Parkour as a donor sport for athlete development in team sports

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Abstract

This thesis explores Parkour as a donor sport for athlete development in team sports. **Chapter 1** introduces the thesis and provides a structural overview of this mixed-methods programme of research. **Chapter 2** presents a literature review, outlining how Parkour could be a suitable donor sport for developing athleticism in team sport athletes. The chapter is summarised by identifying the current gaps in the literature and the aims of the thesis are outlined. **Chapter 3** is the first qualitative study in the thesis and explores Parkour Traceurs' experiential knowledge on the functional performance behaviours they perceived to be developed during Parkour, and their recommendations for how to effectively design Parkour-style practice sessions to facilitate such functional behavioural development. These recommendations were used to develop an indoor-Parkour environment that is utilised in chapter four of the thesis. **Chapter 4** is the field-based study in the thesis and examines what functional movement skills correlate with Parkour speed-run performance. Parkour speed-runs were selected as these are a recognised form of Parkour competition that provide an objective measure of performance (time), compared to skill and free-style events that use subjective coach ratings/screening. Data suggest that, from a practical perspective, the agility T-test, standing long jump, and counter movement jump with and without arm swing can form a basic battery to evaluate the physical effects of Parkour speed-run interventions on functional movement skills. **Chapter 5** is the second qualitative study in the thesis exploring talent development specialists' and strength and conditioning coaches' pre-existing knowledge about Parkour-style training and perceptions held on the potential applications of Parkour-style training for athlete development in their sports. Participant perceptions revealed that: 1) Parkour activities were viewed as supplementary activities to enrich sport-specific training routines, including use of obstacle courses and/or tag elements, 2) Parkour-style obstacle environments needed to be scalable to allow individual athletes and coaches to manipulate object orientation and tasks using soft play and traditional gym equipment, and 3), The implementation of continued professional development opportunities, athlete-centred approaches to learning design and coach-parent forums were recommended to support inclusive Parkour learning environments. **Chapter 6** concludes the empirical data collection in the thesis using a Delphi study to gain consensus on factors relating to the feasibility of integrating Parkour-style training into team sport practice routines. The findings from this chapter establish a set of design principles for the integration of Parkour-style training in team sport settings. **Chapter 7** concludes the thesis by presenting a critical discussion of the observed findings in relation to contemporary research and theory. The limitations of the programme of work are also discussed alongside future research directions.

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Dedication

Dedicated to my family. For everything.

Candidate Declaration

I hereby declare that:

1. I have not been enrolled for another award of the University, or other academic or professional organisation, whilst undertaking my research degree.

2. None of the material contained in the thesis has been used in any other submission for an academic award.

3. I am aware of and understand the University's policy on plagiarism and certify that this thesis is my own work. The use of all published or other sources of material consulted have been properly and fully acknowledged.

4. The work undertaken towards the thesis has been conducted in accordance with the SHU Principles of Integrity in Research and the SHU Research Ethics Policy.

5. The word count of the thesis is: 48, 047

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PhD Research Outputs

Peer Reviewed Journal Articles

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Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2020). Designing Parkour-style training environments for athlete development: Insights from experienced Parkour Traceurs. *Qualitative Research in Sport, Exercise and Health*. https://doi.org/10.1080/2159676X.2020.17202753.1.

Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2021). Effects of Functional Movement Skills on Parkour-Speed-Run Performance. *European Journal of Sport Science.* https://doi.org/10.1080/17461391.2021.1891295 .

Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2021). Exploring coach perceptions of Parkour-style training for athlete development. *Journal of Motor Learning and Development*. https://doi.org/10.1123/jmld.2021-0005.

Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (revisions invited). Feasibility of Parkour-style training in team sport practice routines: a Delphi study. *Journal of Sport Sciences.*

Conference Proceedings and Presentations

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Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. Feasibility of Parkour-style training in team sport practice: A Delphi study. Oral presentation at Movement, Learning and Pedagogy - A contemporary perspective, Norwegian School of Sport Sciences and Norwegian University of Science and Technology. 22nd October 2021

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Finally, to anybody reading this who will build upon this programme of research, whoever you are, wherever you are, I am wishing you well. Make the most of it.

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Chapter 1: Introduction and Thesis Structure

1.1. Thesis Introduction

Individuals who demonstrate elite and exceptional performance are often thought to have specialised in their domain of expertise early in their life (Seifert et al., 2019). Yet, an array of scientific enquiry also recognises that skill can be developed and harnessed via an individual's continuous and enriched interactions with performance environments through a variety of play, practice, and competition scenarios (Araújo & Davids, 2011). In the context of skill acquisition, the research consensus on the impact of early sport specialisation on athlete development remains mixed (Mosher et al., 2021). The promotion of domain specificity and potential performance-related adaptations gained through a higher amount of time spent in sport-specific training are often cited as being positive potentialities of early sport specialisation on athlete development (for review, see Young et al., 2021). However, imbalances between the amount of time spent in sport-specific training and the developmental needs of the athlete leading to injury are often cited as negative potentialities of early specialisation on athlete development (Jayanthi et al., 2017; LaPrade et al., 2016; McFadden et al., 2016).

Much of the debate about the value of early specialisation comes from the inability to reconcile the positive and negative potentialities of early sport specialisation (Mosher et al., 2021). As Mosher et al. (2021) suggested, the negative potentialities of early specialisation are likely not because of early specialisation alone but instead the design, implementation and management of early specialisation programmes, similar to those proposed within development systems and talent identification pathways in a variety of team sports (Rongen et al., 2018). For example, early specialisation in team sports is often associated with success in junior competitive levels only (Güllich et al., 2017), with limited evidence that such success translates to adult or senior levels of participation (Güllich & Emrich, 2013).

There is a rapidly expanding body of evidence suggesting that specialising early in a specific sport is not necessarily a prerequisite for elite-level attainment in sports domains (e.g., Buckley et al. 2017; Huxley et al., 2017; Black et al., 2019; Ross et al., 2021), with some evidence demonstrating that the most successful elite athletes competed in, and trained for, multiple sports in their youth and only specialised during adolescence (Davids et al., 2017; Güllich, 2018). As skills acquired in one performance context may transfer (benefit performance) to another (Schmidt & Young, 1987), and that there are many pathways to attaining expertise (Phillips et al., 2010; Güllich, 2014), it has been argued that sports organisations of all levels of participation should promote early diversification (Hendry et al., 2014). It has been suggested that such an approach to promote early diversification may increase the engagement and intrinsic motivation of athletes (Lidor et al., 2009), reduce injury risk (Myer et al., 2016), and enhance the adaptive capacities of individuals (Araújo & Davids, 2011). Furthermore, early diversification aligns with emergent practitioner-led training and talent development models, exemplified by the Athletic Skills Model (Wormhoudt et al., 2018).

In sports domains, practitioners are often warned to advise parents and athletes against the practice of sport specialisation without understanding why or how it should be negated (Mosher et al., 2021). The Athletic Skills Model attempts to reconcile this issue in proposing a transition from more diversified to more specialised sports experiences as an athlete develops on a continuum (Wormhoudt et al., 2018). According to the Athletic Skills Model, to negate some of the negative consequences of early sport specialisation, practice in specific sports programmes could be (re) designed to facilitate the experience of various physical activities, termed donor sports, which cultivate athletic skill development through exploratory practice and guided discovery. In this sense, Parkour theoretically has potential as a donor sport for developing talent in team sports because Parkour challenges performers (known as Traceurs) to learn how to negotiate

obstacles with different properties such as angles, textures, surfaces, inclinations and sizes in the most effective and efficient way possible (Greenberg & Culver 2019).

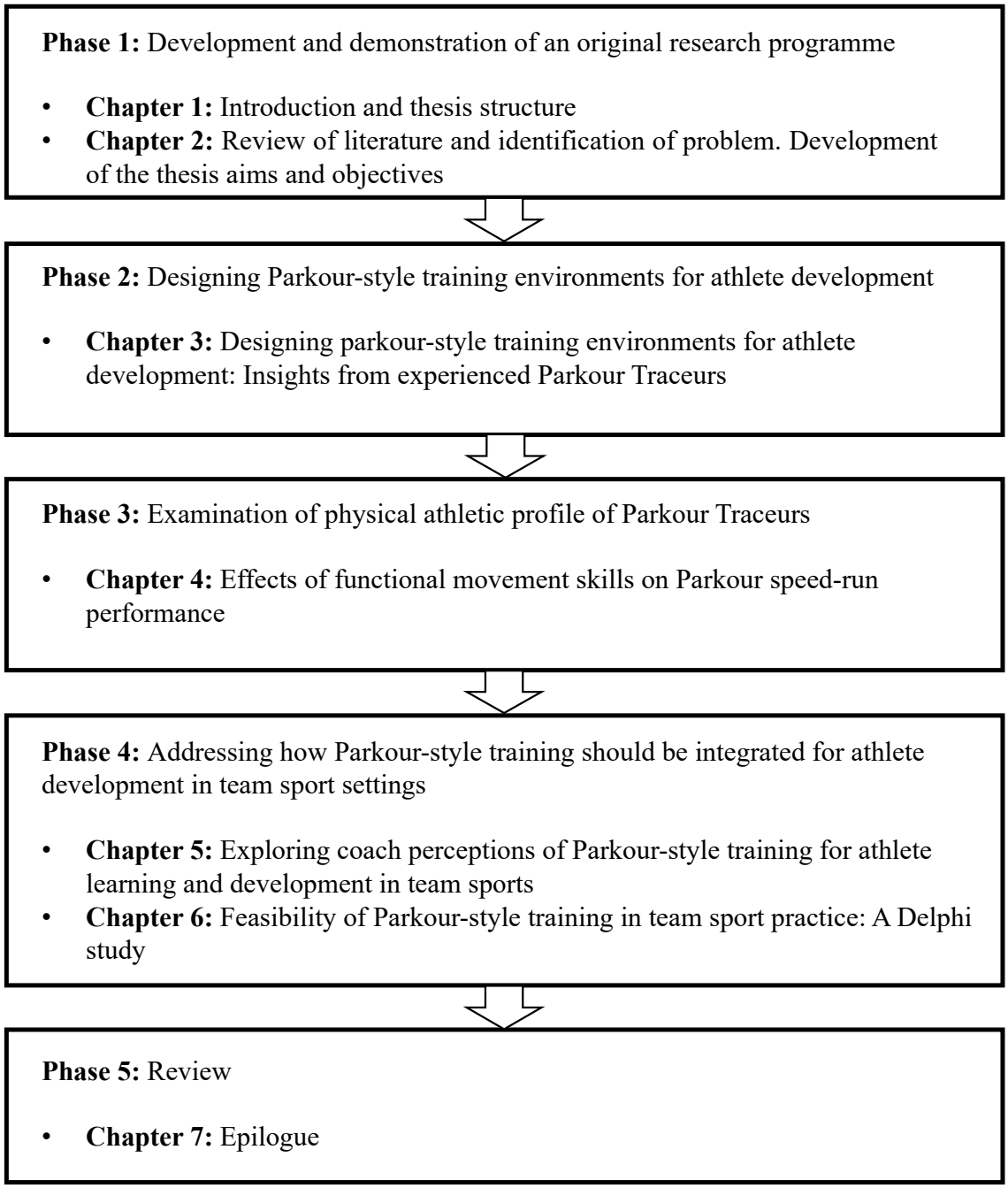
The term ‘traceur’ originated from the French verb “tracer”, which broadly means ‘going fast’ and ‘drawing a line’ (i.e., moving one point to another). Early Parkour Traceurs drew motivation from George Hébert’s Méthode Naturelle, a training method which emphasises the value of functional exercises relating to physical conditioning and development of foundational movement skills (i.e., attack-defence, carrying, climbing, jumping, rising, running, swimming, throwing, walking) (Terret, 2010). According to Méthode Naturelle, these foundational movement skills underpin the execution of more complex movement patterns, supporting well-rounded athleticism (Hébert & Till, 2017). This focus on the development of functional movements to develop adaptive and versatile performers shares many similarities with the Athletic Skills Model (see section, 2.5 Wormhoudt et al., 2018), related principles of Nonlinear pedagogy (see section, 2.4 Chow et al., 2016), and ecological dynamics theory (see section, 2.2 Chow et al., 2019). However, a mixture of complementary quantitative and qualitative investigation is required to explore Parkour as a donor sport for athlete development in team sports.

1.2. Thesis Structure

This thesis explores Parkour as a donor sport for athlete development in team sports. **Chapter 1** introduces the thesis and provides a structural overview of this mixed-methods programme of research. **Chapter 2** presents a literature review, outlining how Parkour could be a suitable donor sport for developing athleticism in team sport athletes. The chapter is summarised by identifying the current gaps in the literature, and the aims of the thesis are outlined. **Chapter 3** is the first study in the thesis that explores Parkour Traceurs' experiential knowledge on the functional performance behaviours they perceived to be developed during Parkour and their recommendations for effectively designing Parkour-style practice sessions to facilitate such functional behavioural development. These recommendations were used to develop an indoor-Parkour environment that is utilised in chapter four of the thesis. **Chapter 4** is the field-based study in the thesis and examines what functional movement skills correlate with Parkour speed-run performance. **Chapter 5** is the second qualitative study in the thesis, exploring talent development specialists' and strength and conditioning coaches' pre-existing knowledge about Parkour-style training and perceptions held on the potential applications of Parkour-style training for athlete development in their sports. **Chapter 6** concludes the empirical data collection in the thesis using a Delphi method to gain consensus on factors relating to the feasibility of integrating Parkour-style training into team sport practice routines. The findings from this chapter establish a set of design principles for integrating Parkour-style training in team sports settings. **Chapter 7** concludes the thesis by presenting a general critical discussion of the observed findings in relation to contemporary research. The limitations of the programme of work are also discussed alongside future research directions.

Figure 1.

Structure and overview of the thesis.



Chapter 2: Literature Review

This chapter reviews literature outlining how Parkour could be a suitable donor sport for athlete development in team sports. Using key concepts from ecological dynamics, critical analyses of scientific literature are provided in relation to affordances, affordance landscapes and constraints on neurobiological systems. Research on the Athletic Skills Model and the applications of coach experiential knowledge for the enrichment of experimental and practice design in Parkour are also evaluated. It concludes by reviewing the current gaps in the literature outlined throughout the chapter, and the aims and objectives of the thesis are outlined.

This chapter is based on the following peer-reviewed journal article: Strafford, B. W., Van Der Steen, P., Davids, K., & Stone, J. A. (2018). Parkour as a donor sport for athletic development in youth team sports: insights through an ecological dynamics lens. *Sports Medicine-Open, 4*(1), 21. https://doi.org/10.1186/s40798-018-0132-5.

2.1. Research Overview

Acquiring skill and expertise in sport requires athletes to engage in an array of sporting activities (Güllich, 2017). However, the type and number of activities an athlete should engage with on the path to expertise has been a prominent debate for decades (for a review, see Coutinho et al., 2016). Despite considerable interest in expertise and skill acquisition, the majority of research in these fields classifies learning design using a deliberate practice or deliberate play framework and fails to include a wide range of learning activities that are representative of the underlying structures of competition and transfer of athletic skill (Seifert et al., 2019). Whilst these approaches to skill learning are not without merit, the conceptualisation of an 'either-or' approach is reductive for developing well-rounded athletes. The theoretical concepts of ecological dynamics propose that sports practice should comprise rich and varied opportunities for action (termed affordances) to enhance self-regulation in performance (Davids et al., 2015). Therefore, practice landscapes should invite learners to perceive and utilise affordances for perceptual, cognitive, psychological, and physical behaviours across a variety of sports and physical activities (Renshaw et al., 2019), commonly attributed to early diversification models of athlete development. Aligned with an ecological dynamics conceptualisation of learning, practitioner informed models of athlete development, such as the Athletic Skills Model, present a more nuanced approach to expertise attainment, advocating a transition of practice experiences (termed enrichment activities) from diversification to greater specialisation as athletes develop (Wormhoudt et al., 2018). Although, the components and proposals of the Athletic Skills Model are underpinned by sound theoretical ideas, they require substantiating through empirical investigation (Strafford et al., 2018).

This chapter begins by providing a comprehensive background on ecological dynamics theory (section 2.2), with relevant discussion on constraints (section 2.2.1), and

an introduction to affordances (section 2.2.2). Section 2.3 subsequently explains why affordances are important for skill acquisition in sport and discusses the concept of affordance landscapes (section 2.3.1) and potential applications of affordance landscapes for learning design in sport (section 2.3.2). Sections 2.4 and 2.5 move into the practical applications of ecological dynamics by first explaining the conceptual model and principles of Nonlinear Pedagogy (section 2.4), followed by the Athletic Skills Model and donor sports concept with reference to affordance landscapes and constraints (section 2.5). Following on from this, Section 2.6 provides an explanation on the potential applications of Parkour speed-run as a donor sport, with specific reference to psychological (section 2.6.1), social (section 2.6.2), physical (section 2.6.3), and perceptual (section 2.6.4) determinants in Parkour. Learning design in Parkour is then discussed (section 2.7) along with the applications of experiential knowledge of expert coaches and athletes (section 2.8). The penultimate section of the literature review (section 2.9) draws on critical issues discussed in the preceding sections to identify the current challenges and gaps in research when examining Parkour as a donor sport, and the thesis aims and objectives are outlined (section 2.9.1).

2.2. A Background to Ecological Dynamics

Ecological dynamics is a theoretical framework used to understand athlete development on an ecological scale (Button et al., 2020). Over the last two decades, ecological dynamics has been used to inform the design and structure of 'enriched' practice experiences, which cultivate athlete development and lifelong engagement in physical activity (Rudd et al., 2020). Conceptualised initially from the works of Davids et al. (1994), Handford et al. (1997), Warren (2006), and Araújo et al. (2006), ecological dynamics proposes an embedded role for cognition, emotions, perceptual, and physical skills in the motor learning process, founded on the multidisciplinary intersections between ecological psychology (Gibson, 1979) and dynamical systems theory (Berstein,

1967). Ecological dynamics was selected to underpin the studies outlined through this thesis, as the theoretical framework affords athlete development to be studied on an ecological scale, with athlete-environment relationships modelled as a complex dynamic system (Seifert et al., 2019; Button et al., 2020).

The analysis of behaviour on an ecological scale is informed by research from ecological psychology, notably James Gibson (1979) and Egon Brunswick (1956), which outlined a shared and reciprocal relationship between the performer and environment. As stated by Gibson (1979, p.233), "we must perceive in order to move, but we must also move in order to perceive". This reciprocity between perception and action leads to the performer and environment being viewed as a mutually coupled dynamical system when investigating how behaviours emerge (Warren, 2006). Central to ecological psychology is the notion that learning movement skills are not predicated on information processing attributed to the acquisition of symbolic representations, such as movement templates (also referred to as 'movement models') or schema (Schmidt, 1975), but instead on the continuous perceptual regulation of the learners' action(s) in a specific learning context (Rudd et al., 2020). From a dynamical systems perspective, functional movement solutions emerge from multiple sub-system interactions within the task, person (also referred to as individual or organismic constraints) and environment relationship (Newell, 1986; Thelen, 1989; Davids et al., 2008). When in motion and under-constraint, all sub-systems spontaneously 'self-organise, or 'come together' and interact in a specific way to explore, discover, and exploit efficient, effective and functional movement solutions to satisfy a specific task goal (Thelen, 1989; Davids et al., 2008). Early in development, individuals perceive these opportunities for action (affordances) (Gibson, 1979) at each moment in time and space, relative to their current intrinsic dynamics (predicated on cognitive development and skill competency) and dynamics of the performance and task goal (Adolph & Hoch, 2019) (see section 2.2.2 for more detail).

Functional movement skills refer to the repertoire of behaviours (actions, cognition, and perception) that afford an individual to navigate the environment, interact with others and negotiate tasks to achieve intended goals (Chow et al., 2020). Functional movement skills are, therefore, not acquired at a steady state as changes in an individual as a complex neurobiological system (relative to physiological and psychological development) involve a non-linear process (Chow et al., 2016), and small (but critical) changes in one sub-system can result in a cascade across the whole system, leading to the emergence of new movement solutions via a process of 'exploration' (Davids et al., 2008; Chow et al., 2016). As a function of experience (through familiarity) and learning, functional movement skills typically stabilise in an attractor state (i.e., experiences of synergy formation that results in a greater breadth of stable coordination patterns) in the complex dynamic system (Rudd et al., 2020). Learning in complex dynamic systems (i.e., a self-organising system, continuously regulating its behaviours without being regulated by an external regulator), results in synergy formation between system components, such as synaptic connections in the brain, joints, muscles, and limb segments, resulting in adaptations across the whole neurobiological system to support an adult or child, to flourish in the environment and seek out and actualise opportunities to be physically active (Chow et al., 2011).

When viewed through an ecological dynamics framework, learning involves constraint-induced synergy formation of physical literacy capacities (cognitive, emotional, perceptual, and physical) found via discovery, exploration, and adaptation of action possibilities (Rudd et al., 2020). As appropriate to each individual, physical literacy can be described "as the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engaging in physical activities for life" (Whitehead, 2019, p.8). For academics, practitioners, and movement scientists observing athlete development in 'natural settings', it is of paramount importance to understand how

differing constraints, relating to task, individual (organismic) and environment (Newell, 1986), converge to engage the formation of synergies, for the utilisation of affordances in the environment (i.e., opportunities or invitations for action in the environment) (Gibson, 1979; Pinder et al., 2011). Therefore, it is essential to examine the reciprocal relationship between the performer and the information which shaped a performance environment when investigating emergent and dynamic behaviours under constraints (Davids et al., 2005; Newell & Jordan, 2007; Davids & Araújo, 2010a; Davids & Araújo, 2010b).

The implications of this ecological conceptualisation of athlete development suggest practice tasks should provide an environment where athletes are challenged by continued problems they are required to solve to achieve task goals. Therefore, an important task for practitioners is the consideration of the manipulation of key constraints to educate the athletes' attention towards features of their environment critical to solving emergent problems of their action capabilities (Woods et al., 2020a; Woods et al., 2020b). Experimental manipulations will, therefore, be considered as constraints throughout this thesis. The following sections explore relevant literature and concepts relating to constraints and affordances in athlete development settings in greater detail.

2.2.1. Constraints

Constraints are “boundaries or features that limit motion of the entity under consideration at any moment in time” (Newell, 1986, p.347). Within complex neurobiological systems, rich patterns of behaviour emerge under specific constraints (Passos et al., 2009; Pinder et al., 2012). To guide and shape emergent pattern formation among the degrees of freedom within the complex neurobiological system, self-organising processes need to be juxtaposed with competing and cooperating internal and external constraints that pressure a change in organisational states (Newell, 1986; Glazier & Davids, 2009). This process is commonly referred to as ‘self-organisation under

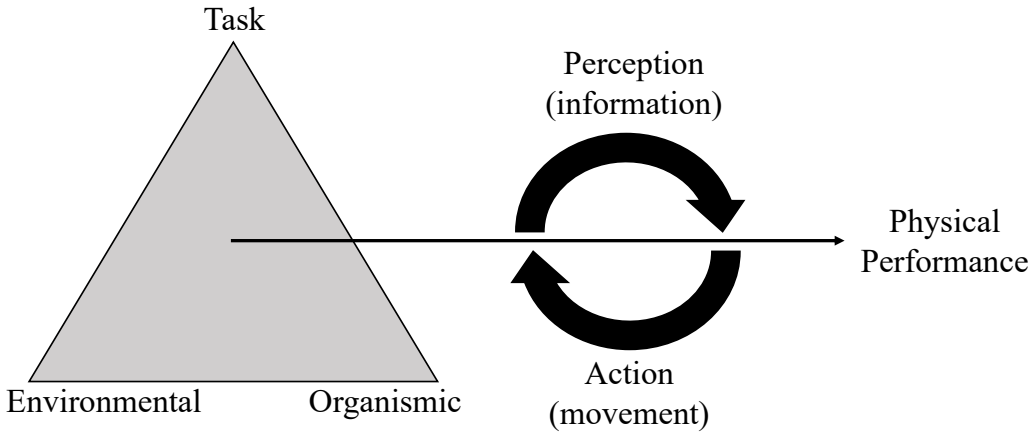
constraint' (Davids, 2013; Passos et al., 2013). Therefore, constraints can be described as design features, limitations or boundaries that restrain the organisation of the degrees of freedom nested at different levels of the movement system (Sparrow & Newell, 1998).

Inspired by Kugler et al. (1980) and Kugler et al. (1982), Newell's (1986) constraints led approach proposed that task, environment and organismic (individual) constraints shape and channel emergent patterns of human behaviour (see Figure 2.1). Environmental constraints are external from the movement system and are physical or social in nature. Physical examples of environmental constraints include gravity, temperature, and ambient light, whereas social-environmental can be spectators or observing coaches (Glazier & Davids, 2009). Organismic constraints reside within the boundaries of the individual movement system and are inherent to the physical and mental aspects of the performer (e.g., genetic make-up, level of maturation, perceptual skill, cognition, and emotions). Arguably the most influential and prominent organismic constraint that shapes movement coordination is the intention of the learner (Kelso, 1995). Task constraints are more specific to the performance context (e.g., specific performance goals, performance surfaces, rules, equipment). Clark (1995) discussed how task constraints operate as a hierarchy over the environmental and organismic constraints, with adaptations in movement patterns even in highly consistent tasks, dependent on changes in task constraints from one performance attempt to another. Thereby, a critical feature of expertise and skill acquisition is the variability of motor performance under different performance contexts (Davids, 2014). The concept of 'self-organisation' or 'constrained optimisation' suggests that the behaviour of a system at any point in time will also be optimised for the specific constraints acting upon the complex neurobiological system. However, although some constraints are more influential than others in certain performance environments, it is the confluence of interacting organismic, environment and task constraints that channel the patterns of movement control and

coordination and consequently performance outcomes (Davids & Araújo 2010a; Davids & Araújo 2010b).

Figure 2.1.

Newell's (1986) model of interactive constraints. Adapted by Davids et al. (2003) to illustrate the resulting effects on variability of physical performance.



From an ecological dynamics perspective, humans are open systems, with variable amounts of energy moving among their component parts at any given time (Davids & Araújo 2010a; Davids & Araújo 2010b). The force applied (e.g., force due to gravity, tactile pressure applied to objects in a Parkour-speed-run) within a neurobiological system results in organisation changes in the internal energy that interacts with the forces in a given performance environment (Kugler et al., 1982). This suggests that humans have onboard sources of energy that allow them to be self-sustained and adaptive. Humans can adapt and exploit the surrounding environment and energy flows through further exploration and learning, allowing the system to become more effective (Kugler et al., 1988). Therefore, skilled performers are attuned to use such energy in the environment, like optical energy, to constrain their actions (Gibson, 1979). Thereby, the critical adoption of a constraints led approach aligned with key concepts of ecological dynamics demonstrates the important implication for learning and practice design in the sport. In recent years, the critical application of constraints have formed the basis of

practitioner informed models of athlete development, notably Nonlinear pedagogy and the Athletic Skills Model, which are discussed later in the thesis (see sections 2.3 and 2.4).

2.2.2. Affordances

According to Gibson's (1979) theory of direct perception, the environment offers potential opportunities for humans and animals to perceive and act upon properties of objects, surfaces, and events in the surrounding landscape via opportunities or invitations for action (termed *affordances*) (Gibson, 1979). These affordances take the form of functional performance behaviours which can achieve specific intentions and goals. For example, in Parkour activities, when athletes climb a vertical surface, affordances for support and negotiation are afforded by cracks, gaps, and ledges in the surface of wooden objects in the pre-determined route, or when athletes race a moving opponent the trajectory of a moving opponent invites an interception with one or more limbs, like the legs, arms, fingers, hands (Rudd et al., 2020). Affordances are not perceived material entities but *functional relationships* or *relational entities* shaped via the individual and their environment (Chemero, 2009). Through this lens, affordances are functional rather than structural, and relational rather than material, properties of a performance environment (i.e., what a surface, object, or another teammate or opponent, affords the individual regarding opportunities for actions) (Davids et al., 2016). For example, affordances are scaled to each organism's (individual's) action capabilities, which are *relational* to relevant properties of that individual (animal-environment relationship), including key body dimensions (e.g., stature, body mass, limb length) and scale of action capabilities (e.g., functional movement skills: aiming; balance; climbing; jumping; kicking; rolling; romping/fighting; running; swinging; throwing) (Davids et al., 2014; Strafford et al., 2018). This view that affordances are *relational* properties between an individual and performance environment outlines how affordances have both objective

(they are perceivable in a performance environment) and subjective (they need an actor to perceive them) characteristics (Gibson, 1979; Chemero, 2003).

2.3. Why are Affordances important for Skill Acquisition in Sport?

In sports domains, specific affordances capture relationships between the athlete and their performance environment, which may be perceived directly and invite adaptive actions under different performance scenarios (Davids et al., 2017). In short, perceiving an affordance is to perceive *how* to act when confronted with specific conditions in a performance environment. Furthermore, elite performers are attuned to perceiving affordances related to their long-term perceptual-motor experiences from previous training and competition experience (Weast et al., 2011). Therefore, key informational constraints can be designed into sports practice to supplement the discovery of opportunities to act, which are emergent through continuous and reciprocal interactions between the athlete and key features of their performance environment.

Expanding on Gibson's (1979) original description of affordances, Withagen et al. (2017) proposed that affordances are *action possibilities* that *invite* behaviours from individuals – with these time-based invitations for action being specific to an individual, founded on their past experiences, development, and understanding of the sport. In this regard, each athlete's experiences, motivations, skills, and intentions guide performance as they (re) organise movement to seek and utilise affordances in their performance environment. The advancement of affordances proposed by Withagen et al. (2017) emphasises a requirement for subtle interactions between the athlete and emergent affordances during sports performance. Whilst affordances attract, engage, invite, and solicit athletes, individuals can accept or reject these invitations by modulating the strength of the coupling formed with affordances during sports practice and performance. Rietveld and Kiverstein (2014) capture this implied particularity of affordance utilisation, suggesting that the athlete selectively engages with a *rich affordance landscape* as a

function of learning, experience, and development. Hence, sports performance and practice should be highly interactive, shaping the design of the work of coaches in athlete-development programmes.

2.3.1. Affordance Landscapes

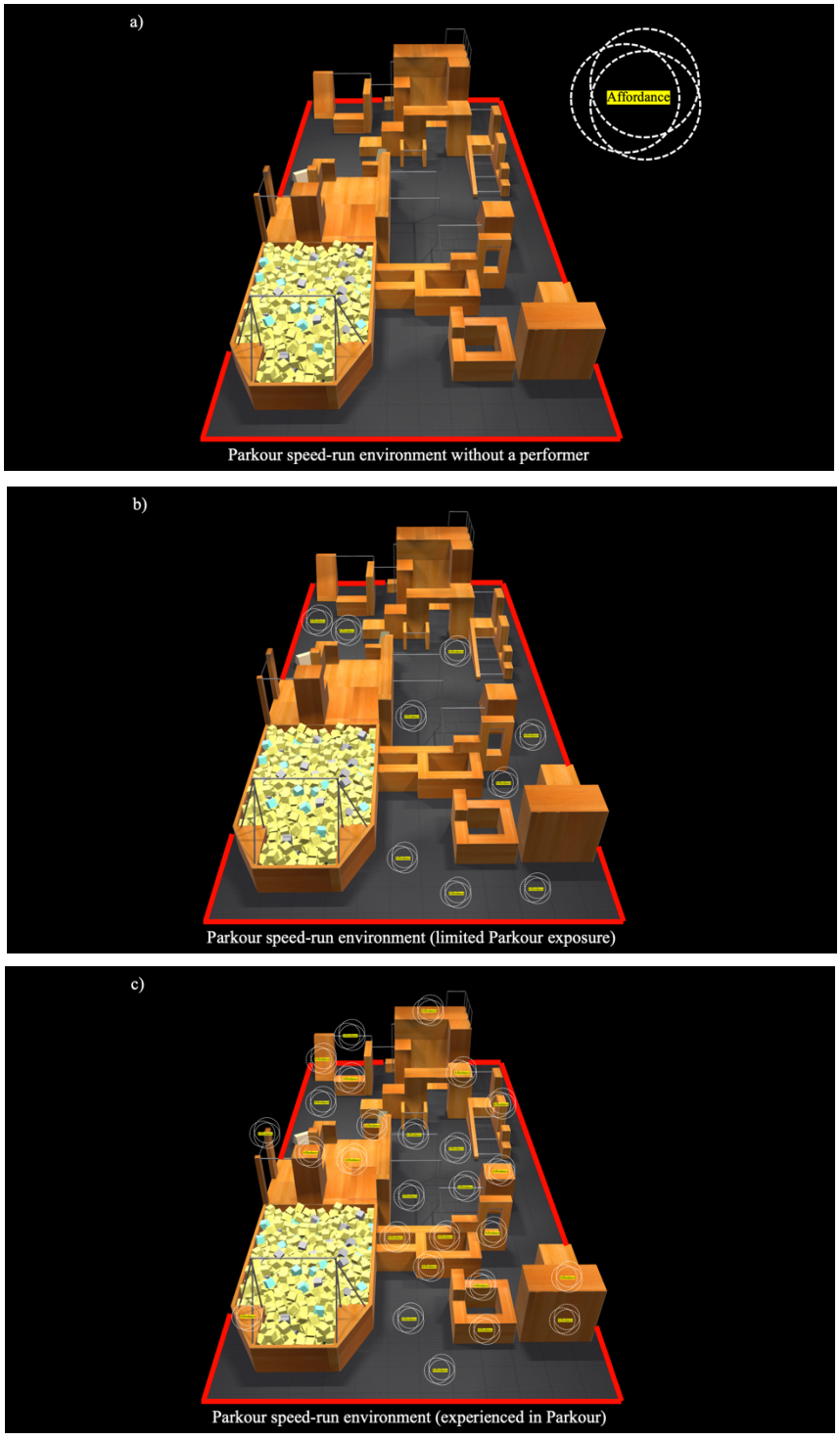
Due to the dynamic nature of sport, athletes have numerous affordances available in an *affordance landscape*, which differ in relational strength and are dependent on emergent task, environmental, and organismic constraints (Rietveld & Kiverstein, 2014). Whilst affordances *invite* action, an important factor to the selection from an *affordance landscape* refers to the action capabilities of the performer. This effect can be seen in individuals who may immediately be drawn towards certain actions, indeed being in a state of *action readiness,* in certain fields within the affordance landscape (Rietveld & Kiverstein, 2014). Affordance fields emerge from the *affordance landscape* based on the interaction between the performer and their environment (Kiverstein et al., 2019). Like the *affordance landscape*, affordance fields are relational in nature, but relative to the individual – guided by their intrinsic dynamics and effectivities. However, affordance fields differ in their inviting character over time (soliciting power) with experience which draws the performer to act (Kiverstein et al., 2019). For example, skilled Parkour performers should, theoretically, be able to exploit a variety of affordance fields relative to their intrinsic dynamics (founded on physical, psychological, and perceptual skills developed through Parkour training) to negotiate the objects in the affordance landscape, compared to individuals with limited Parkour speed-run experience (see Figure 2.2). The inviting character of relevant affordances differs from those belonging to the *affordance landscape*, which remain available to others when the individual is no longer present (Kiverstein et al., 2019).

In terms of skill acquisition, the affordance fields depend on the *affordance landscape* over short time scales, which constrains the possibilities currently available.

Over prolonged time scales, the *affordance landscape* depends on the affordance fields as it is via the invitation of relevant affordances that practices are regulated and maintained (Kiverstein et al., 2019). The affordance field is then always "at the forefront" of the evolving landscape, continuing it in a particular way, sometimes in new and previously unexplored directions (van Dijk & Rietveld 2018). Therefore, when an individual acts, the field of relevant affordances and the landscape of affordances are jointly enacted, albeit to different degrees and at different time scales (Kiverstein et al., 2019). The strength of affordance socialisation can vary depending on contextual circumstances. For example, in Parkour speed-runs, the strength of affordance solicitation may vary depending on the trial number; theoretically, the first trial should be slower due to a lack of familiarity, whereas the final trial should be faster as the athletes become attuned to the constraints on the pre-determined route.

Figure 2.2.

Parkour speed-run affordance landscape, demonstrating how affordance fields differ between the landscape without a performer (a), with a performer inexperienced in Parkour (b), and an experienced Parkour athlete (c).



Note. Objects in the red boundaries contribute to the affordance landscape.

2.3.2. Affordance Landscapes for Learning Design in Sport

A key task for sports coaches is how to design multiple affordances into practice tasks that are simulations of competitive performance environments. Through practice, athletes may become attuned to specific affordances that attract them in the *affordance landscape*. Not all affordance fields, however, will have the same degree of attraction for all athletes, as outlined in Figure 2.2. The coupling strength (soliciting power) can be varied with practice task designs (e.g., manipulating object properties and orientation in a Parkour landscape relative to the performer's skill level). Coaching practices in team sports that emphasise highly structured drill-based practice may restrict and reinforce coupling to narrow affordance fields within an affordance landscape (Button et al., 2020). However, many competitive sports domains are highly variable and not inclusive of predictable performance sequences. Alternative task designs are required during practice to allow athletes to couple their actions to affordances flexibly (e.g., integrating an opponent into a Parkour speed-run between practice experiences). Nikolai Bernstein's view of practice as *"*repetition without repetition" (Bernstein, (1967) translated in 1996, pg. 204) captures this type of task-constraint manipulation in practice. In practical terms, this involves athletes searching the *affordance landscape* to explore the functional movement solutions through continuous and refined interactions with key features, objects, surfaces, and other people in the performance environment. Therefore, modulating the coupling strength within a range of affordances during practice may alter the dynamics of interactions so athletes can become attuned to reacting to environmental constraints (Button et al., 2020). Rather, designing dynamical interactions with a selection of different but highly relevant possibilities for action can assist athletes in selecting and using affordances to support their actions in sport.

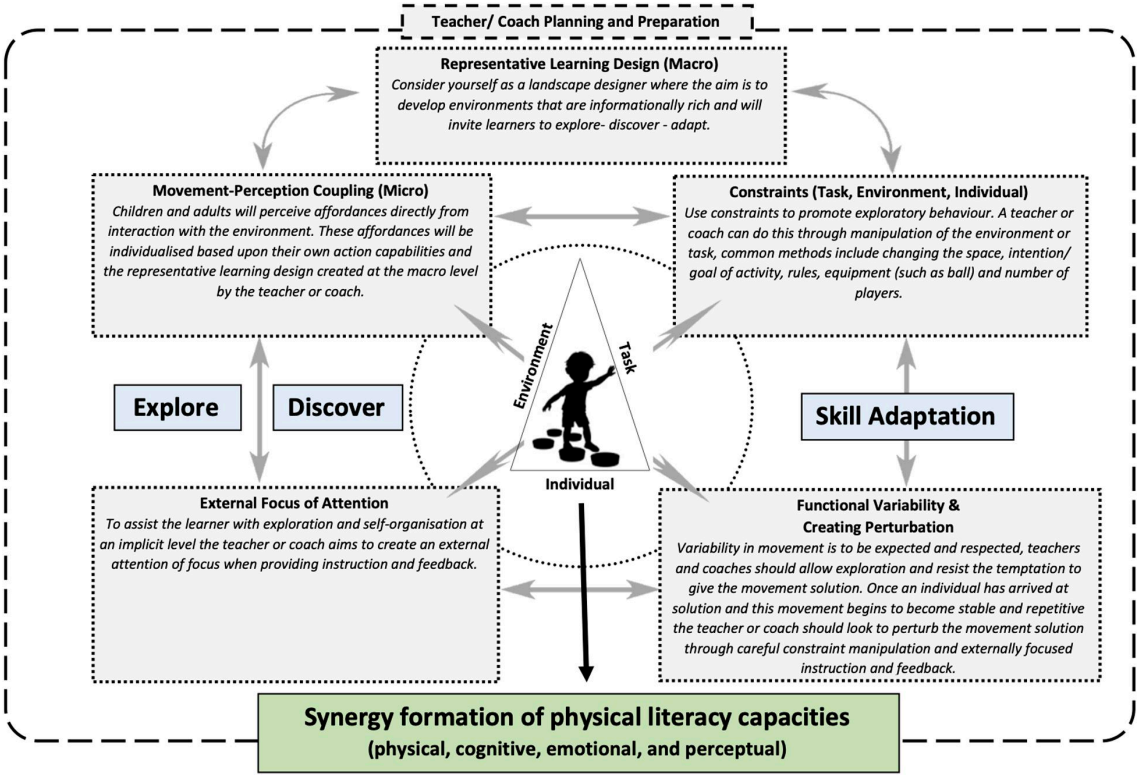
The size and nature of an affordance field in a practice task depend on the learner's intrinsic dynamics and needs (Kiverstein et al., 2019). Therefore, to ensure the affordance fields are not narrow and do not restrict exploratory search activities, coaches must holistically appraise the athlete's needs, encompassing physical, psychological, and social development. The reciprocal nature of physical, psychological, and social development forms the basis of contemporary models of talent development, notably Nonlinear Pedagogy (Chow et al., 2016) and the Athletic Skills Model (Wormhoudt et al., 2018).

2.4. Nonlinear Pedagogy

Successful coaching and learning are often underpinned by effective pedagogical design principles that encourage learners to search for individualised movement solutions (Chow, 2013; Chow et al., 2021). The application of ecological dynamics framework (see section 2.2) in applied coaching practice and scientific research has led to the development of five learner-centred principles which satisfy individual developmental needs via an 'explore-discover-adapt' approach to learning termed "Nonlinear Pedagogy" (Chow et al., 2016). These five learner-centred principles outlined in Nonlinear Pedagogy are representative design, constraints manipulation, task simplification, informational constraints (i.e., attentional focus), and functional variability (Chow et al., 2016; Renshaw & Chow, 2019; Rudd et al., 2020) (Figure 2.3). Each of the five learner-centred principles from Nonlinear Pedagogy are explained in the following sub-section.

Figure 2.3.

Conceptual model of Nonlinear Pedagogy (Chow et al., 2016; Renshaw & Chow, 2019; Rudd et al., 2020).



The first key pedagogical principle of Nonlinear Pedagogy is designing representative learning environments (Pinder et al., 2011; Chow et al., 2020; Chow et al., 2019). The design of representative learning environments requires an in-depth understanding of the information that constrains actions in a specific sport (task functionality), so that affordances available in a performance environment may be utilised to aid individual learners to achieve task goals (for more information on constraints, please section 2.2.1.) (Renshaw et al., 2019). From a pedagogical perspective, representative learning design is founded on long-standing specificity of learning principles (see Henry, 1958). The rationale for developing and integrating representative learning environments is to closely replicate and include critical information that is required to perform well in specific learning and play activities (Chow et al., 2019, Chow et al., 2020). This is achieved via functionality of a task design, where performers base

actions in learning environments on comparable informational variables to those existing in performance environments (Brunswik, 1956; Pinder et al., 2011).

The second key pedagogical principle for Nonlinear Pedagogy is constraints manipulation. Section 2.2.1 outlines how the manipulation of interacting task, environmental, and organismic constraints by the coach or athlete can support skill acquisition and learning. Practically, the design and successful implementation of representative learning environments, task constraints such as task goals, space, rules and equipment properties need to be carefully manipulated (Chow et al. 2021). Coaches can manipulate equipment to increase or decrease the temporal and spatial challenges learners face, for instance scaling of constraints relating to the equipment could be used in Parkour to allow self-organised behaviours to emerge (e.g., exploiting self-organisation tendencies in the learner as a complex system, see section 2.2). Nonlinear Pedagogy considers coaches as environmental designers (Rudd et al., 2020; Woods et al., 2020a; Woods et al., 2020b). In the Parkour specific example outlined above, as a designer, the coach would scale the parameters of task constraints relative to task difficulty to aid the engagement as learners search, exploit and act upon innovative exploratory movement behaviours in the absence of reductive top-down instructions by the teacher or coach, akin to traditional approaches to pedagogy (i.e., linear pedagogy, see Lee et al., 2014). Therefore, coaches should be well-versed in the principle of constraints manipulation to design practices that support exploratory learning in their sport of expertise, perhaps by engaging with relevant text or alternative peer-reviewed research pitched at 'pracademics' (practical academics).

The third key pedagogical principle for Nonlinear Pedagogy is task simplification, rather than task decomposition. As outlined in section 2.2, ecological dynamics advocates that learners need to develop and maintain strong functional couplings of information action, which are gradually strengthened during learning. Decomposing, or 'breaking

down' a task into small component parts may perturb the coupling of information and action and, therefore, inhibit learning and performance. In representative learning environments, information is available to be perceived directly and picked up by the individual as they learn to constrain their actions (Chow et al., 2016). Simplifying tasks could maintain the links between perception and action and support the search for 'specifying' information utilised to generate and regulate functional movement solutions (Chow et al., 2019; Chow et al., 2020). Practically, task simplification helps learners seek, explore, and maintain information and action relationships in task designs (Rudd et al., 2020). Furthermore, task simplification has relevance to the principle of constraints manipulation as the scaling of constraints by a teacher can allow for greater simplification of a produced movement (exemplified by the scaling of or tennis racket and ball compression properties or playing area dimensions in mini-tennis games for children (see Fitzpatrick et al., 2017). Importantly, task simplification supports learners in moving flexibly to explore the environment and generate more information that can be subsequently used for regulating performance but without compromising on the relevance of the intended learning objective or task goal (i.e., it cannot be so simplified to the point where it is not meaningful for the learner) (Tan et al., 2012).

The fourth key pedagogical principle for Nonlinear Pedagogy is related to manipulating informational constraints, where attentional focus on augmented information such as instructions and feedback may emphasise either movement form or movement effect (Chow, 2013). When augmented information provided by the coach is focused on specific expected movement forms, there is a greater tendency for overtly conscious control of movement to solve movement challenges in a learning environment (Chow et al., 2019; Chow et al., 2020). Hence, providing specific verbal instructions in search of optimal forms of movement can result in skill paralysis as these verbal instructions typically fail to account for differences in individual constraints (Seifert et

al., 2019). Conversely, providing instructions that do not seek to solve specific problems for learning but instead focus on the outcome of the movement can encourage learners to search and explore new and varied solutions to solve a movement problem in a variety of different ways (Chow et al., 2016). Therefore, it is critical that learners become attuned to the relevant informational constraints to support exploratory movement behaviours to solve task goals in specific learning contexts.

