Reversal Theory-Based Sport and Exercise Research: A Narrative review

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Although reversal theory (RT; Apter, 1982, 2001) has been applied to a wide range of topics in psychology, it is sport and exercise that has received the most attention from researchers. Other topics include, but are not restricted to smoking cessation (e.g., Cook, Gerkovich, O'Connell, & Potocky, 1995), delinquent and hooligan behaviour (e.g., Jones & Heskin, 1988; Kerr & de Kock, 2002), addictions (e.g., Brown, 2001), psychotherapy (e.g., Wilson & Wilson, 1996), leadership development (e.g., Carter & Davies, 2004), violence (e.g., Howard, 2011), risk-taking (e.g., Trimpop, Kerr, & Kirkcaldy, 1999), espionage (e.g., Wilson, 2012), humour (e.g., Downing, 2000; Murgatroyd,1987), design (e.g., Fokkinga & Desmet, 2012), and sexual behaviour (e.g., Gerkovich, 1997; Vera-Cruz, Vinsonneau, & Mullet, 2010). The research focus on sport and exercise may be because it offers a unique context for research which is different from the other domains in which RT has been applied (e.g., immediacy, inherent competition, performance outcomes, varying levels of expertise and experience). Sport and exercise are actually two different research areas. However, they are considered together in this review because both involve performance to some degree. In the majority of the research studies reviewed here, both athletes and exercisers have accepted a personal and/or team challenge, and have a strong desire to be successful and perform as well as possible, whether that is measured against opponents or their own standards.

In 1985, the first journal manuscript on reversal theory (RT) and sport was published in the *Journal of Sport Sciences*. That paper applied the theory's "trademark" X-curve relationship between arousal and hedonic tone to the experience of arousal in sport (Kerr, 1985). In the 30-year period since that publication appeared, RT (Apter, 1982, 2001) has grown from its original insights to become more complex and possibly daunting to some newcomers. In this period, the theory has been used as a theoretical foundation for studies exploring research questions across the full palette of topics in sport

and exercise psychology (see e.g., Kerr, 1991, 1997, 2001; Kerr, Lindner, & Blaydon, 2007). Consequently, because of: (a) the gradual development of reversal theory from its early beginnings; (b) the increasing complexity of the theory; (c) the unique context; and (d) a diverse and expanding literature base reflecting a critical mass of sport and exercise research work, a review would appear to be timely. Such a review would, not only summarise RT research results to date, but also highlight successful RT research strategies, techniques and procedures, acting as a kind of "research test bed" potentially beneficial to both sport and exercise psychologists and psychologists working in other psychology domains.

It was the aim of this comprehensive review to critically scrutinize peer-reviewed journal publications on reversal theory sport and exercise research from 1985-2014. A combined systematic/narrative approach was adopted, similar to that used by, for example, Rice et al. (2016) in their review of mental health in elite athletes. Systematic searches ensure that all articles published within a certain time-span are identified. In the present review, the types of databases searched and the criteria for the inclusion of research publications found during those searches are reported (see Method section). Narrative reviews can make connections between diverse research articles, allowing integrations and possible reinterpretations, as well as providing a useful overview of a topic. In addition, narrative reviews can suggest broader, higher-level theoretical conclusions, beyond those possible in individual research reports and thus these may draw attention to weaknesses, gaps in the literature and contradictions where necessary (Baumeister & Leary, 1997). For example, in the present review the authors comment on the strengths or weaknesses of methodologies used in particular research studies where this was considered central to the discussion. However, in spite of these advantages, care must be taken to guard against possible bias in narrative reviews.

An overview of the most relevant features of the theory, illustrated using examples from sport,

is provided in the following section. Where relevant, brief comparisons are made with other theories. An overview of RT is necessary to identify its most relevant elements and inform readers' understanding of the core research questions or propositions that emerge in the Method section. If readers are to make sense of the review, it is crucial that they understand basic RT concepts, such as motivational states and dominance, their possible relationship with performance, and the motivational reversal process itself.

Reversal Theory Explained

RT's basic premise is that people's motivations and emotions are inherently inconsistent, but that there is a pattern to this inconsistency. The theory posits a framework of eight bistable motivational states. Motivational states operate in pairs and as reversals take place, an individual's motivation and felt experience changes. The eight motivational states, arranged in four bistable pairs, are outlined below:

Four Somatic Motivational States

In the serious (telic) and playful (paratelic) motivational states any activity is experienced in two contrasting ways. In the serious state, an individual prefers activities that are perceived to be significant and have meaning beyond their immediate fulfilment (e.g., achieving training goals prior to an important competition). In the playful state, activities tend to be unplanned, spontaneous, and concerned with immediate pleasure (e.g., a "lap of honour" around the arena by athletes after victory in an Olympic final). The negativistic and conformist states are oriented around the individual's response to implicit or explicit rules. In the conformist state, an individual's experience is oriented around the value of belonging, of "fitting in" to the prevailing norms and meeting social expectations. Behaviour is likely to be compliant, dutiful, and obedient (e.g., when a new player joins a national team training camp). In contrast, the negativistic state is one in which an individual's experience is oriented around a core value of freedom and autonomy. He or she will want to react against the rules, be autonomous and

prefer to "go against the flow" (e.g., when a player breaks a team curfew before an important game).

