The role of elite coaches' expertise in identifying key constraints on long jump performance: how practice task designs can enhance athlete self-regulation in competition

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Abstract

Understanding performance behaviours provides useful information for practitioners that can assist with the design of tasks to enhance specificity of practice. In this study, the experiential knowledge of six elite long jump coaches was investigated using a constructivist grounded theory approach, with the aim of furthering our understanding of the competitive behaviours of elite long jump athletes and how they adapt actions to the emotional and physical demands of performance environments. Findings offer a coaches' perspective on three performance contexts which shape athlete performance – *perform, respond* and *manage*– toward two common performance intentions (maximum jump and sub-maximal jump). We contend that these findings reflect how coaches perceive performance as a series of connected events (jumps), during which athlete intentionality facilitates self-regulatory strategies in the face of unique interactions between individual, task and environmental constraints across a competition. These findings highlight how individuals must continually co-adapt with constraints in performance environments supporting how athletes self-regulate using intentionality, emotions and cognitions. Practice task designs should, therefore, provide greater opportunities for athletes to learn to self-regulate in performance contexts, with opportunities to *perform, manage* and respond. Interpreting the coaches' insights, we suggest that these major performance contexts of *perform, respond* and *manage* could, therefore, be strategically used to frame representative learning designs, providing a framework for better organisation of training tasks.

Keywords: Experiential knowledge, elite coaches, long jump, representative learning design, ecological dynamics, interacting constraints, grounded theory, affective learning design

The role of elite coaches' expertise in identifying key constraints on long jump performance: How practice task designs can enhance athlete self-regulation in competition

Understanding movement behaviours in sport is critical to improving performance, due to effective and efficient use of practice time and reducing injury risk. This understanding has largely been driven by the creation of deterministic models: a paradigm that aims to provide a *normative* model of a putative 'idealised performance behaviour' of the athlete (Chow and Knudson 2011). For example, in long jump, deterministic models have revealed that distance jumped is the product of height, speed and angle of take-off, as well as the influence of air resistance (Hay, Miller, and Canterna 1986). Whilst this knowledge has played a prominent role in shaping performance understanding (e.g., Hay, Miller, and Canterna 1986; Leigh et al. 2008), underpinning coaches' practical applications through 'passed-down craft knowledge of sports techniques' (Chow and Knudson 2011, p. 229), it fails to provide understanding on individualised performance solutions in competition environments (Glazier and Davids 2009). This is critical as recent investigations into the competitive behaviours of elite long jumpers revealed that performance is shaped by interactions between individuals (e.g., athlete intentionality), performance environments (e.g., strength and direction of wind) and tasks (e.g., rules of the sport) (McCosker et al. 2019). Importantly, this research highlighted that coaches need to go beyond solely addressing technical performance and prepare athletes to self-regulate during competition, adjusting to the specific constraints of a performance environment.

Given these nuanced complexities needed in understanding sport performance, an emerging body of work underpinned by the theoretical framework of ecological dynamics (ED) has begun to examine the regulation of actions in performance settings (Araújo, Davids, and Hristovski 2006; Vilar et al. 2012; McCosker et al. 2019). An ED approach promotes movement as facilitating the exploration and utilisation of affordances (opportunities for action available in a performance environment), continuously shaped by the continuous interaction of individual, environmental and task constraints acting on the (athlete-environment) system (Araújo, Davids, and Hristovski 2006; Araújo, Davids, and Passos 2007; Gibson 1979). This process of self-organisation underpins the emergence of functional coordination patterns during goal directed behaviour (Newell 1986; Davids, Button, and Bennett 2008). Adopting an ED approach allows practitioners to move beyond the reductionist approach of seeking to describe which performance parameters are important and provide a holistic approach to understanding how movement co-ordination patterns emerge under competition settings. This supports a more nuanced, contextualised understanding of movement performance behaviours central to enhancing fidelity of practice conditions, where decisions and actions should simulate those found in competition (Pinder et al. 2011).

In the study of long jumping, most empirical research has focussed on the run-up, demonstrating that athletes regulate their step lengths using continuous perception-action coupling (athlete perceptions and movements co-adapt continuously). Run-up performance is shaped by the key constraints of athlete intentionality (individual constraint), wind strength and direction (important environmental constraints) and the rules of the sport (task constraint) (e.g., McCosker et al. 2019; Bradshaw and Sparrow 2000; de Mestre 1991; Lee, Lishman,

and Thomson 1982). Importantly, an athlete's intentions embedded within specific performance goals, frame self-regulation under various task and environmental constraints (Araújo, Davids, and Renshaw 2019). This self-regulation process implies that athletes create self-directed feedback loops oriented towards achieving performance goals adjusting cognitions, affects and behaviours to suit (Zimmerman and Schunk 2011). For example, recent research using performance analytics has suggested that athletes use the first round in a competition to achieve a 'safe' jump (McCosker et al. 2019), making deliberate adjustments to running velocity in an attempt to control for subsequent foot placement error on the take-off board (Bradshaw and Sparrow 2000; Maraj, Allard, and Elliot 1998). In contrast, a jump for maximum distance would require an increase in running velocity (Hay, Miller, and Canterna 1986) and a greater risk of foot placement error at the take-off board, increasing the likelihood of a no jump (speed-accuracy trade-off). These examples help us understand why different individual coordination patterns emerge from athletes as they attempt to negotiate the ever-changing demands of the competitive performance environment (Davids et al. 2013; Araújo, Davids, and Renshaw 2019).

