideas like distributed leadership are not terms they're familiar with. It's helping people to understand the benefit of operating in that way […] but again [what] that requires often is change. It's helping people see the changes that will actually be possible for them, their organisation, and the people they work with and for **[Participant 5]**.
>
> Operating in a whole systems way really requires potentially a lot of compromise, a little bit of letting go and that can be difficult […] what this work requires is change, and that can be difficult for some people and threatening for others **[Participant 5]**.

One participant believed that change is something that '*takes time to put into place and people to get used to **[P1]**.'* Indeed, they cautioned, '*There's a massive amount of change and when you don't have opportunity to embed it, then there's always a danger it could slide back **[P1]**.'* Leadership was perceived to be strong when agents actively addressed change and embraced its difficulties. Participant 5 offered the following thoughts '*about change in a partnership context,'* in particular the need to have a common reference point from which to depart on a journey of change:

> Often, organisations who are working together have the same vision about whatever it is. In this sense it might be sport and physical activity […] But often again that isn't the case. So, I think there's sometimes assumptions about there being a common vision and a common value for being active, when actually there isn't.

5.3.1.3 Driving the vision

Participants were looking to leaders to drive the partnership's agreed vision through the local system. Typifying a collective view that the partnership had not been as effective as it may be in this regard, Participant 1 explained:

> So, while it was always good to see people around the table, there wasn't any strategic direction or decisions being made.

Participant 3 went further to explain how this situation *'could arguably have led to some partners struggling to see how the group [partnership] was relevant to them.'* By overcoming the fact that they *'didn't get the decision-maker **[P2]**'* from certain parts of the system around the table, a more strategic approach was thought to enable discussion *'about the right agenda, and looking at how things can be mapped at a system-level, rather than at an individual organisational-level or an individual sector-level even **[P4]**.'* Participant 4 went on to explain that in their opinion, *'If people don't prioritise a meeting and send somebody else […] it dilutes the strategic element […] what you end up with is a network, not a strategic partnership.*'

However, it is not necessarily just enough to ensure identified strategic decision-makers are involved in partnership work, but also *'it's empowering those around them to recognise what it looks like as well **[P1]**,'* ensuring stakeholders are able to execute difficult and necessary decisions:

> Well, I think effective leadership firstly would be, like I say, providing or facilitating the process of getting a really clear strategy of what we want to achieve, and for me it's being brave in terms of decisions about what we're going to focus on and what we're not going to focus on, because I just think we try to please everyone quite often and we really would make a lot more progress and accelerate impact if we had more focus. So, that whole decision-making, what we should do and shouldn't do, making those decisions **[Participant 3]**.

> It was quite reactive and organic in how it's grown, and it's all been really useful but there was nothing really saying where do we want to be in five years-time and what needs to change in terms of the system and things for us to get there **[Participant 3]**.

Through their discussion, participants intimated that they felt *'there's been a lot of reactionary leadership **[P1]**'* and an effective leadership quality was the ability to *'lead by example **[P3]**,'* be able to pre-empt the policies and programmes that will be needed to make a difference, and provide *'some proactive involvement and investment from different partners **[P3]**:'*

> And I think there's a lot of reactionary leadership that happens in that way because whether it's a programme comes out or a government policy comes out, or something, people tend to react. And I think what would be better for the county is to bring that into the [new] committee or whatever, wherever it happens, where does that get communicated and transcended down into all the networks **[Participant 1].**

> I think one thing that, as and when things come down [from government], we're always proactive in looking how our work aligns to that. And equally, how we're influencing those policies as they're being developed **[Participant 3].**

Informal organisation of the partnership was thought by one participant to allow them to *'cut through the bureaucracy and get things done **[P2]**.'* There is however a slight contradiction between this proactivity, and ideas of distributed leadership and togetherness. A careful balance may be necessary to ensure a collective endeavour in systematically sharing national policy messages throughout the system and that everything is aligned to local priorities and policies.

5.3.2 Part 2: Implementation conditions

Table 6 displays the implementation conditions that were discussed, both directly and indirectly, by participants during the interviews. It is important to note that these reflect the participants' experiences and perceptions of the partnership environment at a single point in time. Overall, there were 34 different conditions present in the data set, which are closely linked with the realist notion of context (*i.e.* the values, structures, systems and rules that constrain or support implementation efforts (Pawson and Tilley, 1997)). The sentiment with which these conditions were discussed was varied.

Table 6. Implementation conditions – expressed sentiment among participants

		Sentiment		
Condition	Count	Positive	Neutral	Negative
Account for existing policies and aims	4	1	2	1
Advocate PA and motivate change	8	5	3	0
Build capacity to secure maintenance	3	1	2	0
Building relationships	5	2	0	3
Characteristics of implementing agencies	12	5	2	5
Commitment from leadership networks	6	0	3	3
Create networks	6	1	5	0
Cross-sectorial collaboration	9	5	3	1
Culture-sensitive	4	2	2	0
Data to identify goals, stimulate change and support leadership roles	2	2	0	0
Dealing with conflict	10	3	2	5
Disposition of implementers – motivation and attitudes	8	6	1	1
Effective leadership to secure collaboration	8	5	0	3
Evaluating and solving time-related issues	2	0	1	1
Feasibility of implementation and acceptability of implementation among providers, stakeholders and participants	4	3	0	1
Fidelity of the programme	1	0	0	1
Identify roles and responsibilities	7	1	3	3
Implementers' skills, knowledge and competence	3	0	1	2
Increasing accessibility to environmental structures	1	0	1	0
Institutional mechanisms for coordination	2	1	0	1
Involvement of multiple stakeholders at multiple levels	10	7	1	2
Key political and stakeholders' support for implementation	7	5	2	0
Local authority involvement	16	8	4	4
Methods to increase communication	11	5	5	1
National government issued programmes	5	4	0	1
Plans for implementation	3	1	0	2
Policy decisions have unambiguous policy directives	3	1	1	1
Policy standards and objectives	1	0	1	0
Potential adaptations to enhance fit with community contexts	15	2	12	1
Review to fill gaps and align new projects with the master plan	1	0	1	0
Secure funding and resources	17	5	9	3
Securing involvement of local community	4	1	2	1
Synergy with existing or operating programmes	18	4	12	2

The most prominent conditions were created by the structure of the partnership and by making *connections*. For example, through the *involvement of stakeholders at multiple levels* and *local authority involvement*. In particular, the embedded presence of national agencies in the local partnership were considered to be a useful conduit for policy messages to be communicated from government:

> One of the positives for [the partnership] is they are directly connected to Sport England and key messages that come down, and I think that's the value that they bring to the county **[Participant 1]**.

> So, if we think about linking to the policies, the national policies, I think it was really helpful to have Sport England there, which we did right from the beginning. I mean *[anonymised]* were really helpful **[Participant 2]**.

Bringing people together is one of the *methods to increase communication* employed by the partnership, as well as to identify *synergy with existing or operating programmes* that potentially *fit with community contexts.* These factors are illustrated by the following examples:

> My personal opinion is that we should be translating these government policies because that is where you get the resonance, and that's where it opens up lines of funding or things like that, because if you start your own campaign and it's nothing to do with what Government or any national policy is then, it becomes a one off, but if you go on the back of some of the campaigns that are out there now, particularly with the #stayhomestayactive, that sort of thing, then you've got your economies of scale and you can use that as your leverage for the local area **[Participant 1]**.

> I think there's a growing recognition that one size doesn't fit all, and prescriptive policy and or strategy coming down from a central place to apply everywhere often is problematic. It needs to be framed in a way where there's space to take account of context **[Participant 5]**.

Furthermore, the ability to *secure funding and resources* was a commonly discussed condition. Developments in the local landscape may afford the *'opportunity to pool resources so that we make better use of those, and it becomes stronger. There will also be opportunity to apply for joint funding **[P1]**.'*

Participants also perceived the *characteristics of implementing agencies* to be a key consideration. While *local authority involvement* was generally cited as positive and supportive, it *'is obviously a huge organisation and sometimes it's difficult to work alongside a big organisation like that **[P1]**.'* Conversely, Participant 5 also remarked:

> Often there's some very small [organisations] and working in a voluntary capacity. Not that they can't grasp these things [whole systems], of course they can, but they're less familiar with them, and the resources they have at their disposal are a lot smaller. The system is lots of organisations of very many different sizes, backgrounds, interests and make-ups.

The *disposition of implementers* (*i.e.* motivation and attitude) was one condition framed more positively by some participants:

> I think the partnership have bought into the Government policy straight away, I mean obviously the CMO guidelines on the recommended activity levels, but also the Government sport strategy as a key turning point for active partnerships because, you know, it just a purpose to everything that was being delivered **[Participant 1]**.

This positive disposition relates to the extent that partners *advocate physical activity and motivate change* in their local domain:

> It's a place where being active, and particularly sport as being part of that, has always been very important. It's been well supported, even though sport and leisure (or however we want to define it) is not a statutory service. It's always been very well supported through the council, and they've been a strong advocate for that **[Participant 5]**.

More negative aspects discussed by participants pertained to the *commitment from leadership networks*, the ability of the partnership to effectively *deal with conflict*, and to date, an inability to *identify roles and responsibilities* for implementation stakeholders. Examples are highlighted in the discussion of key themes above. Participant 5 suggested that in their experience honesty was necessary to overcome such issues:

> Essentially you need to have open honest conversations about what you're trying to achieve and how […] But as long as there's enough benefit in it for you, the organisation and the people you work for, then I think there's a route to move forwards. And that's really just open honest discussion.

To this end, it is evident that the key leadership qualities detailed above are integral to enhancing the implementation of national policy in local places. By creating connections which allow discussion, togetherness and distribution, as well as addressing change and driving the vision, this helps create supportive implementation conditions.

5.4 Discussion

This study was designed to extend upon the findings of study one, in which UK national physical activity policy-makers were interviewed about their experiences of policy-making and complexity. In particular, it addressed a gap in the literature by exploring the relationship between physical activity policy implementation and leadership, as well as how these concepts are enabled in ways that support change in local systems. The findings presented within this novel setting typically reflect previous research on policy implementation, systems leadership and partnership working. However, the data give rise to several critical questions, which are discussed here in relation to practical examples and theory. To aid the reader, each key thematic area is discussed in turn. However, it is important to note that these are necessarily interrelated.

5.4.1 Creating connections

Collaboration is considered essential for systemic change in physical activity promotion (Milton *et al.*, 2021; Public Health England, 2014a). Given the partnership setting, the theme that illustrates leadership as *creating connections* was somewhat

unsurprising. The participants' experiences support previous work that has shown numerous perceived benefits of bringing people, skills and experiences together to address the complexities of physical inactivity (Matsudo, 2012; Parent and Harvey, 2009; Rigby *et al.*, 2020b; Stott, 2018; Weiss *et al.*, 2002). These include enhanced focus, commitment, cooperation and cross-boundary function.

However, partnership working and collaboration has been central to government policy since New Labour (Wang, 2011). Arguably, whole-system approaches as they are currently conceived are little different. Researchers have questioned the extent to which the perceived benefits of collaboration result in meaningful public health impact (Perkins *et al.*, 2010). Yet the rhetoric around collaboration and whole-systems approaches suggests a panacea effect (Piggin, 2019; Rowe, 2006). This study further highlights the need to move beyond rhetoric to create an understanding of how systems-based approaches founded on complexity theories may work. That there are consistent perceived benefits suggests one of two things. Either these perceptions are genuinely misguided (*i.e.* complex systems approaches are not the solution to inactivity), or alternatively, efforts to evaluate these approaches are perhaps insensitive to their complexity, or are focused on the wrong outcomes (*e.g.* population health outcomes over changes in culture, disposition or awareness).

5.4.1.1 Making space for discussion

Enabling *discussion* was believed by participants to be a second key feature of system leadership, and they raised concerns about local restructuring within the partnership and the constraining effect that this may have on the voices that need to be heard the most. The current findings are mostly consistent with Lindsey (2014),

demonstrating that the collaborative environment may significantly impact which voices can be raised, and the emphasis on information-sharing, learning and bottom-up implementation is indicative of an increased emphasis on localism and decentralisation. However, the current study differed through participants' desire to create a more strategic partnership. Lindsey's (2014) case study suggested that this may not be possible if the collaborative flexibility and fluidity are to be maintained. This needs to be explored further to determine how, if at all, both aspects are compatible.

Participants also recognised the need to create space to discuss and debate national policy in relation to the local context. This is thought to support implementation (Horodyska *et al.*, 2015; Rigby *et al.*, 2020b). Partnerships may benefit from creating a 'brave space,' in which controversy, debate and open communication are encouraged (Shapiro, 2017; Stott, 2018).

5.4.1.2 Distributing leadership

The current data, along with study one, challenge the appropriateness of complex systems leadership models as applied to physical activity promotion. While the notion of distributed leadership was thought by participants to be important, as per previous research including study one (Bengoa, 2013; Lichtenstein and Plowman, 2009), there remained recognition of, and appetite for, specific leaders whose role it is to oversee, galvanise and shape the direction of the system. Consequently, this partially contrasted Lichtenstein *et al.*'s (2006) assertion that collective system-level leadership is the overriding feature. There is a need to explore the role of individual leaders in more depth, and how they complement or contradict existing notions of system leadership.

While distributed leadership is a desirable system end-state, the current findings suggested that the *act* of distributing is in fact the key leadership quality. In accordance with previous literature from psychology and governance studies (Douglas *et al.*, 2003; McDonald, 2005; Onyx and Leonard, 2011; Parent and Harvey, 2009; Weiss *et al.*, 2002), participants articulated numerous processes through which distribution may occur. These included setting clear roles and responsibilities and empowerment, as well as harnessing the broader leadership qualities discussed in this paper. While the King's Fund (2015) argued that their remained uncertainty as to whether or not system leadership can be developed through teaching or experience, the current findings suggested that system leadership may arise with experience in an emergent fashion (Onyx and Leonard, 2011), and that perhaps certain structures of leadership are more actively constructed.

5.4.1.3 Fostering togetherness

The perceived leadership quality of *fostering togetherness* in the current study supports earlier research that synergy and aligned priorities are central tenets in collaborative work in sport and physical activity development (Parent and Harvey, 2009; Robson and Partington, 2013). This subtheme relates to both discussion and distribution, as giving voice and identity are recognised strategies to foster leadership. A further possible mechanism suggested by participants was the use of policy tools (*e.g.* collaborative goals) and frameworks to mandate collective efforts. This reflects the views of participants in study one, as well as published research (Matsudo, 2012).

Participants also discussed their experiences of *togetherness* in terms of relationships. Applying self-determination theory (Deci *et al.*, 2017), it is evident

how the mechanisms and leadership qualities discussed here may create a sense of relatedness and competence. However, it is unclear how autonomy is supported and indeed participants suggested that people and organisations doing their own thing was potentially detrimental to partners and the wider system. In the present context, it may be that some of the approaches identified above foster autonomous pursuit of collective goals. With the increased emphasis on collective action, shared goals and inseparable interconnections between system agents, it may be pertinent to explore the effect this has on the ability to display and stand behind one's initiative, react to windows of opportunity and create change.

5.4.2 Addressing change

This study supports research that has shown leadership to be an important aspect of system change (Onyx and Leonard, 2011). However, it raises questions about the extent to which systems are understood among local stakeholders and the suitability of the environment to support change. Participants unanimously recognised the need for change, but accepted it is often difficult to understand and effect, as demonstrated in other domains (Fullan, 2007).

System change requires stable leadership and a favourable policy environment (Bengoa, 2013; King's Fund, 2015). However, participants discussed service cuts, regular changes to the leadership committee, and a restructuring of the local landscape. This reflected an ongoing challenge in physical activity promotion, whereby stakeholders fluctuate due to the decommissioning of Public Health services and increased policy involvement of non-traditional sectors (McKinnon *et al.*, 2011).

Furthermore, participants cited further difficulties in encouraging systems-thinking and sought greater awareness of how systems operate. This reflects findings

from study one, which question the extent to which these concepts are appropriately applied. The current rhetoric from government and other national agencies around whole-systems is based on long-established notions of collaboration (Wang, 2011) and socioecological models (Kay, 2016; Sport England, date unknown). There is insufficient attention paid to complexity theories, and the data suggest that agents may benefit from education (whether that be formal or informal) about these, and how they may be put into practice.

5.4.3 Driving the vision

The perceived need among participants for leadership to drive the strategic vision throughout the system is most consistent with Boal and Schultz (2007). These authors argued that self-organisation should not preclude the development of strategic leadership, which is important for navigating complexity, shaping agent interactions, and aiding learning and adaptation. However, the current study also places a greater emphasis on proactivity and decision-making, which may be supported by vision, energy and motivation (Bengoa, 2013; Onyx and Leonard, 2011; Samimi *et al.*, 2020).

While ensuring a strategic and cultural fit is necessary for effective collaboration (Parent and Harvey, 2009), the increased emphasis placed on strategy by participants may be influenced by external factors rather than driven by an intrinsic desire for system improvement. Lindsey (2014) argued that flexibility and fluidity may be desired and necessitated amid decentralisation and austerity. However, in the current climate described by my participants as one with a more rigid local leadership structure, heightened need for accountability amid continued

economic constraints, and the societal impact of the SARS-Cov-2 pandemic, these constructs may be less likely to materialise.

5.4.4 Implementation conditions

Analysis of the current case identified numerous conditions that may support more effective policy implementation, which had previously been reported (Gornitzka *et al.*, 2005; Horodyska *et al.*, 2015; Matland, 1995; Sabatier and Mazmanian, 1979; Salvesen *et al.*, 2008). The frequency with which any given condition was referred to by participants is likely to reflect, at least in part, the context of the current research setting. Nevertheless, this study contributes to knowledge about the implementation of physical activity policy in several ways. First, it may be prudent to consider leadership as conceptualised in this study (*i.e.* in all its guises) as an implementation condition in itself. In a review of implementation conditions for policies and interventions aimed at physical activity and sedentary behaviour change, leadership was considered important *'to secure collaboration between facilitators, institutions and organisations* (Horodyska *et al.*, 2015, p.9)*.'* However, my study provided a more detailed understanding of leadership's form and function. It is about more than bringing stakeholders to the table. It is about the processes of ensuring values and practices percolate across the system, and understanding how these processes occur.

Considered together, the most prominent conditions cited by participants (*i.e. involvement of stakeholders at multiple levels*; *local authority involvement*; *synergy with existing or operating programmes;* and *secure funding and resources*) indicated the value of collaboration and lateral networks, which balance top-down and bottom-up approaches. A broad coalition of agents, with a positive disposition, has been

shown to help alleviate barriers to implementation of physical activity policy (Barnidge *et al.*, 2013; Cerna, 2013). The nodal effect (Hood and Margetts, 2007) of the partnership committee has been crucial for the collection and dissemination of policy-related information. Furthermore, Matland (1995) argued that in implementing policy to address intractable issues, such as physical inactivity, effectiveness relies on the strength of coalition between those agents who control the power and resources. While participants in this study acknowledged the importance of resources, it may now be necessary to consider the strength of coalition in broader terms, for example the strength of discussion, distribution and togetherness, as well as to the distribution of power in physical activity policy systems. This may become increasingly necessary in relation to the SARS-Cov-2 pandemic and its economic impact.

Despite the evidently positive effect of collaboration, through participants' experiences, this study raised issues about organisation (Hood and Margetts, 2007) and how broad networks and strong coalitions are mobilised. Currently, there is an apparent tension between the desirable features of collaboration and the potentially detrimental implementation barriers that existing collaborative practice may generate.

Parent and Harvey (2009) argued that multiple and flexible instruments are required to create partnership synergy. However, participants cited concerns about an inability to *identify roles and responsibilities*, *commitment from leadership networks*, and an inability to effectively *deal with conflict*. These issues have arisen as a result of creating a collaborative approach to physical inactivity. An inability to address these may be related to insufficient political acumen or capital. In particular, commitment and conflict resolution are key features of political leadership (Gilson,

2016). Instruments such as binding cross-sector targets were suggested by participants in this study and study one, as well as in previous literature (Matsudo, 2012). This requires political decision-making, and is inherently an issue of power. Considering the make-up of the partnership in this study and possibly elsewhere, which has significant voluntary or lay involvement, the capacity of existing structures to effect changes that may mobilise networks and coalitions is perhaps likely to be limited unless such political drivers are mobilised. This warrants further investigation.

The range of implementation conditions in a given local setting is important, but the extent to which they are present in any given context is likely to differ. It is not possible to consider them in isolation, as they intersect with one another and as has been demonstrated in this study, are inextricably tied to notions of system leadership. To translate national policies into local actions with the potential to increase population physical activity, it will be necessary to consider leadership and implementation as integrated, and develop strategies to promote these accordingly. It may be, however, that the positive conditions created through collaboration and leadership may currently be overshadowed by a lack of clarity about how to address the inevitable negative conditions that also materialise (*e.g.* policy conflict, or a lack of role identity).

5.4.5 Strengths and limitations

This study's major strength was that it was the first to provide an in-depth exploration of experiences related to leadership and national physical activity policy implementation in a local setting. In doing so, agents with varied experiences and backgrounds were interviewed. While the generalisability of case-study research is

often challenged, this study has been able extend theoretical understanding in ways that can be tested, and may influence the development of systems-based approaches in other settings.

This study was limited by the small number of stakeholders that could be recruited and therefore other important experiences may be missing. It may be prudent to supplement these data with further research (*e.g.* analysis of stakeholder documents). This partnership offered a unique countywide setting which at the time of study has been undergoing a specific organisational transition, and as such some findings tied to enduring problems that are subsequently solved, may soon be outdated. Nevertheless, other findings will transcend implementation of one policy at a given time. Finally, given the analytical approach taken, the range of implementation conditions that were identified on the basis of existing literatures is unlikely to be exhaustive, and dedicated study to uncover further context and mechanism related conditions is warranted. This points toward the potential for a realist evaluation (Pawson and Tilley, 1997) of particular policy implementation efforts.

5.6 Conclusion

Creating leadership for policy implementation in local health systems remains a challenge. This study has demonstrated how these two concepts are interrelated. However, it has also further reinforced that while notions of systems, leadership and implementation are common among local physical activity promoters, the process of how to create these in practice remains unclear. It may be that this increased emphasis on systems and interconnections is detracting from the value of key individuals in the sector.

Nevertheless, leadership is considered important for driving local visions and creating systemic change. Furthermore, leadership that is founded on the basis of discussion, distribution and togetherness may create conditions for effective policy implementation. Certain barriers still need to be overcome and this may require increased political involvement.

Chapter 6. Advancing complex systems approaches to physical activity policy

This chapter sets out the final empirical study of my doctoral research, which was conceived, developed and conducted in 2020 and 2021, as an alternative to my intended action-orientated research project that was curtailed by the SARS-Cov-2 pandemic. Building on my previous studies, I engaged expert stakeholders through an online workshop, to explore how complexity theories and systems-thinking can be mobilised in relation to physical activity policy. Specifically, I emphasise ways in which these perspectives may be useful, to whom, and in what circumstances.

The chapter begins by highlighting knowledge gaps and areas for further investigation arising from my previous studies, namely the translation of complexity theories and systems-thinking concepts into practical applications, how these concepts align with existing policy practices, and whether these approaches can be suitably embedded to support policy implementation. The methods section details the specifics of the workshop, and how I incorporated realist principles in a thematic analysis of the data. The analyses led to the development of four propositions that may advance the use and usefulness of complex systems approaches to physical activity, by reorientating the common deterministic and structural focus of complexity, to one that more concerns the agency of individuals working in this domain.

6.1 Background

As detailed in the introductory chapters of this thesis, complex systems approaches to public health issues, which emphasise the multiple interacting factors that influence health outcomes in non-linear causal patterns (Friel *et al.*, 2017), have become increasingly prevalent, including in physical activity promotion (Friel *et al.*,

2017; Rutter *et al.*, 2019; Sport England, 2021d), throughout the duration of my doctoral studies. To date, research has typically focused on advocating the complexity frame of reference (Rutter *et al.*, 2019; Speake *et al.*, 2016; World Health Organization, 2018), or describing the state of systems by mapping the multiple interacting structures and determinants of physical activity (Cavill *et al.*, 2020; Nau *et al.*, 2019; Rutter *et al.*, 2019). However, there has been little critical examination of their application (Piggin, 2019), especially in physical activity policy settings. The potential implications of this are severalfold. For example, the rapid expansion of these approaches may be at the expense of alternative useful perspectives (Piggin, 2019). Moreover, the importance of agency is like to have been obscured. There is little known about how people who act in the physical activity policy space respond to and optimally (or otherwise) implement these approaches to effect system change.