The fifth key pedagogical principle for Nonlinear Pedagogy is functional variability. Given Nonlinear Pedagogy places emphasis on using augmented information to facilitate learners exploring different movement solutions, manipulating variability in practice affords a functional role for emergent and adaptive exploratory behaviours (Chow et al., 2021). Moreover, movement variability is critical from an ecological dynamics perspective to allow a system (human) to explore the transition to new behavioural patterns (Davids et al., 2008) and support the skill acquisition process (Button et al., 2020). Task constraint manipulation is often used to provide opportunities to explore movement variability and expose individuals to an environment where skill can be developed (see section 2.2.1). In Parkour, this could theoretically be achieved by requiring athletes to explore objects of different dimensions, mass, shape and material compositions to create varying levels of uncertainly during play activities. According to Nonlinear Pedagogy, there is no need for a high level of variability to be maintained in practice for prolonged periods, especially when the individual is early in learning and is seeking to stabilise the coupling of information and action (Rudd et al., 2020). Therefore, as the environmental designer, the amount of variability designed into play activities needs to be considered by the teacher/coach concerning the learner's needs (Renshaw & Chow, 2019). Variability in practice should afford the search for functional movement solutions for learners to achieve an intended goal (Seifert et al., 2019). The coach should guide these search and exploratory behaviours via skilful design and task constraint

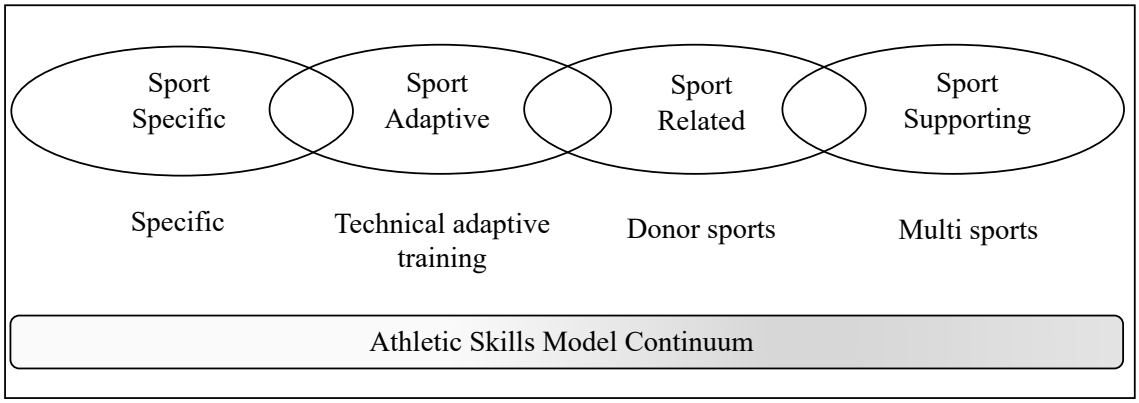
manipulation (Renshaw et al., 2019). Exploratory behaviours are critical and support the learner to become better attuned to information that matches the environmental properties and the learner's own action capabilities (effectivities) (see section 2.2 and section 2.3) (Jacques et al., 2020). Therefore, to challenge individual learners and enhance self-regulation capabilities', rather than over-rely on coach or teacher feedback, a key task for the teacher or coach is to consider how to manipulate the amount of variability in task, organismic or environment constraints, within and between sessions (Renshaw & Chow, 2019). These five learner-centred principles from Nonlinear pedagogy operate through the key pedagogical channels of practice, information, and constraints, with less emphasis placed on verbalised instructions (extrinsic feedback) and greater emphasis placed on implicit learning to allow for the emergence of functional goal-directed actions in the individual learner (Chow et al., 2016; Renshaw & Chow, 2019; Rudd et al., 2020). The long-term impact of engaging with practices designed using these principles of Nonlinear Pedagogy could be the acquisition of a wide range of functional movement solutions that are attuned and adaptable across performance domains and physical activity environments (Chow & Atencio, 2014). The key tenets of ecological dynamics and the related principles of Nonlinear pedagogy are harmoniously aligned with ideas of a contemporary practitioner model of skills development and learning, the Athletic Skills Model, which is discussed next.

2.5. A Background to the Athletic Skills Model and Donor Sports

The Athletic Skills Model is a concentric skill-centred approach to athlete development, comprising of three intrinsically linked building blocks: (1) 10 Basic Movement Skills (referred to hereafter as *Functional Movement Skills* (Newell, 2020) (*aiming; balance; climbing; jumping; kicking; rolling; romping/fighting; running; swinging; throwing*), (2) Coordinative Abilities (*adaptability; balance; coupling; kinetic differentiating; spatial orientation; rhythmic ability*) and (3) Conditions of Movement (*agility; stability; flexibility; power and endurance),* all of which encapsulate elements of functional motor properties (*coordination; speed; strength; flexibility and endurance*). The Athletic Skills Model proposes that developing an athlete's functional movement skills will lead to further gains in their coordinative abilities and conditions of movement (Wormhoudt et al., 2018). The Athletic Skills Model appraises the physical requirements of each sport against these 10 Functional Movement Skills, which are separated into four different classifications using the Athletic Skill Model continuum: sport-specific, sport-adaptive, sport-related, and sport-supporting (see Figure 2.4).

Figure 2.4.

The Athletic Skills Model Continuum (Wormhoudt et al., 2018).



Central to the Athletic Skills Model is the notion that athletes must become versatile and adaptive movers before they can become expert athletes (for detailed overviews of the Athletic Skills Model, see Chapter 5 of Wormhoudt et al., 2018). The Athletic Skills Model suggests that athletes, more generally, need to become attuned to affordances in sport performance contexts, leading to varied movement experiences that develop health, well-being, and athletic potential (Lubans et al., 2010). To achieve this, the Athletic Skills Model proposes that practice in some sport training routines could be (re)designed to accommodate 'Donor Sports'. "Donor sports refer to sports or activities that are selected to contribute to performance in a chosen target sport", with; "the Athletic Skills Model describing donor sports as sports and activities that have partly or mostly the same basic movement skills as the target sport" (Wormhoudt et al., 2018, p.86, p.111).

According to the Athletic Skills Model, donor sports should promote the transfer of varied and specific movement experiences across a range of practice environments that support athlete performance functionality at the moment of sport specialisation (Savelsbergh & Wormhoudt, 2019). Integrating donor sports in team sport practice routines requires a careful and continuous transition between generality (non-target sport and activities) and specificity (engaging with various forms of target sport) of transfer (Travassos et al., 2018). Insights from ecological dynamics suggest that donor sports and team sports share adjacent fields of affordances (Rietveld & Kiverstein, 2014; Strafford et al., 2018) that include an extensive range of opportunities for action which transfer functional performance behaviours from a donor sport to a target sport through greater behavioural adaptability (Seifert et al., 2019). This potential overlap of performance-enhancing affordances in the donor sport landscape presents opportunities for the development of athletic skills, supported by shared coordination dynamics, which require further development in an individual's target sport. Team sports are suggested to benefit from donor sports due to the dynamic nature of the invasion task elements, where athletes

have to negotiate not only the constraints governing the rules of the game, but also environmental properties and their opponents. It is thought that time taken away from training in a target sport and participating in a donor sport instead, will reduce the potentially negative effects of early specialisation by offering an enrichment platform for developing athletic skills that is varied enough to supplement training with sport specific elements (Rudd et al., 2020).

Research on donor sports is currently limited, but one notable example was outlined by Travassos et al. (2018), who explored how the invasion team sport futsal could be a donor sport for football. Both football and futsal require players to utilise both feet to execute the skills required during competitive performance, in addition to engaging in collective tactical behaviours relative to possession (with or without) and direction of the ball (Travassos et al., 2018). Unlike other invasion team sports, like football, futsal emphasises the control and manipulation of the ball in a small relative space per player. In futsal, to perform well, performers must use 'soft feet' to manipulate the ball into tight spaces, using different segments of the foot, to pass, dribble and shoot the ball (which is small (size 3) and has a lower coefficient of restitution than a regulation size 5 football) (Araújo et al., 2004). In this regard, futsal is distinct from football, with football's emphasis on increased player area dimensions, differences in timing, coordination and decision making relative to team numbers, and requirement of gross motor skills. For these reasons, compared to futsal athletes, footballers are required to have greater levels of explosive power and relative strength to navigate around larger pitch areas efficiently (with and without the ball), which requires the dynamic (re) organisation and coordination of body segments in relative space (Travassos et al., 2018). Whilst, on a macro level, futsal and football are different in playing area dimensions (in terms of covering space, goal-directed actions and goal-scoring), on a micro-level, futsal promotes the development of functional movement skills required to perform well in certain football

contexts. For example, the capability to react quickly and rhythmically for the smoothing of perturbations, coordination for changes of direction and balancing to react to sudden changes of direction of the ball. Additionally, like football, futsal requires performers to (re) couple their movements relative to the movement of opposition players, teammates, and the direction of the ball, via visual exploratory behaviour (referred to as 'scanning' in team sport performance contexts (e.g., Oppici et al., 2017). For example, empirical data from Oppici et al. (2017) suggests that futsal players scan for the co-positioning of other players and space 54% of the time prior to taking a first touch of the ball compared to 16% of the time in football players. This finding could be potentially explained using relative space per player; due to pitch dimensions, futsal has a smaller relative space per player, leading to a higher frequency of chances for performers to engage with the ball compared to full 11-a-side football (Davids et al., 2013). This preliminary evidence suggests that futsal can act as a donor sport to enrich athletic skills relevant to behavioural adaptability, which footballers can exploit for skill transfer in a shared performance landscape. In this sense, integrating futsal activities into football practice routines may lead to heightened behavioural adaptability, perceptual, physical and psychological skill development via the exploitation of similarities in informational constraints on performance between the two practice domains. Whilst it is anticipated that engaging with a donor sport enriches performance in a target sport by developing higher levels of behavioural adaptability and perceptual, physical, and psychological skill development, this is yet to be examined through empirical investigation (Seifert et al., 2019).

These theoretical ideas on the potential overlap of shared affordance landscapes between donor sports and target sports provide a principled basis to help coaches understand how they can design training tasks to help athletes explore and exploit the complementarity between donor sports and target sports. Additionally, participating in donor sports has potential psychological benefits such as enhanced perception, cognition,

and emotional self-regulation, as athletes begin to control anxiety during competition where they need to regulate their performance behaviours under pressure. However, the psychological effects of partaking in donor sports are yet to be substantiated in the literature. Hence, empirical evidence investigating the potential role of specific donor sports in enriching athletic behaviours is warranted.

In addition to futsal, Parkour has been proposed as a potential donor sport for team games given the emphasis on enjoyment and creativity in movement exploration rather than focusing on developing movement skills in traditional drill-based repetitive practices (Strafford et al., 2018). Unlike futsal, Parkour does not require ball-handling skills similar to football and other invasion team sports, but instead focuses on the holistic development of athletes via exploratory practice and guided discovery in different performance environments (Strafford et al., 2018; Rudd et al., 2020).

2.6. Parkour as a Donor Sport for Team Sports

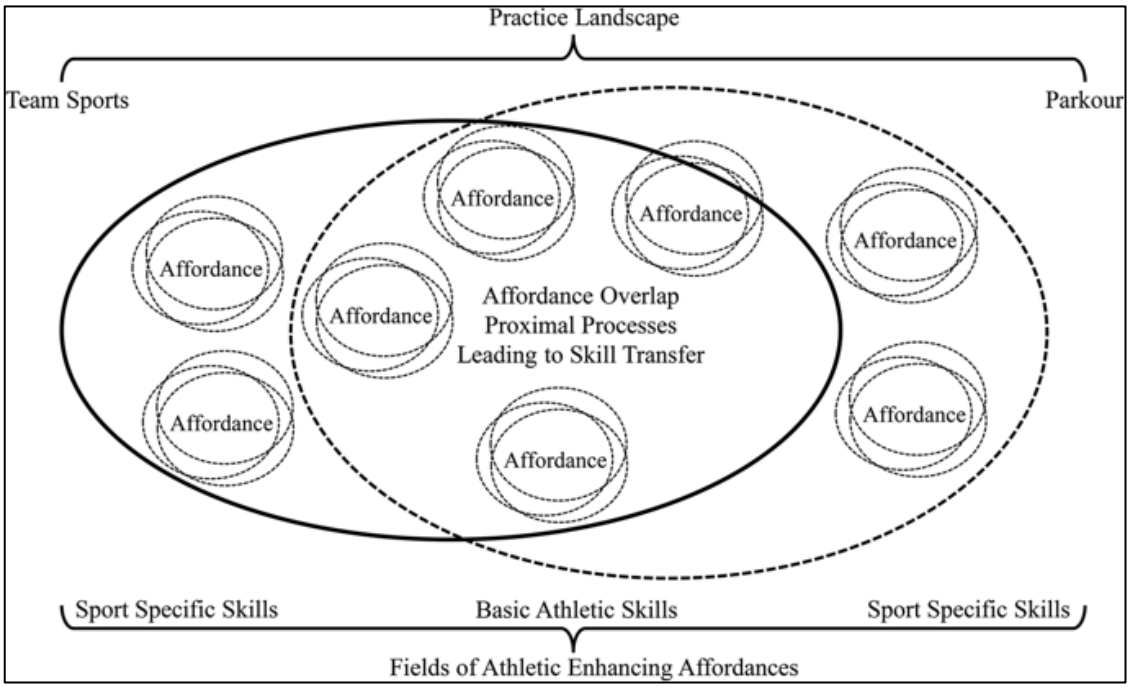
With origins in France, the popularity of Parkour has grown considerably since the 1990s, and it is now practised as a competitive sport via different event formats, notably: speed, skill, and freestyle (Padulo et al., 2019). Parkour requires performers (known as Traceurs) to negotiate obstacles with different properties such as textures, surfaces, inclinations, sizes, and angles in the most effective and efficient way possible (Greenberg & Culver 2019). The term ‘traceur’ originated from the French verb ‘tracer’, which broadly means ‘going fast’ and ‘drawing a line’ (i.e., moving one point to another). Early Parkour Traceurs drew motivation from George Hébert’s Méthode Naturelle, a training method which emphasises the value of functional exercises relating to physical conditioning and development of foundational movement skills (i.e., attack-defence, carrying, climbing, jumping, riding, running, swimming, throwing, walking) (Terret, 2010). These foundational movement skills are thought to underpin the execution of more

complex movement patterns, supporting a well-rounded athleticism (Hébert & Till, 2017).

This focus on skill development through exploration of one's environment to develop adaptive and versatile performers shares many parallels with key tenets of ecological dynamics (see section 2.2 and section 2.3, Chow et al., 2019) and the related principles of Nonlinear pedagogy (see section 2.4, Chow et al., 2016) and concepts outlined in the Athletic Skills Model (see section 2.5, Wormhoudt et al., 2018). A similarity in key tenets of ecological dynamics, the related principles of Nonlinear pedagogy and the Athletic Skills Model is that the general transfer of learning between Parkour-style training and team sports may be supported through learners being enabled to adapt their existing coordination dynamics. Therefore, the coupling of perception and action, the fundamental basis of skilled behaviour in ecological dynamics (see section 2.2), can be developed through exposure to Parkour training to alter each athlete's intrinsic dynamics (dispositions based on individual system development (puberty) status and skill level), via continuous interactions of personal, task and environmental constraints (Croft & Bertram, 2017). Abilities such as fluidity of movement, safe landing strategies, creativity in negotiating obstacles, perception of information and related decision making (Travassos et al., 2013; Strafford et al., 2018) are deemed critical to athlete development and could be 'donated' by Parkour, through a shared network of affordances. Ideas regarding the transfer potential of overlapping fields in an affordance landscape (capturing relations between team sports and Parkour) are depicted in Figure 2.5.

Figure 2.5.

Overlap of performance-enhancing affordance fields between team sports and Parkour as a donor sport (Strafford et al., 2018).



Performing Parkour activities requires athletes to judge distances, gap sizes, and surface properties and use cognitive skills such as perception, attention, problem-solving, and creativity to negotiate environmental features. The challenges of a Parkour-style learning environment can be (re) designed by manipulation of task, environment and organismic (personal) constraints (see section 2.2.1 for future detail on constraints). As outlined in section 2.3.1., a network of shared affordances in the environment may invite specific actions, which provide opportunities for athletic skill development as athletes become more adaptive at sampling a variety of environmental properties and energy flows intrinsic to Parkour-style training and a team sport being targeted (Croft & Bertram, 2017). The term 'Parkour-style training' is used as the training may not have to formally represent Parkour (i.e., in a specific Parkour facility or under the supervision of a Parkour coach), but instead, could include key features of Parkour and or integrate features from the target sport as per the description of a 'donor sport' outlined in the Athletic Skills

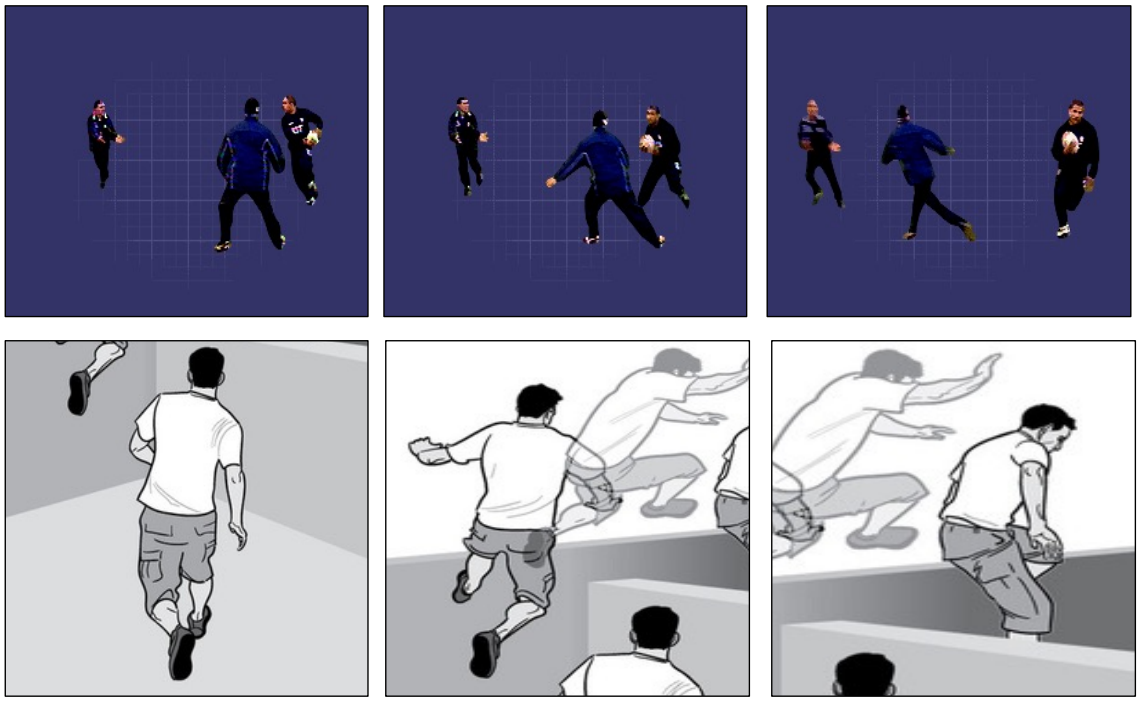
Model. However, a mixed-methods programme of research is required to provide a panoramic view of Parkour as a donor sport via the purposeful integration of data from a series of qualitative and quantitative studies. It is anticipated that these studies will develop new knowledge of the nature of Parkour in team sport settings and advance practice via the development of a framework and design principles for integrating Parkour-style training into team sport practice routines to support athlete development.

Team sport athletes are required to dynamically reorganise movement system components relative to an opponent's movements with respect to the ball position, direction, and speed (Esteves et al., 2015). Parkour practitioners similarly emphasise the importance of fluidity and dynamism in movement exploration within a performance environment (Rudd et al., 2020). One example is the precise foot placement required to negotiate constraints of a performance environment, such as the location and orientation of objects. Parkour practitioners target improvements in foot placement using striding techniques, during which athletes negotiate obstacles of various shapes and sizes to reach an intended location in the most efficient way whilst maintaining movement at high speeds (Puddle et al., 2013). Parkour practitioners target improvements in turning ability and spatial awareness using the 'tic tac' technique, during which athletes must approach obstacles and take off with a change of direction. The intention here is for the athlete to clear the obstacles or use perceptual variables, such as time to contact with the object, to regulate the next phase of movement (Witfeld et al., 2011; Williams et al., 2021). A shared task goal in Parkour and team sports is to react to perturbations in a performance environment, and the 'tic tac' activity could transfer between athlete development programmes. In team sports, this activity would target the compensatory athletic skills required during phase transitions where athletes couple their movements at various speeds relative to the movements of opponents, teammates, and direction of the ball in Rugby union (Vaeyens et al., 2007; Travassos et al., 2016) (see Figure 2.6). The transfer of

specific athletic skills using the affordance landscape is dependent on several factors such as the skill level, injury status and maturation of the athlete, and sport coaches should adapt the difficulty of the Parkour-style activities during practice programmes accordingly. However, understanding the implications of Parkour training interventions for skill development needs to be further developed through empirical research.

Figure 2.6.

Overlap of performance enhancing affordance fields between a 1 versus 1 scenario in ruby union (top) and the 'tic tac' technique (bottom).



Note. The tic-tac technique (bottom), which is characterised by pushing off of a wall with the ball of the foot to gain height (Witfeld et al., 2011), requires the use of perceptual information and spatial orientation from the foot contact to regulate the successive phase of the movement (Strafford et al., 2018). As outlined in figure 2.6. this tic tac action may present developing rugby union players (top) with the opportunity to explore their capabilities to decelerate, propel, land, and move in a new direction when attempting to evade opponents and maintain possession of the ball or score a try.

Parkour emphasises enjoyment and fosters creativity in movement exploration rather than focusing on developing movement skills in traditional drill-based repetitive practices (Strafford et al., 2018; Williams et al., 2021). Emphasising enjoyment and creativity via Parkour-style training may reduce boredom and enhance movement coordination and control as every obstacle an athlete meets during Parkour will need to be negotiated in a different way, although this needs to be confirmed via empirical investigation. In Parkour, each interaction with a surface or an obstacle may not have an immediately obvious solution, so theoretically athletes must use their creativity to interact with them and solve performance problems in meaningful ways (Strafford et al., 2018). Sports practitioners in youth team development programmes could exploit the exploratory and creative nature of Parkour to enable physical conditioning whilst at the same time enhancing perceptual, decision making, and functionality of actions in an enjoyable way (Dvořák et al., 2017). In youth team sports, a physical change in athletes during the adolescent growth spurt phases of puberty influences how affordances are perceived and acted upon (Rudd et al., 2020). The playful nature of Parkour activities would ensure that an athlete's nervous system is adapted to coping with variations in cognitions, perceptions, and actions that emerge during the acquisition of physical, perceptual, and psychological skills. Such Parkour experiences may afford an exploratory environment that enables performers to adapt to intrinsic changes during puberty (e.g., increased stature, rapid changes in limb properties, body mass and muscular strength) (Wormhoudt et al., 2018).

Parkour-style activities could also have emotional benefits. The social dimension of these interactions with coaches and peers during Parkour-style training and activities may help regulate athletes' emotional control, resilience and self-confidence through a shared network of affordances rooted in a desire to interact with others and have fun, although this warrants future empirical investigation. The playful aspects of Parkour

could allow athletes to explore and consolidate movement patterns that they normally avoid. This implicit focus of skill learning educates the athlete's attention towards the performance environment, supporting affordance selection and utilisation through intrinsic capacities described as effectivities (Turvey, 1993; Jacobs & Michaels, 2007; Davids et al., 2017). Individuals trained in Parkour may perceive and interact with a Parkour environment and task context with different levels of adaptive behavioural flexibility than athletes not trained in Parkour, as previous exposure to Parkour environments may afford the discovery/specification of athletic enhancing affordances (Dotov et al., 2012). Moreover, Parkour athletes demonstrate the capacity to manage risk in their environmental interactions skilfully and creatively. In this way, exposure to Parkour-style activities could help youth athletes learn to undertake risk-benefit analyses in contact team sports, on and off-field (Strafford et al., 2018). Additionally, regular implicit practice in the playful and exploratory learning environments afforded by Parkour could help regulate stress, reduce performance anxiety, and increase resilience as athletes can become more proficient at utilising affordances with their athletic capabilities, but this requires research to empirically verify.

2.6.1. Psychological Determinants of Parkour

Movement behaviours in Parkour environments could be refined through constant attraction to challenges which offer opportunities for new actions to emerge (Aggerholm & Højbjerre Larsen, 2017; Croft & Bertram, 2017). These opportunities for novel interactions with different surfaces, obstacles and ledges may not have an immediately obvious solution, so Parkour Traceurs must be creative in how they interact with them to solve performance problems (Greenberg & Culver, 2019). Through exposure to these environmental interactions, athletes can become more resilient to overcome challenges in the environment by exploring their body capabilities and learning how to regulate cognitive and somatic responses when these arise (Merrit & Tharp, 2013). Therefore,

Parkour may have further advantages such as developing athlete mentality, but this requires further empirical investigation via field-based studies examining the potential effects of Parkour on psychological factors which influence behaviour in team sport settings, and qualitative inquiry to provide rich experiential data on how athlete mentality may be developed via Parkour.

A willingness to take risks in Parkour is affected by a person's cognitive appraisal of their Parkour abilities (Merrit & Tharp, 2013). Taylor et al. (2011) identified the link between practising Parkour and cognitive appraisal, by demonstrating skilled Parkour Traceurs perceived a typical Parkour obstacle (such as the height of a wall to negotiate) as being shorter in comparison to a novice control group. This observation is consistent with the action-specific account of perception, as the performer's perception is scaled by their perceived capacities and abilities, known as effectivities in ecological psychology (Fajen et al., 2009). Therefore, as self-efficacy refers to an individual's perception of their capabilities, this psychological function may also increase with Parkour practice and training (Baundura, 1997; Llewellyn et al., 2008).

In team sports, it may be beneficial for practitioners to exploit the creative and explorative nature of Parkour. This would not only enable physical conditioning in athletes but at the same time enhance perceptual decision making and functionality of actions in an enjoyable way. Exposure to Parkour-style activities would potentially allow team sport athletes to develop and utilise effectivities relative to both the actual and perceived capabilities of their movement system, which could aid the development of risk-benefit analysis abilities, both on and off the field (Jacobs & Michaels, 2007; Immonen et al., 2017). Exposure to Parkour learning environments could also help regulate stress, reduce performance anxiety, and increase resilience as athletes can become more proficient at utilising affordances of the environment with their athletic capabilities. However, without current empirical evidence to substantiate such ideas,

research evaluating the psychological effects of partaking in Parkour as a donor sport is required.

2.6.2. Social Determinants of Parkour

Clegg and Butryn (2012) argued that Parkour promotes a spirit of inclusive collaboration through a culture that is not always competitive. This proposal supports the conceptualisation of Parkour as a 'lifestyle sport' where, as a social group, Parkour Traceurs engage with their sub-cultural identities and values to develop new skills (Ojala & Thorpe, 2015; Ellmer & Ryne, 2016). A feature of 'lifestyle sports' is the self-organised nature in which learning takes place in unstructured and often informal settings, with or without external regulation or with some limited supervision from a coach. This approach contrasts with the more structured practice designs in traditional team sports (e.g., rugby, soccer, and field hockey), which emphasise formal teaching (Wheaton & O'Longhlin, 2017). In this regard, Parkour style activities such as 'follow the leader' or 'extreme tag', where groups of athletes elicit and model creativity in movement to explore the environment with coaches and peers, could be integrated into practice routines of team sport athletes, although this warrants future investigation. It is anticipated that the social dimension of these interactions with coaches and peers may help athletes regulate self-confidence, resilience, and emotional control through a shared network of affordances in a practice environment, routed in a desire to interact with others while having fun (O'Grady, 2012).

The influence of Parkour training on social behaviour has been investigated in the physical education (PE) and school sports literature. Coolkens et al. (2018a) investigated the effects of organised versus supervised recess on the proportions of physical activity levels, social behaviours and play over a five-month period. A Parkour session was integrated into the student's normal PE lesson (20 minutes of Parkour, 30 minutes of usual PE). The proportion of time spent in Parkour activity was higher in organised

(coach-led Parkour) than supervised recess (child-led Parkour) (59 vs 47%), suggesting that at younger ages, the coach is perceived as a regulating agent for social behaviours. Coolkens et al. (2018b) investigated the effect of generalisation of engagement in Parkour from PE to organised and supervised Parkour recess on the proportion of children voluntarily participating and their amount of moderate physical activity. All classes received a mandatory 6-day Parkour unit in PE (20 minutes of Parkour, 30 minutes of usual PE), spread over 3 to 6 weeks depending on the schools' schedule. Participants were then given a choice to participate in additional physical activity with Parkour training during recess hours. Engagement and the amount of moderate physical activity were higher in organised Parkour compared to supervised recess. Coolkens et al. (2018a; 2018b) have provided impetus into the feasibility of integrating Parkour inventions into an applied research setting. It is beneficial to investigate the psychological, social, and physical effects of Parkour training as this will provide a holistic understanding of how Parkour could be a potential donor sport in team sports. An important consideration for future research investigating the effects of Parkour training on skill learning is to ensure that the Parkour environment is variable and that the intervention is of a sufficient duration to address multi-day and multi-week effects on skill adaptation, given that shorter intervention periods where the task or environment constraints are isolated and not varied can often lead to potential learning effects (Kim et al., 2013).

2.6.3. Physical Determinants of Parkour

The physical performance characteristics of Parkour Traceurs are often examining in relation to their jumping capacities (e.g., Marchetti et al., 2012; Grosphrêre & Lepers, 2015; Seyhan, 2019). For example, Grosphrêre and Lepers (2015) identified that compared to powerlifters, gymnasts and a control group, Parkour Traceurs demonstrated better standing long jump performance, which was due to higher plyometric abilities and greater upper-to-lower limb coordination in the Parkour Traceurs. This contrasted with

results from Seyhan (2019) who reported that Parkour Traceurs and gymnasts share a similar physical profile. Seyhan (2019) suggested that commonality in the physical profile is because the disciplines do not differ in structural features of training, which led to heightened aerobic power, flexibility, agility, and explosive power. However, these findings should be taken with caution as Seyhan's (2019) research design was largely descriptive and without reference to contextual information relating to task, environmental and organismic constraints that govern Parkour activities and gymnastic events (Rudd et al., 2020).

Previous research has also examined the potential effects of Parkour experience on an individual's physical characteristics. For example, Marchetti et al. (2012) identified that compared to Non-Parkour Traceurs, Parkour Traceurs elicited greater: pull up test scores, plyometric push-up test score, bipodal countermovement jump (CMJ), dominant unipodal CMJ, non-dominant unipodal CMJ, maximal horizontal jump height and bilateral deficit. Marchetti et al. (2012) assumed self-cadence (velocity) during jumping, and the data was corrected using body mass to account for this. The kinetic energy of the participants is a function of mass (m) and velocity (v), so in theory, in standardised measures of athleticism (e.g., submaximal, jumping task and agility tests), it takes greater work to decelerate and then accelerate the body. This provides a rationale for comparing sacral kinematics between a t-test for agility and a simulated Parkour event, as addressing if kinematics during a standardised linear measure of agility represents the kinematic profile of a Parkour event will identify the movement strategies innate to Parkour. Whilst findings from Marchetti et al. (2012), Grosphrêre and Lepers (2015) and Seyhan (2019) provide some descriptive insights into the physical characteristics of Parkour Traceurs, future research is needed to examine the commonality between Parkour Traceurs and team sport athletes. It is anticipated that outlining the type of skills donated between

Parkour and team sports domains will inform the design of Parkour interventions targeting athletic development in team sports domains.

Abellán-Aynés and Alacid (2016) examined how anthropometric profiles and physical fitness of Parkour Traceurs are influenced by performance level. A specific test that simulated Parkour competition was performed to establish two groups (A: high performance; B: low performance). These groups were defined using scores for execution, difficulty and flow graded by a Parkour expert. The Parkour task used to separate participants into groups included several individual tasks (e.g., length jumps, rail vaults, stair climbs with a 360-degree turn on the frontal or sagittal axis with and without hands). A battery of six tests was employed to assess: agility, hamstring extensibility, horizontal jump distance, vertical jump height, vertical jump power, maximal oxygen consumption, body composition and somatotype. The results suggested that Parkour was an effective training method for developing high levels of horizontal and vertical jump and agility. The high performance group demonstrated significantly higher CMJ jump height than the low performance group. Moreover, the high performance group demonstrated a significantly greater standing long jump distance (297±71cm) than the low performance group (260 ± 22cm). However, Abellán-Aynés and Alacid (2016) did not use a validated Parkour assessment tool to support the stability of the judges scores or use an objective measure of performance, such as time to completion. Therefore, it cannot be assumed that the criteria used to separate groups by performance were reliable. In addition, contextual information on the background of the Parkour expert should have been provided. While recent research supports the reliability of a Parkour performance specific measurement tool (see Dvořák et al., 2018), this still relies on a Parkour Traceur's perception of sub-scales representing certain levels of Parkour performance. Future work should utilise objective measures of performance relating to kinematic, kinetic, and spatial-temporal variables, as these can be cross-examined to investigate skill transfer

during functional performance scenarios in a performer's target sport (Grosphrêre & Lepers, 2015; Grosprêtre et al., 2018) following Parkour interventions. Future work is also required to contextualise the physical athletic profile of Parkour Traceurs relative to Parkour performance.

In competitive Parkour, there are two main event specialisms (speed and freestyle), both of which dictate how the performer explores the environment. For speed-runs, Parkour Traceurs must get from a start point to an endpoint in the quickest way possible. Whereas for freestyle runs, Parkour Traceurs are judged based on how they express creativity, efficiency, and flow of movement during an allocated time period (typically one minute). Given the distinct differences between events specialisms, it could be hypothesised that the skill set required to negotiate the environment and perform will be distinct. However, this remains to be empirically tested. Therefore, developing a further understanding of the effect of physical profiles on Parkour Traceurs' performances may be relevant to understand the demands of the activities. This understanding would afford practice tasks that target different physical skills that overlap between Parkour and other sports (e.g., speed-runs for developing speed in team sport players; freestyle runs for developing flow and creativity in movement).

The training effects of Parkour on physical skills have also been investigated. For example, Dvořák et al. (2017) examined the effects of a 10-week Parkour training intervention on measures of cardiorespiratory fitness, strength, and body composition in adolescents with no previous Parkour or sporting participation experience. Participants undertook a 1-hour Parkour session (10 minutes of general warm-up, 10 minutes of specific Parkour warm-up, 25 minutes of Parkour techniques, 10 minutes of conditioning and 5 minutes of warm down) twice a week, which was prepared following the Parkour Generations teaching materials (Parkour Generations, 2017). The Parkour intervention included twelve "dynamic training" sessions and eight "static "training sessions alongside

two different Parkour-specific techniques to vary workouts each week. Results suggest the Parkour intervention improved cardiorespiratory fitness with increases in peak oxygen uptake, oxygen uptake at anaerobic threshold, heart rate at anaerobic threshold and running speed at anaerobic threshold. There was also a 7.4% increase in standing broad jump (from 234 ± 29 cm to 251 ± 23 cm) after the 10-week Parkour training intervention. Whilst the findings from Dvořák et al. (2017) demonstrate feasibility for undertaking Parkour interventions, the study, however, did not include a control group and so it cannot be confirmed that the intervention affected physical profile in untrained participants relative to the population studied. It would have also been beneficial to confirm the effects of Parkour on physical performance using a functional measure of performance (such as a simulated event relevant to the population group studied).

The physical determinants of a Parkour landing have also received considerable attention (e.g., Puddle & Maulder, 2013; Standing & Maulder, 2015; Croft & Bertram, 2017; Maldonado et al., 2018). In Parkour, the roll landing strategy is explored during the early stages of learning, as the ability to land safely and then continue to move in a controlled manner after experiencing a perturbation is fundamental for an athlete's performance, safety, and wellbeing (Puddle & Maulder, 2013). Parkour rolls appear to be more appropriate (safer) for team sport coaches to prescribe over traditional roll landing techniques, given the lower maximal vertical forces, slower times to maximal vertical force and ultimately lower loading rates (Puddle & Maulder, 2013). The ability to use a Parkour roll to fall out of movements, regain balance and regulate postural control may be transferable to performance team sports (Strafford et al., 2018). For example, resourcefulness in movement exploration afforded through Parkour could help athletes recover from perturbations in target sports such as rugby league, rugby union, soccer, and field hockey, where players exert considerable force in tackles to regain ball possession

(Passos et al., 2013). However, understanding the implications of Parkour training interventions in team sports needs to be further developed in empirical research.

2.6.4. Perceptual Determinants of Parkour

In Parkour, the reciprocal relationship between an individual's movement system and the environment will influence the coordination and control of movement. In a recent pilot study, Jabnoun et al. (2018) investigated postural control in Parkour Traceurs with at least five years' experience and a minimum of five Parkour training hours per week compared to a recreationally active group of participants under different visual and or proprioceptive sensory input conditions. The centre of pressure area (CoPA) of the upright standing bipedal and unipedal postures were recorded in different postural conditions: on firm and foam surfaces; on an oscillating surface in the sagittal plane and frontal plane with eyes open and eyes closed. Romberg index (RI) was also calculated to evaluate vision contribution (see Jabnoun et al. (2018) for further detail on the Romberg Index). Collectively, results suggested that Parkour training may improve the postural abilities of young adult practitioners in specific postural conditions. Parkour Traceurs generally had better postural control and presented lower CoPA values than recreationally active participants in the eyes closed condition, suggesting they can maintain a better balance control when vision is removed. Parkour Traceurs were also less dependent on visual cues (lower RI values) and proprioceptive inputs for maintaining balance than recreationally active participants but did not perform better in maintaining the bipedal upright standing posture than recreationally active participants. As results from Jabnoun et al. (2018) demonstrated, Parkour Traceurs perform better than recreationally active participants in challenged postural tests but not in less challenging ones. Therefore, it is also relevant to investigate whether Parkour Traceurs modify the postural strategies in conditions including foot placement and/or postural perturbations representative of a Parkour environment.

Selecting appropriate movements requires that individuals perceive how features of the environment relate to our action capabilities, or what these features of the environment afford (see section 2.2., Gibson, 1979). Croft and Bertram (2017) investigated whether transitions in movement patterns during a precision landing or roll are elicited based on varying the control parameter (i.e., drop height). A secondary aim was to examine if variables triggered transition between movement patterns related to kinetic, kinematic, or organismic factors (e.g., body mass, segment length and maximal vertical jump abilities). Results demonstrated that Parkour Traceurs with greater body mass and less explosive leg power were more likely to transition to a roll landing at a lower height. During these low drops, the primary task constraint is managing momentum which can be achieved through a precision landing or a roll. Here, Parkour Traceurs were free to select their preferred landing strategy, which was only partially influenced by the physical demands of the task. However, athletes with greater leg power appeared capable of managing impulse absorption throughout a leg mediated strategy up to greater drop height. From a practical perspective, results from Croft and Bertram (2017) provides some detail on how Parkour athletes develop multiple movement patterns to regular their momentum during landing which could inform the integration of precision landing and rolls into training routines.

In addition to landing from substantial heights (e.g., Croft & Bertram, 2017; Puddle & Maulder, 2013), Parkour Traceurs may have to scale objects which are simply too high to jump or transverse (Taylor et al., 2011). Croft et al. (2019) examined the mechanics of the horizontal to vertical transition used by Parkour Traceurs in wall climbing. This task was used as an alternative to normal running – where the functional options differ substantially – exposing the movement control priorities required to complete the task. Ground reaction forces were measured in several expert Parkour Traceurs, and the centre of mass trajectory was calculated from force plates embedded in

the wall and ground. Empirical measures were compared with movements predicted by a work-based control optimisation model. The model outlined the fundamental dynamics of the transition and therefore afforded an assessment of parameter sensitivity for success at the manoeuvre (run-up speed and foot placement). From a practical perspective, the optimal transition of both the model and the Parkour Traceurs used a common intermediate run-up speed and appeared determined largely by a trade-off between positive and negative leg work that accomplishes the task with minimum overall work.

Findings from Croft and Betram (2017) and Croft et al. (2019) demonstrate that beyond critical boundaries, certain behaviours, such as the transition between objects of different properties in a Parkour landscape, could cause sudden transitions from one movement pattern to another through perturbation. However, this warrants further investigation, as even if affordances can be actualised in a certain manner, it does not always correspond with whether an individual will actualise an affordance in a particular way (Richardson et al., 2007).

2.7. Learning Design in Parkour

Parkour Traceurs demonstrate that developing athletic abilities and learning at a high level of skill is not limited to highly structured systems within formal coaching. Rather, by exploiting guided discovery in environments representative of the physical and environmental constraints which uphold athletic enhancing affordances that the performer can specify and couple action towards. Aligned with concepts from ecological dynamics, the Athletic Skills Model has the potential to advance learning designs in sport based on the commonality of perception, action, and cognitive demands (affordances) in Parkour (as a donor sport) and team sports.

The findings from Croft and Betram (2017) and Croft et al. (2019) suggest that participant movement capabilities (effectivities) could be informed by reciprocal features in the Parkour environment. However, whilst body scaling may be convenient for

matching task difficulty to ability level, it should be used with caution given that the constraints during team sports performance are relative to the task and not the constraints of the individual's movement system (Chemero, 2003). Instead, the relationship between the performers' perceived dynamic capabilities and features of the environment provide opportunities for manipulating behaviour through action-scaled affordances (Pepping & Li, 2000; Ramenzoni et al., 2008; Fajen et al., 2009). However, learning environments often provide combinations of body-scaled affordances and action-scaled affordances (see Fajen et al., 2009), and these responses require careful consideration for the design of Parkour learning environments. Therefore, learning environments could be designed using a scaled-down version of Parkour style activities relative to a performers age, skill level, and athletic skills being targeted for enrichment (for example, see: https://www.youtube.com/watch?v=f-YwTh7ZWgE, (Strafford et al., 2018)). Theoretically, changing the positioning of objects in the Parkour environment should alter the affordance boundary (Lopresti-Goodman et al., 2009; Taylor & Witt, 2011; Croft & Bertram, 2017), which may invite different actions and behaviours and stimulate creativity in movement exploration and feelings of enjoyment, as participants attempt to find movement solutions to task goals. Future research is needed to investigate how affordances offered by a Parkour environment could be designed into practice landscapes, facilitating their utilisation and the transfer of behaviours through athletic skill (Rietveld & Kiverstein, 2014; Kiverstein et al., 2019).

2.8. Applying Experiential Knowledge of Expert Coaches and Athletes

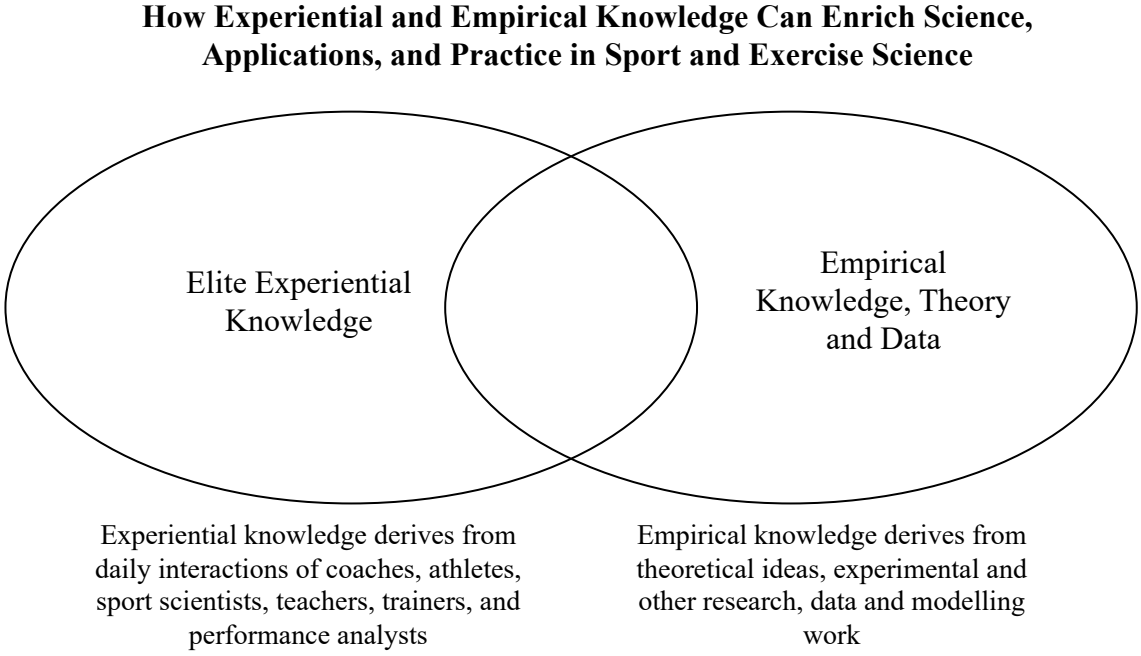
The value of *'experience in education'* was pinioned by the American philosopher, psychologist, and educational reformer John Dewey (1859-1952). According to Dewey (1938), experiences are only educational (inform learning, and therefore practice) when they have continuity (lead to other experiences and advance knowledge) and interaction (meet the internal needs of a person or goal). Dewey (1938)

also emphasised how experiences can be mis-educative (experiences that stop future experiences) or non-educative (experiences where the person has not engaged in reflection or obtained knowledge that is not lasting), outlining the importance of reflective practice and learning from experiences. These original ideas by Dewey regarding the importance of contextualising education experiences were expanded further by one of the pioneers in social and organisational psychology, German-American Psychologist Kert Lewin (1890-1947) in his observation: “There is nothing so practical as a good theory” (Gibson, 1967, p.135).

In this sense, whilst empirical research can examine the intricacy of theoretical concepts and effects of constraint manipulations on sports performance, a nuanced understanding of the sport cannot, therefore, be fully understood without sampling the experiential knowledge of actual performances and coaches working in the sport (Rothwell et al., 2020). The value of experiential knowledge has often been neglected largely due to the inability to collect data through classic experimental designs. As a result, the rationale for evidence-based knowledge in applied sport science and coaches has been skewed in the way of limited categorisation of knowledge to influence practice (Rothwell et al., 2020). In recent years, deeper integration of experiential knowledge (i.e., knowledge gained by ‘doing’, Chow et al., 2016) and empirical knowledge has been utilised by researchers in motor learning to create new and integrated knowledge on coaching and sport science, which is predicated on theory, science, and knowledge (see Figure 2.7). (e.g., Phillips et al., 2010; Greenwood et al., 2014; Burnie et al., 2017; Mckay & O’Connor, 2018; Browne et al., 2019; Mccosker et al., 2019; Woods et al., 2019).

Figure 2.7.

Different types of knowledge needed to support athlete development and preparation for performance in sport adapted from Rothwell et al. (2020).



The space where the two bodies of knowledge overlap can be inhabited by elite sport practitioners, applied scientists, and coaches. This integration of experiential knowledge can enrich (and in turn be enhanced by) empirical knowledge of theory and science. In practice, experiential knowledge, or expert's knowledge of previous experiences, can enrich empirical research and provide underpinning reasons for observed patterns in performance (Renshaw & Gorman, 2015). Therefore, it is of practical and theoretical significance to sample the experiential knowledge of expert Parkour Traceurs on what aspects of enrichment (e.g., exercise, socialisation, and cognitive stimulation) need to be focused on when designing Parkour practice landscapes.

It is anticipated that this will enrich the development of testing protocols for further empirical and applied research that is representative of the sport-specific domain. Second, it is important to build consensus around the feasibility of integrating Parkour-

style training into team sport practice routines, based on the recommendations informed by the team sport coaches' experiential knowledge. As team sport environments are often multiple disciplinary, to avoid 'silo working', it is important to explore what shapes strength and conditioning coaches' and talent development coaches' pre-existing knowledge of Parkour and their perceptions on the potential advantages or disadvantages of integrating Parkour-style training into their practice.

2.9. Gaps in the Literature

In summary, this chapter has outlined how shared constraints intrinsic to Parkour (as a donor sport) and team sports can be explored for athletic and expertise enhancement in sport. Parkour research and theoretical concepts from ecological dynamics that inform Nonlinear Pedagogy and the Athletic Skills Model were comprehensively and critically appraised to outline current gaps in the literature.