Understanding intentionality embedded within athlete performance goals in competition gains significance when we consider that each jump within a competition forms a complex system of nested, connected events impacting overall performance outcomes (Renshaw and Gorman 2015). This insight suggests that a successful (or unsuccessful) attempt at achieving a specific performance goal (e.g., to make a legal jump) impacts performance in future rounds. For example, performance analytics has revealed that a foul jump increases the odds of subsequent fouls later in the competition (McCosker et al. 2019). Rules specific to the sport, fellow competitors' performances, and wind strength and direction, continuously

shape the emotions, cognitions, perception and actions of competitors in different ways (Headrick et al. 2015). Previous research has associated varied cognitive strategies, levels of emotional arousal and efficiency of coordination patterns in accordance with the skill level of an athlete (Connor, Farrow, and Renshaw 2018). Increasing our understanding of the complex interactions between constraints is an important step for practitioners charged with preparing athletes to self-regulate in competitive performance. Given the dynamic nature of the performance environment, athletes need to practise how to continuously adapt to changing task constraints whilst performing under differing emotional states induced in competitive performance (Headrick et al. 2015). This insight is in line with the concept of Representative Learning Design (RLD) (Pinder et al., 2012) and its derivative Affective Learning Design (ALD) (Headrick et al. 2015). The importance of RLD is emphasised by sampling the performance environment to ensure that practice task constraints contain relevant informational constraints representative of sport performance contexts (Chow *et al.,* 2011; Pinder *et al.,* 2011). In this way, practice environments can be designed to elicit the emotions and cognitions present in performance environments and support the emergence of functional behaviours that demonstrate fidelity with the performance environment.

Whilst recent research in long jump has increased our understanding of performance, the complex nature of performance environments give reason to explore additional avenues of knowledge such as the experiential knowledge of expert coaches (e.g., Greenwood, Davids, and Renshaw 2012, 2014; Phillips et al. 2014). Coaches can provide a more nuanced and in-depth understanding of athlete performance behaviours as their knowledge base is attained through continuous and extensive practical experience, evaluation and reflection in supporting athletes to

find performance solutions (Nash and Collins 2006). As such, empirical research has used the experiential knowledge of coaches to inform and direct programmes of scientific research (e.g., Williams and Kendall 2007), understand talent development (e.g., Phillips et al. 2014) and promote learning designs within sport performance (e.g., Greenwood, Davids, and Renshaw 2012, 2014; Burnie et al. 2018). When used to complement empirical understanding gained from research data, experiential knowledge of expert coaches can assist in increasing the knowledge surrounding behaviours in competition settings, enhancing understanding of the self-regulatory interactions of athletes with the performance environment. This is important in sports such as long jump, where coaches play an important role in co-constructing an athlete's performance strategies in competition (Correia et al. 2019).

In summary, understanding what factors influence athlete behaviours in competition settings is an important role of sport practitioners. Whilst traditional deterministic models provide understanding of the mechanical details of technical performance, limitations exist in our understanding of how athletes adapt actions to the emotional and physical demands of changing competition environments. Despite more recent research suggesting that competitive performance behaviours in long jump could emerge from interactions between individual, task and environmental constraints (McCosker et al. 2019), empirical research based upon data collect in representative environments is still limited. With the established role coaches play in understanding and shaping athlete performance, this study offered an opportunity to adopt a constructivist grounded theory approach (Charmaz 2008, 2003) to investigate the beliefs and perceptions of coaches about athlete performance and the factors that they perceived to influence performance in the long jump event. Consequently, this study aimed to better understand: (i) perceptions of the

competitive behaviours of athletes, and (ii), how athletes must adapt actions to the emotional and physical demands of performance environments. The analysis ultimately aims to generate a new substantive theoretical perspective on what performance conditions shape athlete behaviours in competition settings. In doing so, it is envisioned that this will allow researchers, coaches and practitioners to develop a more contextualised understanding of athlete performance, allowing for the design of training environments that better recognise the delicate interactions between emotions, cognitions and actions at an individualised level.

Methodology

Constructivist grounded theory was used in this study to seek 'meaning' (Charmaz 2003) about the perceptions of elite coaches on athlete performance in long jump. We assume a critical realist ontology, which acknowledges that forces which influence and shape social phenomena (i.e., in this case, athlete long jump 'performance') cannot be directly measured, but instead, exist as a social construction reliant on the interactions people have with objects/events emerging in the context around them (Weed 2009). In this sense, a constructivist methodology (Charmaz 2003) addresses human experiences but acknowledges the existence of a real world. The co-construction of meaning further implies that data are not to be construed as an observable entity in the research process either. Rather, data are a product of the process where a researcher's position, perspectives and interactions allow for the development of knowledge through interpretation (Charmaz 2008, 2003; Weed 2009). This in essence promotes the notion that the researcher need not enter the research process with 'an empty head' but rather with knowledge of the

area that increases rather than compromises the theoretical sensitivity (Weed 2009; Charmaz 2006). . This theoretical sensitivity acted as a point of departure in this study to form interview questions, where the broad arbitrary categories of task, environmental and individual constraints were used to collect data. In the following sections we will outline how this perspective provided a place to start, not to end. Rather, it encouraged a deep discussion of a diverse range of long jump incidents and situations which provided data for comparison. In turn, this format enabled the generation of a substantive theoretical view of which performance conditions shape athlete behaviours in competition settings, grounded in the knowledge, experiences and insights of the participants.

Participants

The selection and recruitment of participants was directed by purposeful sampling (Patton 2002) to ensure a set of coaches (n = 6; all male) who had worked or were currently working with athletes who had competed in long jump at the highest competitive level of performance: The Olympic Games, World Championships and Commonwealth Games. Additionally, four of the six coaches had worked with athletes who had medalled at these major championships at the time of the interviews. All elite coaches had a minimum of 10 years coaching experience (M = 31.16, R = 11 – 53) and had attained accreditation that enabled them to coach at a national level. Participants were recruited from Australia, Great Britain and Brazil and were members of National high-performance track and field programmes as coaches within their respective countries. They were considered to be amongst each respective country's top coaches in track and field. Participant recruitment ceased when theoretical saturation was reached. This was a point in the

research process where new data did not add anything meaningful to the emerging model, rather only added to the density of the coded data (Glaser and Strauss 1967). Ethical approval was gained by the local university ethics committee prior to the commencement of the interview process.