Four Transactional Motivational States

In the mastery state, a person values and seeks power, control, and toughness. This state underpins competition and a desire to win (e.g., facing a competent opponent in a Judo competition). In the sympathy state, a person values cooperation and harmony with others and is sensitive and kind (e.g., helping an opposition player who has been injured). The experience of pleasure comes from perceived outcome, in terms of gaining or losing in transactions with other people or objects. In the self-focused state (autic), one gains pleasure or displeasure from what happens to oneself. There is a high value on individuality (e.g., receiving a medal at a major tournament). Conversely, in the other-focused state (alloic), pleasure or displeasure depends on the experience of others. There is a high value in transcendence, going beyond one's individual identity (e.g., empathising with the players in your favourite soccer team who have just lost a cup final in a penalty shootout).

Felt arousal is how worked-up or emotionally intense a person feels about what he or she is doing and is an important concept in RT. The experience of felt arousal is fundamentally different in the serious and playful states. In the serious state, high levels of felt arousal are unpleasant and perceived as a form of anxiety or tension. Low levels of arousal are preferred and likely to be experienced as pleasant relaxation or calmness. Pleasure comes from resolving any "tension" associated with an uncompleted task. In the playful state, high felt arousal is enjoyable, being experienced as excitement, joy, or exhilaration. By contrast, low arousal in the playful state is experienced as unpleasant boredom.

In the sport psychology literature, Jones (1995) criticised RT for using an undifferentiated model of arousal, rather than a multi-dimensional model with separate somatic and cognitive components. The multi-dimensional anxiety model originally comprised a three-factor model of cognitive anxiety, somatic anxiety, and self-confidence (Martens, Burton, Vealey, Bump, & Smith, 1990). It has since been developed to include a facilitative and debilitative interpretation of anxiety

(e.g., Hanton, Wadey, & Connaughton, 2005; Jones & Hanton, 2001). The essence of Jones' (1995) criticism was that RT does not explicitly acknowledge the same three dimensions as the multi-dimensional model. This criticism fails to take into account the phenomenological basis of felt arousal within RT, which is not the same as physiological activation. RT offers a more elegant explanation for how and why the experience of anxiety can be helpful or not, because the interpretation of felt arousal can be pleasant or unpleasant depending on the operative motivational state.

Motivational States and Emotions

Sixteen primary emotions are produced by different combinations of motivational states (see Table 1). Positive, pleasant emotions result when a person's preferred way of feeling matches their current experience. Negative, unpleasant emotions occur when there is a mismatch between a person's preferred way of feeling and their current experience.

Somatic emotions. The theory suggests that the serious-playful and negativism- conformist pairs operate in combination. This leads to the experience of eight possible emotions. These are termed somatic emotions because they all relate to the experience of felt arousal. The emotions will either be pleasant or unpleasant depending on the prevailing state combination. An individual's emotions are posited to change in two ways: first, through their own actions to manage their level of felt arousal. When the serious and conformist states are operative, attempts will be made by the individual to decrease felt arousal. When the playful and negativistic states are operative, attempts will be made to increase or prolong high felt arousal. Second, emotions can change when there is a reversal from one state combination to another, so that the prevailing level of felt arousal is experienced in a different way.

Transactional emotions. These are termed transactional emotions because they all relate to the experience of felt transactional outcome, which is based on the perceived outcome (pleasant gain or unpleasant loss) in transactions with other people or objects. Working in combination, the mastery-

sympathy and self- and other-focused motivational states allow for a range of transactional emotions. For example, when the self-focused and mastery states are operative, high levels of felt transactional outcome are pleasantly experienced as pride, but low levels would be experienced as unpleasant humiliation. A reversal from the self- to the other-focused state would result in the experience of pleasant modesty or unpleasant shame, depending on the level of felt transactional outcome.

