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**Exploring bodily sensations experienced during flow states in professional national hunt jockeys: A connecting analysis**

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## Abstract

Previous research has suggested that distinct bodily sensations are experienced by athletes during flow states, and could represent a sport-specific characteristic of this phenomenon. This study aimed to enrich understanding about bodily sensations and flow states in sport by exploring this experience in national hunt jockeys. The interspecies nature of horse-rider partnerships accentuates the importance of bodily awareness in equestrian sports. Therefore, horse racing provided a fertile context in which to investigate bodily sensations experienced during flow states in sport. In-depth, semi-structured interviews exploring the experience of flow in horse racing were undertaken with 10 professional national hunt jockeys (*M* age = 28.1 years). Data were interpreted iteratively using inductive categorising/thematic and connecting analyses. Present findings suggested that flow states in jockeys produce an idiosyncratic and multifaceted sensory experience, and indicated that altered physical perceptions during flow were not restricted to kinaesthetic properties. Jockeys explained that distinct bodily sensations were experienced during flow states, and described alterations in their perceptions of kinaesthesia, balance, arousal, and strength of touch. Each of these bodily sensations was discussed in relation to sensory information received from the horse, and a connecting analysis enlightened the factors underlying the realisation of these unique bodily sensations that accompanied flow states. Findings are discussed with respect to the existing literature on flow in sport and recommendations for future research are outlined. Further, possible considerations regarding the inclusion of bodily sensations as a characteristic of the flow experience in sport are outlined.

Keywords: optimal experience; senses; kinaesthetic; qualitative; horse; equestrian.

1 **Exploring bodily sensations experienced during flow states in professional national hunt**  
2 **jockeys: A connecting analysis**

3 **Introduction**

4 Flow is an intrinsically rewarding subjective experience that occurs when individuals  
5 are challenged to their limits, but perceive their skills to be adequate to meet the demands of  
6 the task, leading to feelings of control, complete absorption in the task, and the perception  
7 that actions occur in a spontaneous and automatic manner (Csikszentmihalyi 2002). The most  
8 common understanding of flow centres on Csikszentmihalyi's (1990) conceptualisation of the  
9 phenomenon as nine dimensions, comprising: (i) challenge-skills balance; (ii) action-  
10 awareness merging; (iii) clear goals; (iv) unambiguous feedback; (v) concentration on the  
11 task at hand; (vi) sense of control; (vii) loss of self-consciousness; (viii) transformation of  
12 time; and (ix) autotelic experience. Although this conceptualisation has been the primary  
13 framework adopted by flow researchers in sport (see Swann *et al.* 2012 for a review),  
14 questions have been raised about the capacity of Csikszentmihalyi's (1990) nine dimensions  
15 to fully capture the flow experience in sport, particularly with respect to bodily sensations  
16 (Swann 2016). The aim of this study was to explore bodily sensations and flow in sport by  
17 investigating this phenomenon in horse racing, a sport in which bodily sensations are  
18 fundamental to athletic performance.

19 **The experience of flow in sport**

20 Numerous studies have adopted qualitative methods (e.g. semi-structured interviews)  
21 to understand how flow is experienced by athletes across a range of sports (e.g. Bernier *et al.*  
22 2009, Chavez 2008, Jackson 1996, Sugiyama and Inomata 2005, Swann *et al.* 2015a, Young  
23 2000). Overall, the descriptions of flow emanating from these studies have largely reconciled  
24 with Csikszentmihalyi's (1990) nine dimensions framework. However, the majority of these  
25 studies, with the exception of Chavez (2008) and Swann *et al.* (2015a), employed deductive

1 thematic analysis, thereby matching codes generated from the data with the dimensions of  
2 flow proposed by Csikszentmihalyi (1990). Issues surrounding this analytical approach have  
3 been outlined by Swann *et al.* (2015a), who suggested that coding data into a pre-existing  
4 theoretical framework could have constrained the potential emergence of a more refined,  
5 sport-specific conceptualisation of flow.

6         One particular issue with using a deductive style of analysis is that sport performance  
7 involves the execution of complex motor skills, and the level of physical exertion required for  
8 task execution is axiomatically greater than, for example, more cognitively-oriented tasks  
9 (e.g. computer gaming, writing). During sporting tasks, athletes constantly monitor their  
10 bodily movements (Jackson and Csikszentmihalyi 1999). Indeed, Jackson (1992, p. 177)  
11 stated that ‘an acute awareness of body’ can occur during flow states, and it has been  
12 proposed that this awareness of bodily movements could produce a distinct sensory  
13 experience during flow (Toner *et al.* 2016). Kinaesthetic perceptions and bodily sensations  
14 appear to be particularly relevant in qualitative studies that have investigated flow in sport  
15 (Swann *et al.* 2012), although these elements do not easily align with the nine dimensions  
16 framework (Csikszentmihalyi 1990). Chavez (2008) reported that collegiate athletes  
17 described bodily sensations as part of their flow experiences, which included enhanced body  
18 sensitivity and attunement. Similarly, swimmers described an intensification of their bodily  
19 sensations, and specifically referred to a feeling of heat in their extremities and body, a  
20 stronger heartbeat, and ‘tingling’ sensations in their muscles (Bernier *et al.* 2009).  
21 Furthermore, altered cognitive and kinaesthetic perceptions were reported as characteristics  
22 of flow states by elite golfers, who elucidated changes in their visual sensitivity (e.g. visual  
23 narrowing, visualising well) and physical sensations (e.g. sense of lightness, feel enhanced  
24 physically) during flow (Swann *et al.* 2015a).