Interview Procedure

Interviews were conducted by the lead author, who had experience as a sport science provider at a national level within a long jump high performance programme. This experience assisted in establishing a rapport with the interviewees and in the interpretation of results (Patton 2002). Interviews followed a semi-structured format (duration, M = 60 min, R = 30-87 min), utilising open-ended questions designed to encourage unanticipated statements and stories to emerge (Charmaz 2006). Questions were directed towards gaining insights from elite coaches on what factors influence long jump performance in competitions. The interview guide contained initial questions which focused on building rapport with coaches and included gathering information on topics such as: how many years have you been coaching long jump? and, who is the best long jumper you have ever seen and what made him/her so good? After this initial phase, questions become more focused on gathering information on what factors coaches perceived as influencing performance. Critical questions such as: 'tell me about your approach (or strategy) when going into a competition with an athlete' and 'can you provide an example of when an environmental factor influenced performance', formed the basis of this section of the interview. These questions did not direct participants to answer in a certain way, rather encouraging them to share scenarios or observations they have

encountered that best describe key influences on performance (Maxwell 1998). This approach allowed for the emergence of a range of scenarios across different athletes to be discussed ensuring that a constant comparison method (Glaser and Strauss 1967) could be successfully implemented. The presence of a broad range of scenarios and situations allowed for patterns, similarities and consistencies to emerge (Russell, Renshaw, and Davids 2018). This process promoted the need for a level of coding that necessitated comparison and an integration of an abductive method considering all possible explanations of the data through an interplay between induction and deduction (Strauss and Corbin 1998).

Data Analysis

A constructivist grounded theory views methods and analysis 'as flexible, heuristic strategies rather than as formulaic procedures' (Charmaz 2003, 251). In this light, rather than specific techniques defining the quality of our analysis, due diligence was taken to ensure that a 'total methodology' (Weed 2009, 3) was adhered to during the entire research process. Due to practical constraints on the scheduling of interviews in line with a major international track and field competition, we were not able to conduct, transcribe and analyse each interview prior to the next. We recognise this as a limitation of the study, and to mitigate any effects on the data, field notes were collected during each interview with a preliminary analysis of these notes conducted post interview, to gather emerging themes and probes for subsequent interviews (Holt and Tamminen 2010). This process offered the researcher an opportunity to make initial codes on emerging topics of interest for mining in subsequent interviews. In this respect, field notes played an important role

in making the interviews an iterative process, as they helped ensure interviews saturated (or dismissed) emerging codes.

Upon completion of the interviews the 'formal analysis' took place. All steps in this process were undertaken by the lead author unless stated. The process was initiated by listening to each interview several times to re-create the relationships formed with each participant and to gather a sense of the context of the data. All interviews were then transcribed verbatim after which, line-by-line coding (in conjunction with memo-writing) was undertaken. The generation of action codes within this process supported the comparison of data with data, followed by data with codes allowing for the emergence of theoretical categories (Charmaz 2006), formed by the research participants and the lead researcher. After this initial phase, focused coding was undertaken using initial categories that had been formed, which either led to codes being consolidated, becoming subsumed in related codes, or being dismissed. This procedure led to the formation of more robust theoretical conceptions through a cyclical process of sorting and exploration placing theoretical meanings to a smaller set of higher-level concepts (Glaser and Strauss 1967). Selection of the most appropriate codes during this step allows for a check on the fit between 'the emerging theoretical framework and the empirical reality it explains' (Charmaz 2003, 260). As the theoretical framework developed, meanings, interpretations and ideas were constantly reviewed with frequent discussions with 'critical friends' also undertaken. These discussions with critical friends enabled reflection and further exploration of interpretative possibilities. As such, rather than seeking to agree on codes, these sessions were opportunities to explore and critically evaluate whether codes and their properties (e.g., actions and processes described) explained behaviour in conceptual terms (Glaser and Strauss 1967). In this respect,

critical friends offered opportunities to interrogate tensions surrounding proposed theoretical concepts, so that interpretations (and understandings) of data were broader, richer and consequently more complex theoretically (Russell, Renshaw, and Davids 2018; Smith and McGannon 2017; Glaser 2003).

It is important to note that the process outlined above reflects a search for meaning as opposed to an objective truth. Data were often looked at multiple times and new interpretive questions were posed of the data in seeking new ideas and meanings (Charmaz 2008). The findings presented in the following section are, therefore, not meant to represent explicit categories that the coaches voiced rather, as a co-construction of meaning between the researcher and participants of what influences performance in long jump. The concepts and theories presented thus reflect relevant substantive theoretical abstraction of coaches' perceptions of athlete performance in competition and the contexts in which they are performed.

Results

Our analysis revealed perceptions of elite coaches that athlete performance in long jump was directed towards achieving one of two goals: (i) jump for maximum horizontal distance, or (ii), jump sub-maximally to ensure a legal jump. Coaches perceived athletes achieving these goals in contexts which could be conceptually organised into three categories - *perform, respond and manage*. Each performance context was conceptually formed not to represent a rigid set of characteristics that emerge within each performance setting. Rather, each context represented a situation that formed within a competition that warranted a specific adaptation to performance. The notion that each athlete has his/her own 'story' which unfolds in a

competition was a further conceptual idea that was formed to enhance our understanding of how athlete performance is continually shaped in competition, rather than being completely pre-determined (see Figure 1.0).

Figure 1.0 near here

In the following section, each performance context will be conceptually defined and its properties exemplified using extracts from the interview data to help contextualise their true significance and relationship with the overarching performance goals (Russell, Renshaw, and Davids 2018). The overarching performance goals perceived by coaches as directing performance (i.e., jump for maximum horizontal distance or jump sub-maximally to ensure legal jump) are viewed as higher-order conceptualisations that emerge as a result of where an athlete is placed in telling their story for a competition. As such, they will be evidenced throughout each performance context, rather than as separate categories.