RT provides a single primary emotion for each of the sixteen possible state combinations, even though each combination has the potential to host a range of emotions of the same family. For example, love could be considered to be an emotion arising from the other-focused-sympathy combination. This can lead to problems if the specific example given is an unfamiliar emotion (e.g., sullenness, virtue). A related concern is the contrast between the precision of the theory's basic structure of eight bistable states, and the fluid nature of self-awareness. As Ekman (1999, p. 55) states: "It is no easy matter to assess subjective experience, especially if what is wanted is something more than the amount of positive or negative emotion." Also, people vary widely in their ability to name and express emotions (John & Gross, 2004). It could be argued that some emotions within the RT model do not form a recognisable regular component of everyone's emotional landscape. To counter both of these criticisms, RT proponents have developed rich lexicons to describe the many relevant emotions that are salient to specific groups and situations (e.g., Potocky, Cook, & O'Connell, 1993). However, some concern remains that RT emotions, such as sullenness or placidity, may not be readily recognised by individuals.

Furthermore, in contrast to theories that suggest that emotions arise as the result of appraisals of environmental conditions (e.g., Campo, et al., 2012; Lazarus, 2000; Lazarus & Folkman, 1984), RT begins with the premise that people are at all times oriented towards achieving core motivational values (e.g., fun in the playful state). This is close to Ekman's (1990) category of theories of emotion that are oriented toward fundamental life tasks, or Frijda's (1986, 1994) proposition that emotion serves as an

early warning system for evolutionary survival. RT proposes that emotions arise as a consequence of the degree to which a core motivational value is being experienced. This can be considered a form of appraisal, but it is framed within the parameters of the prevailing motivational states.

Stress

Healthy functioning in RT terms requires adequate motivational flexibility to experience all the different combinations of motivational states as and when appropriate (Apter, 2001). Negative emotions are indicative of stress and prolonged experience of negative emotions may affect a person's health and psychological well-being. Apter and Svebak (1989) proposed two fundamentally different types of stress within RT. *Tension-stress* refers to feelings that arise when a person perceives a discrepancy between the preferred and actual level of a salient motivational variable (e.g., felt arousal). For example, in relation to the serious state, there is a preference for low felt arousal. High felt arousal is not preferred and will lead to tension-stress, experienced as anxiety or worry. A lack of control or weakness when in the self-focused-mastery state will lead to tension-stress experienced as humiliation. Therefore, stress as a result of "tension" can take many forms, depending on the operative motivational state combination and will be experienced as an unpleasant emotion. Effort-stress is the feeling of effort made to reduce tension-stress. This has a subjective meaning and is not necessarily linked to the degree of physical activation or exertion. It can be expressed externally, in an attempt to change external factors, or internally, in response to internal factors.

The Process of Psychological Reversals

The theory suggests that there are three types of causal factors that can trigger a reversal from one state to its opposite pair. First, a change in the *environmental situation*, or a specific, relevant external event can trigger a reversal. Second, if a person's needs in a particular motivational state are not met over an extended period, a reversal to the opposite state can occur as a result of *frustration*. Third, irrespective of any external force, reversals will naturally occur over time, due to *satiation*.

Individuals vary in how easily and frequently they reverse between states (*motivational flexibility* or *lability*).

In addition, individual differences affect the patterns of reversals and preference for one state over another. This is termed *motivational dominance* in RT and is the innate bias held by a person to spend time in one state over another in the same motivational pair. It is therefore possible to describe an individual's personality in terms of their dominance (e.g., mastery dominant, negativistic dominant). Apter (2001) argues that dominance differs from a personality "trait" because it is possible for someone to possess a particular dominance, but still spend some time in the opposite state. By contrast, trait-based personality theories measure the degree to which an individual's preferred behaviour lies along a continuous, normalised scale. Individual personality is described by the strength and frequency of how a particular trait, such as neuroticism, is displayed (e.g., Nettle, 2007).

RT sport and exercise research has included a variety of both quantitative and qualitative research techniques and tools that have been used to tap into the experience of individuals in different circumstances and situations in sport and exercise. For example, RT quantitative research has included surveys, laboratory and field experiments, field studies and real-life simulations, using established measures of motivational state and dominance, and emotion, stress and effort. Situation-specific, custom-designed questionnaires, objective indices of motivational state, and psychophysiological measures have also been utilised. Qualitative research has focused on competitive and non-competitive sport and exercise events. The majority have been field or case studies using semi-structured interviews with participants, or have used autoethnography. In some cases, quantitative and qualitative methods were combined.

The plethora of methods and approaches previously used in reversal theory sport and exercise research justifies the use of a narrative review as the most meaningful way to make sense of the results obtained. It is also an appropriate means to pinpoint the main concerns and queries the authors have

about previous research, such as the early concentration on the serious-playful (telic-paratelic) pair of states; the mastery state as a largely unexplored factor in performance; challenges in identifying and measuring reversals; and the nature of ongoing changes in motivational state as events proceed. These and other concerns are addressed in the present review.

