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A systematic review of the experience, occurrence, and controllability of flow states in elite sport

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Abstract

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Keywords

elite, states, flow, sport, controllability, systematic, occurrence, experience, review

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Running Head: SYSTEMATIC REVIEW OF FLOW IN ELITE SPORT

A systematic review of the experience, occurrence, and controllability of flow states in elite sport.

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Abstract

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Conclusions: Based on these findings, recommendations are made including the need for researchers to move from description to explanation of flow, the use of new methodologies, greater focus on the role of personality factors, and possible refinements of existing flow theory to be more specific to sport.

Keywords: athletes, optimal experience, performance, positive psychology, narrative synthesis.

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The field of positive psychology emerged around the turn of the millennium, with an aim to "catalyze a change in the focus of psychology from preoccupation only with repairing the worst things in life to also building positive qualities" (Seligman & Csikszentmihalyi, 2000, p.5). These authors refer to themes such as exceptional performance, fostering excellence, and an interest in the most positive human experiences, including flow (Csikszentmihalyi, 1975, 2002): a deeply rewarding and optimal experience characterized by intense focus on a specific activity to the point of becoming totally absorbed in it, and the exclusion of all other thoughts and emotions. Flow experiences tend to be harmonious for the individual and involve a sense of everything coming together, or clicking into place, even in challenging situations. As such, the person is often left feeling that something special has just occurred and these experiences can be highly valued and positive (Csikszentmihalyi, 2002; Jackson & Csikszentmihalyi, 1999).

The current description of flow (e.g., Csikszentmihalyi, 2002) outlines nine dimensions that are proposed to combine and interact to make up these experiences. These dimensions were subsequently divided into flow conditions and flow characteristics (Csikszentmihalyi, 2000). Flow conditions are prerequisites for flow to occur, and include: *challenge-skills balance* (i.e., situations that are challenging to the individual, but in which they are still able to meet the challenge by extending beyond their normal capabilities in order to accomplish the task); *clear goals* inherent in the activity for the individual to strive towards; and *unambiguous feedback* to either inform the athlete that they are progressing towards these goals, or tells them how to adjust in order to do so. Flow characteristics describe what the individual experiences during flow, including: *concentration on the task at hand* (i.e., complete focus with no extraneous or distracting thoughts); *action-awareness merging* (i.e., total absorption, or feeling at one with the activity); *loss of self-consciousness* (i.e., decreased awareness of self and social

evaluation), while a *sense of control* over the performance or outcome of the activity can also be experienced, as can a *transformation of time* (i.e., the perception of time either speeding up or slowing down). Finally, the combination of these eight dimensions led to flow being characterized as an *autotelic experience,* a term Csikszentmihalyi (1975) used to describe these experiences as being enjoyable and intrinsically rewarding[1].

Flow states have frequently been associated with elevations in well-being (Haworth, 1993), self-concept (Jackson, Thomas, Marsh & Smethurst, 2001), positive subjective experience (Csikszentmihalyi, 1975, 2002) and objective performance (Jackson & Roberts, 1992). This intersection of peak performance and peak experience is the crux of the flow experience, and means that flow is extremely relevant in sport. Flow research was adopted into sport in the early 1990s, with the first empirical studies published in 1992 (e.g., Jackson, 1992; Jackson & Roberts, 1992). Since then a body of sport-specific flow research has emerged, including a number of studies which are considered classics in the field (Jackson, 1995, 1996).

However, whilst the characteristics of flow have been widely studied, and replicated reasonably consistently, the factors that instigate, maintain, prevent or interrupt flow are much less clearly understood. In fact, “there is a degree of uncertainty as to when flow states occur” (Chavez, 2008, p.71), and these experiences are often perceived to be elusive in sport (e.g., Aherne, Moran, & Lonsdale, 2011). For example, Jackson (1992) reported that 81% of the 16 national champion figure skaters in her sample perceived flow to occur only on rare occasions. Indeed, the experience of flow has been regarded as being one of the least understood phenomena in sport (Jackson & Csikszentmihalyi, 1999).

[1] There appears to be some confusion surrounding autotelic experience; in some instances it is referred to as a ninth flow dimension (e.g., Jackson & Csikszentmihalyi, 1999) and in others, usually outside of sport, it is not seen as a separate or additional component, merely a description of the whole flow experience (e.g., Csikszentmihalyi, 2002; Engeser & Rheinberg, 2008). In sport, the trend has been to include it as a ninth dimension and therefore this review will do the same.

Early attempts to review the research regarding peak and flow experiences in sport (Kimiecik & Stein, 1992; McInman & Grove, 1991) were published at the same time as the first studies. Hence these reviews adopted a mainly narrative approach – reviewing and re-stating Csikszentmihalyi's seminal findings and exploring how they may apply in sport. Therefore, the body of sport-specific flow literature that has emerged since 1992 has yet to be systematically reviewed.

Flow is particularly relevant for elite athletes who perform and compete at the highest levels, under the most intense pressure, and with the greatest rewards at stake; therefore even the smallest improvement could have dramatic impacts on success (Nicholls, Polman & Holt, 2005). Furthermore, Catley and Duda (1997) found skill level to be significantly related to the experience of flow, while Engeser and Rheinberg (2008) also suggest "it is likely that individuals with higher ability have higher flow values" (p.161). This could be because elite athletes by definition have been involved in their sport for a substantial amount of time (Jackson, 1996), and are regularly involved in the challenging, competitive situations that are suggested to facilitate flow. They may also have developed exceptional mental skills which facilitate flow experiences. Hence in sport-specific flow research to date, "elite athletes have been the population of primary interest" (Jackson & Kimiecik, 2008, p.385).

Research has also been conducted in non-elite sport contexts, e.g., recreational sport, physical activity, and exercise (e.g., Catley & Duda, 1997; Jackson, Kimiecik, Ford & Marsh, 2001; Stein, Kimiecik, Daniels & Jackson, 1995). Findings have generally concluded that "optimal experience does occur for these kinds of participants" (Jackson & Kimiecik, 2008, p.390), however there could also be differences in how flow may occur or be experienced between these settings. The nature of competition, which is dominant in elite sport, could cause participants to focus more on extrinsic (e.g., results) rather than intrinsic (e.g., flow) aspects of the experience, while it has also been suggested that non-elite sport participants may have an

advantage over elite athletes in being more able to control their sporting environment in a way that optimises the quality of their experience (e.g., by more easily manipulating challenge-skill balance; Jackson & Kimiecik, 2008). Therefore research is warranted which begins to compare athletes from varying skill levels and explores if and how flow states vary between settings.

As research into flow in sport began relatively recently (e.g., 1992), many studies have been exploratory in nature (e.g., Chavez, 2008; Jackson, 1992, 1995, 1996), adopting a primarily qualitative approach which is more difficult to synthesise concisely than statistical data. Therefore due to space restrictions, this review focused only on elite sport in order to provide specific data to those performing at highest standard, and of whom there is more existing literature available. The elite level also represents the domain from which most can be learnt from an applied perspective, in that individuals in lower levels of participation can learn from elite athletes but it is more difficult for higher-level athletes to learn from lower levels of participants, e.g., recreational athletes. Future comparisons could then be made to sub-elite and/or recreational/health/exercise participants, which could highlight similarities and differences in flow states between levels of participation, e.g., in terms of frequency of experience.