Perform

'Perform' is best described as a time point in the competition where coaches believe an athlete can self-regulate during competitive performance, especially with regards to strategic intentions. Here, coaches' perceptions reflected the notion that athletes felt free to write the story that they wanted for that particular competition through the accomplishment of their performance goals. A 'perform mindset' was commonly observed by coaches to emerge at the start of a competition where the influence of an athlete's previous performances or performances of others is limited. Coach One begins:

> *Having observed many long jump competitions, my observation is that a lot of competitions are won on the first round or athletes were able to put out their better jumps in the first round.* (Coach One)

Coach Ones comments demonstrate how Round 1 can be used to provide greater freedom in subsequent rounds to 'perform'. Coach Three explains how that for some athletes, this means using Round 1 as a chance to ease the athlete into the competition:

> *First round is about feeling how the conditions are, feeling how the athlete really feels in the competition. So, it's certainly about getting a jump in, that's important for confidence to know you have a legal jump in. It is also a calibration. Ok, how do you feel today? How are you coping with the weather? How are you coping with any injuries?* (Coach Three)

These observations highlight how coaches are aware of how certain demands of the performance environment may uniquely impact on their athlete, and consequently, the need to develop individual performance goals aligned to their athlete's needs. For example, Coach Two explains that with one specific athlete, "*my overall strategy is get your first jump in. That really takes the pressure off"* (Coach Two). However, while that works for that particular athlete and coach, Coach Four counters that for many of their performers, Round 1 could be better negotiated through executing a jump for maximum horizontal distance:

> *I have always said to my guys to be ready to go from Round 1. I like the idea of pushing the edge [in] Round 1. You put the pressure on the rest in the comp if you do that and once people know they have to chase a big jump, they tend to tighten up and put pressure on themselves and from a mental side of things you have the edge if you are ahead. If you are in the lead, it's catch me if you can.* (Coach Four)

Overall, coaches' comments illustrate how Round 1 can be used to achieve individual performance aims, such as taking the pressure off, building confidence, calibrating to the conditions or to get a mental edge on the other competitors. In contrast, coaches also believe Round 1 can be used to reduce the opportunity of other competitors to 'perform', that is 'write their own story', by putting the pressure back on the rest of the competition (by putting in a big jump).Coach Two explains:

> *If they [my athlete] are in front coming into Round 4, bury them [the opposition]. Take advantage of the lead and just go for it.* (Coach Two)

Coach Two's comments reflect how being in 1st place in the build up to the re-order at the end of Round 3, provides their athletes with the opportunity to jump for maximum distance with a sense of freedom as well as providing a chance to amplify the pressure on their competitors. The notion of 'bury them' suggests that the coach has recognised the potential psychological impact a significant jump will have on opposing athletes, perhaps pressurising their future jump performance. In summary,

regardless of what goal or strategy (maximal or sub-maximal jump) the coach wishes his athlete to execute, there are certain time points in the competition that present as an opportunity for the athlete to 'perform'. The successful (or unsuccessful) execution of these performance goals can influence the emotions of athletes and have a subsequent impact on future jump performance.

Respond

'Respond' refers to a change in the competition demands that requires a certain regulatory response from the athlete. Coaches most commonly perceived this change to be the result of an athlete's previous performance (in that competition), competitor's performances or changes in environmental conditions. The change in competition demands often resulted in subsequent adjustments to athlete performance goals. Here, it appears that the athlete's story for a particular competition is emergent and unfolding and an opportunity presents to prevent their story from going off script. Coach One gives an example of how a foul in Round 1 changes the performance goals of the athlete in Round 2:

> *Get on the board in Round 2. If Round 1 doesn't work, you need to consolidate. Stop and consolidate a little bit and really assess what has gone on.* (Coach One)

Coach One's comments illustrate how a previous performance requires a certain response in the subsequent round. The need to consolidate and respond to the foul in

Round 1 suggests the coach is aware of the importance of registering a legal jump in the competition to ensure being in the top 8 ranked athletes at the conclusion of Round 3. Coach Four explains how a good jump in the previous round has a psychological impact and also has the potential to invite a certain regulatory response:

> *Yeah, they will take the confidence out of that and build from it. They will generally try too hard after a big one and we will see some fouls, but the better jumpers are able to keep building and keep jumping big. The emotion you take out of a foul or a good jump impacts you.* (Coach Four)

The comments of Coach One and Four reflect the notion that coaches perceive jumps as a *connected series of events* impacting future jump performance. Both legal and no jumps are events in a competition that require specific regulatory responses in subsequent rounds and is often influenced by the emotion arising from these jumps. Coach One also suggests that the last three rounds of a competition requires an athlete to respond to the events of the competition:

> *The athlete needs to jump for distance in Rounds 1, 2 and 3. They need to compete in Rounds 4, 5 and 6. They need to be able to respond to what else has happened during the competition in these last three rounds rather than just treat each one as exactly the same.* (Coach One)

This example by Coach One highlights how coaches perceive jump performance as being influenced by the performances of others in the competition and specific situational demands of the competition at the time. As such, coaches observe that their athletes must respond to the performances of other competitors and adapt to maintain their key performance goals. Coach Two gives an example of how these factors interact to influence particular changes to key sub-phases of the long jump (run-up):

> *It comes to Round 5 and my athlete is in 3rd place. Suddenly the wind changes from a cross-wind to a tailwind and my athlete is next to jump. The officials take a week to rake the pit and I am standing there going 'come on come on hurry up with that'. Finally, they take the cone away and BANG [she] does a PB [personal best] and she is in the lead. What she has done when she was standing up there watching the wind sock was adjust her run-up and slide her foot back a touch.* (Coach Two)

These athlete regulatory responses to changes in environmental conditions provide an important recognition by coaches of the impact of wind on the run-up in long jump. This example suggests how coaches have recognised that athletes must *respond* to changes in competition demands and prevent their story for the competition going off script.