1           While bodily sensations were not included as dimensions of the flow experience in  
2 studies in sport that analysed data deductively, several higher-order and raw data themes  
3 produced in these studies could be interpreted as indications of altered bodily perceptions  
4 during flow. For example, Jackson (1996) coded ‘floating sensation’ (e.g. being light, like  
5 floating across the ground) into action-awareness merging, and categorised ‘body feels great’  
6 and ‘feel strong’ as higher-order themes within the autotelic experience dimension. Likewise,  
7 Sugiyama and Inomata (2005) categorised ‘body feels great’ into autotelic experience, and  
8 included ‘very balanced’ and ‘body was light’ in the unambiguous feedback dimension.  
9 Accordingly, these themes appear to closely resemble perceptions of bodily sensations  
10 reported in other studies in sport (Bernier *et al.* 2009, Chavez 2008, Swann *et al.* 2015a).  
11 Hence, it appears that deductively coding data *into* Csikszentmihalyi’s flow framework led to  
12 the submersion of altered kinaesthetic sensations into other dimensions of the flow  
13 experience, and limited the capacity of researchers to explicate how alterations in perceptions  
14 of the body could constitute an idiosyncratic feature of flow in sport.

15           As Csikszentmihalyi’s (1990) conceptualisation of flow emphasises cognitive aspects  
16 of this experience, some have argued that this perspective has limited the potential to  
17 understand this phenomenon as a corporeal experience (Dashper 2017, Humberstone 2011).  
18 Although perceptions of the body are not accounted for in the nine dimensions of flow,  
19 Csikszentmihalyi (1990) stated that ‘the simple act of moving the body...provides optimal  
20 experience...each motor function can be harnessed to the production of flow’ (p. 95).  
21 Interestingly, in the seminal work by Csikszentmihalyi (1975), climbers reported an  
22 intensification of kinaesthetic sensations during flow. Moreover, the Flow Questionnaire  
23 (Csikszentmihalyi and Larson 1984), which contains an amalgamation of direct quotes  
24 provided by participants in Csikszentmihalyi’s (1975) early work, includes the phrase ‘my  
25 body feels good’ among the descriptions of flow. As such, it appears that altered bodily

1 perceptions could constitute a feature of the flow experience, but is not currently represented  
2 by the nine dimensions framework. Therefore, in light of the distinct relevance of bodily  
3 movements in sport, further investigation and refinement of the flow experience is warranted  
4 to account for the importance of kinaesthetic and bodily perceptions in this domain (Swann  
5 2016).

## 6 **Equestrian Sports**

7         It has been suggested that the experience of flow could differ between sporting  
8 contexts (e.g. Chavez 2008, Kimiecik and Stein 1992) and that certain characteristics of the  
9 flow state might be more relevant in particular sports (e.g. Jackson 1992, 1996). One domain  
10 in which bodily sensations are of particular importance for sporting performance is  
11 equestrianism. Although the partnership involved comprised two humans, elite figure skaters  
12 reported that the unique dynamic of combining with another individual produced a distinct  
13 flow experience to that achieved when competing individually (Jackson 1992). While  
14 equestrian partnerships are comparable to sports involving human-human partnerships (e.g.  
15 pairs skating) in terms of the physical contact between both partners, equestrian sports have  
16 the additional feature of combining individuals from different species (Keaveney 2008). The  
17 interspecies nature of horse-human relationships denotes that the shared language between  
18 horse and rider is physical and embodied rather than verbal in nature (Evans and Franklin  
19 2010). Horse riders and horses are highly attuned to their bodily sensations and utilise their  
20 bodies to transmit and receive information (Brandt 2004). This communication between horse  
21 and rider is an interactional process (Wipper 2000), whereby messages are conveyed through  
22 touch and proprioception (i.e. perception of the position of one's bodily movement - Hansen  
23 2014). In acknowledging the relevance of the body in horse-rider relationships, Maurstad *et*  
24 *al.* (2013) stated that horse riding 'is about bodily sensations' (p. 326). Indeed, it has been  
25 suggested that flow states in horse riding could produce a unique kinaesthetic experience

1 (Thompson and Nesci 2016). Thus, equestrian sports could provide a fertile context to  
2 explore bodily sensations experienced during flow states in sport.

3         Horse riding produces a complex and embodied experience (Dashper 2017).  
4 Individuals who participate in equestrian sports aspire to achieve partnership (Wipper 2000)  
5 and ‘oneness’ (Birke and Brandt 2009, p. 196) with their horse. The synchronisation of horse  
6 and rider is commonly recognised by riders when they describe the joy associated with  
7 participating in equestrian sports (Thompson, 2011). In addition to intrinsic rewards, it is also  
8 acknowledged that good horse-rider partnerships are important for mitigating the substantial  
9 risks associated with riding horses (Thompson and Nesci 2016). A myriad of expressions  
10 have been advanced to capture this notion of unification of horse and rider, including  
11 embodying the centaur (Game 2001), ‘centaurability’ (Thompson 2011), co-being (Maurstad  
12 *et al.* 2013), and becoming Pegasus (Birke and Brandt 2009). This harmonisation of horse  
13 and rider produces “an unmistakable moment in the process of finding-creating the rhythm  
14 when ‘it comes together’” (Game 2001, p. 8). These moments of rhythmic mutuality can  
15 generate a ‘kinaesthetic act of transcendence’ (Evans and Franklin 2010, p. 183), and horse  
16 riders often refer to a distinct ‘feel’ that embodies this sense of unity with their equine partner  
17 (Dashper 2017). Therefore, exploring the bodily sensations experienced during flow in  
18 equestrian sports could provide valuable insights into the sensorial qualities underlying the  
19 harmonisation of horse and rider.