Parkour research has largely used reductive laboratory tasks, such as box jumps and static rolls to analyse athletic skills in isolation of the environment (e.g., Puddle & Maulder, 2013; Maldonado et al., 2015; Standing & Maulder, 2015; Croft & Bertram, 2017; Galo et al., 2018). However, these tasks do not represent the spatial-temporal constraints of typical Parkour practice landscapes, notably the speed-run event. Future work should sample the experiential knowledge of experienced Parkour Traceurs to complement the design of experimental research seeking to understand how Parkour training can be utilised as a donor sport to enrich practice and foster skill adaptation in team games. The identification of the skills that could be donated between Parkour and team sports domains is required through empirical investigation. Developing further understanding about the functional athletic skills of Parkour Traceurs may be relevant to understand the demands of the activity, this would afford the development of practice tasks that target different physical skills that overlap between Parkour and other sports (e.g., speed-runs for developing functional athletic skills in team sport players). As

Parkour interventions, including speed-runs, could be implemented across different sports, it is important to confirm what battery of standardised athletic tests for functional movement skills typically used in team sport settings are correlated to Parkour speed-run performance. These tests could then be used to evaluate the effectiveness of Parkour speed-run interventions for developing functional movement skills in performers across the sport.

To meet the challenge of contextually integrating Parkour practice landscapes into high-performance sports organisations, it is important to sample the experiential knowledge and understanding of two groups central to talent development in team sports: talent development specialists and strength and conditioning coaches. Sampling their experiential knowledge and understanding will afford practical recommendations from key stakeholders concerning the potential integration of Parkour-style training into talent development and learning environments in team sports. However, whilst this experiential knowledge from talent development and strength and conditioning coaches will provide an initial insight into how Parkour-style training could be integrated into team sport settings, it cannot serve to provide consensus on recommendations for practice design alone. Therefore, a Delphi method will be used to gain expert consensus on a set of design principles and a framework for the integration of Parkour-style training in team sport settings to guide practice design in team sport settings and support the design of procedures used in future intervention studies that examine Parkour-style training as a donor sport. Enhancing the clarity of practitioner understanding and providing expert consensus around a set of design and integration principles could ensure successful longer-term integration of Parkour into athlete learning and development programmes, rather than being treated as a mere “fad” which may not be sustainable.

2.9.1. Aims and Objectives

The principal research aim of this thesis was to explore Parkour as a donor sport for athlete development in team sports. The objectives were to:

1. Explore how shared constraints intrinsic to Parkour and team sports can be exploited for athletic and expertise enhancement in sport (Chapter 2).
2. Explore Parkour Traceurs' experiential knowledge on the functional performance behaviours they perceived to be developed during Parkour and their recommendations for how to effectively design Parkour-style practice sessions to facilitate such functional behavioural development (Chapter 3).
3. Examine which functional movement skills are associated with a fast Parkour speed-run time (Chapter 4).
4. Explore talent development specialists' and strength and conditioning coaches' pre-existing knowledge on Parkour and their experiential knowledge on the potential applications of Parkour-style training for athlete development in team sports and the feasibility of integrating Parkour-style training into team sport practice routines (Chapter 5).
5. Develop expert consensus on the feasibility of integrating Parkour-style training into team sport practice routines and establish a framework and set of design principles for integrating Parkour-style training in team sports settings (Chapter 6).

Chapter 3: Designing Parkour-style training environments for athlete development: Insights from experienced Parkour Traceurs

This chapter is the first qualitative study in the thesis and explores Parkour Traceurs' experiential knowledge on the functional performance behaviours they perceived to be developed during Parkour, and their recommendations for how to effectively design Parkour-style practice sessions to facilitate such functional behavioural development. These recommendations were used to develop an indoor-Parkour environment that is utilised in chapter four of the thesis.

This chapter is based on the following peer-reviewed journal article: Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2020). Designing Parkour-style training environments for athlete development: Insights from experienced Parkour Traceurs. *Qualitative Research in Sport, Exercise and Health*. https://doi.org/10.1080/2159676X.2020.17202753.1.

3.1. Abstract

This chapter explored Parkour Traceurs' experiential knowledge on the range of physical, perceptual, psychological and social skills that they perceive to be developed during Parkour practice and performance. This chapter also investigated their recommendations on how to design Parkour practice to facilitate the development of foundational performance behaviours. Experienced male Parkour Traceurs (n = 14) were interviewed using an open-ended, semi-structured approach, with a two-stage thematic analysis being conducted to identify themes. The analysis identified two dimensions: Skills Developed Through Parkour and Recommendations for Designing Parkour Training Environments. Parkour Traceurs outlined numerous physical (locomotor skills; endurance; strength; agility; balance), perceptual (multi-limb coordination; control precision; rate control; response orientation), psychological (problem-solving; stress relief; self-efficacy; risk management) and social (networking; initiative; social perceptiveness; receptiveness to feedback) capacities and skills that could be augmented through Parkour training. Parkour Traceurs explained how indoor Parkour environments should promote creative and exploratory movement behaviours that enable physical conditioning, whilst enhancing decision-making and action functionality. Responses suggest that these aims are often achieved by designing a modular practice landscape where Parkour Traceurs manipulate the spacing, orientation and angles of bars and wall set-ups to facilitate the development of different perceptual, cognitive and physical skills. In conclusion, this study provides insights on how affordances offered by a Parkour environment could be integrated into practice to enhance athlete self-regulation and transfer of functional behaviours to team sport performance.

3.2. Introduction

Since the 1990s, the popularity of Parkour has undergone rapid expansion in countries across the globe (Atkinson, 2009; Standing & Maulder, 2015). Parkour requires performers (known as Traceurs) to negotiate obstacles with differing properties such as textures, surfaces, inclinations, sizes and angles in the most efficient and effective way possible (Greenberg & Culver 2019). In comparison to many other sports, preparation for performance in Parkour differs from traditional coaching methods, with coach-led instructions and feedback being limited. Rather, learning tends to take place primarily through exploration and self-guided experiences of discovery and exploration (Greenberg & Culver, 2019).

With origins in France, early Parkour Traceurs utilised George Hébert's Méthode Naturelle, a training model focused around exercises relating to functional movement skills. This focus on skill development through exploration of one's environment to develop adaptive and versatile performers shares many parallels with contemporary approaches to skill acquisition and motor learning informed by concepts of ecological dynamics theory (Seifert et al., 2019) and the Athletic Skills Model (Wormhoudt et al., 2018). These contemporary pedagogical approaches advocate that to develop health, well-being and athletic potential, coaches need to design learning environments that first enrich foundational athletic skills, from which future specialised performance behaviours and self- regulation linked to a target sport can be developed (Savelsbergh & Wormhoudt, 2019). However, many talent and skill development programmes continue to favour early specialisation which advocate a training focus on one specific sport, with repetition and rehearsal of its specific techniques from an early age (for a review, see Coutinho et al., 2016). The early specialisation model, however, can result in some areas of sport performance being underdeveloped (Güllich, 2017) and may result in physical, psychological and emotional problems for developing athletes (Coutinho et al., 2016).

The conceptualisation of ecological dynamics (see Section 2.2) proposes that early training in athletes should comprise rich and varied opportunities for action (termed affordances) to enhance self-regulation in performance. It is through the invitation of relevant affordances that practices are maintained and regulated (Kiverstein et al., 2019). Therefore, practice landscapes should be designed to invite learners to pick up and utilise affordances for perceptual, cognitive, psychological and physical behaviours in a varied range of sports and activities (Renshaw et al., 2019). These functional self-regulation behaviours can often be developed during unstructured activities and experiences, conceptualised as 'enrichment activities' which are not always coach-led.

Aligned with the ecological dynamics conceptualisation of skill acquisition and talent development, the Athletic Skills Model introduces the concept of 'donor sports' as a way to enrich practice and enhance athletic performance and avoid the documented problems with early specialisation in sport (Wormhoudt et al., 2018). Donor sports are proposed to 'donate' elements of basic athletic skills that enable performers to excel in a target sport through transfer of skill learning between sports or sport elements, which support athlete performance functionality at the moment of sport specialisation (Savelsbergh & Wormhoudt, 2019). Donor sports target the development of general capacities that underpin functionality of each athletes perceptual skills and intrinsic dynamics (e.g., anticipation, balance, coordination, postural stability, strength, visual search) under a new set of performance constraints (Strafford et al., 2018). Therefore, the integration of donor sports into sports practice requires careful and continuous transition between generality (non-target sport and activities) and specificity (engaging with specialised training in a target sport) of skill transfer (Travassos et al., 2018). This process of skill transfer enriches performance in a target sport by developing higher levels of behavioural adaptability (Seifert et al., 2019). Hence, engagement with donor sports can be useful when functional behaviours, such as perception, action, and decision-making

for a target sport are considered to be underdeveloped. It is the overlap of fields of relevant affordances in a practice landscape with those of the donor sport which provides the platform for skill transfer (Ranganathan & Newell, 2013; Wormhoudt et al., 2018; Kiverstein, et al., 2019). This is illustrated, in the performance of stepping and reaching actions in Parkour (as a donor sport), which could be specifically transferred to the side-step cutting manoeuvres required in soccer when dribblers have to drive past opponents during the 1v1 sub-phases of the game (Strafford et al., 2018).

Empirical evidence for the role of specific donor sports in enriching athletic behaviours is currently needed. As outlined in Chapter 2, Strafford et al. (2018) proposed Parkour as a suitable donor sport for team games, given the emphasis on enjoyment and creativity in movement exploration, rather than relying on rehearsing technical movement patterns in traditional drill-based, repetitive practices. Strafford et al. (2018) proposed that Parkour-specific techniques such as foot placement, landing, and turning ability share functional performance behaviours, transferable to the spatial-temporal requirements of team sports through a shared network of affordances (see also Travassos et al., 2013). Moreover, Parkour has potential psychological benefits, such as enhanced perception, cognition and emotional self-regulation, as athletes begin to regulate emotions when they need to control their performance behaviours under pressure (O'Grady, 2012; Merritt & Tharp, 2013). However, researchers and practitioners need to consider how affordances offered by a Parkour environment could be designed into practice landscapes, which facilitate their utilisation, and the transfer of behaviours through athletic skill (Rietveld & Kiverstein 2014; Kiverstein et al., 2019).

One approach to resolving this problem in recent applied sport science research has proposed supplementing understanding of the development and design of training and testing protocols emanating from empirical research by sampling the rich experiential knowledge of elite practitioners and athletes (e.g., Phillips et al., 2010; Greenwood et al.,

2014; Burnie et al., 2017; Mckay & O'Connor, 2018; Mccosker et al., 2019; Woods et al., 2019; Brown et al., 2019). These advances in applied scientific and theoretical knowledge are conceptualised as a symbolic process where scientists, theorists and coaches co-create new knowledge and understanding (Renshaw et al., 2019). As the Athletic Skills Model proposes the coach is an 'environmental designer', it is important to seek a transition from simply describing skills developed through certain donor sports, and instead move towards a contextualised understanding of how learning environments could be best designed and used to target the development of such skills. Therefore, to develop understanding of how Parkour could act as an appropriate donor sport for team sports, the aims of this study were twofold. First, this chapter explored the experiential knowledge of experienced Parkour Traceurs to identify the range of athletic skills and foundational performance behaviours (physical, perceptual, psychological and social skills) that they perceive to be developed during Parkour practice and performance. Following on from this, a second aim of this chapter was to provide recommendations, based on the experiential knowledge of these experienced Parkour Traceurs, as to how Parkour environments could be best designed to facilitate the development of these athletic skills and foundational performance behaviours.

3.3. Methods

3.3.1. Research Design

To address the research aims, the thesis author adopted a pragmatic research paradigm (Creswell & Creswell, 2017). In adopting pragmatism, the author placed the research aim centrally; emphasising communication, shared meaning-making and transferability to consider the applications of research findings to advanced applied practice in sport (Morgan, 2007; Shannon-Baker, 2016). In line with pragmatism, qualitative inquiry in the form of semi-structured interviews was adopted, as the use of open-ended questions permits flexible observations of participants' perceptions and experiences (Smith & Sparkes, 2016).

3.3.2. Participant Recruitment and Demographics

Fourteen experienced male Parkour Traceurs (Mean age: 26 ± 6 years) were interviewed. Participant recruitment occurred in person and online using a combination of purposive and snowball sampling (Tongco, 2007). To ensure that participants were immersed in the Parkour culture and form of life, the author employed criteria to guide purposive sampling (Palinkas et al., 2015). At the time of interview, participants had to be active in Parkour as a coach and/or athlete and have a minimum of three years Parkour training experience (mean experience of the sample was 11 ± 4 years) (Jabnoun et al., 2019). A summary of participants' demographic information is displayed in Table 3.1. From the author's experience in conducting Parkour research, experienced Parkour Traceurs are a 'hard-to-reach' group. Therefore, the combination of purposive and snowball sampling was a pragmatic decision to aid the recruitment of a nuanced sample immersed in Parkour culture and form of life. Institutional ethical approval was granted by the university ethics committee of the thesis author, with all participants providing informed written consent prior to the commencement of the interviews (Converis ID: ER9294740, see Appendix 3.1.).

Table 3.1.

Participant demographic information.

Parkour Traceur ID[a]	Age (years)	Parkour experience (years)	Nationality
1	28	13	Dutch
2	26	12	French
3	21	3	British
4	25	14	British
5	26	12	British
6	24	9	British
7	20	5	British
8	24	13	Dutch
9	28	11	German
10	27	13	British
11	43	16	British
12	22	9	German
13	24	13	Dutch
14	23	10	British

Note. [a]The names of the Parkour Traceurs have been transformed using a number prefix to protect their anonymity.

3.3.3. Data Collection

Development of a semi-structured interview guide ensured that each participant was asked the same set of central questions, while enabling participants to lead the conversation, and elaborate and discuss the skills they perceived to be developed through Parkour and how they designed Parkour practice landscapes (see Appendix 3.2.). All interviews were conducted by the thesis author over video call (n = 7), telephone (n = 1) or in person (n = 6) and lasted between 20 and 51 minutes (mean 34 minutes). The list of questions that formed the interview guide started with a general warm up question that was relevant to each Parkour Traceur, to build rapport between the participant and interviewer and encourage the Parkour Traceurs to talk descriptively in the presence of the audio recording device (Dicicco-Bloom & Crabtree, 2006). After that, the discussions moved on to specific questions about Parkour training philosophy, sporting experience, perceptions of skill developed through Parkour, and Parkour practice design. Probe

questions were used to obtain further details (Smith & Sparkes, 2016). All interviews were recorded in their entirety using a digital voice recorder and transcribed verbatim, using desktop transcription software (Audio Notetaker, Sonocent Ltd, Leeds, United Kingdom) (see Appendix 3.3.).

3.3.4. Data Analysis

A two-stage reflexive thematic analysis was employed to identify themes across the data set (Braun & Clarke, 2006; Braun & Clarke, 2019). The interview transcripts were coded in Microsoft Excel (Version 16, Microsoft Cooperation, Washington, United States). During the thematic analysis, the thesis author did not adopt an 'either or approach' (i.e., deductive approach: use of structure, theory or a pre-determined framework, or inductive approach: with little pre-determined structure, theory or framework). Instead, a pragmatic form of enquiry was undertaken that included inductive and deductive approaches (Robertson et al., 2013; Braun et al., 2016). The first coding stage followed a deductive analysis to organise the data into two dimensions (skills developed through Parkour environments and design features of Parkour environments). The first coding stage was initially undertaken by the thesis author, who read the transcripts several times to identify language related to skills developed through Parkour environments or design features of Parkour environments. Peer consultation was conducted after the first coding stage, this involved the supervisors reading the transcripts independently to discuss the initial dimensions determined by the thesis author. The research team accepted that theory-free knowledge cannot be achieved, in that knowledge can be both implicit (as with practical skill or expertise) or explicit (as with theoretical understanding of the subject) (Dewey, 1938). Therefore, once data were organised into these two dimensions, both inductive and deductive analysis was undertaken in what represented a second coding stage (Guba & Lincoln, 2005). This collaborative and reflexive approach to the analytic process was designed to develop richer and a more

nuanced interpretation, rather than seeking consensus on meaning (Braun & Clarke, 2019). For example, during the analysis several experiences articulated by the Parkour Traceurs expressed clear and appropriate meaning without the application of a theoretical lens to interpret the findings (inductive). In contrast, other experiences articulated by the Parkour Traceurs were interpreted from a theoretical position (deductive), as the findings represented appropriate meaning with regards to the functional relationship between the performer and environment. Codes were then grouped into higher order and lower order themes in relation to the research question. If a code had classification in one or more of the themes it was assigned to the best one that 'fit'. Additional discussion of the higher-order and lower-order themes took place between the thesis author and supervisory team, to maintain analytic rigour (Tracy, 2010). During this process members of the research team gave voice to their interpretations of higher and lower order themes via the medium of critical verbal dialogue. Where any coding differences were identified, these were resolved through discussion and alteration of codes if appropriate.

3.3.5. Research Quality and Rigour

To ensure that research quality and rigour was upheld to the highest standard, this study/chapter was designed, conducted and reported in accordance with Journal Article Reporting Standard for Qualitative Research in Psychology, dictated by the American Psychological Association (see Levitt et al., 2018). Methodological rigour was facilitated by conducting a pilot interview with a member of the research group who had an extensive background in Parkour. This consultation process allowed the author to appraise the flexibility of the interview format in the context of the participant group.

In line with a pragmatic research paradigm, it is important to acknowledge the personal biography of the thesis author and research team, given that their previous work was a motivation for undertaking the current study and that this past research may have played a role in the development of the study's methodology (Tracy, 2010). The thesis

author and supervisory team were, at the time of writing, academics at universities across the United Kingdom with varying experiences of working in research (4–40 years). Authors' previous work is underpinned by the ecological dynamics approach to motor learning. The thesis author has several years' experience working in applied Parkour research and is engaged with Parkour Traceurs from around the globe. Rather than categorising such influences as potential contamination of the data to be eschewed, the authors engaged with prospective (which concerns the effect of the whole-person-researcher on the research) and retrospective (which concerns the effect of the research on the researcher) reflexivity to confirm the significance of their knowledge, feelings, and values that they brought to the conceptualisation of the research questions and the analytical lens applied to the findings (Attia & Edge, 2017; Braun & Clarke, 2019). In accordance with recommendations from Smith and McGannon (2018), an independent critical friend was used during the data analysis process over alternatives like a triangulation consensus and inter-rater reliability conversations. The independent critical friend, who was a senior lecturer in sport and exercise science and external to the supervisory team and the research group where the thesis author sat, discussed with the thesis author and supervisory team about the interpretations made throughout the analysis process. During these discussions, the role of the critical friend was 'not to agree' or achieve consensus but rather to encourage reflexivity by challenging the authors' "construction of knowledge" (Cowan & Taylor 2016, pp. 508). In this way, independent critical friends construct, but do not find or discover through consensus, a coherent and theoretically sound argument to support and defend the case they are making in relation to the data generated in a particular study (Smith & McGannon 2018).

3.4. Results and Discussion

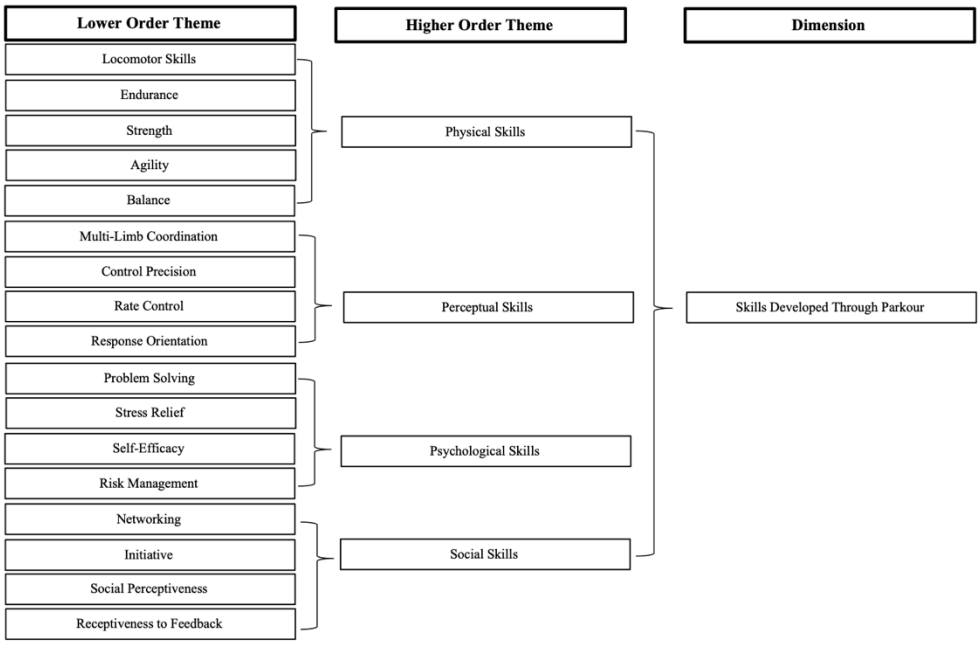
The thematic analysis highlighted a total of 21 lower-order themes, 6 higher-order themes and 2 dimensions. The 2 dimensions were: (1) Skills Developed Through Parkour, and (2) Recommendations for Designing Parkour Training Environments.

3.4.1. Skills Developed Through Parkour

Skills developed through Parkour was a dimension from the data set, with Parkour Traceurs discussing a variety of physical, perceptual, psychological and social performance behaviours developed through Parkour training (Figure 3.1).

Figure 3.1.

Thematic map: skills developed through Parkour.



3.4.1.1. Physical Skills

Parkour Traceurs described a series of physical capacities that are developed through Parkour training, including locomotor skills, endurance, strength, agility, and balance. Parkour Traceurs described that Parkour training develops an athlete's adaptive behaviours in interacting with variety in the environment:

> So that sort of thing, so if you do Parkour and go into a martial art, your body is going to be already used to that adapting to falling over so you're gonna be more adaptive to that sort of stuff. If you go into football, when you kick a football because you've done a running jump when you were doing Parkour, you are now going to have a good kick because you're used to that sort of stuff (Parkour Traceur 7).

Parkour and team sports often require athletes to perform dynamic tasks under high temporal demands in response to external constraints, such as variations in distances, and emerging spaces and gaps, the location of obstacles provided by the movement of teammates, location of opponents and direction of the ball. These performance constraints mean team sport athletes must often adapt and use different movement strategies (guided through athletic and sport-specific skills) and react to perturbations in the performance environment to achieve equivalent performance outcomes (Whitacre, 2010; Seifert et al., 2013; Seifert et al., 2016).

Parkour and team sports share an intermittent performance tempo, where athletes are often required to move slowly and then quickly (accelerating and decelerating), with maximal effort several times with limited rest as this Parkour Traceur explained:

> I think that by practicing the flows (from movement to movement), you are training the endurance in terms of like your muscles having to be constantly engaged, so you are metabolically more active and you are also getting the

plyometric power from the sequencing and the reaction time and the spatial awareness (Parkour Traceur 6).

Hence, developing greater levels of endurance through the integration of Parkour-style training would be of benefit to team sport athletes to negate degradations in movement coordination and control which can occur through fatigue. In addition to developing endurance capabilities, Parkour Traceurs commented on how taking part in Parkour training affords strength gains:

> But it depends, like the great thing about Parkour is compared to other sports, it the different range of movement and strength types that you can work on which will help you like in loads of different aspects, so if you are going to do rugby and you want a stronger core so you can take the impact of other people, whatever, it's like so many different exercises in Parkour that will help you with that sort of stuff (Parkour Traceur 2).

Parkour Tracuers' experiences align closely with key proposals of the Athletic Skills Model in relation to transfer of movement skills from donor sports to a target sport (Wormhoudt et al., 2018). The suggestion is that Parkour could be particularly useful as a donor sport when a strength component is needed in the target sport or is considered to be under-developed in an athlete's current skillset. Parkour Traceurs also described how taking part in Parkour training has made them more agile:

> I would say like the agility. If you train Parkour in a diversified way, in that you practice lots of different abilities, different skills, and then I think you get a sense of agility. I don't know how else to describe it to be honest, I think it is agility is the one word I would use to sum it up. So, it's kind of like a transferable spatial awareness and proprioception to the other skills. Like now that I have improved in Parkour, when I go to other sports I tend to progress at them faster than people who don't do sports, but I don't know if that is just because of Parkour, or just

because of developing some kind of like neuromuscular facilitation to certain movements (Parkour Traceur 6).

Agile athletes can react to perturbations in a performance environment by finding different movement solutions to tasks goals, which is an essential skill of Parkour and team sports. In Parkour, improvements in agility are targeted through specific movements such as the 'tic tac'. To execute the 'tic tac' activity, athletes have to approach obstacles and take off with a change of direction. The intention here is for the athlete to clear the obstacles or use perceptual variables, such as the remaining 'time to contact' with an object or surface, to regulate the next phase of movement (Strafford et al., 2018). In team sports practice, the 'tic tac' activity would target the compensatory athletic skills required during phase transitions where athletes require agility to couple their movements at various speeds relative to the movements of opponents, teammates and direction of the ball (Travassos et al., 2018). In addition to agility, Parkour Traceurs explained how undertaking Parkour training affords greater balance, postural control and awareness of their body:

> So, I train precision jumps because they're like my favourite kind of thing. But I find my balance is a lot better because you have to land and stay in control of movements a lot more with your legs. Compared to swinging and dangling off things are not as much preferred because the basis of my movement is through my legs (Parkour Traceur 10).

This enhanced awareness of body orientation, coupled with proprioceptive and haptic information from the soles of the feet and the lower limbs, would be of benefit in team sports given that the ability to regain balance and postural control following physical challenges is continually required to maintain and advance a sub-phase of play (Puddle & Maulder, 2013; Maldonado, et al., 2018).

3.4.1.2. Perceptual Skills

Parkour Traceurs described a series of perceptual skills that are developed through Parkour training, which were organised into the lower order themes of multi-limb coordination, control precision, rate control and response orientation. Parkour Traceurs described how Parkour training develops an athlete's multi-limb coordination:

> As I said, I would incorporate some rails and bars just to have a certain amount of precisions always as it is helpful to develop precision and also for the developing of swings and that would mean, for example, performing upper body and hand eye and of course feet eye coordination (Parkour Traceur 9).

Parkour actions are complex and require rapid (re) organisation of body segments to maintain movement coordination and control. Consistent with Bernstein's (1967) degrees of freedom problem, there are two main concepts that determine coordination of body segments during Parkour training: degeneracy and variability. Movement variability is the variance of movements generated by an individual under the same task conditions (Newell & Slifkin 1998) (i.e., repeated movements cannot be completely identical). The adaptive and functional role of movement variability is regulated by system 'degeneracy' which refers to an individual's ability to vary motor behaviour structurally to deal with information-rich, dynamic environments from moment to moment without compromising function (Seifert et al., 2013; Komar et al., 2015). This is exemplified in body segment orientation during the cutting manoeuvres, which are commonly used in Parkour as Parkour Traceur 9 explained:

> I think I adapted my Parkour practice experiences a little bit when I started American football. Because American football consists of a lot of cuts and direction changes and those kinds of things. And I was not really familiar with that before I started, and it also consists of a lot of foot work which I under estimated. There is something called the agility ladder where you have to be able

> to move your feet through quite quickly and as soon as I realised that is something that I had to practice I adapted my training a little bit and for example in Parkour I did more foot work. So I would run on rails, I would do more precisions to be able to coordinate my feet better, and for the direction changes for example I would incorporate that into my runs, so for example all of sudden I would make a 90 degree cut to another direction to be able to practice that (Parkour Traceur 9).

With regards to performance in team sports, a certain level of movement variability may be desirable to evade an opponent and distribute joint loading (McBurnie et al., 2019, Dos'Santos, et al., 2019a; Dos'Santos, et al., 2019b). Therefore, in team sports like rugby union, integrating Parkour activities into practice tasks that require precise foot placement and the ability to change direction quickly would, through shared coordination dynamics, transfer the skills needed in rugby union, such as cutting manoeuvres (Weir et al., 2019). In addition to being able to react to changes in the environment and change direction, Parkour Traceurs also described how Parkour training affords functional and controlled landing strategies to bail out of movements safely when required, as this Parkour Traceur described:

> Yeah well in sort of recent years that has sort of become a big thing in Parkour is learning how to fail safely. So if you are doing a jump where either something goes a bit wrong on take-off like you slip a bit or it is just a bit out of your limit knowing how to bounce off the wall in way that you are not going to hurt yourself that can definitely apply to other sports (Parkour Traceur 5).

Developing safe landing strategies as a means of recovering balance, initiating dynamic changes of direction, use of 'soft feet' in running and landing, and postural control following physical challenges (perturbations) is critical for Parkour athletes to avoid injuries and maintain performance longevity (Puddle & Maulder, 2013; Maldonado

et al., 2018). The Parkour roll-landing strategy and the use of 'soft feet' are explored during the early stages of learning, as the capability to land safely, and then continue to move in a controlled manner, after being perturbed, is fundamental to an athlete's safety and wellbeing, as well as performance (Puddle & Maulder, 2013). In team sports, the development in resourcefulness afforded through Parkour training could help athletes recover from force landings in target sports, such as rugby union and rugby league, where players exert considerable force in tackles to regain ball possession (Puddle & Maulder, 2013).

3.4.1.3. Psychological Skills

Parkour Traceurs described a series of psychological skills that are developed through Parkour training, which were organised into the lower order themes of problem-solving, stress relief, and self- efficacy risk management. Parkour Traceurs outlined how training Parkour affords opportunities to explore space and overcome problems presented in the environment, for example:

> I really love the problem solving as well, learning how things work so why does your body do that? Why does it work like that? Why doesn't this work? I love those mechanical aspects of it and to be able to understand all those things has added a great deal to my progression as an athlete because I progressed very quickly as an athlete and as a coach (Parkour Traceur 7).

In Parkour, movement behaviours in the environment are refined through constant attraction to new challenges which offer new actions to emerge (Aggerholm & Højbjerre Larsen, 2017). These opportunities for novel interactions with ledges, surfaces or obstacles may not have an immediately obvious solution, so athletes must use their creativity to interact with them and solve performance problems in innovative ways (Greenberg & Culver, 2019). In terms of developing an athlete's mentality, through exposure to these environmental interactions, Parkour athletes may become more resilient

to overcoming challenges in the environment by exploring their own body capabilities and learning how to regulate cognitive and somatic responses when these arise (Merritt & Tharp, 2013), as this Parkour Traceur outlined:

> It's not just looking at the things you can do, it's mostly looking at the things you cannot do and what needs to be done to get there. So, like I said this could be the physical, social or mental skills. But like it comes from the mental part, in that if I see a jump I cannot make, I always train from the real world perspective. So, do I need to be stronger? Ok, so I will need to train a few weeks (Parkour Traceur 8).

O'Grady (2012) outlined that the principal goal of Parkour athletes is to learn how to 'let go' physically and psychologically, which requires intense focus and unity of body and mind. Parkour Traceurs here described Parkour as a 'stress relieving' activity as it allows them to train while being in the moment:

> Psychologically it's fun, it's stress relieving you know I can go out and do that it's a break away from the norm. It keeps me fit and healthy in some ways, keeps me strong (Parkour Traceur 14).

Furthermore, when socially framed, Parkour has been described as potentially liberating with regards to learning through movement exploration (O'Grady, 2012), which is concurrent with findings from the present study:

> Psychologically, I think it is really good fun destressing yourself . . . my attitude towards it now, is more like what I said – seeing what you can do in that moment because you are defined by what you can do in that moment and there is no way to regret it or be unhappy. So, in that sense it is very freeing because it's kind of like writing poetry or thinking of some kind of fictitious thing you create of your thoughts and expression of that which is very liberating (Parkour Traceur 6).

Implicit learning is augmented through the playful and exploratory nature of Parkour learning environments (O'Grady, 2012). Therefore, exposure to Parkour learning

environments could help regulate stress, reduce performance anxiety and increase resilience as athletes can become more proficient at utilising affordances of the environment with their athletic capabilities. In addition to regulating stress and performance anxiety, Parkour can also train an athlete's capabilities to manage fear and take risks, as this Parkour Traceur outlined:

> Yeah it gets pushed back obviously; fear is just an absence of familiarity like pretty much everything in life. So, if you don't understand something then you are more likely to be afraid of it. And obviously as you understand your body's capabilities and your potential in your limits what you can and can't do you are therefore less likely to be afraid of movements as you are more knowledgeable of what you can do, you are more familiar with them. You can choose them or not (Parkour Traceur 11).

These results suggest that a willingness to take risks in Parkour is affected by a person's cognitive appraisal of their own Parkour abilities (Merritt & Tharp, 2013). This link between practising Parkour and cognitive appraisal has been identified previously by Taylor et al. (2011) who demonstrated skilled Parkour athletes perceived a typical Parkour obstacle (such as the height of a wall to negotiate) as being shorter in comparison to a novice control group. This observation is consistent with Gibson's (1979) notion of reciprocity between perception and action, given that performer's perception was scaled by their perceived capacities and abilities, known as effectivities in ecological psychology (Fajen et al., 2009). Therefore, as self-efficacy refers to an individual's perception of their capabilities, this psychological function may also increase with Parkour practice and training (Bandura, 1997; Llewellyn et al., 2008). Indeed, many of the Parkour Traceurs in this study suggested that the capacity to alter self-efficacy through exploration was missing in other sports, compared to Parkour:

> Like, I have trained martial arts, I have trained football; I went quite high up in football and judo. But you didn't get that kind of same fear management, you never got put on a high point and are told you have to do this, and you can do it. I think learning how to manage and control fear that is such a big thing and people don't understand that's what we do a lot and why people think we are daredevils and reckless. It's because they don't understand that actually we manage that sort of stuff, because knowing you can do something and physically doing it are two separate things. So yeah those are the big psychological elements of it (Parkour Traceur 7).

An implication here is that, in the context of team sports, practitioners should exploit the creative and explorative nature of Parkour, to enable physical conditioning in athletes, whilst at the same time enhancing perceptual decision-making and functionality of actions in an enjoyable way. Exposure to Parkour-style activities would allow team sport athletes to develop and utilise effectivities relative to both the actual and perceived capabilities of their movement system, which could aid the development of risk-benefit analysis abilities, both on and off the field (Jacobs & Michaels, 2007; Immonen et al., 2017). For example, prohibiting the use of landing mats during Parkour-style training may facilitate athletes' awareness of risk of falling, relative to their current abilities, allowing them to consider their intrinsic dynamics or effectivities during movement exploration (Strafford et al., 2018).

3.4.1.4. Social Skills

Parkour Traceurs described a series of social skills that are developed through Parkour training, which were organised into the lower order themes of networking; initiative; social perceptive- ness and receptiveness to feedback. In lifestyle sports (such as Parkour), individual sporting groups attempt to develop new skills and techniques through building and engaging with their sub-cultural values and identities (Ojala &

Thorpe, 2015; Ellmer & Rynne, 2016). Parkour Traceurs described how the Parkour culture of training allows them to network and build relationships with others:

> So, there is sort of a social element. I also feel like I should train Parkour more than I currently do, so it is a good incentive to go. It is also nice to just keep one foot in the community, because obviously if you train less, you see the people less, so you get out of touch (Parkour Traceur 1).

Clegg and Butryn (2012) argued that the non-competitive culture of Parkour promotes a spirt of collaboration and inclusion. A feature of sports such as Parkour is the self-organised nature in which learning takes place in unstructured, informal settings, without external regulation by a coach. This approach contrasts with the more structured practice designs in traditional sports (e.g., football, rugby, tennis) which have a greater focus on formal teaching (Wheaton & O'Loughlin, 2017). Parkour Traceurs described how they use feedback from peers to inform their own Parkour training:

> And then after that I got to know some of the other people in the area who did it and trained with them on Saturdays where they could show me everything in detail properly. Like proper techniques it was really just sort of experimenting with what you could do and just trying things out pretty much (Parkour Traceur 5).

In addition to giving feedback, Parkour Traceurs discussed how they are receptive to receiving feedback from others during training due to the team element of working together to identify and solve challenges:

> So, it's kind of like although the sport is individual there is a team element of working together to spot and solve challenges. And then there's the sort of camaraderie like when someone makes a jump, and everyone is glad for them I guess (Parkour Traceur 3).
>
> Yeah and like the Parkour community it is so welcome and friendly compared to other sports I have tried. Just because there's not that elitism there, nobody is

> going to one up anyone else, everyone is there to help each other grow. I think it's stemmed from that outcast community, where everyone has been pushed away and them come together to form a group (Parkour Traceur 4).

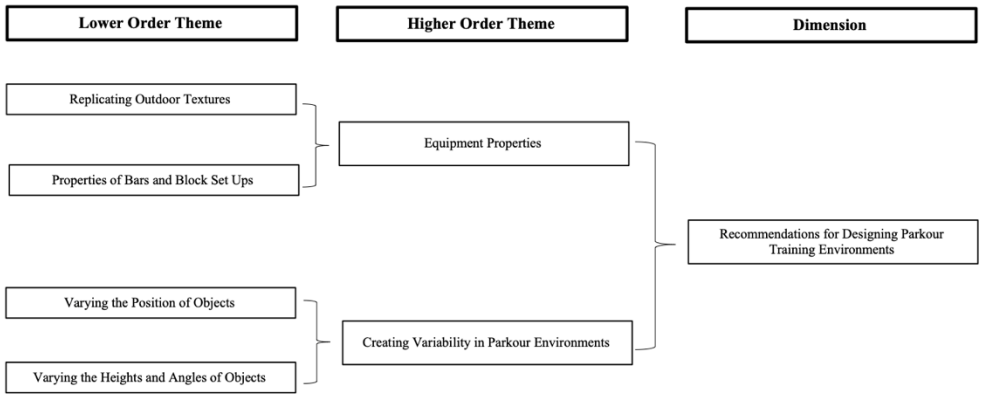
In this regard, integrating Parkour activities such as 'follow the leader' games, where groups of athletes elicit and model creativity in movement as they explore the environment with coaches and peers. The social dimension of these interactions with coaches and peers can help athletes regulate emotional control, resilience and self-confidence through a shared network of affordances in a practice environment, rooted in a desire to interact with others while having fun (O'Grady, 2012).

3.4.2. Recommendations for designing Parkour training environments

Recommendations for designing Parkour training environments to develop physical, perceptual, psychological and social skills was the second dimension from the data set, with Parkour Traceurs providing insights into equipment properties and the methods for creating variability in indoor Parkour environments (see Figure 3.2.).

Figure 3.2.

Thematic map: recommendations for designing Parkour training environments.



3.4.2.1. Equipment Properties

Parkour Traceurs described a series of features relating to equipment properties when designing practice environments, which were organised into two lower-order themes of replicating outdoor textures and properties of bars and block set ups. Despite the common public perception that Parkour solely involves participating in outdoor urban environments, the majority of Parkour Traceurs here discussed that, dependent on the facilities available, coaching indoors was preferable, because indoor environments offer more control over the athletic skills targeted:

> I think I prefer to teach indoors. I predominantly teach outdoors because I don't have the facilities to teach indoors. I think I'd rather teach indoors if I had the equipment that sort of stuff just because it creates that safer environment and that environment where you are already in it learning (Parkour Traceur, 7).

A few Parkour Traceurs mentioned how, whilst it is preferable to teach indoors, they prefer the majority of their practice outdoors, with indoor practice perceived as an opportunity to train for new movement possibilities outdoors:

> There is new challenges and finding possibilities for ways of moving and it can open new possibilities outdoors as well because you might have spotted something outdoors that you can swing on and land on but it's quite big and you've never practiced that movement before so having this indoor environment where you could practice it and work on the technique that can give you the confidence and ability to go to this outdoor location and do the movement there (Parkour Traceur 7).

Parkour environments found in nature are typically fixed and environmental factors can influence surface properties. In this regard, Parkour Traceurs discussed how the equipment used in these indoor Parkour environments should share similar textures found in an outdoor Parkour environment to attain a sense of representativeness:

> I would like to have different textures as what I have not seen in many Parkour parks is a variety of texture. There are generally woods and metals but it doesn't seem that they have incorporated other kind of textures like a random solid place or something somewhere, which is what you would find outside . . . So I would say include different textures and lots of ascending and descending obstacles so you can practice the upper body and lower body and compound movements rather than just loads of jumps (Parkour Traceur 6).

In addition to discussing object texture, Parkour Traceurs outlined how bars and block set ups should be considered as a core feature when designing indoor Parkour environments:

> So, there were lots of these wooden blocks in load of different shapes and metal bars like scaffolding bars and they had a foam pit as well. That is the main thing we use indoors (Parkour Traceur 2).

> Bars like bar set ups. That's something you don't find outside much; you only find them in Parkour parks. And I love bar set ups, like swinging and that sort of stuff. So, I'd design a sick bar set up straight away that would be like first things first. So, I'd design a bar set and design walls around it with really good grip and varying levels. So, the bars would have varying levels so high, medium and low and the walls would also have levels so high medium and low to makes sure that there is a nice mix in level (Parkour Traceur 7).

The focus on bars and block set ups concurred with recommendations from Strafford et al. (2018) who proposed that Parkour actions may emerge from performance of basic athletic skills that an athlete can exploit in affordance landscapes which do not require specialist equipment. Moreover, having bars and blocks of varying levels and heights would manipulate the difficulty of the environment, potentially leading to increases in self-efficacy and resilience in movement exploration through heightened

cognitive appraisal of the athletes' ability to act in that environment (Taylor et al., 2011). In accordance with the Athletic Skills Model, the focus of training should be to first develop the athlete and then the specialist, so a safer environment, afforded through indoor environments of varying textures bar and block set ups could improve longevity in training allowing for this transition. Therefore, as long as organisations adhere to health and safety regulations, the modular aspects of this equipment could be integrated into training across a variety of different sports.

3.4.2.2. Creating variability in indoor Parkour environments

Parkour Traceurs described a series of important features relating to the challenge of creating variability in indoor Parkour environments, which were organised into the lower order themes of varying the position of objects in the environment and varying object heights and angles. When asked about the position of objects, Parkour Traceurs discussed how the environment should be variable, with several participants suggesting that asymmetrical environments that have bars stimulate creativity:

> But we don't tend to look for, or need or require symmetry and in fact angles and not making everything perfectly perpendicular to everything else, having angles and different degrees and setting the bars at different angles and different gradients is really important. Because that creates again more variability, which in terms of movement health, you know variability of movement is healthy so you need to create spaces that allow for variations of movement and are moving people through different planes of movement at the same time whilst changing directions successfully (Parkour Traceur 11).

> Yeah so I think symmetry caters to power and speed a lot more . . . Whereas asymmetrical environments I think cater for more creative movements, slower, strength heavy in a way. But not power, controlled strength movements, I think (Parkour Traceur 14).

Changing the positioning of objects in the environment alters the affordance boundary (Croft & Bertram, 2017), which may invite different actions and behaviours and stimulate creativity in movement exploration and feelings of enjoyment, as participants attempt to find movement solutions to task goals (e.g., symmetrical for developing speed and agility, and asymmetrical for controlled movements). To design affordances in a creative learning environment, Parkour Traceurs discussed how they change the number of bars and vary the height and distance between each bar or bar cluster:

> So, if there is let's say for example 5 bars behind each other and they're perfect and the same distance I would not find that very interesting. But you would take these five bars and put them apart and maybe make them cross maybe have different levels and maybe put them in different angles and not the same distance, then I would find that very interesting. Because that's an environment that would simulate my creativity, so to say. Because these different angles, these different distances they all mean that I have to find a different solution to this particular situation. So, whereas when I have 5 bars which are in exactly the same distance and exactly the same height and angle it's always the same solution, which for me is relatively boring (Parkour Traceur 9).

Further, Parkour Traceurs articulated how the height and angles of objects should be scalable to allow for manipulation of task complexity, for example:

> Well the modular aspect of it means that is immediately scalable. So, we have everyone from five, six year olds training in the *** academy to elite adult athletes. And the modular nature of the structure means that you can totally scale it as you can move the boxes, move the rails so you can make the j umps bigger, smaller, higher, shorter, easier, less complex, and more complex. It's very easy and that's why we do it that way so you never get bored, no matter how good you

> get there will always be challenges you can find. And no matter how experienced or inexperienced you are there will always be stuff you can do to get on the first running ladder and progress your skills (Parkour Traceur 11).

This observation suggests that participant movement capabilities (effectivities) are informed by reciprocal features in the environment such as the geometric features. Whilst body scaling may be convenient for matching task difficulty to ability level, it should be used with caution given that the constraints during team sports performance are relative to the task and not the constraints of the individual's movement system (Chemero, 2003). Instead, it is the relationship between the performers perceived dynamic capabilities and features of the environment that provide opportunities for manipulating behaviour through action-scaled affordances (Pepping & Li, 2000; Ramenzoni et al., 2008; Fajen et al., 2009). However, learning environments often provide combinations of body-scaled affordances and action-scaled affordances (see Fajen et al., 2009) and these responses require careful consideration for the design of Parkour learning environments.

3.5. Conclusion

In conclusion, sampling the experiential knowledge of experienced Parkour Traceurs has provided rich insights into how affordances offered by the Parkour environment could be designed into practice landscapes in team sports, to facilitate their utilisation and the transfer of skilful behaviours. The recommendations for learning design outlined from Parkour Traceurs here, are used to create an indoor-Parkour environment and select a series of physical skills to investigate in Chapter 4 of the thesis. Further, the identification of these skills provides impetus to the proposal set out in the Athletic Skills Model that Parkour could be a suitable donor sport to develop a range of athletic skills (Chapter 2; Strafford et al., 2018; Savelsbergh & Wormhoudt, 2019). It is anticipated that this experiential knowledge will complement the design of experimental research seeking to understand how Parkour training can be utilised as a donor sport to enrich practice and foster skill adaptation in team games which is explored further in Chapter 4.

Chapter 4: Effects of Functional Movement Skills on Parkour Speed-Run Performance

This chapter is the field-based study in the thesis and examines what functional movement skills correlate with Parkour speed-run performance. Parkour speed-runs were selected as these are a recognised form of Parkour competition, that provide an objective metric of performance (time), compared to skill and free-style events that use subjective coach ratings/screening.

This chapter is based on the following peer-reviewed journal article: Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2021). Effects of Functional Movement Skills on Parkour-Speed-Run Performance. *European Journal of Sport Science.* https://doi.org/10.1080/17461391.2021.1891295 .

4.1. Abstract

Parkour speed-runs require Parkour Traceurs to negotiate obstacles with divergent properties such as angles, inclinations, sizes, surfaces, and textures in the quickest way possible. The quicker the run, the higher the performer is ranked. Performance in Parkour speed-runs may be regulated through Parkour Traceurs' functional movement skill capacities given the physical requirements of the event. This chapter examined what functional movement skills correlate with Parkour speed-run performance. Nineteen male Parkour Traceurs undertook a physical testing battery inclusive of: agility T-test, maximal grip strength test, and maximal vertical and horizontal jumps across several jump modalities. For the speed-run, Parkour Traceurs navigated an indoor Parkour installation. Pearson's correlation analyses (*r)* revealed that agility T-test performance showed a positive correlation with Parkour speed-run performance, whereas standing long jump and counter movement jump (with and without arm swing) were significantly negatively correlated with Parkour speed-run performance. Concurrent with the intrinsically-linked building blocks in the Athletic Skills Model, the data from the present study suggest that performance in Parkour-speed-runs are underpinned by functional movement skills (jumping, running; arm swinging) and conditions of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength). From a practical perspective, the agility T-test, standing long jump, and counter movement jump with and without arm swing can form a basic battery to evaluate the physical effects of Parkour speed-run interventions on functional movement skills.