The research set out in my thesis has been, to my knowledge, among the first to address the predominant emphasis on deterministic structures over agency in the application of complexity theories to policy studies (Cairney, 2012a; Sniehotta *et al.*, 2017), in a physical activity context. In this context, structure refers to both the arrangement of a system's components and its material conditions that shape or are shaped by people's actions. Agency is the capacity for action, which may perpetuate or transform the material conditions or arrangement of components in a system. Through a careful exposition of complexity theories and systems-thinking, I have explored how people make sense of complexity and systems, and how in turn these understandings influence multiple actions, practices and behaviours that facilitate or inhibit efforts to effect system change through physical activity policy. Here I briefly recap key findings of my previous research in light of emerging evidence during the

period of my doctoral study, and pose outstanding questions that I address in the current chapter.

Reflecting previous reports (Bellew *et al.*, 2020; Cairney, 2012a; World Health Organization, 2018), but advancing understanding in the UK context, I found that among two groups of national-level policy-makers and local partnership stakeholders respectively, complexity theories and systems-based approaches remain contested notions. Additionally, my findings further emphasised the importance of strong system leadership and cross-cutting governance in contributing to active societies (Nau *et al.*, 2020). I highlighted practical agency-focused features of these constructs for working amid complexity (*e.g.* discussion, distribution and togetherness) that can support the development of contextualised physical activity solutions, and crucially foster conditions for more effective physical activity policy implementation (Rigby *et al.*, 2020b). My findings also alluded to a third construct that is central to developing complex systems approaches to inactivity (*i.e.* knowledge mobilisation) (Haynes *et al.*, 2020; Nau *et al.*, 2020). This has not, as yet, been explored in detail in this thesis.

Knowledge mobilisation *'is the activation of available knowledge within a given context. Within this are notions of recognition, movement, active use and context specificity of knowledge'* (Langley *et al.*, 2018). In the context of the current study therefore, knowledge mobilisation processes shape people's ability to learn about, communicate and embed new perspectives about physical activity promotion in practice and across systems (Nau *et al.*, 2020). This is particularly important regarding complexity theories and systems-thinking as they derive from numerous scientific disciplines (Cairney, 2012a; Gerrits, 2012). My research has proposed possible mechanisms by which complex systems perspectives may propagate in the

physical activity policy context, including the apparent appetite for the assimilation of scientific, political and practical implementation knowledge to address the complexities of inactivity and understand how policy action intersects with localised delivery systems. However, further exploration is warranted in light of three key research gaps.

First, complexity theories have largely been developed by and for academics, and are not easily translated into real world applications (Cairney, 2015; Holmes *et al.*, 2017). Despite the proliferation of ideas associated with complexity and systems-thinking, there remains a potential discord between their meaning and application in academia, and that demonstrated in practice by agents in the physical activity policy domain. For example, so-called conceptual purity may be a factor in this. This is the belief that concepts of complexity theories, which were derived in the natural sciences, should not be applied to, or developed through, explanations of social systems (Gerrits, 2012; Tosey, 2002). While the contextual and emergent nature of complex phenomena are experienced differently by individuals (Cairney, 2012a; Cilliers, 1998), inconsistencies in the understanding or application of these concepts can detrimentally impact how agents perceive and respond to physical activity across different elements of the system. My previous research provided a foundation for developing a common frame of reference for academics, policy-makers and practitioners alike (*e.g.* bringing people together in dialogical learning networks). However, this raises an important second consideration.

It remains unclear how systems approaches to physical activity promotion, as they are currently implemented in practice in the UK, differ from traditional ideas of collaboration, which have been advocated in policy since the turn of the century and the New Labour government (Lindsey, 2014; Wang, 2011). As such, there is need to

support policy-makers, practitioners and other key stakeholders to reflect on their established ways of working, to better understand how and when the introduction of complex systems perspectives adds value or otherwise. This is the basis from which complexity theories can be addressed and mobilised with increased confidence (Cairney, 2015).

Last, it is important to consider policy implementation. Although this is a widely examined and theorised space, both in terms of physical activity (Horodyska *et al.*, 2015; Howie and Stevick, 2014; Lobczowska *et al.*, 2022; Rigby *et al.*, 2020b) and more broadly (Matland, 1995; Nilsen *et al.*, 2013; Sabatier and Mazmanian, 1979), and my previous studies identified certain practices that may lead to more effective local actions, there are continuing problems concerning the relationship between leadership and policy implementation conditions amid complexity. There is still uncertainty as to whether notions of complexity and systems are suitably understood and embedded in the physical activity sector to enable effective evaluation of policy implementation against this backdrop. A number of practical tools have been developed to assist policy stakeholders in this endeavour. For example, systems mapping is increasingly common in physical activity research (Cavill *et al.*, 2020; Guariguata *et al.*, 2021; Murphy *et al.*, 2021; Rutter *et al.*, 2019). While a useful *'first step'* in contextualising systems-thinking (Cavill *et al.*, 2020, p.279), it is unclear whether this, and other similar tools, provide sufficient direction in taking the subsequent steps to catalyse growing knowledge of complexity, and importantly its integration in practical applications in contexts that support the development and implementation of effective physical activity policies (Redman *et al.*, 2015; Riley *et al.*, 2012). These factors warrant further exploration.

Together these knowledge gaps outline difficulties in optimising complex systems approaches in physical activity policy contexts. They indicate a need to initiate a forum to discuss ways in which agents can create, share and use these concepts in ways that complement the day-to-day practices and experiences of policy stakeholders, and to understand who these concepts are most useful for, how and in what circumstances. This is particularly pertinent to consider given the significant disruption of the SARS-Cov-2 pandemic to political, policy and delivery spaces, and especially to collaborative interactions on which complex systems approaches prosper. To address these questions, this research instigated and analysed findings from a translational workshop with key physical activity policy stakeholders, drawing from a realist framework (Wiltshire and Ronkainen, 2021).

6.1.1 Aim

The aim of this study was two-fold. First, to critically reflect on previous research about the understanding and influence of complexity among national and local policy stakeholders, drawing attention to issues of conceptual purity (Gerrits, 2012; Tosey, 2002) and discord between theory and practice. Second, to explore how to optimise the application of complex systems approaches to physical activity policy, by focusing on the actions of mobilisers, in terms of why, what, whose and how knowledge mobilisation occurs (Ward, 2017).

6.2 Methods

6.2.1 Ethics declaration

This study was approved by Durham University Ethics Committee. The participant information sheet and consent form are provided in Appendices 10 and 11, respectively.

6.2.2 Research process

Participants were purposively sampled and recruited via email or social media to reflect broad international stakeholder interest in complex systems and/or policy across academia, policy and practice settings, both within and, importantly, beyond the physical activity context. They had not participated in my previous research. This approach was taken to provide critical reflection on previous findings with a new sample of participants who were also able to offer insight into complexity and policy from various perspectives. Twenty-eight individuals were invited, of which 19 agreed to participate (11 women, 8 men). Table 7 details their disciplinary backgrounds. Additional personal characteristics of participants were not collected as demographic information was not deemed necessary for the intended analyses. Prior to the study, participants received an information sheet, had the opportunity to ask questions, and provided informed consent.

Table 7. Professional and disciplinary background of workshop participants

		Disciplinary expertise			
#	Profession	Physical Activity	Policy	Complexity and systems	Realism
1	Academic	✓	✓	-	✓
2	Academic	✓	✓	-	-
3	Academic	✓	✓	-	-
4	Academic	✓	✓	-	-
5	Academic	✓	✓	-	-
6	Academic	✓	-	✓	✓
7	Academic	✓	-	✓	✓
8	Academic	✓	-	✓	-
9	Academic	✓	-	-	-
10	Academic	-	✓	✓	-
11	Academic	-	✓	✓	-
12	Academic	-	-	✓	-
13	Policy professional	✓	✓	✓	-
14	Policy professional	✓	✓	-	-
15	Policy professional	✓	✓	-	-
16	Policy professional	✓	✓	-	-
17	Practitioner	✓	-	✓	-
18	Practitioner	✓	-	✓	-
19	Practitioner	✓	-	✓	-

A half-day workshop was held using Zoom video conferencing software in March 2021. A week before the event, participants were sent two pre-recorded videos that they could opt to view. One was a brief introduction to physical activity for health and current prevalence data, which was designed for those without a physical activity background. The second presented key findings from my previous research and set out the rationale for the workshop. The workshop itself began with an introductory presentation that explained the conceptual basis of complex systems approaches to policy alongside a summary of my previous research findings. Thereafter, participants considered three core questions in a combination of breakout groups and plenaries:

i. To what extent are previous research findings indicative of the every-day experiences of those working in this domain?
ii. How can changes in systemic cultures and practices be stimulated?
iii. How can knowledge of complexity and systems be mobilised in the physical activity policy domain?

Breakout groups were pre-determined to ensure balanced representation of academic disciplines, and policy and practice stakeholders. Discussions were facilitated by three experienced workshop deliverers (BR, PB and JW) and recorded for transcription. Primary data collection was through the use of Padlet, an online whiteboard platform, to create digital artefacts. Appendix 1 details the content of each Padlet board. This method was supplemented by Zoom chat comments and field notes. Padlets were shared with participants for comment during and after the session.

6.2.3 Analyses

QSR NVivo 12 software was used to store data and manage analyses. Adopting a realist perspective (Wiltshire and Ronkainen, 2021), data were analysed using a pragmatic modification of thematic analysis (Braun and Clarke, 2006) enabling comparisons to previous research and integration across research questions.

Following data immersion and recording of preliminary observations, initial codes were generated across the whole dataset for each core question as follows: i) a deductive framework that consisted of themes identified through my previous studies (see Appendix 12). These codes were collated into potential themes that captured, further consolidated and extended key findings from data across all studies; ii) an inductive approach generated both semantic and latent codes that were organised into

candidate themes; and iii) a second deductive organising framework identified data extracts that provided information about how complexity and systems-thinking can be mobilised, in what circumstances these approaches are useful or not, and to whom (Appendix 12). These codes were collated into candidate themes.

The candidate themes identified across the three research questions were reviewed against the coded data extracts and then against the entire dataset, enabling recurring and salient patterns relevant to all research questions to be identified through systematic comparison and iterative refinement. Note, in the following analyses it was not possible to present participant identifiers alongside quotations, due to a function of anonymity on the Padlet whiteboard.

6.3 Results

Analysis of the workshop discussions resulted in four emergent propositions concerning how to advance complex systems approaches in physical activity policy. Two relate to influencing the environment in which such approaches are applied, while two present considerations for supporting individuals in creating system change. These findings are discussed in relation to key concepts from complexity theories. Note, the term emergent is used here in the literal sense (*i.e.* these are novel propositions intended for further consideration and development), rather than with reference to them having emerged from the data, or to the emergent properties of complex systems.

6.3.1 Emergent proposition 1: The environment is currently non-conducive to complex systems approaches for physical activity policy; it is important to understand why.

The first proposition relates to the context that seemingly constrains efforts to develop complex systems approaches to physical activity policy. Participants' views

and experiences highlighted enduring challenges faced by system agents. As complex systems are often characterised by stability due to social and structural negative feedback loops that reinforce system norms (Byrne, 1998; CECAN, 2018), it may be assumed that it is challenging to mobilise knowledge of complexity or stimulate system change if agents are unaccustomed to such perspectives. This difficulty and feedback manifested in my data, as some participants' experiences meant that they believed these approaches to be onerous, particularly in the current global climate.

> Thinking in different ways and obviously industry and partners all work in [different ways], that's a really hard work thing to do.

> There is a significant momentum or force to hinder any change from happening in the first place. We probably all appreciate that, there's a lot of passionate people who are trying to make change happen, but also a lot of resistance out there, lots of people wanting to return to the way things were in December 2019 [pre-pandemic].

Simplification of the decision-making environment by ignoring negative feedback is a strategy to navigate the difficulty of complex systems (Cairney, 2012a). However, this approach was not evident in my data. Rather, simplification was expressed both in terms of having *'common language on terms, theories, methods and concepts in the physical activity area'* and being *'pragmatic in application and not getting lost in the science that may scare people.'* Claims for a consensual and literal use of terminology to realise the value of complexity theories in policy (Cairney, 2012a) seem at odds to the aims of simplification, where analogy (Anzola *et al.*, 2017) and pragmatism indicate a more selective use of these perspectives.

Participants' reflections on timescales and funding were often presented in tandem during the workshop. The trajectories of complex systems indicate the benefit of adopting longer-term policy approaches that allow for innovations and

patterns in outcomes to arise (Cairney *et al.*, 2019; Snowden and Boone, 2007). However, the short-term targets and budget cycles that still characterise Public Health policy (Evans, 2021; Taylor-Robinson *et al.*, 2008) may preclude effective systems approaches to inactivity. This was demonstrated through many participants' beliefs that complex systems innovation is inhibited by short-termism and budgetary constraints.

> Funders go, "well let's not do something that might be radical and innovative because we know we are not going to get funding next year. Because it's going to fail, we're not going to be able to show that evidence." So, it's having that consistency of not working to government cycles, or allowing funders to say, "right we are going to use this money and it is going to be a long-term thing, we are going to believe in that, and we're not going to judge you next year." But that's tricky because everyone wants payback straight away.

To support the wider uptake of complex systems approaches, it is important to ensure scalable learning from well-funded systems-based programmes, such as Sport England's Local Delivery Pilots, *'is translatable elsewhere if you don't actually have the same level of resource.'*

Calls have been made for a complex systems model of evidence for Public Health (Rutter *et al.*, 2017). It is possible however that agents may be unaware of different types of evidence beyond the traditional linear and hierarchical models to which the sector is accustomed. My data reflect considerable discussion about generating evidence to support the implementation of complex systems approaches. *'There were questions around what are the sources of evidence, [and] how policymakers find those'*, and whether *'we need entirely different ways of thinking about evidence.'* Responses often focused on systems mapping, and the emphasis *'was very much co-production'* orientated (see proposition three). Complexity-

specific methods, such as Qualitative Comparative Analysis or agent-based modelling, were raised in fleeting discussions about evaluation.

> We haven't spoken in depth about evaluation, but systems approaches can create many challenges for evaluation – not a reason not to do it, just need better evaluation approaches to deal with complexity.

Lastly, there was an overwhelming sense of uncertainty about complexity and systems-thinking and how these concepts apply to physical activity policy. This was apparent in the 21 distinct queries raised about these concepts among the 19 participants. Complexity itself is poorly defined and its meaning shifts across people and policy sectors (Cairney, 2012a; Gerrits, 2012). Therefore, people tend to be sceptical of, or misapply, these concepts. Uncertainty was observed in the data through participants' difficulty in differentiating between systems-based and other perspectives, and how to advance these perspectives meaningfully in the prevailing policy context.

> To what extent does adopting complexity or systems-thinking look different to historical approaches to partnership working, community development, *etc*.?

> Using a bicycle initiative, adapting it, having to learn from it. I was trying to think, well, we can put a complexity language on this, but does it really need it?

> I don't know what stops the sector from understanding the value of a complex systems point of view, and what it enables us to have in terms of solutions.

> There's maybe a need to be realistic in recognising that the centralised mode of government and (associated) hollowed-out local capacity that we have in England/UK presents significant challenges for local systems approaches.

While participants recognised that notions of complex systems are increasingly common, their remains a gap between knowledge of complexity and applying it. This may be due to a lack of awareness about the mechanisms that underpin the bridging

process, which is manifesting as a collection of contextual barriers experienced by system agents.

6.3.2 Emergent proposition 2: Finding a role in influencing policy is key to creating system change.

The second proposition sets out for whom and in what circumstances the mobilisation and application of complexity theories may be particularly effective. From experience, participants *'talked about intervening in the right place in the system'* and recognised that *'what kind of stakeholders we talk about is important.'* Shifting the emphasis from the whole system to the policy domain, something under-examined in relation to physical activity, appears to be a significant way to generate system change.

Diverse policy actions are necessary to shape physical activity systems (Rutter *et al.*, 2019; World Health Organization, 2018). This presupposes a need to have key policy agents from across different sectors engaged in physical activity promotion. This was reflected in my data through participants' consideration of who can impact system change.

> Having high level engagement up those hierarchies there are in systems, or local authorities or government, and having that buy in and agreement would really help effect change.

The way participants here, and in my previous research, emphasise the importance of the hierarchy is an interesting contradiction to claims that one of complexity theory's most important policy contributions is to signal the virtues of bottom-up approaches (Cairney, 2012a).

However, policy-making is in itself an inherently complex process (Cairney *et al.*, 2019). It is plausible, therefore, that policy-makers already have established practices to address complexity and may require less direction in that regard. This

sense came through the data in the way that some participants questioned the mobilisation of complexity knowledge among particular groups.

> For whom is this knowledge on the complexity of the system and how it works relevant? Is it really for policy-makers? […] if we try to educate policy-makers that they should think in terms of complexity and systems, I don't think that that will work, because their logic of policy behaviour is different. They consider complexity, it's key for them, but they are not interested in knowledge about complexity.

This points toward the need to understand policy processes, and that it may be more effective to mobilise knowledge of complexity among those agents seeking to influence policy-makers, so as to better understand the context in which policy-making occurs. This was most extensively considered by participants with reference to their experiences of policy entrepreneurship (*i.e.* working collaboratively to identify opportune moments to promote policy innovation) (Kingdon, 2003).

> If you really go for a system change, you should really explore what kind of window of opportunity in the policy area is there. I think this kind of analysis is as important as the [system] mapping.

Therefore, if, as participants suggested, *'we [agents in the physical activity system] think of ourselves as policy entrepreneurs,'* this may result in a two-fold benefit.

First, a sense of system-identity underpins effective systems-based practices (Bothma *et al.*, 2015). However, my previous studies suggested that this is lacking among physical activity policy agents, and that this may present a barrier to operationalising complex systems approaches. It may be inferred that people do not always understand their roles in systems and seek to understand how they can better contribute to the system's desired outcomes. This absence of role clarity was evident in the way participants discussed how they were '*trying to make everyone realise that they're part of this system.'* Policy entrepreneurship provides agents with a clear role, may foster belonging, and generate a crucial *'activation approach*.'

> As policy entrepreneurs […] we are a kind of catalyst to activate local system stakeholders, to develop collaboration within the system. And this works for the national-level, it's the same approach. If you want to change the physical activity promotion structure, you have to take an active role as a catalyst, and systems-thinking and complexity thinking would help to find the appropriate approach.

Second, policy entrepreneurship may create further engagement with policy principles, which aid understanding of the complex dynamic nature of policy systems, and how to influence them. Policy-making is often characterised by long periods of relative stability and incremental change. Occasionally, there are brief moments of dramatic change that are typically more enduring (Hayes, 2017). Therefore, it may be assumed that, given the stability observed in population physical activity levels for over a decade, these latter moments are of greater interest to those seeking to change the physical activity system. Perhaps influenced by the timing of the workshop (*i.e.* during a global pandemic), participants' perceived faith in targeting moments of crisis as key tipping points in system trajectories was observed in the data.

> Well, there are examples of course of very radical change that have happened, but it's interesting that they often occur at key crisis points.
>
> We've already seen a significant shift in the system, in the way the system behaves. And COVID really amplified that.

However, linked to the first proposition, caution about the role of complex systems approaches during times of crisis was raised by one participant with extensive experience of policy analysis:

> When that crisis arises, the policymakers are looking for really, as you say, ready solutions, and simple solutions that fit their interpretations of the crisis. So, I'm not sure that they'll look at a solution that'll be immediately before somebody in a crisis that is complexity and systems-thinking.

There will often be serious disagreements about policy responses amid crises due to complexity (Head, 2022). Nevertheless, it is the role of policy entrepreneurs to be

ready with solutions whenever sought by policy-makers. Research in physical activity policy suggests that these solutions should neither be too radical, nor too modest (Piggin and Hart, 2017).

Through the views of participants expressed in the data, I inferred a possible symbiotic relationship between complexity theories and policy theories. Careful consideration, mobilisation and application of these, by the necessary agents, and at the appropriate times, has the potential to effect significant system change, and thus realise the potential of complex systems approaches. This may require advocacy coalitions (Jenkins-Smith *et al.*, 2018) and a coordinated lobby of entrepreneurs from across the system.

6.3.3 Emergent proposition 3: Creating connections and dialogue contribute to system awareness and affiliation.

The third proposition concerns established practices in systems approaches, with which many participants were familiar and able to communicate their experiences of developing. However, through the application of a complexity theory lens it helps to explain why these practices may be effective. Complex systems are characterised by multiple scales, whereby boundaries between levels within a system (*e.g.* local, regional and national) are sites of extensive interaction and interpenetration (Byrne and Callaghan, 2014; Cairney *et al.*, 2019; Meadows, 2008). Therefore, gathering agents from across the system to discuss policy issues seems an intuitive thing to do. This was reflected in the participants' belief that *'just bringing people together'* was foundational to complex systems approaches:

> Then just having those workshops is bringing those people together […] I guess a lot of it boils down to those relationships doesn't it, and partnerships. But I suppose even just bringing them along in that journey is a start.

However, through observations in the data, I was able to infer three reasons why this is perhaps important.

First, given that effective physical activity promotion requires integrated action across multiple domains within the system (Milton *et al.*, 2021; Rutter *et al.*, 2019), there is a tendency to try and create buy-in from as many stakeholders as possible. These attempts were observed in participants' reflections on how they have tried stimulating involvement and ownership of the inactivity issue.

> A few things have struck me. I'm certainly aware that in physical activity, from a high-level policy perspective, I think we're still very much working with health and sport, and perhaps talking about the broader system, but perhaps we still haven't really worked out how to engage with the whole system, and what the even means and what it looks like.
>
> People own what they help create. Real change happens in real work. Those who do the work, do the change, connect the system to more of it.

Second, people fundamentally need to feel a degree of control in their work, as well as a relationship with others and their environment (Deci *et al.*, 2017). As such, bringing people together to address common policy issues may foster a sense of affiliation or relatedness, be that to one another, the problem, or the system more broadly. This sense manifested in the data as some participants expressed the importance of belonging in sustaining systems approaches and preventing feelings of detachment from the system:

> It's amazing. When we looked at it, we went, "right, the only thing that was really different [across each area] was the fact that one had been out to tender." The people had done exactly the same job, but they don't know who they belong to. It's mad to see, because you wouldn't think that would be impacting but it was a huge thing. Things like that can really influence that ownership and that engagement.
>
> That can affect people, understanding how they're part of the bigger picture, or if they don't know, it's going to feel disjointed.

The third reason is perhaps most important for explaining the mobilisation of complex systems knowledge. Another key feature of complex systems is openness (*i.e.* the exchange of people, ideas and materials) (Althusser, 2005; Byrne and Callaghan, 2014). This seems compatible with processes of co-production and education for raising awareness of systems. Specifically, given that education is both informal and formal (Byrne, 2011), gathering people from across a defined system to stimulate dialogue may be deemed crucial to create an environment in which *'everybody teaches, everybody learns.'* These ideas were evident in the data:

> One of the things about when you get people involved in a mapping exercise [for example], they start taking the system seriously […] in other words, Public Health people started to think about complex systems and about what we're doing. So, it's a learning exercise for all concerned.
>
> There's an interactive learning moment where we can learn from each other, and this especially can co-produce new knowledge for solutions for problems in a specific context.

Using complexity theories, it is plausible to infer from the data that by creating connections this, i) supports Freire's concept of dialogical learning (Freire, 1996) as a means to overcome contested knowledge of complex systems; and ii) enables the identification of strange attractors (*i.e.* the shared vision that drives agents' actions and beliefs toward new interactions) (Gilstrap, 2005). This seems appropriate for the emergent nature of systems, which necessitates fluid and interpenetrating networks in response (Byrne and Callaghan, 2014).

It is important to reflect, however, on the structures that mould collaborative systems approaches. Durable changes to an otherwise stable policy subsystem may, in part, result from a type of political upheaval or learning (Howlett and Cashore, 2009). Consequently, it may be prudent to consider the dynamics generated by bringing people together. I observed these ideas through participants' reflections on

the implications of complexity and systems-thinking being typically only understood in any depth by niche groups, and how the concepts are usually framed:

> I think we've got to recognise talk about systems can become a technocratic and I do wonder if we need to integrate that kind of political nature of developing any kind of approach and recognising that this is political and to do with power. Some of the issues of technocracy can just mask the need to address these fundamental questions about politics and power.

While some participants suggested that collaborative working can *'grow that new power'* (*i.e.* that which is held by the many who then contribute and channel it), in turn leading to a greater sense of control among system agents, my findings point toward the importance of being able to identify and influence particular key agents who have the power and autonomy to affect systems more readily (see proposition two above). In some cases, creating connections has perhaps unexpectedly opened a political dimension to complex systems approaches. The preparedness of system agents to address this is unclear. However, collaborative practices and dialogue certainly have the potential to raise awareness about complexity theories, and the structures and agents that make-up the systems we seek to change.

6.3.4 Emergent proposition 4: Increasing a focus on their agency can support those working to change complex systems.

The final proposition draws further inference from those set out above to explain how adopting complex systems approaches may be impacting individual agents working in physical activity and systems domains, and how adopting a new perspective may overcome these difficulties.