Positive psychology emphasizes an applied approach, calling for psychologists to focus on amplifying strengths, developing talent, fostering excellence, and helping individuals to realize their human potential (Seligman & Csikszentmihalyi, 2000). In order to realize this applied and pragmatic philosophy, research into flow should, ideally, deliver useful real-world findings and advice that can be easily implemented – such that athletes might understand the occurrence of flow and perhaps even experience flow with greater frequency and intensity. As such, three issues have received attention in previous literature exploring flow in sport: (i) understanding the experience of flow through the eyes of the elite athlete (e.g., Chavez, 2008; Jackson, 1996); (ii) exploring the factors that influence (i.e., facilitate, disrupt and prevent) flow

occurrence (e.g., Jackson, 1992, 1995); and (iii) investigating the potential of controlling and manipulating flow (e.g., Jackson, 1995; Sugiyama & Inomata, 2005). The issue of how exactly flow influences performance is also interesting and currently unclear (see Engeser & Rheinberg, 2008), however this review is interested more in flow itself and not its correlates. One possibility though, which does not appear to have been explored yet, is the relationship between flow and psychological momentum which may shed light on this issue.

The systematic review process aims to evaluate and interpret all available research evidence relevant to a particular question (Glasziou, Irwig, Bain & Colditz, 2001); it attempts to be systematic in the identification and evaluation of materials, objective in its interpretation, and reproducible in its conclusions (Smith, 2010). This method provides a powerful tool to establish generalizability of scientific findings and summarize research findings to provide ideas for future research (Mulrow, 1994). A systematic review was deemed to be more appropriate than alternative methods, e.g., meta-analysis, which involves statistical analysis of existing quantitative data (Borenstein, Hedges, Higgins & Rothstein, 2011). As discussed, the nature of research into flow in sport has lent itself to qualitative studies which are not compatible with meta-analysis. Where systematic reviews are transparent in the selection of included studies and the decisions are specified clearly, they are not limited to quantitative analysis of the data, and can include some aspect of quality appraisal and interpretation of data, offering an advantage over the “unthinking mechanical nature of meta-analysis” (Torgerson, 2003, p.10). Therefore, the purpose of this study was to systematically review all existing research relating to flow in elite sport. Specifically, this review aimed to summarize existing literature exploring: (i) how flow states are experienced by elite athletes; (ii) how flow states occur, and are influenced, in elite sport; and (iii) the control and manipulation of flow.

Approach

Development of Search Strategy

The development of a search strategy within a systematic review is an iterative process, essentially refining a strategy from a series of preliminary searches which are evaluated, and discussed and/or reflected upon (Smith, 2010). To begin this review, a list of key words was created by breaking down the research question (cf. Smith, 2010) and trialled in a preliminary search on the SPORTDiscus database. The returns from this search where then *sampled* (e.g., every 10th return examined and assessed for relevance), and *mined* for alternative keywords that were most relevant and widely used in the literature (Weed, Coren & Fiore, 2009). Findings from this exploratory search were reviewed, and the process was repeated until the most efficient and effective search terms were identified (i.e., those returning the most relevant and specific studies). This process also identified a number of irrelevant terms which were repeatedly returned (e.g., blood flow) and were therefore noted within the search strategy as 'limiters' to be removed them from the final results. The list of search terms employed was:

Flow AND (State* OR Experienc*)

AND

(Sport* OR Perform* OR Athlet* OR Exercis* OR Motivat* OR Experienc*)

NOT

(Blood Flow OR Optic* Flow OR Expirat* Flow OR Ventil* Flow)

The databases deemed to be most relevant (based on accessibility and relevance to the topic area), and therefore searched, were SPORTDiscus, PsycINFO, SAGE journals online, INGENTA connect, and Web of Knowledge. Hand searching was also conducted by drawing from the reference lists of identified studies and chapters (e.g., Centre for Reviews and Dissemination [CRD], 2009).

Inclusion/Exclusion Criteria

Inclusion/exclusion criteria were employed to ensure that the boundaries of the review were clearly defined, and that the search strategy would identify all literature relevant to the three key aims of the review (CRD, 2009; Smith, 2010). The studies included in this review needed to: (i) be peer-reviewed research studies; (ii) be published in the English language only; (iii) have gathered original empirical evidence; (iv) be published before August, 2011 (when the formal search was finalized); (v) contain specific references to flow in either the title or abstract; (vi) explicitly relate to elite participants, defined as those competing in the NCAA Division 1 in America (cf. Jackson & Kimiecik, 2008), county level in the UK (cf. Callow & Hardy, 2001), or national level (cf. Sheard & Golby, 2010) *and above*, and either needed to use samples containing entirely elite participants, or a separable/discreet elite sample (e.g., comparing elite participants to non-elite); (viii) involve sporting activities as defined by the Oxford Dictionary of Sports Science and Medicine (Kent, 2006)[2]; and (ix) include data that was relevant and compatible with the three aims of this study (e.g., a study using elite participants and mentioning flow, but with no relevance to the aims, could be excluded).

Search Returns

The search process was finalized on 16th August, 2011, and initially returned 12,819 potentially relevant studies. After duplicates were removed, and the titles were assessed for relevance, this number was reduced to 156 and the abstract for each article was obtained where possible (no abstracts for empirical or includable studies were unobtainable). 88 studies were then excluded based on assessment of their abstract against the inclusion/exclusion criteria, leaving a total of 68 studies eligible for full-text retrieval. Subsequently 49 studies were excluded, often because they contained non-elite samples, and two further studies were

[2] Any highly structured, goal directed physical activity governed by rules, which has a high level of commitment, takes the form of a struggle with oneself or involves competition with others, but which also has some of the characteristics of play, and involves either vigorous physical exertion or the use of relatively complex physical skills.

excluded for not presenting data that was reconcilable with the aims of the study (i.e., criteria ix). Hence 17 studies met the inclusion criteria.

Data Synthesis

Once the final 17 included studies had been identified, each was repeatedly read in full by the lead researcher in order to become familiar with, and immersed in the data in order to fully appreciate what it was saying (see Maytuk & Morehouse, 1994; *indwelling*). This was followed by a two-stage process of thematic analysis, which "comprises the identification of the main, recurrent or the most important issues or themes arising in a body of evidence. It is typically the method used for identifying, grouping and summarizing findings from included studies" (Pope, Mays & Popay, 2007, p.96). First, deductive analysis was deployed to sort data from different studies into each of the three organizing constructs (experience, influences, and controllability). As CRD suggested: "once the relevant studies have been data extracted, the first step is to bring together, organize and describe their findings" (2009; p50), for which inductive thematic analysis was used. Following this: "there is a clear attempt to explore relationships between: (a) characteristics of individual studies and their reported findings; and (b) the findings of different studies" (CRD, 2009; p.51).

The majority of findings were qualitative, which necessitated a more narrative/interpretive approach to synthesis than would be the case for more quantitative data. Hence, a *narrative synthesis* was chosen as it "relies primarily on the use of words and text to summarize and explain the findings of multiple studies…(and) where evidence allows, it can also involve some element of integration and/or interpretation" (Pope et al., 2007; p.102). Narrative synthesis has been suggested to form the middle ground in a continuum from quantitative (e.g., meta-analysis) to qualitative (e.g., meta-ethnography) synthesis approaches, and allows the synthesis of both qualitative *and* quantitative data, as well as the use of a range of techniques (e.g., thematic analysis) because the synthesis is text-based (Pope et al, 2007).

Establishing Trustworthiness

As most data was qualitative and a text-based approach to synthesis was adopted, a number of processes were followed in order to establish trustworthiness and increase objectivity. The term *trustworthiness* has been used by qualitative researchers to describe methods used to meet the criteria of validity, and credibility in their research (e.g., Harrison, MacGibbon & Morton, 2001; Lincoln & Guba, 1985).