20         Horse riders participate in a range of equestrian activities, including eventing,  
21 dressage, show jumping, endurance riding, polo, and horse racing. In a study exploring the  
22 factors influencing the occurrence of flow in horse racing<sup>1</sup> (Jackman *et al.* 2015), flat-race  
23 jockeys identified that *confidence and positive thinking, positive performance assessment,*  
24 *focus, preparation, optimal arousal, motivation to perform, optimal interaction with trainer,*

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<sup>1</sup> In this article, horse racing refers to thoroughbred racing.

1 *optimal physical state, optimal environmental and situational conditions, and experience*  
2 facilitated flow. These factors were largely consistent with previous understanding of flow in  
3 sport (see Swann *et al.* 2012 for a review), but two novel themes also emerged, namely  
4 *positive horse demeanour and performance* and *optimal relationship between horse and*  
5 *jockey*. In turn, it was suggested that the flow experience in jockeys appeared to be affected  
6 by and permeated through the horse-rider dyad. More specifically, Jackman *et al.* (2015)  
7 reported that partnering a horse that was performing proficiently (e.g. rhythmic galloping<sup>2</sup>  
8 motion), displayed an appropriate racing temperament (e.g. remain calm and cope with  
9 demands), and achieved an optimal level of arousal (i.e. relaxed) prior to and during the race  
10 facilitated flow. In contrast, observable and felt signs of over-arousal (e.g. sweating, muscular  
11 tension) were adversative to flow. These findings suggest that bodily sensations are  
12 particularly relevant for the experience of flow in horse racing. Thus, further exploration of  
13 the phenomenon in this domain could offer a rich lens through which to advance  
14 understanding about bodily sensations associated with flow states in sport.

15 To date, most qualitative research on flow states in sport has employed thematic  
16 analysis (i.e. raw-data themes, higher-order themes, and general dimensions) to interpret the  
17 factors that facilitate, inhibit, and disrupt flow states (e.g. Jackman *et al.* 2015, Jackson 1992,  
18 1995, Sugiyama and Inomata 2005), and describe the subjective experience of athletes during  
19 flow (e.g. Chavez 2008, Jackson 1996, Swann *et al.* 2015a). While previous studies have  
20 attempted to temporally distinguish the facilitative conditions from the flow characteristics,  
21 overlaps between these elements are apparent (Swann *et al.* 2012). Chavez (2008) outlined  
22 that there was ambiguity regarding whether or not bodily sensations were considered to be a  
23 facilitative condition for flow occurrence or a characteristic of the flow experience, as some

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<sup>2</sup> Galloping consists of a high-speed, asymmetrical, four-time beat (i.e. non-lead hind, lead hind, non-lead fore, lead fore) in which the horse is airborne (i.e. not touching the ground) for one phase per stride (Pilliner *et al.* 2002).

1 participants outlined that internal sensations acted as precursors to flow, while others outlined  
2 that unique bodily sensations were experienced *during* flow.

3         Connecting analysis could be useful to address the issues outlined above as this  
4 approach enables the researcher to search for key relationships within the data and  
5 subsequently create links between categories (Maxwell 2013). This analytical approach can  
6 complement thematic/categorising analysis as synthesising categories generated from the data  
7 could provide a more composite understanding of the information (Maxwell and Chmiel  
8 2014). Swann *et al.* (2015b) utilised connecting analysis to better understand the occurrence  
9 of flow in elite golf by searching for and identifying connections between factors that  
10 facilitated the occurrence of flow and those that characterised the experience. The results of  
11 this process yielded novel insights into the relationship between the antecedents and  
12 characteristics of flow in elite golf in that 24 connections were identified between the factors  
13 facilitating flow and the characteristics of flow. For example, elite golfers described a feeling  
14 of confidence during flow, and the connecting analysis revealed that this belief could stem  
15 from several factors, including a high-quality performance, effective practice and preparation,  
16 optimal environmental and situational conditions, the caddie, positive feedback, and  
17 commitment. As previous research reported that horses could facilitate the flow experience in  
18 horse racing (Jackman *et al.* 2015), connecting analysis could be a valuable analytical  
19 strategy to investigate how horses can facilitate corporeal aspects of the flow experience in  
20 jockeys.

21         Horse racing is segregated into two categories: flat-racing and national hunt racing. In  
22 flat-racing, races take place on flat tracks, and can range in distance from five furlongs<sup>3</sup> to  
23 two-and-a-half-miles. National hunt races are longer in distance than flat races, ranging in  
24 length from two to four-and-a-half miles, and involve the additional task of jumping fences or

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<sup>3</sup> A furlong is the equivalent of 220 yards, or one-eighth of a mile.



1 years, ranging from 20 to 38 ( $SD \pm 5.21$ ). All participants held professional national hunt  
2 licences at the time of the study. The mean career length was 11.6 years ( $SD \pm 5.06$  years).  
3 Professional participants were selected on the basis that highly-skilled athletes are more  
4 likely to be familiar with the concept of flow and have a larger reference base of experience  
5 to draw from (Jackson 1996).

### 6 ***Procedure***

7 Ethical approval for the study was granted by the departmental ethics committee at an  
8 Irish institution. The participants were contacted directly by the first author and asked if they  
9 would be interested in taking part in an interview regarding their experiences of flow in horse  
10 racing. Upon agreement, an interview was arranged for a location and time that was  
11 convenient for the participants. Prior to commencing the interview, participants were given  
12 the opportunity to ask further questions about the study and provided written consent prior to  
13 commencing the interview. As each interview transcript was sequentially analysed, the  
14 research team could perceive when theoretical saturation (e.g. Holt 2016) became apparent.  
15 After the seventh interview, the emergence of new information became substantially reduced.  
16 In accordance with good practice (Guetterman 2015), three further interviews were  
17 conducted. As no further themes or connections emerged during that process, theoretical  
18 saturation was deemed to have occurred. All interviews were conducted face-to-face and  
19 digitally recorded, with brief notes also taken throughout to aid the development of  
20 preliminary themes and connections. The interviews, which lasted on average 42 minutes ( $SD$   
21  $\pm 6$ ), were later transcribed verbatim in preparation for data analysis.