Method

Search Strategy

General computer databases, Sportdiscus, PsychINFO, PubMed, and Google Scholar were searched for all English language, peer-reviewed articles that featured sport or exercise research studies that used reversal theory (1985-2014). The search terms used were combinations of sport or exercise and key words related to RT, including *reversal theory, reversal(s), (meta)motivational state, (meta)motivational dominance, felt arousal, somatic emotions, transactional emotions, tension stress, effort stress,* as well as the terms for individual motivational states (e.g., *telic state, mastery state*). In addition, sport and exercise studies, found on the RT publications database (www.reversaltheory.org), retrieved from journal publication reference lists, and any other published studies known to the authors were also included. Theoretical journal manuscripts, books, theses, dissertations, and conference abstracts and proceedings were excluded. All the published studies identified were included in the present review, thus eliminating any possible selection bias. This produced a total of 56 reversal theory-based studies. For sport, there were 15 studies examining athletes' personality dominance characteristics, two on aggression, nine on adventure or risk sports, one on injury rehabilitation, and 17 field studies involving competing athletes. For exercise, there were five field and five laboratory studies. Two studies examined motor skill and performance.

To facilitate understanding, the studies identified in the review were divided thematically using broad inclusion criteria based on three basic assumptions, or pillars of the theory itself (e.g., the reversal process), and an ever-present topic from within the body of sport and exercise research in

general (i.e., mental state and optimal performance). These themes represent core research questions or propositions explored in the identified RT studies. Some studies present evidence related to more than one theme. The four themes which provide structure to this review were:

1. Evidence that the full range of motivational states have been reported in sporting contexts and that these constructs provide a valid description of athletes' experience across different phases of competition, in different types of sport, and in both individual and team events.
2. Evidence supporting the reversal process and its causal factors, providing a theoretically coherent explanation as to how and why change occurs in a performer's emotional and motivational experience.
3. Evidence for the role of motivational dominance in preference for, and participation in different types of sport. Thus, providing a basis for understanding individual differences in personality.
4. Evidence for a definite relationship between motivational state and performance, providing a means of optimising competitive performance.

The final summary paragraph of each theme presents a critical analysis of current knowledge, limitations, strengths, or future directions within that theme.

Evidence of the Full Range of Motivational States in Sporting Contexts

A series of research studies that have explored the role of the motivational states in sport performance included international level individual athletes in slalom kayaking (Males, 1999; Males & Kerr, 1996; Males, Kerr, & Gerkovich, 1998), and national level team players in volleyball (Males, Kerr, Thatcher & Bellew, 2006) and lacrosse (Kerr & Males, 2010, 2011). These studies used high-level athletes in naturalistic settings to provide detailed data collected over an extended time period. In the case of the slalom kayaking studies, this comprised a complete competitive season of domestic and international events, and over major tournaments for volleyball and lacrosse.

Slalom Kayaking Studies

These slalom kayaking studies focused on the athletes' experiences in pre-event, during

competition and post-event time periods. The results of quantitative and qualitative studies (Males & Kerr, 1996; Males, Kerr, & Gerkovich, 1998) showed that individual competitors reported all four somatic motivational states (serious, playful, conformity, negativism). The actual proportions varied between individual athletes, as RT would predict. Serious-conformity was the most frequently reported combination, occurring in over 70% of coding units pre-race, just under 60% during the race runs, and increasing to 84% between race runs. Playful-conformity was the next most frequently reported combination, most often reported during performance (35%) and least often in the post-race period (4.1%). Negativism, in either the playful or serious combination, mainly occurred post-race, but infrequently. In terms of the transactional emotions, these individual athletes reported self-focused-mastery as their predominant state, with only isolated examples of self-focused or other-focused-sympathy. The authors claimed that these examples occurred in the type of situations that RT would predict, for example at times when a competitor needed to seek rest or medical treatment (self-focused-sympathy), or briefly when expressing concern for those who had not qualified for the national team (other-focused-sympathy). The other-focused-mastery state combination, representing a desire to help others experience control, was not reported amongst the elite slalom kayakers in this study.

Volleyball and Lacrosse Studies

The volleyball and lacrosse studies (Kerr & Males, 2010, 2011; Males et al., 2006) presented qualitative data using a thematic approach. The aim was to explore how motivational states might relate to coaching style, team communication, reactions to substitution, and responses to game outcomes. Post-game interviews in volleyball and lacrosse environments also showed a range of motivational state combinations, before, during, and after competition (Kerr & Males, 2010, 2011; Males, et al., 2006). Transactional emotions and the underpinning motivational states were salient in these team contexts. For example, the other-focused-mastery state combination was less frequently reported by volleyball players in a poorly performing team than the self-focused-mastery combination. Team

cooperation and cohesion appeared to suffer as a result. The results also provided insights into individual differences in motivation, suggesting that the players were likely to require very different performance strategies to maintain their preferred level and type of emotional focus during competition.