Peer debrief. This process involves the review of data and the research process by someone who is familiar with the research or the phenomenon being explored, and who provides support, plays devil's advocate, challenges the researcher's assumptions, and pushes the researcher to the next step methodologically, including questioning the methods used and the resulting interpretations (Creswell & Miller, 2000; Lincoln & Guba, 1985). This process took place between the lead researcher (first author) and the second, third and fourth authors, who provided guidance on the process of conducting systematic reviews, and of research on flow states in sport. Peer debrief took place throughout this study, by way of regular formal meetings and informal discussions.

Advisory group and audit trail. In accordance with Weed et al (2009), CRD (2009), and Smith (2010), an advisory group was set up comprising of three external researchers who had previously published studies on flow in sport. Each researcher was contacted and invited to become part of a panel serving to critique and guide the procedures followed in this review and to provide recommendations on how to improve where possible. This process aimed to seek the guidance of experts who had experience in this specific field. A comprehensive audit trail of the preliminary search, the refined formal search strategy, and the returned studies was sent to the advisory panel for verification and suggestions on any relevant material or missing search terms. The panel approved the audit trail and methods employed, and provided

recommendations for other possible inclusions, which were compared to the inclusion/exclusion criteria but subsequently did not lead to any further studies being included.

Findings

General Findings

The 17 papers included in this systematic review comprised a total population size of 1194 athletes, made up of 785 males and 409 females. 16 independent samples were included; two of Jackson's studies (1995, 1996) used the same sample of athletes while investigating different topics. In the case of two studies, the whole sample was not included: Canham and Wiley (2003) included an expert and a novice group, so only data relating to the expert group was used; and Bernier, Thienot, Codron & Fournier (2009) included two studies within their paper, but only Study 1 was related to flow. Nine studies contained data relating to how flow is experienced by elite athletes, ten related to its occurrence, and eight related to the control and manipulation of flow. The results of the review are therefore presented in three separate categories, one for each aim, and the subheadings reflect the themes discussed within the papers. Table 1 presents a summary of the participants and methods used in each study, and the relevant aim(s) to which each study pertained.

The Experience of Flow

Qualitative exploration of flow. Five studies (Bernier et al, 2009; Chavez, 2008; Jackson, 1996; Sugiyama & Inomata, 2005; Young, 2000) qualitatively explored athletes' perceptions and descriptions of flow states in order to understand what the experience is like. These findings have been summarized in Table 2, which describes the number and percentage of the 114 athletes reporting each of the flow dimensions combined between these five samples.

This process essentially identified a ranking within the flow dimensions, i.e., those that were reported most to least. Over 80% of athletes reported *concentration on the task at hand* in their flow states, followed by *action-awareness merging* almost 75% of the time. Conversely,

loss of self-consciousness and *transformation of time* were both reported by less than 30% of athletes. Not all nine dimensions were present in every flow state (see *number of flow dimensions experienced*) and some themes emerged which did not fit into the existing description of flow (see *concepts not fitting with flow dimensions*).

In some of these exploratory studies, researchers have tended to introduce and define flow for the participant at the beginning of the interview, often providing a lot of information. For example, Jackson's (1995) athletes were asked to describe an experience that "stood out as being better than average…where they were totally absorbed in what they were doing and that was very rewarding" (p.78), before they were read three quotes illustrating flow, including:

> My mind isn't wandering, I am not thinking of something else. I am totally involved in what I am doing. My body feels great. I don't seem to hear anything. The world seems to be cut off from me. I am less aware of myself and my problems (Jackson, 1996, p.78)

Similarly, Sugiyama and Inomata (2005) asked a series of questions including "Have you had a competition experience in which you were completely absorbed in what you were doing?" These authors followed the questions by showing the participant a written description of flow and asking if they had experienced a state which corresponded to that description.

Quantitative measurement of flow dimensions. Two studies (Canham & Wiley, 2003; Jackson, 1992) used quantitative measures to explore flow experience. Jackson (1992) used an exploratory quantitative flow questionnaire and found mean scores (on a 10-likert scale) of 8.4 or above for all of the flow dimensions except loss of self-consciousness, which she suggested may require further subscale development to more adequately address this component of flow in athletes. Canham and Wiley (2003) used an abbreviated Flow State Scale (FSS; Jackson & Marsh, 1996) and found that expert climbers were more likely to report dimensions of automatic performance, unambiguous feedback, clear goals, and time transformation than novices. However, as these studies both used different measures the data cannot easily be reconciled. Furthermore, it has previously been noted that quantitative measures are not as

effective at exploring flow as qualitative methods, especially as they attempt to explore an intensely subjective experience by using objective measures (Jackson & Kimiecik, 2008).

Two further studies quantitatively investigated the flow experience, including Stavrou, Jackson, Zervas, and Kerteroliotis (2007) who examined intercorrelations between the flow dimensions on the FSS. These authors found a close relationship between the dimensions of challenge-skill balance, clear goals, unambiguous feedback, concentration on the task at hand, sense of control, and autotelic experience, including close relationships between the first three; the flow conditions. These authors suggest that if these results can be generalized, experiencing flow could be associated with high scores in these six dimensions on the FSS, and speculated that the flow conditions perhaps "modulate the rest of flow-experience qualities and represent the preconditions to get into flow" (2007, p.452). Bakker et al (2011) found that environmental resources (e.g., performance feedback and support from the coach) predicted flow during a soccer game. They suggested that this could have been because environmental resources can: (i) boost one's belief in their ability to succeed and reach their goals; (ii) foster core self-evaluations including optimism, hope, and self-esteem; or (iii) satisfy basic psychological needs, including the need for competence. These findings suggest an important role for feedback in flow experiences.

Number of flow dimensions experienced. Two studies (Jackson, 1996; Sugiyama & Inomata, 2005) have explored the number of dimensions that occur simultaneously during athletes' flow experiences: Jackson reported that all athletes mentioned themes which fit into three or more of the nine flow dimensions, while 93% of the sample mentioned themes which fit into five or more of these. Sugiyama and Inomata also found that on average 5.8 of the nine dimensions applied to their athletes' experiences (although it is neither discussed, nor clear, how an athlete could experience 0.8 of a dimension). On the basis of these two sets of data, the athletes involved have commonly reported experiencing approximately five of the dimensions

at a time. However, these findings are not discussed in either case, and it is unclear which dimensions these were, and if there was any consistency between them (e.g., typical combinations which essentially define the quality of the experience).

Frequency of experiencing flow states. One study (Jackson, 1992) discussed the frequency with which the elite figure skaters in her sample experienced flow, reporting that 81% of her athletes did not experience it very often (although no unit of frequency was provided). Reasons given for this included the fact that it was difficult for "everything to be on" (p.177), because it usually only happened in the biggest competitions, and the rarity of being at one with your partner.

Flow and mindfulness. Two studies (Aherne et al, 2011; Bernier et al, 2009) using elite athletes have explored flow and mindfulness, the non-judgmental focusing of one's attention on the experience as it occurs in the present moment (Kabat-Zinn, 1994). This concept has its roots in Eastern meditational practice (Bernier et al, 2009), and has only emerged in Western sport-psychology research in the last decade. The link between mindfulness and flow is based on the proposal that mindfulness is linked to present-moment focus, similar to the flow dimension *concentration on the task at hand.* Bernier et al (2009) attempted to explore this link but did not add conclusive data, instead concluding that "it is important to study how mindfulness and acceptance could specifically contribute to the attainment of optimal performance states in various sport contexts" (p.330). Aherne et al (2011) employed an intervention, which is therefore discussed in *Intervention Studies*.

Team flow. Bakker, Oerlemans, Demerouti, Bruins Slot and Karamat Ali (2011) proposed that team-level flow in soccer could be experienced since players in the same team share some common aspects of experience (e.g., the same opponent, weather, coach) and are highly dependent on each other as they share similar goals (i.e., playing well and winning the match). These authors also suggested that this could be the result of contagion effects, where

individual players transfer their own moods and behaviours to other players in their team. Findings showed that perceptions of flow at the team level had a positive relationship with the objective match result in that flow experience was higher when the match resulted in a draw than in a loss (the differences with winning was not significant).