Manage

‘Manage’ can be described as an athlete needing to cope with challenging circumstances influencing performance and having the skills to *manage* the performance situation. This can be associated with an athlete’s story for the competition going off track and requiring a certain type of performance, despite these difficult circumstances, to maintain their performance goals. This was commonly observed by coaches as being associated with an athlete’s emotional response to events and subsequent adaptations to performance if they were unable to manage the situation. Coach Five begins by providing an example of how successive fouls can redirect the course of the competition:

> *At big events, confidence can by impacted a foul or two, especially at the qualification round. I remember at the Beijing Olympics, where one of the favourites with a personal best of 7.12m, failed to qualify for the final even though she was in great shape. She had two marginal fouls, both big jumps, and at the third everything changed. She barely managed to jump 6.20m.* (Coach Five)

Whilst Coach Five explicitly mentions fouls as provoking a change in performance, a combination of the competition structure and the number of opportunities left for the athlete to achieve their performance goals, interact to influence the athlete’s ability to *manage* the performance situation. For instance, at a major championship such as the Olympic Games, athletes must compete in a three-jump qualification round and are required to either jump a mark equal or greater than a pre-determined distance or produce a performance that is in the top 12 athletes to qualify for the

final. The influence of a qualification round on performance is elaborated on by Coach Six:

> *A qualifying round is really not about performing at all. It is a mental stress. For whatever reason, if you have all the male long jumpers who could jump 8 metres, jump over a 7metre wide hole, there would be some who could not make it. It becomes a barrier rather than just going out there to compete. Because for them I think it is something to lose rather than something to gain. Today is to get into the final and it is almost like what is the least I can do to actually get in.* (Coach Six)

Coach Six indicates how athletes have to manage expectations surrounding performance and how these expectations impact on regulation strategy and decision-making of the jumper. The difficulty here was created by a qualification round associated by the athlete who felt they had 'something to lose'. This created a psychological stress that athletes had to cope with whilst still needing to produce a certain performance. The notion that athletes want to do the 'least they can do' has implications for the physical workload that qualification jumps may induce. If for example, an athlete produces a jump that meets qualification standards (distance jumped) in Round 1, they are then automatically qualified for the final. This reduces the need to complete two additional jumps. In this respect, although the story for the competition had yet to be physically 'written', the possibility of how the competition may 'play out' in itself constrains and alters jump performance.

These coaches' observations highlight how athletes do not view information in the performance environment just in terms of the jump at hand, but rather, in terms of what might or could happen with respect to their own performances and of other competitors. Coach Four explains how athletes must then attempt to manage these potential scenarios, in conjunction with varying environmental conditions during competition:

> *You know even before the athletes get into warm-up, they turn up to the track and the wind is doing all sorts of things. If is not just a straight tail they already start to change the way they start to talk about the upcoming comp. They get fixated on that stuff. Within the comp, if they are getting a cross-wind gusting from head to tail, again you can see it in their body language and they get antsy about it. Especially with the rule where you only get 30 seconds to jump. They are at the top of the runway just standing there waiting for the headwind to go away. And you can see when it gets to 25 seconds, they already look defeated.* (Coach Four)

Coach Four reflects on how wind can influence an athlete's performance even before the competition starts. Coaches' perceptions reflect how athletes must deal with these environmental conditions and still produce the required performance. These conditions must therefore be managed by athletes in order for performance not to be sacrificed. Another example of a specific environmental factor that might shape long jumping performance is outlined by Coach Six:

> *I have a jumper who will jump without a crowd clapping. When the crowd starts to clap, she will stop them. Because it takes it out of her rhythm and now she is going to run to their rhythm and not her own. Other athletes, if they want to be riled up, they get the crowd going. But my thing to them is to make sure they control them. If they are clapping too quickly you make sure you stop them.* (Coach Six)

This example illustrates how the presence of a crowd and their involvement creates a situation that needs to be appropriately managed through self-regulation by athletes. It was noted how athletes must intervene if crowd participation was seen to be detrimental to the 'rhythm' of the run-up. This is an example of a component of the performance environment that an athlete can manage by proactively exerting control. This control was necessary to 'prime' the run-up by creating a 'rhythm' that matched with the desired footfalls on the athlete, an unmeasurable quality that was commonly associated with the ideal execution of the long jump by coaches.

Discussion

Our study used a constructivist grounded theory approach to investigate the beliefs and perceptions of elite long jump coaches to enhance understanding of athlete performance in competition environments. In doing so, we aimed to more specifically understand: (i) the competitive behaviours of athletes, and (ii), how athletes must adapt actions to the emotional and physical demands of performance environments. Analysis of coaches' perspectives revealed that athlete performance in

long jump competitions was ultimately directed towards achieving one of two performance intentions (maximum jump and sub-maximal jump). These intentions facilitated the emergence of self-regulatory strategies in the performance contexts of *perform*, *respond* and *manage.* This platform of intentionality for self-regulation emerged as a result of unique interactions between individual, task and environmental constraints across the course of a competition. Coach observations, therefore, reflected how a key tenet of athlete performance was the requirement for athletes to continually adapt to the constraints of the performance environment rather than merely completing a technical performance. Understanding of fulfilling this requirement is facilitated by our new theoretical perspective that an athlete must *perform*, *manage* and *respond* in competition environments. This raises important questions over how a coach prepares an athlete for competition and requires critical shifts away from a traditional focus on technically proficient idealised movement patterns. Practice task designs therefore need to provide greater opportunities for athletes to learn to self-regulate in performance contexts that allow them the opportunity to *perform*, *manage* and *respond.*

Coaches' observations revealed how athletes had tactically defined performance intentions that shaped the emergence of behaviours. Adding to previous findings suggesting that athletes used the first round as a 'safety' jump (McCosker et al. 2019), coaches' observations suggested that alternately, some athletes use the first round to jump for maximum horizontal distance. For example, Coach Four wanted his athletes to *perform* in Round 1 and to be 'ready to go' and to 'push the edge'. Importantly, coaches reflected how these intentions can change round by round depending on the needs of the athletes and those of the competition. Coach One for example expressed the importance to *respond* after a 1st round foul and consolidate

with a sub-maximal jump to ensure a legal jump is registered. An athlete's intentions are a key informational constraint that facilitates the manipulation of functional patterns of behaviour (run-up velocity) and hence perception-action couplings (Maraj, Allard, and Elliot 1998; Araújo, Davids, and Renshaw 2019). For example, after a first-round foul, an athlete may emphasise the need to *respond* by making a submaximal jump in Round 2 (i.e., speed/accuracy trade-off) and if successful, can change performance intentions in Round 3 to jumping for maximum horizontal distance or *perform,* knowing they have a legal jump registered. Entering the last three rounds of a competition, the athlete may decide to continue to *perform* by jumping for maximum horizontal distance knowing that previous round jumps have already met performance goals for that competition (i.e., jump a personal best). This conceptualisation of how performance intentions shape emergent behaviours across a competition provides further understanding of a conditioned coupling (in a series of connected jumps) in the performance environment and has important implications for the design of more representative training environments. The context in which a performance takes places dynamically changes in a competition setting and, therefore, an athlete must adapt intentions and actions to meet these demands.