4.2. Introduction

The popularity of Parkour has grown considerably in recent years and it is now practised as a competitive sport. However, its original guiding principles drew motivation from George Hébert's Méthode Naturelle, a training model focused on functional exercises relating to physical conditioning and development of functional movement skills (i.e., walking, climbing, jumping, rising, carrying, running, throwing, attack-defence, and swimming) (Terret, 2010), that underpin execution of complex movements and cultivate a well-rounded athlete (Hébert & Till, 2017). Parkour Traceurs still emphasise the importance of Parkour for the development of functional movement skills, such as climbing, jumping, running and quadruped movements (see Chapter 3), although these are yet to be substantiated in empirical research. This emphasis on development of functional movement skills shares parallels with practitioner-informed models of athlete development underpinned by the theory of ecological dynamics, notably, Nonlinear Pedagogy (Chow et al., 2016; see Section 2.4) the Athletic Skills Model (Wormhoudt et al., 2018; Savelsbergh & Wormhoudt, 2019; see Section 2.5).

Similar to Méthode Naturelle, the Athletic Skills Model suggests that functional movement skills are not isolated movements, but rather fundamental motor skills which support the functionally adaptive movements needed in a specific performance environment. Concepts in ecological dynamics predict that adaptive movement behaviours will emerge through a Parkour Traceur's interactions with rich and varied opportunities for action (Chow et al., 2019), (termed *affordances*) in the environment (Gibson, 1979) (see Section 2.3 and 2.6). The coupling of perception and action, which emerges as Traceurs explore their Parkour environment seeking opportunities for action, forms the fundamental basis of skilled behaviour in ecological dynamics, established and refined by developing an athlete's *effectivities* (movement/action capabilities). In the context of athletic development in Parkour, *effectivities* might reside in the functional

movement skills outlined in the Athletic Skills Model (see Chapter 3). Over time, as Traceurs are repeatedly exposed to the Parkour environment, this process will lead to the establishment and refinement of acquired perception-action couplings, in particular those underpinning functional movement skills, resulting in improvements in performance by enhancing athlete self-regulation (Strafford et al., 2018; Chapter 2). The nature and landscape of Parkour environments offer many available affordances for jumping, landing, and changing direction. Therefore, Traceurs who are repeatedly exposed to such environments have the opportunity to explore and discover solutions to navigate them and so develop these functional movement skills. In turn, it is possible that the best Traceurs may excel in tests of these functional movement skills, although it remains unclear what functional movement skills (if any) correlate with Parkour performance.

The suggestion that functional movement skills could be associated with Parkour performance has to some extent been investigated by Abellan-Aynes and Alacid (2017) who separated Traceurs into high and low performance groups based on judges' scores. The high-performance group significantly outperformed their counterparts in both counter movement and long jump tasks, suggesting that performance on these tests of functional movement skill is associated with Parkour performance. However, the use of subjective judge ratings meant the study failed to employ an objective or validated measure of Parkour performance. Recently, Dvorak et al. (2018) sought to confirm the reliability of a Parkour skills assessment tool, however, it was also reliant on ratings of coaches and so was again limited by subjectivity of interpretation. Most recently, Padulo et al. (2019) validated a Parkour specific repeated sprint ability test (SPRSA) and, whilst it has the advantage of providing an objective and quantifiable measure, it nevertheless only assesses linear performance (when movements are performed in a straight line). As identified from the experiential knowledge of Parkour Traceurs in Chapter 3, Parkour is a highly variable performance landscape, rich in many diverse affordances. With the

growing popularity of Parkour and its expansion as a competitive sport, one notable development has been the Parkour speed-run event in which Traceurs are required to transition between a pre-determined start and end point in the quickest time possible (Padulo et al., 2019). Speed-runs, therefore, provide an alternative means of assessing Parkour performance as they are a recognised form of Parkour competition which captures the variable movements as identified in Chapter 3, and provides an objective and quantifiable measure of performance.

The intrinsic link between functional movement skills, coordinative abilities and conditions of movement in the Athletic Skills Model suggest that performances in standardised athletic tests (e.g., maximal horizontal and vertical jumps) may be related to Parkour speed-run performance. This is because, through previous interactions, Parkour Traceurs will potentially integrate isolated movement components into patterns of coordinated action to support dynamic interactions with obstacles in the Parkour speed route (Strafford et al., 2018; Rudd et al., 2020). As Parkour interventions, including speed-runs, could be implemented to improve functional movement skills in a variety of domains (indoors, outdoors, collectively as members of Parkour team or individually), it is important to explore the composition of a battery of standardised athletic tests for functional movement skills (see Chapter 3) which correlate to Parkour performance. It is necessary to first understand the physical profile of Parkour Traceurs, and then move beyond description to contextualise functional skills relative to performance in Parkour speed-run settings. Therefore, the aim of this chapter was to examine which functional movement skills are associated with a faster Parkour speed-run time.

4.3. Materials and Methods

4.3.1. Participants

Following ethical approval from the thesis author's academic institution (Converis ID: ER16056164, see Appendix 4.1.), nineteen experienced male Parkour Traceurs (age: 23.58 ± 3.01 years, body mass: 73.08 ± 6.60kg, experience: 9.45 ± 3.8 years; stature: 176.45 ± 6.11cm) voluntarily took part in this study. The Parkour Traceurs spent on average 8.08 ± 5.59 hours practising Parkour per week, with 29 ± 19 % of this training time dedicated to physical conditioning. Parkour Traceurs partook in 1 ± 2 Parkour competitions per year. The study procedures were explained in detail to the Parkour Traceurs who subsequently provided written informed consent.

4.3.2. Procedures

Data were collected in three stages at a specialist indoor Parkour training facility in the United Kingdom. The first stage consisted of participant anthropometric measurements and completion of a Parkour questionnaire. The questionnaire was distributed to participants on arrival at the Parkour training facility and comprised of a series of multiple choice and short-answer questions covering demographic information, Parkour experience, training characteristics, other sporting experiences and their background before practicing Parkour. The second stage consisted of a maximal grip strength measurement and maximal jump tests across eight jump modalities. The third stage consisted of an agility T-test and performing competitive speed-runs around an indoor Parkour speed-run course. All procedures took place over the course of one day.

Before experimental procedures began, Parkour Traceurs' stature and body mass was measured using a portable stadiometer (Seca Leicester Height Measure, Seca Limited, Birmingham, United Kingdom) and digital scales (HD, Tanita, Tokyo, Japan). Parkour Traceurs' upper and lower body dexterity were also recorded (i.e., hand: what hand do you write with? Foot: If you were to kick a ball at a target, what foot would you

kick a ball with?). Parkour Traceurs were right hand dominant (right hand dominance = 100%), and mostly right foot dominant (right foot dominance = 90%, left foot dominance = 10%).

4.3.2.1. Hand Grip Dynamometry

A digital Hand Grip Dynamometer (Takei Digital 5401, Takei Scientific Instruments Limited, Niigata City, Japan) was selected to record maximal grip strength (kg), as TTK dynamometers have demonstrated higher criterion-related validity and reliability for measuring maximal grip strength than alternative devices (i.e., Jamar and DynEx Dynamometer) (Espana-Romero et al., 2010). Parkour Traceurs could adjust the grip span to a size comfortable to them (range 3.5-7cm). Parkour Traceurs were instructed to look forward, with their feet shoulder width apart whist squeezing the dynamometer gradually and continuously for at least 2 seconds until they reached maximal effort. The thesis author ensured participants did not touch the dynamometer with any part of their body except the hand being measured. This test was administered 3 times using each hand (left and right alternatively) with 1-minute rest between each trial. For each trial, Parkour Traceurs' elbow position was in full extension (Espana-Romero et al., 2010). The dynamometer display faced the thesis author, providing blind measurement and reducing learning effects. The highest score for each hand was used for analysis.

4.3.2.2. Jump Battery

The jump testing battery and procedures for each jump modality are outlined in Table 4.1. Before completing the jump battery, Parkour Traceurs performed a 10-minute self-selected warm-up, and were instructed not to perform activities which encompassed static stretching (Grosprêtre et al., 2018). Following this, Parkour Traceurs completed 5 submaximal jumps for each jump modality. Before each jump modality, the thesis author performed a demonstration and answered any questions that participants had. Parkour Traceurs then performed maximal jump tests for each jump modality, with at least 2

minutes rest between each of the jump modalities. Parkour Traceurs completed 2-5 jumps of each modality type until the variation between the highest and second highest jumps did not exceed 5% (Grosprêtre & Lepers, 2015). The highest or longest jump value was then used for analysis.

Vertical jump height for the squat, counter movement and drop jump modalities was measured through an OptoJump™ photoelectric cell unit connected to a laptop with the proprietary software (Version 1.10.70). The OptoJump™ photoelectric cells (Microgate, Bolzano, Italy) consisted of two parallel bars which were placed approximately 1m apart (one transmitter consisting of 32 light emitting diodes and one receiver, each measuring 100 x 4 x 3cm). The OptoJump™ has reported near perfect reliability and been shown to be strongly correlated with force platforms for the assessment of jump height (Glatthorn et al., 2012). Consistent with Glatthorn et al. (2012), a test-retest protocol undertaken during the pilot stages of the current study also confirmed excellent within-day and between-day reliability for the OptoJump™ at determining maximal jump height (see Appendix 4.2.). A 2-dimensional video camera (Panasonic, HC-V7770EB-K, Panasonic UK & Ireland) recorded vertical jumps in a 4-meter-wide calibrated field of view. The camera was located 4 m perpendicular to the plane of motion and affixed to a rigid tripod with an approximate height of 1.20 m from the ground to lens centre. A 3-5-4 triangle aligned the optical axis 90° to the horizonal plane of motion, minimising parallax and perspective errors. The video and raw data corresponding to each jump was cross-examined to reaffirm consistency in jump technique across the Traceurs**.**

Table 4.1.

Jump battery and procedures for each jump modality (Grosprêtre & Lepers, 2015).

Jump Modality	Procedures
Standing Long Jump (cm)	Parkour Traceurs were instructed to jump as far as possible using both feet simultaneously. The standing long jump (SLJ) began from a controlled starting position where both of the Parkour Traceurs feet were parallel on a marked starting line on the floor. No specific instructions were provided regarding technique or an end-point, but Parkour Traceurs were free to use arm movement as long as the take-off and landing were executed with both feet. A tape measure was affixed to the surface to indicate each decimetre and after each landing the precise length was measured from the closest mark. The distance of the jumps were measured as the distance between the forefoot at take-off and forefoot at landing. The trial was excluded if the Parkour Traceur fell forward or backward.
Squat Jump (cm)	The squat jump (SJ) began from an upright standing position with hand on hips (i.e., without arm swing). Parkour Traceurs were instructed to flex their knees to approximately 90° whilst keeping their hands on hips, trunk in an upright position and eyes looking forward. The principal researcher then counted for 3 seconds and on the count of 3, Parkour Traceurs were instructed to accelerate upwards to jump as high as possible ensuring a concentric movement without any countermovement before the execution of the jump.
Counter Movement Jump (cm)	The counter movement jump (CMJ) began from an upright standing position with hand on hips (i.e., without arm swing). Parkour Traceurs were instructed to flex their knees to approximately 90° as quickly as possible whist keeping their hands on hips, trunk in an upright position and eyes looking forward and then, without pause, accelerate upwards to jump as high as possible. The counter movement jump procedure was repeated with the dominant (CMJ DF) and non-dominant foot (CMJ NDF).
Counter Movement Jump + (cm) *+ denotes with arm swing	The counter movement jump + (CMJ+) began from an upright standing position and Parkour Traceurs were instructed that they could swing their arms during the execution of the counter movement jump (i.e., hands were free to move). For consistency and safety reasons it was recommended that Parkour Traceurs extended their knees and ankles during the take-off phase and land in a similarly extended position. The counter movement jump + procedure was repeated with the dominant (CMJ+ DF) and non-dominant foot (CMJ+ NDF).
Drop Jump (cm)	The drop jump (DJ) procedure began standing in an upright position with hands on hips. Parkour Traceurs were then instructed to drop off a box from a height of 35cm, land on both feet and then without pause on landing jump as high as possible. Participants were allowed to select a knee angle during the landing, these ranged from 90° to 70° relative to full extension of the knee joint (180°).

4.3.2.3. Agility T-Test

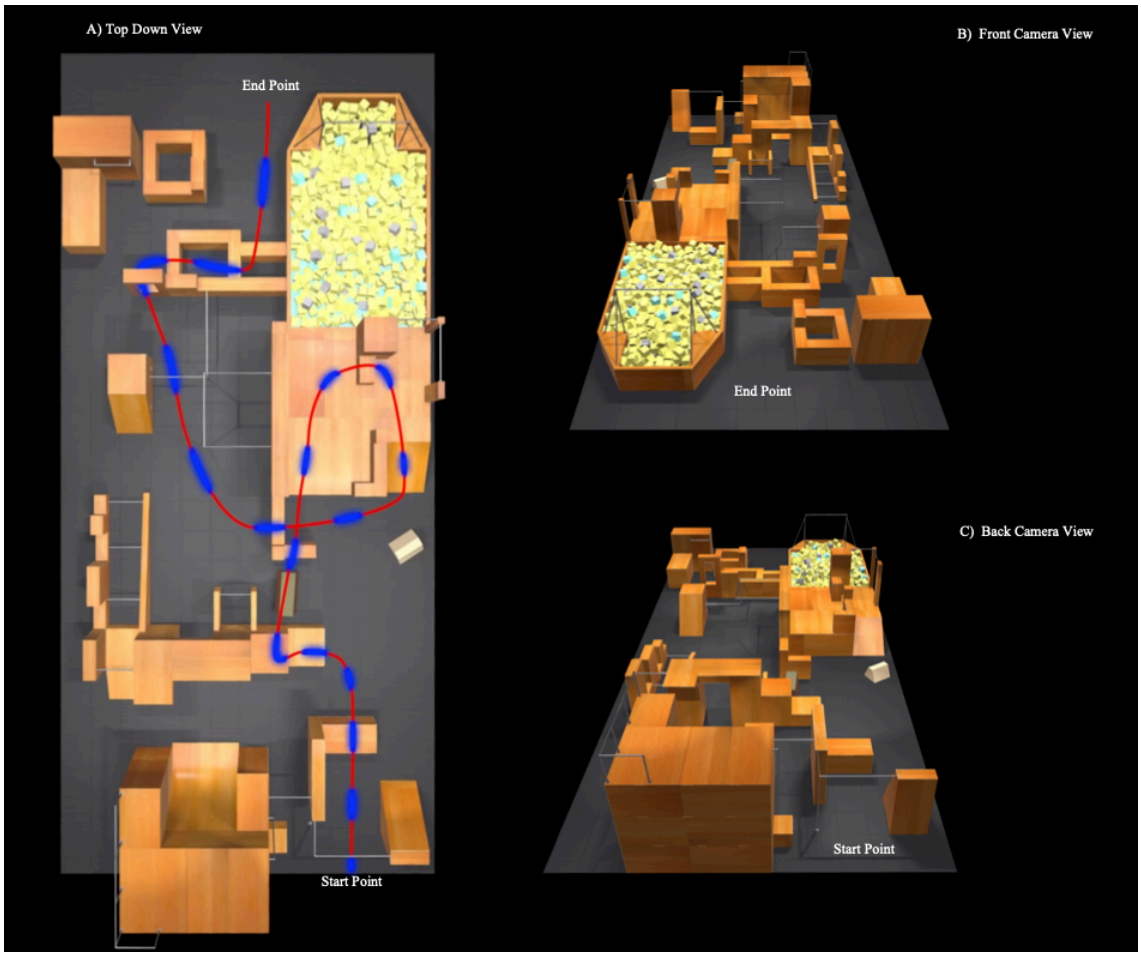
Based on stop-and-go planned agility, the agility T-test is a valid and reliable measurement of the ability to rapidly change direction with multidirectional displacements (forward sprinting, left and right side shuffling, and backwards running) (Paulo et al., 2000; Sheppard & Young, 2006). The agility T-test was used as the start and end point of the Parkour speed-event is typically linear in fashion, with the route changing in direction and structure thereafter (Padulo et al., 2019). The agility T-test was performed on a wooden floor. Four 30 cm cones which formed a T-shape were situated as markers for turning points. Parkour Traceurs began the test with both feet behind the start line (Cone A) began the test by maximally sprinting 9.14 m forwards, touching the second cone (Cone B) with their right hand, shuffling 4.57 m to the left touching the cone (Cone C) with their left hand, shuffling right 9.14 m touching the cone (Cone D) with their right hand, shuffling left 4.57 m back touching the cone (Cone B) with their left hand, and finally backpedalling 9.14 m at speed to the starting point (Cone A). Brower timing gates (Brower Timing Gates, Utah, USA), set at a height of 1 m, measured time to completion and the height of the transmitter was set at 1 m to match the Traceurs' hip height (Altmann et al., 2015). Timing began on a sound signal and stopped when the Parkour Traceur passed through the timing gate on their return. Parkour Traceurs performed 3 agility T-test trials with 45 s of passive rest between trials. The fastest trial was taken forward for analysis. Parkour Traceurs then rested passively before commencing the next stage of the experimental procedure.

4.3.2.4. Parkour Speed-Runs

In speed-run competitions, the basic route is set and Parkour Traceurs need to transition from a set start point to an endpoint in the quickest way possible. The route for the speed-run was designed in line with the recommendations from Parkour Traceurs outlined Chapter 3 and was set by two expert Parkour Traceurs who were unaware of the study aims (Figure 4.1).

Figure 4.1.

Parkour speed-route setup. A) top down view, b) front camera view, c) back camera view (dotted line = direction of movement).



Before each speed-run, Parkour Traceurs received no instruction on technique, but were instructed to complete the route as quickly as possible. Time to completion was recorded using timing gates positioned at the start and end point of the course. The start and end points were consistent between trials. Parkour Traceurs completed three speed-runs, with self-selected recovery allowed between each attempt, and the fastest trial was used for analysis. Parkour Traceurs were not informed of their run times or the times of other participants until all runs were completed. Video footage of the Parkour speed-runs were recorded using two, 2-dimensional video cameras (Panasonic, HC-V7770EB-K, Panasonic UK & Ireland), which were affixed to rigid tripods and operated in the superior plane, one camera was placed behind the start line and one placed behind the finish line at a height of 7 m from ground to lens centre, which ensured that the full volume of the route was captured.

4.3.3. Data Analysis

Data are reported as mean ± standard deviations, unless otherwise stated. Normality was confirmed though a Shaprio-Wilk test and a parametric method of analysis was employed. Pearson's correlation coefficients (*r)* were employed to examine relationships between athletic skills and Parkour speed-run performance. The reference criteria from Hopkins (2000) were employed to guide interpretation of Pearson's correlation coefficients (0-0.09, trivial; 0.1-0.29, small; 0.3-0.49, moderate, 0.5-0.69, large; 0.7-0.89 very large; 0.9-0.99, nearly perfect; 1, perfect). The alpha level was set at $p < 0.05$.

4.4. Results

4.4.1. Functional Movement Skills

The functional movement skills of the Parkour Traceurs are outlined in Table 4.2.

Table 4.2.

*Performance across the testing battery (Mean ± SD)***.**

	Mean ± SD
Maximal Grip Strength: Dominant Hand (kg)	45.33±7.80
Maximal Grip Strength: Non- Dominant Hand (kg)	44.47±8.23
SLJ (cm)	308.74±21.82
SJ (cm)	38.28±5.77
CMJ (cm)	39.21±5.89
CMJ DF (cm)	18.36±4.23
CMJ NDF (cm)	19.66±4.69
CMJ+	47.73±5.22
CMJ+ DF	23.28±4.33
CMJ+ NDF	24.19±3.95
DJ	44.86±5.79
T-test (sec)	9.33±0.65
Parkour Speed-Run Performance (sec)	15.49±2.00

Note. *where df = dominant foot, ndf = non-dominant foot, and + = with arm swing.

4.4.2. Relationship between functional movement skills and Parkour Speed-Run Time

Pearson correlation coefficients between performance variables and Parkour speed-run time are displayed in Table 4.3.

Table 4.3.

Relationships between performance variables and Parkour speed-run time.

	r	Sig.
Body Mass (kg)	.292	0.225
Stature (cm)	—.192	0.432
Experience (years)	.273	0.258
Maximal Grip Strength: Dominant Hand (kg)	—.130	0.606
Maximal Grip Strength: Non- Dominant Hand (kg)	—.315	0.203
T-test (sec)	.824**	0.001
SLJ (cm)	—.649**	0.003
SJ (cm)	—.440	0.06
CMJ (cm)	—.514*	0.024
CMJ DF (cm)	—.550*	0.015
CMJ NDF (cm)	—.585**	0.009
CMJ+ (cm)	—.719**	0.001
CMJ+ DF (cm)	—.744**	0.001
CMJ+ NDF (cm)	—.769**	0.001
DJ (cm)	—.353	0.138

Note. ** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed), where df = dominant foot, ndf = non-dominant foot, and + = with arm swing.

4.4.2.1. Relationship between T-test and Parkour Speed-Run Time

A very large positive correlation was identified between T-test time and time to completion (increase in T-test time = increase in time to completion) (r (19) =.824, p = 0.001).

4.4.2.2. Relationship between SLJ and Parkour Speed-Run Time

A moderate negative correlation was identified between SLJ height and time to completion (increase in SLJ distance = decrease in time to completion) (r (19) = —.649, p = 0.003) .

4.4.2.3. Relationship between vertical jumps without arm swing and Parkour Speed-Run Time

There was a moderate negative correlation between CMJ and time to completion (increase in CMJ height = decrease in time to completion) (r (19) = —.514, p = 0.024). A moderate negative correlation was identified between CMJ dominant-foot and time to completion (increase in CMJ dominant-foot height = decrease in time to completion) (r (19)= —.550, p = 0.015). A moderate negative correlation was identified between CMJ non-dominant-foot and time to completion (increase in CMJ non-dominant-foot height = decrease in time to completion) (r (19)= —.585, p = 0.009).

4.4.2.4. Relationship between vertical jumps with arm swing and Parkour Speed-Run Time

There was a large negative correlation between CMJ+ and time to completion (increase in CMJ+ height = decrease in time to completion) (r (19) = —.719, p = 0.001). A large negative correlation was identified between CMJ+ dominant-foot and time to completion (increase in CMJ+ dominant-foot height = decrease in time to completion) (r (19) = —.744, p = 0.001). A large negative correlation was identified between CMJ+ non-dominant-foot and time to completion (increase in CMJ+ non-dominant-foot height = decrease in time to completion) (r (19) = —.769, p = 0.001)**.**

4.5. Discussion

This chapter investigated which, if any, functional movement skills were associated with Parkour speed-run performance. To achieve this aim, this chapter examined the intrinsic link between functional movement skills, coordinative abilities and conditions of movement outlined in the Athletic Skills Model which suggests that performances in standardised athletic tests (e.g., Agility T-test maximal horizontal and vertical jumps) may be related to performance in their chosen sport or activity, in this case Parkour speed-runs. Using ecological dynamics theory, researchers have provided theoretical proposals and evidence in the form of qualitative, experiential knowledge for how Parkour may develop functional movement skills across domains (Strafford et al., 2018; see Chapter 3). The data presented in this chapter, however, supplements these theoretical proposals and existing qualitative experiential knowledge (see Chapter 3), with empirical evidence that correlates performance on standardised athletic tests of functional movement with Parkour speed-run performance. The findings of the current study can be used to identify which functional movement skills may be developed through engagement with, and exploration of, Parkour landscapes. The correlation analyses revealed that maximal grip strength, squat jump, and drop jump performances were not related to Parkour speed-run time. However, agility T-test performance, standing long jump and counter movement jump (with and without arm swing) were, with quicker speed-run times associated with enhanced levels of these functional movement skills, supporting the notion that functional movement skills (effectivities) provide a strong foundation for performance, as outlined in the Athletic Skills Model (Wormhoudt et al., 2018; Strafford et al., 2018).

The very large positive correlation value between time to completion in the agility T-test and Parkour speed-run suggests that Parkour Traceurs require a similar combination of functional movement skills (running, arm swinging), coordinative

abilities (aiming, kinetic differentiating and spatial orientation: in terms linear sprint movement at the start of the speed-run), and basic motor properties (speed), which are assessed in the agility T-test. In both activities, performers must rapidly change direction and speed, based on stop-and-go planned agility with multidirectional displacements of the body in relative space (e.g., forward sprinting, left and right-side shuffling, and backwards run). The Athletic Skills Model proposes the benefits of experience in "donor sports" which can "donate" elements of functional movement skills that enable performers to excel in a target sport through transfer of skill learning between sports or sport elements (Savelsbergh & Wormhoudt, 2019). Strafford et al. (2018) proposed Parkour as a suitable "donor sport" for developing functional movement skills in team sport players. In the context of identifying Parkour as a donor sport, agile athletes can react to perturbations in a performance environment by finding different movement solutions to achieve intended task goals, an essential skill of Parkour and team sports. Findings from the current study imply how exposure to Parkour environments and activities would enrich the repertoire of team sport athletes. The data suggest that experience in Parkour would enable team sports athletes to enrich their functional movement skills required during phase transitions in game play where they require agility to couple their movements at various speeds relative to the movement dynamics of opponents, teammates and direction of the ball (see Chapter 3; Travassos et al., 2018).

When considering how jump performance was related to Parkour speed-run performance, a determining factor was whether the jump required countermovement. During the speed-run, Parkour Traceurs are required to rapidly (re) organise their body, so a reciprocity between positive and negative muscular work is essential for Parkour performance, which is evident in the moderate negative correlations identified between CMJ, CMJ dominant foot, CMJ non-dominant foot and speed-run time to completion (those with higher jump heights completed the course quicker). Engaging in Parkour may

lead to enhanced reciprocity between positive and negative muscular work in functional movement skills, although this warrants further empirical investigation using inverse dynamics.

Another important finding concerned differences in how jumps requiring arm swing, and those that did not, correlated with Parkour speed-run performance. Jumps with arm swing were more strongly correlated with Parkour speed-run time than those that did not use arm swing, suggesting that jumps using the arms are more representative and better capture the demands of Parkour. This notable relationship between arm participation and speed-run performance demonstrates how through exposure to a Parkour speed-run environment, perception and action couplings are refined by developing a Traceur's effectivities, in this case residing as the functional movement skill: jumping with arm swing. As a potential donor sport, exposure to Parkour environment may refine an athlete's arm swing in jumping to intercept an object which could be beneficial for performance in team sports. An effective use of arm swing may also lead to enhanced awareness of body orientation leading to the regulation of balance and postural control following physical challenges with opponents jumping to intercept the same object (Puddle & Maulder 2013; Maldonado et al., 2018).

From an ecological dynamics perspective, the open and exploratory nature of the Parkour landscape means that it offers opportunities for novel interactions (affordances) founded on functional athletic skills for jumping, landing, twisting, turning and changing direction. These opportunities for novel interactions, with different obstacles, ledges and surfaces may not have an immediate or obvious solution, and require Parkour Traceurs to adapt and be creative in the way they interact with them to solve performance problems efficiently (i.e., complete the route in the quickest time possible). Therefore, Parkour Traceurs who are repeatedly exposed to such environments have opportunities to explore and discover solutions to navigate a speed-run route and so develop these functional

movement skills. Data from the present study suggest that performance in Parkour-speed-runs are underpinned by functional movement skills (jumping, running; arm swinging) and condition of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength). These findings suggest how Parkour could serve as an effective donor sport for training and skill development of team sport athletes. Future research may wish to investigate if Parkour interventions are effective in developing other functional movement skills and specific motor properties. Based on findings reported here, it would be recommended that testing batteries employed to evaluate the effectiveness of such interventions are inclusive of the following components: agility T-test, CMJ jumps without arm swing using both feet and the dominant and the non-dominant foot, standing long jump, and CMJ jumps with an arm swing component using both feet and the dominant and the non-dominant foot.

4.6. Conclusion

This study has examined which functional movement skills correlated with Parkour speed-run performance. The correlation analysis revealed that agility T-test performance, standing long jump and counter movement jump (with and without arm swing) performances were related to Parkour speed-run performance. In line with the intrinsically-linked building blocks in the Athletic Skills Model, the data from the present study suggest that performance in Parkour-speed-runs are underpinned by functional movement skills (jumping, running; arm swinging) and condition of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength). These findings provide support for the notion that functional movement skills (effectivities) are not isolated movements, but skills that can be integrated to support functional interactions of athletes within a Parkour speed-run performance environment. Data suggest Parkour Traceurs who are repeatedly exposed to Parkour speed-run environments develop specific functional movement skills and as such have the opportunity to explore and discover solutions to navigate speed-run environments more efficiently. From a practical perspective, the agility T-test, SLJ, and CMJ with and without arm swing should form the base of testing batteries that evaluate the physical effects of Parkour speed-run interventions on functional movement skills. Whilst Chapter 4 has provided empirical evidence on Parkour-speed-runs as a potential donor sport in team sport settings, it is important to explore the perceptions of team sport coaches and their receptiveness of Parkour-style training for athlete development as this has not been investigated and remains unclear.

Chapter 5: Exploring coach perceptions of Parkour-style training for athlete learning and development in team sports

This chapter is the second qualitative study in the thesis and explores talent development specialists and strength and conditioning coaches pre-existing knowledge about Parkour-style training and perceptions held on the potential applications of Parkour-style training for athlete development in their sports.

This chapter is based on the following peer-reviewed journal article: Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (2021). Exploring coach perceptions of Parkour-style training for athlete development. *Journal of Motor Learning and Development*. https://doi.org/10.1123/jmld.2021-0005.

5.1. Abstract

Contemporary learning and development models have identified Parkour-style training as a vehicle for athlete enrichment. However, perceptions of team sport coaches and their receptiveness to such models of athlete enrichment have not been investigated and remain unclear. To explore how Parkour-style training could be integrated into athlete development programmes in team sports, sport practitioners were interviewed to explore their pre-existing knowledge of Parkour and their perceptions on its potential applications. Experienced talent development (n=10) and strength and conditioning coaches (n=10) were interviewed using an open-ended, semi-structured approach, with a two-stage thematic analysis being conducted to identify themes. Three dimensions were identified: Coaches' General Perceptions of Parkour, Potential Applications of Parkour, and Feasibility of Integrating Parkour into athlete development programmes. Participant perceptions revealed that: 1) Parkour activities were viewed as supplementary activities to enrich sport-specific training routines, including use of obstacle courses and/or tag elements, 2) Parkour-style obstacle environments needed to be scalable to allow individual athletes and coaches to manipulate object orientation and tasks using soft play and traditional gym equipment, and 3), The implementation of continued professional development opportunities, athlete-centred approaches to learning designs in sport, and coach-parent forums were recommended to support the integration of Parkour-style training.

5.2. Introduction

Nonlinear Pedagogy (see Section 2.4) and the Athletic Skills Model (see Section 2.5.) consider coaches as *'environmental designers',* responsible for facilitating an individualised and inclusive learning environment for developing athletes (Rudd et al., 2020). As is evident by findings from Chapter 3 and Chapter 4, the successful integration of empirical research and experiential knowledge has aided understanding on how to create Parkour-style learning environments. However, Parkour research to date, has been largely quantitative and descriptive in nature, for example focused on measuring mechanical components of performance such as the jumping capacities of Parkour Traceurs, evaluated in isolation of Parkour environments (e.g., Grosphrêre & Lepers, 2015; Abellán-Aynés & Alacid, 2017 Padulo et al., 2019). This concern was addressed in Chapter 4 by examining which functional movement skills were correlated with Parkour-speed-run performance.

Consistent with insights of the Athletic Skills Model (see Section 2.5.), the data from Chapter 4 suggested that performance in Parkour-speed-runs were underpinned by functional movement skills (jumping, running; arm swinging) and condition of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength). These findings provided evidence that functional movement skills (effectivities) are not isolated movements, but functional skills that can be enriched and integrated to support functional interactions of athletes within a Parkour speed-run performance environment. It was suggested that repeated exposure to Parkour speed-run environments developed specific functional movement skills which enabled the Traceurs to navigate speed-run environments more efficiently. Therefore, the findings from Chapter 4 provide evidence that Parkour can be an effective donor sport to promote specificity of learning and skill development in team sport athletes.

Chapter 3 explored Parkour Traceurs' experiences and the skills they believed were developed through Parkour, and how they developed Parkour practice landscapes to support their development of necessary physical, perceptual, psychological and social skills. Parkour Traceurs explained that, for athletic development, indoor Parkour environments have to promote creative and exploratory movement behaviours, whilst physically and psychologically conditioning the athlete through heightened opportunities for enhancing decision making and acquiring functional actions (see Chapter 3). Practically, Parkour Traceurs discussed how these enrichment processes are achieved through the development of modular practice landscapes, where the spacing, orientation and angles of the installation blocks and bar set ups are manipulated to adapt task difficulty. These recommendations provided rich insights into how 'affordances' (opportunities for action; Gibson (1979), offered by the Parkour environment, could be designed into practice environments to facilitate their utilisation, and the development and transfer of skilful behaviours. However, this suggestion has yet to be examined and research on the insights of Parkour from strength and conditioning coaches and team sport coaches is needed to address the feasibility of integrating Parkour performance installations into traditional team sport training programmes.

When integrating new approaches such as Parkour-style training in practice, the aim should be to promote collaborations between sport practitioners and discussion on how to adapt practice landscapes in athlete development programmes (Rothwell et al., 2020). Enhancing clarity of practitioner understanding could ensure a successful longer-term integration of Parkour into athlete learning and development programmes, rather than it being treated as a mere 'fad' which may not be sustainable. In meeting the challenge of contextually integrating Parkour practice landscapes into high performance sport organisations, it is important to sample the experiential knowledge and understanding of two groups central to talent development in team sports: talent

development specialists and strength and conditioning coaches. Sampling their experiential knowledge and understanding could afford practical recommendations from key stakeholders concerning the potential integration of Parkour-style training into talent development and learning environments in sport.

The aims of this chapter were threefold: (1) explore talent development specialists' and strength and conditioning coaches' pre-existing knowledge about Parkour-style training, (2) explore the perceptions held by talent development specialists and strength and conditioning coaches on the potential applications of Parkour-style training for athlete development in their sports, and (3) explore the feasibility of integrating Parkour-style training into team sport practice routines, based on recommendations arising from the coaches' experiential knowledge.

5.3. Methods

5.3.1. Research Design

In line with Chapter 3, a pragmatic research paradigm was adopted to place the research aim centrally, by emphasising communication, shared meaning-making, and transferability of research findings to the potential practical applications of Parkour-style training in team sport settings (Creswell & Creswell, 2017). In accordance with a pragmatic approach, qualitative inquiry using semi-structured interviews was adopted, as the use of open-ended questions permits flexible observations of participants' experiences and perceptions (Smith & Sparkes, 2016).

5.3.2. Participant Recruitment and Demographics

Twenty experienced coaches were interviewed, including ten talent development specialists (Mean age: 34.8 ± 10.1 years) and ten strength and conditioning coaches (Mean age: 32.7 ± 7.9 years). Participants were recruited online and in person using a combination of purposive and snowball sampling (Tongco, 2007). At the time of interview, participants had to be active in sport coaching and been in their working setting for a minimum of three years (talent development specialists: 15.0 ± 8.2 years, strength and conditioning coaches: 12.3 ± 7.4 years). A summary of participant demographic information is displayed in Table 5.1. Institutional ethical approval was granted by the university ethics committee of the thesis author, with all participants providing informed written consent prior to commencing the interviews (Converis ID: ER21132479, see Appendix 5.1.).

Table 5.1.

Participants demographic information.

Coach ID[a]	Sport Specialism (s)	Age (Years)	Coaching Experience (Years)	Country of Employment
Talent Development Coach 1	National Level 2 Rugby Union	45	20	United Kingdom
Talent Development Coach 2	Grass Roots Soccer	30	8	United States
Talent Development Coach 3	Division 1 Soccer	52	30	Sweden
Talent Development Coach 4	Division 1 Soccer	22	4	Netherlands
Talent Development Coach 5	Division 1 Soccer	27	8	Netherlands
Talent Development Coach 6	County Gymnastics	23	10	Netherlands
Talent Development Coach 7	International Soccer	30	14	Morocco
Talent Development Coach 8	Rugby Union	37	14	United Kingdom
Talent Development Coach 9	Academy and International Soccer	45	25	United Kingdom
Talent Development Coach 10	International Field Hockey	37	17	United Kingdom
Strength & Conditioning Coach 1	Sport Academy Boarding School	25	8	United Kingdom
Strength & Conditioning Coach 2	League 2 Soccer Academy	33	8	United Kingdom
Strength & Conditioning Coach 3	Golf and Athletics (Track and Field)	38	16	United Kingdom
Strength & Conditioning Coach 4	Ballet and Weightlifting	37	16	United Kingdom
Strength & Conditioning Coach 5	Basketball	37	15	United Kingdom
Strength & Conditioning Coach 6	Rehab and Winter Sports	49	30	United States
Strength & Conditioning Coach 7	Sport Academy Boarding School	25	7	United Kingdom
Strength & Conditioning Coach 8	Championship Football Academy	32	10	United Kingdom
Strength & Conditioning Coach 9	High School/College Sports	27	8	United States
Strength & Conditioning Coach 10	Basketball and Track and Field	24	5	United Kingdom

Note. [a]The names of the coaches have been transformed using a number prefix to protect their anonymity.

5.3.3. Data Collection

Development of a semi-structured interview guide ensured that each coach, regardless of coaching specialism, was asked the same set of central questions, which enabled participants to lead the conversation, and discuss and elaborate on their coaching philosophy, perceptions of Parkour and recommendations for integrating Parkour into coaching practice (see Appendix 5.2.). All interviews were conducted by the thesis author in person (n = 3) or over video call (n = 17) and lasted between 24-52 minutes (Mean Duration: 31.6 ± 7.2 minutes). The interview guide began with a warm-up question that was relevant to each coach, to develop rapport between coach and interviewer, and to encourage each coach to talk descriptively in the presence of an audio recording device (Dicicco-Bloom & Crabtree, 2006). The discussion then transitioned on to specific questions about each participant's background and journey into coaching, philosophy towards athlete development, perceptions on the potential applications of Parkour for athletic development, and recommendations for integrating Parkour into coaching practice. Probe questions were used, where deemed necessary, to encourage participants to expand on responses and provide depth to articulated responses (Smith & Sparkes, 2016). All interviews were recorded, with permission, in their entirety using a digital voice recorder and transcribed verbatim, using desktop transcription software (Audio Notetaker, Sonocent Ltd, Leeds, United Kingdom) (see Appendix 5.3.).

5.3.4. Data Analysis

To identify themes across the data set, a two-stage, reflexive thematic analysis was employed (Braun & Clarke, 2019). The interview transcripts were coded in Microsoft Excel (Version 18, Microsoft Cooperation, Washington, United States). During the thematic analysis, the thesis author did not adopt an 'either or approach' (i.e., inductive approach: with little pre-determined structure, theory or framework, or deductive approach: the of structure, theory or a pre-determined framework). A pragmatic form of

enquiry was undertaken that comprised of deductive and inductive approaches (Robertson et al., 2013; Braun et al., 2016). The first coding stage employed deductive analysis to organise the data into three dimensions (general perceptions of Parkour, potential applications of Parkour, and feasibility of integrating Parkour into coaching practice). The first coding stage was initially undertaken by the thesis author, who read the transcripts several times to identify language related to general perceptions of Parkour and feasibility of integrating Parkour into coaching practice. After the first coding stage, a period of peer consultation was undertaken, which involved the supervisory team reading the transcripts independently to facilitate an open discussion on the initial dimensions determined by the thesis author. The author accepted that theory-free knowledge cannot be achieved, in that knowledge can be both explicit (as with theoretical understanding on the subject) or implicit (as with practical skill of expertise) (Dewey, 1938). Therefore, once data were organised into these three dimensions, both deductive and inductive analyses were undertaken in a second coding stage (Guba & Lincon, 2005). This reflexive and collaborative approach to the analytic process was employed to develop a more nuanced and richer interpretation of the data, rather than seek consensus on meaning (Braun & Clarke, 2019). Codes were next grouped into higher and lower order themes in relation to the research questions. Codes classified in more than one of the themes were assigned into the one perceived to best 'fit'. To maintain analytical rigour, additional discussions of the higher and lower order themes were conducted between the thesis author and supervisory team (Tracy, 2010). During this process the thesis author and members of the supervisory team gave voice to their interpretations of higher and lower order themes via the medium of critical verbal dialogue. Where any coding differences were identified, these were resolved through peer discussion and evaluation and alteration of codes as appropriate. For example, critical dialogue informed the (re) wording of the higher order theme "Addressing Potential Barriers to the

Integration of Parkour-Style Training", where the word "Addressing" was added to best represent the recommendations outlined by coaches on how potential barriers for integration of Parkour-style training could be resolved.

5.3.5. Research Quality and Rigour

Pilot interviews with two participants who had experience either as a talent development specialist or strength and conditioning coach were undertaken to facilitate methodological rigour. These pilot interviews were led by the thesis author and acted as a consultation process which allowed the thesis author and supervisory team to appraise the flexibility and suitability of the interview format in the context of the population group. The interview guide was not amended following pilot interviews.

Concurrent with a pragmatic research paradigm, it is important to acknowledge the personal biography of the thesis author and supervisory team, given that their previous work was a motivation for undertaking the current study and that this past research may have played a role in the development of the study's methodology (Tracy, 2010). The thesis author and supervisory team were, at the time of writing, academics at universities across the United Kingdom with varying experiences of working in research (4–40 years). The research team were, at the time of writing, academics at universities across the United Kingdom with varying experiences of working in research (5-41 years). The previous work of thesis author and supervisory team is underpinned by the ecological dynamics approach to motor learning. Rather than viewing such influences as potential contamination of the data to be avoided, the authors engaged with retrospective (which concerns the effect of the research on the researcher) and prospective (which concerns the effect of the whole-person-researcher on the research) reflexivity. This process confirmed the significance of their values, feelings, and knowledge that they brought to the conceptualisation of the research issues and the analytical lens applied to the findings (Attia & Edge, 2017; Braun & Clarke, 2019). In line with recommendations from Smith

and McGannon (2018), an independent critical friend was utilised during the data analysis process, to discuss interpretations made throughout with the co-authors. During these discussions, the role of the critical friend was to encourage reflexivity by challenging the authors' "construction of knowledge" (Cowan & Taylor, 2016).

5.4. Results and Discussion

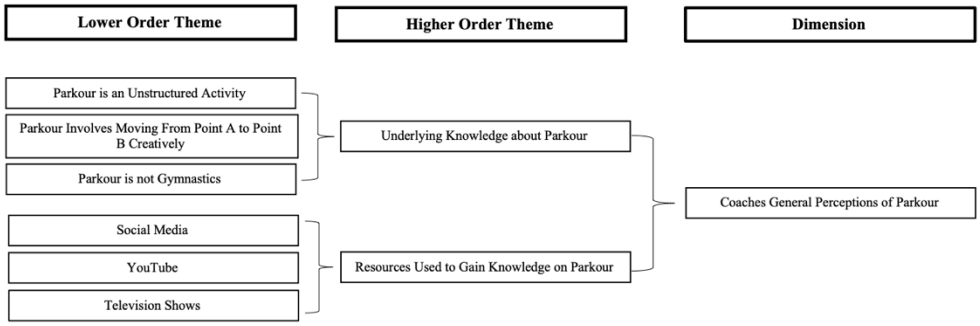
Thematic analysis highlighted a total of three dimensions, seven higher-order themes, and 24 lower-order themes. The 3 dimensions were: (1) Coaches General Perceptions of Parkour, (2) Potential Applications of Parkour, and (3), Feasibility of Integrating Parkour into Coaching Practice.

5.4.1. Coaches' General Perceptions of Parkour

Within the coaches' general perceptions of Parkour dimension, two higher order themes emerged, first, underlying knowledge of Parkour and, second, the resources they have engaged with to acquire knowledge on Parkour (Figure 5.1).

Figure 5.1.

Thematic map: coaches general perceptions of Parkour.



5.4.1.1. Underlying Knowledge about Parkour

The coaches described Parkour as an 'athlete-centred sport', which requires participants to solve unstructured movement challenges to move from *point a to point b* creatively:

> Yeah I have heard of Parkour, my understanding of the activity is that it challenges whoever take parts in it, will have a set out route where they might want to get from say A to B, with lots of different obstacles in the way. But they can be creative in how they are going to go over those obstacles to get from A to B, and they might set up their own way of doing that and different movements to be able to do it. (Talent Development Coach 1)

This coach's description of Parkour is consistent with that provided by expert Parkour Traceurs in Chapter 3, who also emphasised the unstructured and creative value of Parkour participation and the requirement for athletes to move from one point to another creatively. By highlighting the use of obstacles, the coaches identify varied opportunities for action (affordances) that they believe are innate to Parkour learning environments (Strafford et al., 2018). When discussing the structural features of Parkour, some coaches drew on their experiences in gymnastics for contrast:

> So, I think it (Parkour) is a nice way of moving and, to me, it's a bit similar to gymnastics but without all the rules and everything being nice and perfectly straight and stuff. So, it's more you get to do some similar moves with obstacles, running, jumping, turning, flipping, and everything like that. But, then move more in a freeway than the strict way of competition gymnastics. (Talent Development Coach 6)

In gymnastics, the athlete's body has to be oriented in specific position, according to set criteria, to score points evaluated by the judges. This type of structure for the sport can lead athletes to become dependent on explicit coach feedback in practice, due to the need to satisfy set criteria, which, in turn, may impede performance due to reduced

reliance on intrinsic feedback (Button et al., 2020). In contrast, the implicit nature and landscape of the Parkour environment offers an array of affordances for jumping, landing, and changing direct through a process of self-regulation (Rudd et al., 2020). Athletes who are repeatedly exposed to Parkour environments have copious opportunities to discover, explore and exploit movement solutions to navigate through the environment, and so develop or enhance their functional movement skill capacities.