The application of complexity theories to policy has typically focused on analyses of system structures, rather than agency (Cairney, 2012a; Sniehotta *et al.*, 2017). It is possible that this has precluded understanding of the factors that facilitate, or inhibit, people to flourish in working amid complexity. The

shortcomings of a structure-dominant focus appeared to be a concern among some participants.

> There was a lot of talking about the solution in this [issue of inactivity] starting from people, in terms of [putting] the complexity and systems into practice, starting with people and see what can we do there. Rather than starting from the structure because that will not work.
>
> It just feels like we haven't really, as a sector, we haven't particularly got our heads round the fact that we're working with humans, and we need to take a complexity approach [to doing so].

Questions were raised by participants about who the key agents may be to involve and support in addressing inactivity. While it was suggested that the *'very senior have influence,'* it was also believed that those *'on the ground are the ones doing it, so engagement is required across levels.'* Complexity theories reinforce this premise.

Complex policy systems appear to have self-organising properties (Cairney, 2012a). This means that they do not typically have focal leaders around which they coalesce, they are unpredictable and difficult to control, and consequently policy failure is common (Cairney, 2012a; Pawson and Tilley, 1997). Needs theories of motivation submit that individuals require a sense of autonomy and competence to prosper, both generally and in organisational settings (Deci and Ryan, 2000; Deci *et al.*, 2017). If, however, the natural order of complex systems precludes the accomplishment of these needs, it is reasonable to suggest that it may be hard for individual agents to effectively develop complex systems approaches to issues such as inactivity, without being at risk of the deleterious and isolating effects of needs thwarting. The symptoms of needs thwarting were evident in several participants' experiences of the *'issue of competencies'* and the *'fatigue in our community'* from adopting these perspectives.

> Everything you said resonates with him. He was interested in this sociological complexity […] and people are actually alienated from understanding the system […] I think some key common threads across this [discussion] are around this idea of alienating.

This finding extends my observation of *detachment* in previous studies, whereby agents become removed from the complexity of both the system and the policy issues. Conceptually, this is problematic, as one cannot stand outside a system they seek to change (Cilliers, 1998). However, it is now possible to consider at least one way in which this situation arises. Moreover, it impresses the need to urgently understand the potentially thwarting effects of complex systems approaches, and develop ways to support the needs of individual agents. Without a renewed focus on agency, as the catalyst of system change, current conceptualisations and applications of complexity theories and systems-thinking in physical activity policy may remain partially effective at best.

6.4 Discussion

In this chapter, I present findings from an expert stakeholder workshop convened to address research questions concerning how to advance the uptake of complexity theories and systems-thinking in physical activity policy contexts. These findings, which also validate and extend my previous research, both in doctoral study and elsewhere (Rigby *et al.*, 2020b), are packaged in four novel propositions that detail how key actions and agents may redress previously underexamined aspects of this interdisciplinary endeavour. While these propositions are necessarily interrelated, I offer core implications of each in turn.

That conditions in the physical activity policy context were found to seemingly be non-conducive to the mobilisation and uptake of complex systems perspectives reflects other contexts, where uncertainty about complexity (Cairney,

2012a; Gerrits, 2012), short-termism and inadequate resources and evidence (Rutter *et al.*, 2017; Rutter *et al.*, 2019) were presented. While complementing existing evidence, the views of participants suggest that complex systems perspectives are at times incompatible with existing needs, values and practices associated with the physical activity policy domain. Reasons for this are unclear, but may relate to policy-makers' desire for ready-made solutions to issues (Cairney and Kwiatkowski, 2017; Ragin and Rihoux, 2004; Rutter *et al.*, 2017), or the predominant clinical effectiveness-type models of evidence (*e.g.* the UK's NICE guidance) that have traditionally informed Public Health decision-making (Brownson *et al.*, 2009a). While the need for a complex model of Public Health evidence informed by social science, and for investigation into approaches to systems knowledge development and use, is clear (Riley *et al.*, 2012; Rutter *et al.*, 2017), improving the uptake of different bodies of knowledge about physical activity remains a challenge (Kay, 2016; Rigby *et al.*, 2020a).

I propose that an inability among stakeholders across the physical activity policy system to extend beyond their own notions of complexity to a collective understanding of how, in practice, to address inactivity through a complex systems lens, may serve to create a negative feedback loop that reinforces decision-makers' persuasion toward traditional models of evidence. However, although the stability of the system and longevity of its characteristics may seem immutable, it may be possible to address these through a pragmatic approach to adapting and applying complexity, mobilising agents and creating influence at a policy-level.

These findings also question the basis on which agents seek to create system change, and enable the identification of for whom, and in which circumstances, knowledge and application of complexity theories and systems perspectives may be

particularly effective. While it is necessary to consider the whole system, the amelioration of inactivity depends on robust and decisive policy action (Rutter *et al.*, 2019; World Health Organization, 2018), and it is suggested that efforts be directed toward this. To that end, and given the complexity of policy-making itself (Cairney *et al.*, 2019), it appears that, alongside knowledge of policy processes, complexity theories may be most useful to those seeking policy change. The potential for system influence may be enhanced if agents across the system reorientate their perspectives and assume the role of policy entrepreneurs (Kingdon, 2003). This may also instil agents with a critical sense of belonging and system-identity (Bothma *et al.*, 2015), which my previous studies and current findings indicated is lacking, thus enhancing collective motivation (Deci *et al.*, 2017).

Due to the complexities of physical activity promotion, policy change is typically incremental (Piggin and Hart, 2017). However, there are many frameworks that enable the consideration of complex policy contexts and how to influence them, especially in times of acute (*e.g.* a pandemic) or creeping (*e.g.* physical inactivity) crises (Head, 2022). While beyond the scope of this discussion to critique them, theories and frameworks such as punctuated equilibrium, multiple streams analysis, and advocacy coalition frameworks hold promise (Cairney, 2016; Cairney and Oliver, 2017; Jenkins-Smith *et al.*, 2018; Kingdon, 2003), including in physical activity (Rütten *et al.*, 2013). If we want *'policy makers [sic] to take physical activity more seriously* (Das and Horton, 2016, p.1),' we need people within the wider system to take influencing policy equally seriously.

That participants raised the importance of creating connections and dialogue is not surprising; these aspects are well known features of physical activity policy implementation and systems perspectives (Cavill *et al.*, 2020; Lindsey, 2014; Nau *et*

al., 2020; Rigby *et al.*, 2020b; Wang, 2011). However, my findings extend on these works to demonstrate why these approaches may be particularly effective in policy settings. Specifically, they serve to reinforce the sense of belonging and ownership, facilitate knowledge mobilisation through dialogical learning (Byrne, 2011) in response to the open and emergent nature of systems practices, and raise awareness about a system's structures and leverage points (Cavill *et al.*, 2020; Nau *et al.*, 2019; Rutter *et al.*, 2019). Moreover, this study responded to a lack of critical reflection on systems approaches to inactivity (Piggin, 2019). Through a realist lens, manifestations of power and politics, some of which constrained system change, were observed in participants' experiences. System agents need to feel empowered, and through carefully constructed networks that present members with opportunities to engage with key knowledge mobilisation activities, it is possible to foster the necessary agency while overcoming the unique political complexities of physical activity promotion (Rigby *et al.*, 2020b; van der Graaf *et al.*, 2020).

The final proposition diverts attention from structure-orientated perspectives by emphasising the basic needs of system agents. There are many behavioural theories that can help consider these (Deci *et al.*, 2017; Fullan, 2012; Michie *et al.*, 2011). However, as one of my most significant findings, both here and in earlier work, relates to perceptions of alienation, I propose that self-determination theory warrants further exploration in a systems context (Deci *et al.*, 2017). There is little known about the *'undermining, alienating and pathogenic effects of need thwarting* (Deci and Ryan, 2000, p.319)*'* in systems, but our understanding of the nature of complex systems (*e.g.* self-organisation, general stability and common policy failure) are reminiscent of the conditions that induce rigid behavioural patterns, which lead to poor individual wellbeing (Deci and Ryan, 2000; Ryan *et al.*, 2006). I postulate that

this possibly transcends individuals to impact the health of the system and urge scholars to consider this hypothesis. As agency is central to system change (Byrne, 2011), without due care and attention to support the needs of key agents, this will be difficult to achieve.

In sum, I hope this study initiates further critical reflection on the use of complex systems approaches to physical activity policy, and in Public Health fields more broadly. By means of inference, I observe that there remains much to explore in relation to agency in complex systems. Theoretical pluralism, which includes perspectives from complexity, policy, sociology, psychology and beyond, will be necessary to demonstrate the full potential of complex systems approaches in applied settings. Within this, the notion of conceptual purity (Gerrits, 2012; Tosey, 2002) in complexity theories is redundant. Rather a pragmatic and flexible approach to these theories is required to account for the multiple ways agents make sense of systems in which they operate (Anzola *et al.*, 2017). It would be of benefit to the system if these multiple conceptualisations are mapped for the physical activity policy context.

6.4.1 Limitations

These findings are limited to the views of a specific group of stakeholders, with its particular understanding and history of developing complex systems approaches to policy and physical activity. Nevertheless, while neither exhaustive nor inscrutable, the propositions outlined represent practical steps to advance these approaches more broadly. I encourage further work to refine and extend understanding of the concepts and issues raised here among diverse policy stakeholders, particularly those implementing policy locally. Critical systems heuristics may support the identification of additional stakeholder groups (Ulrich and

Reynolds, 2010). Programmes should be developed to support the individual needs of agents tasked with working amid considerable complexity.

6.5 Conclusions

This research, considered alongside my previous studies, sets out the current state of complexity theories and systems-thinking as they relate specifically to the physical activity policy context. By reflecting critically on the application of these increasingly ubiquitous perspectives, I identified several steps that will reorientate attention toward under-acknowledged aspects of mobilising and applying this knowledge. Central to this will be focusing on the needs and practices of system agents. Complex systems approaches to Public Health have advanced greatly, however the real value of complexity theories and systems-thinking may only come from meaningful applications that solve policy problems like physical inactivity. This is hard to do, but the path forward is not indiscernible. My propositions are a steer toward that future.

Chapter 7. General discussion and conclusions

7.1 Introduction

In this thesis, I set out the methodological approach to, and findings from, a programme of research that critically explored the way in which complexity theories and related concepts, such as systems-thinking, are understood and applied in the physical activity policy context. The concept of complexity is used to describe different aspects of public health promotion and often relates to the interplay between problems (*e.g.* physical inactivity), programmes to address such problems, and the context in which programmes are implemented (Moore *et al.*, 2019; Skivington *et al.*, 2021). Thus, complexity theories also provided the framework through which I was able to make observations across these dimensions and consider the complex systems that influence, and are influenced by, those seeking to increase population physical activity levels.

Throughout this research, I made considerable efforts to engage with the UK physical activity policy system as a constituent element (Byrne, 2011), which generated insight into the current philosophies and practices that characterise policy-making and implementation. I remain embedded in this policy space and continue to make evidence-informed contributions to policy development and dissemination. These efforts have coincided with a shift in the policy landscape, as well as the increasing complexity turn in social, policy and Public Health sciences (Barbrook-Johnson *et al.*, 2021; Rutter *et al.*, 2017). Some significant policy developments relevant for contextualising the overall contribution of my research were as follows.

Since the onset of my research, the World Health Organization has set out a global framework for physical activity, which is accompanied by a set of global physical activity guidelines (Ding *et al.*, 2020; World Health Organization, 2018).

This presented the rationale for developing national systems-based approaches that combine robust policy action with individually focused interventions. There is increased guidance and tools, such as systems-maps, that offer a foundation on which to develop these systems approaches to policy (Bellew *et al.*, 2020; Rutter *et al.*, 2019). To date, there is little evidence of their use in the UK policy context, however.

Similar to the global landscape, the UK published new physical activity guidelines between 2019 and 2022 for different subpopulations (Department of Health and Social Care, 2019). The most recent guidelines, related to disabled children and young people, were the first however to explicitly acknowledge the complexities of increasing population physical activity levels (Smith *et al.*, 2022), informed by my contribution as co-author, which was partially based on the research presented in this thesis. Furthermore, a new government-led national plan for sport, health and wellbeing called for a whole-systems approach to physical activity (House of Lords Sport and Recreation Committee, 2021), which echoed the recent Sport England strategy (Sport England, 2021d). Critically however, while methods such as systems and ripple effect mapping are popular in localised physical activity programmes (Cavill *et al.*, 2020; Nobles *et al.*, 2022b), there does not seem to be a coherent national policy implementation plan. By the admission of participants in my first study, *Everybody Active, Every Day* (Public Health England, 2014a) is outdated and not closely informed by complex systems perspectives.

Therefore, within this landscape my research has been contemporaneous with the evolution of policy thinking, which increasingly emphasises complexity and systems-thinking in addressing physical inactivity (Piggin, 2019). However, this thesis offers a critical reflection on this turn, addressing a series of evidence gaps to produce novel contributions to knowledge, which are methodological, conceptual,

and empirical. Notably, I enabled policy-makers and other key stakeholders to reflect on the meaning of complexity theories in the context of their work (Cairney, 2012a); addressed the relationship between systems leadership and policy implementation conditions (Gilson, 2016); and explored ways to advance complex systems perspectives to physical activity policy through the integration of governance, leadership and knowledge mobilisation (Nau *et al.*, 2020), in terms of what, for whom, how and under what circumstances. Furthermore, the work responds to calls for a reorientation of physical activity toward more policy-relevant research (Lee *et al.*, 2021), by acknowledging the complexity of policy-making (Cairney *et al.*, 2019), and incorporating social policy theoretical frameworks that have been sparsely applied in physical activity scholarship (Pogrmilovic *et al.*, 2018).

This study, which initiated a much-needed research agenda, was premised on the arguably uncritical application of complex systems perspectives, prior to this thesis, in physical activity policy (Piggin, 2019), and a need to address issues of system agency (*i.e.* capacity among individuals and organisations, for example, to influence systems), amid a predominantly structural and deterministic complexity evidence-base (Cairney, 2012a; Sniehotta *et al.*, 2017). I aimed to critically assess the understanding and application of complexity theories as a basis for evidence-informed physical activity policy efforts. Specifically, through qualitative exploration of complex systems (Egan *et al.*, 2019), I sought to extend complexity theories; interrogate the suitability of these perspectives for influencing, developing and implementing physical activity policies; and identify conditions that enable more effective complex systems approaches to physical activity policy and programmes.

To my knowledge, the specific approach taken to the phenomena of interest (*i.e.* observing the experiences and actions of policy system agents in the UK

physical activity policy context through a complex realist lens) has not previously been the subject of academic enquiry. Thus, my research has considerable empirical value, which is complemented by theoretical and methodological contributions throughout. Beyond the immediate research context of policy, through post-disciplinarity and considering the complexities of physical inactivity, this thesis posits important considerations for addressing persistent challenges in both physical activity and health promotion more generally. Insufficient consideration of complexity, alongside ambiguous policy, have, I argue, contributed to the persistent nature of inequalities in participation and difficulties in scaling programmes for population benefit (Ball *et al.*, 2015; Lane *et al.*, 2021; Rigby *et al.*, 2020a). Moreover, I hope that this research offers new ways of thinking about how people behave in systems more generally (Teisman and Klijn, 2008), as well as to policy and public health issues, notably through the contribution of social complexity and policy sciences to the physical activity evidence-base.

These contributions have been discussed in detail above in Chapters Three-to-Six. Each of my studies built sequentially on the previous. In the remainder of this final chapter, I will draw together three key dimensions that have arisen through the research, namely considerations for theory; considerations for practice; and considerations for evidence-informed policy. This discussion is 'bookended' by an initial reflection on key contributions from the aforementioned chapters, and a critique of this study's limitations. I make recommendations for future research, before offering my final conclusions. This discussion is presented, not as a line in the sand, but rather a reflection on a work in progress; a developmental process of learning and understanding, engendering ideas for further critical exploration.

7.2 Key contributions

7.2.1 Methodological lenses

As proposed in the introduction to this chapter, critically examining the understanding and application of complexity theories, as conceptualised here, in physical activity policy is a novel research programme. By addressing this gap, I offer empirical value to researchers, practitioners and other stakeholders who have an interest in physical activity promotion. Findings from my research can be used to inform optimal strategies for developing systems-based approaches to physical inactivity, and influencing policy-makers who have the power and capacity to instigate upstream measures that can effect systemic change.

To do so, in Chapter Three, I outlined a novel methodological approach to the qualitative exploration of complex phenomena, which was underpinned by a complex realist ontology (Byrne, 1998; Byrne and Callaghan, 2014). In order to make sense of complexity, I drew on the idea of focusing knowledge through different lenses (Head, 2008; Head, 2022), challenged predominant analytical perspectives (Braun and Clarke, 2019), and incorporated literature from multiple fields, including sociology, social policy, Public Health and psychology.

My approach differed to previous conceptualisations by proposing that the distinctions between multiple lenses of knowledge are more nuanced than that proposed by Head (2008), and that the relative contributions of different agents to different types of knowledge can be integrated at different stages of the research process. In future, adopting similar approaches may contribute toward addressing the under-representation of different disciplinary perspectives on key issues such as physical activity inequalities (Kay, 2016), as well as better understanding the products of interaction between researchers, policy-makers and practitioners, which

will increase alongside the continued proliferation of complexity-informed approaches to Public Health research (Nobles *et al.*, 2022b). Thus, vastly different experiences and knowledge pertaining to systems can be focused on a single point of reference. The idea of multiple lenses is a useful metaphor, reminding of the need to bring together these view-points, alongside different theoretical perspectives, to cast new light on complex policy problems (Head, 2022). Furthermore, it alludes to the idea that population health promotion can be continually refined. Even small adjustments in approach can bring clarity to a previously fuzzy picture.

7.2.2 Reframing physical inactivity as a technology and policy as leadership

In my first empirical study (see Chapter Four), I encouraged policy-makers to reflect on the meaning of complexity, both for policy-making and physical activity promotion, which is considered a predominant contribution of complexity theories to public policy scholarship (Cairney, 2012a). In order to do so, I negotiated unprecedented access to leading UK policy-makers working in this domain. In this regard, gaining insight into how this niche group of individuals make sense of complexity is extremely valuable. While the chapter discusses three key themes, namely uncertainty, that the physical inactivity problem is unexceptionable yet unclaimed, and how to create influence and change, there were two particularly notable empirical findings from this chapter. First, the construction of physical inactivity as a technology. Second, the idea that policy constitutes a form of leadership. Neither of these concepts have been previously considered.

Describing physical inactivity as a technology recognises that the problem may be conceptualised, not as a systemic outcome inextricably tied to the structures and causal properties of the system, but rather as an attempt to adapt and control the

policy system through the application of knowledge, techniques and tools associated with physical inactivity (American Sociological Association, 2020). This approach legitimises and informs particular ways of framing and using the physical inactivity problem. The way in which physical activity is embedded in different policies is indicative of the way governments might attempt to portray collaborative practices and joined-up thinking, without addressing the complexity of either the policy environment or the problem itself. This raises considerations for other policy agenda, for example 'Health in All Policies,' whereby multi-stakeholder and cross-government buy-in is either assumed or desired (Godziewski, 2021). Yet, practices and behaviours such as those identified in this study, which are largely divorced from the complexity of the systems, are likely counter-productive to achieving systemic change for public health benefit.

By embedding a focus on physical activity in different policy documents, policy itself (*i.e.* the total sum of government action in which decisions and actions are adopted by agents to achieve particular goals (Richards and Smith, 2002)) becomes a form of leadership designed to connect the system. Rather than creating a systemic leadership culture of learning and development among diverse system agents, this may lead toward more technocratic forms of governance (Godziewski, 2021). This particularly concerns complex systems perspectives, which are often still perceived to belong to a niche domain with a distinct skillset (Jebb *et al.*, 2021). However, technical expertise alone will not determine the outcomes of complex policy problems (Head, 2022).

My findings point toward adopting a balanced approach that incorporates different kinds of leadership across the physical activity policy system. Identifying key agents to also galvanise the policy system is important. These such arguments

were made in an evidence submission to the UK House of Lords Sport and Recreation Committee (2021), and findings from this chapter have led to direct policy recommendations from the upper chamber of the UK parliament.

7.2.3 Identifying new contextual facilitators and constraints in local implementation

In Chapter Five, I shifted focus to the local context. In doing so, I sought to explore an enduring and complex challenge in health policy implementation, namely how local system leadership is fostered in ways to address complexity, support implementation, and connect agents in meaningful and productive ways (Gilson, 2016). While my intended study was impacted by the pandemic (see Chapter Three and limitations below), the resultant findings still represent considerable empirical value.

To some extent, those adopting a complex systems perspectives naturally engage in collaborative multi-stakeholder practices (Nobles *et al.*, 2022b), which are longstanding approaches to policy and physical activity promotion (Lindsey, 2014; Wang, 2011). Furthermore, the notion of distributed leadership is a commonly assumed principle of complex systems leadership theories (Lichtenstein and Plowman, 2009; Lichtenstein *et al.*, 2006; Uhl-Bien *et al.*, 2007). However, my study unpacked these assumptions and demonstrated how and why leadership formed on the basis of discussion, distribution and togetherness, may create known supportive conditions for physical activity policy implementation (Horodyska *et al.*, 2015). This suggests the need for such theories and approaches to be interrogated in other health domains to determine key contextualised mechanisms and components of effective distributed leadership. Furthermore, conceptually, this study alluded to the possibility

that by focusing efforts on the whole system, this may detract from the value and role of agents promoting physical activity. This was corroborated in my final study.

7.2.4 Producing evidence-informed recommendations for further advancing the field

The final empirical chapter in this thesis, Chapter Six, proposes ways in which the uptake and application of complex systems perspectives to physical activity policy can be more effective and productive. These contribute to and extend recent literature that has attempted to distil the current state and direction of complex systems approaches to population health research (Apostolopoulos *et al.*, 2019; Jebb *et al.*, 2021). In this way, this chapter is in and of itself a critical discussion-like piece, supported by evidence from additional empirical study. Specifically, my propositions are contextually novel in that they pertain to physical activity policy, but also represent avenues for possible exploration in alternative Public Health contexts.

In this chapter, I apply realist principles to identify what, for whom, how and under what circumstances complex systems approaches may contribute to physical activity policy (Wiltshire and Ronkainen, 2021). In doing so, I considered how current dispositions in the system tend to imply particular behaviours and practices, which manifest in the data through participants' experiences of complexity, policy and physical activity. In this way, my research extends knowledge of the *'three pillars'* of whole-systems approaches to physical activity policy (Nau *et al.*, 2020, p.2). Examinations of governance and leadership explicated in Chapters Four and Five, are fused with an interrogation of knowledge mobilisation in the final empirical chapter. By nature, the resultant propositions give rise to opportunities for future research that draws on, and evaluates, the ideas presented.

7.2.5 Cross-cutting contributions

Throughout this thesis, there are cross-cutting findings that represent important theoretical and empirical contributions to knowledge. Specifically, there are two key dimensions that warrant further discussion, namely the roles that detachment and alienation, and uncertainty, play in these systems and contexts.

7.2.5.1 Detachment and alienation

A key methodological principle of my research was that one cannot stand outside the system they seek to change (Byrne, 2009a; Cilliers, 1998). However, a critical empirical finding, which was first observed in Chapter Four and then extended in Chapter Six, was that physical activity policy stakeholders can be removed from the complexity of both the system and the problem. In Chapter Four, the theoretical contribution of detachment was constructed to describe how policy-makers actively withdrew from physical inactivity, as if they were not intricately tied to the issue or system that surrounds it. Similarly, in Chapter Six, a further theoretical contribution was made through the development of alienation, a term to describe how implementing systems approaches can ultimately lead to the unintended consequence of displacing agents from the system.

While subtly different, the related constructs of detachment and alienation are complementary. They describe ways in which key policy agents may find themselves standing outside of the system. The language of detachment and alienation points toward the potentially thwarting effects of complex systems approaches, which do not meet the needs of individual agents (Deci *et al.*, 2017), as well as practical and normative considerations about the difficulty and value of adopting these

perspectives (Jebb *et al.*, 2021). In this way, they may become something people seek to avoid.

The mechanisms that underpin these manifestations, and the resultant consequences (either positive or detrimental) remain speculative. It is possible that these constructs arise as a result of the predominant structural and deterministic emphasis on applying complexity theories to social policy (Cairney, 2012a). In this way agency and the implications of current practices have been obfuscated, precluding the development of mitigating strategies to support individuals and organisations. These findings present a fundamental challenge to the way complex systems approaches to public health problems are conceptualised in contemporary literature. They warrant exploration in both Population Health and broader systems research, which continue to advance at a pace with as yet little regard to such issues.