Concepts not fitting with flow dimensions. Three studies (Bernier et al, 2009; Chavez, 2008; Jackson, 1996) discussed concepts that did not easily reconcile with any of the dimensions proposed by Csikszentmihalyi. Jackson's (1996) athletes reported the concepts: *aware of effort; remember hearing the crowd; feel out of body;* and *as if watching self.* Notably, Jackson discussed that, although it is proposed that movements in flow seem easy, some athletes were aware of exerting effort, which they found enjoyable in flow. Jackson suggests that the word 'effortless' may not clearly convey what is occurring during flow when it is part of physical activities; instead it may be an absence of strain and tension (i.e., negative emotions/perceptions) rather than an absence of effort *per se*.

Furthermore, 56% of Chavez's (2008) participants reported relaxed, calm aspects of the flow experience. It is not immediately clear as to which of Csikszentmihalyi's nine dimensions this idea fits into. This theme also provides an indicator of what athletes may be experiencing physiologically during flow. Indeed, Chavez also found that 68% of the sample indicated that there is a heightened perception of the body in the environment in which the athlete is competing, including examples such as a golfer describing that it felt like his club was an extension of his hand. Similarly, Bernier et al (2009) reported that 60% of the elite swimmers in their sample mentioned a heightened state of bodily awareness, including a strong heartbeat, a "tingling" sensation in their muscles, heat in their extremities, and a feeling of "boiling" inside.

Factors Influencing Flow Occurrence

Five studies (Chavez, 2008; Jackson, 1992, 1995; Sugiyama & Inomata, 2005; Young, 2000) explored the factors that athletes reported to have been present when flow occurred,

which this review will refer to as facilitators. These factors can occur prior to, or during the performance. Four studies (Chavez, 2008; Jackson, 1992, 1995; Young, 2000) explored the factors that have prevented flow from occurring. Preventing factors must affect flow *before* it can occur in the first place, and may therefore influence the athlete prior to or during the event but before flow can occur. Fours studies (Chavez, 2008; Jackson, 1992, 1995; Young, 2000) have explored the factors that disrupt flow. Disrupting factors must occur *while* the athlete is in flow, and effectively take the athlete out of the experience (or reduce the magnitude of the experience), during the event itself. Combined in the synthesis were a total of 12 different facilitators, 10 preventers, and 11 disruptors, all of which are highlighted in Table 3.

There is considerable consistency and overlap across the identified influences in that ten factors were found to influence flow as facilitators, preventers, *and* disruptors. The positive or optimal presence of these ten factors facilitates flow, while their presence in negative form inhibits, either preventing if they occur before flow, or disrupting by occurring during flow states. Within this group, the concepts of *focus* and *thoughts and/or emotions* were reported by every study under every category of influence (i.e., facilitate, prevent, disrupt), and therefore could suggest that these are either central to flow experience, or are the easiest to convey.

In regard to its occurrence, flow seems to result from the interaction of internal states (e.g., focus, arousal, motivation, confidence, thoughts and emotions), external factors (e.g., environmental and situational conditions, i.e., weather, or course that suited the athlete) and behavioural factors (e.g., preparation). If any of these factors are in their negative form prior to flow can occur, they prevent the experience, and if they occur in their negative form during the experience flow is disrupted. However, it is difficult to tell whether these influences can act on their own, or in what combinations they interact to bring about or inhibit flow.

In some instances the authors do *allude* to causal mechanisms, such as Jackson discussing that preparation or “knowing everything was in place allowed the athlete to focus on

the task and to switch into a more automatic mode of functioning that seems to be part of the flow process" (1995, p.147). However, such causal links are not discussed in enough depth or formalised in a way which enables suggestions as to the underlying mechanisms of flow.

Overlaps are also noticeable between some facilitators and flow dimensions, both of which refer to the constructs of *concentration*, and *positive feedback*. This overlap seems to have occurred because researchers to date have made a temporal distinction in that facilitators occur *prior* to flow, while dimensions occur *during*, meaning the same constructs have been reported twice. It is also noteworthy that the other two flow conditions, *challenge-skill balance* and *clear goals* were not discussed as facilitators. It has been discussed that these possibly are taken for granted by elite athletes; hence they were not discussed in interviews (e.g., Jackson, 1996). Another issue arises in that the facilitators of *optimal motivation, optimal arousal, confidence,* and *positive thoughts and emotions* all intuitively seem like constructs which individuals could experience as part of the flow state. However it is unclear as to which flow dimensions each of these constructs would be part of.

Further results: Individual differences and flow. Three studies referred to specific personality traits which were proposed to influence an athlete's propensity to experience flow; an idea which has been termed "autotelic personality" (e.g., Csikszentmihalyi & Csikszentmihalyi, 1998). Hodge, Lonsdale and Jackson (2009) found that the satisfaction of the basic psychological needs proposed by Ryan and Deci (2002) (i.e., autonomy, competence, and relatedness), and athlete engagement (an enduring, relatively stable sport experience involving positive affect and cognitions about one's sport as a whole) predicted (using structural equation modelling) dispositional flow. Wiggins and Freeman (2000) found that athletes who interpreted their anxiety as more facilitative and who experienced lower levels of anxiety intensity were much more likely to experience flow than athletes with higher intensity levels and debilitative

interpretation of their anxiety. In relation to achievement goal theory (Nicholls, 1989), Jackson and Roberts (1992) reported that athletes high in mastery orientation experienced flow more frequently than athletes low in mastery, while flow was also found to be associated with high levels of perceived ability.

Control and Manipulation of Flow

Four studies (Chavez, 2008; Jackson, 1992, 1995; Sugiyama & Inomata, 2005) explored the controllability of flow states as perceived by elite athletes. These researchers have done so in two ways: first, by asking athletes whether or not they perceived flow to be controllable; and second, by discussing the perceived controllability of the factors found to influence flow occurrence.

Athletes' perceptions of control over flow. Table 4 below illustrates the findings of these studies in relation to the perceived controllability of flow. On average, 66% of the athletes in these samples perceived flow to be controllable, a figure which rises to 72% if we include those in Jackson's (1992) study who reported flow to be partly controllable. An average of 26.5% of participants in the included studies perceived flow to be difficult or impossible to control.

Athletes' perceptions of control over the factors influencing flow occurrence. Jackson (1995) found that 82.4% of facilitators and just under 70% of preventing factors were perceived to be controllable, while 71.6% of disruptors were seen as uncontrollable, and expanded to note that "this group of elite athletes seem to be saying that they will remain in flow unless some uncontrollable event occurs to take them out of this state" (p.153). Themes that were consistently perceived to be controllable by athletes across two studies (Chavez, 2008; Jackson, 1992) included *preparation*, *optimal arousal*, and *positive thinking*. Both studies also referred to factors which influence flow occurrence but with the perception of limited or no control (see Table 4). Some of these findings appear to be contradictory in that certain factors

were perceived to be both controllable and uncontrollable, specifically *concentration, optimal arousal, motivation,* and *positive/negative attitude*. Hence it appears that some athletes feel they can control certain factors while others do not, again alluding to a role for individual differences (i.e., it is unclear where the locus of causality lies).

Restoring flow. Chavez (2008) also investigated the factors associated with reinstating flow after disruption, which 81% of the athletes in his study perceived to be possible. Themes of positive thinking, task orientation, relaxing, clearing mind, thorough performance and building confidence were reported by these athletes as factors that restore flow. This is an interesting and potentially very useful idea, but one which appears to be somewhat novel in that Chavez is the only study to address this theme.