5.4.1.2. Resources used to gain knowledge on Parkour

Concurrent with the advent of new technologies in sports coaching, the coaches' understanding of Parkour was primarily founded from media sources such as social media, YouTube and television shows:

> Through my time working in academy football, I have used online videos just to get ideas. So, I first came across it (Parkour) as a tool for the athletes of young ages to develop different movements in football. (Talent Development Coach 4)
>
> Yeah that's just kind of adapting as I see things on Twitter, if I like it, I will give it a try basically. (Strength and Conditioning Coach 1)

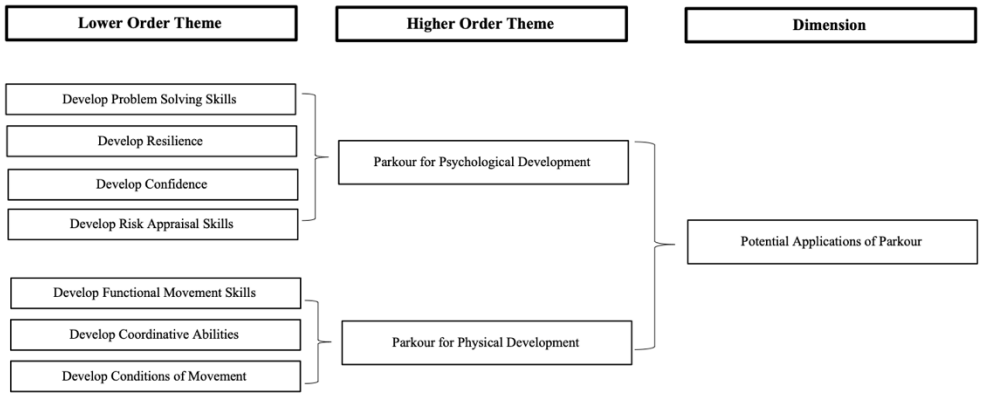
It is clear how online resources on Parkour (which were beyond sport-specific disciplines) have provided a platform for integration and innovation of new approaches to athlete development in football-specific settings (Nicolescu, 2002). It is important to note, however, that some online sources are not always appropriate and could lead to the integration of unsafe or incorrect Parkour-style training. It is important to develop resources on Parkour that could be provided to coaches (and published on social media platforms) which are appropriately informed and relevant, not only for coaches, but also for parents, athletes, and academics. These resources should be developed in consultation with Parkour experts to ensure that they are representative of a safe and inclusive, yet enriching, Parkour environment.

5.4.2. Potential Applications of Parkour

Within the 'Potential Applications of Parkour' dimension, coaches discussed ideas surrounding application of Parkour for the psychological and physical development of athletes (Figure 5.2.).

Figure 5.2.

Thematic map: potential applications for Parkour.



5.4.2.1. Parkour for Psychological Development

The coaches described how exposure to Parkour-style training could develop athlete self-regulation through enriching problem-solving, resilience, confidence and risk-appraisal skills. Some coaches referenced how practising Parkour could be beneficial for developing psychological skills in team sport athletes, in particular problem-solving and resilience following physical movement challenges:

> It (Parkour) would certainly build problem solving and resilience, because obviously within the challenge they (athletes) might not fulfil it and obviously build resilience from that…You know, in a way that would develop their decision-making skills to, you know, in a Rugby game scenario. For, example in

> a penalty kick in Rugby, or catching the drive, which requires you to look at the what the opposing team are doing and react. (Talent Development Coach 1)

> Parkour can develop some real good problem solving for movement challenges. Ultimately this enables our athletes a sense of exploration, fun, and danger which we know is going to strengthen the feedback that is given. If I think back to team invasion sport athletes and what makes good movers, this is often being rhythmical or being smooth or being easy on the eye. Ultimately, I think that comes down to them (athletes) having a good understanding to where their limbs are in time and space and how to create shapes and patterns with their body. I think Parkour is one modality that can enable us to better understand where our bodies are in time and space. (Strength and Conditioning Coach 8)

With the exception of variants of Parkour-style formats like 'world chase tag', Parkour is an individual event without opponents, and unlike team sports does not require ball handling skill. However, engaging in Parkour may led to the transfer of general movement (e.g., dynamic balance, postural regulation, changing direction, landing, twisting and turning, and using limbs in separate ways) and psychological skills between Parkour and team sport domains due to a shared affordance landscape (Strafford et al., 2018). In terms of developing resilience, exposure to interactions with the environment in Parkour landscapes may enable team sport athletes to become more resilient in overcoming emergent movement challenges in their performance environment by self-regulating and exploring their own movement capabilities, relative to the positioning and orientation of their limbs in space (Merrit & Tharp 2013; Aggerholm & Højbjerre Larsen, 2017). In addition to problem-solving and resilience, coaches outlined how exposure to Parkour may develop athletes' capabilities to manage fear and take educated (i.e., understood and evaluated) risks in team sport settings, as this coach outlined:

> I think that can help in pushing the boundaries in other sports as well. So, some things in Parkour might be perceived as dangerous or, they might be afraid of

> some things and I think in the process of learning those skills they learn like ok, I was scared at first, but while practising and learning this, I did manage to do so. So, this could also translate to other sports, when they face difficulties as like ok well I have had this before and I know how to help by influencing this skill. (Talent Development Coach 6)

Here, the coach outlined how a willingness to take educated risks during Parkour practice can transfer to willingness to explore new behaviours in the athlete's target sport through heightened cognitive awareness of their own abilities. The link between Parkour and cognitive appraisal has been previously examined by Taylor et al. (2011) who demonstrated that athletes skilled in Parkour perceived a Parkour obstacle as being shorter than a novice control group. These findings from Taylor et al. (2011) are consistent with the notion of reciprocity between perception and action, advocated for learning designs in Nonlinear Pedagogy. This reciprocal relationship was outlined originally by James Gibson (1979), proposing that a performer's perception of information for utilisation of affordances is scaled by their perceived abilities and capacities, described as *effectivities* in ecological psychology (Fajen et al., 2009). Given that self-efficacy and confidence refer to an individual's perceptions and appraisal of their capabilities, this psychological function may develop with Parkour training (Baundura, 1997; Llewellyn et al., 2008; Chapter 3). Indeed, many coaches in this study outlined how exposure to Parkour leads to increases in athletes' confidence of their general movement abilities, which is missing in other sports:

> So, where I see the value for Parkour is, I think the confidence that can come from like if you've got movement skill and coordination and all of those great things that are important in any sport, you got confidence... So, when it comes to sport, say transfer back into their own context, their own world, they can utilise their body in a far more diverse way than they ever could prior to that form of exposure. (Strength and Conditioning Coach 5)

It is also important to note that the coaches are outlining the integrated relationship between physical and psychological development highlighted in the Athletic Skills Model (Wormhoudt et al., 2018). From an ecological dynamics perspective, exposure to Parkour would afford team sport athletes with opportunities to develop cognitive appraisal skills relative to both the actual and perceived action capabilities of their developing movement system. This enrichment process would assist risk-benefit analysis during sport performance, in addition to heightening perceptual awareness of their body in relative space and decision making (i.e., scaled ego-centrically) (Jacobs & Michaels, 2007; Immonen et al., 2017).

5.4.2.2. Parkour for Physical Development

In addition to psychological skills, coaches also outlined physical skills that could be developed through exposure to Parkour style-training. The coaches often referenced the input of Parkour in building functional movement skills. Coaches described how a series of functional movement skills, conditions of movement and coordinative abilities developed during Parkour could be beneficial for performance in team sports:

> Around the young ages, I am just looking for them to be able to move as well as possible. I don't really mind if they go on to be a hockey player, a footballer, a cricketer, a tennis player. I just know that I want them to have a large foundation of movement that they can then draw upon when needed in a particular situation further down the line. I think at the young age groups Parkour has got a lot of transfer. (Strength and Conditioning Coach 1)

This emphasis on developing foundational movements at young ages aligns with the Athletic Skills Model, which describes how athletes must become versatile and adaptive movers before they can develop into an expert athlete (Wormhoudt et al., 2018). The above quote also references the transfer of functional movement skills between Parkour and team sport domains, which is consistent with the notion that Parkour can serve as a donor sport for athletic development in team sports (Strafford et al., 2018;

Wormhoudt et al., 2018). The development of functional movement skills through Parkour may contribute to performance improvement in the target sport, although the long term benefits of Parkour interventions require investigation in future studies. Coaches also described how developing functional movement skills will lead to gains in coordinative abilities and conditions of movement:

> I think there is a lot of benefit in (Parkour) training, you know in that inner ear and balance aspect, the proprioception aspect. For example, I was able to use some tenets of Parkour with some of our soccer athletes. So, how I was able to implement that was with some rolling patterns, so low level tumbling like a forward roll, a backward roll then into a sprint. So, now we have the aspect of orientation so the inner ear has to adjust to the new orientation of the body and figure out where they are going and what the next task is. Then, you know again readjusting to the new task. (Strength and Conditioning Coach 9)

The Athletic Skills Model proposes that functional movement skills and coordinative abilities are intrinsically linked:

> Parkour could definitely be useful for developing physical skills in rugby… for example in the 5,6,7-year-olds to develop ABC skills. It is through developing movement patterns and using strength through mobility that prepares them (younger athletes) for what they face when do they do finally get through to the full stage of ruby. But also, in the junior section when they are going through maturation, and the stages of growth, it is going to be very important to allow them to access that movement and develop muscle to go along with their longer limbs that they are developing at the time as well. (Talent Development Coach 1)

Here, the coach refers to how the focus on physical conditioning during training routines is relative to individual maturation. This periodised approach to training is concurrent in the Athletic Skills Model, which suggests that for younger ages (up until age at peak height velocity), athletic development should be more focused around

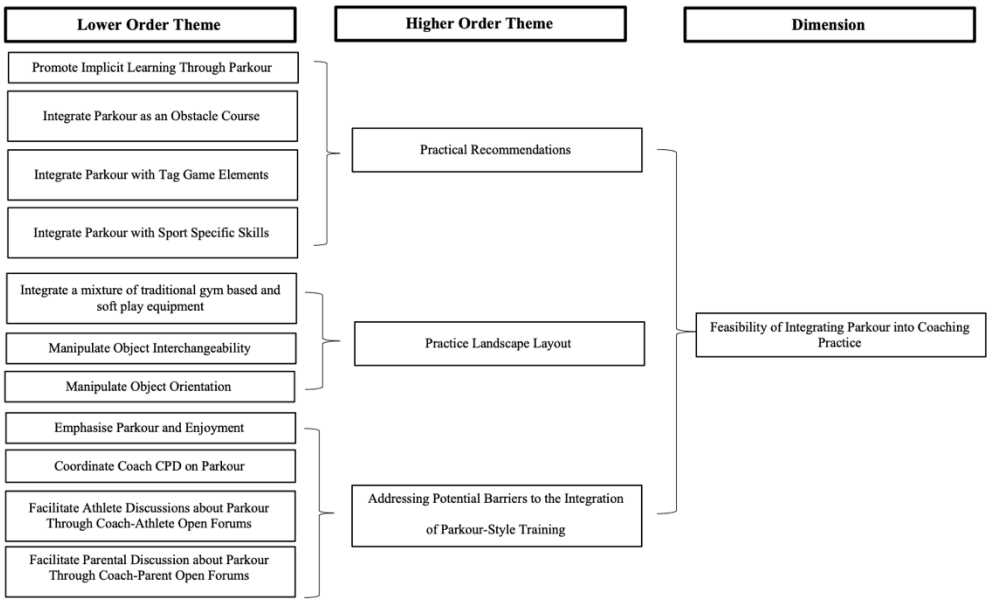
developing functional movement skills, while training for athlete development in older age groups (post age at peak height velocity) should be more related to conditions of movement (Wormhoudt et al., 2018). All elements of conditions of movement and coordinative abilities may be developed through the Athletic Skills Model continuum, by not only enhancing specific functional movement skills, but also engaging in technical adaptive training, as well as donor sports- in the case of the present study, Parkour-style training.

5.4.3. Feasibility of Integrating Parkour into Coaching Practice

Feasibility of integrating Parkour into coaching practice emerged as a dimension from the data set, with coaches outlining practical recommendations for integrating an inclusive Parkour environment in team sport practice (Figure 5.3.).

Figure 5.3.

Thematic map: feasibility of integrating Parkour into coaching practice



5.4.3.1. Practical Recommendations

Coaches described how the implicit nature of Parkour-style training must be maintained when being integrated into team sport practice:

> The more implicit we can make movement mastery, the better for me… I think something like Parkour is a brilliant way of focusing on completing the task set, the movement will happen as a solution to that. (Talent Development Coach 10)

It was also apparent that some coaches were already using Parkour-style activities, notably tag games and obstacle courses, suggesting that these approaches could be successfully integrated into other domains:

> Yeah we are using it (Parkour) already. We have got our obstacle course and often I will get the kids to try and create it so that they can be imaginative in what they want to do. The kids are sort of the environmental designer so to speak. (Strength and Conditioning Coach 1)

> I love tag, I love tag games, and at *** we introduced as part of the warm up a load of tag based games, which I think is about agility, it's about reacting to the opponent, reacting to obstacles and so on and so forth...If I had the budget I would create a performance playground (obstacle course), with crash mats, soft base blocks and so on and so forth…That is the challenge in the gym, once you put a fixed gym it place, it is quite fixed where I think when you have the soft area you can move things around and change the environment, change the stimulus and again you can have so much variety… What you have with Parkour based or gymnastics based equipment, is hundreds of different exercises that you can create…. For me it makes sense, if you got a small budget to focus on the things that can give you that and can increase that bandwidth by giving an infinite number of different exercises. (Talent Development Coach 9)

The interchangeability of Parkour-style equipment, in terms of manipulating the position and orientation of objects affords the athlete a greater variety of potential

interactions with their environment. Practically, Parkour style-equipment could take the form of the soft plyometric boxes that are used to train explosive jump capacity, or traditional gymnastic wooden benches that are used in traditional gym-based settings, if the sport clubs are constrained by budget. Theoretically, altering the orientation and position of objects in the environment changes the affordance landscape (Croft & Bertram, 2017), which may invite different problem-solving and re-coupling of perception and action, facilitating feelings of enjoyment and creativity in movement exploration, as participants seek innovative movement solutions to task goals. However, enjoyment in these tasks may also decrease if athletes cannot successfully adapt and repeatably fail. Coaches should, therefore, remain of aware and manipulate task difficult according to athlete experience and functional skills to accommodate different levels of movement competency. For example, tag games with soft blocks positioned in a varied format could form a section of the warm up in team sport, where exposure to Parkour-style training inclusive of an obstacle course (without or without a tag element) could be integrated as a separate session to supplement strength and conditioning work. Coaches also emphasised the importance of integrating competitive and sport-specific elements into Parkour-style training:

> I would just try and include a range of obstacles. I would still have to keep in mind that they are footballers at the end of the day, no matter how young they are, it is what they are doing being in a football institute. I think that would not be the emphasis at every point, but just through experience at football clubs, coaches need to see something football based. So, even if that included a Parkour obstacle course that had a football kicking to a goal, something little but I think I would just try to include as many movement patterns. So, whether that be, hurdles so they have to jump over, whether that be manakins lined up so they have to sidestep, I would try and get every plane of movement involved. I would also try

and make it competitive, so whether that be a race or be like a tag, cat and mouse, one going after the other. (Talent Develop Coach 4)

Whilst it is not proposed that, as a donor sport, Parkour improves sport-specific skill directly, the integration of sport-specific skills into these Parkour-style obstacle activities could make the activity more representative of the task, environmental and organismic constraint in the sport specific domain (see Chapter 3). One benefit would be coach and athlete "buy in" as it would be clear how football-related movements are being integrated, as identified by Talent Development Coach 4. For example, Parkour-style variants, such as world-chase tag with or without a football, could be integrated as the global constraints governing the activity (i.e., the first person to tag their opponent wins) are comparable to the offensive phases in football, where to regain possession of the ball, athletes have to couple their movements relative to the constant (re)positioning of teammates, opponents and the direction of the ball.

5.4.3.2. Addressing Potential Barriers to the Integration of Parkour-Style training

Coaches described potential, athlete-facing barriers when implementing Parkour style-training, such as gaining athlete cooperation. As a recommendation, coaches outlined that for Parkour style-training interventions to succeed there should be a culture where athletes are active (i.e., co-designing) partners, fully engaged in their own performance development, allowing them to create meaningful learning environments:

I have a good relationship with soccer coaches and athletes, but even when I brought it (Parkour) to the athletes themselves, initially, they were a little bit hesitant to act and participate, they thought it was joke and wasn't sure I was serious. But, as the weeks went on it just became part of the culture, part of what we did and they dove into it. (Strength and Conditioning Coach 9)

The first one you can offer is the idea that it (Parkour) is fun. So, the potential buy in will be far greater by the athlete. (Strength and Conditioning Coach 2)

The idea of athletes and sport practitioners working together to co-design learning and development environments has gained traction in recent times (e.g., Woods et al., 2020a). Emphasising enjoyment, and allowing athletes to co-design their own Parkour environments, may elicit the core social dimension of Parkour where interactions with coaches and peers help athletes regulate resilience and self-confidence through a shared network of affordances, rooted in a desire to interact with others while having fun (O'Grady, 2012). Coaches who were primarily involved with youth performers outlined how an open forum with parents should be arranged to challenge culturally-resistant beliefs about what support for skills learning and practice should look like:

> We have mixed groups and have invested more in having qualified coaches working with parent coaches to this age group. And of course, there are challenges because some have culturally resistant beliefs around the mantra 'we must select the best as early as possible'…… You have to persevere, and get as may interactions as possible around the microsystems of practice with people…As many as possible that you can do. Which is why I don't like these places that exclude parents from training, they're not good. The parents are important parts of any learning environment, very important parts. (Talent Development Coach 3)
>
> …I think the parents are more open to listening, that has been my experience as opposed to when you are with your other coach colleagues, so I think there is probably more in the way of that communication happening as opposed to parents who are maybe a little bit more open to listening in many ways. I have had parents ask me just straight up, what is this about and I say that I am happy to discuss if you want to listen. (Talent Development Coach 2)

It is important to get 'as many interactions as possible' with the parents to challenge culturally-resistant beliefs about the role of Parkour in athlete enrichment. Hence, coordinating an open forum would allow parents to, not just ask questions about

the reasons for integrating Parkour-style training, but also allow them to be involved with the developmental pathway of their child. Parents could also partake in 'Parkour taster sessions' where they 'experience' Parkour, as this could promote meaning making and consensus on the benefits of Parkour-style training for athlete enrichmentt through shared experiences. Coaches also outlined how potential barriers could be negated through continued professional development about Parkour:

> So, your barriers (for integrating Parkour) are going to be, lack of knowledge, people have set attitudes about it, or people not knowing anything about it at all. (Talent Development Coach 8)
>
> I know there are some sort of coaches that do implement this into their practice, so I would try and reach out to them for CPD. Then there is the body of evidence, any peer reviewed articles with practical applications at the end would be beneficial. (Strength and Conditioning Coach 7)
>
> I don't really understand how Parkour relates to football or how could it relate to football. I think it is important to know that football is played on grass, attacking one goal and defending the other, with one ball…. So, where does running off a wall come in?, it doesn't I can't do that in football. I just don't know the relevance to football. I would have to understand Parkour more. (Talent Development Coach 7)

Parkour is a relatively new sport and so its reach across domains is limited at present. Therefore, efforts needs be made at developing an understanding of, not only what Parkour *is*, but also *how* it can be specifically applied in learning and development programmes in different sport settings. Whilst some continued professional development courses are offered by Parkour companies, researchers should look to enhance online learning materials by including examples from applied practice to enhance their own learning. To achieve this aim, continued professional development under the rubric of a '*Department of Methodology'* could be integrated (Rothwell et al., 2020). According to

Rothwell (2020), a Department of Methodology is an approach where a group of practitioners work collaboratively within a unified conceptual framework to: (1) coordinate activity through shared language and principles, (2) communicate coherent ideas, and (3) collaboratively design practice landscapes enriched in information (i.e., acoustic, haptic, proprioceptive, visual) and guide emergence of multi-dimensional behaviours in athlete performance. It is anticipated that such an integrated structural organisation of sport science disciplines will facilitate a working environment where coaches, trainers, educators and other practitioners can adopt an individualised approach to developing athletes, sharing knowledge beyond discipline boundaries that will promote collaborative problem-solving (Nicolescu, 2002; Rothwell et al., 2020).

5.5 Conclusion

In summary, coaches identified that Parkour-style activities and games could be useful for enrichment of functional movement skills in helping to develop a well-rounded and adaptive 'mover' in team sport athletes, supporting the notion in the Athletic Skills Model of Parkour as a donor sport (Strafford et al., 2018; Savelsbergh & Wormhoudt, 2019). The applications arising from the experiential knowledge explored in this study are: 1) Parkour activities should be viewed as supplementary to typical sport training routines and be inclusive of obstacle courses with or without sport specific skills and or tag elements, 2) Parkour-style obstacle environments should be scalable to allow both the developing athlete and coach to manipulate tasks and object orientation using soft play and traditional gym equipment, and 3), The implementation of continued professional development opportunities for sport practitioners, and athlete-centred approaches to learning design and opportunities for coach-parent forums, are recommended to support the integration of Parkour-style enrichment environments.

This chapter has provided some of the first documented insights into how Parkour-style training could be integrated into team sport practice to provide

opportunities for athletes to learn to self-regulate and support the development of functional movement skills. However, with limited research to date, these findings should be considered with caution and further research is required to evaluate such approaches in practice via intervention based studies. An issue in the future design and development of such interventions, is to provide further evidence from sports coaches on how Parkour could be effectively implemented in practice. Chapter 6 will employ a Delphi method to gain expert consensus on a set of design principles and a framework for the integration of Parkour-style training in team sport settings would help guide further intervention research designs. The study outlined in Chapter 6 will provide both theoretical and applied insights on athlete learning and development as advocated in the Athletic Skills Model, with respect to the donor sport concept.

Chapter 6: Feasibility of Parkour-style training in team sport practice routines: a Delphi study.

This chapter outlines the Delphi study that was used to gain consensus, underpinned by finding in Chapter 3-5, on factors relating to the feasibility of integrating Parkour-style training into team sport practice routines. The findings from this chapter establish a set of design principles for the integration of Parkour-style training in team sport settings.

This chapter is based on the following peer-reviewed journal article: Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. (revisions invited). Feasibility of Parkour-style training in team sport practice routines: a Delphi study. *Journal of Sport Sciences.*

This chapter was also presented at an invited conference presentation: Strafford, B.W., Davids, K., North., J. S., & Stone, J. A. Feasibility of Parkour-style training in team sport practice: A Delphi study. Oral presentation at Movement, Learning and Pedagogy - A contemporary perspective, Norwegian School of Sport Sciences and Norwegian University of Science and Technology. 22nd October 2021.

6.1. Abstract

An ecological dynamics perspective advocates a nuanced balance between specificity and generality of training in athlete development programmes. To better understand the potential benefits of Parkour-style training for athlete development, this study acquired expert consensus on the feasibility of integrating Parkour-style training into team sport practice. A three-round, online Delphi method was employed. Talent development and strength and conditioning coaches in team sports were invited to participate. Twenty-four coaches completed Round One, 21 completed Round Two, and 20 completed Round Three. In Round One, coaches answered 15 open-ended questions across four categories: (1) General Perceptions of Parkour-style training; (2) Potential Applications of Parkour-style training; (3) Designing and Implementing Parkour-style training Environments; and (4), Creating an Inclusive Learning Environment. Responses from Round One were analysed using reflexive thematic analysis resulting in 78 statements across three dimensions (1) Application of Parkour Style Training in Team Sports; (2) Designing and Implementing Parkour-style training Environments; (3) Overcoming Potential Barriers when Integrating Parkour-style training. In Round Two and Round Three, coaches rated these statements using a four-point Likert scale and measures of collective agreement or disagreement were calculated. This study established consensus around a set of design principles for integrating Parkour-style training into team sport practice routines.

6.2. Introduction

A deeper integration of empirical data and experiential knowledge aids the development of new and integrated understanding of knowledge, predicated on pedagogy, psychological sciences, sport science, and practice experiences (e.g., McKay & O'Connor, 2018; Browne et al., 2019; McCosker et al., 2021). The previous chapters in this thesis have begun to address *how* Parkour-style training might be integrated in team sport practice routines as a donor sport using coaches experiential knowledge (see Chapter 3 and Chapter 5) and field-based research (see Chapter 4).

Experiential knowledge of Parkour Traceurs sampled in Chapter 3 emphasised that indoor Parkour environments should promote exploratory and creative movement behaviours to condition the athlete psychologically and physically, by providing heightened opportunities to acquire functional movement skills. Parkour Traceurs also recommended that indoor Parkour environments should include modular practice landscapes, where the angle, orientation, and spacing of the installation blocks and bar set ups can be manipulated to alter task difficulty. These recommendations provided rich insights into how 'affordances' (opportunities for action; Gibson, 1979) offered by the Parkour environment could be designed and integrated into practice. This athlete experiential knowledge collected in Chapter 3 was further supported through empirical data from Chapter 4 which demonstrated how performance in Parkour-speed-runs were supported by functional movement skills (arm swinging; jumping; running) and condition of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength).

When integrating novel approaches such as Parkour-style training in practice, the aim should be to encourage partnerships between sport practitioners with dialogue and discussions on how to best adapt practice landscapes in athlete development programmes (Rothwell et al., 2020). Therefore, developing clear practitioner understanding could

ensure a successful longer-term integration of Parkour-style training into athlete development programmes, rather than it being treated as a current 'fad' which may not be sustainable. Chapter 5 sought to meet the challenge of integrating Parkour practice landscapes in team sports by sampling the experiential knowledge of talent development specialists and strength and conditioning coaches. This experiential knowledge outlined that Parkour-style training should be viewed as a supplementary activity, inclusive of obstacle courses with or without sport-specific skills, where the orientation of soft play and traditional gym equipment can be scaled, relative to athlete skill levels and task difficulty (see Chapter 3-5). For successful integration, in Chapter 5 it was recommended that continued professional development opportunities for sport practitioners, athlete-centred approaches to learning design, and opportunities for coach-parent forums should be integrated in team sport settings. However, whilst the experiential knowledge from talent development and strength and conditioning coaches reported in Chapter 5 provided an initial insight into the how Parkour-style training could be integrated into team sport settings, it cannot serve to provide consensus on recommendations for practice design alone. Therefore, informed by ecological dynamics theory, Nonlinear Pedagogy, Athletic Skills Model, initial insights outlined in Chapter 5, and findings from previous Parkour research, it was important to seek consensus via a broader sample of expert talent development specialists and strength and conditioning coaches on how Parkour-style training could be integrated as a donor sport in team sport settings.

To gain expert consensus on a particular topic of interest, researchers have previously used Delphi methods, which is useful in areas of limited research (e.g., see Thangaratinam & Redman, 2005; Hasson & Keeney, 2011, Hasson et al., 2000; Runswick et al., 2021). The Delphi method has a variety of iterations, but typically consists of a sample of subject experts responding anonymously to a series of iterative questionnaires, with feedback used between rounds to reach consensus among the group (Hasson et al.,

2000). Recently, researchers have successfully undertaken Delphi studies to: (i) validate a tennis practice assessment tool (Krause et al., 2017), (ii) develop understanding on the classification for footballers with vision impairment (Runswick et al., 2021), (iii) analyse the physical characteristics underpinning performance in wheelchair fence athletes (Villiere et al., 2021), and (iv), explore the challenges and opportunities in wheelchair basketball classification (Filess Douer et al., 2021). Utilising a Delphi method to gain expert consensus on a set of design principles and a framework for the integration of Parkour-style training in team sport settings would help guide practice design in sport and the procedures developed in intervention studies to examine Parkour-style training as a donor sport. Therefore, the aim of this chapter was to acquire expert opinion on the feasibility of integrating Parkour-style training into team sport practice routines and to establish a framework and set of design principles for integrating of Parkour-style training in team sport settings.

6.3. Methods

6.3.1. Research Design

An online-Delphi study, consisting of three iterative rounds, was employed (Holloway, 2012). For each round, participants received an ad-hoc online-questionnaire, developed and administered using a commercial survey provider (Qualtrics©, Provo, Utah, United States). To ensure rigour in the Delphi process, the thesis author and supervisory team decided on the inclusion and exclusion criteria for selecting 'experts', the number of rounds, the analytical approach, and thresholds for consensus prior to the commencement of the study (Bahl et al., 2016). These decisions were guided by a pragmatic approach and placed centrally to addressing the research aims, with emphasis placed on shared meaning-making, communication, and transferability of research findings to coaching practice in team sport settings (Creswell & Creswell, 2017).

6.3.2. Panel Selection

Talent development specialists and strength and conditioning coaches with expertise in team sports were specifically targeted for inclusion in the study. Participants that fitted more than one of the categories were categorised as 'both' (Robertson et al., 2017). Participants were recruited using purposive sampling via social media and associated contacts from applied coaching science networks in the United Kingdom, United States, Europe, Africa, and Asia (Jorm et al., 2015). To be eligible to participate in the study, at the time of recruitment coaches had to have a minimum of three years' experience working in applied team sport settings and possess accreditation from a relevant governing body and/or university degrees in related subject areas. Unlike traditional experimental designs that are driven by statistical power, sample sizes in Delphi studies are dependent on group dynamics in reaching consensus (Vogel et al., 2019). Guided by previous research, 10-18 expert respondents were considered sufficient for consensus to be achieved in the present study (Okoli & Pawlowski, 2004; Atkins et al., 2005; Vogel et al., 2019). Fifty-three participants that met the inclusion criteria were invited to participate in the online-Delphi study, with 24 participants responding and agreeing to participate. This resulted in 24 participants completing Round One (45.3% response rate), 21 of 24 completed Round Two (87.5% response rate) and 20 of 21 completed Round Three (95.2% response rate). The panel included a mixture of 2 talent development specialists and 4 strength and conditioning coaches who were interviewed for the study outlined Chapter 5 (Strafford et al., 2021b) and 18 new participants. Panel demographics are outlined in Table 6.1. Institutional ethical approval was granted by the university ethics committee of the thesis author, with all participants providing informed written consent prior to the commencement of the study (Converis ID: ER28777777, see Appendix 6.1.).

Table 6.1

Sample demographics.

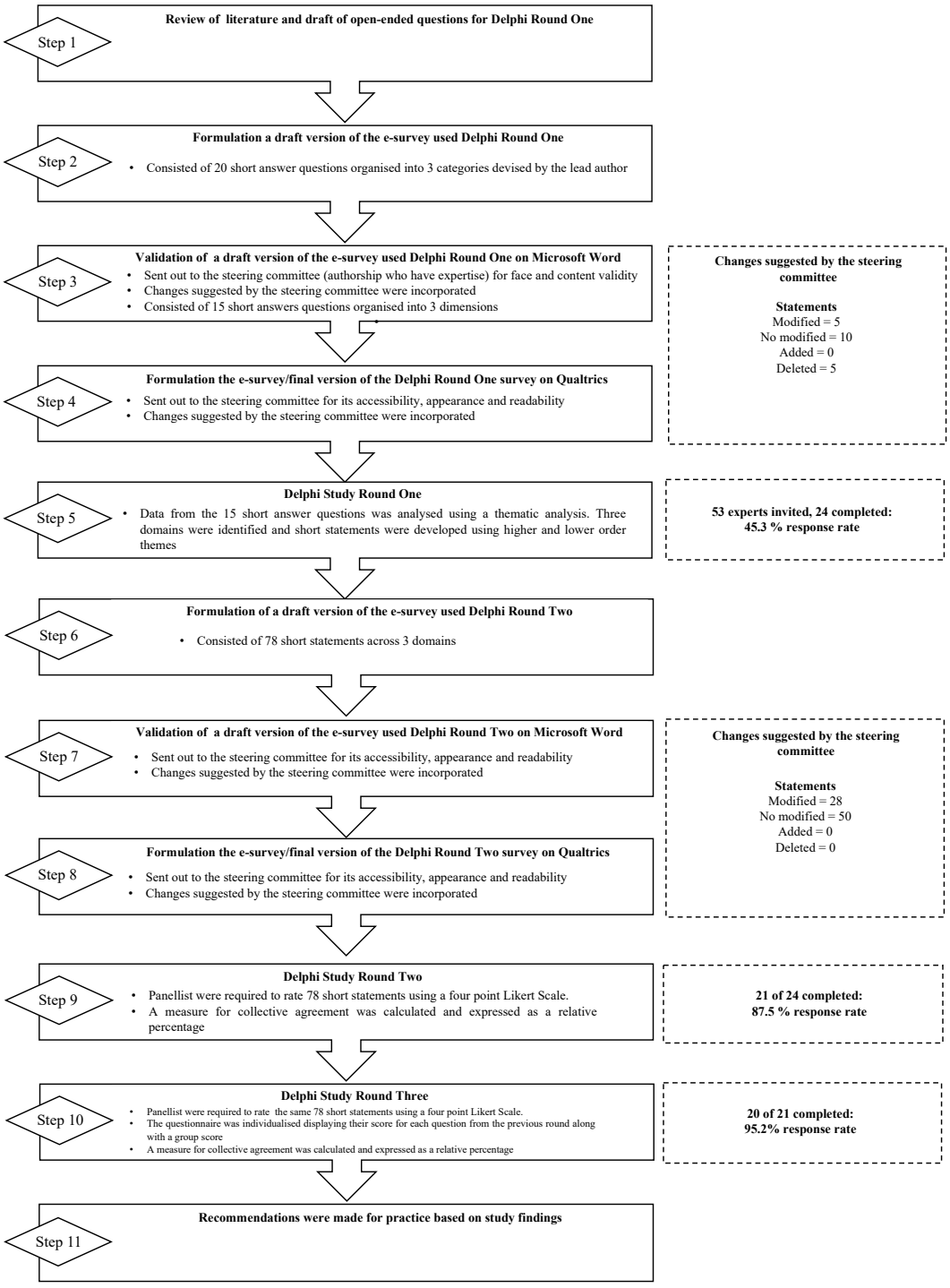
	Round 1 (n=24)	Round 2 (n=21)	Round 3 (n=20)
Descriptives:			
Age (Years) (Mean ± SD)	34.1±9.4	33.2±8.8	32.8±8.8
Coaching Experience (Years) (Mean ± SD)	13.4±7.1	13.4±7.1	11.9±6.4
Current Role:			
Talent Development Coach	41.7% (10)	38.1% (8)	38.1% (8)
Strength and Conditioning Coach	41.7% (10)	42.9% (9)	38.1% (8)
Both	16.7% (4)	19.0% (4)	19.0% (4)
Sports currently working with:			
American Football	4.2% (1)	4.8% (1)	5.0% (1)
Basketball	4.2% (1)	4.8% (1)	5.0% (1)
Gaelic Football	4.2% (1)	4.8% (1)	5.0% (1)
Ice Hockey	4.2% (1)	4.8% (1)	5.0% (1)
Multi-Sport	33.3% (8)	28.6% (6)	35.0% (7)
Rugby League	8.3% (2)	9.5% (2)	10.0% (2)
Rugby Union	4.2% (1)	4.8% (1)	5.0% (1)
Soccer	33.3% (8)	38.1% (8)	40.0% (8)
Team Athletic Sports	4.2% (1)	0.0% (0)	0.0% (0)
Academic Qualifications:			
Undergraduate Degree	79.2% (19)	81.0% (17)	80.0% (16)
Master's degree	54.2% (13)	57.1% (12)	55.0% (11)
Doctorate Degree	12.5% (3)	9.5% (2)	10.0% (2)
Professional Qualification:			
Strength and Conditioning Accreditation	45.8% (11)	38.1% (8)	35.0% (7)
Sport Coaching Qualification	45.8% (11)	47.6% (10)	50.0% (10)
Country of Employment:			
Finland	4.2% (1)	4.8% (1)	5.0% (1)
Ireland	8.3% (2)	9.5% (2)	10.0% (2)
Morocco	4.2% (1)	4.8% (1)	5.0% (1)
Netherlands	4.2% (1)	4.8% (1)	5.0% (1)
Portugal	4.2% (1)	4.8% (1)	5.0% (1)
Singapore	4.2% (1)	0.0% (0)	0.0% (0)
United Kingdom	62.5% (15)	61.9% (13)	60.0%(12)
United States	8.3% (2)	9.5% (2)	10.0% (2)

6.3.3. Procedure

With three rounds being considered optimal to reach consensus (Iqbal & Pipon-Young, 2009) this online-Delphi procedure aimed to reach consensus after three iterative rounds. The procedures undertaken are outlined in Figure 6.1.

Figure 6.1.

Delphi procedure.



Round 1: In accordance with a pragmatic approach, open-ended free-text questions were used in round one to permit observation of participants perceptions and experiences (Smith & Sparkes, 2016). Fifteen open-ended questions were developed, based upon findings from previous Parkour research (e.g., Strafford et al., 2020, Strafford et al. 2021a, Strafford et al., 2021b), aligned with concepts from the Athletic Skills Model and Nonlinear Pedagogy. In particular the higher order themes, lower order themes and quotes from the qualitative data outlined Chapter 5 (Strafford et al., 2021b) were used to structure the wording of these open-ended questions. Open-ended questions were separated into four categories: (1) General Perceptions of Parkour-style training; (2) Potential Applications of Parkour-style training; (3) Designing and Implementing Parkour-style training Environments, and (4) Creating an Inclusive Learning Environment. Once the initial questions were developed by the thesis author, the supervisory team met with the thesis author to discuss the relevance of each question, relative to answering the research aims. To ensure uniformity and to remain as faithful as possible to the original wording of findings and concepts outlined in the Parkour literature, these questions were either accepted without revision, modified to remove bias in language, or deleted (Figure 6.1) (Fischer et al., 2013). The online questionnaire for Round One was then distributed to participants via a secure email link and remained open for four weeks. The full list of questions used in Round One are available in the Appendix 6.2.

Responses from Round One were analysed in Microsoft Excel (Version 19, Microsoft Cooperation, Washington, United States), using a two-stage reflexive thematic analysis which incorporated both deductive and inductive coding to identify higher and lower order themes (Braun & Clarke, 2019). During the reflexive thematic analysis, an 'either or approach' (i.e., inductive approach: with little pre-determined structure, theory, or framework, or deductive approach: the of structure, theory, or a pre-determined

framework) was not adopted. Instead, a pragmatic form of analysis which included a mixture of deductive and inductive approaches was undertaken (Robertson et al., 2013; Braun et al., 2016; Braun & Clarke, 2019). A deductive analysis represented the first coding stage, where free-text response from the open-ended questions were organised into three dimensions (1) Potential Applications of Parkour-style training in team sports, (2) Designing and Implementing Parkour-style training environments, (3) Overcoming Potential Barriers when Integrating Parkour-Style training. This first coding stage was conducted by the thesis author, who read the free-text responses several times to identify language relating to potential applications of Parkour-style training in team sports, designing and implementing Parkour-style training environments and overcoming potential barriers when integrating Parkour-Style training. After this first coding stage, the thesis author and supervisory team undertook a period of peer-consultation, which consisted of each member of the supervisory team independently reading round one responses and undertaking open discussion regarding the initial dimensions determined by the thesis author. Having aligned with pragmatism, the thesis author and supervisory team accepted that theory-free knowledge cannot be achieved, in that knowledge can be both implicit (as with practical skill of expertise) and explicit (as with theoretical understanding on the subject) (Dewey, 1938). Therefore, once data were organised into these three dimensions, both deductive and inductive analyses were undertaken in a second coding stage (Guba & Lincon, 2005).

Concurrent with a pragmatic research paradigm, it is important to acknowledge the personal biography of the thesis author and supervisory team, given that their previous work was a motivation for undertaking the current study, and that their past research may have informed the development of the study's methodology (Tracy, 2010). Please see Chapter 5, section 5.3.5 for an overview of the thesis author and supervisory team. In accordance with recommendations from Smith and McGannon (2018), the thesis author

and supervisory team engaged with an independent critical friend during the reflexive thematic analysis process to discuss interpretations made throughout. During these discussions, the role of the critical friend was to encourage reflexivity by challenging the authors' *"construction of knowledge"* (Cowan & Taylor, 2016).

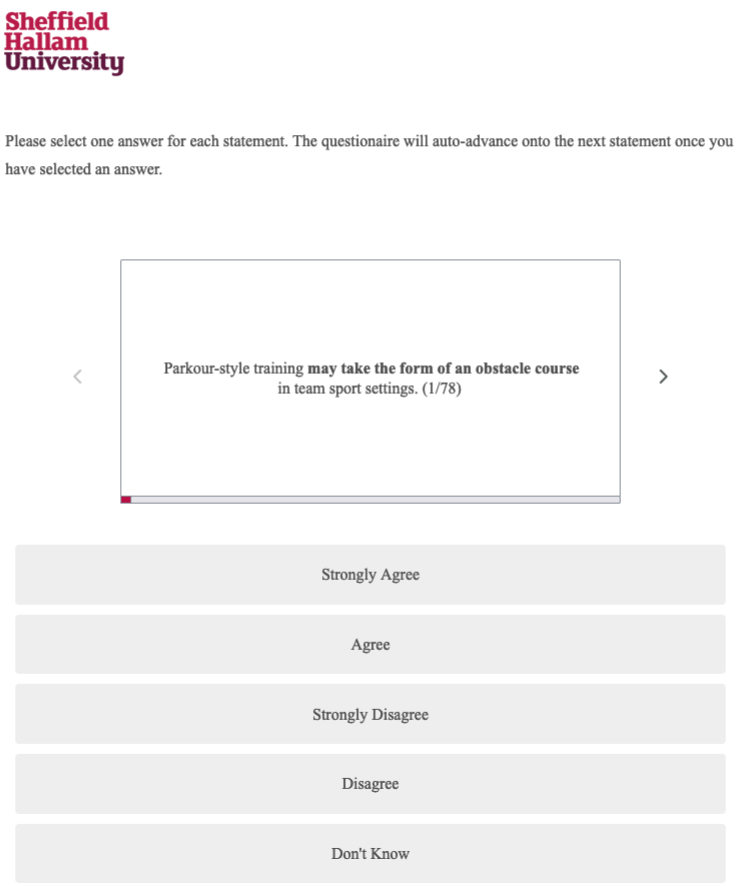
Round 2: Using the higher and lower order themes from the thematic analyses and the language from the free-text responses from the questions presented in Round One, the thesis author developed 78 short statements which were organised into the three deductive dimensions: (1) Application of Parkour Style Training in Team Sports; (2) Designing and Implementing Parkour-style training Environments; (3) Overcoming Potential Barriers when Integrating Parkour-style training. The dimensions and higher order themes informed the grouping of questions, and the lower order themes informed the question focus, with each question corresponding to a lower order theme from the reflexive thematic analysis. The development of these short statements involved the thesis author writing one idea per statement, written as an action, with no ambiguity, and minimum overlap with other items (Jorun, 2015). The thesis author and supervisory team then met again to discuss the relevance of each statement relative to answering the research aims and to refine the draft statements to ensure uniformity and remain faithful as possible to the original wording of the participants free-text responses (Fischer et al., 2013). Statements were either accepted without revision, modified to remove bias in language, or deleted (Figure 6.1.). The full list of final statements used in Round Two and Round Three are available in Appendix 6.3.

The second online questionnaire was distributed to participants that responded in Round One via a secure email link and remained open for two weeks. Participants were asked to rate each statement using a four-point Likert scale as either: strongly agree, agree, disagree, strongly disagree (Vogel et al., 2019). An additional option of 'don't know' was also provided. The inclusion of a 'don't know' option was a pragmatic

decision, to ensure participants had an opportunity to accurately report if they did not have an opinion/attitude on a particular issue, rather than feeling pressured to give a substantive perspective option (strongly agree, agree, strongly disagree, disagree) (Lavrakas, 2008). Raw response data were analysed descriptively using relative and absolute frequencies to give a calculated measure of collective agreement or disagreement for each statement.

Figure 6.2.

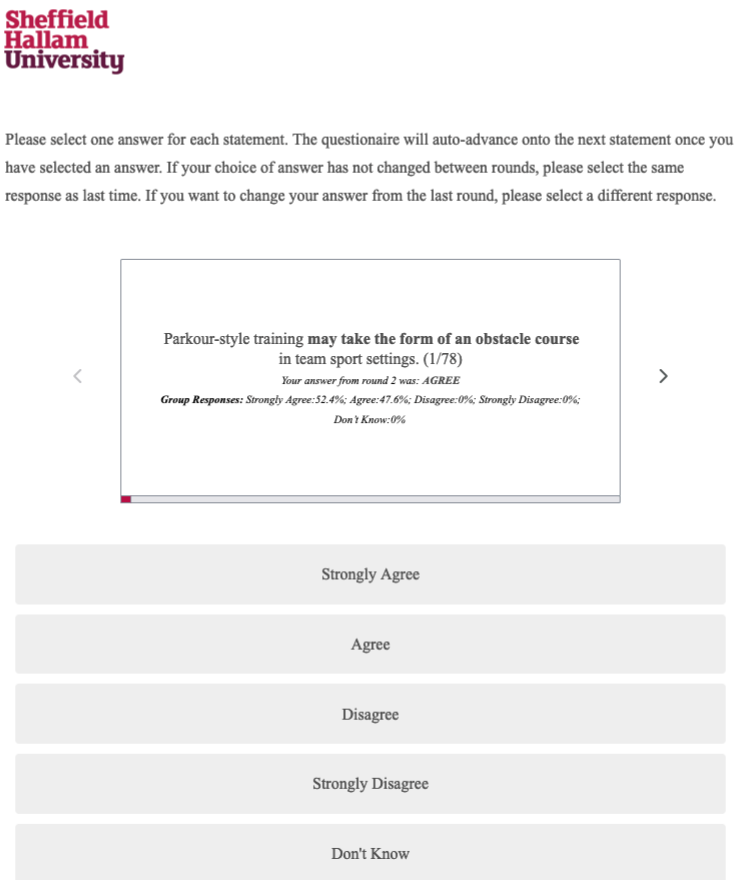
Example Delphi statement from the Round 2 Qualtrics questionnaire.



Round 3: The final round consisted of participants that responded to Round Two being presented with a personalised online questionnaire, which consisted of their answers from Round Two, along with a summary of the group responses expressed as a relative frequency. This method provided participants with the opportunity to amend their answers from Round Two if they wished to do so. In doing so, the initial findings were then evaluated independently by the participants. Raw response data were analysed descriptively using relative and absolute frequencies to give a calculated measure of collective agreement or disagreement for each statement.

Figure 6.3.

Example Delphi statement from the Round 3 Qualtrics questionnaire (personalised with the participant answer from Round 2, alongside group response expressed as a relative frequency).



Criteria for Consensus: Delphi studies have used a wide range of consensus levels ranging from 50 to 80% (Hasson et al., 2000). Based on previous work and after formal discussion between the thesis author and supervisory team, consensus was defined as > 70% of the panel agreeing/strongly agreeing or disagreeing/strongly disagreeing with a statement in Round Three (Vogel et al., 2019; Runswick et al., 2021). All 'don't know' responses were excluded to ensure that the reported percentage agreement or disagreement for each statement represented the consensus among only those who believed they held a firm view. As directed by Duffield (1993), stability of consensus was considered to be reached if the between round group responses (between Round 2 and Round 3 in this instance) varied by ≤ 10%.

6.4. Results

Table 6.2. provides a summary of the Delphi statements and the number of statements which reached consensus in Round Two and Round Three. Stability of consensus was achieved across all three dimensions. Findings from Round Three were used to develop the recommendations which is reflective of the consensus achieved (Ross et al., 2014).

Table 6.2.

Summary of grouped statements by dimension.

Statement Dimensions	Number of statements in each domain		Proportion of statements where consensus was achieved (n)	
	Round 2	Round 3	Round 2	Round 3
Applications of Parkour-style training in Team Sports[a]	13	13	100.0% (13)	100.0% (13)
Designing and Implementing Parkour-style training Environments[a]	32	32	71.9% (23)	78.1% (25)
Overcoming Potential Barriers when Integrating Parkour-style Training[a]	33	33	81.9% (27)	78.8% (26)

Note: Consensus was achieved when 70% of participants strongly agreed/agreed or strongly disagreed/disagreed with a statement. [a]Stability of consensus (≤10% variation) was achieved between Round 2 and Round 3.