7.2.5.2 Uncertainty

The final contribution to knowledge that I outline here is the exposition of pervasive uncertainty that manifested in each of my study's findings. Despite the proliferation of complexity theories and systems approaches in Public Health research and practice (Egan *et al.*, 2019; Jebb *et al.*, 2021; Rutter *et al.*, 2017; Rutter *et al.*, 2019; World Health Organization, 2018), there remains evident uncertainty in what these perspectives are (especially the meaning of their theoretical tenets), what implications they have for the physical activity policy domain, and how to optimise such approaches for public health benefit. While the meaning of complexity will continually evolve and differ between contexts (Gerrits, 2012), my findings consequently raise further questions about the seemingly unrelenting and often uncritical advance of complex systems perspectives. In Chapter Four, I highlighted

that uncertainty could lead to misapplication and scepticism about issues of common interest (Cairney, 2012a; Kernick, 2006). In Chapter Five, I discussed how to generate systems leadership remains unclear. Similar findings were presented in Chapter Six, whereby participants were unable to clearly differentiate between systems-based, and what were considered to be more traditional, approaches to physical activity policy. This thesis highlights the need to take stock of these concerns and uncertainties, and put forth practical considerations for theory and practice, that may first overcome some of this uncertainty, and second help optimise complex systems approaches to public health promotion.

7.3 Considerations for theory

Typically, physical activity policy research has largely been conducted without reference to explicit theoretical frameworks (Pogrmilovic *et al.*, 2018). My research was the first to consider tenets of complexity theories in the physical activity policy context.

An important application of complexity theories in policy studies is to make sense of complexity and its properties (*e.g.* emergence or feedback) in ways that is mutually meaningful to varied stakeholders (Cairney, 2012a). This is particularly challenging in the physical activity context given the range of stakeholders, funders and services involved, which may increasingly be considered as accidental policy-makers due to their vested interests and influence in the domain (McKinnon *et al.*, 2011). My research has reinforced that these complexity theories make important contributions to understanding the complexity of the social world, and provide the platform to understand and effect change in systems (Burns, 2015; Byrne, 1998; Manson, 2001). Furthermore, they are congruent with theories of the policy process,

and allow for interpretations of how policy agents conceive of, and act amid, complexity (Cairney, 2012a; Cairney and Geyer, 2017; Salway and Green, 2017; Teisman and Klijn, 2008). In this section, I discuss three important considerations for the application and evolution of this theoretical domain, and illustrate how complexity theories manifest through the experiences and practices of key physical activity policy agents.

7.3.1 Applying complexity theories

I have argued that to consider and use complexity theories, it is necessary to position oneself as a constituent component of the system of interest (Byrne, 2009a; Cilliers, 1998). In this way, research that seeks to effect system change is inherently and meaningfully applied (Byrne, 2011). Specifically, my research critically assessed the application of complexity theories to physical activity policy systems. This has been useful in both understanding the complexities of policy-making (Cairney *et al.*, 2019), and making sense of policy responses to physical inactivity. However, the first substantive point to make is that the application of complexity theories alone is unlikely to be sufficient to ameliorate the most complex public health challenges. While conceptually suited to analysing wicked issues (Klijn, 2008), such as inactivity, complexity theories provide only some of the many forms of evidence, knowledge and normative judgements that influence policy debates around such problems (Head, 2022).

Throughout, I have demonstrated the importance of theoretical pluralism, which included critical perspectives from sociology (*e.g.* dialogical learning), social policy (*e.g.* policy entrepreneurship), and organisational and behavioural psychology (*e.g.* the adapted decision-making framework and self-determination theory). I argue

that by incorporating these perspectives into new applications of complexity theories, which are reorientated from structural and deterministic arguments toward issues of agency, this has greater potential than narrower applications of theory to address issues such as persistent inequalities (Salway and Green, 2017; Teisman *et al.*, 2009). Applying theories in this pluralistic manner has two key methodological implications.

First, applications of complexity theory that focus on agency suggest a need to move beyond descriptive models of systems. While, for example, systems mapping is increasingly common (Cavill *et al.*, 2020; Rutter *et al.*, 2019), advancements in this research methodology, such as illustrating the actions of key policy stakeholders alongside system components (*e.g.* Maitland *et al.* (2021); Nobles *et al.* (2022b)), remain descriptive. How to interpret such maps, and then use these to design and implement meaningful physical activity strategies based on them, remains unclear to many working in this policy domain, as evidenced by participants in my Ph.D. These findings are reflected in conversations I have had in practice, and through research into participatory systems mapping in Public Health more broadly, which I am currently undertaking at Glasgow University, and is due for publication this year (Rigby *et al.*, Forthcoming). Alternative approaches such as agent-based modelling (*e.g.* Tracy *et al.* (2018)) or participatory action research (*e.g.* Murphy *et al.* (2021)), which are as yet infrequently used in relation to physical activity, may be suitable methods for supporting the turn toward meaningful and critical applications of complexity theories in policy research and practice (Barbrook-Johnson *et al.*, 2021), which will further benefit from being grounded in the experiences of those working 'on the ground' amid complexity.

Second, the pluralistic and multiple lens approach adopted in this study emphasises and supports previous claims that rigid hierarchies of evidence that have traditionally dominated the Public Health research landscape are largely redundant (Rutter *et al.*, 2017). While epidemiological models have successfully identified the dose-response relationship between physical activity and health (Bull *et al.*, 2020; Department of Health and Social Care, 2019), correlates of physical activity (Bauman *et al.*, 2012) and potential intervention strategies (Tuso, 2015), they have done little to address the persistent levels of global physical inactivity (Guthold *et al.*, 2018; Guthold *et al.*, 2020). Both through the findings of my research, as well as during my time spent working as an intern at Public Health England, I observed an eagerness to develop and test new approaches to physical activity research. Complexity theories challenge our domain to do just that.

The application of complexity theories in conjunction with alternative perspectives raises considerations about extending complexity theories. My research supports arguments that their application is aided if extended, adapted and refined for increased contextual relevance (Cairney, 2012a).

7.3.2 Extending complexity theories

Complexity theories have evolved from numerous scientific disciplines. They represent an assemblage of interrelated perspectives with shared characteristics, of which complexity and systems are their key organising constructs (Cochran-Smith, 2014). My findings are consistent with the notion that policy agents learn about complexity from different perspectives through dialogical processes (Cairney, 2012a; Gerrits, 2012). In this way, they construct their own understanding of what complex systems are and how they react to them (Teisman and Klijn, 2008). While it is

important to acknowledge that this theoretical fluidity across domains, as evidenced throughout my research, can detrimentally influence agents (Cairney, 2012a), it also suggests that conceptual purity (*i.e.* the rigid application of complexity theory) is a forlorn aspiration (Gerrits, 2012; Tosey, 2002).

My research alluded to the possibility that the extension of complexity theories may result from micro-emergent processes, that is the emergence of phenomena through the interaction of agents (Byrne and Callaghan, 2014), as well as through explicit scholarly efforts. To this end, it is difficult to predict how properties of complexity and systems manifest themselves in the policy vernacular. It would suggest however that in the context of this research, complexity theories' principles can be extended in a worthwhile manner that retains explanatory power (Gerrits, 2012). Thus, conceptual purity is not a worthwhile endeavour.

One way in which complexity theories seem to have been extended in practice is through the conflation of complexity science and systems-thinking. In research, these constructs have different meanings (McGill *et al.*, 2021), but are often portrayed interchangeably in my data and thus I purposely frame my arguments in line with this conceptualisation. It may be that this approach helps bridge a knowledge-to-implementation gap among policy agents, and should be considered by those seeking to influence the narrative around complexity in physical activity. Alternatively, it may be part of a bigger movement toward an overarching complexity frame of reference (Byrne, 2009b), an umbrella concept that seeks to capture the myriad approaches to complexity.

Nevertheless, there remains more that can be done to translate complexity theories into contextually relevant perspectives (Brownson *et al.*, 2009a; Salway and Green, 2017). It is likely that complexity theories will necessarily continue to evolve

in response to the intricacies of the evidence-policy-practice triad, as our understanding of the problems, systems and contexts are refined. This should include tools that policy-makers can use to understand concepts from complexity theories (Cairney, 2012a).

To this end, Appendix 13 presents an overview of how tenets of complexity theories and complex realism (as applied to this thesis) manifest themselves in my findings. It demonstrates how complexity theories may be extended for specific use in physical activity policy research and practice. It indicates that complex realism offers the tools to understand complex systems and how agents operate amid complexity (Byrne, 1998; Byrne and Callaghan, 2014). These theories grow, promulgate and hybridise. Common terms take on new meanings. This compounds the difficulties associated with complexity's fluidity (Cairney, 2012a), and thus emphasises the importance of those seeking to apply and understand it being embedded in the systems we seek to change (Byrne, 2011), so as to be a party to this continual evolution. Future research may consider using and refining Appendix 13 to develop a more formal complexity toolkit for physical activity policy-makers, as has been produced in other domains (*e.g.* Room (2011)).

7.3.3 Developing middle-range theories

A final brief consideration for theory is the development of middle-range theories. Throughout this thesis, I have sought to present generic propositions based on empirical findings in the physical activity policy domain (*e.g.* Chapter Six), which can then be further tested in alternative contexts (Boudon, 1991). While complexity theories do offer a framework for understanding societies more generally, their particular value may be to encourage the development of middle-range theories,

which, when tested, can iteratively progress our understanding of complex systems (Byrne and Callaghan, 2014; Williams, 2020). Complexity is in and of itself quite a broad and overarching theoretical framework that seeks to explain the organisation of societies and societal processes. Middle-range theorising helps to bridge the gap between empirical observations and larger theoretical schemes such as complexity. For example, by empirically identifying that in working amid complexity, people can find themselves detached or alienated from the system as a result of the interactions and practices this seems to entail, this enables the consideration of strategies to address the effects of complex systems on individuals, and by extension what those complex systems must be like and how they operate. To date, however, the explicit application of middle-range theories has been limited in physical activity research. Further study should consider and test the propositions of this thesis, with a particular emphasis on generating refined theories that provide actionable information for those developing and implementing physical activity policy in practice.

7.4 Considerations for practice

My research has interrogated the suitability of complexity theories and systems perspectives for influencing, developing and implementing physical activity policies, and sought to identify conditions that support more effective systems-based approaches. In doing so it complements and extends previous recommendations and guidance (Bagnall *et al.*, 2019; Bellew *et al.*, 2020; Egan *et al.*, 2019; Rütten *et al.*, 2019; Speake *et al.*, 2016). While some have argued that there might be a lack of appetite for cross-sectoral policy responses to physical activity (Das and Horton, 2016), my findings suggest that this may not be the case. Rather, they demonstrate

how policy agents understand the importance of this, but perhaps lack the tools to connect the system effectively. Throughout this thesis, I make suggestions about why this may be, and potential ways to address this issue. In this section I will discuss four key considerations for practice, which include addressing barriers; creating positive systems; being pragmatic; and practising through policy.

7.4.1 Addressing barriers to complex systems approaches

Numerous barriers to the effective practice of complex systems approaches to physical activity policy have been identified in my research. For example, pervasive uncertainty and an unconducive policy environment. These barriers are similar to those described in a recent report, which generally focused on issues of acceptability and lack of user-friendliness of these approaches (Jebb *et al.*, 2021). It is important these barriers are addressed if such approaches are to be optimised. My research provides a series of complementary suggestions to do so, which extend previous recommendations of building the evidence-base, creating a community of practice (see Chapters Five and Six), and facilitating change (see Chapter Six) (Jebb *et al.*, 2021).

A key outstanding issue is the use of terminology. While I have consolidated current conceptualisations of complexity theories in the previous section (see also Appendix 13), there is further to be done to work toward a consistent use of complexity language in policy spheres (Barbrook-Johnson *et al.*, 2020; Cairney, 2012a). While in practice metaphors serve as useful ways to describe systems and their properties (Cairney, 2012a; Gerrits, 2012), in practice, it may be beneficial to unpack terminological and analogical uses of language, and where possible discuss complexity in more literal terms (Anzola *et al.*, 2017). This would be further

complemented by the increased translation of technical concepts into plain language (*e.g.* Boehnert (2018)). Creating communities of practice (Jebb *et al.*, 2021), or dialogical learning systems as described in my research, rather than formal education, can provide the means for this to transpire.

A second issue that needs to be addressed is the relative lack of Public Health policies and programmes that are actually designed from a complex systems perspective, which means that current evidence of their effectiveness is equivocal (Jebb *et al.*, 2021). However, my research has initiated efforts to address concerns about when and how these perspectives may be most appropriate in the physical activity policy context, which can be tested elsewhere. This should be considered alongside the increasingly available guidance for designing and evaluating complexity and systems-based approaches to Public Health programmes (Bellew *et al.*, 2020; Egan *et al.*, 2019; Public Health England, 2019; Skivington *et al.*, 2021).

7.4.2 Fostering positive systems environments

My research identified a previously unconsidered issue in relation to complex systems approaches, namely the need to foster a positive systems environment. While previous studies outlined important practices such as distributed leadership (Uhl-Bien *et al.*, 2007), my research has extended these to suggest how conditions in systems can be manipulated to allow policy agents to flourish in their work. The first step is to recognise that we are constituent parts of the system that can influence or be influenced by it (Byrne, 2009b; Cilliers, 1998).

Second, through understanding how leadership may be the product of emergence, and the processes by which it is distributed, this increases the likelihood of creating a stable leadership and favourable policy environment upon which system

change depends (Bengoa, 2013; King's Fund, 2015). This will remain a challenge, however, without strategies to minimise the turn-over of Public Health services and leadership committees, as well as the regular restructuring of local government. Nevertheless, given that we are better able to identify the interactions between component parts of the physical activity system (Rutter *et al.*, 2019), and thus its key agents, the increased policy involvement of non-traditional health sectors may be easier to incorporate than previously suggested (McKinnon *et al.*, 2011; Milton *et al.*, 2021). Furthermore, policy conflict may therefore be reduced by means other than ambiguity (Oliver *et al.*, 2016a).

Third, similar to previous research, my findings indicated the need for positive engagement of various stakeholders in implementing systems-based approaches to physical activity (Milton *et al.*, 2021). This previous study suggested that communication, advocacy and community asset building are the foundations of strong engagement. While my research supports this argument, it also proposes that it is necessary to consider whether the needs of those working amid complexity and implementing systems-based approaches are being met, or thwarted. The latter is evidently a condition for disengaged system agents. Further research, which I suggest should be grounded in needs theories such as self-determination theory (Deci *et al.*, 2017), is warranted to explore the positive or deleterious effects of complexity and systems on physical activity policy stakeholders, and those of public health promotion more broadly. Meanwhile, those charged with developing systems-based approaches are encouraged to carefully consider individual and collective needs when designing and implementing programmes.

7.4.3 Being pragmatic and realist(ic)

It would be remiss to assume that complexity theories and systems-thinking are a panacea for Public Health. Nevertheless, through careful and pragmatic application they offer cause for optimism. In this context, pragmatism refers to the extent that theories and knowledge are evaluated on the basis of their practical use (Greenwood and Levin, 2007). Murphy *et al.* (2021) demonstrated that the pragmatic application of systems-based approaches, for example applying existing systems-based learning and strategies in a new context, can help navigate the complexities of engaging all relevant physical activity stakeholders. A pragmatic approach is about learning lessons from outcomes that are experienced in practice. Careful documentation and reflection of such lessons is important when working to produce systems-based approaches. Adopting participatory action research designs, in which stakeholders are embedded in the systems of interest, is a proposed way of achieving this co-constructed learning (Byrne, 2011; Murphy *et al.*, 2021). Furthermore, it is also important to consider what aspects of these perspectives are useful to whom, how and in what circumstances. This relies on an understanding of the causal processes that underpin system dynamics and the interactions of policy agents, for which the realist research tradition is particularly suited (Pawson and Tilley, 1997).

7.4.4 Putting complexity theories and systems perspectives into practice through policy

While often advocating complex systems perspectives (*e.g.* House of Lords Sport and Recreation Committee (2021); Sport England, 2021d)), and having identified key sites across the system for policy actions (Milton *et al.*, 2021; World Health Organization, 2018), few Public Health policies have been developed with explicit reference to these approaches (Jebb *et al.*, 2021). This issue warrants redress.

Nevertheless, it is well established that policy-making itself is complex (Cairney and Geyer, 2017; Cairney *et al.*, 2019) and this argument is reinforced in my research, which also contributes to an emerging evidence-base on theories of the policy process as applied to physical activity (Onagbiye and Bester, 2022; Piggin and Hart, 2017; Rütten *et al.*, 2013).

Wicked issues like physical inactivity require strong collaborative responses driven locally from the bottom-up (Wistow *et al.*, 2015). However, the prevailing UK context is one that maintains the prominence of top-down policy (Cairney, 2012a). While this may be deemed problematic to some, participants in my research (especially in the first two studies) consistently voiced their willingness to accept, and appreciation for, a national government steer. The traditional cornerstone of national UK physical activity policy has been the production of physical activity guidelines (Milton and Bauman, 2015). However, in order to advance systems perspectives, it is necessary to move beyond the analysis of policy documents to consider the actions of government more broadly. Policy rhetoric alone may raise awareness of systems approaches, but there needs to be greater emphasis on systemic practices and how to take these approaches forward. It is suggested that whole systems perspectives to physical activity policy should include a focus on addressing the pillars of leadership, governance and knowledge mobilisation (Nau *et al.*, 2020; Oldridge-Turner *et al.*, 2022). My research offers further insight into how this can be done.

For example, the development of intersectoral partnerships among government departments and other relevant public bodies was reported to create policy alignment for physical activity (Milton *et al.*, 2019). My findings further emphasise how collaboration is increasingly prevalent in physical activity practice at

all levels (Milton *et al.*, 2021; Nobles *et al.*, 2022b). What remains unclear, however, are the mechanisms by which through its policies national government is enabling or constraining the efforts of local agents to develop the necessary collaboration and innovation to maximise complex systems approaches. Further research should also consider the stability of existing partnerships and what makes these more or less likely to be sustainable.

Promoting collaboration and innovation through policy is not necessarily easy, however. Policies that promote conditions of willingness, capacity building and opportunities for change through clear goals and knowledge sharing may increase the likelihood of such practices (Patanakul and Pinto, 2014). To effect change in, and through, policy, it is necessary to understand the intricacies of influencing it, and how agenda are shaped (Cairney, 2012b; Giles-Corti *et al.*, 2015; Piggin and Hart, 2017). This understanding can be operationalised in working with physical activity policy-makers to appreciate and respond to the complexity of physical inactivity, and promote innovative approaches to policy design, implementation and evaluation (McKinnon *et al.*, 2011; Rütten *et al.*, 2019).

7.5 Considerations for evidence-informed policy

In this final discussion piece, I assess the potential for complexity theories and systems-thinking to contribute to evidence-informed Public Health policy. Several approaches to increasing evidence-use in policy have been proposed, which are discussed throughout this thesis and elsewhere. These include the development of compelling narratives that demonstrate the political and moral value of research (Cairney and Oliver, 2017; Stamatakis *et al.*, 2010); increasing collaboration and advocacy coalitions (Cairney *et al.*, 2016; Giles-Corti *et al.*, 2015); and greater

reflection on scientific values (Pearce *et al.*, 2014). In the context of complexity, this latter approach is somewhat contradictory to the multiple lens perspective proposed by Head (2008, 2022), and extended and applied through this thesis. However, these strategies must be complemented with an appreciation of the policy environment and its processes, something which is seldom considered in physical activity policy research (Pogrmilovic *et al.*, 2018; Rütten *et al.*, 2016), but which I embed throughout my analyses. Here, I briefly consider my findings in the context of research on the policy concepts of uncertainty and ambiguity (Cairney *et al.*, 2016).

Reducing uncertainty and ambiguity, both of which are concepts related to bounded rationality, can enhance the uptake of evidence in policy (Cairney *et al.*, 2016). Empirical uncertainty (*i.e.* a lack of knowledge or confidence in one's knowledge) was a consistent finding throughout my studies. This can be reduced through the generation of an increased and improved (*i.e.* richer, more rigorously derived) evidence-base (Cairney *et al.*, 2016).

Previous research suggested that the evidence-base about physical activity and associated evaluation frameworks were insensitive to complexity (Ball *et al.*, 2015; Hanson and Jones, 2017; Lewis *et al.*, 2017). However, there has been a rapid expansion in scientific evidence on systems-based approaches to physical activity, as well as evaluation methods (see for example, Cavill (2012); Murphy *et al.* (2021) Nobles *et al.* (2022b); Pinzon *et al.* (2022); Skivington *et al.* (2021); World Health Organization (2018)). Yet, this has not been accompanied by a concomitant interest in complexity and systems-thinking in relation to physical activity policy research. Existing frameworks (*e.g.* Schmid *et al.* (2006)) warrant update in light of the advancement of complexity theories and updated perspectives on the multi-level policy-making environments (Cairney and Geyer, 2017; Cairney *et al.*, 2019). Even

with these necessary adjustments, it is unlikely to force a change in policy approach as they represent just one form of evidence policy-makers may consider. A multiple lens perspective, as adopted in this thesis, can better capture the range of knowledge and information that is used to inform policy. A key lesson from this research process is that complexity theories and systems-thinking are not simply translated into policy, and that there are myriad considerations, one of which includes reducing ambiguity.

Ambiguity is the ability of policy agents to consider more than one framing of a problem (Cairney *et al.*, 2016). This is not to be confused with the idea of policy ambiguity in implementation, whereby there is unclear direction about what policy goals are, who should achieve them and how (Matland, 1995). Nevertheless, this latter construct was also evident in my research (*e.g.* needing to develop a collective system identity). While ambiguity can be addressed in different ways (Cairney *et al.*, 2016), my research suggested that in the physical activity context, a key strategy will be to create a system of policy entrepreneurs who are well-positioned and skilled in persuasion (Kingdon, 2003) to make the case for systems-based approaches as opportune moments arise. This requires political dexterity and a range of policy-relevant communication skills that speak to the irrational decision-making shortcuts of policy-makers, such as combining facts with emotion and exploiting morals and stereotypes (Cairney *et al.*, 2016). It is argued that early engagement with policy-makers can influence the development of complex systems approaches in ways that are grounded in practical realities (Jebb *et al.*, 2021). However, I suggest that we should go further than that, and ensure that we are embedded in the policy system in an ongoing dialogical exchange of information. This can help overcome issues of complexity being either too abstract (*e.g.* concepts such as emergence and self-

organisation) or banal (*e.g.* increasing collaboration) for policy officials to engage with, by co-developing toolkits that demonstrate the complexity of the policy environment and maximising theoretical perspectives in a user-friendly way (*e.g.* see Appendix 13) (Cairney, 2015). Whether this extends to the need for a common language across policy settings is unclear.

7.5.1 Direct implications for physical activity policy

Having set out the potential contributions of complexity theories and systems thinking to evidence-informed Public Health policy, it is prudent to reflect on the practical implications for physical activity policy that arise from this study's findings. In particular, my research points toward four strategies that may support UK policy efforts to *'create active systems'* (World Health Organization, 2018, p.25). These include: i) how, in practice, systems-approaches may be promoted; ii) developing a new systems-based framework for physical activity policy; iii) securing investment; and iv) reinforcing research systems. Each is discussed briefly in turn.

First, policy action should encourage and adopt a pragmatic approach to framing whole systems responses for physical activity. As demonstrated in this thesis, the nature of complexity theories are particularly challenging for many people to understand. Therefore, it is necessary to engage physical activity stakeholders, which crucially include members of the public, in discussions and actions that relate to systems change, without necessarily being packaged in this way. For example, creating a political, policy and practice-based emphasis on creating healthy communities (*e.g.* Arai and Pedlar, 1997; Pate *et al.*, 2015), which indirectly reflect the intended aims of a systems-based approach to physical activity (see Table 3) and public health more broadly, may hold promise. An illustrative example of developing

a healthy community underpinned by a systems-based approach to physical activity is in Greater Manchester, UK (Shearn *et al.*, 2021).

Second, and conversely, it is also recommended that governments reflect on the physical activity policy system with a more explicit complex systems-framing. Currently, the UK policy landscape remains characterised by significant siloed working and outdated implementation responses. Developing a new systems-based framework will facilitate multi-sectoral collaboration, and better enable decision-makers and practitioners to understand and respond to the complexities of policy-making itself, as well the features that characterise the complex systems they seek to change. Furthermore, this framework should emphasise cross-sectoral policy alignment, monitoring and evaluation. There is a range of published guidance on developing systems-based approaches to physical activity policy from different countries (Bellew *et al.*, 2020; Murphy *et al.*, 2021; Rutter *et al.*, 2019; World Health Organization, 2018).

Third, it is important for policy-makers to advocate for physical activity investment across policy sectors, given the strong return on investment potential (Sport England, 2020c). Systems-based approaches to physical activity need to be supported by appropriate funding and incentives, which prioritise longer-term and cross-sectoral objectives where possible, to support the sustained implementation of policy programmes (World Health Organization, 2018). In the UK, this may practically include working with His Majesty's Treasury to broker pooled budgets to support work toward cross-departmental targets for physical activity promotion, which may be identified through the aforementioned systems framework. This may be accompanied by the commissioning of further economic evaluations of systems

approaches, which are typically lacking, while also reflecting the need to prioritise research and knowledge creation more broadly.