### 22 ***Interview guide***

23 A semi-structured and open-ended approach was adopted by the researcher to enable  
24 participants to elaborate on areas that emerged during the interview and to permit the  
25 utilisation of probing questions to obtain further insight (cf. Sparkes and Smith 2014). Based

1 on the aims of the current study and details provided in previous research (e.g. Jackman *et al.*  
2 2015, Jackson 1995, Swann *et al.* 2015a), a semi-structured interview guide was developed.  
3 Consistent with previous research (e.g. Swann *et al.* 2015b), participants were initially asked  
4 if they were familiar with the term flow. If not, a series of terms (e.g. ‘in the groove’ or ‘auto-  
5 pilot’) used interchangeably with flow in previous research (e.g. Jackson 1996, Young 2000)  
6 were employed in an attempt to familiarise participants with the concept. Subsequently,  
7 participants were asked to give an example of one memorable performance matching these  
8 terms and to describe their experience during that race. The interviewer judged whether or  
9 not these accounts were consistent with common conceptualisations of flow in sport (e.g.  
10 Jackson 1996, Swann *et al.* 2015a) prior to continuing the interview. All descriptions were  
11 deemed to be congruent with flow and participants were then posed a number of questions,  
12 including: (a) can you think of a personal experience in a race that was similar to this?; (b)  
13 can you describe that experience in as much detail as possible?; (c) what factors enable you to  
14 have these experiences?; and (d) what factors prevent you from having these experiences? In  
15 addition to these standard questions, probing questions (e.g. can you tell me more about that  
16 aspect of your experience?) were employed to obtain further information (cf. Sparkes and  
17 Smith 2014). The guide was pilot tested with two conditional jockeys<sup>5</sup>. The pilot study led to  
18 minor adjustments in the interview guide and the addition of more specific probing questions.  
19 Pilot data were not included in the final study as these jockeys did not hold professional  
20 licences.

## 21 ***Analysis***

22 A research team, made up of the first three authors, was used to guide the analytical  
23 process. Initially, the first author (i.e. principal investigator) familiarised herself with the data

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<sup>5</sup> Prior to obtaining a professional licence, jockeys receive a conditional licence until the occasion of their 60<sup>th</sup> win or passing their 25<sup>th</sup> birthday. Conditional jockeys are allowed to reduce the amount of weight allocated to their horse during the race. The amount of weight that conditional jockeys can claim is reduced in accordance with the number of winners accumulated (i.e. 0-20 wins - 7 lbs; 21-40 wins - 5lbs; 41-60 lbs - 3 lbs).

1 by undertaking multiple readings of each individual transcript in a process known as  
2 ‘indwelling’ (Maykut and Morehouse 2002). In line with recommendations (Maxwell and  
3 Chmiel 2014), data analysis involved a recursive process of alternating between inductive  
4 categorising/thematic analysis and connecting analysis. The inductive thematic analysis  
5 followed a similar procedure to that outlined by Braun and Clarke (2006). Initially, the first  
6 author searched for quotes that described the bodily sensations experienced during flow to  
7 produce initial *codes*. These codes were then inductively sorted and combined to form  
8 *higher-order themes*. Subsequently, an identical process of synthesizing similar *higher-order*  
9 *themes* was undertaken to generate more fundamental *categories*, which described the bodily  
10 sensations experienced by participants during flow. These same steps for thematic analysis  
11 were repeated to determine the factors pertaining to the horse that facilitated flow.

12         In accordance with recommended procedures (Maxwell 2013, Maxwell and Chmiel  
13 2014), the connecting analysis involved searching for participant quotes that specifically  
14 linked factors relating to the horse to the bodily sensations reported by jockeys during flow.  
15 The clarity and richness of the described relationship between categories rather than the  
16 number of participants that discussed these links took precedence when exploring the  
17 connections between categories. This decision was taken based on the assertion that more  
18 represented quotations do not necessarily infer the importance of a link (Braun and Clarke  
19 2006). Categorising/thematic and connecting analysis were viewed as being complementary  
20 rather than mutually exclusive (Maxwell and Chmiel 2014), and moving iteratively between  
21 both types of analysis enhanced the researchers understanding of the contextual features  
22 surrounding each category and connection. To aid this process, other members of the research  
23 team provided continual critical evaluations of the first author’s interpretation of the data  
24 through the process of peer debriefing, as outlined below, until consensus was obtained.

25 *Trustworthiness*



1 themes (italicised in text). In addition, connections between the factors pertaining to the horse  
2 that facilitated flow (emboldened in text) and the bodily sensations reported by jockeys  
3 during flow are outlined. Drawing directly on the experience of participants, verbatim quotes  
4 are included throughout to illustrate themes and connections.