6.4.1. Applications of Parkour-style training

In this dimension, the panel reached consensus (Table 6.3.) on which physical and psychological skills may be developed through Parkour-style training. Panellists agreed that Parkour-style training would be useful for developing adaptive athletes as the activities challenged athletes to move in a dynamic way. The panel also agreed that engaging with Parkour-style training could improve competitive performance in team sport athletes' main sport, due to transfer of movement competences between practice domains. Specifically, the panel agreed that Parkour-style training could play a role in supporting team sport athletes to develop movement skills that are not strictly sport-specific but could support strong skill development via conditions of movement (agility; stability; flexibility; power and endurance) relevant for a range of varied sports. In addition to physical skills, panellists also agreed that engaging with Parkour-style training may be useful for developing psychological skills: problem solving, resilience, confidence, emotional regulation, risk appraisal and coordinative abilities.

Table 6.3.

Responses to statements in the applications of Parkour-style training in team sports dimension.

Applications of Parkour-style training in Team Sports	Round 2 (n=21)		Round 3 (n=20)	
	Agreement (%)	Disagreement (%)	Agreement (%)	Disagreement (%)
General Structure of Parkour-style training in Team Sports				
Parkour-style training may take the form of an obstacle course in team sport settings.	100.0%	0.0%	**100.0%**	**0.0%**

Parkour-style training may take the form of tag-games in team sport settings.	100.0%	0.0%	**100.0%**	**0.0%**
Skills Developed Through Parkour-style training				
Engaging with Parkour-style training could develop adaptive athletes.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training challenges athletes to move in a dynamic way.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training could play a role in supporting athletes to develop movement skills relevant for a. range of sports.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training targets movements that are not strictly sport specific but can provide strong foundational movements for athletes to build upon.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training could be used to develop problem solving skills in team sport athletes.	100.0%	0.0%	**100.0%**	**0.0%**

Parkour-style training could be used to develop resilience in team sport athletes.	92.3%	7.7%	**92.9%**	**7.1%**
Parkour-style training could be used to develop confidence in team sport athletes.	90.0%	10.0%	**94.7%**	**5.3%**
Parkour-style training could be used by team sports athletes to develop risk appraisal skills.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training could be used to develop coordinative abilities in team sport athletes.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training could be used to develop conditions of movement (agility; stability; flexibility; power and endurance) in team sport athletes.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training could improve competitive performance in athletes' main sport due to transfer of movement competence between practice domains.	100.0%	0.0%	**100.0%**	**0.0%**

Note: Bold % in shaded areas denotes that ≥70% consensus was achieved; Agreement = agree+strongly agree; Disagreement = disagree+strongly disagree.

6.4.2. Designing and Implementing Parkour-style training Environments

In this dimension, the panel reached consensus (Table 6.4.) on Recommendations for: The Structure of Parkour-style training in Team Sport, Creating Variability in Parkour-style training Environments, Maintaining Enjoyment and Engagement, and Session Delivery and Coach Feedback Methods.

6.4.2.1. Recommendations for Maintaining Enjoyment and Engagement

To promote high and sustained levels of enjoyment and engagement in Parkour-style training, the panel agreed that athletes should be actively involved partners (i.e., co-designing) in their development, allowing them to create relevant, challenging, engaging and fun learning environments.

6.4.2.2. Recommendations for the Structure of Parkour-style training in Team Sport

According to the panel, Parkour-style training in team sport settings can be used in a variety of ways, such as: (i) using obstacle courses both with or without tag game elements, (ii) integrated as a section of the warm-up for the main sport-specific coaching session, and (iii), as a separate session to supplement strength and conditioning work. The panel agreed that soft-play equipment and/or equipment found in gym-based settings (mats, boxes, hurdles, cones, horses, benches, sausage bags, shields and other items) could be used in Parkour-style training landscapes, if the set up does not increase injury risk. Whilst the panel agreed that seeking to integrate sport-specific skills into Parkour-style training could help coach and athlete *"buy in"*, there was little consensus on if/how sport specific skills should be integrated – this issue requires future investigation.

6.4.2.3. Recommendations for Creating Variability in Parkour-Style Training Environments

The panellists agreed that equipment used in Parkour-style training environments should be modular so their properties can be manipulated to create variability in practice

task constraints. Specifically, the height of some objects should be scalable to allow for increases or decreases in task difficulty. The panellists also agreed that the position and angle of some objects should be scalable to allow task difficulty to be altered. The panel agreed that that the equipment layout in these Parkour-style environments should not be exclusively symmetrical, but could be exclusively asymmetrical, with a mixture of symmetrical and asymmetrical components being preferable.

6.4.2.4. Recommendations for Session Delivery and Coach Feedback Methods

The panel agreed that for safety purposes Parkour-style training should be delivered by coaches who have engaged with related coach education resources (Parkour-style training workshops and material). Panellists agreed that Parkour-style training should be primarily athlete-led, where athletes create (co-design) their own Parkour-style environment with equipment that is made available to them by the coach. However, the panel agreed that some level of athlete induction and awareness training should be conducted when first integrated. Panellists agreed that Parkour-style training should be delivered via guided discovery and free play methods, driven by the athletes rathe r than being coach-led.

To exemplify, Figure 6.4 provides a coaching resource which outlines principles for integrating and delivering Parkour-style training in team sport settings, across four pillars: equipment, session structure, creating variability, and session delivery and feedback. Before integrating Parkour-style training in team sport settings it is recommended that coaches engage with this resource and relevant coach education material to aid the development and delivery of an enriched learning environment.

Table 6.4.

Responses to statements in the designing and implementing Parkour-style training environments dimension.

Designing and Implementing Parkour-style training Environments	Round 2 (n=21)		Round 3 (n=20)	
	Agreement (%)	Disagreement (%)	Agreement (%)	Disagreement (%)
Maintaining Enjoyment and Engagement				
For Parkour style-training interventions to succeed there should be a culture where athletes are actively involved partners (i.e., co-designing) in their development, allowing them to create relevant, engaging and fun learning environments.	95.0%	5.0%	**94.4%**	**5.6%**
Equipment Recommendations				
Any equipment found in a typical (traditional) coaching environment can be used for Parkour-style training as long as the set up does not increase injury risk of players.	94.7%	5.3%	**94.1%**	**5.9%**
Equipment found in a typical (traditional) coaching environment typically includes: mats, boxes, hurdles, cones, horses, benches, sausage bags, shields and other items.	90.0%	10.0%	**78.9%**	**21.1%**
In Parkour-style training, the less equipment used the better.	36.4%	63.6%	38.5%	61.5%

Parkour-style training should only use specialist equipment (e.g., specialist Parkour installations and facilities).	0.0%	100.0%	**15.0%**	**85.0%**
Recommendations for Session Structure				
Parkour-style training taking the form of obstacle courses could use equipment found in traditional gym based settings.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training taking the form of obstacle courses could use soft-play equipment.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training taking the form of obstacle courses should form a part of the warm up of the main sport specific coaching session.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training taking the form of obstacle courses should be integrated as a separate session to supplement strength and conditioning work.	66.7%	33.3%	**81.3%**	**18.8%**
Parkour-style training taking the form of obstacle courses with a tag-game element could use equipment found in traditional gym based settings.	94.4%	5.6%	**100.0%**	**0.0%**

Parkour-style training taking the form of obstacle courses with a tag-game element could use soft-play equipment.	95.0%	5.0%	**100.0%**	**0.0%**
Parkour-style training taking the form of obstacle courses with a tag-game element should form a part of the warm up of the main sport specific coaching session.	94.7%	5.3%	**89.5%**	**10.5%**
Parkour-style training taking the form of obstacle courses with a tag-game element should be integrated as a separate session to supplement strength and conditioning work.	68.8%	31.3%	**81.3%**	**18.8%**
Parkour-style training should integrate sport-specific skills (e.g., ball handling, passing, shooting).	46.7%	53.3%	50.0%	50.0%
Integrating sport-specific skills into Parkour-style training could help coach and athlete “buy in” as it would be clear how sport-related movements are being integrated.	85.7%	14.3%	**90.0%**	**10.0%**
Parkour-style training should be used on the day of sport specific competition.	15.4%	84.6%	35.7%	64.3%
Parkour-style training should not be used on the day of sport specific competition.	50.0%	50.0%	43.8%	56.3%

Strategies for Creating Variability in Parkour-style training Environments				
All objects in the Parkour-style environment should be modular so that their height, can be scalable to allow for increases or decreases in task difficulty.	66.7%	33.3%	**70.6%**	**29.4%**
Some objects in the Parkour-style environment should be modular so that their height can be scalable to allow for increases or decreases in task difficulty.	95.2%	4.8%	**100.0%**	**0.0%**
All objects in the Parkour-style environment should be modular so that their position can be scalable to allow for increases or decreases in task difficulty.	55.6%	44.4%	58.8%	41.2%
Some objects in the Parkour-style environment should be modular so that their position can be scalable to allow for increases or decreases in task difficulty.	90.5%	9.5%	**100.0%**	**0.0%**
All objects in the Parkour-style environment should be modular so that their angle can be scalable to allow for increases or decreases in task difficulty.	57.9%	42.1%	52.9%	47.1%

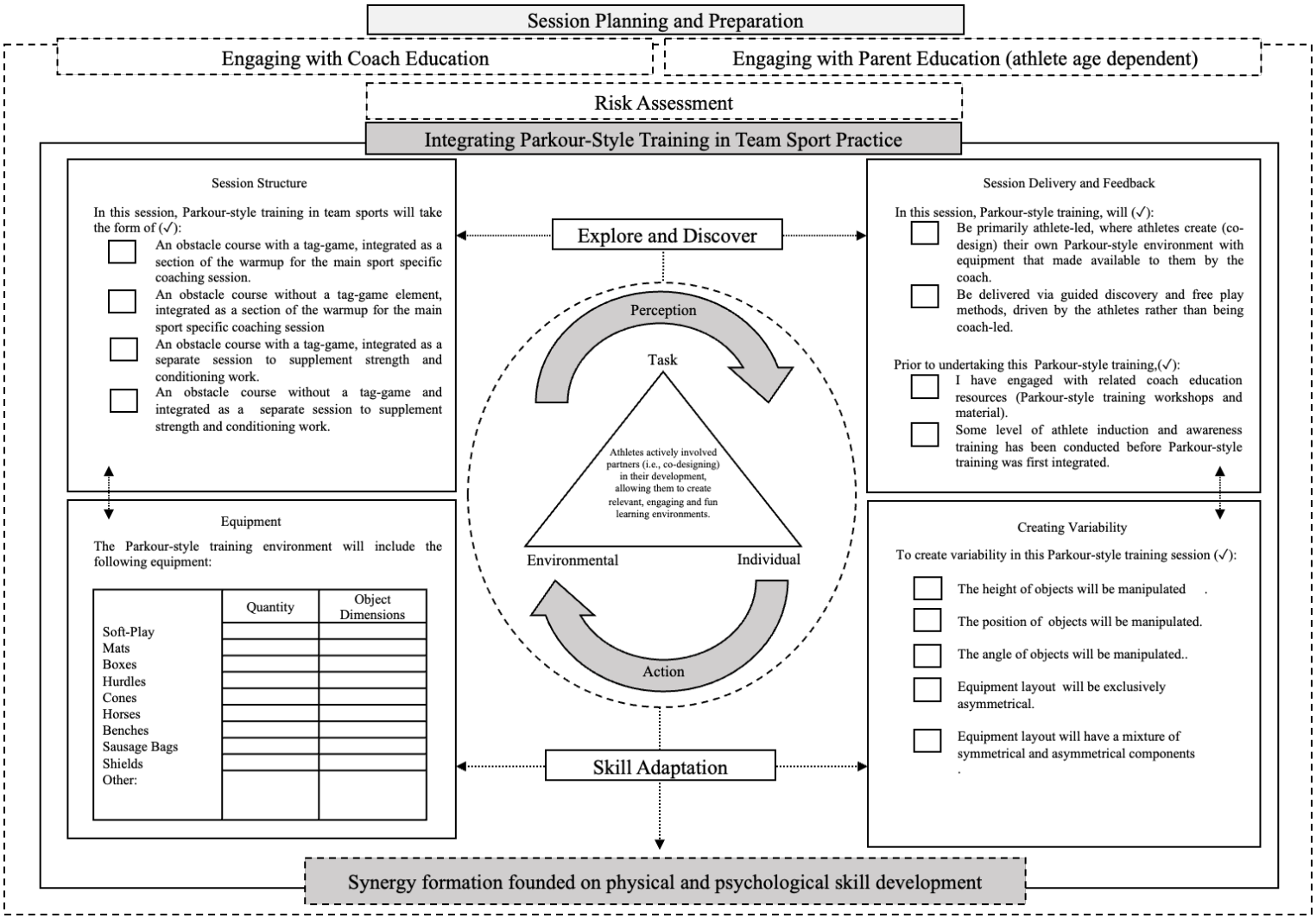
Some objects in the Parkour-style environment should be modular so that their angle can be scalable to allow for increases or decreases in task difficulty.	95.0%	5.0%	**94.7%**	**5.3%**
Parkour style training environment's should be symmetrical.	0.0%	100.0%	**12.5%**	**87.5%**
Parkour style training environment's should be asymmetrical.	75.0%	25.0%	**86.7%**	**13.3%**
Parkour style training environments should have a mixture of symmetrical and asymmetrical objects.	100.0%	0.0%	**100.0%**	**0.0%**
Recommendations for Session Delivery and Coach Feedback Methods				
The coach should attend Parkour-style training workshops and or related coach education courses before integrating Parkour-style training.	89.5%	10.5%	**83.3%**	**16.7%**
When first integrated, Parkour-style training requires some level of athlete induction and awareness training, with coach directed input for safety purposes.	94.1%	5.9%	**85.7%**	**14.3%**

Parkour-style training should be delivered by a mixture of the coach and Parkour specialists.	60.0%	40.0%	52.6%	47.4%
Parkour-style training should be primarily athlete-led, where athletes create (co-design) their own Parkour-style environment with equipment that is made available to them by coach.	78.6%	21.4%	**80.0%**	**20.0%**
Parkour-style training should be primarily delivered via guided discovery and free play methods, driven by the athletes.	90.0%	10.0%	**94.1%**	**5.9%**
Parkour style-training should be primarily coach-led and organised without guided discovery and free play.	0.0%	100.0%	**6.3%**	**93.8%**

Note: Bold % in shaded areas denotes that ≥70% consensus was achieved; Agreement = agree+strongly agree; Disagreement = disagree+strongly disagree.

Figure 6.4.

Principles framework for integrating and delivering Parkour-style training in team sport settings.



6.4.3. Overcoming Potential Barriers when Integrating Parkour-style training

In this dimension, athletes reached consensus (Table 6.5) on Potential Barriers and Recommendations for Resolution, Recommendations for the Development and Application of Coach Education, and Recommendations for the Development and Application of Coach-Parent Forums.

6.4.3.1. Potential Barriers and Recommendations for Resolution

Panellists agreed that Parkour-style training would be easier to implement in team sport settings when it is proposed to coaches as 'obstacle courses' with or without tag elements (e.g., gamifying Parkour). This description was consistent with the panel's recommendation on the structure of Parkour-style training.

Panellists agreed that Parkour-style training workshops should be integrated to challenge traditional coach thinking and resistant beliefs and attitudes around practice design and address the common misconception that Parkour-style training is a high injury risk activity. Panellists agreed that integrating Parkour-style training using equipment typically found in team sport settings would overcome barriers related to specialist equipment and cost, concurrent with the panel's suggestion on equipment properties. Panellists agreed that having equipment that is easily moveable reduces set up time, which is beneficial as Parkour-style environment can either be set up before the athlete arrives or by the athlete during the session.

6.4.3.2. Recommendations for the Development and Application of Coach-Parent Forums

Panellists agreed that coach-parent forums could be delivered in-person and/or online to give parents opportunities to ask questions about the rationale for using Parkour-style training in the developmental pathway of their child/ren. This idea should be relayed to parents in a variety of multi-media (e.g., videos, presentations, podcasts) formats. Panellists agreed that coach-parent forums should use non-technical language so that the

rationale for using Parkour style training in the developmental pathway of their child/ren can be clearly understood. The coach-parent forums should emphasise two key aspects: 1) safety aspects of Parkour-style training by outlining to parents what Parkour-style training is (e.g., obstacle course/tag) and what it is not (e.g., jumping off buildings and riding on the tops of trains), 2) the added-value of Parkour-style training for the development of their child/ren's athletic skills and foundational capacities. Where possible, panellists outlined how parents should be provided with opportunities to partake in 'Parkour taster sessions' to allow them to 'experience' the Parkour-style training that their child/ren will undertake.

6.4.3.3. Recommendations for the Development and Application of Coach Education

Panellists agreed that Parkour-style training workshops should be developed and delivered in conjunction with professional training programmes of sport national governing bodies. According to the panellists, this material should be developed in consultation with Parkour specialists to ensure that they are representative of a safe and inclusive Parkour environment by outlining to coaches what *Parkour-style training* is (e.g., obstacle course/tag) and what it is not (e.g., 'free running' involving jumping off buildings and riding on top of trains). Specifically, the material and delivery should demonstrate a range of activities that can be implemented with and without equipment, implemented in different environments (e.g., outdoors, and indoors) and with varying athlete numbers. The material should also demonstrate how to progress, regress, and manipulate the difficulty of Parkour-style training relative to age, skill level and functional capacities of athletes. These materials could also provide examples of animal flow and primal movement pattern activities found in contemporary strength and conditioning programmes. Panellists agreed that coach education workshops should offer support and advice for coaches to design Parkour-style training and receive feedback from

Parkour specialists, other coaches in their sport (peer-consultation) and athletes (co-design). The panellists also recommended that coaches should be given opportunities to partake in 'Parkour taster sessions' where they 'experience' the Parkour-style training that athletes may undertake.

Figure 6.5. and 6.6. provides principles for supporting the successful integration of Parkour-style training via education opportunities. Whilst these recommendations are provided, future work is required to develop parent and coach education materials and examine the feasibility of these developmental activities in team sport settings.

Table 6.5.

Responses to statements in the overcoming potential barriers when integrating Parkour-style training dimension.

Overcoming Potential Barriers when Integrating Parkour-style training	Round 2 (n=21)		Round 3 (n=20)	
	Agreement (%)	Disagreement (%)	Agreement (%)	Disagreement (%)
Recommendations for the Development and Application Coach-Parent Forums:				
In youth sport, where possible, parents should be given opportunities to partake in 'Parkour taster sessions' to allow them to 'experience' the Parkour-style training that their child/ren will undertake.	93.8%	6.3%	**93.8%**	**6.3%**

In youth sport, in-person coach-parent open forums should be organised to give parents opportunities to ask questions about the rationale for using Parkour-style training in the developmental pathway of their child/ren.	89.5%	10.5%	**94.4%**	**5.6%**
In youth sport, online coach-parent open forums should be organised to give parents opportunities to ask questions about the rationale for using Parkour-style training in the developmental pathway of their child/ren.	78.9%	21.1%	**88.9%**	**11.1%**
In youth sport, coach-parent forums should use non-technical language so that the rationale for using Parkour style training in the developmental pathway of their child/ren can be clearly understood.	90.0%	10.0%	**89.5%**	**10.5%**
In youth sport, coach-parent open forums should emphasise the safety aspects of Parkour by outlining to parents what Parkour-style training is (e.g. obstacle course/tag) and what it is not (e.g. jumping off buildings and riding on the tops of trains).	95.5%	5.0%	**94.7%**	**5.3%**

In youth sport, coach-parent open forums should emphasise the added-value of Parkour-style training for the development of their child/ren's athletic skills and foundational capacities.	100.0%	0.0%	**100.0%**	**0.0%**
In youth sport, the rationale for using Parkour-style training sessions in the developmental pathway of their child/ren, should be relayed to parents in a variety of multi-media (e.g., videos, presentations, podcasts).	94.4%	5.6%	**94.1%**	**5.9%**
In youth sport, coach-parent forums, should not take time away from discussing any sport-specific opportunities of their child/ren.	50.0%	50.0%	53.3%	46.7%
Recommendations for the Development and Application of Coach Education:				
Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented with and without equipment.	100.0%	0.0%	**100.0%**	**0.0%**

Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented in different environments (e.g., outdoors and indoors).	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented with varying athlete numbers.	95.2%	4.8%	**100.0%**	**0.0%**
Where possible, Parkour-style training workshops should give coaches opportunities to partake in 'Parkour taster sessions' where they 'experience' the Parkour-style training that athletes may undertake.	95.2%	4.8%	**100.0%**	**0.0%**
Parkour-style training workshops and coach education materials should demonstrate how to progress, regress and manipulate the difficulty of Parkour-style training relative to age.	95.0%	5.0%	**94.7%**	**5.3%**
Parkour-style training workshops and coach education materials should demonstrate how to progress, regress and manipulate the difficulty of Parkour- style training relative to skill level and functional capacities of athletes.	95.0%	5.0%	**90.0%**	**10.0%**

Parkour-style training workshops and coach education materials should offer support and advice for coaches to design Parkour-style training and receive feedback from Parkour specialists.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training workshops and coach education materials should offer support and advice for coaches to design Parkour-style training and receive feedback from other coaches in their sport (peer-consultation).	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training workshops and coach education materials should offer opportunities for coaches to design Parkour-style training and receive feedback from athletes.	100.0%	0.0%	**100.0%**	**0.0%**
Parkour-style training workshops and coach education materials, should provide examples of animal flow and primal movement pattern activities found in contemporary strength and conditioning programmes.	86.7%	13.3%	**93.8%**	**6.3%**

The development and delivery of Parkour workshops and coach education materials should be linked to professional training programmes of sport national governing bodies.	70.6%	29.4%	**81.3%**	**18.8%**
Parkour-style training workshops and coach education materials should be developed in consultation with Parkour specialists to ensure that they are representative of a safe and inclusive Parkour environment.	95.2%	4.8%	**90.0%**	**10.0%**
Parkour-style training workshops and coach education materials should emphasise the safety aspects of Parkour by outlining to coaches what Parkour-style training is (e.g. obstacle course/tag) and what it is not (e.g. jumping off buildings and free-riding on top of trains).	100.0%	0.0%	**100.0%**	**0.0%**
Potential Barriers and Recommendations for Resolution:				
Parkour-style training would be difficult to implement in team sports settings due to traditional coach thinking and resistant beliefs around practice design.	55.6%	44.4%	61.1%	38.9%

Parkour-style training workshops and coach education materials could be implemented in team sport settings to challenge traditional coach thinking and resistant beliefs and attitudes around practice design.	95.2%	4.8%	**90.0%**	**10.0%**
Parkour-style training would be difficult to implement in team sports due to common misconceptions that Parkour is a high injury risk activity.	44.4%	55.6%	41.2%	58.8%
Parkour-style training workshops and coach education materials should address the common misconception that Parkour-style training is a high injury risk activity.	100.0%	0.0%	**95.0%**	**5.0%**
The availability of specialist equipment is a barrier to integrating Parkour-style training.	36.8%	63.2%	50.0%	50.0%
Parkour-style training could use equipment typically found in team sport settings which would overcome barriers related to specialist equipment.	94.4%	5.6%	**100.0%**	**0.0%**

Parkour-style training would be easier to implement when it is proposed to coaches as tag games or negotiation of obstacle courses (e.g., gamifying Parkour).	90.5%	9.5%	**80.0%**	**20.0%**
Having the development and delivery of Parkour-style training workshops and coach education materials linked to sport national governing bodies would help challenge traditional coach thinking and resistant beliefs around Parkour-style training.	76.5%	23.5%	68.8%	31.3%
The time it takes to set up the physical environment and equipment is a barrier to implementing Parkour-style training successfully.	38.9%	61.1%	44.4%	50.0%
An environment where equipment is easily moveable would reduce time as the Parkour-style environment can either be set up before the athlete arrives or by the athlete during the session.	100.0%	0.0%	**95.0%**	**5.0%**
Finance and cost is a barrier to implementing Parkour-style training.	36.8%	63.2%	44.4%	55.6%

Where finance and costs may be a barrier to implementing Parkour-style training, creating Parkour-style environments with equipment typically found in team sport settings could be useful and inexpensive alternative to specialist Parkour equipment.	100.0%	0.0%	**94.7%**	**5.3%**

Note: Bold % in shaded areas denotes that ≥70% consensus was achieved; Agreement = agree+strongly agree; Disagreement = disagree+strongly disagree.

Figure 6.5.

Principles for supporting the successful integration of Parkour-style training via parent education opportunities.

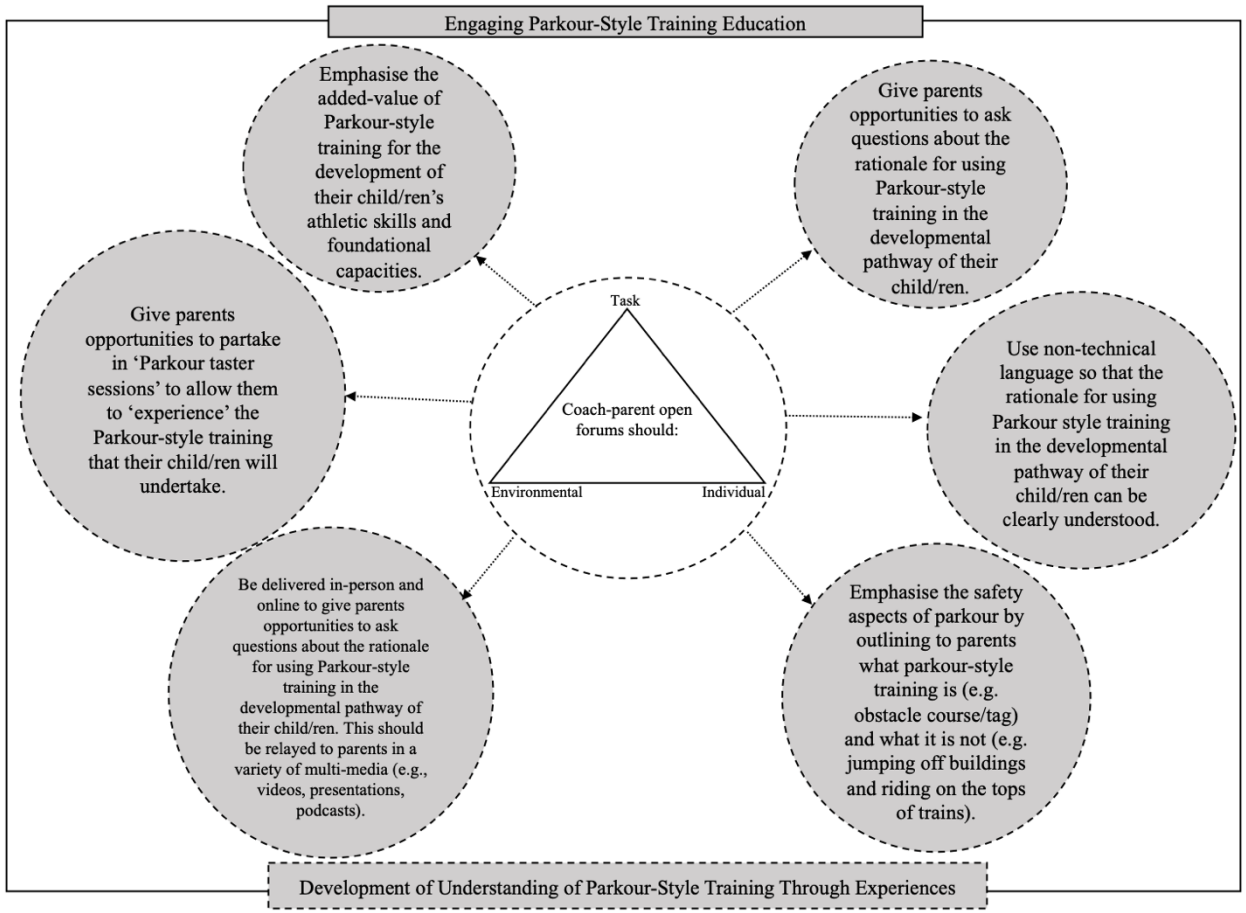
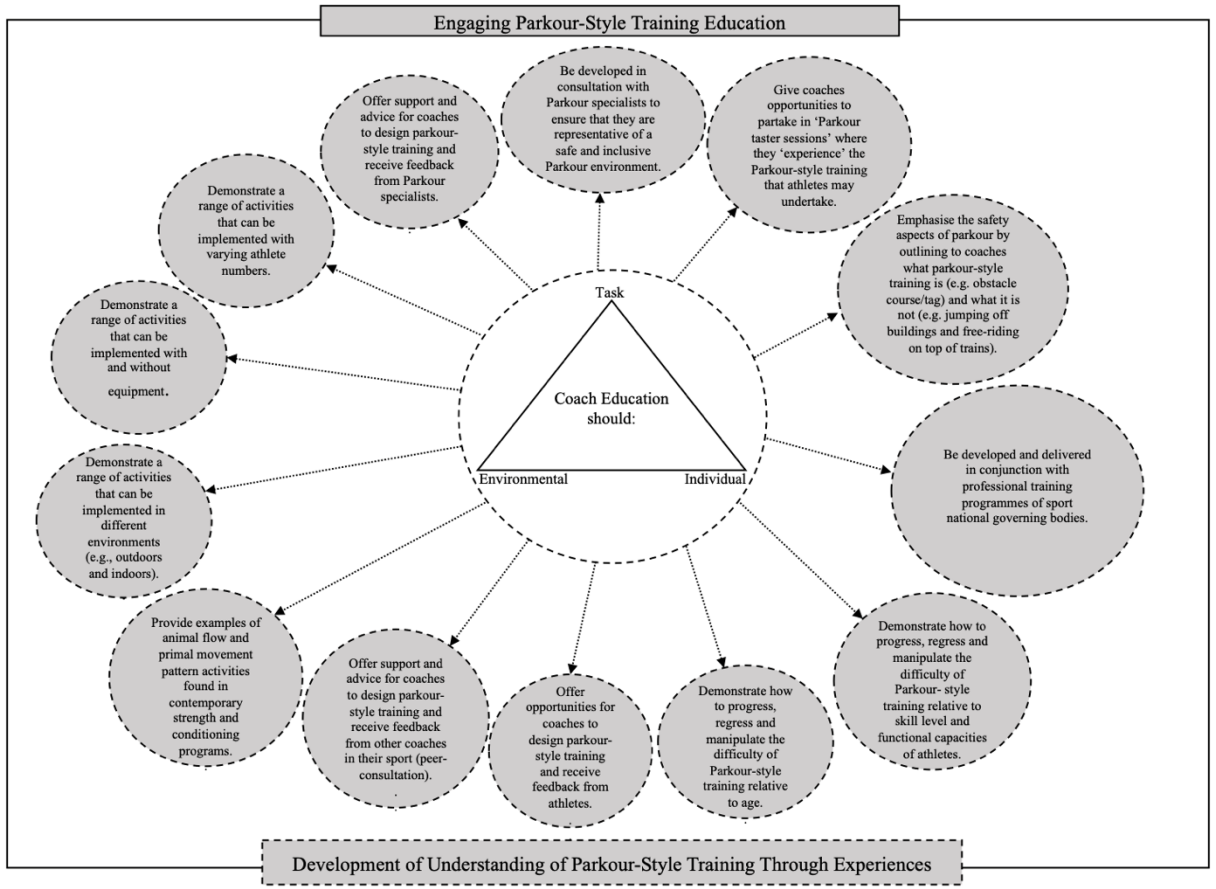


Figure 6.6.

Principles for supporting the successful integration of Parkour-style training via coach education opportunities.



6.5. Discussion

This study sampled expert opinion from coaches in team sports on factors relating to the feasibility of effectively integrating Parkour-style training into team sport practice routines. The study systematically gained consensus on factors relating to: 1) Applications of Parkour-style training in Team Sports, 2) Designing and Implementing Parkour-style training Environments, and 3), Overcoming Potential Barriers when Integrating Parkour-style training.

A key point of agreement amongst the coaches was that Parkour-style training could improve competitive performance in a team sport athletes' main sport through transfer of movement competences through more general play and physical activity experiences. Parkour-style training provides opportunities for athletes to explore available affordances (opportunities for action; Gibson, 1979) in their performance landscape and expand their effectivities (capacities and functional abilities) in achieving intended task goals, exploiting it as an effective donor sport (Strafford et al., 2018; Ribeiro et al., 2021). In Parkour-style training, these opportunities are afforded by an enriched platform for athlete development predicated on the integrated relationship between physical and psychological skill development outlined in the Athletic Skills Model (Wormhoudt et al., 2018; Savelsbergh & Wormhoudt, 2019). Practically, enrichment of an athlete's effectivities via Parkour-style training may allow them to negotiate the dynamic landscape of competitive performance in a target sport, in which affordances are continually evolving as a function of interacting task, environmental and organismic constraints (Button et al., 2020). As 'environmental designers' it is important for coaches to facilitate a diverse and wide range of affordances when integrating Parkour-style training environments into team sport practice routines. As the coaches agreed, Parkour-style training can take the form of obstacle courses with or without tag elements which would afford athletes opportunities to explore practice landscapes

representative of task, environmental and organismic constraints in the sport specific domain. This approach to enrichment training could lead to improvements in competitive performance due to transfer of movement competences between practice domains.

Through an ecological dynamics lens, team sport athletes have been conceptualised as 'wayfinders' who self-regulate their way through competitive performance environments (Otte et al., 2020). By placing athletes in an obstacle course environment which is goal-directed and allowing time and space for adaptive skill exploration, the athletes may learn to seek and develop individualised and creative actions (Otte et al., 2021). Moreover, the global constraints governing the tag aspect (i.e., the first person to tag their opponent wins) are comparable to offensive phases in team sports, such as soccer, where to regain possession of the ball, athletes have to couple their movements relative to the constant (re)positioning of teammates, opponents and the direction of the ball. The process of 'wayfinding' via obstacle course activities could challenge athletes to develop and refine decision-making, self-awareness, and engagement with various constraints of their environment, and discover how to detect the most relevant information and drive their intended actions in performance (Woods et al., 2020a; Woods et al., 2020b). As the coaches agreed, early integration of Parkour-style training activities may aid physical and psychological development of athletes leading to an increased capability to solve problems through their movements and actions as they negotiate complex performance environments (Wormdhoudt et al., 2018). Additionally, integrating these activities in adulthood (later in development), would afford the exploration of new movement activities and enrich experiences and sports for athletes who have previously experienced a traditionally highly structured talent development pathway (Rudd et al., 2020; Savelsbergh & Wormhoudt, 2021).

As findings from this study suggest, coaches should look to embrace the 'unpredictability of performance' in practice designs, by including opportunities for

exploring and exploiting movement variability as higher levels of variability typically yield enlarged movement repertoires and more functional solutions in response to changing constraints in performance (Seifert et al., 2013; Otte et al., 2019; Seifert et al., 2019). In team sports, given that tasks are highly variable (e.g., behaviour in dyadic systems relative to the position of teammates, opponents, direction of the ball and rules governing the game) it is important that athletes practice in environments that encourage exploration and adaptation, as such task constraint manipulations can help learners experience and explore movement variability and skill adaptation in training (Chow, 2013; Ranganathan & Newell, 2013). In this regard, it is important to transition away from 'playscapes' that are highly symmetrical and which lack variety in order to challenge athletes beyond entry level interactions (Rudd et al., 2021). As agreed, and recommended by coaches in the present study, arranging objects in a mixture of symmetrical and asymmetrical formats will enable coaches to manipulate constraints in Parkour-style training landscapes and afford athletes opportunities to continually adapt their action and solve movement problems (Jongeneel et al., 2015). The interchangeability of equipment properties in Parkour-style training affords the athlete a variety of potential interactions with their environment (see Chapter 3). Altering the orientation, height, and angle of objects in the environment as recommended by the coaches, will modify the dynamic affordance landscape (Croft & Bertram, 2017), which will in turn invite re-coupling of perception and action and problem-solving, facilitating movement exploration as well as creativity and enjoyment as athletes seek to find innovative movement solutions to task goals (Siefert et al., 2019). However, enjoyment may also decline if athletes repeatedly do not succeed and cannot successfully adapt. Therefore, as participants agreed here, coaches should continue to monitor closely and manipulate task difficulty according to athlete experience and functional skills to accommodate different levels of movement competency.

Feedback provided by coaches to athletes is another constraint that can influence skill learning (Robertson & Woods, 2021) and should also be considered when designing and integrating Parkour-style training environments. A key point of agreement among the coaches in the present study was that Parkour-style training should involve limited explicit feedback. Limiting coach directed (explicit) feedback is concurrent with the landscape and implicit nature of Parkour environments which offers an array of affordances (opportunities for action) for changing direction, jumping, and landing through a process of self-regulation (Rudd et al., 2020). Over time, athletes who are repeatedly exposed to Parkour environments have copious opportunities to explore, discover and exploit movement solutions to develop or enhance their functional movement skill capacities by navigating through the environment (see Chapter 4 and Chapter 5). Moreover, adopting this affordance-based perspective for Parkour-style training, in terms of session structure and strategies for variability, negates the traditional dualist 'structured versus unstructured' approach and affords specific 'practice/play' environments to be appraised in terms of the interaction possibilities for the individual (Rudd et al., 2021). A key feature of what any environment affords an athlete is how it shapes their intentionality (Woods et al., 2020a; Woods et al., 2020b). Therefore, as the coaches recommended, emphasising enjoyment, and allowing athletes to be active partners in the co-design of Parkour-style training environments may elicit the core social dimension of Parkour where interactions with peers and coaches enable athletes to regulate self-confidence and resilience through a shared network of affordances (opportunities for action) rooted in a desire to have fun whist interacting with others (O'Grady, 2012). According to Gee (2005), when initiated early in talent develop settings, engagement in co-designing learning activities will enrich learning designs by developing an athlete's general performance *'intelligence'*, as they are challenged to appraise critical features of their learning environment which support self-regulated cognitions,

perceptions, and autonomous actions in performance (Gee, 2005). Specifically, co-design will afford the athlete opportunities to develop *knowledge of* their learning environment so they can make informed choices about how to manipulate its design (Gee, 2005; Woods et al., 2020a). Hence, there was a consensus in the present study that coaches should look to integrate aspects of co-design when designing and implementing Parkour-style training into training sessions.

Regardless of advancements in theoretical and practical understanding of coaching methods, there will be potential barriers that have to be overcome (Stone et al., 2020). Often, local knowledge about the sport and the socio-cultural context in which the sport is carried out is required for the successful integration of new methods (Rothwell et al., 2020). This knowledge helps practitioners to identify and understand the socio-cultural constraints that may be shaping the club structure, parental expectations, coach pedagogy and session design (O'Sullivan et al., 2020). The influence of social-cultural constraints can be addressed by contemporary models of talent development in sport that expedite behavioural change along two timescales: (i) at the macro-scale of talent and expertise development (observed over annual periods), and (ii) at the micro-scale of practice (hourly, daily, weekly, and monthly) (Davids et al., 2017). As findings from the present study suggest, a macro-level example from the present study is the integration of Parkour-style training workshops for parents and coaches which challenge traditional thinking, resistant beliefs and attitudes and address the common misconception that Parkour-style training is a high injury risk activity. Whereas a micro level example is addressing financial barriers associated with specialist Parkour equipment by developing Parkour-style training environments using traditional gym-based equipment that are easily movable instead.

6.6. Conclusion

This study acquired expert opinion on factors relating to the feasibility of integrating Parkour-style training into team sport practice routines. It is the first study to systematically gain consensus on factors relating to: 1) Applications of Parkour-style training in Team Sports, 2) Designing and Implementing Parkour-style training Environments and 3) Overcoming Potential Barriers when Integrating Parkour-style training. Informed by the findings from the study, a set of design principles for integrating Parkour-style training into team sport practice routines has been established.

Chapter 7: Epilogue

This chapter concludes the thesis by presenting a general critical discussion of the observed findings in relation to contemporary research and the new and advanced knowledge arising from the thesis. The limitations of the programme of work are also discussed alongside future research directions.

7.1. Advancing Knowledge on Parkour as a Donor Sport

The Athletic Skills Model proposes that to negate some of the negative potentialities of early sport specialisation, practice in sports-specific programmes could be (re) designed to facilitate the experience of various physical activities. These experiences have been termed donor sports, which cultivate athletic skill development through exploratory practice and guided discovery (see Wormhoudt et al., 2018; Savelsbergh & Wormhoudt, 2019; Savelsbergh & Wormhoudt, 2021). It was outlined early in the thesis how Parkour may be a candidate donor sport for athlete development in team sports. It was theoretically argued that Parkour may share an overlap of athletic-enhancing affordances with team sports by challenging performers to learn how to negotiate obstacles with different properties such as angles, inclinations, sizes, surfaces, and textures as effectively and efficiently as possible. The studies in this programme of research (i.e., Chapters 2-6) have collectively explored Parkour as a donor sport for facilitating athlete development in team sports. Chapter 2 (based on the publication by Strafford et al. 2018) provided a novel theoretical and conceptual contribution outlining how the relationship between task, environmental and organismic constraints and affordances, intrinsic to Parkour activities and team sports, can be utilised. Chapter 2 also provided some initial conceptual and practical ideas for designing programmes for athlete development and expertise enhancement in sport using Parkour, which was supported with, and adapted, using findings from subsequent Chapters 3 to Chapter 6 of this thesis.

The experiential knowledge of experienced Parkour Traceurs sampled in Chapter 3 (based on data reported in Strafford et al., 2020) provided rich insights into how affordances offered by the Parkour environment could be designed into practice landscapes in team sports to facilitate their utilisation and transfer of skilful behaviours. Chapter 3 used a two-stage reflexive thematic analysis and identified two dimensions: (1) Skills Developed Through Parkour and (2) Recommendations for Designing Parkour

Training Environments. Parkour Traceurs outlined numerous physical (locomotor skills; endurance; strength; agility; balance), perceptual (information regulation of (re) organisation of movement patterns to achieve the whole body or limb control;- coordination; precision and rate control; response orientation), psychological (problem-solving; decision-making; resilience; stress relief; self-efficacy; risk management) and social (networking; initiative; social perceptiveness; modelling behaviours; receptiveness to feedback) capacities and skills that could be augmented through Parkour training. Identifying these skills provided support to the proposal outlined in the Athletic Skills Model (Wormdhoudt et al., 2018) that Parkour could be a suitable donor sport which provides a relevant affordance landscape to develop a range of athletic skills. In Chapter 3, Parkour Traceurs provided experiential knowledge explaining how indoor Parkour environments should promote creative and exploratory movement behaviours that enable physical conditioning in a holistic way that also enhances decision-making, self-regulation and action functionality. Parkour Traceurs suggested that these aims are often achieved by designing a *modular* practice landscape where they can manipulate the spacing, orientation, and angles of bars and wall set-ups to facilitate the development of different perceptual, cognitive and physical skills. These recommendations were then used to create an indoor-Parkour environment and select a series of skills to investigate in Chapter 4 of the thesis (based on the study reported by Strafford et al., 2021a), which examined the effect of functional movement skills on Parkour speed-run performance. Speed-runs were selected, providing an alternative means of assessing Parkour performance as the activity is a recognised form of Parkour competition that provides an objective and quantifiable measure of performance (time to completion) compared to other activities such as freestyle and skill, which require subjective coach rating scales to assess performance.

In Chapter 4, it was important to explore the composition of a battery of standardised athletic tests for functional movement skills which correlated to Parkour performance, as Parkour interventions, including speed-runs, could be implemented to improve functional movement skills in a variety of domains (indoors, outdoors, collectively as members of Parkour team or individually). Pearson's correlation analyses (*r)* in Chapter 4 revealed that agility T-test performance showed a positive correlation with Parkour speed-run performance, whereas standing long jump and countermovement jumping (with and without arm swing) were significantly negatively correlated with Parkour speed-run performance. In line with the intrinsically-linked building blocks in the Athletic Skills Model, the data in Chapter 4 suggested that functional movement skills (jumping, running; arms swinging) underpin dynamic performance in Parkour-speed-runs and condition of movement (agility), all of which encapsulate elements of basic motor properties (speed; strength). Chapter 4 findings also supported the notion that functional movement skills (effectivities) are not isolated movements, but skills that can be integrated to support functional interactions of athletes within a Parkour speed-run performance environment. Furthermore, data from Chapter 4 suggested Parkour Traceurs who are repeatedly exposed to Parkour speed-run environments develop specific functional movement skills and, as such, have the opportunity to explore and discover solutions to navigate speed-run environments more efficiently. In terms of informing applied practice, results suggested that the agility T-test, Standing Long Jump, and Counter Movement Jump with and without arm swing should form the base of testing batteries that evaluate the physical effects of Parkour speed-run interventions on functional movement skills. Whilst Chapter 4 provided empirical evidence on Parkour-speed-runs as a potential donor sport in team sports settings, and it was important to then explore the perceptions of team sport coaches and their receptiveness of Parkour-style training for athlete development as this had not been investigated and remained unclear.

Sampling the experiential knowledge of experienced talent development and strength and conditioning coaches in Chapter 5 (based on the study reported in Strafford et al., 2021b) identified that Parkour-style activities and games could be helpful for the enrichment of functional movement skills. Enhancing these functional movement skills could aid the development of a well-rounded and adaptive 'mover' in team sport athletes, supporting the notion in the Athletic Skills Model of Parkour as a donor sport. Three dimensions were identified via a two-stage reflective thematic analysis: (1) Coaches' General Perceptions of Parkour, (2) Potential Applications of Parkour, and (3), Feasibility of Integrating Parkour into athlete development programs. The perceptions of talent development and strength and conditioning coaches in Chapter 5 revealed that: (1) Parkour activities were viewed as supplementary activities to enrich sport-specific training routines, including use of obstacle courses and/or tag elements, (2) Parkour-style obstacle environments needed to be scalable to allow individual athletes and coaches to manipulate object orientation and tasks using soft play and traditional gym equipment, and (3), The implementation of continued professional development opportunities. Athlete-centred approaches to learning designs in sport, and coach-parent forums were recommended to support the integration of Parkour-style training. Chapter 5 provided some of the first documented insights into how Parkour-style training could be integrated into team sport practice to provide opportunities for athletes to learn to self-regulate and support the development of functional movement skills; however, to help guide coaching practice and future intervention research designs, it was important to seek consensus of expert opinion on a set of design principles and a framework for the integration of Parkour-style training in team sport settings.

With procedures informed by findings from preceding chapters, a three-round Delphi study was conducted in Chapter 6 to acquire expert opinion of talent development and strength and conditioning coaches on factors relating to the feasibility of integrating

Parkour-style training into team sport practice routines. It was the first study to systematically gain consensus on factors relating to: (1) Applications of Parkour-style training in Team Sports, (2) Designing and Implementing Parkour-style training Environments, and (3), Overcoming Potential Barriers when Integrating Parkour-style training. Informed by the findings from the study in Chapter 6, a set of design principles for integrating Parkour-style training into team sport practice routines has been established.

The contextual interpretation of results presented throughout this thesis outline the receptiveness of coaches and practitioners to Parkour-style training as a donor sport. The novel design principles outlined in Chapter 6 provide a theoretically and coach-informed method of integrating Parkour-style training into team sport practice routines founded from this mixed-methods programme of research. Designed to inform future practice, the applied implications below relate to three key areas: advancing practice, advancing theory, and directions for future work.