Intervention studies. Four studies investigated the effects of psychological interventions on flow experience in elite athletes, using slightly different designs. Lindsay, Maynard and Thomas (2005) used a non-concurrent multiple baseline design to examine the effects of a *hypnosis* intervention; Nicholls et al (2005) employed a single-subject replication reversal (ABA) design to examine the influence of an *imagery* intervention; Pain, Harwood and Anderson (2011) used a single-subject multiple baseline design across individuals to examine pre-competition *imagery and music*; and Aherne et al (2011) used control and experimental groups and assessed flow before and after a six-week *mindfulness* intervention.

In the cases of Lindsay et al. (2005) and Nicholls et al. (2005), findings were small in magnitude which “makes it unclear whether the changes in flow and performance are due to the imagery intervention” (Nicholls et al., 2005, p.56). Despite this, Nicholls et al. (2005) use a “social validity argument” (p.58) to propose that the small percentage improvements their study produced may actually be significant. Lindsay et al. (2005) also stated that their findings “do not add conclusive support” to the hypothesis that hypnosis interventions can be used to increase flow and performance (p.173), and suggest that “there is also the possibility of a

Hawthorne effect, meaning changes in performance might merely be a result of being involved in the investigation" (p.174).

In contrast, Aherne et al. (2011) reported that athletes who underwent mindfulness training reported sizeable increases not only in global flow scores but also specifically on the dimensions of "clear goals" and "sense of control" compared to a control group. These authors suggested that both of these dimensions could be related to the self-regulation of attention, which is a key component of mindfulness. While advocating the need for further research employing larger samples, and thus greater statistical power, before firm conclusions can be met these findings seem to provide initial evidence for the potential of enhancing flow. This suggestion is echoed by the findings of Pain et al. (2011) who reported "consistent and sizeable increases" (p.226) in flow when imagery and music were combined during pre-competition. These authors conclude that this combination "generally had a facilitative effect on flow" (p.229), while also noting that further research is needed to confirm their findings.

Discussion and Recommendations

The Experience of Flow in Elite Sport

The first aim of this systematic review was to summarize existing research exploring how flow states are experienced by elite athletes in order to explore how Csikszentmihalyi's model applies to elite sport. Findings identified aspects of the flow experience in elite athletes and ranked them in order of prevalence between studies (see Table 2). This variance could be explained by the different variables across sporting contexts (such as type of sport), as noted by Jackson (1996). We do not suggest that this ranking will generalize to all sporting contexts, but it does provide an indication that some dimensions may be experienced more frequently (or more readily reported) than others, or could even be more characteristic of flow experiences.

On the basis of the limited data available, athletes reported experiencing approximately five of the flow dimensions at any given time. Although it could simply be the case that athletes did experience the remaining dimensions but did not or could not articulate them to the interviewer, this finding could suggest that there are nine theoretical dimensions that *could* be experienced, but the number and make-up of these that are actually experienced may vary between flow occurrences. This alludes to Csikszentmihalyi's (e.g., 1975) proposed *flow continuum* whereby these states can occur as rare, 'macro' flow and everyday 'micro' flow states. However, there is little empirical data examining this proposition in sport, and Jackson (1992) proposed that "further research is needed to clarify whether flow is something experienced only infrequently by top athletes or whether it occurs, to varying levels, on more frequent occasions, for athletes of all levels" (p.177).

While data has described how elite athletes experience flow, some ideas also emerged which did not easily reconcile with Csikszentmihalyi's model of flow. The majority of athletes in two studies (Bernier et al., 2009; Chavez, 2008) reported experiencing heightened perceptions of the body, or bodily sensations in flow. Similarly, in Jackson's (1996) and Sugiyama and Inomata's (2005) analyses, themes relating to the body were subsumed under *autotelic experience*, e.g., "endless supply of energy", "body feels great", "no pain", and "feel strong" (although it is also questionable as to whether these should be coded under autotelic experience; see *Methodological critique*). Indeed, recent studies outside of sport have begun exploring this link between flow and physiology: De Manzano, Theorell, Marmat and Ullén (2010) found a significant relation between flow and heart period, blood pressure, heart rate variability, activity of the zygomaticus major muscle, and respiratory depth during piano playing; and Keller, Bless, Blomann and Kleinböhl (2011) identified reduced heart rate variability and higher levels of salivary cortisol during flow in computerised tasks. Therefore it

could be the case that flow is not solely psychological, but a psychophysiological phenomenon, and there may be both physiological responses to, and activators of flow, e.g., optimal arousal which was identified as a facilitator.

Furthermore, heightened body awareness may only apply to certain sports. For example, the results suggest that for swimmers awareness of their body's state is highly relevant, and could be regarded as being part of the task itself, whereas for sports which need reactions to changing outside stimuli (e.g. tennis, soccer) this may not be the case, and awareness of one's body could even hinder good performance. Other differences in how flow is experienced across settings was also alluded to: Chavez (2008) discusses minor differences in perceived control of flow between athletes from individual and team sports, and also alludes to differences in participation level, while Sugiyama and Inomata (2005) note differences in flow experience between types of sport, namely speed and endurance events. These differences should be explored and compared in future.

Bakker et al. (2011) also referred to flow occurring at the team level, and not solely within the individual. It could be possible that players within the team act as a catalyst for others; when the 'catalyst' goes into flow other players on the team follow. It could also be that these players act as the leaders within the team. This may explain why some sports teams can produce exceptional team performances, and could present an interesting area to explore further, e.g., by conducting interviews or focus groups with one team to discuss if they share flow experiences, and exploring the relationship between leadership and flow in sport.

The Occurrence of Flow States in Elite Sport

The second aim of this systematic review was to summarize the existing literature exploring how flow states occur in elite sport; its facilitation, prevention and disruption.

Findings suggested that there appears to be one group of ten concepts that generically influence flow occurrence (see Table 3), with *focus* and *thoughts and/or emotions* the most-reported factors. These ten concepts range from internal states (e.g., optimal motivation) to behaviours (e.g., preparation) to external influences (e.g., environmental conditions), suggesting that flow occurs through a complex interaction of different variables. Additionally, it is difficult to know what specifically makes each of these influences 'optimal' or 'negative', although it could be likely that they depend on individualised perceptions. Hence ideographical research such as Hanin's (1997) Individual Zones of Optimal Functioning may be useful in exploring this issue in future. However, thus far the identification of these influences is based on associations (i.e., factors present when flow has occurred previously), and Kimiecik and Stein (1992) note that:

> It is one thing to know, for example, that a flow experience is accompanied by focused concentration, feelings of control, and clear goals. It is quite another to know why or how the flow experience actually occurred…(and) the mechanisms underlying the experience (p.148).

Such underlying mechanisms have been alluded to but not formalised, nor investigated explicitly or thoroughly (see *Factors influencing flow occurrence*). Instead, current understanding remains descriptive and cannot suggest an explanation of flow, and as a result flow states remain to be reported as being elusive and unpredictable (e.g., Aherne, 2011; Chavez, 2008). It also appears that not all of these dimensions and factors are experienced/present during every flow experience and it remains unclear as to why certain factors may be experienced in a certain state but not others. Similarly, there seems to be no evidence suggesting how much of each flow dimension is necessary (e.g., intensity of concentration on the task at hand).

Hence researchers should strive to explain how and why flow occurs, particularly in terms of the causal mechanisms that are responsible for producing these experiences. Such mechanisms have not yet been addressed in sport, but could provide important insights into exactly how flow experiences occur, rather than simply describing associations. One possible

way of exploring such mechanisms could be through the analysis strategies of researchers in qualitative, exploratory studies, which have tended to rely on deductive thematic analysis, categorising similar themes into the nine flow dimensions. An alternative is connecting analysis which involves "identifying actual connections between events and processes in a specific context" (Maxwell, 2004; p.255), and could begin to identify the causal processes and interactions underlying flow.