5 [INSERT FIGURE 1 NEAR HERE]

### 6 ***Kinaesthetic perceptions***

7 Distinct kinaesthetic perceptions in the horse-jockey dyad characterised the flow  
8 experience for national hunt jockeys. A signature feature of the flow experience for all  
9 jockeys was the distinct *kinaesthetic feel* that accompanied motion, as Nick outlined: ‘the feel  
10 they give you, the way they move to the start, and the way they carry you is different.’ The  
11 distinct kinaesthetic perceptions experienced during flow also included references to  
12 alterations in perceptions of speed. The jockeys outlined that a sense of control over the speed  
13 at which they were galloping accompanied the flow experience. Whereas the inhibition of  
14 flow was linked to insufficient or excessive speeds, flow states were characterised by the  
15 perception that the horse-jockey dyad was *moving at the right pace*: ‘when you are on top of  
16 a horse and you are in the zone, you never feel like you are going too quick’ (Chris). In  
17 explicating this embodied experience during flow, the sense that horse and jockey were  
18 *moving as one* was prominently discussed. The synchronised movements concomitant with  
19 flow states produced a distinct perception of connectedness and rhythmic mutuality between  
20 horse and jockey, which led to a switching of their attentional focus from the horse towards  
21 the broader performance context: ‘you are in rhythm with him the whole way... You nearly  
22 see everything else going on because you are just not thinking about what you and your horse  
23 are doing...everything has just clicked’ (Nick). The rhythmic and unified nature of motion  
24 was one of the most integral features of the flow experience for these jockeys.

1           In acknowledgement of the importance of jumping in national hunt racing, these  
2 distinctive kinaesthetic perceptions were proliferated when a horse was **jumping**  
3 **proficiently**. This higher-order theme captured the idiosyncratic feeling that surfaced when  
4 partnering horses that approached fences with the correct stride pattern and initiated their  
5 jump from the optimum take-off point: ‘in jump racing, you definitely feel it...they jump  
6 brilliantly...they can pick a stride, and set themselves up very well’ (Sam). A common view  
7 amongst jockeys was that horses with superior jumping ability were more likely to induce the  
8 kinaesthetic ‘feel’ associated with flow states: ‘If you are on nicer horses, they give you that  
9 [feel]. They will end up jumping better so it gives you a much nicer feel’ (Mark). The distinct  
10 kinaesthetic perceptions associated with flow states were heightened when jockeys judged  
11 that their horses were **in rhythm**. These jockeys were highly sensitive to detecting when their  
12 horse was moving in a rhythmic and fluent manner, and conveyed their ability to distinguish  
13 the kinematic ability of horses based on the bodily sensations experienced during motion:  
14 ‘You know a [good] horse underneath you. They can gallop easier. They have more in their  
15 stride. They jump better. [On] inferior horses...(pause)...they’re under pressure to gallop,  
16 and that puts even more pressure on [you] when you are jumping’ (Michael). Positive  
17 feedback about the motion of the horse was integral to producing the kinaesthetic perceptions  
18 elicited during flow states. While the jockeys could identify that their horses were **galloping**  
19 **proficiently** at an early stage in the performance, this information could be acquired prior to  
20 the commencement of the race (e.g. cantering to the race starting point): “You can tell the  
21 type of horse you are sitting on by cantering down to the [starting] post. You sometimes  
22 canter down and think ‘oh, this fella is quite nice’” (Mark). The capacity to obtain this  
23 positive feedback about the horse’s motion prior to the performance enhanced the immediacy  
24 with which jockeys could experience altered kinaesthetic perceptions.

25 *Lightness of touch*

1           During flow states, the jockeys outlined that there was a distinct delicateness in the  
2 strength of their instructional cues. This *lightness of touch* was epitomised by the reduced  
3 level of tension exerted on the reins, which was an expression of the innate harmonisation  
4 between horse and jockey:

5           There are some you feel you are interacting so well with them, and a little  
6 touch is all you need...they aren't pulling you and you don't have to be  
7 pulling them back in, and you have a nice contact on the reins. (Sam)

8 In contrasting the perceptions of touch experienced during flow to performances in which  
9 flow was inhibited, he continued by stating: 'on another one you might have to yank the reins  
10 going down to the jump and give it a big kick to get it to go.' Further, the lightness of cueing  
11 during flow was regarded as an observable indicator of the experience.

12           A **favourable response to command** from the horse enabled the initiation and  
13 continuation of these deft instructional cues during flow states. By generating the desired  
14 behavioural response from the horse through more delicate movements compared to normal  
15 performances, this created the sense that horse and jockey were in tune with one another:

16           It's just so much easier to ride a good horse. You don't have  
17 to...(pause)...nothing is an effort. You don't have to try and do anything,  
18 everything you ask the horse to do, it will do it for you. You're so in rhythm  
19 with the horse that without even trying the horse is listening to you. You don't  
20 have to force anything or make any drastic moves. Nothing is difficult... it just  
21 happens. It just flows. (Nick)

22 The likelihood of being afforded the opportunity to deliver subtler and more refined  
23 instructional cues was greatest when jockeys partnered horses with superior ability:

24           You feel as though you know everything that's going to happen before it  
25 happens. It's very rare that you'd be on a horse that nice...There is very little

1 interaction with the horse...you only have to make very gentle touches and  
2 they'll automatically give you every reaction that you want. (Sam)

3 The capacity to experience this bodily sensation was considered to be highly contingent on  
4 the performance and response efficacy of the horse. In contrast a less desirable/prompt  
5 response to command led to more vigorous cueing commands, thus opposing the lightness of  
6 touch concomitant with flow states.