In other research, Thatcher, Kerr, Amies, and Day (2007) examined intra-individual responses to injury by mapping operative motivational state combinations in athletes during sports injury rehabilitation. The results suggested that a prevailing state combination of serious-conformist self-focussed-mastery over time appeared to assist athletes in successfully completing their rehabilitation. More recently, Houge Mackenzie's work extended the use of qualitative and quantitative methods in RT research to adventure sports participants (Houge Mackenzie, Hodge, & Boyes, 2010, 2011, 2013; Houge Mackenzie & Kerr, 2012, 2014; Kerr & Houge Mackenzie, 2012, 2014). Among other findings, these studies showed the multifaceted nature of adventure sports motivation, which could be attributed to a variety of different operative motivational state combinations and identified the existence of a multi-phasic relationship between flow experience (e.g., Csikszentmihalyi, 1975) and motivational reversals (serious (telic) flow and playful (paratelic) flow).

Critical Summary

Taken together, these studies represent data from athletes and sport participants of differing ability when competing, or during recreation. The quantitative and qualitative findings provided useful evidence for the existence of a range of motivational states in both individual and team sports. The results also showed that different motivational states can be operative at different times during the course of an event, and that some states are experienced less frequently than others. In view of criticism that the reasons for reversals in sport are poorly understood (Balague, 2005), it would be useful to know from future research how, and for what reasons, performers' motivational states change (or not) during the course of an event. The next section examines research on motivational reversals in sport

and exercise.

Motivational Reversals in Sport

Early evidence for the reversal phenomenon in a sporting context came from an exercise study using objective indices (Kerr & Vlaswinkel, 1993: see also Kerr & van den Wollenberg, 1997). Arousal preference (a defining feature of the serious and playful states) was assessed based on colour choices made by recreational runners throughout the duration of a run. Preference for the colour red has been linked to the arousal-seeking playful state and preference for light blue to the arousal-avoiding serious state (Walters, Apter, & Svebak, 1982). Participant runners in the study were required to choose between a red or light blue card (as an indicator of their arousal preference and therefore their operative motivational state) at regular points during the run. The results indicated a pattern of extreme shifts in colour preference and state consistent with RT reversal constructs. For example, fast runners started the run in the serious state and reversed to the playful state at some point during the run, while slow females remained playful throughout the run (generally, RT does not predict differences between males and females).

Hudson and Bates (2000) identified reversals between the serious and playful states during a dart-throwing task. Participants were free to choose between two versions of the task within a ten-minute period. In the serious version, participants were required to achieve a randomly selected score with one set of three darts. A cash bonus was awarded each time the score was achieved. This task was intended to enable participants to plan their actions, adopt a serious state of mind, and engage in the activity for a specific purpose. In the playful version, a target score was again randomly selected for each set of three throws, but it was not conveyed to the participants, so they were throwing for an unknown outcome. Quantitative data was collected using an RT state measure, the Telic/Paratelic State Inventory (TPSI; Cook, Gerkovich, Potocky, & O'Connell, 1993), and participants were invited to explain their reasons for each task change in short semi-structured interviews. Five participants made

no reversals, four remained for the whole trial with the serious task and one with the playful task. The remaining 11 participants made between one and four reversals within 10 minutes. The reasons given for changing tasks were categorised into four themes, “desire for a goal” and “lack of success” (taken as evidence of frustration as the causal factor) and “boredom” and “no explanation” (taken as evidence of satiation). The lack of evidence for contingent events was explained by the closed environment of a laboratory task.

Naturalistic and Competitive Environments

Research in more naturalistic and competitive environments has also found evidence for reversals. Bellew and Thatcher (2002) examined motivational state changes between the serious and playful states in 20 male rugby players over three matches.Participants completed the State of Mind Indicator For Athletes (SOMIFA; Kerr & Apter, 1999) between 30 and 90 minutes after each match and recorded key incidents that had occurred during the game, the time the incident occurred and any short or long term effects on their behaviour or goals. Matches were video-recorded, and two days after each match participants reviewed the video in an individual interview. At each of the key incidents, the researcher paused the video, questioned the participant in more detail and collected TSM (Telic State Measure; Svebak & Murgatroyd, 1985) responses. All participants reported reversals across the three matches. The number of reversals for each participant ranged from 1 to 10, which can be taken as support for individual variation in the propensity to reverse (lability). A total of 22 reversals were identified, 12 serious to playful and 10 playful to serious. Sixteen were due to a contingent event, 2 to frustration, and 4 to a combination of these two factors. None were due to satiation. The authors pointed out that, while the study focused on the serious and playful state reversals, some of the examples given in interviews pointed to the salience of other motivational states during competition.