Within the reviewed research, Sugiyama and Inomata (2005) do propose an "Advanced flow model" (p.979) that displays links between the nine dimensions of flow, yet disappointingly these links are not discussed. However, one possible explanation from broader flow research is that of Dormashev (2010), who argues that "prolonged effortless concentration of attention is the principal characteristic of the flow experience" (2010, p.306), and proposes an explanation of flow based on an activity approach to attention. Although this explanation of flow is based on theoretical analysis and is, therefore, preliminary, others have also suggested that flow is the result of unconscious, or automatic, processing (e.g., Pates, Cummings & Maynard, 2002; Singer, 2002). This proposal does seem promising and we recommended that future studies in sport gather empirical evidence that address the efficacy of this explanation.

The majority of flow research in sport has focused upon situational factors involved in the experience, while the influence of individual differences has largely been neglected. To compound this, researchers have relied, in many cases, on individual differences to explain inconsistency in their findings, e.g., Jackson (1995, p152), who noted that "optimal arousal level was athlete specific" and Chavez's (2008) suggestion that "it is imperative to be aware of the individual differences in how athletes experience flow" (p.90). However, such differences have, to date, not been explored or elaborated upon. The consequence is that research can only be descriptive, researchers remain relatively unsure of how flow states vary between individuals, and "individual differences" offers a ready-made (and difficult to query)

explanation whenever data contains unexpected variability/variance. Given that flow is a very subjective experience, understanding the influence of individual differences in its causation and experience is arguably vital in order to progress our scientific understanding of this phenomenon.

Furthermore, no clear understanding currently exists as to what the proposed autotelic personality actually is in sporting terms, although Jackson and Kimiecik (2008) tentatively proposed "a number of dispositional factors that together could make up something resembling an autotelic personality in sport" (p. 392). These factors were goal orientation, perceived sport ability, competitive trait anxiety and intrinsic motivation, and while the findings of the studies included in this review provide some support to this suggestion, more research is clearly needed.

The Controllability of Flow in Elite Sport

The third aim of this study was to summarize the existing research concerning the control and manipulation of flow in order to assess whether it could be possible to increase the frequency and quality with which flow states occur. The majority (approximately 66%) of athletes involved in the included studies have reported flow to be controllable, or "within their control to achieve" (Jackson, 1995, p.151; see Table 4). Possible mechanisms through which flow could be controlled include *preparation*, *positive thinking*, and *optimal arousal*, although these findings remain unclear because they are based on limited research, and appear to be very individual.

While such numerical percentages of athletes' perceptions of control do provide a useful indication as to the potential controllability of these states, it is perhaps limited in that we do not yet know the extent to which it is controllable, or, more importantly, what the athletes' differences in perception depend upon. To date, studies have devoted very little attention to this

topic, even though it arguably holds the potential to significantly improve our understanding of flow occurrence in sport. It also provides an interesting caveat to the idea that athletes do not experience flow very often; a contradiction which highlights the need for researchers to better explain flow occurrence.

One possible reason for this contradiction is in the methods in which researchers have gone about exploring controllability: trying to identify which influencing factors are and are not controllable, on the assumption that increasing controllable influences will help enhance flow. However, just because these factors are perceived to be controllable *as well as* related to flow does not mean that they *cause* flow to occur, or guarantee its occurrence. This problem highlights the need to fully understand the mechanisms underlying flow states, in terms of how it is experienced and how it occurs; and *then* such controllable influences could be tested as possible ways of enhancing flow. Additionally, some of the methodological issues underlying flow research (discussed in next section) may have an influence here.

At this point in the history of flow research, intervention studies appear to have been relatively unsuccessful, arguably because the existing research has been unable to provide comprehensive working/explanatory models of flow phenomenon (i.e., given the state of research to date evidence, interventions are, by necessity, quite speculative). However, while the intervention studies included in this review do not add conclusive evidence *per se*, they are perhaps promising in that they suggest interventions *could* potentially increase the experience of flow in elite sport. Furthermore, the interventions all involved psychological concepts which have not been strongly linked with the experience or occurrence of flow (i.e., hypnosis, imagery, mindfulness, and music). Intervention studies are likely to improve once an understanding has been accrued regarding the determinants of flow states and the mechanisms through which flow is produced. Further exploration of the idea of restoring flow may also be

able to identify specific strategies that athletes can use to restore flow once it has been disrupted.

Methodological Critique

Procedural methods. Flow is acknowledged as being notoriously difficult to measure (Jackson & Kimiecik, 2008), and a number of issues are apparent within this literature. Firstly, quantitative measurement of flow has been based solely on the Flow Scales (Jackson & Marsh, 1996; Jackson & Eklund, 2004), namely the Flow State Scale, Dispositional Flow Scale, or an early variation, the Flow Questionnaire (see Table 1). This could mean that the results of this review only reflect Jackson's concept of flow yet, as noted, different interpretations do exist regarding the description of flow (see p. 4). Therefore it may be difficult to confidently generalize the results of this review to settings outside of sport, at least not before these differences in interpretation of flow are addressed.

Second, in quantitative studies using the Flow State Scale, questionnaires are often distributed after a certain performance, and any flow state within *that* performance is measured using a Likert scale which also enables low ratings to be provided. Therefore, it could be unlikely that flow is experienced in that specific performance given that flow is so difficult to predict, and it could be difficult to be sure that participants in those studies were truly in a state of flow. In future, researchers could distribute questionnaires after events that are more likely to be optimally-challenging, and therefore more likely to facilitate flow than normal performances, e.g., finals.

Finally, in regard to qualitative studies using interviews, the technique researchers use could have had an impact on their results. Commonly, a definition is provided to orient the participant with flow (e.g., Jackson, 1992, 1995; Sugiyama & Inomata, 2005). In some cases though, these definitions are relatively in-depth (e.g., Jackson, 1995), and could bias the

resulting accounts provided by participants. In future, qualitative researchers should seek other ways of introducing flow in interviews, or only provide vague definitions which are not likely to influence the participant's account of their own flow experiences. Furthermore, careful consideration should be made to the questions asked during the interview, which can obviously influence results also. For example, Bernier et al (2009) reported that participants "had been particularly mindful of their bodily sensations" (p.320), and that they "spontaneously mentioned a heightened state of bodily awareness" (p.323), but also state in their procedure that the participants were asked to describe in-depth aspects of the experience including their bodily sensations.

Study design. As research has revolved around exploration and description, the methods employed have developed certain tendencies which, when synthesized, have inevitably resulted in a picture lacking clarity and simplicity. Studies have tended to use samples of athletes combining variables such as sex, sport, type of sport, and ability/skill level in order to describe flow in sport. However combining data from different sports, which all have differing demands, means one little-reported theme present in one study could actually have a great role in flow states for athletes in another study. Furthermore, it could be the case that team sports and individual sports make a difference in how flow occurs and is experienced, or the same with self-paced versus externally paced sports. Future studies should attempt to isolate the determinants/antecedents of flow in order to identify if, to what extent and in what circumstances each variable contributes to flow experiences.

In exploring and describing flow, studies have often conducted in-depth interviews discussing previous flow experiences and retrospectively relying on the participant's memory (e.g., Chavez, 2008; Jackson, 1995, 1996). While this tendency has been as argued to be a defensible and appropriate method for gaining exploratory data (e.g., Jackson & Kimiecik, 2008), if it becomes the prevalent methodology then the limitations begin to accumulate and

produce blind-spots. Perhaps the most notable limitation is that the flow experience discussed in the interview is often chosen by the interviewee and could have been months, even years before the interview, which can reduce the accuracy and precision of the data provided (e.g., the 'rose-tinted glasses effect'). As such, researchers could seek to reduce the extent to which these interviews are retrospective and aim get closer to flow experiences (e.g., by exploring flow as or immediately after it occurs, or trying to produce flow experience which are then concurrently analyzed). For example, Engeser and Rhienberg (2008) employed such a strategy in education which could be tailored to, or provide guidance for, studies in sport.