Whilst previous research has asserted that intentionality can frame an athletes interactions with task and environmental constraints to shape emergent behaviour (Araújo, Davids, and Renshaw 2019), coaches' observations suggest that a more complex relationship exists. This complexity arises upon recognition of the premise that there is a connectedness between jumps. Identifying this complex system of jumps where each jump contributes to overall performance outcomes (Renshaw and Gorman 2015) brings specific attention to how an athlete must self-regulate in a competition after a successful or unsuccessful jump. For example, Coach Four noted

how athletes might ‘try too hard’ after a good jump and must *respond* to that previous performance whilst Coach Five expressed how ‘everything changed’ after successive fouls and the athlete needed to *manage* the situation. In both instances, coaches observations reflected how an athlete’s emotional response to previous attempts were intensified, constraining future jump performance and placing the narrative of each athlete in danger of going off script or further off script, providing examples on how emotions are embedded within performances (Araújo, Davids, and Renshaw 2019). These findings gain significance when considering previous investigations have demonstrated how changes in emotions can lead to changes in co-ordination (e.g., Pijpers, Oudejans, and Bakker 2005; Cottyn et al. 2012) and coaches’ observations reflected how positive and negative appraisals of performances can lead to changes in movement. Recognising that these appraisals are cognitively driven (Lazarus and Folkman 1984) is important as a performance reaction would not be emotional if it did not carry significance. From an ecological dynamics perspective emotions and cognitions are thus considered to interact in a similar vein to perception and action (Lewis 2004) and should be recognised by practitioners in the design of practice environments. Intentions, emotions and cognitions should, therefore, not be viewed as separate entities existing in isolation when understanding competitive behaviours. Instead these processes should be viewed as emergent behaviours as an athlete continuously interacts within the performance environment and navigates the performance contexts of *perform, manage* and *respond.*

A key attribute of elite performance is the interaction between action, cognitions and emotions and how these are managed and adapted to suit the performance environment (Connor, Farrow, and Renshaw 2018). Our new

substantive theoretical perspective assists with better understanding how this interaction influences performance. Coaches' observations suggest that if these emotions and cognitions are not managed appropriately, then this can constrain behaviour. For example, Coach Six reflected on the impact of qualifying rounds in major championships and how this was viewed as 'something to lose' and became a 'barrier' to performance. The cognitive evaluation of the qualifying round as something for an athlete to lose and thus *manage*, has significant meaning as an athlete does not win anything for successfully reaching a final. To exemplify how cognitions interact with emotions, this thought of something to lose could also be associated with increases in anxiety associated with potential failure (Lazarus 2000). The barrier that this then creates could be interpreted as an athletes' under (or over) estimation of the running velocity required to meet competition demands resulting in changes in foot placement error on the take-off board and a sub-par performance. Previous research has shown how movement coordination patterns vary according to an individual's cognitive strategy and regulation of emotions (Connor, Farrow, and Renshaw 2018) and coaches observations provide further evidence to support this notion. This situation that athletes had to *manage* serves as an exemplar on how cognitions interact with emotions to shape perception-action couplings and self-organisation tendencies of athletes. These findings suggest that, whilst intentionality may frame each athlete's specific interactions with task and environmental constraints, the success of an athlete in meeting performance goals is further influenced by the athlete's emotional responses emerging from interactions with the momentary task constraints. Emotions, therefore, present as a key constraint on athlete behaviours that emerge as a competition unfolds (Lewis 2004, 2000). These findings highlight the need to build practice tasks based on the ideas of Affective

Learning Design (Headrick et al. 2015) where athletes learn to self-regulate in performance contexts that allow them the opportunity to *perform, manage* and respond.

Our findings have important implications for coaches in the design of practice environments where movements and decisions of athletes should be more representative of those found in competition. Coaching resources (e.g., Brown 2013; Jacoby 2009; Doherty 2007) currently provide valuable knowledge of the mechanical attributes of performance with due emphasis placed on critical positions necessary to achieve a certain performance. Whilst providing an understanding of movement, this methodology fails to address how athletes must self-regulate in competition under interacting constraints. We suggest that our conceptual framework of *perform, respond* and *manage* (see Figure 2.0) be viewed in the context of affective learning design to ensure that athletes gain experience in self-regulating during practice. In this way preparation for competition behaviours could be invited through the specific designs of practice environments, recognising the importance of emotion-laden learning experiences to simulate the constraints of performance environments (Headrick et al. 2015). Through the strategic manipulation of key competition constraints coaches are able to make an evaluation of how athletes navigated these spaces and whether athletes were afforded the opportunity to *perform, respond* and/or *manage.* Central to this is the individualisation of these situational spaces according to each performer and their available resources which will allow for individual adaptations to key informational constraints in the performance environment. This design template will also provide for ‘repetition without repetition’ (Bernstein 1967) through the reduction on emphasis on constant

repetition to promote an idealised movement pattern whilst simulating the physical, emotional and psychological demands of competition

Figure 2.0 near here

(Headrick et al. 2015). Given the identified role of intentionality and associated interactions with emotions and cognitions, it is important for coaches to enable athletes to attune and calibrate their actions under varying and interacting constraints whilst attempting to meet one of the identified performance intentions. For example, if a coach wants their athlete to *perform*, this could be achieved by creating specific 'vignettes' for athletes by designing a performance context whereby an athlete is in the 1st round jump with the intention of jumping for maximum distance. Further to this, if this first jump was a foul jump, then coaches may then ask the athlete to *respond* to the situation through a sub-maximal jump to ensure a legal jump is registered. Alternatively, a coach could create a qualification type scenario in practice, incorporating target jump distances within a pre-determined number of jumps in order to stimulate varied emotions and cognitions from the athlete. This would then create a situation that the athlete would need to *manage* through self-regulation. Allowing athletes to complete a series of connected jumps that replicate the demands in competition provides coaches the freedom to manipulate key competition constraints allowing for individualised 'within-session periodisation'. The creation of these specific 'vignettes' for athletes allows for the conditioned coupling and level of uncertainty that exists in competitive performance. In doing so, coaches can place less emphasis on correcting apparent technical flaws and focus more on providing opportunities for athletes to self-regulate in training and to practice how to continuously adapt to changing task constraints whilst performing

under differing emotional states that are induced in competitive performance (Headrick et al. 2015).