Finally, my findings suggest a need for policy-makers to increase their support for research into developing, implementing and evaluating systems-based approaches to physical activity. This may include identifying and disseminating national priorities for understanding gaps in knowledge of the system; encouraging funders (*e.g.* research councils) to prioritise projects that address these priorities, while enabling continued methodological development; and commissioning and supporting the development of a new strategic approach to whole systems surveillance, which extends beyond prevalence of population physical activity levels (*e.g.* Bellew *et al.*, 2022; World Health Organization, 2018). By establishing and supporting a national network of localised dialogical learning systems, as described in this thesis, this has the potential to accelerate the sharing of such knowledge about physical activity and the system that enables or constrains it.

7.6 Limitations and future research directions

This study offers an exploration of complexity theories as applied to the physical activity policy domain. It has been shaped both by my conscious decisions as the researcher, as well as circumstances beyond my control. This has led to some inherent limitations in terms of design and focus. I present these limitations alongside recommendations for future research, which complement those already discussed in the findings of Chapters Four-to-Six, as well as earlier in this discussion.

In researching complex systems, it is not necessarily possible or desirable to examine the system in its entirety. Based on the significance of policy action for creating system change for physical activity (World Health Organization, 2018), I

purposely selected policy as the context of focus for this study. This research is therefore contextually, as well geographically and temporally, bound. While direct generalisations to other contexts cannot be made, the empirical and theoretical contributions set out in this thesis can be explored in terms of causal mechanisms, and thus tested in different contexts to identify points of similarity and difference. Future research should seek to continue to advance knowledge within this specific policy context as the system will change over time (Byrne and Callaghan, 2014), but also in other related domains that contribute to a fuller appreciation of the physical activity system.

Related to the first, a second limitation of my study was the lack of participation among agents from the education and sport sectors in national government positions. This was not for a lack of extensive recruitment efforts, however. Nevertheless, stakeholders within these policy domains, each bringing an added-value perspective to the system (Hester *et al.*, 2012), have been identified as being located at the centre of the system's problems and principal contributors to solutions for promoting physical activity (Milton *et al.*, 2021; Rutter *et al.*, 2019). The implications of their absence are three-fold.

First, insufficient diversity in stakeholder engagement precludes the development of richer descriptions of systems (Jebb *et al.* 2021), which in turn may inhibit the capacity for system agents to co-evolve and adapt to changing circumstances and evidence (Kovacs, 2016; Room, 2011). Participation among the sport and education sectors, for example, has the potential to elicit information that is uniquely held within these domains. These perspectives may be complementary or contradictory to the view presented by participants in this study. It is necessary to try to understand the involvement of these sectors in physical activity policy from a

systems perspective (as well as their lack of involvement in the research). This may further our knowledge of how complexity and the physical activity system is understood and responded to in different sections of government.

Second, the absence of key stakeholders precludes their ability to rebut claims made against them. For example, in the first study (see Chapter Four), one participant perceived that the sport sector had a propensity to avoid meaningful collaboration with the health sector. Given that all voices do not necessarily contribute to a truthful narrative about a system (Byrne, 2011), without counter-arguments, it is harder to verify the narrative presented in the research findings. Future studies should develop strategies to engage missing voices and empower these stakeholders to contribute their perspective (Haynes *et al.*, 2020).

Third, without the participation of certain sectors, pathways to impact from this study may be obstructed. Diversity of stakeholders in systems research is important for knowledge translation (Laird *et al.*, 2020; Rütten *et al.*, 2019). Through the multiple-lens approach adopted, the knowledge created in this study is intended to foster cross-sectoral engagement and lead to actionable recommendations for policy and practice. Given the centrality of the education and sport sectors in this system, the potential to boundary-span and mobilise knowledge about complexity theories is dampened by their absence. Further research is needed to understand how these stakeholders can enhance the mobilisation and implementation of research findings (Laird *et al.*, 2020), across the physical activity policy system.

Furthermore, as highlighted in the limitations of Chapters Four-to-Six, this study did not explicitly examine how, if at all, different perceptions of complexity can be reconciled across policy sectors. While I have assimilated core tenets of complexity theories as expressed through my data, there remains significant

opportunities to validate these, and study the mechanisms that underpin knowledge mobilisation and implementation across sectors engaged in physical activity policy.

This study was also limited by the effect of the SARS-Cov-2 pandemic, I was unable to complete some of my intended research activities. While through the data collected in study two (see Chapter Five), I was able to make preliminary observations about system leadership and policy implementation, I recommend that in future scholars pay greater attention to these constructs. There is particularly space for the application of action research methods and techniques such as process tracing (George and Bennett, 2005). This will strengthen knowledge of the relationships identified between leadership and implementation in this study, as well as the complex dynamics of the policy implementation systems.

Finally, given the nature of complexity theories, the research sometimes presented challenges to participants in trying to understand the material and make informed contributions. While through a process of reflection and learning, my skills in communicating complexity improved, this is reflective of the wider uncertainty that persists around systems approaches in Public Health (Jebb *et al.*, 2021). There remains much work to normalise and simplify ideas related complex systems perspectives to Public Health research, but also making these accessible beyond this in policy, practice and among the public too. Therefore, the ideas presented here may also benefit from exploration of population groups' social practices in the co-production of active systems (Rütten *et al.*, 2019).

7.7 Overall conclusions

This programme of research has demonstrated that, similar to other aspects of Public Health systems research, complexity and physical activity policy is a rapidly

evolving domain. While the benefit of applying complex systems approaches to physical activity policy is generally supported, the findings highlight that continued travel in this direction warrants increased reflection on several important considerations; for example, addressing continued uncertainty, issues of detachment and alienation from complex systems, and the refinement of complexity theories for contextual relevance.

On the basis of the work presented in this thesis, I argue that a more critical application of systems-based approaches to physical activity policy is needed, as their foundational evidence-base remains contested. Alone, complexity theories cannot provide the knowledge and tools to develop more effective systems-based approaches to physical activity policy and programmes. Rather, this requires a broader evidence-base to inform the development of supportive and rewarding policy environments. Nevertheless, complexity theories provide a framework for understanding physical inactivity as a complex public health issue, and the structures and agency of the policy system that surrounds it. In this manner, they help to identify leverage points in the policy system, in both space and time. They encourage us to reorientate efforts, across research, policy and practice, from the whole system toward agency, mobilisation, and application of complex systems perspectives in physical activity policy to strengthen collective impact. In turn, this may help address persistent challenges in physical activity and public health promotion more generally.

My thesis presents several considerations to advance this school of thought. I hope that the longer-term value of this work is that it demonstrates and inspires our collective ability to make theoretical and practical progress, through post-disciplinary research that enables us to examine complexity in ways that are critical, yet contextually relevant and beneficially applied.

Fīnis

8. Appendices

Appendix 1 - Study 3: Padlet board questions and content

Padlet board	1. Your reflections on previous research findings	2. Stimulating change in systems cultures and practices	3. How to mobilise knowledge of complexity theories and systems-thinking
Discussion questions	a. What would you like to know about complexity, systems and policy. Initial thoughts or concerns. b. Which aspects of complexity and systems-thinking do we need to improve understanding of?	a. Problems – what needs to change in this policy space? • *Things to consider: radical vs incremental change, policies, culture, practices.* b. Solutions – how can we stimulate these changes? • *What are the mechanisms?* c. What practical steps are required to make these happen?	a. How can complexity and systems-thinking contribute to more effective physical activity policy? • *Which aspects are useful, to whom and in which circumstances?* b. What are the limitations to these approaches? c. How can we motivate this policy domain to engage in complexity and systems-thinking? d. How do we take these approaches further?
Resources	i. Link to pre-workshop video. ii. Link to visual representation of key features of complex systems, created by CECAN.	i. Link to pre-workshop video. ii. Link to visual representation of key features of complex systems, created by CECAN.	i. Link to pre-workshop video. ii. Link to visual representation of key features of complex systems, created by CECAN.

	iii. Links to the Padlet boards being populated by the other breakout groups.	iii. Links to the Padlet boards being populated by the other breakout groups.	iii. Links to the Padlet boards being populated by the other breakout groups.

Appendix 2 – Study 1: participant information sheet

Participant Information Sheet

Study Title: Exploring how policy-makers understand and react to the complexity of physical activity promotion

What is the purpose of this study?

This study is part of a wider Ph.D. programme of research that explores the challenges of evidence-informed policy-making in the physical activity domain. It will test the extent to which academic theories of complexity may help our understanding of, and offer solutions to, these challenges. Specifically, this initial study explores what complexity means to national-level policy-makers and their work, by inviting them to share their views and experiences of physical activity promotion.

What is meant by physical activity in this context?

Physical activity is a broad term referring to all bodily movement that uses energy. It has known benefits for health and social outcomes. It includes, but is not limited to, sport, exercise and physical education, as well as generic activities such as walking, cycling or daily-living activities. Therefore, we are seeking policy-makers from across the national-level physical activity promotion sector.

Why national-level policy-makers?

National policies are known to be important for providing overarching direction to the sector, and creating conditions in which innovative and collaborative physical activity promotion efforts may be developed and evaluated to meet local needs.

Why have I been invited to participate?

You have been invited to take part in this study as you are, or have been, involved in the development and delivery of national-level policy, including for physical activity. There is no obligation to participate in this study. Participation is voluntary.

What will participation entail?

If you are willing to do so, you will be invited to take part in a one-to-one interview that involves asking you about several pre-determined topics:

- the challenges of policy-making in this domain
- ways in which academic research evidence may inform policy-making
- perceived complexities of physical activity promotion
- strategies for managing this complexity

It is anticipated that interviews may last for between 60 and 90 minutes. However, there is flexibility to keep time commitment to a minimum.

Interviews will be conducted by Benjamin Rigby, an Economic and Social Research Council-funded Ph.D. researcher in the Department of Sociology, Durham University. They will take place at an agreed time and location to suit the participant.

There is the option for interviews to be conducted face-to-face, via telephone, or via online media.

What are the risks of participation?

We do not foresee any risks to participation and will ensure that you are made to feel as comfortable as possible. You may refuse to respond to questions or topics that you do not wish to discuss.

How will collected data be used?

Data collected will only be used for the purpose of analysing the aforementioned topics. Analysis will involve collating responses from all of the interviews and producing a series of themes that best summarise what has been discussed, or that highlight any key differences in responses.

General findings will be included in the lead researcher's doctoral thesis and potentially in academic publication or presentation.

Participants should be aware that as this is quite a small-scale and specific project, it may be possible for readers of the final research to infer groups that have been involved. Therefore, all participants will have the opportunity to see their own data at various stages, including pre-publication, to confirm that they are happy for the findings to be used as proposed by the researcher.

Every effort will be made to ensure that all data that you provide is anonymised and remains confidential. No personal identifying information will be included in the write-up of findings. With your permission, interviews will be recorded using a digital audio device. Once the conversation has been typed-up for analysis, the audio file will be deleted from the device. All data and files will be held on a password-protected computer. Signed consent forms will be filed securely under lock in the Durham University Department of Sociology building.

In the unlikely event of the need to change the way in which data and files are handled, participants will receive written notification of this.

If I agree to take part, can I subsequently withdraw?

Participants will reserve the right to withdraw themselves or their data from the study at any time without justification, up to 31st October 2018. To withdraw, participants

will need to email the lead researcher. Any participant information or data held at this time will be destroyed so far as is feasible.

What will happen after data collection and analysis are complete?

Following the completion of data collection and analysis, participants will receive:

- A copy of the interview transcript with invitation to make comment or clarification
- A report of best practice for physical activity policy generation and implementation (please note, permission will be sought for any identifiable examples of best practice)
- Invitation for them, or their representatives, to attend a networking and dissemination event regarding the project in late 2018

How do I respond to this invitation?

If you are happy to participate in this study, please simply respond to the email address below. You will then be sent a consent form for your consideration. On the return of this, Benjamin will arrange a suitable time and location for the interview.

If you do not wish to participate, please express this in an email reply. This will avoid unnecessary follow-up emails. We would be grateful if you may be able to suggest alternative contacts better placed to respond.

Contact details:

Please feel free to contact lead researcher, Benjamin Rigby, with any comments or queries that you may have. He can be contacted in the following ways

Email (preferred)**:** benjamin.p.rigby@durham.ac.uk
Tel (Mon-Fri, 9am to 5pm)**:** [redacted]
Address: Department of Sociology, Durham University, 32 Old Elvet, Durham, DH1 3HN

Personal profile:
https://www.dur.ac.uk/research/directory/staff/?mode=staff&id=15232

Thank you

Mr Benjamin Rigby (lead researcher, Ph.D. candidate)
Dr Emily Oliver (project supervisor)
Dr Caroline Dodd-Reynolds (project supervisor)

Appendix 3 – Study 1: consent form

Participant Consent Form

All participants must provide their informed consent. This ensures that you understand why the research is being done, what taking part means for you, how the data you provide will be used, and that you have had opportunity to ask questions or raise any concerns.

Please review the following statements carefully and select an appropriate response from the boxes provided. Upon completion, please print your name, sign (electronic or written) and date the form in the spaces provided. A copy should be forwarded to Benjamin at the email address below.

If you have any further questions or queries, you may contact Benjamin Rigby (lead researcher) at any time by email: benjamin.p.rigby@durham.ac.uk

	Yes	No
	(Please tick)	
I confirm that I have read and understood the participant information sheet, and have been given opportunity to ask questions or raise concerns.		
I understand that participation is voluntary and that I may withdraw at any time without justification before the deadlines in the information sheet.		
I agree to have the interview recorded and later transcribed for analysis.		
I understand how data will be used and stored during this study, including how it will be anonymised and kept confidential.		
I understand that I may refuse to respond to any given question or topic, or ask for the interview to be terminated without justification.		
I agree not to discuss the content of this interview with others without express consent of the researcher.		
I understand that I can keep a copy of this form for my records.		
I am happy to be contacted about a second study, and understand that I may alter this preference at any time by contacting the lead researcher via email.		

Having read the participant information sheet and the statements above, I consent to taking part in an interview for the purposes related to the aforementioned doctoral research programme.

Participant	**Researcher**
Name (print):	Name (print): Benjamin Rigby
Signature:	Signature:
Date:	Date:

Appendix 4 – Study 1: COREQ checklist

Section/topic	#	Checklist item	Reported on page(s)
Domain 1: Research team and reflexivity			
Personal characteristics	1	Interviewer/facilitator – *which author/s conducted the interview or focus group?*	148
	2	Credentials – *what were the researcher's credentials?*	148
	3	Occupation – *what was their occupation at the time of the study?*	148
	4	Gender – *was the researcher male or female?*	148
	5	Experience and training – *what experience or training did the researcher have?*	148
Relationship with participants	6	Relationship established – w*as a relationship established prior to study commencement?*	148
	7	Participant knowledge of the interviewer – *what did the participants know about the researcher (e.g. personal goals, reasons for doing the research)?*	148-149
	8	Interviewer characteristics – *what characteristics were reported about the interviewer/facilitator (e.g. bias, assumptions, reasons and interests in the research topic)?*	148-149
Theoretical framework	9	Methodological orientation and theory – *what methodological orientation was stated to underpin the study (e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis)?*	144
Participant selection	10	Sampling – *how were participants selected (e.g. purposive, convenience, consecutive, snowball)?*	146
	11	Method of approach – *how were the participants approached (e.g. face-to-face, telephone, mail, email)?*	146
	12	Sample size – *how many participants were in the study?*	147
	13	Non-participation – *how many people refused to participate or dropped out? Reasons?*	147
Setting	14	Setting of data collection – *where was the data collected (e.g. home, clinic, workplace)?*	149
	15	Presence of non-participants – *was anyone else present besides the participants and researchers?*	149

Section/topic	#	Checklist item	Reported on page(s)
Setting (cont.)	16	Description of the sample – *what were the important characteristics of the sample (e.g. demographic data, date)?*	147
Data collection	17	Interview guide – *were questions, prompts, guides provided by the authors? Was it pilot tested?*	145-146, 149
	18	Repeat interviews – *were repeat interviews carried out? If yes, how many?*	145
	19	Audio/visual recording – *did the research use audio or visual recording to collect the data?*	149
	20	Field notes – *were field notes made during and/or after the interview or focus group?*	149
	21	Duration – *what was the duration of the interviews and focus groups?*	149
	22	Data saturation – *was data saturation discussed?*	146
	23	Transcripts returned – *were transcripts returned to participants for comment and/or correction?*	150
Domain 3: analysis and findings			
Data analysis	24	Number of data coders – *how many data coders coded the data?*	150
	25	Description of the coding tree – *did authors provide a description of the coding tree?*	N/A
	26	Derivation of themes – *were themes identified in advance or derived from the data?*	150
	27	Software – *what software, if applicable, was used to manage the data?*	150
	28	Participant checking – *did participants provide feedback on the findings?*	150
Reporting	29	Quotations presented – *were participant quotations presented to illustrate themes/findings? Was each quotation identified (e.g. participant number)?*	148, 151-180
	30	Data and findings consistent - *was there consistency between the data presented and the findings?*	151-180
	31	Clarity of major themes – *were major themes clearly presented in the findings?*	151-180
	32	Clarity of minor themes – *is there a description of diverse cases or discussion of minor themes?*	151-180

Appendix 5 – Study 1: interview guide

Interview Guide

Salutations and pleasantries.

Thank participant.

Check timings – how long do they have?

Introduction

Remind participant:

- *Who I am*
- *Exploring the challenges of physical activity promotion – policy perspective*
- *Particular interest in inequalities*

Reassure no right or wrong answers – interested in your views, experiences and expertise on the research area.

Any questions and queries before start.

Obtain verbal consent and explicitly start recording.

Facesheet information (if necessary)

Age, gender, ethnicity, time in current role, activity levels, descriptor.

Introduction

- Can you describe your current role and how it relates to physical activity and policy?

Physical Activity

- In your experience what are the biggest challenges in promoting physical activity and exercise?
  - How may these be addressed?
  - How can we address inequalities?
  - Whose responsibility is physical activity promotion?
  - Is policy a useful tool in trying to influence population health behaviours such as physical activity?
  - Knowing that policy and guidance will land differently in different places, how do you try to account for that in your work?

- What are the challenges to developing a collaborative cross-government approach to increasing public health and physical activity participation among the general population?
    - How do you manage these challenges?
    - What more needs to be done?
    - What are the key features of successful collaboration, for example, Public Health and sport are more closely aligned, what has been key to that? And what challenges do you still face? How can you convince the sport sector that this is what they should be doing?

Complexity

- Some people have described physical inactivity as a complex problem in need of complex solutions. What does complexity mean to you in the context of physical inactivity?

- To what extent do these ideas and the notion of whole-systems approaches influence your work?
    - How do they relate to policy-making?
    - How may they influence the policies and programmes which are developed to promote physical activity?

Influencing policy

- How does academic research inform your work in developing policy in this area?
    - As policy-makers, how do you prioritise the vast array of evidence and signals you receive?
    - Do you feel engaged with the research process?

- Which other factors influence your decision making in this area?
    - Who do you take advice from?
    - Are you more receptive to creating policy change at particular times?

- How important are your values and beliefs in your decision-making around this topic?
    - How have these been shaped and by whom?

The Future

- What advice would you give to academic researchers trying to influence your work?

Thank participant.

Explain next steps and discuss summary sheet.

Appendix 6 – Study 2: COREQ checklist

Section/topic	#	Checklist item	Reported on page(s)
Domain 1: Research team and reflexivity			
Personal characteristics	1	Interviewer/facilitator – *which author/s conducted the interview or focus group?*	198
	2	Credentials – *what were the researcher's credentials?*	N/A
	3	Occupation – *what was their occupation at the time of the study?*	N/A
	4	Gender – *was the researcher male or female?*	N/A
	5	Experience and training – *what experience or training did the researcher have?*	N/A
Relationship with participants	6	Relationship established – w*as a relationship established prior to study commencement?*	198-199
	7	Participant knowledge of the interviewer – *what did the participants know about the researcher (e.g. personal goals, reasons for doing the research)?*	199
	8	Interviewer characteristics – *what characteristics were reported about the interviewer/facilitator (e.g. bias, assumptions, reasons and interests in the research topic)?*	199
Domain 2: Study design			
Theoretical framework	9	Methodological orientation and theory – *what methodological orientation was stated to underpin the study (e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis)?*	197
Participant selection	10	Sampling – *how were participants selected (e.g. purposive, convenience, consecutive, snowball)?*	198
	11	Method of approach – *how were the participants approached (e.g. face-to-face, telephone, mail, email)?*	198
	12	Sample size – *how many participants were in the study?*	200-201
	13	Non-participation – *how many people refused to participate or dropped out? Reasons?*	198
Setting	14	Setting of data collection – *where was the data collected (e.g. home, clinic, workplace)?*	198

	15	Presence of non-participants – *was anyone else present besides the participants and researchers?*	198
Section/topic	**#**	**Checklist item**	**Reported on page #**
Setting (cont.)	16	Description of the sample – *what the important characteristics of the sample (e.g. demographic data, date)?*	201
Data collection	17	Interview guide – *were questions, prompts, guides provided by the authors? Was it pilot tested?*	197, 199
	18	Repeat interviews – *were repeat interviews carried out? If yes, how many?*	197
	19	Audio/visual recording – *did the research use audio or visual recording to collect the data?*	199
	20	Field notes – *were field notes made during and/or after the interview or focus group?*	199
	21	Duration – *what was the duration of the interviews and focus groups?*	199
	22	Data saturation – *was data saturation discussed?*	198
	23	Transcripts returned – *were transcripts returned to participants for comment and/or correction?*	199
Domain 3: analysis and findings			
Data analysis	24	Number of data coders – *how many data coders coded the data?*	200
	25	Description of the coding tree – *did authors provide a description of the coding tree?*	N/A
	26	Derivation of themes – *were themes identified in advance or derived from the data?*	200
	27	Software – *what software, if applicable, was used to manage the data?*	200
	28	Participant checking – *did participants provide feedback on the findings?*	199
Reporting	29	Quotations presented – *were participant quotations presented to illustrate themes/findings? Was each quotation identified (e.g. participant number)?*	202-214
	30	Data and findings consistent - *was there consistency between the data presented and the findings?*	202-214
	31	Clarity of major themes – *were major themes clearly presented in the findings?*	202-214

Section/topic	#	Checklist item	Reported on page(s)
Reporting (cont.)	32	Clarity of minor themes – *is there a description of diverse cases or discussion of minor themes?*	202-214

Appendix 7 – Study 2: participant information sheet

Participant Information Sheet

Study Title: Exploring leadership and policy implementation for promoting physical activity in [redacted].

What is the purpose of this study?

This study will give volunteers from the [redacted] partnership an opportunity to discuss experiences of:

- Leadership in promoting physical activity.
- Putting UK-wide policies into action in [redacted].
- Supporting cross-sector working for physical activity promotion.

This study forms part of Benjamin Rigby's (Ben) Ph.D. research. Working alongside [redacted] through a broader action research approach, Ben aims to support stakeholders in identifying and making changes in cultures, policies or practices that may enhance the implementation of the UK Chief Medical Officers' physical activity guidelines in the [redacted]. In particular, it will explore the role of leadership in connecting local systems and facilitating physical activity promotion.

Why have I been invited to participate?

You have been invited to take part in this study as you are, or have been, involved in the [redacted] partnership leadership group. Through this partnership you will have had experience of connecting people, organisations and sectors in promoting physical activity locally. There is no obligation to take part in this study. Participation is voluntary.

What will participation entail?

If you are willing to do so, you will be invited to take part in a one-to-one interview that involves asking you about several pre-determined topics that are related to local circumstances, leadership and policy implementation for physical activity promotion.

It is anticipated that these interviews may last for between 45 and 90 minutes. However, there is flexibility to keep time commitment to a minimum.

Interviews will be conducted by Ben, who is an experienced qualitative researcher. They will take place at an agreed time and location to suit the participant.

There is the option for interviews to be conducted face-to-face, via telephone, or via online media.

How will collected data be used?

Data collected will only be used for the purpose of analysing the aforementioned topics. Analysis will involve collating responses from all of the interviews and producing a series of themes that best summarise what has been discussed, or that highlight any key differences in responses.

General findings will be included in the lead researcher's doctoral thesis and potentially in academic publication or presentation.

Participants should be aware that this project is specific to members of the [redacted] leadership group, consequently data will be generated from among a known group of individuals. It is proposed that data will be fed-back to leadership meetings to aid the project and inform further stages of the research project. Participants will be given the opportunity to ask for any interview responses to be withheld for the purposes of these meetings.

Every effort will be made to ensure that all data that you provide is anonymised and remains confidential. No personal identifying information will be included in the write-up of findings. With your permission, interviews will be recorded using a digital audio device or mobile phone. Once the conversation has been typed-up for analysis, the audio file will be deleted from the device. All data will be held on a password-protected computer. Signed consent forms will be filed securely under lock in the Durham University Department of Sociology building. Data will be held in accordance with the University's research data management policy: https://www.dur.ac.uk/research.innovation/governance/policy/rdm/

In the unlikely event of the need to change the way in which data and files are handled, participants will receive written notification of this.