Qualitative RT-based studies (Grange & Kerr, 2010; Kerr & Males, 2011) have specifically examined the motivation behind aggressive and violent actions in contact sports (e.g., lacrosse,

Australian football). The results confirmed the role that reversals can play in these incidents. The authors pointed out that when playing these sports elite athletes generally have the playful-mastery state combination operative. However, under certain conditions, reversals can occur to serious-mastery, serious-negativism or playful-negativism state combinations, bringing about aggressive and violent acts concerned with demonstrating power (serious-mastery), exhibiting anger (serious-negativism), and experiencing thrill (playful-negativism), respectively.

An examination of reversals across all eight motivational states was carried out in a case study analysis of five male golfers taking part in a round-robin tournament (Hudson & Walker, 2002). Using post-event interviews based on the Motivational State Coding Schedule (Potocky, Cook, & O'Connell, 1993) and content analysis, they found evidence for all three reversal inducing factors, with 17 reported reversals in total. The authors found 17 reported reversals. Of these, contingent events accounted for 11 (65%), frustration for 5 (29%) and satiation for 1 (6%). The authors were able to link reversals to participants' key moments in play across the tournament.

In the Kayaking study mentioned earlier which used post-event interviews (Males et al., 1998), contingent events (usually an error during the race), were found to precipitate reversals in slalom kayakers' motivational states. Males et al. (2006) also provided evidence that volleyball players experienced changing motivational patterns and reversals throughout a tournament. All three causal factors were identified, triggering reversals across state combinations. For example, the coach's behaviour triggered a reversal from the conformist to negativistic state in one player. For another player, the coach's failure to "substitute him on", when a team-mate was performing poorly, caused a reversal from other-focused-sympathy to self-focused-sympathy as a result of his frustration.

Kerr and Kuk (2001) conducted a field experiment where recreational runners completed theTension and Effort Stress Inventory (TESI; Svebak, 1993) pre- and post- high and low intensity running on outdoor trails. Half completed a 5.0km run and half a 1.7km run. The researchers argued

that, while it is possible to use the TESI as a straightforward measure of emotions and stress, The researchers argued that, while it is possible to use the TESI as a straightforward measure of stress, it is also possible to link changes in individual emotions with reversals in motivational states. Among the results they obtained, for pre-to post-running 5.0 km, was a significant increase in total pleasant emotions and a significant decrease in total unpleasant emotions, suggesting that a number of runners reversed during the run. Furthermore, Kerr et al. (2006) compared recreational and competitive runners under laboratory and natural conditions and found that changes in some individual TESI emotions reflected particular motivational state reversals. For example, for somatic emotions in recreational runners, significant increases in excitement (playful-conformist) and decreases in anxiety (serious-conformist) found pre- to post-running, were indicative of serious to playful reversals. Also, for transactional emotions in recreational runners, significant decreases in shame (other-focused-mastery) pre-to post-running and increases in pride (self-focused-mastery) post-running were indicative of other-focused to self-focused state reversals. Other RT sport or exercise studies that found positive changes in emotions and stress (indicative of reversals), include three studies that examined recreational participation in aerobics, circuit training, and Tai Chi (Frith, Kerr, & Wilson, 2011), baseball (Fujiyama, Wilson, & Kerr, 2005), and tennis (Kerr, Fujiyama, & Campano, 2002).

Not all studies have provided evidence of reversals. Thatcher, Reeves, Dorling, and Palmer (2003) found no significant differences in motivational state amongst 23 experienced skydivers, who completed the TPSI and TESI 15 minutes pre-jump and 15 minutes post-jump.

Critical Summary

Elite and recreational level, individual and team competitors reported rapid changes in their emotional and motivational state that can be explained by RT's concept of reversals. Therefore, there is research evidence to confirm that reversals occur in sport and exercise, and that they do so for the reasons suggested by the theory (environmental events or settings, frustration, and satiation). On the

positive side, in reading through the interview transcripts from those qualitative studies described above, Apter and Heskin (2001) pointed out that it was possible to follow the reversals that occurred in response to the changing situations that confronted the athletes in a realistic and meaningful way. However, on the negative side, identifying and measuring reversals can be challenging. Some research on reversals, described above, has dealt with this challenge by using questionnaires that attempted to objectify experiential states and measure them on linear scales. This approach was only partially successful, as it failed to maximise the theory's potential to capture the subtleties and variety of individual meaning and experience. Also, some studies were limited because they only considered the serious and playful states and did not address other motivational states.