Conclusions

Our findings suggest how increasing the understanding of the performance environment can enhance the knowledge surrounding competition behaviours. By using a constructivist grounded theory approach, we examined the experiential knowledge of elite long jump coaches with the aim of furthering our understanding of the competitive behaviours of elite long jump athletes and how they adapt actions to the emotional and physical demands of performance environments. It is important to recognise that these elite coaches, whilst playing a crucial role in shaping athlete performance, co-construct performance with the athlete. With this in mind, further work is needed to explore the beliefs and perceptions of athletes on what they view as influencing their own performance in competition settings. Analysis of coach observations revealed the recognition of the connectedness between jumps and the conditioned coupling in performance environments both integral to moving beyond reductionist approaches of viewing jumps in isolation. By conceptualising that athletes must *perform*, *respond* and *manage* in competition contexts, provides us with a basis for understanding movement under varying competitive contexts where, importantly, athletes must adapt to changing task constraints under varying emotional states induced by the competition environment (Jones 2003; Lewis 2004). This has important implications for coaches in the design of practice environments where decisions and actions should simulate those found in competition (Pinder et al.

2011). We suggest that our new substantive theoretical framework of *perform, respond* and *manage* be used alongside affective learning design to help in creating individualised training interventions to assist in maximising an athlete's opportunity to self-regulate in training, adapting to changing task constraints. A challenge for future research is to address limitations surrounding the homogeneous sample used within this investigation and how years of experience influence coaches' observations of performance. Coaches of different gender and level of experience maybe attuned to different information within the performance environment and future research can be used to investigate any differences present. Future research is also needed to quantify how our identified performance contexts change perception action couplings in competition environments. This will allow for the development of more contextual training interventions where athletes will be required to attune to and exploit specific informational constraints to regulate intentions, and perception-action couplings during run-ups in sports.

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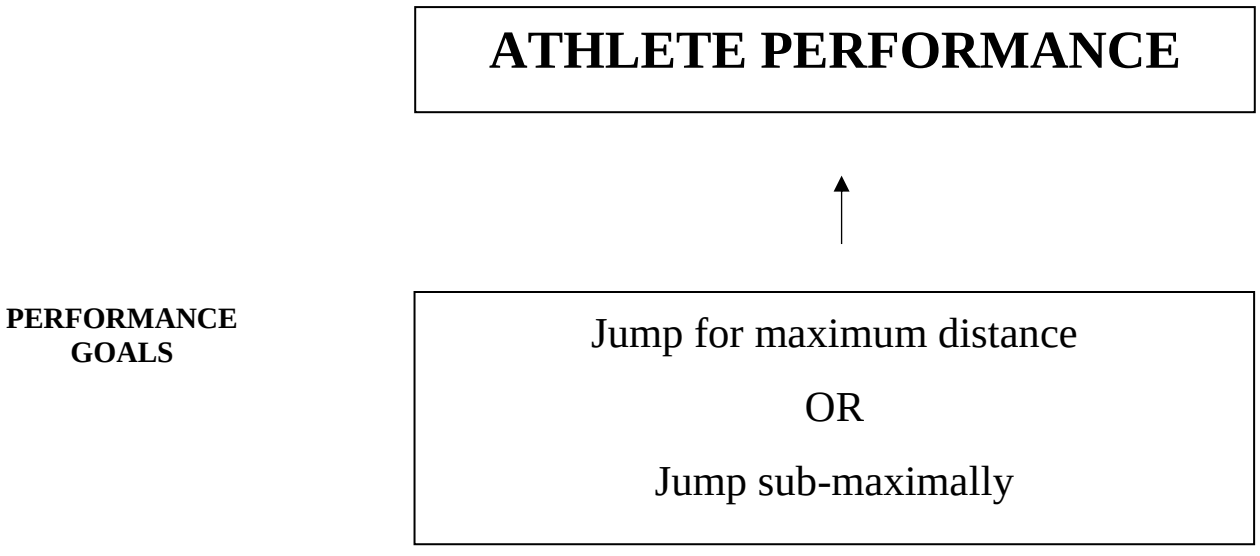
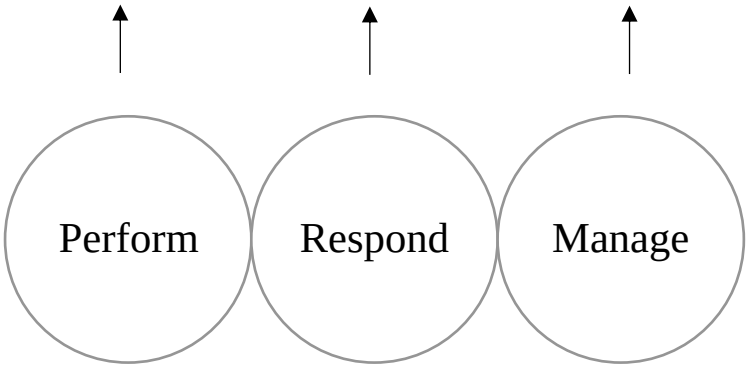
Figure 1.0


ATHLETE PERFORMANCE
PERFORMANCE GOALS
Jump for maximum distance
OR
Jump sub-maximally