If I agree to take part, can I subsequently withdraw?

Participants will reserve the right to withdraw themselves or their data from the study at any time without justification, up to 31st May 2020. To withdraw, participants will need to email the lead researcher. Any participant information or data held at this time will be destroyed.

What will happen after data collection and analysis are complete?

Following the completion of data collection and analysis, participants will receive:

- A copy of the interview transcript with invitation to make comment or clarification.
- Invitation to attend a subsequent [redacted] meeting for the dissemination of findings.
- An invitation to a stakeholder workshop to discuss leadership and implementation with wider stakeholders.

How do I respond to this invitation?

If you are happy to participate in this study, please simply respond to the email address below. You will then be sent a consent form for your consideration. On the return of this, Benjamin will arrange a suitable time and location for the interview.

If you do not wish to participate, please express this in an email reply. This will avoid unnecessary follow-up emails. We would be grateful if you may be able to suggest alternative contacts better placed to respond.

Contact details:

Please feel free to contact lead researcher, Benjamin Rigby, with any comments or queries that you may have. He can be contacted in the following ways:

Email (preferred)**:** benjamin.p.rigby@durham.ac.uk
Tel (Mon-Fri, 9am to 5pm)**:** [redacted]
Address: Department of Sociology, Durham University, 32 Old Elvet, Durham, DH1 3HN

Personal profile:
https://www.dur.ac.uk/research/directory/staff/?mode=staff&id=15232

Thank you

Mr Benjamin Rigby (lead researcher, Ph.D. candidate)
Dr Emily Oliver (project supervisor)
Dr Caroline Dodd-Reynolds (project supervisor)

Appendix 8 – Study 2: consent form

Participant Consent Form

All interview participants must provide their informed consent. This ensures that you understand why the research is being done, what taking part means for you, how the data you provide will be used, and that you have had opportunity to ask questions or raise any concerns.

Please review the following statements carefully and select an appropriate response from the boxes provided. Upon completion, please print your name, sign (electronic or written) and date the form in the spaces provided. A copy should be returned by hand or to the email address below.

If you have any further questions or queries, you may contact Benjamin Rigby (lead researcher) at any time by email: benjamin.p.rigby@durham.ac.uk

	Yes	**No**
	(Please tick)	
I confirm that I have read and understood the participant information sheet, and have been given opportunity to ask questions or raise concerns.		
I understand that participation is voluntary and that I may withdraw at any time without justification before the deadline written in the information sheet.		
I agree to participate in this interview.		
I understand how data will be used and stored during this study, including how it will be anonymised and kept confidential, as outlined on the information sheet.		
I understand that I may refuse to respond to any given question or topic, or ask for my involvement in any activity to be terminated without justification.		
I am happy to be contacted for other activities related to this research project, including the system mapping workshop and observation diaries.		
I understand that I can keep a copy of this form for my records.		

Having read the participant information sheet and the statements above, I consent to taking part in in the project for the purposes related to the aforementioned doctoral research programme.

Participant	**Researcher**
Name (print):	Name (print): Benjamin Rigby
Signature:	Signature:
Date:	Date:

Appendix 9 – Study 2: interview guide

Interview Guide

Remind about the context of the research – any questions.

Get verbal permission to record.

Introductions and background info

- Face sheet and demographic information.
- Participant's background, their current role, and their organisation's role.
- What is unique about [redacted] (*e.g.* cultural, social, economic, political factors) and how does this influence the way you promote physical activity?

Leadership

Preamble
In previous work, understanding local leadership was reported to be a key challenge of physical activity promotion nationally. The kind of leadership we're interested in encompasses people, organisations, policies and practices, anything that enables other people and organisations at all levels to work productively to their potential.

System leadership is about how one leads across boundaries (e.g. departmental, organisational or sectoral), as well as internally within these. It is about how one can influence and connect people, rather than manage them, even when one is not 'in charge'. System leaders are distinguished by operating across services and organisations, almost invariably in circumstances of considerable complexity.

Examples of system leadership raised in previous work include: prescribed leaders such as active travel commissioners; developing policies that mandate interdependent working; and more informal community leadership models that open up the physical activity sector.

This study will explore how these factors influence physical activity policy implementation in [redacted].

- Who, or what, offered leadership on physical activity promotion within the [redacted] partnership (before the transition phase)?
    - *Prompt – who more broadly within* [redacted]*?*
    - *Prompt - What did this leadership look like?*
- How do you think leadership is being facilitated or inhibited in physical activity promotion locally?

- <u>*Prompt*</u> – how do you envisage the new [redacted] transition helping or hindering the process?

<u>Implementation</u>

Preamble
Implementation involves translating the goals and objectives of a policy into an action. In this study, I am particularly interested in your views related to implementing the CMO's National Physical Activity Guidelines across the system, but invite you to discuss your experiences related to all policies. These may include:

- *PHE - Everybody Active, Every Day*
- *DCMS strategy - Sporting Futures;*
- *Sport England strategy – Towards an Active Nation;*
- *DfT - Cycling and Walking Investment Strategy;*
- *DHSC - CMOs' 2019 physical activity guidelines*

- Reflecting on these various policies, or others that you are aware of, did any have a particular influence on the way that you work?

- How has the shift in policy emphasis from sport for sports sake (*e.g.* participation rates), to sport and physical activity for health and other social outcomes, and more recently related to underrepresented groups in society, impacted work in the sector?

- How have you, or your organisation, taken previous national policy messages and adapted them for the local context?

    - <u>*Prompt*</u> *- Are the policy messages from national government useful when addressing local physical inactivity? Why? Are there any issues with them?*

- With specific regard to [redacted] pre-transition, how central was this organisation to acquiring and distributing information about policies? How did it do this, if at all?

- How did [redacted] seek to influence its partnership members to respond to policy messages, given its relative lack of authority?

    - <u>*Prompt*</u> *- Have you experienced any conflict among individuals or organisations?*

- Looking forward, how may the new [redacted] partnership create opportunities to put policy into action?
    - <u>*Prompt*</u> *– You may wish to consider the following – capacity to structure and mobilise networks of organisations; the allocation of resources; opportunities for leadership; added authority.*

- How can we translate the national physical activity guidelines into local goals and actions?
    - *Prompts – who is involved? what is to be done? what, if anything, is currently preventing this from happening? How may we overcome this?*

Debrief

- Opportunity to raise any questions or concerns with the researcher.
- Next steps.

Appendix 10 – Study 3: participant information sheet

Durham University
Department of Sociology

Workshop Information Sheet

Making complexity theories and systems-thinking work for physical activity policy

Thank you for expressing interest in this workshop, in which we will explore the concepts of complexity and systems-thinking in the physical activity policy domain. By gaining insight into your thoughts and experiences, we can better understand how to make the most of these concepts in policy processes to better promote population physical activity.

What are complexity and systems-thinking?

Definitions in complexity sciences remain debateable, and to some extent we hope you can help us create clear ideas in relation to physical activity policy. However, it is generally accepted that complexity focuses on the behaviours and interactions within and between systems, which are largely unpredictable. Complex systems characteristics include:

> *"Their adaptive and dynamic nature, feedback loops, multiple scales, thresholds for change, areas of high and low stability, and open or ill-defined boundaries that can span (socio-technical) domains or areas of expertise and responsibility. Such features result in systems characterised by tipping points, non-linearity, emergent properties, and unpredictability (Barbrook-Johnson et al.*, 2020)*."*

Please note, a glossary of terms will be made available to participants for use during the workshop.

What is involved?

We are aiming to bring together a range of stakeholders with interests and expertise in physical activity, policy or complex systems to identify ways in which the concepts of complexity and systems-thinking can be operationalised in practice to support those promoting physical activity and advocating system change. Expertise in this regard is considered those whose organisational roles specifically focus on the idea of systems (in any sector) or that span departments, policy arenas or similar. Therefore, we would like to invite you to take part.

We would like to conduct an online workshop with yourself and other stakeholders to discuss your views and experiences of complexity and systems-thinking:

Participants will be encouraged to view a short video (10-15 mins) prior to the workshop that highlights recent research and provides background information. The workshop will be conducted using Zoom and an online discussion board, facilitated by Ben Rigby (ESRC Ph.D. candidate and lead researcher). The workshop will be recorded, upon your consent. We plan the event to last 3 hours (half-day) to ensure we can explore a range of questions about your experiences and opinions of these topics in suitable depth.

We anticipate that the resources shared with participants, the workshop itself, and the resulting reports will be of professional and intellectual interest. As such, we anticipate that most (if not all) will be able to participate as part of their job role, during typical working hours. The workshop will take place between 1:30pm and 4:30pm (UK time) on Monday 1st March 2021. Benefit to your organisation will include a summary of findings and recommendations, which we would encourage you to share more widely.

Confidentiality and data handling:

The project complies with the Data Protection Act (2018) and the General Data Protection Regulation (2018). Participating stakeholders will be aware of each other. However, all data will be strictly confidential and anonymised (you will be given a pseudonym). Full details about how data will be stored and processed can be found in the accompanying ***Privacy Notice.*** In the unlikely event of the need to change the way in which data are handled, you will receive written notification.

The Zoom workshop will be hosted through Durham University's secure licence.

Voluntary participation

Participation is voluntary. Should you wish to withdraw, please contact the lead researcher. You can withdraw up to 10 days after the completion of the workshop (*i.e.* your contributions will be discarded). You do not need to give any reasons for your withdrawal request.

Where do the findings go?

Anonymous data (using pseudonyms) will be analysed by the lead researcher. The findings will be reported in their Ph.D. thesis, as well as via possible peer reviewed publication or academic presentation.

What are the risks of participation?

A risk assessment for this activity has been conducted and approved by Durham University. We do not foresee any likely risks to participation and we will ensure that you are made to feel as comfortable as possible. You may opt out of any activities,

and refuse to respond to questions or topics that you do not wish to discuss. Measures will be taken to ensure the security of the Zoom call.

What will happen after the workshop?

Following the completion of the workshop you will receive an evaluation questionnaire, as well as a copy of the draft findings on which you may offer comment.

How do I respond to this invitation?

If you would like to attend this workshop, please simply respond to the invitation email. You will be sent an electronic *consent form* for your consideration. On return of this, you will be added to a mailing list from which you will receive further updates.

If you do not wish to participate, please express this in an email reply. This will avoid unnecessary follow-up emails. We would be grateful if you may be able to suggest alternative contacts better placed to respond.

Contact details:

Please feel free to contact lead researcher, Ben Rigby, with any comments or queries that you may have. He can be contacted in the following ways:

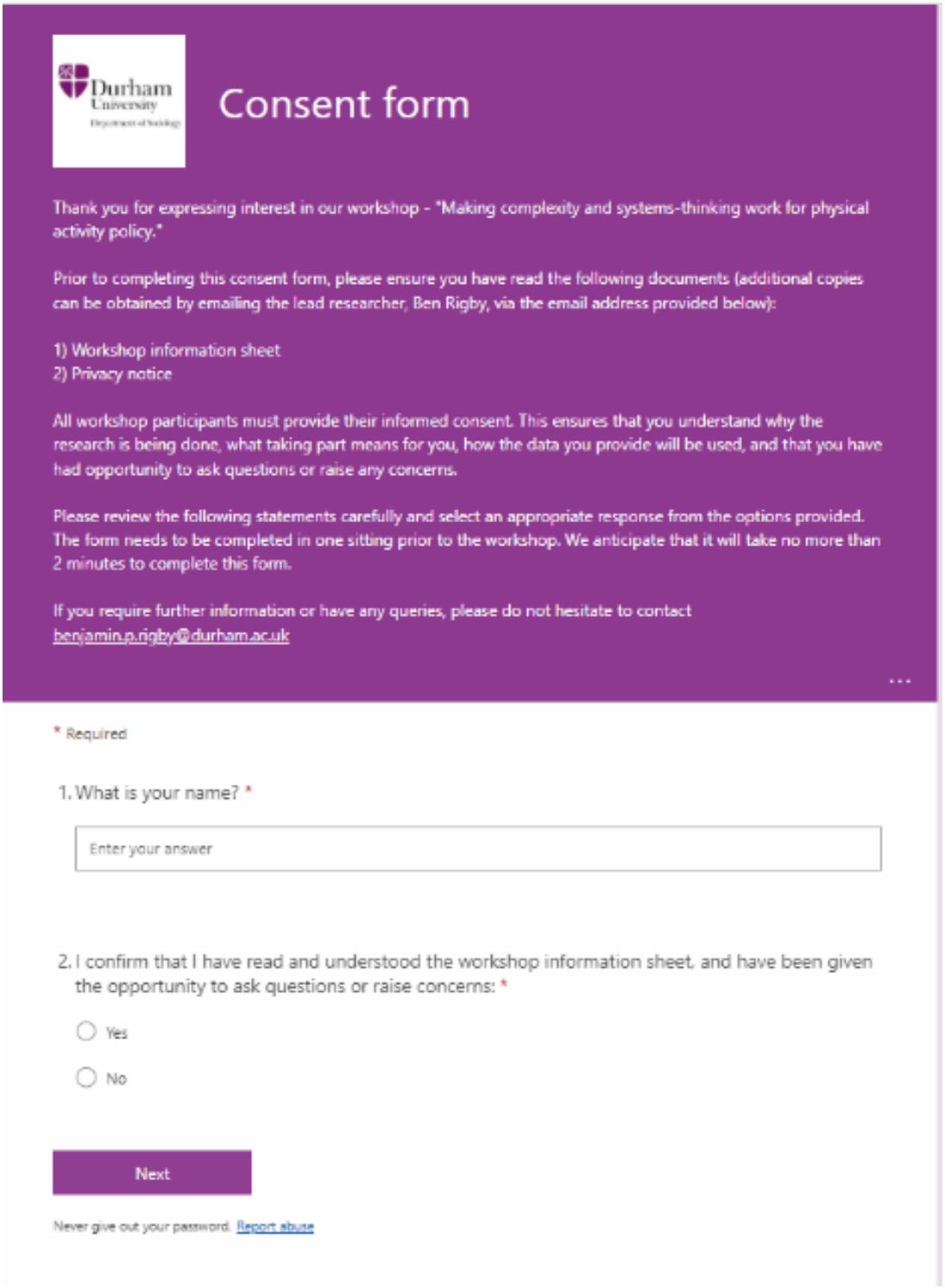
Email (preferred)**:** benjamin.p.rigby@durham.ac.uk
Tel (Mon-Fri, 9am to 5pm)**:** [redacted]
Address: *Please note, due to Covid-19 restrictions, I am working from home and cannot receive mail.*

Researcher profile:
https://www.dur.ac.uk/research/directory/staff/?mode=staff&id=15232

Appendix 11 – Study 3: consent form

Informed consent was provided through an online survey platform:

Page 1:



Durham University

Consent form

Thank you for expressing interest in our workshop - "Making complexity and systems-thinking work for physical activity policy."

Prior to completing this consent form, please ensure you have read the following documents (additional copies can be obtained by emailing the lead researcher, Ben Rigby, via the email address provided below):

1) Workshop information sheet
2) Privacy notice

All workshop participants must provide their informed consent. This ensures that you understand why the research is being done, what taking part means for you, how the data you provide will be used, and that you have had opportunity to ask questions or raise any concerns.

Please review the following statements carefully and select an appropriate response from the options provided. The form needs to be completed in one sitting prior to the workshop. We anticipate that it will take no more than 2 minutes to complete this form.

If you require further information or have any queries, please do not hesitate to contact benjamin.p.rigby@durham.ac.uk

...

* Required

1. What is your name? *

Enter your answer

2. I confirm that I have read and understood the workshop information sheet, and have been given the opportunity to ask questions or raise concerns: *

Yes

No

Next

Never give out your password. Report abuse

Page 2:

3. I confirm that I have read the privacy notice and understand how data will be used and stored during this study, including how it will be anonymised and kept confidential: *

- (●) Yes
- ( ) No

4. I confirm that I understand that participation is voluntary and that I may withdraw myself, or my data, at any time without justification before the deadline indicated in the workshop information sheet and privacy notice: *

- (●) Yes
- ( ) No

5. I understand that I may refuse to respond to any given question or topic, or ask for my involvement in any activity to be terminated without justification: *

- (●) Yes
- ( ) No

6. I understand that I will be offered the chance to be a named contributor to research outputs, as set out in the privacy notice: *

- (●) Yes
- ( ) No

7. I understand that a copy of my responses to this form may be obtained for my records by emailing the lead researcher: *

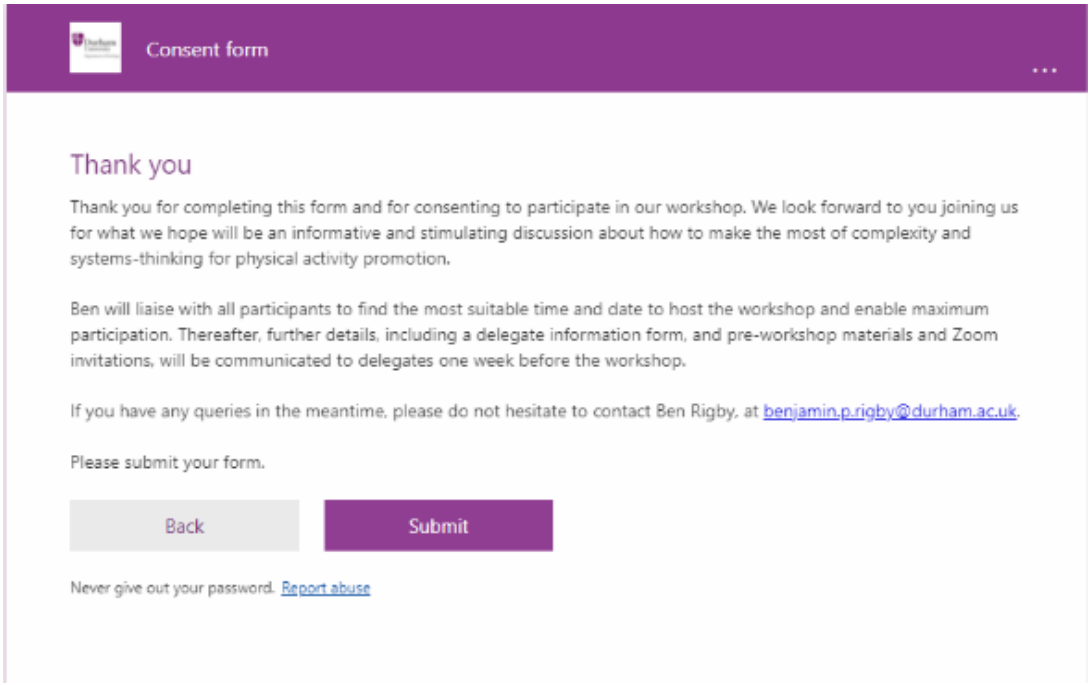
- (●) Yes
- ( ) No

8. I agree to participate in this stakeholder workshop: *

- (●) Yes
- ( ) No

Next

Page 3:


Consent form
...
Thank you
Thank you for completing this form and for consenting to participate in our workshop. We look forward to you joining us for what we hope will be an informative and stimulating discussion about how to make the most of complexity and systems-thinking for physical activity promotion.
Ben will liaise with all participants to find the most suitable time and date to host the workshop and enable maximum participation. Thereafter, further details, including a delegate information form, and pre-workshop materials and Zoom invitations, will be communicated to delegates one week before the workshop.
If you have any queries in the meantime, please do not hesitate to contact Ben Rigby, at benjamin.p.rigby@durham.ac.uk.
Please submit your form.
Back
Submit
Never give out your password. Report abuse

Appendix 12 - Study 3: deductive coding frameworks used in the analysis of stakeholder workshop data

Framework 1: Themes taken from previous research findings

1. Codes derived from study one	**Subcodes**	**Definition/description**	**Example**
A. Uncertainty	**A1** Debateable implications	**A1** Uncertainty as to the utility of complexity as a concept in physical activity policy	**A1** Systems approaches work in theory, but perhaps not in practice
	A2 Insecurity	**A2** Struggle in understanding and conveying complexity-related ideas	**A2** It is too scientific, to mathematical
B. Unexceptionable, yet unclaimed	**B1** Detachment	**B1** Being removed from the complexity of the problem and policy environment	**B1** Periodic attention paid to physical activity and its complexities
	B2 Diffused responsibilities	**B2** Multi-centric and multi-layered structures of policy-making and governance	**B2** Policy-making at national, regional and local levels
	B3 Local matters	**B3** The importance of engaged local stakeholders in systems approaches to inactivity	**B3** Community engagement activities
	B4 Evidence and implementation	**B4** A subset of B3, the different forms of evidence used to support and implement national policies	**B4** Evidence-informed policy-making
C. Influence and change	**C1** Connecting the system	**C1** Bringing together agents who are, and ought to be, involved in creating system change for physical activity	**C1** Lobbying and advocacy groups

	C2 Mechanisms	**C2** Subset of C1, the causal processes that underpin connections in the system	**C2** Relationships built on a common set of values
	C3 Passion and enterprise	**C3** Exhibiting the drive, determination and innovation in trying to change the physical activity system	**C3** Piloting new programme
	C4 Systemic issues	**C4** Subset of C generally, barriers to system change	**C4** Short-term thinking in policy settings
2. Codes derived from study two	**Subcodes**	**Definition/description**	**Example**
D. Address change	**D1** Moving it forward	**D1** Proactive efforts to confront systemic challenges, and initiate and lead change efforts	**D1** Embedding change strategies through strong partnerships
E. Connections	**E1** Discussion	**E1** Creating the space for the exchange of ideas and information relevant to local physical activity decision-making	**E1** A forum to discuss new policies or strategies
	E2 Togetherness	**E2** Bringing people together in meaningful relationships	**E2** Realignment of policies or practices toward a common goal
	E3 Distribution	**E3** Practices that enable leadership to be distributed	**E3** Providing clear roles and accountability for system stakeholders
F. Drive the vision	-	**E4** Promoting an agreed vision across the system	**E4** Ensuring strategic decision-makers are involved in partnership work and empowering them
G. Implementation conditions	-	**E5** Conditions, practices and procedures that facilitate the	**E5** Local authority involvement

		implementation of physical activity policies	
3. Codes derived from both studies	**Subcodes**	**Definition/description**	**Example**
H. Leadership	-	**H.** Complex dynamic processes that emerge from the interactive spaces between people and ideas	**H.** Exhibiting practices associated with codes D, E and F in attempts to connect the system and foster suitable conditions for physical activity policy implementation
I. Key agents	-	**I.** People at all levels of the system who have a key stake in using and mobilising complexity-related ideas in physical activity policy settings	**I.** Dependence on government ministers

Framework 2: Mobilising knowledge about complexity theories and systems-thinking in physical activity policy

1. Mobilising knowledge codes	Definition/description	Example
A. How is knowledge mobilised	**A1** The processes and mechanisms that underpin the mobilisation of complexity-related knowledge in physical activity policy settings	**A1** Systems mapping workshops
B. Who mobilises the knowledge	**B1** Agents who have, or ought to have, the capacity, power and will to mobilise knowledge of complex systems in physical activity policy settings	**B1** Policy entrepreneurs
C. Circumstances in which knowledge may be mobilised	**C1** Times and occurrences whereby knowledge of complex systems may be mobilised to good effect	**C1** Developing people's skills in influencing policy
D. Circumstances in which knowledge of complexity and systems may not be useful	**D1** Times and occurrences whereby knowledge of complex systems may be mobilised to no effect, or bad effect	**D1** Educating policy-makers directly