7.2. Advancing Practice

In national sport systems across the globe, sports are outcome orientated, with sport-specific results and engagement often resulting in greater fiscal contributions in commercial contracts by sponsors, investors and national governing bodies (e.g., this is how funding Olympic sports are largely allocated). Therefore, a series of poor results or lack of public engagement in a particular sport can result in the sport/team being largely 'siloed' and losing athletes to other sports, which can have significant repercussions for the short- and long-term success of the sports programme (Mohser et al., 2021). Consequently, sports systems that experience a series of poor results or lack of engagement may develop and implement additional sport-specific training programmes to compete in the off-season to maintain athlete engagement within a particular sport, increasing the potentiality of sport specialisation without ample opportunities for athletes

to engage with other sports or physical activities (Mohser et al., 2021). On the balance of evidence presented in this thesis, Parkour-style training as a donor sport offers a potential solution that allows athletes to engage in a different sport that shares characteristics (affordances for action) with their target sport. There are several practical implications for coaching practice arising from this thesis which are outlined in detail below.

The concurrency of findings outlined in the Chapters of this thesis is further evidence of the practicality and importance of experiential knowledge for developing and understanding new approaches in skill development. The recommendations for integrating Parkour-style training outlined in Chapter 6 provide consensus on a series of theoretically sound and practitioner informed recommendations for the successful integration of Parkour-style training as a donor sport (either as obstacle courses, with or without tag/ speed-run elements). It is also recommended that coaches utilise the procedures outlined in Chapter 4 to address the physical effects of Parkour-style training via the testing battery developed.

The use of experiential knowledge and explanation of the Parkour-style training in the thesis is a testament to the quote by Kurt Lewin outlined in Chapter 2: “There is nothing so practical as a good theory” (Gibson, 1967, p.135) and John Dewey’s distinction between mis-educative (experiences that stop future experiences) or non-educative experiences (where the person has not engaged in reflection or obtained knowledge that is not lasting) outlined in Chapter 2 (section 2.8, Dewey, 1938). Specifically, the collective thesis findings support the (re) conceptualisation of the role of the coach as an ‘environmental designer’ (Wormhoudt et al., 2018; Renhsaw et al., 2019; Savelsbergh & Wormhoudt, 2019; Savelsbergh & Wormhoudt, 2021). In this role the coach is responsible for harnessing the nonlinear, continuous and inherently intertwined interactions emerging between the performer, task and their environment (see Chapter 3, 5, 6; Woods et al., 2020a; Woods et al., 2020b). As findings from Chapter 3,

Chapter 5 and Chapter 6 suggest, this (re) conceptualisation of the role of the coach is learner-centred, with a central emphasis on the athlete-environmental interactions in the learning process via representative co-design (the coach taking overall responsibility for learning design, but in many cases athletes working with them to design practice). Moreover, the design principles and recommendations for integrating Parkour outlined in Chapter 6 provide empirical evidence of the usefulness of a departmental methodology in creating and implementing new knowledge of athlete development in team sports- in this case, Parkour-style training as a donor sport for athlete development. Developing this clear practitioner understanding will ensure successful longer-term integration of Parkour-style training into athlete development programmes, rather than treating it as a temporary "fad" that may not be sustainable (Rothwell et al., 2020). This sub-section concludes with a case example where Parkour-style training has been implemented with the design of the learning environment informed by the thesis findings and recommendations outlined in Chapter 6.

7.2.1. Case example where the thesis findings have been used to integrate Parkour-style training in a basketball setting

Case Example: Integrating Parkour-Style Training in Basketball

Introduction: The following case example is founded on an ongoing pilot programme of Parkour-style training that is being conducted by a strength and conditioning coach working in a youth basketball setting in Southern England. At the time of first integrating Parkour-style training, the participants' training routine typically included a mixture of traditional strength and conditioning and sport-specific provision, alongside some multi-sport activities. The strength and conditioning coach leading the programme of training elected to include Parkour-style training as a donor sport as a way of targeting skills and affordances shared between basketball and Parkour, without taking

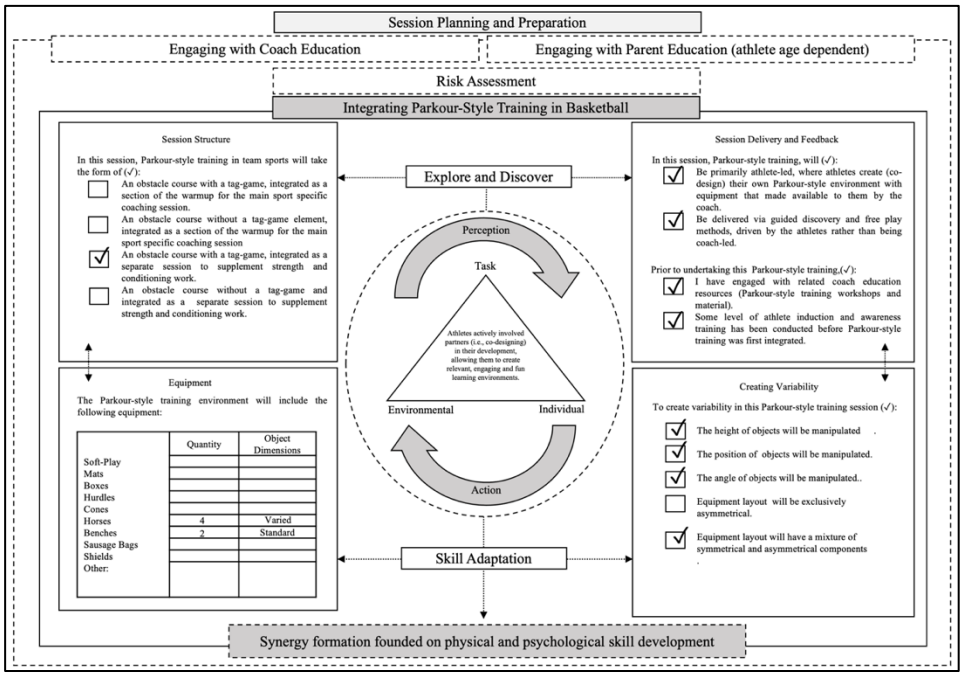
time away from specialised practice. These donor sport training sessions, which take place weekly for an hour, integrate Parkour-style training inclusive of an obstacle course and tag-game elements to supplement strength and conditioning work.

The strength and conditioning coach has collaborated with the thesis author on Parkour-related projects in the past and made initial contact with the thesis author for a consultation about the design and implementation of the Parkour-style training programme. During the consultation process, which was undertaken over several weeks, the strength and conditioning completed the resource outlined in Chapter 6 (Strafford et al., under review) to identify the session structure, session delivery and feedback, equipment and strategies to create variability (a completed resource is displayed in Figure 7.1.). It is worth noting that the strength and conditioning coach had undertaken a comprehensive risk assessment and engaged with relevant coach education opportunities before the programme of Parkour-style training commenced.

The strength and conditioning coach set the aim, session structure, session delivery and feedback, equipment, and strategies used to creative movement variability using publications forming the chapters in this thesis (Chapters 2-6).

Figure 7.1.

Completed resource on design principles.



Context: In consultation, the strength and conditioning coach informed the thesis author that when developing adolescent basketball players, the number of basketball-specific practice hours typically increases at a proportional rate to the time spent in other physical activities (Jayanthi et al., 2013). Due to this approach, the thesis author and strength and conditioning coach discussed how the inclusion of Parkour-style training in this specific basketball setting may depend on the constraints of time in the athletes' training routine. The strength and conditioning coach informed the thesis author that due to the participant group being youth athletes, the Parkour-style training should form a section of a more advanced strength training strategy alongside an evaluation of the specific-sporting action being targeted (Williams et al., 2021).

In the consultations, the strength and conditioning coach outlined how time constraints had made previous attempts to integrate alternatives to traditional strength and conditioning work unsuccessful. To satisfy time constraints the thesis author and strength and conditioning coach discussed how Parkour-style activities could be embedded within

the strength and conditioning program itself (as outlined in Chapter 5, Strafford et al., 2021b; Chapter 6, Strafford et al., revisions invited). The strength and conditioning programme for youth basketballers now integrates this Parkour-style training in the form of a complex training regimen, with parkour actions performed concurrently within the same training session as conventional strength and conditioning training exercises focused on speed, agility, and jumping. The strength and conditioning coach anticipates that the varied jumping patterns in this Parkour-style training presents players with more varied landing challenges than those in conventional complex training, which may better prepare players for scenarios encountered in basketball (Williams et al., 2021).

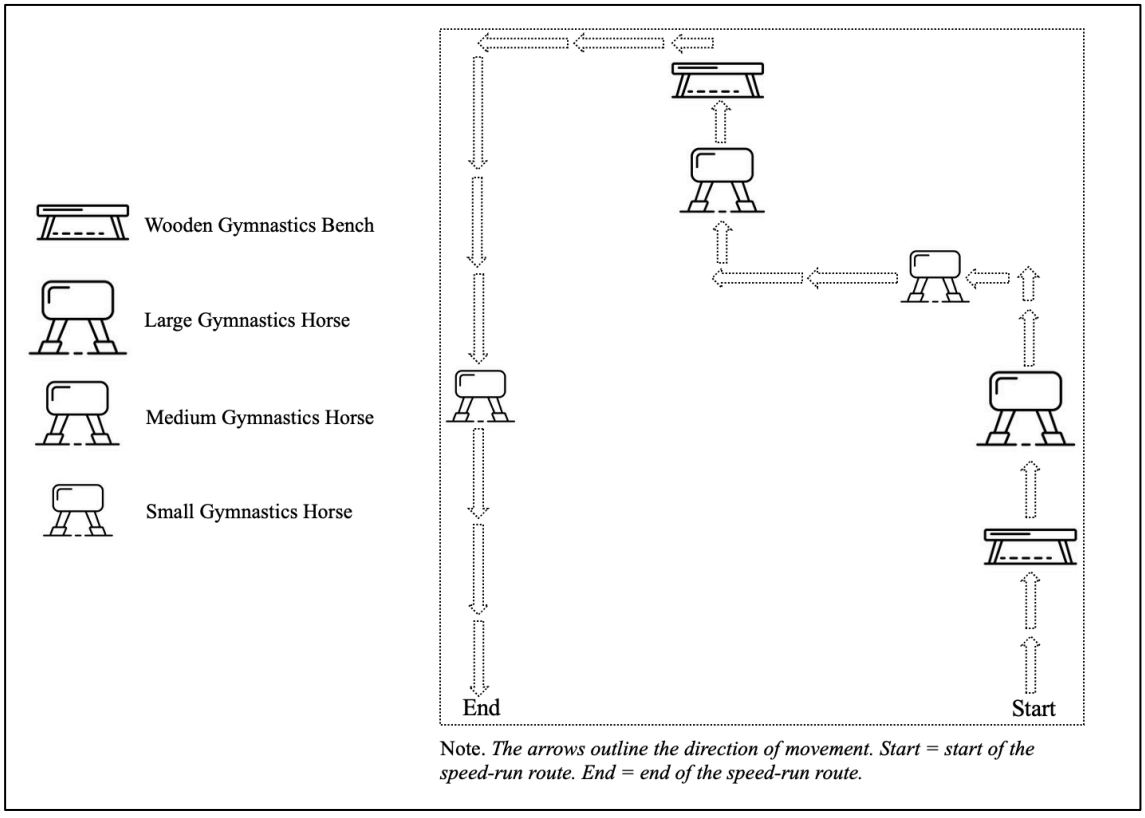
While currently there is limited information on loading parameters for parkour-based actions, the thesis author and strength and conditioning coach agreed that it would be prudent to follow the guidelines for exercises that are typical of plyometric and complex training regimens. However, future research is required to validate these suppositions. The strength and conditioning coach informed the thesis author that they are using the testing battery and procedures outlined by Strafford et al. (2021a) to measure the development of functional movement skill during the first and last week of the Parkour-style training block.

Session Structure: According to the strength and conditioning coach, the Parkour-style training supplements strength and conditioning and includes an obstacle course with tag-game elements in the sessions, typically lasting between 15-30 minutes. The strength and conditioning coach allows the participants relatively free choice in choosing their opponent and gives participants the time to explore the route before the tag-game element begins. The strength and conditioning coach is keen to stress that they do give some initial feedback on the route and outline some health and safety expectations as they are legally obliged to as per the risk assessment conducted at the facility where the sessions take place.

Equipment: The strength and conditioning coach uses a mixture of traditional gym equipment to develop the Parkour-style training environment, specifically, two gymnastic benches and four gymnastic horses (Figure 7.2. and Figure 7.3.). The strength and conditioning coach is keen to stress that, at present, this is the only equipment available at the venue. Prescriptive information is not used a great deal, but the strength and conditioning coach does demonstrate the Parkour speed-run route to participants before the session begins. The strength and conditioning coach does not use floor markings to mark equipment spacing between sessions, the general route remains similar, but the equipment is not necessarily organised in the same space.

Figure 7.2.

Parkour speed-route used in the basketball training setting.

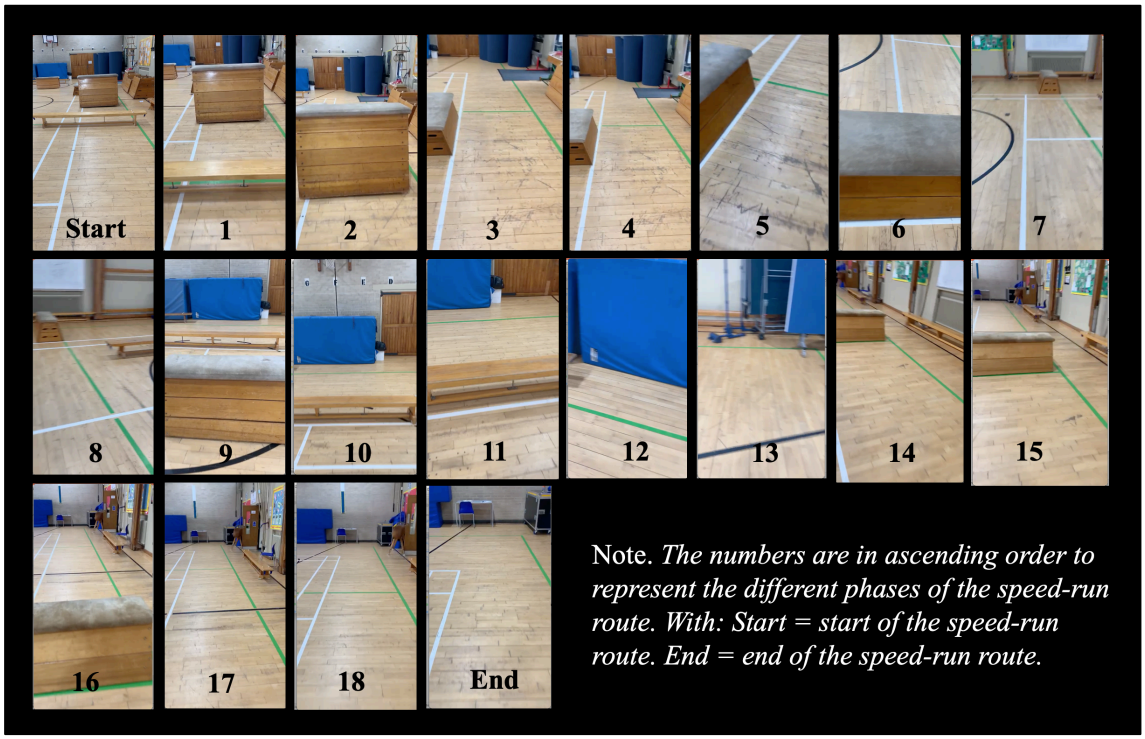


Note. *The arrows outline the direction of movement. Start = start of the speed-run route. End = end of the speed-run route.*

Note. This concept drawing is not to scale.

Figure 7.3.

Images of the Parkour speed-route used in the basketball setting..



Session Delivery and Feedback: The Parkour-style training is primarily athlete-led. Athletes create (co-design) their Parkour-style environment with equipment made available to them by the strength and conditioning coach. The equipment used in this Parkour-speed route is not fixed, so the height, position, and angle change slightly throughout the session as the athletes interact with the environment. The Parkour-style training is delivered via guided discovery and free play methods, driven by the athletes rather than coach-led. The strength and conditioning coach is keen to stress that the feedback on movement behaviour or performance is not given to athletes. The strength and conditioning coach also restricts participants' access to the data from the testing battery, so that only the strength and conditioning coach can see the data in real time.

Creating Variability: The strength and conditioning coach ensures that the Parkour-style training environment is modular, where properties are manipulated to create

variability in practice task constraints (Figure 7.2. and Figure 7.3.). Specifically, the strength and conditioning coach manipulates/scales some objects' height, position, and angle to allow for increases or decreases in task difficulty. In addition, the equipment layout employs a mixture of symmetrical and asymmetrical components.

Summary: This case example evidences how the key findings arising from the thesis are currently being used by a strength and conditioning coach to design and implement Parkour-style training into pilot training programme situated in a youth basketball setting. Future interventions in similar settings should utilise the principles for integrating Parkour-style training into team sport practice routines that have been outlined in Chapter 6 and seek to assess whether there are short term (< 6 weeks) benefits of Parkour-style training interventions on the physical development assessed using the testing battery outlined in Chapter 4.

7.3. Advancing Theory

In addition to creating new knowledge to advance coaching practice in team sport settings, the collective findings of the thesis have also provided valuable empirical and experiential data for advancing theoretical understanding about constraints, affordances, affordance landscapes, donor sports, and the Athletic Skills Model. Chapter 2 discussed that, whilst the donor sport concept had merit, due to the novelty of the Athletic Skills Model and limited research on donor sports, a programme of research was required to appraise the model. In this thesis, Parkour was used as a vehicle to investigate a donor sport for athlete development in team sports. From the experiential (see Chapter 3 and Chapter 5) and experimental data (see Chapter 4 and Chapter 6) outlined, it is evident that the notion of Parkour-style training being a donor sport for athlete development in a team sport has merit. This idea is supported with experimental data and experiential knowledge from expert coaches working in the field of integration (specifically experienced talent development and strength and conditioning coaches). Such an investigation has led to

several advances in theoretical understanding of the donor sport concept (and Parkour as a donor sport) and the Athletic Skills Model. In this section, some theoretical advances are presented regarding recent literature, findings from the thesis and some recommended revisions to the original Athletics Skills Model are also outlined.

7.3.1. Revising the Athletic Skills Model

On the balance of evidence, the key findings of the thesis suggest that the Athletic Skills Model may need some revisions to realise the nuanced nature of Parkour as a donor sport and appreciate the value of a confluence of constraints. In particular, deeper integration of links between talent development domains are required to root the approach in holistic athlete development, rather than focusing solely on the physical or psychological development of the athlete as a complex system in isolation of the environment (as evident in Chapter 3, Chapter 5 and Chapter 6).

7.3.1.1. Why so basic? Skills are a function of the performer-environment relationship – not basic or foundational actions developed in isolation.

As outlined throughout the thesis, the Athletic Skills Model is a concentric, skill-centred approach to athlete development, comprising three intrinsically linked building blocks: Basic (Functional) Movement Skills, Coordinative Abilities and Conditions of Movement, all of which encapsulate elements of basic motor properties. The Athletic Skills Model proposes that developing an athlete's basic movement skills could support further gains in their coordinative abilities and conditions of movement (Wormhoudt et al., 2018). This idea of developing basic movement skills to provide foundations for more advanced skills and specialised forms of movement is not unique to the Athletic Skills Model (see for example, Hulteen et al., 2018). Indeed, a general point of concern in the development of youth sports is the lack of emphasis on 'generalised fundamental movement skills', in favour of early sport specialisation (Bridge & Toms, 2013; DiStefano et al., 2017; Liefeith et al., 2018). The debate around the classification of motor

skill is contested in the fields of motor learning and development (e.g., Barnett et al., 2016; Hulteen et al., 2018; Newell, 2020). The Athletic Skills Model, utilises the term 'basic movement skill' to classify motor skills. However, given the diversely interpreted research agendas in the area of skill classification, there is also an array of literature that supports the replacement of the term 'basic movement skills' in the Athletic Skills Model with the term 'foundational motor skill' (Hulteen et al., 2018), or the term 'fundamental motor skill' (Morgan et al., 2013; Barnett et al., 2016). Nevertheless, beyond these theoretical differences in classifying motor skills the use of such terms (e.g., basic, foundational, fundamental) simply raises a conceptual question as to the one originally proposed by Newell (2020): 'basic movement skill for what? foundational motor skill for what? or fundamental motor skill for what?', beyond the authors' diversely interpreted basic and applied research agendas. According to Newell (2020), although these approaches to classification of motor skills may be distinct and can be useful in the learning and performance of particular physical activity and sport contexts, the classifications of motor skills which include references to task constraints are arguably not basic, essential, or important in the movement domain.

A central point of discussion arising in this thesis is that in Parkour-style training, skills are acquired via interactions with the environment and are not developed in isolation of the environment (see Chapter 2-6). As outlined in the literature and throughout the thesis, in ecological dynamics the functionality of movement skill implies the ability to find functional solutions in a *particular performance environment* (Rudd et al., 2020, Woods et al., 2020). This is why the term 'basic movement skills' in the Athletic Skills Model from this perspective should be replaced with 'functional movement skills', not alternatives such as 'foundational motor skills' or 'fundamental motor skills; as skills performed are a function of the specific athlete-environment relationship (O'Sullivan et al., 2020, Rudd et al., 2020). Here, constraints need to be satisfied by the individual

learner and do not *cause* behaviour, but perturb it by concurrently reducing the number of configurations available to a complex, dynamical movement system at any instance (Williams et al., 1999). Moreover, the traditional view towards 'basic movement skills' outlined in the Athletic Skills Model simply represents a conventional, but constricted movement approach to the action problem in that it eschews the nature of the cause for the goals of the task, which is reductive given that emergence of new functional movement skills allows further information (and affordances) to be realised and new functional movements skills to emerge in the athlete's repertoire of behaviours (Chapter 4, Rudd et al., 2020). With this reframing of terminology, it is important to note that the movement domain alone tends to say little about the role or needs and functions of the individual in motor learning and development (Newell, 2020). It is, therefore, relevant for strategies to examine the development of functional movement skills that are not just passive movements to fulfil the criteria for action, but require an intention to realise a specific goal. For example, the framed intention for athletes was to complete a Parkour speed- run course in the quickest time possible in Chapter 4 of this thesis.

From a practical perspective, it is important to acknowledge that traditional approaches to measuring movement skills are somewhat reductionist, given that the terminology and conceptualisation of skill gives little (if any) consideration for the role of the environment on skill development – and are implicitly aligned to a schema or movement model (Rudd et al., 2020; Rudd et al., 2021). Whilst some attempts are made in the original Athletic Skills Model to move away from this approach, additional research, as outlined in this thesis was required, as evidenced via the development of testing battery in Chapter 4 that is to be contextualised relative to Parkour speed-run performance. Furthermore, observing functional movement skills during practice in a donor sport and performance setting is important as coaches can begin to understand the holistic development of the athlete, both the meaning and value of an environment and

how deep their knowledge of the environment currently is. Notwithstanding the suggested revisions to the Athletic Skills Model that have been outlined in this chapter, it is important to acknowledge that much debate remains regarding the classification of movement skills (Barnett et al., 2016; Hulteen et al., 2018) and will do for some time (Newell, 2020). A recent example is youth-level basketball coaches who had differing notions of functional movement skills and variable ideas as to who is responsible for their development (Williams et al., 2021). Therefore, in certain team sports (in this case, basketball), functional movement skills may not be developed with adequate diversity to underpin movement capabilities for sports-specific skill development (Young, 2006; Young et al., 2015). Indeed, regardless of the athlete's target sport, exposure to parkour-style activities, such as speed-runs, may be relevant during pre-adolescence, which is regarded as a period of sensitivity for developing fundamental (functional) skills due to high levels of neural plasticity (Myer et al., 2015; Ng & Button, 2019).

7.3.1.2. 'Building Blocks' can crumble without good foundations. 'Pillars' provide a functional way for upholding athletes through development.

The conceptual idea that certain motor skills provide the 'building blocks' for the learning and development of new motor skills in different contexts is not unique to the Athletic Skills Model. Indeed, the term 'building blocks' arises from the common framing of 'fundamental motor skills' outlined in the majority of motor learning and motor development literature (see Newell, 2020 for review). However, this body of work remains poorly rationalised, relative to the confluence of task, environmental and organismic constraints which reside beyond isolated observations of 'fundamental' motor skills. Structurally, it is proposed here that the term 'building blocks' may be revised in the Athletic Skills Model as this terminology does not fully appreciate the *functionality* of movement skill (see Rudd et al., 2021). In addition to revising the Athletic Skills Model to include a more 'functional' connotation of 'movement skills', the structural term

'pillars' should be used in replacement of the term 'building blocks'. The term 'pillars' provides a functional and practical way for supporting athletes through their development by focusing on enrichment of the athlete-environment relationship, which is a central concept to ecological dynamics. Indeed Seifert et al. (2019) used a pillared approach to contextualise skill transfer from an ecological dynamics perspective. Furthermore, supporting athlete development via 'pillars' is also conceptually relevant to ecological dynamics given that, structurally, the term 'building blocks' insinuates that development is always a linear, step-wise process: one skill develops from the other, which is not the case (see Newell, 2020; Rudd et al., 2021). Indeed, the collective findings of the thesis support the notion that athlete development is non-linear as outlined in Chapter 3-6. In those chapters, recommendations are outlined for the usefulness of Parkour-style training as a donor sport and designing principles for integrating Parkour-style training span across ages and skill level regardless of sport specialisation or diversification. In this sense, it is also recommended that the (re) conceptualisation of training in sports domains inclusive of donor sports should be viewed as 'enriched' and 'holistic' rather than focusing on either an athlete's physical or psychological development in isolation (Rudd et al., 2020). This is pertinent, given that the Athletic Skill Model suggests that the coordinative abilities, conditions of movement and basic (functional) movements skills should not be considered to function in isolation of one another. However, the psychological effects of Parkour-style training as a donor sport do require some initial investigation.

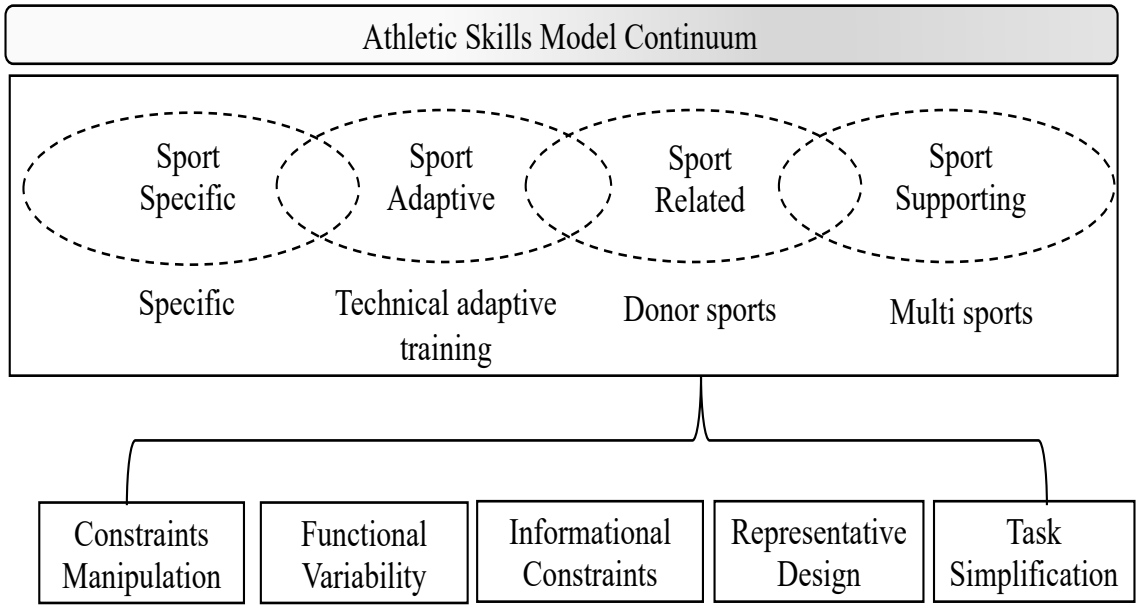
7.3.1.3. Realising the Intertwinement of Nonlinear Pedagogy and the Athletic Skills Model

Throughout the thesis, it has been outlined how both Nonlinear Pedagogy and the Athletic Skills Model are similar in emphasising the importance of enrichment experience from an early age and throughout the lifespan to facilitate a greater generality and later

specificity of skill adaptation needed to engage in and maintain involvement in high-performance sports through recreational activities (Chapters 2-6, Rudd et al., 2020). This thesis was constructed to discuss Nonlinear Pedagogy and the Athletic Skills Model in unison, with the integrated relationship between these models alluded to throughout the thesis. The models are still discussed in the literature as distinct entities underlined by ecological dynamics theory (for instance, in Rudd et al., 2020). However, findings from this thesis demonstrate how these models are not distinct but interrelated or intertwined in structure and function, which reflects the inherent complexity involved in the learning process and to realise the potential of donor sports. It is therefore recommended that the Athletic Skills Model integrates the five principles of Nonlinear Pedagogy (constraints manipulation, functional variability, informational constraints, representative design and task simplification) (Rudd et al., 2020) into the Athletic Skills Model continuum (Figure 2.4). This recommendation is made in addition to realising the advancements in the field of affordance research outlined in this thesis (see section 2.3.1 and 2.3.2.) to support the overlap of athletic skills between practice domains (Figure 7.4).

Figure 7.4.

A Revised Athletic Skills Model.



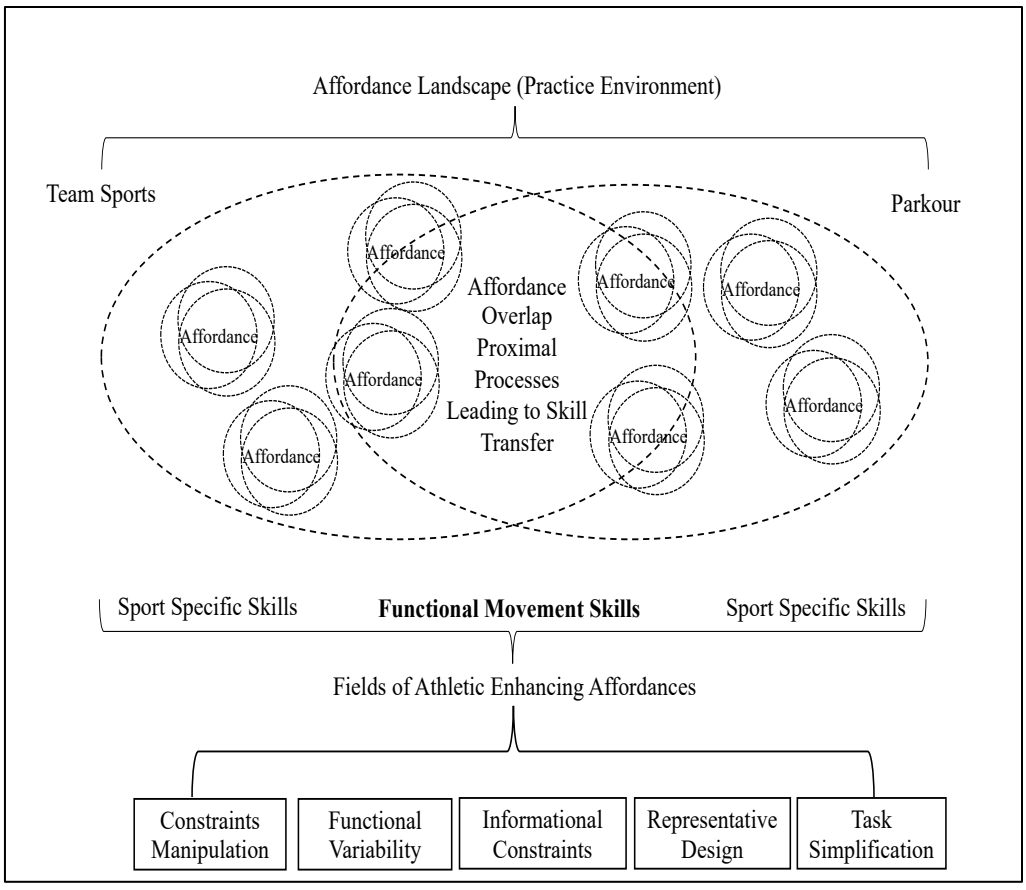
It is anticipated that constructive alignment of components of the Athletic Skills Model (Rudd et al., 2020) and Nonlinear Pedagogy in an ecological dynamics rationale for athlete development in sport would provide additional support for the (re) conceptualisation of the role of coaches as 'environmental designers', responsible for facilitating individualised and inclusive learning environments for developing athletes. The Athletic Skills Model continuum should also be viewed as a way of integrating approaches to athlete development via an *athlete-centred approach* on a micro and macro level– the theory outlines this in some way but still seems process-driven, as the continuum is fixed in places. The integration of these principles will afford athlete development along with two timescales: (i) at the macro-scale where the revised model is used to structure longer-term talent development programmes, and (ii) at the micro-scale of practice (hourly, daily, weekly and monthly) where athletes are co-designers of their continuous and ongoing learning (Davids et al., 2017). It is important to note that the range of the transition throughout the landscape may also differ depending on the age and skill level of the performer (as outlined in Chapter 3-6).

In addition, it is also recommended that fixed rings in the Athletic Skills Model continuum graphic should be 'permeable' as additional factors can be attributed to each concept or merged, dependent on the domains of the task (i.e., as donor sports experiences may integrate features of both multi-sports and specialised practice) (Figure 7.4). Metaphorically, the practice landscape can be conceptualised as an affordance landscape, with many overlapping affordances fields that can be potentially 'shared'/ 'donated' between sport domains (Figure 7.5.). Here, it is important to acknowledge how traditional team sports practices will still sometimes emphasise highly structured drill-based practice that may restrict and reinforce couplings to very narrow affordance fields within an affordance landscape (Button et al., 2020). However, this is still reasonable in certain circumstances, and the revisions to the Athletic Skills Model proposed in this chapter is

not an attempt to 'stop' sport specialisation from occurring (certainly, there are several positive potentialities to sport specialisation, as outlined Chapter 1 and Mosher et al., 2021). Instead, it is a matter of timing of specialised training, to help guide *the period* in which specialisation may occur and provide opportunities for engagement in other activities that are similar to the target sport when athletes do specialise. Parkour-style training, integrated into team sports using recommendations outlined in Chapter 6, will provide highly variable competitive sports contexts and are not inclusive of predicable performance sequences. Providing this alternative task design, via Parkour-style training as a donor sport, will allow athletes to couple their actions to available affordances flexibly (e.g., integrating an opponent into a Parkour speed-run between practice experiences).

Figure 7.5.

Revised Overlap of performance-enhancing affordance fields between team sports and Parkour as a donor sport (Adapted from Strafford et al., 2018, Chapter 2)



In line with findings from the thesis and suggested revisions to the Athletic Skills Model, the original figure from Strafford et al. (2018) (outlined in Chapter 2), which outlined the theoretical and conceptual ideas of Parkour as a donor sport, has been adapted in this chapter to capture the five principles of Nonlinear Pedagogy and the overlap of 'functional movement skills' as suggested earlier in Chapter 7 (Figure 7.5). In practical terms, Figure 7.5 depicts athletes searching the affordance landscape shared between Parkour and team sports to explore the functional movement solutions through continuous and refined interactions with key features, objects, surfaces and other people in the performance environment (as recommended in Chapter 6). When integrating Parkour as a donor sport into team sport practice, coaches should consider how affordances attract, engage, invite, and solicit athletes and that individuals can accept or reject these invitations. Hence, affordances in a donor sport that overlap with those of another competitive sport may be more soliciting for a team games player (Withagen et al., 2017). Coaches could therefore select donor sports based on the conceptualisation that affordances in the landscape may be more soliciting of specific behaviours of an individual athlete. In the context of this programme of research, practical recommendations for integrating Parkour-style training into team sport practice as outlined in Chapter 6, provide a practical measure for designing dynamical interactions with a selection of different but highly relevant possibilities for action can assist athletes in selecting and using affordances to support their actions in sport. The size and nature of an affordance field in a practice task depend on the learner's intrinsic dynamics and needs, which may have multiple dimensions such as psychological (i.e., need for more risk taking), physical (i.e., need for more dynamic strength) or emotional (i.e., need for better emotional control under pressure). Therefore, to ensure the affordance fields are not too narrow and do not restrict exploratory search activities, coaches must holistically appraise

the athlete's needs, encompassing physical, psychological and social development (see Chapters 4-6).

7.4. Future Work

This thesis contributes to new knowledge and advanced practice (see Chapter 2-7), focusing on the application of Parkour as a donor sport and providing a foundation stone for the successful integration of Parkour-style training as a donor sport. This was achieved by gaining expert consensus on design principles to support the integration of Parkour-style training in team sport settings (Chapter 6, informed by findings from Chapters 2, Chapter3, Chapter 4 and Chapter 5). Following the studies outlined in this thesis, there are areas for future work to examine Parkour-style training as a donor sport.

Future research should address the effectiveness of translating Parkour into team sports settings as a donor sport. Such intervention studies should utilise the principles for integrating Parkour-style training into team sport practice routines that have been outlined in Chapter 6 and seek to assess whether there is short term (< 6 weeks) benefits of Parkour-style training interventions on the physical development assessed using the testing battery arising from Chapter 4, and psycho-social skills in team sport athletes and also additional longitudinal studies to the same effect. Future work should also seek to develop coach and parent education materials relating to Parkour-style training and examine the efficacy of education programmes in team sports (see Chapter 6, with recommendations for design and delivery outlined in Figures 6.5 and 6.6). With foundations rooted in findings from this thesis, these future studies could provide both theoretical and applied insights on athlete learning and development as advocated in the Athletic Skills Model, concerning the donor sport concept. Future research should also investigate Parkour performance events that require innovation/creativity in movement (e.g., freestyle or skill event), rather than focusing on the Parkour speed-run event only. From an applied perspective in particular, it is relevant to examine the effects on athlete

creative adaptive movements based on coach observations and analyses. This thesis is already contributing to the expansion of the field of study, with the thesis author having worked recently with collaborators on a paper contextualising the ideas outlined in the thesis to settings in basketball (see Williams et al., 2021).

7.5. Thesis Summary

In conclusion, this thesis has explored Parkour as a donor sport for team sports. It is evident from the studies included in the thesis that coaches are receptive to the notion of Parkour as a donor sport. Experimental data from Chapter 4 outlined skills that inform Parkour-speed-run performance, leading to the development of a testing battery to examine the short- and long-term effects of Parkour as a donor sport in future studies, and the consensus on design principles outlined in Chapter 6 provides a theoretically and coach informed method of integrating Parkour-style training into team sport practice routine.

It is recommended that a speed-run element is integrated when examining the effect of Parkour-style training on athlete development in team sport players in applied environments and future research, due to the objective performance element regarding time-to-completion in comparison to other Parkour events (skill and free-style) that require the use of subjective coach rating scales (that require a higher level of experience coaching or participating in Parkour). Informed by findings from previous chapters, the Delphi study sampling expert opinion in Chapter 6 gained consensus on a framework for integrating Parkour-style training into team sport settings, alongside theoretically and practically informed design principles to support the design of Parkour-style training environments. Recommendations were made in Chapter 7 to revise the Athletic Skills Model to contextualise the donor sport concept further based on findings from the thesis. The thesis has gained a detailed understanding of Parkour-speed-runs in terms of the dynamics and structure of the activity. The new knowledge outlined in this thesis provides

a basis to examine the effects of Parkour-style training (for instance, speed-runs using obstacle courses or tag game elements, see Chapter 6) in future work, with avenues for future work outlined.

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Appendices

Appendix 3.1.

Chapter 3 (Study 1) Ethical Approval (Converis ID: ER9294740).

Designing enriched parkour training environments to target the development of physical and psychological skill in team sports: insights from parkour athletes.

Ethics Review ID: ER9294740
Workflow Status: Application Approved
Type of Ethics Review Template: Very low risk human participants studies

Appendix 3.2.

Chapter 3 (Study 1) Interview guide.

Interview Guide: *Designing enriched parkour training environments to target the development of physical and psychological skill in teams ports: insights from parkour athletes.*

Interview Introduction

State the following, for the purposes of the recording:

Warm up: Specific to the interviewee, change for each participant (Sparks & Smith, 2014).

Length and structure: This interview will between 45 and 60 minutes.

Primary Goal: This study aims to explore your general background of your current role and journey, philosophy for athlete preparation and development and perceptions on parkour as potential tool for athletic preparation/development during an interview which will be audio recorded.

Verbal and Written Consent

Having read the participant information sheet, interview questions study and consent form, would you like to participate in this interview? If so could you please complete the consent form, or (if via skype/phone) please email me a copy.

Tick where appropriate:

Verbal Consent was obtained from the study participant ……

Verbal Consent was **NOT** obtained from the study participant …....

Written Consent was obtained from the study participant ……

Written Consent was **NOT** obtained from the study participant ……

*Where an interview in person is not possible, an email of written consent will be acquired from the participants, as per the directives of the chair of the sport ethics committee, dated October 2018.

Participant Characteristics

The following questions will be about your characteristics

1. What is your age in years? Answer:…….
2. How many years have you been working in the field? Answer……

Interview Question	Further probe/prompt
Parkour practice/sporting experiences: Warm up: Specific to the interviewee, change for each participant How long have you been taking part in Parkour activities (years)?	How did you discover the sport? At what age?
Can you explain what your first experience training parkour was like?	How did you feel?
Can you explain to be what your more recent parkour session was like?	How did you feel compared to the first experience?
Psychological, Physical and Social Benefits of Parkour (enrichment): Why do like doing parkour?	Elaborate on psychological wellbeing, physical wellbeing, social wellbeing?
Do you think there are benefits of taking part in Parkour ?	
Designing Parkour environments: Can you describe to me what your typical parkour training environment looks like?	What sort of tasks are involved? (e.g., tick tac) What is the goal of their training?
What are the most important design features/aspects of parkour training environments?	Elaborate on *why* they think this.
What are looking for in parkour environment outdoors where you might train? , what would it look like and consist of?	Why do you select these places to train? How does this differ to an indoors environment?
If you were to design a parkour environment indoors, what would it look like and consist of?	Elaborate about design features, object orientation, equipment used and why the equipment is useful. What would athletes gain from this environment?

	Which is preferable, outdoor/indoor?
Thinking about the answers outlined in this interview. Could taking part in parkour impact performance in other sports?	Elaborate using the answers about psychological wellbeing, physical wellbeing, social wellbeing and learning design. Do you take part in another sports? Try and get them to link to a personal experience
Is there anything you would like to add regarding your experiences taking part in of Parkour?	Could elaborate if they have said something interesting in the previous questions.

Appendix 3.3.

Chapter 3 (Study 1) Example transcript.

Date: Tuesday 13th November 2018
Time: 10:00am
Location: HoC
Interview type: In person.

0-1.20 minutes: Participant was introduced to the interview and made aware of their right to withdraw. Written consent was obtained before the interview commenced and verbal consent was obtained at the 0.43 time stamp.

Section 1

So this first section is going to sample your parkour practice and other sport experiences you may have. How many years have you been taking part in parkour?

10 years

How did you discover parkour?

I think a friend of mine when I was around in year 7 he started doing cartwheels and front hand springs around in the garden and he had seen some videos online and I think I just started copying him at that age, and I found it quite fun. You think it's quite cool when you are younger.

Can you explain to me what your first experience training parkour was like?

Well it's got a bit of a community wibe, so I went up in town, I think that was the first time I properly did it and that was with about 20 other people in Nottingham. And it was quite intimidating obviously as I was quite young, small and there were a lot of older kids who were far better than me. So I was quite nervous but it was also quite cool you know feeling as a part of something, as it's quite a new and interesting thing. So, yeah, excited really.

Can you explain to me what your most recent parkour session was like, and how did you feel compared to your first experience?

It's completely different now, whenever I go out. But I am injured at the moment and that's three months ago trying to move so I would say my most recent experience was a bit - it wasn't the best one, like it hurt. But day to day it is completely different to how it used to be, I have got close nit group of mates that I go out with, I am confident, I am lot better so if I meet new people I am very rarely nervous anymore. I am older, I know where to go, what I want to do.

So you know your body more then?

Defiantly. Defiantly.

Section 2

Why do you like doing parkour?

I like it because I think it a quite of versatile movement, in that I have got a trampoline, I am going to go high diving. So at lot of these things aerial awareness, what I can do with my body is yeah is a very versatile sport. It is very applicable in most senses and if I don't have a skateboard or anything when I am out and about I can do parkour, it is really accessible, which is one of things I like about it.

Do you think there are benefits of taking part in Parkour?

I think I have got a lot better balance, for physical and aerial awareness. I do get injured a lot so I suppose that's not a great benefit. Psychological it's fun, its stress relieving you know I can go out and do that it's a break away from the norm. It keeps me fit and healthy in some ways, keeps me strong. Social benefits, I suppose I have met a lot of makes through it, and I still mates with a lot of these people now. It has taken me you know around the world I have gone to different countries and met some really great people through it. So I think it ticks all of those boxes benefit wise.

In terms of the social aspects then, would you say that meeting new people and getting a tight knit group is something that is beneficial?

Yeah I think it depends person to person you see some people and their quite reserved and might be a bit more introverted generally and they would come out and train and keep themselves to themselves. I mean you've got some people who have got more of a group mentality you know their really close mates, they might hang out outside of parkour and go to the pub, you know so. Personally I fall into more group mentality I suppose.

Section 3

Can you describe to me what your typical parkour training environment looks like? In terms of the tasks involved?

I think you'd have vaults, kongs. You'd have balancing beams kind of thing. Well it depend on where you do it and if you are doing it inside the gymnasium, the gymnastics gymnasium the equipment is what you've got to work with already, you've got the vaults, you got the mats, you've got the balancing beams, all the bars. But then if you've got an outdoor training environment like a parkour part you've got some mats, you've got some vaults but there are not moveable, you've got climbing, swinging, pull ups, climb ups. But then if you doing in the urban environment, if you are doing in the street, you kind of work with what you've got I suppose, staying with walls, with precisions, with vaults, but you don't really have as many bars outdoor. Obviously you don't have crash mat, you don't really teach flips outside much, it's a lot more plyometric I suppose if you are doing it in an urban setting.

What are the most important features or design aspects of parkour training environments?

Bars. Different varied heights of walls. Thickness of walls, matter. A good kong, or a good vault wall is what 700mill tall maybe and that's quite standard (ish) around that range. You can't kong if it goes any lower than that. So rails, climbing things, I think a lot of well-designed parkour parks rely heavily on rails now. I think less on walls because

it's cheaper than concrete to cast outside or you know it's quite precise and technical, which I think it quite a fun aspect to.

If you were to coach in these environments how would you scale it for someone's ability and age?

I think, well, when you first starting with someone you teach them the basics. You know you teach them how to land safely, you probably teach them now to roll. You start getting them to things to climbing up to build up their upper body strength so they are able to get onto the higher obstacles. And then when you start to teach someone more advanced, depending on the advancement you end up on not teaching them as much anymore and you're helping them often, so they know exactly what they want to try, they've got something in mind, they've had a move in mind and you, your there then to cater to whatever needs they want in a sense. So you still do all the working out and conditioning as well of course, but with younger people it's more generally conditioning there's not much risk to it I suppose. Whereas, in older people just spending and helping them along with what they want to do.