### 7 *Optimal arousal*

8 The jockeys in this study reported that optimal arousal was an essential feature of  
9 their flow states. A *relaxed* physical state was described during flow, and this sensation  
10 appeared to be a somatic indicator of the calm psychological state experienced during flow,  
11 as Ben outlined: 'you are a little bit more relaxed and mentally things are happening a little  
12 bit slower in your mind too.' In addition to this feeling of relaxation, these jockeys outlined  
13 that distinct perceptions of *positive energy* were concomitant with their flow states, as  
14 conveyed by statements including: 'you have a positive energy about you' (Adam); and 'it  
15 gives you this energy that you didn't know you have' (David). In acknowledgement of the  
16 physiological sensations emitted by optimal arousal and the physical connection between  
17 horse and rider, it was explained that these bodily sensations could be transmitted to the horse  
18 through the cutaneous interface between horse and rider:

19 When you are more relaxed, your body is more relaxed, and when you are  
20 more relaxed, the horse is more relaxed and trusts in you more. When you are  
21 sitting on the horse [in flow], you give it a more positive vibe when you are  
22 riding. (Nick)

23 A positive perception of the horse's level of physiological activation was integral to  
24 achieving optimal arousal. The jockeys explained that a **relaxed** horse was important to  
25 experience the relaxation associated with flow states: 'At the time when it's going perfectly,

1 the horse will be calm, and will want to go the same pace as everyone else' (James). Positive  
2 sensations also stemmed from perceiving that a horse was **feeling good**. A noteworthy  
3 finding was the perception that symptoms of physiological arousal in the jockey could be  
4 interpreted by the horse and reciprocated across the horse-jockey dyad, as Nick outlined:

5       You automatically gain confidence from sitting on a better horse. From him  
6       giving you more confidence, you'll give him confidence as well and it just  
7       makes everything easier...the horse has the same mentality [as you] really and  
8       they run better for it. Maybe that's in my head, but I think horses run better for  
9       me when I'm confident.

10 The jockeys explicated the ultrasensitive physiological antennae of horses ('they get a sense  
11 of what you are thinking') and their capacity to discriminate between bodily sensations  
12 emitted by jockeys (e.g. anxiety or relaxation).

### 13 *Perceptions of balance*

14       Information concerning perceptions of balance is sourced from the vestibular system,  
15 and a feeling of equilibrium was reported as a feature of the flow experience. In explicating  
16 the importance of balance for riding horses, these jockeys appeared to be highly sensitive to  
17 acquiring and interpreting information about their own balance as well as that of the horse.  
18 The distinct perception of *balance* experienced during flow was a highly desirable sensation:  
19 'Everything is in a balanced situation. It's going to feel nicer, it feels better' (David). This  
20 bodily sensation was a hallmark of the heightened levels of kinematic effectiveness in the  
21 horse-jockey dyad experienced during flow states.

22       The achievement of this bodily sensation was highly dependent on the level of  
23 equilibrium achieved by the horse during performances. Jockeys emphasised the reciprocal  
24 nature of equilibrium within the horse-jockey dyad, with the degree of equilibrium in one  
25 partner affecting the equilibrium of the other. A **balanced** horse helped jockeys to achieve

1 this sense of equilibrium during the performance. It was broadly discussed that some horses  
2 are more proficient in maintaining their own equilibrium than others, and that this capacity  
3 enhances the likelihood of a jockey realising the sense of balance associated with flow. An  
4 additional finding was that the equilibrium of the horse could enhance perceptions of control  
5 and effortlessness during performances, as Sam explained:

6 A horse running well is really the same as a nice runner. They are very  
7 controlled, their body is perfectly balanced and they are perfectly  
8 composed...If the horse is perfectly balanced, they are in control of everything  
9 in that moment, so you are sitting on it and having to do very little work really.  
10 If the horse is balanced in itself, it's very easy to look stylish and look neat  
11 and tidy on top of it.

12 In contrast, a horse that was unbalanced prevented the achievement of equilibrium associated  
13 with flow. Subsequently, these jockeys outlined that such negative bodily sensations forced  
14 them to adjust their riding position, which resulted in the inefficient use of energy resources:  
15 'If a horse is unbalanced, it's going to be pulling and dragging out of you, which causes you  
16 then to have to try and counter-balance them, so there is a massive waste of energy in that  
17 system' (Mark). This example highlights that being balanced not only enhanced their  
18 subjective experience, but was also integral to optimising performance.

## 19 **Discussion**

20 This study was designed to better understand the bodily sensations experienced by  
21 athletes during flow by qualitatively exploring this phenomenon in national hunt jockeys. The  
22 primary contribution of this study was the identification of an amalgam of bodily sensations  
23 experienced by jockeys during flow. In turn, this study begins to answer calls for further  
24 understanding of bodily sensations and flow in sport (Chavez 2008, Swann 2016) by  
25 providing in-depth insights into how perceptions of the body can alter during flow from the

1 perspective of athletes who rely heavily on bodily sensations during their performances. The  
2 present research builds on previous work that identified altered bodily sensations as  
3 components of the flow state in sport (e.g. Bernier *et al.* 2009, Chavez 2008, Swann *et al.*  
4 2015a). By doing so, the findings support the contention that Csikszentmihalyi's (1990) nine  
5 dimensions framework might not adequately account for the embodied sensory aspects of the  
6 phenomenon (cf. Dashper 2017, Humberstone 2011), and suggest that further refinement of  
7 the flow framework could be warranted to account for the complex and multisensorial nature  
8 of the flow experience in sport.