The Role of Motivational Dominance in Sport Preference and Participation

The third research theme to be explored is the evidence for a relationship between motivational state dominance (how much time is spent in one state compared to its opposite) and choice of sport. In early RT research, motivational dominance studies focused on the serious-playful and negativism-conformity dimensions because the Telic Dominance Scale (TDS; Murgatroyd, Rushton, Apter, & Ray, 1978) and the Negativism Dominance Scale (NDS; McDermott & Apter, 1988) were the only measures that had been developed at that time.

Research has shown that serious dominant individuals are more likely to choose safe and/or endurance-based sports, such as long-distance running, while playful dominant individuals are more likely to participate in risk and/or explosive sports such as surfing or rock-climbing (e.g., Kerr 1991; Kerr & Svebak, 1989; Svebak & Kerr, 1989). This is most strongly identified through responses to the arousal-avoidance dimension of the TDS. Trimpop, Kerr, and Kirkcaldy (1999) found a positive correlation between TDS arousal seeking and Zuckerman's Sensation Seeking Scale (Zuckerman, 1979) that has been widely used to investigate participation in high-risk activities. NDS proactive negativism scores, along with TDS high arousal seeking and low serious-mindedness scores, pointed to

increased participation and injury in the high-risk sport of snowboarding (Cogan & Brown, 1999; see also Chirivella & Martinez, 1994).

Motivational dominance also relates to level of participation in sport. Professional athletes reported higher levels of serious dominance than less committed or amateur athletes (Kerr, 1987). Serious dominance brings an ability to plan ahead, be serious-minded and focused on long-term goals. In addition, Vlaswinkel and Kerr (1990) found no difference in NDS scores between recreational and professional soccer players, while Braathen and Svebak (1990) found that skilled explosive sport performers scored significantly higher on the NDS Reactive Negativism scale than endurance and team sport athletes. In 1998 it became possible to assess an individual's dominance across all four pairs of states and show which state is salient using the Motivational Style Profile (MSP; Apter, Mallows, & Williams, 1998). Studies employing this measure, and therefore assessing a greater array of dominances, are discussed below.

The Hong Kong Sport Participation Studies

Adding to the evidence linking motivational dominance with motives for taking part or not taking part in sport and physical activity were results obtained from large samples of Hong Kong students by Lindner and his colleagues (Lindner & Kerr, 2000, 2001; Kerr, Au, & Lindner, 2004). In the first study, new university entrants responded to a survey questionnaire in which motives for participation or non-participation were phrased in terms of reversal theory's eight motivational categories (Lindner & Kerr, 2000). Questionnaire responses were then used to classify respondents according to their primary sport participation or non-participation motivational orientation (MO). Significant differences between participants and non-participants were found, in addition to some significant gender differences. The serious and other-focused MOs were most frequently rated by participants. For non-participants, the playful, serious, mastery and self-focused MOs were rated most frequently. In the second study (Lindner& Kerr, 2001), for samples of (a) school children and youth,

and (b) university students, sport participation motivation was found to be weakly, but reliably predicted by motivational dominance scores.

The third study (Kerr, Au, &Lindner, 2004) explored a number of factors related to participation, including whether student participants in sport and physical activities involving varying levels of risk differ in their situational dominance. Situational dominance is a particular form of motivational dominance relating to the amount of time a person spends in one state rather than its opposite in particular situations, for example, regular participation in a particular sport. Respondents who completed a modified version of the MSP were grouped, on the basis of their main sport or physical activity, as being relatively low, medium, or high risk of physical injury. For male, high risk participants, situational dominances were significantly less serious, arousal avoiding, and conformist than their low risk counterparts. For females, situational dominance scores were found to be similar for all three risk groups. The results of these three Hong Kong-based studies were used by the university physical education department to help decide on the provision of a range of sport and exercise activities which would be attractive to students with different dominance profiles.