Use of Csikszentmihalyi's flow dimensions. All studies made explicit comparisons to Csikszentmihalyi's model of flow, which has been a key framework for research in this area. Indeed, Chavez (2008) was the only exploratory study which did not deductively code data into the flow dimensions. An issue with over-reliance on deductive coding is that findings could essentially be shoe-horned into the flow dimensions, without allowing for evolution or refinement of the theory, e.g., to be more specific to sport. There are also instances where such coding seems questionable, suggesting such a show-horning effect. For example, "endless supply of energy", "body feels great", "no pain", and "feel strong" were coded into autotelic experience (Jackson, 1996; Sugiyama & Inomata, 2005), which is defined as the fun, enjoyable, intrinsically-rewarding aspect of flow (Csikszentmihalyi, 2002; Jackson & Csikszentmihalyi, 1999), and does not seem appropriate. Future studies should consider inductive analysis to let themes emerge from the data, which can *then* be compared to Csikszentmihalyi's description of flow.

Other issues have also emerged from this review, firstly in terms of overlaps between facilitators and dimensions of flow, with *concentration* and *feedback* highlighted in both categories. While it is unclear as to which criteria are used to define the flow conditions, this overlap does seem to suggest that concentration could be a condition of flow rather than a

characteristic. Secondly, aspects which seem intuitively to be part of the flow experience (e.g., optimal arousal, motivation, confidence) were also found as facilitators, which poses two problems. First, it is unclear as to where these constructs fit into the nine flow dimensions. To illustrate, confidence is discussed in relation to three different dimensions (challenge-skill balance, sense of control, and clear goals) by Jackson and Csikszentmihalyi (1999). Second, if they are indeed aspects of the experience, and have also been identified as facilitators, it suggests that these too could be considered as conditions of flow.

Hence, it seems that clarification and clearer definition of the conditions and characteristics of flow is warranted. Mackie's (1965) distinction between *necessary* and *sufficient* conditions may be useful in this regard, which could also help researchers begin to explore the causality of flow. Overall, however, these findings suggest that flow theory should be at least critically evaluated before being adopted as a framework for investigating flow in sport, and that there could be an opportunity to take steps "towards refining Csikszentmihalyi's…model of flow to more specifically describe flow in sport environments" (Jackson, 1996, p.85). Such refinements could also include consideration for physiological aspects of flow.

Limitations

Because the procedures in a systematic review are explicit and transparent, the values used to inform the review should be open to criticism and comment (Torgerson, 2003); hence it is important to note some of the possible flaws within the adopted approach. Some findings are based on the reports from only one or two papers, and the review process inevitably identifies studies that are diverse in their design, methodological quality, specific interventions used, and types of athletes studied; all of which may affect validity. Additionally, the inclusion/exclusion criteria employed may have excluded literature which

could have been relevant to answering some of the aims of this review, but did not meet all criteria, for example, relating specifically to elite sport. However, some of these issues (e.g., the limited number of studies available in certain sections) are unavoidable due to the nature (and limited amount) of research in the area which this review was synthesising. Furthermore, as a narrative approach to synthesis was adopted, procedures of enhancing trustworthiness were also employed (e.g., peer debrief, audit trail, advisory group) which aimed to overcome, or at least minimise, such issues.

A final limitation is that there is no comparison group within this review (i.e., the focus was solely on elite athletes) and it is also interesting to question whether flow is experienced by individuals performing on a lower level, such as sport beginners or participants of health-oriented sports courses. It could be the case that different flow characteristics are dominant, the flow experience could be facilitated by different factors, or experts could control flow better than beginners (or vice versa). By presenting a review of elite sport, future research can make comparisons between elite and lower level participants (e.g., by conducting a similar review on non-elite sport).

Applied Recommendations

Although the emphasis should be on developing clear understanding and explanation of the phenomenon, practitioners may be able to use the findings emerging from this review to suggest ways of promoting flow in their athletes. Specifically, we suggest a multi-faceted intervention, including psychological, physical and social factors, may be the most appropriate approach, rather than testing the influence of a single mental skill on flow (as has been the case to date). The skills involved should be matched to the causal influencing factors and dimensions of flow, and the personality characteristics of the individual. Based on the present findings, these could revolve around thorough preparation, task-focus, coping strategies, goal-

setting, motivational exercises, confidence building, and arousal manipulation. These exercises may initiate flow, but could also help the athlete restore flow, in line with Chavez's (2008) findings (see *Restoring flo*w). Such an intervention does not yet appear to have been conducted in elite sport, but could be designed, tested and refined based on the findings of this study.

Conclusion

The exploration of flow in elite sport has only occurred relatively recently, with the first studies published in 1992. Since then, the area has grown and a relatively in-depth description of flow has been developed. Elite athletes experience the nine flow dimensions with varying frequency and research has developed a comprehensive impression of what it is like for these athletes to experience flow (Jackson, 1996). A set of ten factors have been found to influence flow in terms of facilitating, preventing, and/or disrupting; leading to the possibility that these could be the essential "ingredients" in producing flow. Finally, despite its anecdotal reputation of being elusive, and research suggesting athletes do not experience it frequently (Jackson, 1992), the majority of athletes participating in the studies sampled perceived flow to be within their control, at least to some extent. However for knowledge to progress, we argue that research should move from such description to *explaining* flow, and explicitly searching for its underlying causal mechanisms. We also suggest there are opportunities to refine Csikszentmihalyi's flow model to be more specific to sport, and methodological issues which researchers can overcome to provide clearer, more specific data.

The possibility of being able to enhance the frequency and quality of an elite athlete's flow experiences is exciting for practitioners and the athletes themselves, especially in terms of the potential of improving performance. By building towards an explanation of flow and its occurrence, this possibility becomes greater: the more researchers understand flow and can explain it, the greater chance they have of delivering effective applied recommendations and

interventions to athletes, and of enhancing their performance and experience within sport to the highest levels possible.

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Table 1: Summary of participants and methods used in the included studies.