Appendix 13 – Tenets of complexity theories in physical activity policies

Feature	Definition	Expression in the data	Extension to knowledge	Remaining gaps
Complexity theories				
Adaptive	Systems acquire an adaptive capacity in the process of evolution. It does not only indicate that systems shape themselves, but also includes an active concern with mastery, or the ability to change the environment to meet the needs of the system, as well as the ability to change in the face of its unalterable features (Byrne and Callaghan, 2014).	Participants experienced the dynamics of the system in relation to the broader political environment (*e.g.* Brexit, austerity and the mechanisms of government). There were apparent tensions and trade-offs where individuals tried to shape this broader environment through, for example, lobbying, support, and working with, and bringing in, existing environmental structures, but also where practices are adapted to maintain the function of the system in response to the unalterable environmental features (*e.g.* the process of cross-pollination).	The findings of this research have extended our understanding of the role of politics in shaping the physical activity policy-making system, especially in the UK. In particular, it has identified how system agents can play a critical role in creating change or stability in the face of environmental influences.	There is a general lack of clear examples of the adaptive nature of the physical activity policy system. It remains unclear whether or not, at a national level in particular, the environment is particularly amenable to change. At a local level, there is growing recognition of the need to understand context, and boundaries are being pushed, but these remain somewhat blurred and can be better delineated.
Bifurcation points	At these crucial transformation points the system seems to have two possible trajectories into which it can move, and it chooses (through human action) between them on the basis of very small differences in the values of controlling parameter(s) at the point of change (Byrne, 1998).	The physical activity system was perceived by participants to have reached a critical juncture for how agents operate. While impossible to determine a definitive future system state, examples of changing practices were provided.	-	While recognising the need for change, participants in earlier studies were less able to articulate how system change is actually stimulated.
Cases	Cases are fuzzy realities with complex properties, that have a	My research is concerned with several cases (*i.e.* the national	My research has highlighted the importance of the national-local	While I have created a collective narrative of cases,

	holistic element whilst being constituted from complex configurations, that are intersected with their environment, with boundaries being not the things that cut off, but rather the domain of intercommunication. We deal with these entities through the construction of narratives. We need to establish the kind of thing we are dealing with, and the nature of the relations of the thing (Byrne and Callaghan, 2014).	policy-making system, a local physical activity system, and the organisations and individuals who participated in this study). Using multiple lenses, we have collectively created a narrative about these cases and sought to uncover their nature and relationships. Of particular note are the interactions at the boundaries between national and local systems, and different government departments.	system boundary, and the interactions that occur at this point.	there is little evidence to suggest system agents are aware of the importance of cases, their function and properties.
Complexity (general)	General complexity states that systems are characterised above all else by emergence, by the possession of properties which are not amenable to description in terms of the elements which describe the system (Byrne, 2011)	-	-	While participants understood complexity, there is work to be done to increase the literal understanding of complexity in relation to physical activity policy.
Complexity (restricted)	Complex systems can always be understood in terms of emergence from the interaction of simple, or at least simpler, elements, usually on the basis of rules of action (Byrne, 2011).	Often participants' understanding of complexity is more related to its restricted form. They were able to articulate elements and features that constitute the system and interact with one another. However, to them the whole was amenable to description from these constituent parts.	My research highlighted the contested and uncertain understanding of complexity. Packaged in more restricted terms, this has negative implications for the implementation of effective complex systems approaches to physical activity.	A clear understanding on what complexity is, conceptually speaking, and how it operates in a general versus restricted sense is still needed. Without this, attempts to develop complex approaches to physical activity are likely to be ineffective.
Complex systems	Complexity focuses on systems which have characteristics that	Complex systems were characterised in numerous ways	My research has demonstrated the uncertain and inconsistent	A consistent working understanding of complex

	make their behaviour hard to understand and predict. Key characteristics associated with complex systems include their adaptive and dynamic nature, feedback loops, multiple scales, thresholds for change, areas of high and low stability, and open or ill-defined boundaries that can span (socio-technical) domains or areas of expertise and responsibility. Such features result in systems characterised by tipping points, non-linearity, emergent new properties, and unpredictability (Barbrook-Johnson *et al.*, 2020).	by policy-makers and local practitioners (for example study one gave rise to 12 separate conceptualisations). In particular, participants recognised that the boundaries are ill-defined and that policy actions are not always predictable.	ways in which complex systems are characterised, which can lead to scepticism misapplication and further uncertainty.	systems across the physical activity system may support more effective whole systems approaches.
Complex causality	The social emerges from multiple, multidimensional nonlinear, networks of nested systems. We are no longer dealing with *the* cause but rather with multiple interacting causes and, more, with multiple interacting causal sets. For complex systems, what is caused is the *state of the system.* There is no simple direction of causality for systems, but the complex can cause the simple. Causes operate in any and all directions. They are seldom if ever single or additive,	Participants were aware of the multi-dimensional and non-linear influences of physical activity.	-	Claims of complex causality was not directly examined in this thesis, rather, future research should examine the proposed causal mechanisms in greater depth.

	interaction is vital and is core to emergence. Time matters, the sequence and duration are both important. Causality is historical, conjunctural and contingent. It may be useful to think of causes as necessary or sufficient (Byrne and Uprichard, 2012).			
Dynamic	The formal mathematical equation which describes how something changes over time, including non-linear development in the condition of whole systems as opposed to simple objects (Byrne, 1998).	Participants have articulated numerous ways in which physical activity promotion has continually changes over time in response to the conditions of the environment in which they find themselves. However, this is not typically expressed in terms of non-linear development.	-	It is important to track the dynamic changes of the physical activity policy system moving forward.
Emergence	Causal theories of emergence suggest that emergent properties are those of structured wholes which have causal influence over the constituents of the whole (which when observed have properties its parts do not have on their own), suggesting that one of the emergent properties that a system can have is the power to exert causal influence on the components of a system in a way that is consistent with, but different from, the causal influences that these	Possible instances of emergence were only implied in the data and inferred through the complex realist lens adopted for the study. See also macro and micro emergence below.	My research has demonstrated how both knowledge of complexity, and systems leadership may be the products of the policy system's emergent properties.	Emergence remains a misunderstood concept in many applications of complexity theories.

	components exert upon each other (Newman, 1996).			
Feedback loops	Feedback describes the consequences of change in the system. Self-governing systems characteristically contain negative feedback. Plainly the functionalist account of social orders depends on the existence of negative feedback systems, usually considered to centre on agencies enforcing social norms, which are analogous to the biological negative feedback in an organism. Positive feedback occurs when a change tendency is reinforced, not dampened. The significance of positive feedback is not 'boundary defending' but is likely to lead to boundary breaking and transition to a new phase state (Byrne, 1998).	Participants did not discuss feedback in conceptual terms (see policy-making below).	My findings suggest a potential feedback loop that dampens the effects of new models of physical activity evidence, perpetuating traditional forms.	-
Far from equilibric	Far from equilibric does not mean that systems cannot operate within domains of relative stability for long periods of time. It means rather that they have a potential for radical change, not that that potential is always instantiated (Byrne and Callaghan, 2014).	Research with national policy-makers, encapsulated in the themes of influence and change, highlighted mixed feelings about the propensity for radical system change in the face of very stubborn issue. This was somewhat contrasted by local physical activity stakeholders who seemed more receptive to the idea of change.	My research raises questions about policy-makers' belief in the possibility of radical change in the physical activity system, even at opportune times such as crises.	There is space to help agents understand the concept of far from equilibric systems, and create a vision for what radical change may be and how it can come about.

Fitness landscapes	A biological term that describes an approach where possibilities in evolutionary terms are represented by a landscape of peaks and valleys. Where you start from is of great importance. You can only start where you are and there are constraints on the range of movement, short of a revolutionary transformation which changes the whole character of the social order (Byrne, 1998).	In essence, my research has attempted to describe the point in the landscape in which the system and our understanding of it currently sits. More specific details are provided in the policy-making section below.	My research has provided one perspective on how complex systems are understood in the context of physical activity and how individuals within the system navigate these complexities.	-
Fuzzy boundaries	The junction between system and context in which the propensity for change (fails to) materialise. Fuzzy refers to partial membership of a set, it allows for degrees of being a kind of thing (Byrne and Uprichard, 2012).	Fuzzy boundaries were articulated throughout my findings. At a local level, participants perceived the need for a better understanding of where the physical activity system ends, and another system starts. At a national level fuzzy boundaries were expressed in the perceived dissipated efforts to address physical activity and through the increased recognition of context in which physical activity is enacted. However, the idea of partial membership is also important and observed in the way policy-makers perceive their ability to disassociate themselves, or	The previously unobserved concepts of detachment and alienation has important implications for the way in which physical activity is used as a concept, and how attempts to increase it are made.	There is a clear need to support policy-makers to recognise their position in systems, whose actions can help co-evolve the state of the system. There is also a need for further research to delineate the boundaries of the system, particularly to support local stakeholders.

		become alienated, from the system.		
Macro emergence	The role of 'structure' and the significance of the inter-relationships of systems with other systems (Byrne and Callaghan, 2014).	-	-	Clear evidence gap.
Micro emergence	The emergence of phenomena from the interaction of agents (Byrne and Callaghan, 2014).	Ideas of micro emergence were observed at different levels, but more so in the experiences of national policy-makers. Key examples included the cross-pollination of ideas and initiatives between government departments, the interactions between those of different sides of the cultural divide (those who have experienced positives of physical activity, versus those who have not), and the way which complexity is discussed and learned about. At a local level, emergence seemed to be related to how system leadership came about.	These findings are previously unobserved, and represent new conceptualisations of complexity theories in this domain.	-
Multiple scales	Scalar thinking transcends discussion of bounded places as the basis for actions or identities. Boundaries (*e.g.* between local, regional and national) may be reconsidered beyond their dividing roles, but as connecting, as sites of interpenetration that make it difficult to separate inside from	All participants expressed an awareness of the multiple scales at which the complex policy issue of physical activity is understood, the different perspectives required to understand it, and the range of programmes needed to increase activity. Of particular note was the connection between the	-	-

	outside in any simple way. The consequences for realist thinking on policy and practice arise in reframing reality to include the relevance of multiple perspectives and scales away from simple nested hierarchies and toward more fluid and interpenetrating networks (Byrne and Callaghan, 2014).	national and the local, as both sets of participants articulate the importance of this juncture and how a close and interpenetrating network was necessary.		
Non-linearity	Non-linearity is the direct result of the mutual interdependence of components in a system. Causal structures and pathways are multiple, conjunctural and non-deterministic (Boehnert, 2018).	While participants understood the non-linear nature of policy work, this was most explicitly expressed in local terms in recognition that trying to create system change had resulted in several bumps along the way.	-	Similar to complexity in general, non-linearity appears to be one of the more poorly understood concepts in this policy domain.
Openness	An open system is a process that exchanges material, energy, people, capital and information with its environment (Althusser, 2005).	It is evident that agents in the physical activity domain operate in open systems, and bring with them experiences from their wider environments. At a local level creating connections creates a forum for the exchange of information and ideas, particularly whereby people are brought into the system. This is encapsulated in a shared learning approach. Nationally, the interaction of agents with wider environmental organisations are key examples of openness.	My research has highlighted some of the ways this openness is created and can be used for the benefit of the system (*e.g.* dialogical learning systems)	-

Path dependence	The development of a complex system depends on it history, rather than where it is currently (Boehnert, 2018).	Local level practitioners were better able to articulate the history of the system, but not in a sense that captures the key tipping points from which it could not return.	-	Clear evidence gap.
Self-organisation	Systems are governed by spontaneous order. They have a degree of self-containment and closure and adapt to their environment but do so with properties and characteristics that are created and sustained in the system itself (Klijn and Snellen, 2009).	Self-organisation is expressed in the ways an understanding of complexity is generated and sustained among policy agents' interactions. It may also relate to how some described their organisation as the *glue* that keeps the system together. The self-organising properties of systems may preclude the accomplishment of critical needs of policy agents.	Self-organisation is one possible mechanism that could explain how systems approaches to physical activity policy may have needs thwarting effects on agents. This is a new empirical observation of my study.	-
Stability	Systems are characterised by areas of high or low stability. They may have several relatively stable states which may change as the context evolves. If a system has multiple domains of stability, and a change in the system has moved beyond a certain threshold (or tipping point), the system can slide rapidly into another state, a change that may be very difficult to reverse (Boehnert, 2018).	Multiple domains of stability were evident in my research. At a national level, while policies come and go, the general make-up of the organisations remains similar, the likelihood of significant change may be low, and the system can become quite resistant. At a local level, the situation evolves more quickly, and is shaped and adapted by the more stable national policy landscape, which is often not directly related to physical activity. Nevertheless, behavioural physical activity at population	-	-

		levels remains stable and stubborn. In general, policy systems remain unconducive to systems approaches.		
Strange attractors	In the context of organisations, strange attractors serve as a useful metaphor for a shared vision which drives individual agents' actions and beliefs towards new patterns of interaction (Gilstrap, 2005).	At a national level there is a consistent passion and enterprise among policy agents which drives their efforts to find new solutions to physical inactivity. At a local level there is consistent belief that new patterns of organisation are required to move the system forward. This is accompanied by a clear vision, connections and value placed on physical activity in the research domain examined. Driving this vision is a critical part of system galvanising leadership. Overall, the role of a system of policy entrepreneurship can promulgate a shared vision of solutions to physical inactivity.	My research highlighted several ways in which the idea of strange attractors manifests in this policy domain.	-
Tipping points	The threshold beyond which a system goes through rapid change into a different state (Klijn and Snellen, 2009).	Tipping points were discussed in two main contexts during my research. First, the idea that population physical activity levels may one day reach a threshold at which it is no longer necessary to actively promote it through policy. Second, through considering at what times complexity theories	Through a discussion related to tipping points (notably policy crises), this research has raised questions about the suitability of complexity theories in certain contexts.	Further research should conceptualise, evaluate and test potential tipping points for systems-based approaches to physical activity policy, to determine how we can arrive at them.

		have practical use in policy domains.		
Traces	Measures of complex systems cannot be separated from the systems of interest, but only describe those systems in terms of attributes which have no reality beyond the systems, and that measurements are most interesting to us when they describe the characteristics of systems at multiple time points and hence can help us delineate trajectories (Byrne and Callaghan, 2014).	-	-	Clear evidence gap, likely to be addressed through quantitative approaches to physical activity policy systems (*e.g.* surveys or Qualitative Comparative Analyses). Nevertheless, if repeated, the findings of the current study can be assessed in terms of system characteristics at different time points (see limitations).
Trajectories	The state of the system in possibility space through time (Byrne and Callaghan, 2014).	All participants were able to express their hopes and fears for the future of the system, although trajectories was not expressed in formal conceptual terms.	-	Clear evidence gap (see traces above).
Complexity and policy-making				
Bottom-up implementation	Complexity theories encourage policy-makers to consider the values of bottom-up implementation. Bottom-up approaches reject the notion that central government is the main influence in policy outcomes, rather the street level bureaucrats who deliver it. A focus at the bottom highlights a multiplicity of influences and distance from government (Cairney, 2012ab)	There is recognition among all participants that an engaged local system is important to developing and achieving key policy objectives for physical activity. Likewise, there was a desire among locally located agents to be involved more proactively in development and implementation, and seek to provide advocacy and influence. This element of the system is instrumental in	My study has contributed to an understanding of how positive implementation conditions may be created, and has started the process of making the connection between leadership and implementation. How the national-policy-makers perceive the local system is also previously unobserved.	-

		creating the conditions for effective policy implementation.		
Bounded rationality	Policy-makers cannot consider all issues at all times, they ignore most and promote relatively few to the top of their agenda. It is difficult to rank these in any meaningful way. We question our ability to separate values and facts. Policymaking organisations have limited knowledge and research capabilities, therefore must use shortcuts to gather a limited amount of information in a limited time (Cairney *et al.*, 2019).	Bounded rationality is evident in the way national policy-makers engage with different forms of evidence and knowledge, and the perceived lack of time and capacity to deal with their complexity. In particular a lack of time may mean policy-makers search for particular forms of evidence or indeed act based on hunches and experience, before accumulating the evidence at a later point. There did not seem to be a prioritising of particular evidence types, but clearly some issues were ignored relative to others.	My study contested some of the notions of bounded rationality, by demonstrating the rational processes national policy-makers went through first before turning to irrational processes. Previously, these latter processes are thought to have been a default position of policy-makers.	There is always more that can be done to promote the use of evidence to inform policy-making. Policy-makers articulated various forms of evidence they felt may be beneficial for them, including real-time data, assimilating 'what works' and looking for international examples of best practice. There is a need to decrease both uncertainty and ambiguity.
Complex government	A description of policy practices and outcomes that seem to 'emerge' from complex policymaking systems in the absence of central government control (Cairney *et al.*, 2019).	Policy-makers expressed that their actions were sometimes dictated by happenings elsewhere in the system, as they do not hold the policy levers in government. Moreover, an absence of control more broadly across the system had implications for empirical contributions of detachment and alienation, to which this construct may similarly influence.	-	Clear evidence gap to understand the specific implications of instances where there is a lack of central government control in physical activity policy.

Complex policy-making systems	Policy-making systems have the same basic properties as other complex systems. Most notably, complexity theories identify the ways in which policy-making systems often appear to produce unpredictable outcomes that seem impossible to control. A key term is emergence, which results from the interaction between practitioners and their local environments, in the apparent absence of central government control (Cairney, 2015).	National policy-makers presented fleeting examples of unintended consequences of policy action (*e.g.* the discriminatory impact of *Everybody Active, Every Day*, or the impact of cycle lanes on blind pedestrians). While there was some understanding of complex systems reflected in the description above, again the notion of emergence did not really come through. However, I do present some examples of interactions between practitioners and their environments.	My research helps conceptualise the physical activity policy system in complexity terms.	There is particular need to explore what emergence is, and the impact that it has on this policy domain.
Decentred policy-making	Decentred government can be described empirically, as a trend or an outcome (the central state is losing or has lost its power). Some apply decentring as a form of analysis to argue that too many studies assume or assert that powerful central governments exist (Cairney *et al.*, 2019).	National policy-makers recognised that they did not hold all of the policy levers and had varied perceptions of their control in the system, some felt more powerful than others. Certainly, the importance of the engaged local system is a critical feature of physical activity policy. Nevertheless, being able to identify policy-makers who have the power, in government or beyond, is vital in developing effective systems approaches to physical activity policy.	My findings contest some aspects of this concept, and bring forth the particular dimensions associated with power and control that have not previously been explored in this context.	Further examination of the relative importance and influence of this construct would be valuable.
Disengagement	Innovation may be inhibited due to policy-makers feeling	This did not manifest in my data. On the contrary, it was	-	-

	disengaged in the local evidence-making process (Langlois *et al.*, 2016).	proposed that local agents may feel disengaged from the national policy-making process.		
Experimentation	The fact is that in situations of unmanageable complexity, practice in matters of public policy is often guided more effectively by localized experimental trial-and error than by the theorizing resources of an intellectual technology unable to cope with the intricacy of interaction feedbacks and unpredictable effects (Sanderson, 2009).	The passionate and enterprising nature of policy-makers means that they are willing to try new things, and they support local areas to pilot approaches to physical activity promotion. The learning process associated with *Local Delivery Pilots* is an example of more local experimentation.	-	-
Feedback loops	Related to bounded rationality, policy-makers simplify their decision-making environment by ignoring most signals (negative feedback) and promoting few to the top of their agenda (positive). Negative feedback can produce long periods of stability, positive feedback can produce policy punctuations (Cairney, 2012a).	At a national-level, one policy-maker offered the example of making a ball of evidence that can easily be understood, that is to simplify their environment and reinforce their decision-making. Nevertheless, there was a general trend for national policy-makers not to simplify their environment so explicitly. Lobbying may lead to short bursts of punctuations in policy approaches. A collegiate approach was thought to amplify policy goals in neutral territories. At a local level, participants articulated ways in which creating connections were both positive and negative processes. For example, task	My research provided several examples of possible feedback loops in the physical activity policy domain.	-

		and finish groups seemed to discuss and reinforce the same issues over and again, thus progress was not made. On the flip side, creating connections enabled positive leadership behaviours to be reinforced and developed. Overall, the policy system may be subject to a dampening feedback loop.		
Fitness landscapes	The metaphor of the 'fitness landscape' or 'surroundings in which living beings exist and behave'. This landscape, which provides the context for the choices of agents, is unstable and often changes rapidly. Therefore, agents or organisations must adapt quickly and not rely on a single policy strategy (Cairney, 2012a).	At all levels, agents were well aware of the threats and opportunities that were present on their patch. However, this understanding stopped short of ideas of stability, as discussed in the associated definition. My findings also consider ways in which policy agents may adapt to rapid changes, for example different policy approaches to physical activity during the pandemic.	-	This relates to the need to work out how to bring about change in systems, making the most of opportunities that are presented and developing appropriate and timely policy responses to changes in the environment.
Multi-centric policymaking	The term employed to sum-up a collection of concepts used to explain many 'centres' (or no centre) of policymaking, including multi-level, complex and polycentric governance (Cairney *et al.*, 2019).	This is articulated throughout my research in the range of agents who were deemed to have a vested interest in the system.	I have expanded these ideas in the physical activity context, demonstrating some of the structures and agents that constitute the multi-centric nature of this policy domain.	-
Multi-level governance	A description of power diffusion from central government, vertically (to other levels such as global, supranational, devolved,	This is evident in the diffused responsibilities that are present in study one. It also relates closely to the multiple scales feature above. The arrangement	I have expanded these ideas in the physical activity context.	There is an opportunity to understand and map these levels of governance more closely, in particular the flows of leadership and influence.

	regional and local) and horizontally (to other types of policymaking bodies at the same level of government) (Cairney *et al.*, 2019).	of people, information and ideas through connections at a local level are further evidence of this. Moreover, the desire among local agents for a top-down diffusion of policy efforts, further reinforces the significance of this construct.		This may help identify key agents in the system that link the network more effectively.
Multiple lenses	Three broad knowledge types help address complex policy issues: political know-how; rigorous scientific and technical analysis; and practical and professional field experience (Head, 2008).	My study has adopted this multiple lens approach and further adds the experiences of policy-makers and practitioners, who use a variety of knowledge types to inform their decision-making.	My research extended the notion of multiple lenses in the complex realist framework. See methodology chapter for full explanation.	-
Path dependency	Path dependence suggests that when a commitment to a policy has been established and resources devoted to it, over time it produces 'increasing returns' (when people adapt to, and build on, the initial decision) and it effectively becomes increasingly costly to choose a different path (Cairney, 2012a).	There are few examples of path dependency, although as highlighted above, agents are able to articulate how things have changed. Nevertheless, several national policy-makers highlighted the vested interests of government in the obesity agenda, which may be the key issue on which to build an effective physical activity policy response.	-	To what approaches are the government committed and to which new ones can incremental change be instigated? What are the political, societal and systemic (including agents) costs associated with different change strategies?
Perceived behaviours	If we look at social practices one way we can see actors, another we can see structures. On one side, we have self-organising landscapes and emergent behaviour; on the other side we have self-referential behaviour and agents	My work is concerned with identifying how participants navigate the specific complexities of their environments, physical activity and policy-making.	-	-

	creating their own sense of what they want and how to behave in the landscape they are in (Cairney, 2012a).			
Punctuated equilibrium	Most policy-making exhibits long periods of stability, but with the ever-present potential for sudden instability. Most policies stay the same for long periods. Some change very quickly and dramatically (Cairney *et al.*, 2019).	While used as framework for understanding physical activity policy processes, I did not identify specific examples of punctuated equilibrium in this study.	-	Clear evidence gap.
Self-organising	Systems appear to have 'self-organising capacities', making them difficult to control; the effect of an internal or external force may be large or small and this is impossible to predict from the force alone. This lesson could be learned by policy makers who otherwise would be surprised that their policy interventions did not have the desired effect (Cairney, 2012a).	In contrast to the definition offered here, national policy-makers did not appear to be disheartened by policy failure. They were in fact very pragmatic. Further details above.	My research questions existing notions of the reactions of policy-makers amid policy failure. Nevertheless, findings also extend ideas associated with new, previously unconsidered effects of self-organisation.	-
Soft-management	Soft management methods replace the outwardly forceful but practically blunt traditional hierarchical hard management methods. This may involve giving implementing organisations more freedom to learn from their experience and adapt to their environment (Cairney, 2012a).	National policy-makers recognised that the local matters and that individual locales should have the freedom to choose what and how to implement in terms of policy responses to physical activity. In particular this was evident in the acknowledgement that the local is quite a lonely place to	I have expanded these ideas in the physical activity context.	-

		be promoting physical activity, particularly in smaller, or less densely populated areas. At a local level, creating the space for discussion allows stakeholders to learn from experiences and adapt policy to local context.		
Unpredictable consequences	The behaviour of complex systems is difficult (or impossible) to predict (Cairney, 2012a).	See complex systems above.	My research helps describe the physical activity policy-making system.	-
Wicked problems	Issues with complex causal pathways that are difficult to define and have no immediate solution. One wicked problem is often a symptom of another (Wistow *et al.*, 2015).	Some recognition that physical inactivity was a wicked issue and that this relates to complex policy issues.	My research identified ways in which physical inactivity may be considered wicked. Physical activity is a contextually influenced behaviour, which evolves over time. It has been suggested that people are always somewhat active or inactive, thus the issue is never likely to disappear entirely. The complexities of the behaviour, and the intricate array of determinants, mean that a one size all approach will not suit all inactive people.	How can we increase awareness of wicked issues and strategies designed to address them in the physical activity policy domain?
Behaviour in complex systems				
Agency for change	Complexity accepts the inevitability that individuals are often subservient to social structures, but realizes that feedback from individuals, however small in power, can contribute in unpredictable	Ideas of agency and influence are prominent across all studies, suggesting the need to reorientate away from structural approaches to complexity in Public Health research.	My research sets out a unique methodological approach for exploring the role of agency in physical activity policy systems.	-

	ways to the future organisation and representation of structures' (Cairney, 2012a). Above all else, agency forms the basis of system change (Byrne, 2009a).			
Boundary spanning	Work to enable exchange between the production and use of knowledge to support evidence-informed decision-making in a specific context. The idea is that solutions for wicked problems have to account for many dimensions of "knowing and learning". This includes the ways different actors engaged in, or affected by, an issue view the cause of a problem, their institutional and political incentives, how they feel about each other, how they view the relevance and credibility of available evidence, how they access and understand evidence, and how they view potential solutions and their viability (Bednarek *et al.*, 2018).	Sharing and learning occurs in different fora at all levels. At a local level, certain roles are embedded across sector boundaries, or across levels which connect these elements of the system in formal ways. At a national level, similar examples were offered. MPs were often those who could open doors between the system and its boundary environments. However, there was also the use of physical activity as a tool in the sociological sense of the word, which was used to extract agents from their silos and connect the system with policy, rather than people. Moreover, the development of dialogical learning systems helps boundary spanning efforts.	My research has been the first to observe how physical activity, constructed as an issue from which agents detach themselves, is used as a policy tool to extract siloed workers. Moreover, I articulate properties of effective boundary spanning techniques.	There is more research required on creating the optimum system connecting conditions, triggering mechanisms such as how to generate buy-in when people perceive their role in uncertain terms, relationship building, financial support and political leverage.
Collaboration	Considerable multi-sectoral collaboration is necessary to enable successful co-evolution of novel adaptations to unpredictable outcomes (Kovacs, 2016; Room, 2011).	Collaboration was evident in all aspects of complexity and systems-thinking pertaining to physical activity policy.	My research articulates the importance of collaboration and some of its key features in the physical activity policy domain.	As policy-makers note there is always more to be done to develop effective collaborative efforts.