PERFORMANCE CONTEXT

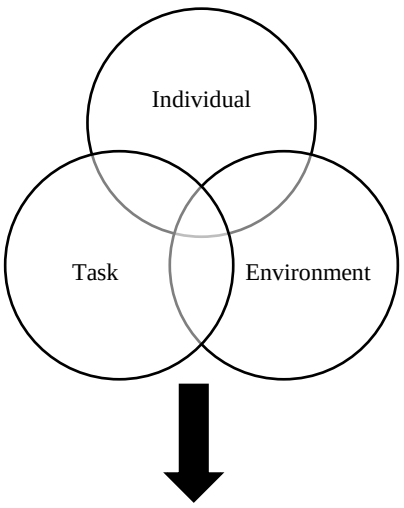


INFLUENCING FACTORS ON PERFORMANCE

Athlete ability	State of warm-up	Runway speed	Desire	Round 1	Competitor performances
Crowd input	Round number	Pre-existing injuries	Previous jump outcomes	Position in field	Competition level
Wind Strength	Emotions	Top 8 after round 3	Pressure to produce	Wind direction	Final
Qualifying round	Time of season	Fatigue	Mental capacity	Motivation	Adrenalin
Physical capacity	Self-confidence	Type of track surface	Athlete expectations		

Figure 2.0

Interacting Constraints



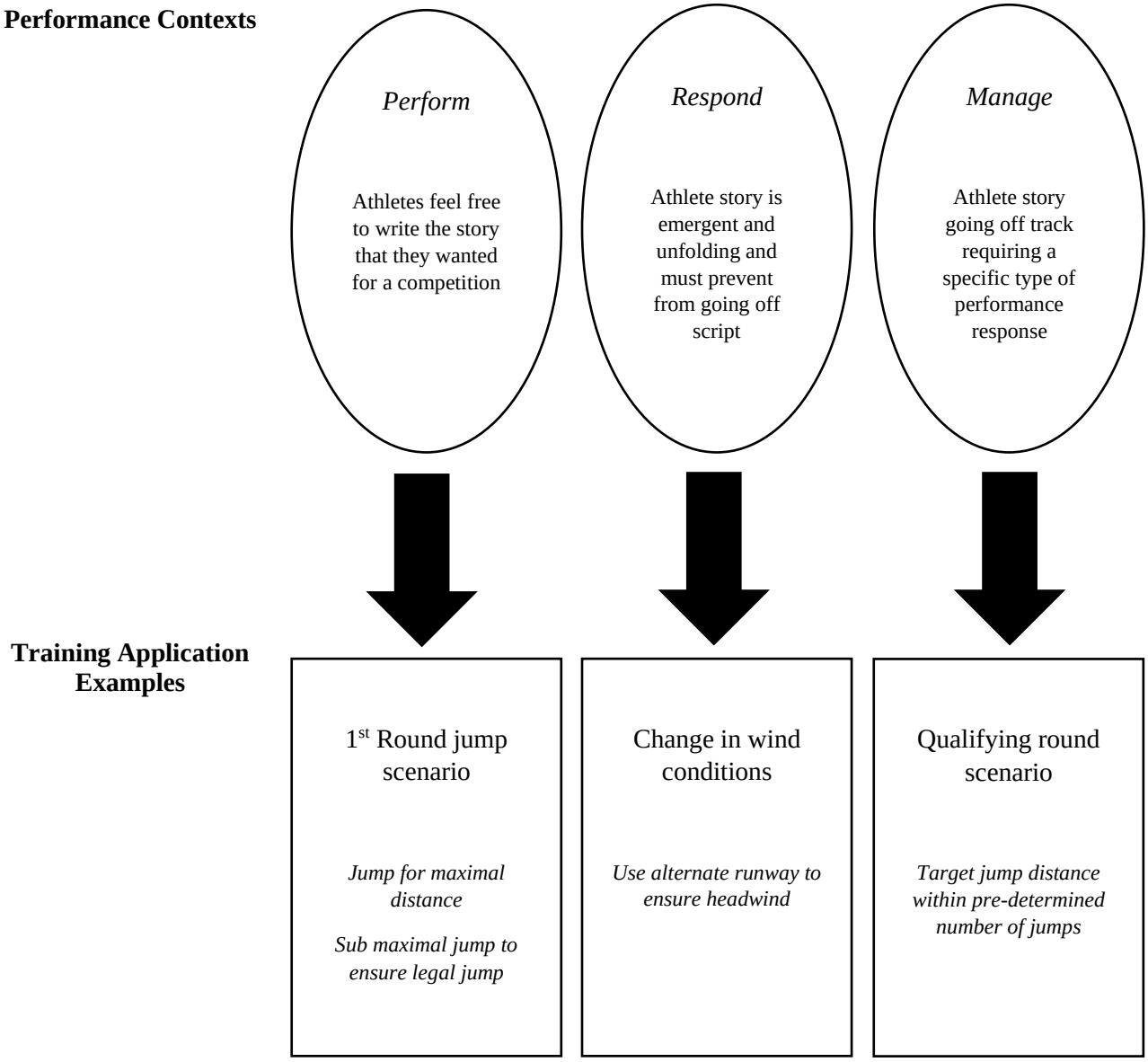


Figure 1.0 Caption

Perform, Respond and *Manage* conceptual framework to assist in the understanding of athlete behaviours in competition settings. Each performance context was conceptually formed not to represent a rigid set of characteristics that emerge within each performance setting. Rather, each context represented a situation that formed within a competition that warranted a specific adaptation to performance towards achieving one of two performance goals (i) jump for maximum horizontal distance, or (ii), jump sub-maximally to ensure a legal jump.

Figure 2.0 Caption

Practical application of the *Perform, Respond* and *Manage* conceptual framework. Through the strategic manipulation of key competition constraints coaches are able

to make an evaluation of how athletes navigated these spaces and whether athletes were afforded the opportunity to *perform, respond* and/or *manage.* Central to this is the individualisation of these situational spaces according to each performer and their available resources which will allow for individual adaptations to key informational constraints in the performance environment.