9         The reliance on bodily sensations for the transmission and interpretation of  
10 information between horse and jockey offered a rich context to explore perceptions of the  
11 body during flow in sport. In this study, altered perceptions of kinaesthesia, touch, arousal,  
12 and balance represented jockeys' descriptions of bodily sensations experienced during flow.  
13 While elements of each of these categories are apparent under various codes in previous  
14 studies (e.g. Bernier *et al.* 2009, Chavez 2008, Jackson 1996, Sugiyama and Inomata 2005,  
15 Swann *et al.* 2015a), the present study produced a clearer and more definitive presentation of  
16 some bodily sensations that can be experienced by athletes during flow. Notably, several  
17 bodily sensations identified in previous research were not reported in the present study,  
18 including *intensified body sensitivity* (Chavez 2008), *intensified perceptions of heat* (i.e.  
19 thermic perceptions - Bernier *et al.* 2009) and *absence of pain*<sup>6</sup> (i.e. nociceptive perceptions -  
20 Jackson 1996, Sugiyama and Inomata 2005). As such, it is possible that bodily sensations  
21 experienced during flow could differ between sporting contexts, and that the idiosyncratic  
22 physical demands and environments contained within certain sporting activities could  
23 produce unique corporeal experiences. Furthermore, previous research has indicated changes

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<sup>6</sup> References to the absence of pain were coded as components of the autotelic experience by Jackson (1996) and Sugiyama and Inomata (2005).

1 in other senses, including *auditory perceptions* (e.g. Chavez 2008) and *visual perceptions*  
2 (e.g. Swann *et al.* 2015a). Therefore, any refinement to the flow framework should go beyond  
3 physical perceptions and account for the multitude of sensorial features that have been  
4 reported as part of the flow experience in the current study as well as previous research in the  
5 area.

6 An important feature of the flow experience reported in the current study was the  
7 locomotive synchrony between horse and rider. More specifically, these jockeys referred to  
8 the distinct kinaesthetic ‘feel’ that embodied their experience whilst jumping and galloping.  
9 The relevance and desirability of this ‘feel’ reinforces the contention that the unification of  
10 horse and rider can generate distinct kinaesthetic sensations during flow states (Thompson  
11 and Nesci 2016). This kinaesthetic ‘feel’ was epitomised by a sense of oneness and rhythmic  
12 mutuality in the horse-jockey dyad. The rhythmic harmony and corporeal synchrony  
13 described by jockeys during flow states appears to reflect the concept of entrainment, a term  
14 Game (2001) uses to explicate how horses and riders synchronise and attune with each  
15 other’s rhythm. This locomotive synchrony between horse and jockey forged a distinct sense  
16 of connectedness and partnership during flow states. Previous work in sport has alluded to  
17 perceptual changes in athletes’ connections with sporting objects and environmental features  
18 during flow. For example, Jackson (1996) included ‘like boat becomes part of you’, ‘tuned  
19 into water’, and ‘feel as though body and bike one’ as raw-data themes describing the flow  
20 experience, but coded these within the loss of self-consciousness dimension. Similarly,  
21 Chavez (2008) outlined that swimmers reported a connection with the water, and a golfer  
22 described their club as an extension of their hand during flow. Subsequently, this led the  
23 author to conclude that ‘there is a heightened perception of the body in the environment in  
24 which the athlete is competing’ (p. 88). While the sentient nature of horses undoubtedly  
25 differentiates the nature of this embodied experience in equestrian sports, the current findings

1 build on previous work by suggesting that the experience of flow is associated with altered  
2 perceptions of kinaesthesia and relations with elements that are external to the body (i.e. the  
3 horse).

4         Distinct perceptions of balance whilst riding were reported as characteristics of flow  
5 states. Jockeys are required to maintain balance whilst riding an animal travelling at close to  
6 40-miles-per-hour across undulating terrain, and necessitate supreme levels of balance to  
7 continually adapt their bodily position to optimise the equilibrium of the dyad. Increases in  
8 movement velocity place greater demands on the horse's balance and dynamic equilibrium  
9 (Pilliner *et al.* 2002). In contrast to other equestrian riders who generally ride in a three-point  
10 position and maintain contact with the horse through their two legs and saddle (e.g. show  
11 jumping, dressage), jockeys typically ride in a two-point position (i.e. two legs in contact  
12 with horse) and rarely 'sit' in their saddle. While this riding position is considered to be more  
13 effective for racing performance (Pfau *et al.* 2009), it also accentuates the importance of  
14 balance for this sporting activity. Sugiyama and Inomata (2005) reported that athletes  
15 described perceptions of being *very balanced* during flow, although this was categorised  
16 deductively within the unambiguous feedback dimension. Arguably, this bodily sensation  
17 could be more relevant for sports that impose greater demands on the balance of athletes,  
18 including sports that involve undulating surfaces (e.g. snowboarding) and unstable objects  
19 (e.g. gymnastics rings), and those that contain movements involving rotation (e.g. hammer  
20 throw) and landing (e.g. figure skating).

21         Functioning horse-rider combinations should perform effortlessly, harmonically, and  
22 without signs of duress or force (Wolframm 2014). During flow states, jockeys described the  
23 softness of their hands when in contact with the reins, and outlined that lighter and more  
24 delicate movements elicited the desired behavioural response from the horse. Alterations in  
25 proprioceptive perceptions were linked to positive feedback regarding the horse's

1 progression, and horses that were meeting the demands of the task were less likely to require  
2 more pronounced cueing commands, thus enhancing perceptions of effortlessness during the  
3 performance. This bodily sensation reconciles with previous research in sport, as golfers  
4 reported a *sense of lightness* in their bodies and a *feeling of lightness* in their club (Swann *et*  
5 *al.* 2015a), while Sugiyama and Inomata (2005) and Jackson (1996) reported *body was light*  
6 and *feeling light* as features of the flow experience. Present findings suggest that perceptions  
7 of lightness described by jockeys referred more precisely to the strength of movements  
8 underlying their instructional cues rather than more broadly to their body as a whole.  
9 Previous studies in sport reported *feel strong* (Sugiyama and Inomata 2005) and *feeling*  
10 *stronger* (Swann *et al.* 2015a) as features of flow, but this characteristic was not apparent in  
11 the current study. Instead, jockeys outlined that exerting stronger force through the reins and  
12 legs was more likely to coincide with the absence of flow as this type of instruction was  
13 generally required when a horse was not performing capably or responding in the desired  
14 manner. Therefore, it is likely that perceptions of the strength of movement produced during  
15 flow states could be specific to the demands of a sport, degree of strength or precision  
16 required for executing specific skills, and parts of the body that are most involved in  
17 executing particular movements in different sports.