Complex leadership	Complexity science suggests a paradigm for leadership as a complex interactive dynamic from which adaptive outcomes (*e.g.* learning, innovation, and adaptability) emerge. The paradigm has an epistemology consistent with connective, distributed, dynamic, and contextual views of leadership (Uhl-Bien *et al.*, 2007).	Leadership is expressed in several ways in my dataset. First, national policy-makers are left considering where the leadership for physical activity promotion is and what it looks like, especially at a local level. Nevertheless, they provide examples of national leadership, which included policy as leadership, the means by which people are connected using policy instruments, as well as key individuals. Local agents sought key national leaders too and support a strong top-down approach. Through discussion they articulated three key features of local system leadership: creating connections, driving the vision and addressing change.	My research adds important context to systems leadership in relation to physical activity specifically. It also challenges some traditional notions of distributed leadership. It provides examples of how these qualities may emerge.	-
Control	Complexity theories suggest that some factors sit outside the control of policy-makers (Cairney, 2012a). Policy-makers may exhibit defensive behaviours when they feel their control is diminishing (Doerner, 1980).	See above. Policy-makers did not exhibit defensive characteristics.	-	-
Innovation	Addressing policy complexity also requires understanding of how learning, adaptation and innovation occur within the systems which seek to foster	See experimentation above.	-	-

	these outcomes elsewhere (Flanagan and Uyarra, 2016).			
Long-termism	Complex systems are particularly sensitive to initial conditions that produce a long-term momentum or 'path dependence' (Cairney, 2012a). Longer-term perspectives allow patterns to emerge, which in turn uncover opportunities for innovation and creativity (Snowden and Boone, 2007).	Concerns were raised throughout about the incongruence of systems-based approaches and the short-term dynamic nature of policymaking and politics. There was evidence of quite a bit of turn-over of agents at all levels. Further, the instability of factors at a local level is difficult to adapt to at times. There were some examples of longer term approaches in the *Local Delivery Pilots*.	My research is the first to question policy-makers perceptions of the applicability of systems-based approaches.	This is a political and funding related issue.
Narrative	A narrative is a story told in sequence where events follow each other. Complex realism is interested in the validity of stories, of accounts, of the past, present and future of complex systems - of how they have been, of what they are, and of what they may become (Byrne, 2011).	My research has created a narrative about the physical activity policy system. It is formed of the narratives of others, as well as my own. An interesting note was the experience of one national policy-maker who did not perceive the policy narrative around boxing was effective. Narratives are often thought to be important for influencing policy decisions.	My research has created a novel contribution in this regard. It is the first to try to depict the system and explain some of its practices and actions.	It is necessary to 'validate' narratives as best as possible. The one presented here will always be partial, but there is an opportunity to sense-check with those individuals who have helped construct this narrative. Narratives should be refined and improved over time through the application and testing of middle-range theories.
Realistic expectations	Policy-makers should harbour realistic expectations about the aims and potential impacts of policy (Cairney, 2012a). Modest expectations about 'solving' social problems	National policy-makers understand that they only exert so much influence through their efforts. Moreover, my research suggests the need to temper expectations in relation to the	-	-

	implies a recognition of an incomplete understanding of its causal mechanisms and processes, and can facilitate experimental policy-making (Sanderson, 2009).	benefit of complex systems approaches (see discussion section 7.4.3).		
Self-referential	Self-referential behaviours are those that advance one's own ambitions and place onus of undesired outcomes on to others (Teisman and Klijn, 2008).	In the national policy space, some actors have questioned the role of particular groups of people who 'get physical activity' and those that do not. The latter have been accused of the frustrating policy efforts. Likewise, there were instances where policy-makers were unsure of the way in which certain departments were living up to their remit and responsibilities. These were not acrimonious experiences, more simple observations. Nevertheless, there was a general sense that physical activity promotion was a collective endeavour.	-	-
Physical activity as complex				
Enacted in complex systems	The human societies in which people engage in physical activity, and which promotion efforts are enacted, are complex systems (Room, 2015).	Nested complex systems were not expressed in the data, and complex systems were expressed as below. This may be a result of the boundaries being fuzzy and the difficulty of delineating one system from the next or its environment.	-	This may relate to the way in which policy is conceived and the general paucity of true whole systems approaches to physical activity policy. There is space to understand and experiment with research, policy and practice that

				recognises and promotes the view of a complex social world.
Multi-layered influences	Multiple layers of factors interact in a non-linear fashion to determine physical activity participation, which require numerous strategies to change (Buchan *et al.*, 2012; Rütten *et al.*, 2013).	Participants expressed their understanding of physical inactivity being a complex policy issue. They framed it as similar to other public health issues, such as obesity or type II diabetes. They did so on the basis of its numerous multi-layered influences.	-	-
Non-linear behaviour change	The process by which people's behaviour changes and physical activity increases does not occur in a deterministic nor linear fashion (Resnicow and Page, 2008).	-	-	Clear evidence gap.
Political complexity	There is a high degree of political complexity in which numerous agents, sectors and ideas are required to enable change (Rütten *et al.*, 2013).	My data emphasises the way that the political complexity of physical activity promotion continues to increase, as the range of vested interests expands.	-	There is space to consider optimal strategies to connect policy agents, breaking down political differences and understanding who or what can offer the best leverage in particular contexts.
Understanding complexity				
Analogical	An analogical use of the term is when defining characteristics of complexity are being employed or explicitly referred to, but where there is still no explicit link to complexity science or its theoretical and methodological foundations (Barbrook-Johnson *et al.*, 2020).	In their description of complexity, national policy-makers referenced some of the defining characteristics of complexity, but without links to its theoretical foundations.	-	-

Literal	A literal use of the term(s) 'implies explicit awareness of or reference to complexity sciences' (Barbrook-Johnson *et al.*, 2020).	-	-	Clear evidence gap to increase the literal use of complexity among policy actors and ensure the sound foundations of a complex systems approach in this domain.
Metaphorical	Complexity's application to public policy is often unclear and the term 'complexity' (like the term 'evolution') is often used very loosely or denotes a metaphor (Cairney, 2012a).	Metaphors were common in national policy-makers descriptions of complexity. It enabled them to make sense of complexity's features.	-	-
Terminological	A terminological use of complexity involves reference to the term in purely linguistic terms rather than in conjunction with concepts from complexity science (Barbrook-Johnson *et al.*, 2020).	Whole systems approaches has become a buzz phrase in the sector, and it is questionable to what degree this is being used in a context other to say lots of different sectors involved.	My research raises questions about the application of systems-based approaches to physical activity, and how these theoretical constructs differ from traditional policy theories or otherwise.	-

Appendix 14 – Curriculum vitae

Curriculum Vitae

Benjamin P. Rigby *M.A., B.A. (Hons.), FHEA.*

Qualifications

2019 – 2021 PgCert. Reflective Learning and Teaching in Higher Education. Durham University, UK.

2016 – 2017 M.A. Social Research Methods (Social Policy) – Distinction. Durham University, UK.

2012 – 2015 B.A. (Hons.) Sport, Exercise and Physical Activity – 1st class. Durham University, UK.

Current position

2021 – **Research Assistant, Glasgow University**
I am currently a research assistant in the MRC Social and Public Health Sciences Unit at Glasgow University, where I provide project support and methodological expertise to the Complexity in Health programme, specifically the complex interventions workstream. Ongoing projects include developing an MRC guidance document about participatory systems mapping, developing a whole systems approach to older adults' physical activity and social connectedness, reviewing the effect of outdoor space on physical activity and sedentary behaviour in early years settings, and a process and feasibility evaluation of a ketogenic diet for bipolar disorder.

Previous research positions (including consultancy and commissions)

2021 **Research Assistant, Durham University**
I was Co-I on a project team that was commissioned by the UK Department of Health and Social Care (DHSC), on behalf of the UK Chief Medical Officers, to conduct a rapid evidence review and critically appraise the Public Health research literature relating to physical activity and health outcomes among disabled children and young people. I was the main reviewer. Major tasks included searching for and appraising literature, extracting and analysing data, and writing a report for submission to DHSC.

2019 **UKRI policy intern, Public Health England Behavioural Insights Team**
In this role I supported colleagues across numerous workstreams to review evidence and evaluate policy programmes in relation to physical activity promotion by healthcare professionals, anti-microbial resistance stewardship, and healthy lunchboxes for school children. I co-authored a systematic review of reviews of the effectiveness of digital health interventions in the prevention of cardiovascular risk factors. I produced behavioural insights-informed evidence briefs for internal colleagues and other government

departments and ministers, at times handling sensitive and time-critical information. I co-led the Team's data governance workstream, supported project management and mentored colleagues in qualitative research methods.

2017 **Research Assistant, Durham University**
I conducted a theoretically-driven rapid evidence review (using the socioecological model of health) on older people's physical activity for the now defunct Active Durham Partnership, which was presented to stakeholders and subsequently used to support strategic planning for local service delivery by Active Durham and its successors. This review purposely sought non-academic literature, to help stakeholders make sense of the evidence they more typically engage with day-to-day. To complement the report and presentation, I created a searchable database of older people's physical activity resources, using Microsoft Excel. This allowed easy access to the cited evidence and for continual update and renewal among stakeholders.

Outputs

Peer reviewed journal articles

Rigby, B.P., Dodd-Reynolds, C.J. and Oliver, E.J. (in preparation). *'It's really hard work':* Advancing complex systems approaches to physical activity policy.

Martin, A., Brophy, R … **Rigby, B.P.** *et al.* (under review). Environmental and practice factors associated with children's device-measured physical activity and sedentary time in early childhood education and care centres: a systematic review.

Rigby, B.P., Dodd-Reynolds, C.J. and Oliver, E.J. (under review). The understanding, application and influence of complexity in national physical activity policymaking.

Williamson, C., Baker, G … **Rigby, B.P.** *et al.* (2021). The Physical Activity Messaging Framework (PAMF) and Checklist (PAMC): International consensus statement and user guide. *International Journal of Behavioral Nutrition and Physical Activity.* **18**(164). https://doi.org/10.1186/s12966-021-01230-8.

Gould, N., Yau, A., **Rigby, B.P.**, Dyke, C., Remfry, E.A. and Chadborn, T. (2021). Effectiveness of digital intervention for reducing behavioural risks of cardiovascular disease in non-patient adult populations: a review of reviews. *Journal of Medical Internet Research.* **23**(5): e19688. https://doi.org/10.2196/19688.

Rigby, B.P., van der Graaf, P., Azevedo, L.B., Hayes, L., Gardner, B. and Dodd-Reynolds, C.J. (2020). Challenges, opportunities and solutions for local

physical activity stakeholders: an implementation case study from a cross-sectoral physical activity network in Northeast England. *BMC Public Health.* **20**(1760). https://doi.org/10.1186/s12889-020-09847-3.

Rigby, B.P., Dodd-Reynolds, C.J. and Oliver, E.J. (2020). Inequities and inequalities in outdoor walking groups: a scoping review. *Public Health Reviews.* **41**(4). https://doi.org/10.1186/s40985-020-00119-4.

Rigby, B.P., Buckley, B.J.R., Kelly, M.C. and Hanson, C.L. (2017). Exercise on referral – symposium hosted by the Physical Activity Special Interest Group for the Wolfson Research Institute for Health and Wellbeing, Durham University. *Sport and Exercise Psychology Review.* **13**(2), pp. 60-64.

Published conference proceedings

Rigby, B.P., Oliver, E.J. and Dodd-Reynolds, C.J. (2018). Outdoor walking groups insufficiently address inequalities: findings from a scoping review. *Journal of Physical Activity and Health.* **15**(S1), p.114.

Rigby, B.P. (2018). Diversifying the public health evidence-based: how scoping reviews can contribute to progress regarding physical activity inequalities. *Journal of Physical Activity and Health.* **15**(S1), pp.195-196.

Oral conference presentations

Rigby, B.P., Dodd-Reynolds, C.J., Oliver, E.J. (forthcoming). Passion, problems and pathways forward: United Kingdom physical activity policy-makers' experiences of working in complex systems. *Paper to be presented at Health Enhancing Physical Activity (HEPA) 2022, Nice, France.*

Rigby, B.P., Dodd-Reynolds, C.J., Oliver, E.J. (2022). The policy environment is not naturally conducive to complex systems approaches to physical activity promotion. Why is this? And what can we do about it? *Paper presented at the UK Society for Behavioural Medicine Conference [Online].*

Rigby, B.P. (2020) – cancelled due to SARS-Cov-2. Rapid methods to capture rapid change: can action-orientated approaches be meaningfully condensed. *Paper accepted for presentation at Qualitative Research in Sport and Exercise 2020, Durham, UK.*

Rigby, B.P. (2018). Exploring how national policy-makers understand, interpret and react to the complexity of physical activity promotion. *Paper presented at the British Sociological Association Sport Study Group postgraduate forum: 'Sporting identities, careers and opportunities', Durham, UK.*

Rigby, B.P. (2017). Addressing social disadvantage in physical activity interventions protocol: priority setting and story sharing. *Paper presented at*

the Wolfson Research Institute for Health and Wellbeing 2nd Annual Early-stage Research Conference, Durham, UK.

Rigby, B.P. (2016). From labs, to leisure centres, to legislation: an exercise in shaping the political agenda. *Paper presented at the Wolfson Symposium on Exercise Referral Schemes: Emerging Evidence and Future Developments, Durham, UK.*

Invited presentations and workshops

Rigby, B.P. (2022). Physical activity for general health benefits among disabled children and disabled young people: rapid evidence review. *Presentation delivered at the launch webinar for the new UK CMOs' physical activity guidelines for disabled children and young people,* virtual.

Van der Graaf, P. and **Rigby, B.P.** (2021). Ten guiding principles to support knowledge exchange and implementation for physical activity. *Paper presented at 'From science to the real world: a Fuse physical activity workshop,* virtual.

Rigby, B.P. and Hockin-Boyers, H. (2019). Planning your event. *Workshop delivered at the 3rd ESRC NINE DTP Annual Conference, Belfast, UK.*

Rigby, B.P. (2019). Complexity theory. What is it and how does it apply to physical activity policy? *Presentation delivered to Public Health England Behavioural Insights Team, London, UK.*

Rigby, B.P. and Fitzgerald, M. (2018). Ten Fuse PAWs in the North East: Implementation and practical implications. *Paper presented at the 11th Fuse Physical Activity Workshop, Durham, UK.*

Kay, T., **Rigby, B.P.** and Fitzgerald, M. (2018). Physical activity and health inequalities. *Workshop delivered at the 10th Fuse Physical Activity Workshop (10th anniversary event), Newcastle, UK.*

Rigby, B.P., Lindsey, I. and Oliver, E.J. (2018). Influencing older people's physical activity: a pilot rapid evidence review. *Paper presented to the Active Durham Partnership Leadership Group, Durham, UK.*

Rigby, B.P. and Morris, S. (2017). Thinking about social disadvantage and physical activity interventions. Exploring priorities and sharing stories. *Workshop delivered at the 8th Fuse Physical Activity Workshop (physical activity and health inequalities, a level playing field?), Stockton-on-Tees, UK.*

Poster presentations

Rigby, B.P., Dodd-Reynolds, C.J. and Oliver, E.J. (2018). Outdoor walking groups insufficiently address inequalities: findings from a scoping review.

Oral e-poster presented at the 7th International Society for Physical Activity and Health Congress, London, UK

Rigby, B.P. (2018). Diversifying the public health evidence-base: how scoping reviews can contribute to progress regarding physical activity inequalities. *E-poster presented at the 7th International Society for Physical Activity and Health Congress, London, UK.*

Reports

Smith, B., **Rigby, B.P.**, Netherway, J., Wang, W. Dodd-Reynolds, C.J., Oliver, E.J., Bone, L. and Foster, C.E.M. 2022. *Physical Activity for General Health in Disabled Children and Disabled Young People: Summary of Rapid Evidence Review for the UK Chief Medical Officers' Update of the Physical Activity Guidelines.* London: Department of Health and Social Care.[5]

Rigby, B.P., Donkin, B., Oliver E.J., Lindsey, I. and Mitchell, I. (2018). *Influencing Older People's Physical Activity: A Pilot Rapid Evidence Review Produced on Behalf of the Active Durham Partnership Evidence-based Approach Group.* Commissioned by County Durham Sport.

Other publications

Rigby, B.P. and van der Graaf, P. (2021). 10 principles to translate national physical activity policy into local practice. *A Fuse evidence brief.* http://www.fuse.ac.uk/research/briefs/10%20principles%20to%20translate%20national%20physical%20activity%20policy%20into%20local%20practice.pdf.

Rigby, B.P. (2020). Policy-making and possibilities amid coronavirus: a few brief reflections. *Contribution to the Durham Department of Sociology Health and Social Theory Blog.* https://www.durhamhealthresearch.co.uk/post/policy-making-and-possibilities-amid-coronavirus-a-few-brief-reflections.

Rigby, B.P. (2018). Be *'pro-active'* but reflect on lessons from exercise referral schemes. *Contribution to the Westminster Health Forum – Where Next for Social Prescribing in England – Outcomes, Patient Choice and Cost-effectiveness seminar proceedings.* https://dro.dur.ac.uk/24585/1/24585.pdf.

Rigby, B.P. (2016). 'A nation stood still for 25 years: Can we find solutions for action in policy and practice?' *Contribution to the Fuse Open Science Blog.*

[5] This report has been translated into a co-produced infographic, which is published in BJSM and different accessible formats, including Braille. Widespread media attention. Impact includes educational approaches to reading in special schools. All resources are available: https://www.gov.uk/government/publications/physical-activity-in-disabled-children-and-disabled-young-people-evidence-review

Masters dissertation

Rigby, B.P. (2017). Mapping walks: A scoping review exploring equity considerations in outdoor walking group literature. Grade: Distinction (80%).

Undergraduate dissertation

Rigby, B.P. (2015). *"It Would be Lovely to Have Some of the Answer!" An Investigation into the Knowledge and Application of Physical Activity Guidelines and Interventions by General Practitioners.* Grade: 1:1 (85%).

Published acknowledgements

Smith, B., Netherway, J., Jachyra, P., Bone, L. Baxter, B., Blackshaw J. and Foster C.E.M. 2022. Infographic. Communicate physical activity guidelines for disabled children and disabled young people. *British Journal of Sports Medicine.* doi: 10.1136/bjsports-2022-105411

Lindsey, I. and Bitugu, B.B. 2018. Distinctive policy diffusion patterns, processes and actors: drawing implications from the case of sport in international development. *Policy Studies.* [Online]. doi: 10.1080/01442872.2018.1479521.

Invited peer reviewer

International Journal of Sport Policy and Politics
International Journal of Equity in Health

Grant capture

2021	DHSC	CO-I	Rapid evidence review on physical activity for general health benefits in disabled children and young people – Undeclared.
2016	ESRC	Ph.D.	Theories of complex systems and policy implementation in community-based health promotion - £72,436.

Small support grants

2019 – 2022	UKRI open access publications fund	£6,042
2018 – 2021	ESRC RTSG, Durham University student grants	£1,556

Teaching experience

Postgraduate

2017 – 2018 Seminar leader - SOCI59515 Perspectives on Social Research (Taught MA course).

Undergraduate

2020 – 2021 Seminar leader, module and assessment content designer – SPRT1331 Introduction to Sport and Exercise Industries (1st Year).

2018 – 2019 Seminar leader, module and assessment content designer and guest lecturer – SPRT2271 Physical Activity and Health Psychology (2nd Year).

2016 – 2018 Seminar leader and summative assessment marker - SPRT1261 Introduction to Sport Psychology (1st Year).

2016 – 2020 Seminar leader, module and assessment content designer and summative assessment marker - SPRT1311 Introduction to Physical Activity Diet and Health (1st Year).

Teaching experiences: team teaching; design, delivery (including online) and evaluation of lectures and small group teaching; marking and moderating essays, presentations, exams and MCQs.

Supervision

I currently supervise two Master's in Public Health students at the University of Glasgow.

I have previously co-supervised one undergraduate and one postgraduate student at Durham University.

Tutorial support

I offer regular tutorial support, both academic and pastoral. I have experience of working with students with disabilities and of providing remedial support for students who have fallen behind in their learning.

Conferences and workshops hosted

2021 Making complexity and systems-thinking work for physical activity policy. Zoom.

2020 7th International Conference on Qualitative Research in Sport and Exercise. Durham, UK (cancelled due to the SARS-Cov-2 pandemic).

2018 11th Fuse Physical Activity Workshop: *Getting the North East ready for action: how the forthcoming revised UK physical activity guidelines can be used to rethink regional physical activity policy and implementation.* Durham, UK.

2017 BSA Sport Study Group Postgraduate Forum: *Sport Identities, Careers and Opportunities.* Durham, UK.

Professional affiliations

2021 – Member of the UK Society for Behavioural Medicine

2021 – Member of the UK Evaluation Soceity

2021 – Fellow of the Higher Education Academy.

2020 – 2021 Special member of the UK Chief Medical Officers' expert group for the communication of physical activity guidelines.

2019 – 2021 Associate Fellow of the Higher Education Academy.

2018 – Associate member of Fuse: The Centre for Translational Research in Public Health.

2016 – Postgraduate Associate of the Wolfson Research Institute for Health and Wellbeing, Durham, UK.

Additional Indicators of Esteem

- Recipient of the Faculty of Social Sciences and Health MA Social Research Methods (MARM) Special Achievement Prize for highest overall degree average across the faculty.

- Recipient of Department of Sociology prize for highest overall Master's in Social Research Methods (MARM) degree average.

- Selected for an ESRC-funded North East Doctoral Training Centre Studentship having been successful in the 2016 competition. The number of available studentships was limited to approximately 40, of which 20% were reserved for collaborative projects. The award-winning programme offers an advanced, cutting-edge, multidisciplinary doctoral training programme that provides participants with the knowledge, skills and tools to undertake high-quality social science research.

- Recipient of the Undergraduate Prize for Academic Achievement in recognition of attaining the highest overall degree average.

- Two-time recipient of the Vice-Chancellor's Scholarship for Academic Excellence (undergraduate). This prestigious scholarship is awarded to 60 students annually in recognition of their achievements over the previous year. The award's aim is to support and promote excellence in academia.

Personal development

2021 Systems Science for Social Impact (Group Model Building), Washington University in St. Louis, USA, virtual.

2020 CECAN Participatory systems mapping training. Surrey, UK (intended training cancelled due to SARS-Cov-19).

2019 Public Health England data anonymisation training. London, UK.

RIS Inside Policy. Durham, UK.

2018 CAROD Introduction to R. Durham, UK.

CSJCA Developing policy and practice through participatory research. Durham, UK.

SRA Introduction to Qualitative Interviewing. Guildford, UK.

Durham University Learning and Teaching Award. Durham, UK.

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Baldwin, A., Birks, M., Mills, J. and Budden, L. 2014. Putting the philosophy into PhD. *Working Papers in the Health Sciences*. Available from: https://www.researchgate.net/profile/Adele-Baldwin/publication/273694286_Putting_philosophy_into_PhD/links/550f51370cf2752610a00d2d/Putting-philosophy-into-PhD.pdf [Accessed 6 April 2022].

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Barbrook-Johnson, P.., Proctor, A., Giorgi, S. and Phillipson, J. 2020. How do policy evaluators understand complexity? *Evaluation.* **26**(3), pp.315-332.

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