Study	Participant information	Design	Method	Study aim
Aherne, Moran & Lonsdale (2011)	13 (9male, 4 female) national/international level athletes from 7 sports. *M* age = 21.00, *M* years participation = 8.69.	Mindfulness intervention	Flow State Scale-2 (FSS-2) and Cognitive and Affective Mindfulness Scale-Revised.	E,C
Bakker, Oerlemans, Demerouti, Bruins Slot & Karamat Ali (2011)	398 (male) players from 15 Dutch professional soccer clubs (reserve, 16-18, and 14-16 year old teams). *M* age = 17.5, *M* time in current team = 10.4 months.	Correlational study	Players completed questionnaire about environmental resources, flow (FSS) and performance during a particular match. Coaches rated players' performance during same match via questionnaire afterwards.	E,O
Bernier, Thienot, Codron & Fournier (2009; Study 1)	10 (4 female, 6 male) elite swimmers at French national training centre; 7 had competed at international level. *M* age = 20.23.	Descriptive investigation	Semi-structured qualitative interviews describing flow experiences.	E
Canham & Wiley (2003; expert group)	7 (male) climbers with at least 3 years' experience and climbed at least a 5.10a level or harder. *M* age = 30.1.	Quasi-experimental design	Pre-experiment abbreviated FSS, memory task, two climbing routes, self-report measures of enjoyment, memory, experience of climbs.	E
Chavez (2008)	16 (9 female, 7 male) NCAA Div.1 athletes from 6 sports; 7 had competed at international level. *M* age = 20.	Descriptive investigation	Lead and follow-up interview discussing factors perceived to facilitate, prevent, disrupt, and reinstate flow, plus those athletes perceived to be controllable.	E,O, C
Hodge, Lonsdale & Jackson (2009)	201 (121 female, 80 male) athletes from 51 sports who received funding from Canadian Sport Centre. *M* age = 22.92, *M* years participation = 9.52	Correlational study	Athlete Engagement Questionnaire, Dispositional Flow Scale-2 (DFS-2), basic needs satisfaction questionnaire. Structural equation modelling used.	O
Jackson (1992)	16 (9 female, 7 male) national champion figure skaters; all had competed at world level. *M* age = 25, *M* skating experience = 13 years.	Descriptive investigation	Interview examining possible antecedent, preventing and disrupting flow factors. Exploratory Flow Questionnaire assessed components of flow.	E,O, C
Jackson (1995)	28 (14 male, 14 female) athletes from 7 sports who had achieved at least a top 10 placement in international competition. *M* age = 26.	Descriptive investigation	Interview on factors perceived to have helped or hindered athletes from getting into flow, disruption of flow, and controllability of flow.	O,C
Jackson (1996)		Descriptive investigation	Interview on athletes' experience of flow	E
Jackson & Roberts (1992)	200 (110 male, 90 female) Div.1 college athletes from 8 individual sports. *M* age = 19.4, *M* years competitive involvement = 8.	Correlational study	Questionnaire assessing master and competitive goal orientations, perceived ability, flow, and experience in best and worst competitive performances.	O
Lindsay, Maynard & Thomas (2005)	3 (2 male, 1 female) cyclists carrying UK ranking ranging from 1-28. *M* age = 25.3, minimum competitive experience = 4 years.	Hypnosis intervention	FSS and British Cycling Federation performance measures.	C
Nicholls, Polman & Holt (2005)	4 (3 male, 1 female) amateur golfers with handicaps of 0 to +1 who had competed at county, national or international level. Age range = 20-23	Imagery and music intervention	FSS, position-specific performance measures, Brunel Music Rating Inventory-2, Movement Imagery Questionnaire.	C
Pain, Harwood & Anderson (2011)	5 (male) soccer players previously coached at English professional clubs. *M* age = 20.9.	Imagery intervention	FSS-2, DFS-2, and individual golf performance measures.	C
Stavrou, Jackson, Zervas & Kerteroliotis (2007)	220 (112 male, 108 female) athletes from 7 individual sports, competing at national or international level. *M* age = 19.95, *M* competitive experience = 6.98 years.	Correlational study	Challenges and skills measured before and after competition, FSS measured flow after competition, subjective and objective measures of athletes' performance assessed.	E,O
Sugiyama & Inomata (2005)	29 (25 male, 4 female) university and semi-professional athletes from 3 sports competing at national or international level. *M* age = 20.6, *M* experience = 10.5 years.	Descriptive investigation	Semi-structured interview examined psychological elements of flow experienced during competition, and explored the psychological states leading to flow experience.	E,O, C
Wiggins & Freeman (2000)	13 (female) Div.1 college volleyball athletes. *M* age = 19.08.	Correlational study	Observations, Competitive State Anxiety Inventory-2D prior to competition, FSS after competition.	O
Young (2000)	31 (female) professional tennis players. *M* age = 22.7, *M* years participation = 12.2.	Descriptive investigation	Self-report instrument combining qualitative (factors perceived to influence flow) and quantitative (FSS, Experience Questionnaire, ratings of challenge, skill, and frequency of flow) measures.	O

Note: (E) = the experience of flow; (O) = the occurrence of flow; (C) = controllability of flow.

Table 2: Analysis of qualitative studies exploring experience of flow in elite sport

Ranking	Flow Dimension	N and (%) of athletes citing
1	Concentration on the task at hand	92 (80.7%)
2	Action-awareness merging	85 (74.56%)
3	Sense of control	77 (67.54%)
4	Autotelic experience	76 (66.67%)
5	Unambiguous feedback	66 (57.89%)
6	Clear goals	51 (44.74%)
7	Challenge-skills balance	47 (41.23%)
8	Loss of self-consciousness	34 (29.82%)
9	Transformation of time	33 (28.95%)

Table 3: Summary of factors identified as influencing flow

	Construct	Facilitating	Studies	Preventing	Studies	Disrupting	Studies
Consistent	Focus	Appropriate focus	1,2,3,4,5	Inappropriate focus	1,2,3,5	Inappropriate focus	1,2,3,5
	Preparation	Effective preparation (physical, mental and competitive) and readiness	1,2,3,4,5	Non-optimal preparation and readiness	1,2,3,5	Incomplete preparation and non-optimal readiness	1,2,3
	Motivation	Optimal motivation	1,2,3,4,5	Lacking motivation	2,3,5	Non-optimal motivation	3
	Arousal	Optimal arousal	1,2,3,4,5	Non-optimal arousal	2,3,5	Non-optimal arousal	3
	Thoughts and emotions	Positive thoughts and emotions	1,2,3,4,5	Negative thoughts and emotions	1,2,3,5	Negative thoughts and emotions	1,2,3,5
	Confidence	Confidence	1,2,4,5	Lacking confidence	1,2,5	Losing confidence	1,2,5
	Environmental and situational conditions	Optimal environmental & situational conditions	2,3,5	Non-optimal environmental and situational conditions	1,2,3,5	Non-optimal environmental and situational conditions	1,2,3,5
	Feedback	Positive feedback (internal or external)	2,3	Negative feedback	3	Negative feedback	3
	Performance	Starting well	2	Poor performance	1,2,5	Performance mistakes	1,2,5
	Team play and interaction	Positive team play and interaction	1	Negative team play and interaction	1,2	Problems with team performance or interactions	1,2
Separate		Absence of negative influences	2,4,5				
		Personal experience	2				
						Losing rhythm	5

Note: 1= Jackson (1992); 2= Jackson (1995); 3 = Young (2000); 4= Sugiyama & Inomata (2005); 5= Chavez (2008)

Table 4: Perceived controllability of flow

Perceived Controllability	Jackson (1992)	Jackson (1995)	Sugiyama & Inomata (2005)	Chavez (2008)
	Participants: 16	Participants: 28	Participants: 29	Participants: 16
Controllable	7 (43.75%)	22 (79%)	21 (71%)	11 (69%)
Partly Controllable	4 (25 %)			
Difficult to Control			8 (29%)	5 (31%)
Uncontrollable	4 (25%)	6 (21%)	None said impossible to control	
Other	2 (12.5%) uncommitted			
Explanations Provided	**Controllable facilitators:** being well-trained, maintaining appropriate focus, channelling energies/staying relaxed, confidence/positive thinking, enjoying what one was doing, and surrender (not actively trying to control). **Uncontrollable facilitators:** physical state/how feeling physically on the day, performance of partner, partner unity, crowd response, and "everything being in place".	"It was not possible to determine what was behind this range of perceptions regarding the controllability of flow" (p.153).	Reasons given for control being difficult included "difficulty in producing proper tension, difficulty controlling one's state when not on a big stage, and difficulty producing such a state as it always seems to come from when there is pressure on external sources" (p.977).	**Perception of controllable factors:** Preparation, positive thinking, optimal arousal, task orientation, motivation, concentration. **Perception of limited or no control:** Environmental and situational factors, optimal arousal, negative attitude, concentration, motivation.

Note: We acknowledged that Jackson's (1992) percentages add up to 106.25%, however this was not explained in the original study.