What are you looking for in a parkour environment that is outdoors, what would it look like and consist of?

Well... different spots are good for different things. Outside here the collegiate campus there is a load of little benches that are about 400mil high, so there are quite low to the ground but scattered in a random way. You can find load of different jumps there load of rails outside so I think a varied mixed of heights, grippy walls I think that's quite important. Fast drying ground, because if it's raining beforehand you know that were not going to that sport and it's gonna be wet. If it's undercover that's always a bonus for when it is raining. Yeah. Concrete mazes like structures.

How does this differ to an indoors environment?

An indoors environment is a lot more self-build, there is a lot more matts, and things are a lot less ambitious. Like this vaults has been designed to be a vault, whereas outside you might see something like a bin that can be used to vault but you've got to be more creative in thinking outside. So indoors I suppose it's a bit more palatable, it's a lot more obvious. And you do have things like bars that go into foam pits and that's where you practice your doubles or if there a good height into foam bit. It's a lot more safe and controlled, and whatever move you wanna do there is normally somewhere in the gym that facilitates that. Whereas, outside if you've got a specific move in mind it might take you weeks of walking around the city before you find something and be like that looks bang on for that sort of thing.

Like you almost control the environment?

Yeah you've got a lot of control over an indoor free running environment.

I want you to design me a parkour environment indoors, what would this look like and consist of? You've got free rain over design features, object orientation and equipment.

I think there is gym in Rotherham, I don't know if you have been there? TK - team katerlist of Enova. There is one in Barnsley, but the one in Rotherham is better because it is a lot larger. But that I think is a really good example of how an indoor free running gym should

built and obviously for the recording, so it is quite a large warehouse type room with wooden obstacles, there slightly moveable some of them and take a bit of effort to move them around. It's got bars, got a foam bit, got a sprung floor, like a gymnastics floor. It's got a trampoline down there which is great and I think all these things are quite essential. Moveable blocks, yeah. Rails, just the more space the larger it can be the better. There is a free running gym in America, tempest that's renowned as the best parkour gym; they've got the cash that has been pumped into that. That's got huge trampolines, bar sets up. It is just massive, I suppose the more money you can chuck at it the more versatile, the more you can do. Yeah.

So I am really interested in symmetry and asymmetry and how can affect the way someone mores, so their variability in movement. How do you think a parkour athlete might move differently in a symmetrical versus an asymmetrical environment?

What do you mean by symmetrical and asymmetrical?

Symmetrical multiple lines of symmetry, blocks down one side and the other and they match. But asymmetrical there is no line of symmetry and are variable and random. A bit like the stuff outside collegiate.

Yeah so I think symmetry is a lot more caters to power and speed a lot more. So you know what is coming and often speed based free running competitions are all symmetrical. You go one way normally racing another person, it's kind of ninja warrior style, just a straight obstacle course and it caters to single movements. Double kongs where you really run at it and really want to get your power on it. You take off and every variable is bang one, you don't have to think about anything else, so a sense of symmetry in that sense helps. Whereas asymmetrical movement I think caters for more creative movements, slower, strength heavy in a way. But not power, controlled strength movements, I think. And you see athletes as they get older they tend to do more technical asymmetrical movement, because there comes a point where they can just run their fasted at a giant jump anymore because their body is not how it used to be. So I think technical, creative movement caters better for asymmetrical environment.

Section 4

Thinking about the answers outlined in this interview. Could taking part in parkour impact performance in other sports?

I think so for things like trampolining, parkour incorporates a lot flips but I suppose that that is a lot more free running and parkour I suppose. Free running based movement obviously because of the flips that is going to double up for trampolining and diving and any kind of gymnastics based type movement and flexibility which is beneficial in every way. But then parkour based movement learning how to roll, how to take a break and fall, that's helpful in most urban sports like skateboarding or scootering, where you have to quickly think on your feet sometimes and roll out so you're not injured. Same with rugby or football, I suppose I could probably recover myself a lot better with my change in movement without ever doing football because I have done parkour. So if I was sprinting after a football and tripped up I think I would be a lot better at recovering the injury and knowing when to take the fall, with muscle memory than if I'd never done parkour. If I was sprinting after a football and tweaked my leg because I don't know how to change my momentum, so I think it quite safe in that respect. It has made me do yoga to stay

strong and stay flexible sometimes. I don't know I think it gives you a feel for your body doing parkour and in that feeling you know. Like one day you wake up and feel sore or one day you can't jump as far or you can see a decline in how far you jump, so you realise I am putting on a bit of weight or I have lost a bit of strength. So I think it gets a better understand of who you are what your body is. Better connection.

What is your background in terms of parkour, do you take part in any competitions?

I have done. I competed in a competition in the Netherlands, Switzerland about three years ago. I have been to events, I have judged events. I have been to a lot of events, not competitive around the world. I have been to gymnasiums in morocco; we went to Poland and did a whole tour of Europe once doing parkour. So it had taken me quite a lot of places really.

So before we finish, is there anything you would like to add regarding any answers you have given today?

I think parkour and free running are quite different. And I think that the movement of both its trains complete different athletes. There is different socials circles among it, there is different ways of looking at it, different displaces, different ways it trains your body, the strength. Free running is very much more flipped based, creative and attracts kids more, I think because it is quite cool. Whereas, parkour comes quite more, I think the parkour community the ones that avoid free running are a bit stricter in a sense, less injury prone, stronger at times. I think there is a difference between the two even though both of them cross over into each other a lot, but I think that's.

I know it's quite a contest point in the literature. But really there is that much overlap it's hard to tell the difference?

There not the same and I think it is quite visible when you know what you're looking for. And I think that the community is understanding that a bit better. In that I think that when competition first started it was style that was its only competition. And style incorporated points like creatively, flow, difficulty. So at lot of these people throwing really technical freeing moves that you see in gymnastics, and eventually they came a point when people were like this isn't parkour because you can only score points when you are doing flips, what about the people who train just parkour, this isn't a parkour competition. So now there is more competitions that do things like speed, so it is one end of the course to another so no one is going to do flips in there as it doesn't make you quicker. It's not quicker. So speed competitions are generally always parkour and there is a lot where they do specific parkour technical movements.

Ethics statement

END

Appendix 4.1.

Chapter 4 (Study 2) Ethical Approval (Converis ID: ER16056164).

Effects of athletic profile, experience and event specialism on parkour athlete's performance.

Ethics Review ID: ER16056164
Workflow Status: Application Approved
Type of Ethics Review Template: All other research with human participants

Appendix 4.2.

Chapter 4 (Study 2) within-and-between-day reliability for the OptoJump™

Test-Retest Protocol

The within- and between-day session test-retest reliability of OptoJump™ was examined across three jump modalities (SJ, CMJ and CMJ+: with arm swing), prior to commencing the main data collection at the Parkour facility. Six male participants (age = 20.00 ± 1.26 years, stature = 177.7 ± 8.35cm, body mass = 72.98 ± 6.78kg) voluntarily took part in the test-retest protocol. Participants were free from injury and performed more than two exercise sessions per week (either strength or endurance training), but none were elite level athletes (Glatthorn et al., 2011). Participants were asked to refrain from strenuous exercise on the day preceding the assessments. The study procedures were explained in detail to participants who subsequently provided written informed consent.

The protocol for assessing jump height across each jump modality was strictly identical across the test-retest protocol and the main data collection which occurred at the Parkour training facility. Participants undertook 2-5 jumps in each jump modality (SJ, CMJ and CMJ+: with arm swing) until the variation between the highest and second highest jumps did not exceed 5% (Grosprêtre & Lepers, 2015). The test protocol was repeated two hours later for within-day and one week later for between-day reliability analyses. The testing sessions took place at approximately the same time of day (i.e., afternoon) and participants wore the same clothing and footwear across each testing session. The highest and second highest jumps for each jump modality was used as criterion to establish the highest jump and were taken forward for within- and between-day test-retest reliability analyses.

Reliability Analyses

Paired sample t-tests were used to detect any systematic differences (bias). The reliability of the OptoJump™ was established using intraclass correlation coefficients (ICC) tests with 95% confidence intervals (CI), and Bland-Altman systematic bias ± random error. ICCs (2,1) for absolute agreement were used to determine the reliability between sessions. Within-day reliability was determined using ICC (3,1). ICCs and confidence intervals were interpreted with reference to Cicchetti (1994), where <0.40 represents poor agreement; 0.40-0.58 represents fair agreement; 0.60-0.75 good agreement and >0.75 excellent agreement. As suggested by Koo and Li (2016), for a variable to be classified as having 'excellent' reliability, both the upper and lower bounds of the confidence interval must fall within the excellent range (i.e., >0.75). ICCs were

combined with the standard error of measurement (SEM) which provides a measure of absolute reliability and allows results to be extrapolated to measurement tools and populations, as it is expressed in the actual unit of measurement (Atkinson & Nevill, 1998). Minimal detectable difference (MDD) was also calculated to provide an indication of the magnitude of change required to be classified as 'real' to aid researchers in the interpretation of results. Coefficient of variation (CVs) were calculated to describe the intra-participant variation between jumps and a 5% threshold was adopted. Statistical significance was set at $p \leq 0.05$.

Coefficient of variation was calculated using the formula (Hopkins, 2000):

$$CV = \sigma / \mu \times 100 \qquad (1)$$

Standard error of measurement (SEM) was calculated using the formula (Weir, 2005):

$$\text{Standard deviation of the mean difference (SD)} \times \sqrt{(1\text{-ICC})} \qquad (2)$$

Minimal detectable difference (MDD) was calculated using the formula (Weir, 2005):

$$1.96 \times \text{SEM} \times \sqrt{2} \qquad (3)$$

Results

Test-retest reliability of the OptoJump™ was excellent across all three jump modalities. For within-day (ICC, 3, 1) and between-day analyses (ICC, 2,1), analysis of 95% CI revealed that the OptoJump™ demonstrated excellent reliability across all 3 jump modalities. Systematic biases were non-significant and close to 0, and random errors were also low across jump modalities for within-day and between-day sessions. Within-day reliability (ICC 3,1: 0.981-0.996) was greater than between-day reliability (ICC 2,1: 0.964-0.983) for all three jump modalities. SEM and MDD were lower for the within-day testing compared to between-day testing. Coefficient of variation was lower for within-day testing compared to between-day testing for all 3 jump modalities.

Within day ICC (3,1) and Between day ICC (2,1) reliability analyses (Procedures adapted from Glatthorn et al., 2012).

Within-Day (ICC 3,1)	SJ	CMJ	CMJ+
Session 1 (95% CI), cm	27.84 ± 7.02 (27.76, 27.93)	29. 31 ± 7.02 (29.16, 29.45)	33.31 ± 9.10 (33.20, 33.41)
Session 2 (95% CI), cm	27.73 ± 7.08 (27.64, 27.81)	28.93 ± 7.29 (28.78, 29.07)	33.03 ± 8.69 (32.92, 33.13)
Systematic bias, cm	-0.12	-0.38	-0.28
Random error, cm	0.65	1.32	0.90
ICC (3,1) (95% CI)	0.996 (0.985-0.999)	0.981 (0.942-0.995)	0.995 (0.983-0.999)
SEM	0.04	0.17	0.06
MDD	0.11	0.48	0.18
CV, %	1.51	2.76	1.50
Between-Day (ICC 2,1)	SJ	CMJ	CMJ+
Session 1 (95% CI), cm	27.84 ± 7.02 (27.76, 27.93)	29. 31 ± 7.02 (29.16, 29.45)	33.31 ± 9.10 (33.20, 33.41)
Session 2 (95% CI), cm	28.48 ± 7.66 (28.33, 28.64)	29.71 ± 7.37 (29.50, 29.91)	33.65 ± 9.03 (33.34, 33.96)
Systematic bias, cm	0.64	0.40	0.34
Random error, cm	1.26	1.80	2.50
ICC (2,1) (95% CI)	0.983 (0.937-0.995)	0.970 (0.902-0.991)	0.964 (0.883-0.990)
SEM	0.16	0.31	0.47
MDD	0.45	0.87	1.31
CV, %	2.52	3.30	4.74

CI = Confidence Intervals; CMJ = countermovement jump; CMJ+ = countermovement jump with arm swing; CV = coefficient of variation; ICC = intraclass correlation coefficient; MDD = minimal detectable difference; SEM = standard error of measurement; SJ = Squat Jump (Mean ± SD)

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Appendix 5.1.

Chapter 5 (Study 3) Ethical Approval (Converis ID: ER21132479).

Parkour as a donor sport for athlete development: perceptions of sport coaches

Ethics Review ID: ER21132479
Workflow Status: Approved with Advisory Comments
Type of Ethics Review Template: Very low risk human participants studies

Appendix 5.2.

Chapter 5 (Study 3) Interview guide.

Interview Guide: *Parkour as a donor sport for athlete development: perceptions of sport coaches*

Interview Introduction

State the following, for the purposes of the recording:

Warm up: Specific to the interviewee, change for each participant (Sparks & Smith, 2014).

Length and structure: This interview will between 45 and 60 minutes.

Primary Goal: This study aims to explore your general background of your current role and journey, philosophy for athlete preparation and development and perceptions on parkour as potential tool for athletic preparation/development during an interview which will be audio recorded.

Verbal and Written Consent

Having read the participant information sheet, interview questions study and consent form, would you like to participate in this interview? If so could you please complete the consent form, or (if via skype/phone) please email me a copy.

Tick where appropriate:

Verbal Consent was obtained from the study participant ……

Verbal Consent was **NOT** obtained from the study participant …....

Written Consent was obtained from the study participant ……

Written Consent was **NOT** obtained from the study participant ……

*Where an interview in person is not possible, an email of written consent will be acquired from the participants, as per the directives of the chair of the sport ethics committee, dated October 2018.

Participant Characteristics

The following questions will be about your characteristics

3. What is your age in years? Answer:…….
4. How many years have you been working in the field? Answer……

Question	Probe Question
Warm up question, specific to each individual	Lead into the explanation of the procedures and informing the participants of their right to withdraw at any point, without having to give a reason
General Background: *"The first set of questions are about your background in applied sport"*	
Question 1: How many years have you been working in your current role?	Level of athletes? Sport/Organisation?
Question 2: Can you please tell me about your current role? (This will be important to get good detail for the participant background section)	How long have you been in your current role? Level of athletes? Sport/Organisation
Question 3: Prior to starting in your current role, can you please give me some insight into your journey into working in applied sport?	Experiences, Challenges, Informational and Formal Education
Question 4: Can you please tell me about the team culture in your working environment, and how does these influence wider practices?	Hierarchy, team dynamics of the sport science/coaching team.
Philosophy for Athlete Preparation and Development: *"The following set of questions are about your philosophy for athlete preparation and development "*	
Question 1: What is your philosophy towards athletic preparation and development?	What form and informal experiences have shaped your philosophy?
Question 2: Can you please tell me about the methods you use for athlete preparation for performance?	How does this differ depending on level and age of the athlete?
Question 3: Does your approach for athlete preparation differ compared to your approach to athlete talent development?	How? Why? And what is the purpose?
Question 4: What might the (coaching/sport science) session look like when adapting these methods?	Outline a typical coaching session with your athletes? When? Where? And how frequently?
Question 5: How is this method different from the traditional methods you might have been taught/used previously?	Context dependent and can be skipped. Focus on how these differ/or are similar to the traditional top down method to athlete preparation/development.
Question 6: Have you experienced any challenges when using these methods?	Answer dependent.
Question 7: How have athletes adapted these methods?	How? Why? And what is the purpose?
Question 8: How do you peers/colleagues perceive the methods and your approach?	Answer dependent

Perceptions on Parkour as a potential tool for Athletic Preparation/Development (aka Donor Sport) *""In my area of work, there is a load of interest in different sports at the moment. One in particular is the sport of Parkour."*	
Question 1: Have you heard of Parkour?	What do you think it is?
Question 2: Going back to your philosophy, do you think there is any value of parkour-style training for athlete preparation or performance?	Let's start with athlete preparation for performance and then move onto athlete development.
Question 2a: If not, why not? What do you base your knowledge/opinion on?	What information/material/perception shapes your knowledge/viewpoint?
Question 2b: If so, what do you see as the benefits of Parkour training in terms of performance and athlete development in your sport? What skills are developed and do you think this will impact performance?	Skill Development (Physical, Perceptual, Psychological, Social). Can it support development and transfer of foundational movement skills for use in specific performance contexts like team games?
Question 2c[i]: How could you integrate Parkour into your practices? Give some specific examples that you have observed or have used. Going back to what you typical session would look like, what would this look in terms of the design into the session?	When? Where? Why? And how frequently? Here, try to tap into whether it can enhance S&C, recovery from injury in a rehab programme, psychological skills such as resilience, self-regulation, emotional control, foundational movement skills such as agility, dynamic speed, balance and postural control, adaptation of movements and skills
Conclusion: Conclude the interview by saying thank-you to the participant and ask them if they want to add anything for the purposes of the tape.	Outline the following 1) who they should contact if they have a complaint about how the study was conducted and 2) if they are willing to be contacted for further clarification on discussion points.

Interview Notes:

This is a good opportunity to enhance understanding of how parkour may be being used by coaches, teachers, sport scientists, practitioners to enrich athlete performance. It can provide a wealth of experiential knowledge to complement the empirical knowledge that we have on how parkour may act as a donor sport or as part of a multi-sport programme helping athletes learn how to adapt to differing task constraints. It is an important opportunity to acquire some practical ideas and examples from practising trainers, coaches, teachers and sport scientists.

Appendix 5.3.
Chapter 5 (Study 3) Example transcript.

Date: 25th February 2020
Time: 2:47pm
Location: HoC
Interview type: In person.

Welcome to SHU and thanks very much for agreeing to be interviewed today. Do you agree to take part in this study, to provide verbal consent?

I do yeah.

You have also signed the consent form after reading the participant information sheet?

Yeah

What is your age in years?

45 years

How many years' experience do you have working in talent development?

Quite a few now, from a coaching perspective, probably , I would say about 20 years.

How many in your current role, and what sort of level of athlete and sport organisations have you been working during that time?

Quite a few and it might take some time. In regard to myself, just from a coaching perspective I have been head coach or my full title is director of rugby at a national 2 rugby union club. This my 13th currently going into it. In relation to talent development, to a certain degree I worked in schools for around 15-16 years which involved generally in secondary schools, I set up rugby clubs for each age group. So obviously that was more grass roots coaching. And then I moved into a sixth form college, where I had gone as a student as well as teaching there, I set up a rugby development centre which was specific to get talented players in from the age of 16-18, of which they had 6 hours a week of ruby, which I orchestrated between S&C or performance analysis, as well as their training and playing. Whilst I was working there, I also go the role of coaching England colleges, which was basically a team selected from all the colleges in England and we played against wales, Ireland, and we played again Leicester and Wooster academies. And I did that role for two years. Outside of that the only other I had in relation to the development of talented athletes is I have worked in conjunction with the county team for senior rugby as well.

Really interesting background, very varied. Prior to starting in your current role, can you just give me some insight into your journey working in applied sport? What I mean by that is what experiences, informal or formal education informs your approach/desire to be a rugby coach?

Well, it started obviously teaching in secondary schools. Like I say that was for around 10-15 years. Setting up for all sports really, from rugby, athletics, cricket, you name it.

But, through my specific role, I set up rugby for each year group, and obviously fixtures against opposition. So, I truly enjoyed that side of it, particularly the grass roots side of coaching children. A lot which hadn't done any rugby before, to see their development within rugby and in two of the schools I was able to see them through a four to five year period, seeing them from year 7 all the way through to year 11 to see their development and I still bump into quite a few kids that I taught, as I am now coaching senior rugby at a national 2 level. So, this season alone, I have bumped into four players that I coached at the school, and two of them I taught actually how to play rugby. They had never played any rugby before they came to the school in year 7 and now they are playing at a very decent level so it is nice to see that side of it. Also, whilst I was in secondary schools. I then moved to a sixth form college, where I was setting up the rugby development centre at the same I was still playing rugby. I literally retried from playing rugby and the club that I retired from was my local club, where it started on the ruby journey. I retired from playing and the chairman rang me up a couple of days later and asked if I would come back as the head coach for the senior team. And obviously, I have been there ever since, 13 seasons now, it has been a long old hit.

Would you say that your background as a physical educator, has informed your approach to coaching rugby?

Quite a lot, because obviously, when you are teaching you look at coaching as a whole. But generally, in grass route sports, a lot coaches will come in from a voluntary basis, they have probably played the game but there what you would say coaching process skills are something they need to develop. Where, from a physical education side you have to come up with a lot of differentiation and ways and strategies to work with all different kinds of kids at different levels of sport. And one motivate them and inspire them to do that. So, I presume that the coaching side of it has come of the back of teaching in physical education and working in environments and trying to build the dynamics of those environments that is the most important factor.

Could you give me an example of building that dynamic environment in your rugby practice?

Yeah its one that a lot of coaches will believe that technical and tactical is the way forward and what is going to make teams better. I would go the other way and say it is the social side and how you can build rapport with players and individuals understand what makes them tick the most. Sometimes when you need to put an arm round them or speak to improve certain areas of the game, you have to be a bit more forceful. Obviously, that environment is key for breading success, or what I call a success which is development in players really and getting them to perform to the best of their ability. So, I would certainly say that management side of these environments is the most important, if we were looking at percentages, 20% of coaching is coaching, 80% is management and delivery.

What is your philosophy towards athlete preparation and development?

Obviously, that differs depending on the age range of the people you are working with. With adults and seniors at the moment that I work with at the moment, my philosophy, in ruby is built from my childhood really. When 12 my dad took me to Twickenham to watch France play rugby and I was blow away with how the French play actually. That they played this open style of rugby, where continuity was key in the game. Whereas the English type of game at that stage was very forward orientated and it was kicking for

territory. And I just loved that philosophy of how the French played and so in some ways I supported France over a long period of time, as I enjoyed the way that they played and the standard and style of play. So, my rugby philosophy and how I want teams to play is built from that. My philosophy as a whole, of how to coach has been based from what I received when I was growing up through sort of development rugby and grass-roots through to elite performance. Where a lot of it was very much technical driven, very repetitive in drills, with what we had to do to develop skills and there was lots of times in my career where we hadn't done something well as a side, when I was playing professionally. The following week for example it was rooking, we would spend the whole week just rooking through repeated drills and everything else, and I remember one time vividly, we played against Richmond in a game and I played fullback and the first two high balls I dropped, and I got an absolute bollocking at half time because it cost us two scores. My own thought process of that was that we spend the whole week practicing rooking and not done anything specific to taking high balls under pressure or anything like that and after the game in the review, I challenge the coach on it and he told me that is something I should be doing in my own time and actually I could do it on my own back by kicking it in the air and catching it. I just thought that's nowhere near what it is like in a game, with the opposition and the pressure you are put under, the wind if it's a really windy day and the environment that goes with it. And I just thought that when I have gone into coaching, I try and if we can replicate as much as we can what they do in games and how that is simulated in training. And obviously since, sort of coming into the academic work a lot of my coaching, as I have found has been based of ecological dynamics and the constraints led approach, really.

Can you please tell me about the methods you use to prepare your athletes for performance?

Yeah so in my current environment, we have two sessions a week, which are contact sessions, which are Tuesday and Thursday nights from 6:30-8:30pm. And then we have games on a Saturday. So, what we tend to do is we have a team of coaches and myself as head coach and I have got a continuity coach, skills coach. We have also got a player centred environment, so under that we have a leadership team that within that leadership team, players have responsibilities for certain areas of the game. Whether that be line outs, scrum, attacking play or defensive play. We then a physio and a misuse, and a S&C coach. So, between all of that we map out the year and do a full macrocycle to state what we are doing from late may early June, where I sort of pre-season starts, all the way through to may when I season finishes. So, we do a macrocycle, which is what I write over a year process, and then we do individual monthly mesocycles, which obviously include the fixtures in that. So generally, the Tuesday and Thursday evenings are based predominately on rugby and the development of the team. The players also see the S&C coach for stuff that they have to do outside, generally they should be doing 5-6 sessions a week S&C to correspond what they are doing on training nights. How we sort out the Tuesdays and Thursdays what we mix between me and the other coaches and their elements and what they are doing, so just for example we are in a tapering phase at the moment, so we are only training once a week, which is a Thursday. So, for this week's Thursday session, we will be looking at game play attack quite a bit, but what comes into that is defence as well. At the moment we are looking at because conditions have changed a little bit, how we orchestrate the games. So a lot of what we do is what I know as representative learning design, so in relation to that we will be look, this week for example is we are playing top of the table away, so we will look to not challenge so much at the breakdown, so constraints led approach is what we will use for Thursdays session. So the task constraints that we will put in there, is that only one player, usually the tackler will

be able to challenge at the breakdown in training, the rest will have to fan out and defend for attack play, will try and only commit, as looking at the opposing team through performance analysis, they don't overly consent the breakdown, either so will be looking to commit only two players to the breakdown each time. So, in training we will put that as a task constraint, and then to change that sometimes we will put extra defenders in, so they will have to change and adapt to that breakdown situation. The we will base a lot of training on scenarios, so it might be looking at scenarios where we are lots of points down but we've for two tries and we got two attacks in the red zone, can we get two points out of that. If we do we can get a bonus point, so it will be working on those sort of scenarios. Both for attack and defence. That is generally how we work from a monthly cycle and then we work from a week to week basis.

What about preparing an athlete for their development throughout their entire career with you? How would you approach to that sort of training differ to training to prepare for performance, the game so to speak?

So, overall, within the club I am at the moment, we have a squad of 41 players at the moment and 37 of them have come all the way through our pathway. So, they have come through the under 6-under 7 or joined our mini junior section at some point and them come all the way through to adult senior rugby. Some have gone away to elite pathways along the way and then come back to us. But the majority have been in that pathway somewhere along the line. So, we have got the mini junior coaches which I sort of see as a coach coordinator, and then we have the senior section which includes from under 18 upwards. And then we also have the under 16 which filter through. So, what we try and do is, is do a lot of work with the mini junior coaches on the development of the athletes as they come through so, particularly in the mini section, we look at lot of fundamental skills, we look at agility, balance coordination and the development of fun sort of games and scenarios in that. Although, we have a formalised game that they do play from under 8 upwards, which there are a few national governing bodies that they put in place. That is our emphasis as club, what we try and look at. We then look from the junior sides as they get through to under 13s and start to play the full 15 a side game, we then start to look at more tactical side of the game, but that is done through decision making and creativity really, as much as possibly can. Then as they come through to the senior end of the club, we liaise with the coaches and we do a lot of the session with the conference players again. And again that's more looking at decision making and creative side of each individual player. So that is how the development will come through to the players that are in our pathway. Obviously, we meet quite a lot of obstacles with that and coaches have different perspectives and thoughts on how you should do things. We try and run a lot of CPD and coach feedback and observations to try and improve the pathway as much as they can and be geared towards sort of what I am looking for.

Have you come across any challenges from your colleagues when implementing approaches?

Yeah constantly, the challenge is there. Because obviously, everybody has their own subjective opinion and the guys that are voluntary coaches in the junior section, a lot of them have played the game at a decent level (the majority within our club) and obviously they have been coached in certain way and feel that they have developed because of that. So, they want to utilise that and think that that is the best approach to use for the development of players. We had quite a few of the coaches come on board and really like the ideas we put across and the approach that we use and are really wanting more information and attend the CPD and come and watch our sessions and really try and

development. So yeah we do, we get sort of feedback from coaches who are happy to do what they do. In some instances, it is great that they are voluntary, so sometimes you've got to be very careful how you tread that and bridge that gap, because at the end of the day you do not want them to be involved in coaching. Because there are some of them coaches who have fantastic rapport with the kids and build a great environment and the kids love it. So, in some ways you can to get say ok the rate of development for those kids will be a bit slower, but at least they are going to be involved in the game and will come through to us at some point.

In my area of work there is load of interest in how we can take part in different sports for athlete development and skill transfer. The particular sport, that I am interested in is parkour. How you ever heard of parkour? and if so what is your understanding of the activity?

Yeah I have heard of parkour, my understanding of the activity is that the challenges that who every take parts in it, will have a set out route, that they might want to get from said A to B, with lots of different obstacles in the way. But they can be creatively in how they are going to go over those obstacles to get from A to B, and they might set up their own way of doing that and different movements to be able to do it. That is my most basic understanding of what parkour is.

As a coach, do you see any benefits of integrating parkour into your coaching practice?

TR: Yeah, I think it would be very important in two aspects. Certainly, for fundamental skills and in developing within the mini junior section, in particular the mini section it would be very useful, just in regard to what is delivered anyway at that age range, with the development of ABC skills and how that is done through adaptive and fun games. There is a lot of what would be covered skill wise in parkour, is similar. So, I certainly would say that it would be useful for the development of players at that age range. I think it would be massively important in junior rugby, because the biggest issues I see as a coach, is that where we need to up-speed players or development the quickest in, is the transition from under 18 to senior rugby. They are very good rugby players, they don't see the buy in of S&C and they find that quite boring at time. When we do tests on those players that come through, those are the biggest areas that we need to improve. We haven't got money to buy players in and we prefer to grow our own players anyway, so the transition from under 18 to senior rugby is a bit step, but we want our players to make it quickly. And that is one of the biggest areas is strength development, where those players are lacking and actually some of that strength development (though parkour) would make a big different to what they do. To put that into perspective with what the senior players do, a lot of our representative design in the off season, and work that we do in preseason, we still do a lot of ruby based work, but we put different constraints in there, different task constraints or individual constraints to how and help development of strength and explosive power, rather than just sending them into the gym, because all the lads are pretty much amateur and what we find, is when we got an S&C coach that has got his own place is that the numbers drop off if we doing sessions there. Whereas if we do rugby based sessions, the numbers are quite big. And also what falls into that is the lads that really taken on the S&C and understand that the majority of them now a lot of cross fit based work and a lot of strong man rounds and specific wads of cross fit in the gym, and that is what a lot of our S&C guy puts across as well. And obviously, from my little knowledge of parkour, but just the work that they do to develop strength, is that sort of mobility strength is so applicable to rugby.

How would you intergrade the parkour style training into your coaching practice? Where would it be based? How long, how frequent?

Yeah it would be interesting to do actually, it would be interesting to speak to some parkour coaches to see how if we did a session with some representative design of training, to see how a parkour coach could start to think and look at some of the movements the players make and how they could maybe add to that movement. When I was a player playing professionally, we used to get a lot of judo coaches coming in to look implicate movements into tackles and also we had a guy who was a big jujitsu tkyando, mixed martial arts coaches, that our players did a six week block with them to look at certain movement patterns and holds and different factors that came into play. It was very useful. I certainly think that for parkour it would be great to do with the little children, so if we are looking at age ranges 6-8 I would say as part of their training, as well as what they do with the ruby side of it obviously. Yeah, I would factor it into their warm ups but also their main training block I would say.

Why do think physical skills are important for your sport?

In relation to the components that make up ruby, for the development of ruby players, and if that's they are going to go into being elite players, or play first team with us or fifth team with us. We still want them participating in ruby. So, they are key skills that they are going to develop over time, to make them a successful rugby player. Whether that be play for the fifth team or first team. Our club is a big community environment and we need to try and maintain as many players as its good for rugby but also for the community as a whole as you got people becoming healthy. So, I think that they are the main stages within the game of rugby, there are also the main stages of healthy living basically as well.

Do you think that parkour could be useful to develop physical skills in your athletes?

Yeah parkour could defiantly be useful for developing physical skills in rugby. Like I said previously at all levels as well. So, for the mini section, for the 5,5,7 year olds to develop ABC skills, because the movement patterns and the mobility and using strength through mobility is what they will face when do they do finally get through to the full stage of ruby. But also, in that junior section when they are going through maturation, and the stages of growth, it is going to be very important to allow them to access that movement and develop muscle to go along with their long limbs that they are developing at the time as well.

You talk about representative design, so if we were to integrate a parkour activity into your practice, would you suggest doing it with a performer and opponent, linking with ruby skill?

Depends on the age group. But, yeah even for the 6 year olds I would still factor in opponents in a parkour style environment, as we are keeping a lot of affordances that they are going to see in rugby and it allows them to access at an early age and start to see it so.

Do you think that parkour could be useful to develop perceptual skills in your athletes? How do you develop perceptual skills through your practice?

Yeah to basically keep the emphasis of what they are going to develop to. So, it's great to develop individual balance, coordination and do certain movements, but those

movements need to be put into the affordances that they are going to into play as they go through and progress through the age groups. For example, for age grade rugby, under 8s, they do four aside and it is tag ruby, so they have to grab tags to stimulate a tackle. So, to develop all those movements it still needs to be that similar environment with other people about. So, they can process that information and understand those movements in terms of how to do it. It is vitally important to not be too specific with movements, particular at younger ages, as children will develop themselves how to move in certain aspects and certain ways and if we take a lot of those affordances away, I think for their development is slows the rate of development. Yes, they might get the precise movement, but actually that precise movement might not be relative to if they suddenly have to change direction before somebody tags them when they are playing age grade rugby at under 8s. I would defiantly say parkour can be used to develop a better rugby player, it would be a very good addition to training and certainly the development at younger age groups. But I still think it would have huge benefits for senior players as well, to develop their sort of mobility and different forms of strength, other than going into the gym and doing beach weights sometimes.

How does your training develop an athletes psychological skills?

Through representative design, through challenge, so we will be looking at what the players will face on a Saturday. We try and not to do it week to week, we try and be specific over a period of time so they can develop and adapt to their surroundings. So, in this country with rugby at the level we are playing at you meet lots of different teams that have lots of different strengths and weakness so some teams play very direct, very forward orientated and try and basically bulldoze you. We have some teams that try and move us from one side of the pitch to the other, so they can pick mismatches with fast players that are very agile. We got some teams that play to a very structured game plan, which is very specific but can be hard to stop. Some teams play very varied games and so what you want from the players is to be able to adapt whatever is in front of them and be able to see it within the game and adjust how we are playing as a team and they are playing as an individual to obviously try and win the game. That is the biggest key. So in training, like I said earlier we do a lot of scenario based work, so we might do where we will set certain task constraints for the defence they could be performer constraints in their as well, where we will look at setting a certain defensive structure. Which might be specific to an opposition that we play against, it might be specific to an opposition we might play in 5-6 weeks. But just to set that challenge there to see if the attack can come up with the answers so for the attack, we have lots of different ways of playing. Like my side based on the playing style of France, to be able to adapt and play different approaches, wide, and sort of different game plans. It is about challenging the players in training so they can come up with the solutions. Sometimes as a coach we have to facilitate that, but generally speaking we are setting thing up and manipulating the constraints that they have to accommodate that challenge and overcome it really and that is what we try and do in training. And the last one of those challenges is the environmental affordances as well. So, in training if there is strong wind, we will orientate the pitch, so sometimes they will have to attack against the strong wind and that might limit the amount of kick or type of kick.

Could parkour help your athletes develop psychologically?

It would certainly build problem solving and resilience, because obviously within the challenge they might not fulfil it and obviously build resilience from that. And then information processing in that regards, in that they have got a challenge and got to try and

solve and come up with the right movements to do it. You know in a way that would develop their decision making skills to you know in a game scenario for ruby where they might have a penalty kick for a corner and say like look should be catch the drive, looking that opposing or should we be moving wider first. So, it is decisions we have to make similar to what they would have to make.

Do your coaching practice in rugby, help performers develop socially?

TR: We do that on quite a few basis, the first one is we the actual environment. Our players have to take on responsibilities, a lot environments that I played in the responsibility was taken away from you. But then you were blamed if things didn't go well, which obviously got your back up quite considerably. So certainly with all the environments just try and create that responsibility and ownership from the players, within that leadership tough what I try and build is that people are not given the leadership roles so that gives them power so that they can't be given power and I will give you a couple of examples of how that sort of developed. So it's not about them having power over others, it is about them having an overseer of what we are doing and being able to be critical in what we are doing and that criticism will come back to them and how they can then adjust and work with other players to make things work. So, an example of that is that we had a player that their responsibility was line outs to make sure we win our own ball. He was given that responsibility and get on well and got on tougher with really players and he got them involved with different calls. There was a period last season when things did go particularly well with the lineout and some of the other players started to challenge. The player that had responsibility for that area rang me up and said nah don't want the responsibility anymore and having a go at me.

So, you do reckon parkour would be able to develop that interaction of working together?

Yeah it would certainly help to develop team cohesion, particularly if they had to do it as a team, like I said earlier having to get from A to B maybe, and getting the players to work in groups or teams to do that with different ideas of how they are going to formulate to get one side. Obviously, it is not exactly the same but it's a similar sort of challenge to what they might face in games.

END

Participant read statement about the complaints procedure.

Appendix 6.1.

Chapter 6 (Study 4) Ethical Approval (Converis ID: ER28777777).

Consensus on the feasibility of Parkour-style training in team sport practice routines: a Delphi study.

Ethics Review ID: ER28777777
Workflow Status: Approved with Advisory Comments
Type of Ethics Review Template: Very low risk human participants studies

Appendix 6.2.

Chapter 6 (Study 4) Round One Open Ended Questions.

In your own words, and based on any experiences you may have, please describe what you think *'Parkour-style training'* is?

Have you previously accessed any resources about Parkour-style training? If you have, what resources did you access?

Do you think there is any value of Parkour-style training (e.g., obstacle courses, tag-games) for athlete development? Please expand on your reasons for why or why not.

Do you think there is any value of Parkour-style training (e.g., obstacle courses, tag-games) for athlete development? Please expand on your reasons for why or why not.

Would you consider integrating Parkour-style training into your own coaching practice? Please expand on your reasons for why or why not.

Would you consider integrating Parkour-style training into your own coaching practice? Please expand on your reasons for why or why not.

Would the Parkour-style training be led by yourself and colleagues or would your place of work pay an external Parkour coach to deliver the session? Please expand on your answer with reasons why.

How would you prefer this Parkour style-training to structured (e.g., related, coach-directed, guided discovery, free-play)?. Please expand on your answer with reasons why.

What equipment would you prefer to be used during the Parkour style-training session? Please expand on your answer with reasons why.

How would you prefer the Parkour-style training environment to look like in terms of the design and layout of equipment? Please expand on your answer with reasons why.

In your opinion, could a continued professional development programme for coaches focused on the application of Parkour-style training be useful in your sport specific

domain?. If so, what would you like the materials/structure of the programme to look like? If not, please expand on why you think it would not be useful.

In your opinion, could coach-parent open-forums be useful for communicating the potential applications of Parkour-style training in your sport specfic domain?. If so, what resources would be useful and what would the structure of these open-forums look like? If not, please expand on why you think these would not be useful.

Do you think Parkour-style training would be easy or difficult to integrate in the sport you are currently working in? Please expand on why you think it would easy or difficult to integrate.

In your opinion, would they be any barriers to integrating Parkour-style training into your sport specific domain? Please expand on your answer in as much detail as possible.

Where barriers might exist, do you think these could be overcome? If these barriers can be overcome, how might this be achieved? If these potential barriers cannot be overcome, why not?.

Appendix 6.3.

Chapter 6 (Study 4) Round Two and Three Short Answer Questions

Applications of Parkour-style training in Team Sports

Parkour-style raining may take the form of an obstacle course in team sport settings.

Parkour-style training may take the form of tag-games in team sport settings.

Engaging with Parkour-style training could develop adaptive athletes.

Parkour-style training challenges athletes to move in a dynamic way.

Parkour-style training could play a role in supporting athletes to develop movement skills relevant for a range of sports.

Parkour-style training targets movements that are not strictly sport specific but can provide strong foundational movements for athletes to build upon.

Parkour-style training could be used to develop problem solving skills in team sport athletes.

Parkour-style training could be used to develop resilience in team sport athletes.

Parkour-style training could be used to develop confidence in team sport athletes.

Parkour-style training could be used by team sports athletes to develop risk appraisal skills.

Parkour-style training could be used to develop coordinative abilities in team sport athletes.

Parkour-style training could be used to develop conditions of movement (agility; stability; flexibility; power and endurance) in team sport athletes.

Parkour-style training could improve competitive performance in athletes' main sport due to transfer of movement competence between practice domains.

Designing and Implementing Parkour-style training Environments

For Parkour style-training interventions to succeed there should be a culture where athletes are actively involved partners (i.e., co-designing) in their development, allowing them to create relevant, engaging and fun learning environments.

Any equipment found in a typical (traditional) coaching environment can be used for Parkour-style training as long as the set up does not increase injury risk of players.

Equipment found in a typical (traditional) coaching environment typically includes: mats, boxes, hurdles, cones, horses, benches, sausage bags, shields and other items.

In Parkour-style training, the less equipment used the better.

Parkour-style training should only use specialist equipment (e.g., specialist parkour installations and facilities).

Parkour-style training taking the form of obstacle courses could use equipment found in traditional gym based settings.

Parkour-style training taking the form of obstacle courses could use soft-play equipment.

Parkour-style training taking the form of obstacle courses should form a part of the warm up of the main sport specific coaching session.

Parkour-style training taking the form of obstacle courses should be integrated as a separate session to supplement strength and conditioning work.

Parkour-style training taking the form of obstacle courses with a tag-game element could use equipment found in traditional gym based settings.

Parkour-style training taking the form of obstacle courses with a tag-game element could use soft-play equipment.

Parkour-style training taking the form of obstacle courses with a tag-game element should form a part of the warm up of the main sport specific coaching session.

Parkour-style training taking the form of obstacle courses with a tag-game element should be integrated as a separate session to supplement strength and conditioning work.

Parkour-style training should integrate sport-specific skills (e.g., ball handling, passing, shooting).

Integrating sport-specific skills into Parkour-style training could help coach and athlete "buy in" as it would be clear how sport-related movements are being integrated.

Parkour-style training should be used on the day of sport specific competition.

Parkour-style training should not be used on the day of sport specific competition.

All objects in the Parkour-style environment should be modular so that their height, can be scalable to allow for increases or decreases in task difficulty.

Some objects in the Parkour-style environment should be modular so that their height can be scalable to allow for increases or decreases in task difficulty.

All objects in the Parkour-style environment should be modular so that their position can be scalable to allow for increases or decreases in task difficulty.

Some objects in the Parkour-style environment should be modular so that their position can be scalable to allow for increases or decreases in task difficulty.

All objects in the Parkour-style environment should be modular so that their angle can be scalable to allow for increases or decreases in task difficulty.

Some objects in the Parkour-style environment should be modular so that their angle can be scalable to allow for increases or decreases in task difficulty.

Parkour style training environment's should be symmetrical.

Parkour style training environment's should be asymmetrical.

Parkour style training environments should have a mixture of symmetrical and asymmetrical objects.

The coach should attend Parkour-style training workshops and or related coach education courses before integrating Parkour-style training.

When first integrated, Parkour-style training requires some level of athlete induction and awareness training, with coach directed input for safety purposes.

Parkour-style training should be delivered by a mixture of the coach and Parkour specialists.

Parkour-style training should be primarily athlete-led, where athletes create (co-design) their own Parkour-style environment with equipment that is made available to them by coach.

Parkour-style training should be primarily delivered via guided discovery and free play methods, driven by the athletes.

Parkour style-training should be primarily coach-led and organised without guided discovery and free play.

Overcoming Potential Barriers when Integrating Parkour-style training

In youth sport, where possible, parents should be given opportunities to partake in 'Parkour taster sessions' to allow them to 'experience' the Parkour-style training that their child/ren will undertake.

In youth sport, in-person coach-parent open forums should be organised to give parents opportunities to ask questions about the rationale for using Parkour-style training in the developmental pathway of their child/ren.

In youth sport, online coach-parent open forums should be organised to give parents opportunities to ask questions about the rationale for using Parkour-style training in the developmental pathway of their child/ren.

In youth sport, coach-parent forums should use non-technical language so that the rationale for using Parkour style training in the developmental pathway of their child/ren can be clearly understood.

In youth sport, coach-parent open forums should emphasise the safety aspects of parkour by outlining to parents what Parkour-style training is (e.g. obstacle course/tag) and what it is not (e.g. jumping off buildings and riding on the tops of trains).

In youth sport, coach-parent open forums should emphasise the added-value of Parkour-style training for the development of their child/ren's athletic skills and foundational capacities.

In youth sport, the rationale for using Parkour-style training sessions in the developmental pathway of their child/ren, should be relayed to parents in a variety of multi-media (e.g., videos, presentations, podcasts).

In youth sport, coach-parent forums, should not take time away from discussing any sport-specific opportunities of their child/ren.

Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented with and without equipment.

Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented in different environments (e.g., outdoors and indoors).

Parkour-style training workshops and coach education materials should demonstrate a range of activities that can be implemented with varying athlete numbers.

Where possible, Parkour-style training workshops should give coaches opportunities to partake in 'Parkour taster sessions' where they 'experience' the Parkour-style training that athletes may undertake.

Parkour-style training workshops and coach education materials should demonstrate how to progress, regress and manipulate the difficulty of Parkour-style training relative to age.

Parkour-style training workshops and coach education materials should demonstrate how to progress, regress and manipulate the difficulty of Parkour- style training relative to skill level and functional capacities of athletes.

Parkour-style training workshops and coach education materials should offer support and advice for coaches to design Parkour-style training and receive feedback from Parkour specialists.

Parkour-style training workshops and coach education materials should offer support and advice for coaches to design Parkour-style training and receive feedback from other coaches in their sport (peer-consultation).

Parkour-style training workshops and coach education materials should offer opportunities for coaches to design Parkour-style training and receive feedback from athletes.

Parkour-style training workshops and coach education materials, should provide examples of animal flow and primal movement pattern activities found in contemporary strength and conditioning programmes.

The development and delivery of Parkour workshops and coach education materials should be linked to professional training programmes of sport national governing bodies.

Parkour-style training workshops and coach education materials should be developed in consultation with Parkour specialists to ensure that they are representative of a safe and inclusive Parkour environment.

Parkour-style training workshops and coach education materials should emphasise the safety aspects of parkour by outlining to coaches what Parkour-style training is (e.g. obstacle course/tag) and what it is not (e.g. jumping off buildings and free-riding on top of trains).

Parkour-style training would be difficult to implement in team sports settings due to traditional coach thinking and resistant beliefs around practice design.

Parkour-style training workshops and coach education materials could be implemented in team sport settings to challenge traditional coach thinking and resistant beliefs and attitudes around practice design.

Parkour-style training would be difficult to implement in team sports due to common misconceptions that Parkour is a high injury risk activity.

Parkour-style training workshops and coach education materials should address the common misconception that Parkour-style training is a high injury risk activity.

The availability of specialist equipment is a barrier to integrating Parkour-style training.

Parkour-style training could use equipment typically found in team sport settings which would overcome barriers related to specialist equipment.

Parkour-style training would be easier to implement when it is proposed to coaches as tag games or negotiation of obstacle courses (e.g., gamifying Parkour).

Having the development and delivery of Parkour-style training workshops and coach education materials linked to sport national governing bodies would help challenge traditional coach thinking and resistant beliefs around Parkour-style training.

The time it takes to set up the physical environment and equipment is a barrier to implementing Parkour-style training successfully.

An environment where equipment is easily moveable would reduce time as the Parkour-style environment can either be set up before the athlete arrives or by the athlete during the session.

Finance and cost is a barrier to implementing Parkour-style training.

Where finance and costs may be a barrier to implementing Parkour-style training, creating Parkour-style environments with equipment typically found in team sport settings could be useful and inexpensive alternative to specialist Parkour equipment.