18         Similar to flat-race jockeys (Jackman *et al.* 2015), national hunt jockeys conveyed the  
19 importance of reaching an optimal level of arousal for achieving superior performance.  
20 Descriptions of distinct perceptions of physiological activation during flow states in previous  
21 research have varied, with some athletes alluding to *relaxed and calm aspects of the*  
22 *experience* (Chavez 2008), while elite golfers reported *feeling calm/relaxed* and *feeling the*  
23 *adrenalin* (Swann *et al.* 2015a). As such, it is possible that optimal levels of physiological  
24 activation could be influenced by the sport and individual preferences. A noteworthy finding  
25 was that jockeys' descriptions of optimal arousal during flow included references to their

1 own level of arousal as well as information relating to the arousal levels of the horse. Flow  
2 states were associated with perceptions of relaxation for both horse and rider, and jockeys  
3 explained that the bodily sensations associated with a relaxed physical state could be  
4 transmitted to and interpreted by the horse. This finding exemplifies the embodied nature of  
5 communication between horse and rider (Brandt 2004, Dashper 2017), and emphasises the  
6 exceptional somatic sensitivity of horses (Brandt, 2006). In a broader sporting context, the  
7 potential transmission of information regarding an individual's level of physiological  
8 activation could be important in sports that involve physical contact between human partners.  
9 For example, in paired figure skating and dancing, it is possible that the cutaneous interface  
10 between partners could provide a medium for the transmission of bodily sensations between  
11 partners.

## 12 **Limitations and future recommendations**

13 Although this study provides greater understanding of bodily sensations experienced  
14 during flow in sport, and specifically in the sport of horse racing, there are some limitations.  
15 The findings are unique to this sample of professional national hunt racing jockeys, and  
16 future research should seek to investigate bodily sensations and flow in other sports, as well  
17 as other equestrian disciplines. While career-based interviews can provide initial  
18 understanding, the retrospective nature of this approach has been criticised (e.g. Jackson and  
19 Kimiecik 2008, Swann *et al.* 2012). In an attempt refine this approach and collect experience-  
20 near data on the psychological states underlying excellent performance in sport, Swann *et al.*  
21 (2016) conducted 'event-focussed' interviews with athletes soon after recent and specific  
22 excellent performances. This approach has enriched understanding of flow in sport and future  
23 studies could attempt to acquire more recent and detailed descriptions of bodily sensations  
24 experienced during flow. In addition, this approach could also explore whether or not  
25 perceptions of bodily sensations differ between flow and other psychological states

1 underlying excellent performance (e.g. clutch states - Swann *et al.* 2016). Ethnographic  
2 approaches to the study of sensory experiences in sport have been advocated (e.g. Sparkes  
3 2009), and as present findings suggest that flow states involve a distinct sensory experience,  
4 ethnographic research designs could offer a potential avenue for further research. Calls for  
5 physiological and psychophysiological approaches to the study of flow in sport have been  
6 forwarded (e.g. Jackson and Kimiecik 2008, Swann *et al.* 2012). The concept of challenge  
7 and threat states (Blascovich and Mendes 2000) has been recently proposed as a potential  
8 avenue for experimental flow research (Tozman and Peifer 2016), and the Theory of  
9 Challenge and Threat States in Athletes (Jones *et al.* 2009) could be a useful starting point for  
10 researchers to examine the physiology of flow states in sport. Finally, the subjective nature of  
11 data analysis and interpretation of findings derived in the present study could be different to  
12 the opinion of others, although we aimed to address this issue by utilising various  
13 trustworthiness strategies throughout the analytical process.

## 14 **Conclusion**

15         The current study provided detailed insights into bodily sensations experienced by  
16 national hunt jockeys during flow states. The importance of bodily sensations in equestrian  
17 sports provided a rich context in which to explore perceptual changes in the body of athletes  
18 during flow. Consistent with previous research (e.g. Bernier *et al.* 2009, Chavez 2008, Swann  
19 *et al.* 2015a), the findings indicate that perceived alterations in the body can be produced  
20 when athletes experience flow. In the current study, jockeys reported a lightness of touch,  
21 optimal arousal, and altered perceptions of balance and kinaesthesia during flow.  
22 Furthermore, in comparing the current findings to previous research, it appears that the  
23 corporeal aspect of the flow experience could differ between sporting contexts. The  
24 environment in which athletes perform (e.g., water), the objects they use (e.g., golf club), and  
25 the physical movements involved in specific activities can vary across sports, thus altering

1 the nature of the sensory information acquired by the body (Hockey and Allen Collinson  
2 2007). In acknowledgement of the interspecies nature of the sporting partnership in  
3 equestrian sports, the jockeys elucidated that altered perceptions of the body during flow  
4 were facilitated by the horse. Although unique interactions with auxiliary objects (e.g. bikes)  
5 and environmental features (e.g. water) have been identified as components of flow in sport  
6 previously (e.g. Jackson 1996), the sentient nature of horses arguably leads to a more  
7 dynamic and complex embodied experience during flow compared to non-equestrian sports.  
8 In conclusion, while common understanding of flow centres on Csikszentmihalyi's (1990)  
9 nine dimensions framework, the current findings suggest that revision of the  
10 conceptualisation of flow in sport could be warranted to account for the complex and  
11 multisensorial nature of the experience in this domain.  
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