Svebak's Model of Dominance, Muscle Composition and Type of Sport

Svebak (1990, 1999) offered an explanation for these sport participation patterns that integrated the results from a series of psychophysiological studies into a model of personality and sports participation (Braathen & Svebak, 1990, 1994; Svebak, 1984, 1986; Svebak, Howard, & Rimehaug, 1987; Svebak, Storjfell, & Dalen, 1982). This model combined motivational dominance, muscle composition and the demand characteristics of the sport. His conclusions were that, individuals who are serious-dominant, have a greater proportion of slow-twitch muscle fibre and are more suited to participation in endurance events, and individuals who are playful-dominant, have a greater proportion of fast-twitch muscle fibres and are more suited to participation in explosive sports. Svebak’s (1990) model has been tested in a set of laboratory studies. For example, Legrand, Bertucci, and Thatcher

(2009; see also Legrand & Thatcher, 2011), found that serious dominant runners felt significantly less pleasure and greater perceived exertion than playful dominant runners after an explosive ten-minute bout of intense treadmill running. Thatcher, Kuroda, Legrand, and Thatcher (2011) explored the importance of a match between dominance and state using a cycle ergometer task. Participants' state was manipulated by means of watching either a comedy (playful) or documentary (serious) film prior to and during exercise. Playful dominant participants were more stressed than serious dominant participants when exercising in the serious state and serious dominant participants were more stressed than playful dominants when exercising in the playful state. Playful dominant participants also reported greater discrepancy between internally reported stress and effort when exercising in the serious compared with the playful state. Thus, the findings from this study partially supported Svebak's (1990) model.

Thatcher, Kuroda, Thatcher, and Legrand (2010) also used a treadmill running task to test for differences in motivational state, perceived exertion, attentional focus, heart rate, and oxygen consumption (an index of higher workload) between serious and playful dominant participants. While, there was no significant difference in the workload attained based on either dominance or state, participants in a serious state reported greater perceived exertion at the end of a 30 minute run. Serious state participants also paid more attention to their own body sensations (i.e., reported more associative than dissociative thoughts) than participants in a playful state. In telic-dominant individuals preference for congruence between state and dominance was demonstrated. These results also partially supported aspects of Svebak's (1990) model.

In another laboratory study that used a similar methodology, EMG gradients (a physiological correlate of task-focused behaviour) were observed in serious dominant participants regardless of whether the serious or playful state had been induced before a leg flexion exercise task (Kuroda, Thatcher, & Thatcher, 2011). This finding contrasted with earlier research findings that suggested that

the EMG gradient was a marker for the serious state, not serious dominance (e.g., Apter & Svebak, 1986; Rimehaug & Svebak, 1987). Playful-dominant individuals performed better in the playful than the serious state condition, whereas in the serious state condition, serious-dominant individuals performed better than playful-dominant individuals. Although this difference wasn't significant, there was a trend in this direction. Findings tended to support Svebak's (1990) model, in that outcomes are more positive when metamotivational state and dominance are congruent.

Using a different approach, Kerr, Wilson, Svebak, and Kirkcaldy (2006) conducted a field study to test the proposition that serious dominant individuals have a greater affinity and preference for endurance sports than playful dominant individuals, who prefer explosive sports. The TDS was used to divide university student participants into serious and playful dominance groups and the TESI state version used to measure changes in emotion and stress completed before and after participation in an endurance sport (long distance running) and an explosive sport (basketball). The results indicated that, irrespective of the type of sport, participation consistently produced positive changes in emotional tone with significant increases in excitement and decreases in anxiety, boredom, sullenness, modesty, resentment, and guilt. There was no direct evidence that specifically linked the dominance groups to either running or basketball, or to pre- to post-sport changes in emotions or stress.

Motivational Dominance and Unhealthy Exercise Correlates

In some instances, dominance characteristics in participants have been found to be associated with unhealthy sport and exercise participation, including exercise dependence or addiction, and eating disorders, such as anorexia nervosa and bulimia nervosa. Blaydon, Lindner, and Kerr (2002) found dominance differences between triathletes classified as primary (exercise dependent only) or secondary exercise dependent (exercise dependent plus an eating disorder), eating disorder, and no dependence or disorder groups. MSP responses indicated that there were significant differences in dominance between the exercise dependent and other groups. The secondary exercise dependent group was significantly

more serious dominant than the primaryexercise dependent group and both eating disordered groups were significantly more mastery dominant than the non-dependent group.

Pain and Kerr (2004) reported the case study of a male high risk sport athlete who, in spite of severe physical and mental damage, continued to participate in extreme sports. In one incident alone, he had broken his back, broken and dislocated his right shoulder, broken four ribs which punctured both lungs, and incurred serious brain damage. His scores on the TDS indicated that he was highly playful dominant and this played the predominant role in his high risk sport motivational experience. His interview comments indicated that he had become seriously dependent on high arousal sport experiences, hence his strong motivation to continue participating in high risk sports in spite of further danger to his health and wellbeing. The results of these studies indicate that some people have dominance, or personality profiles that predispose them to taking physical risks through activities such as sky diving or mountain climbing, others to take part in endurance events, such as long distance running or triathlon. With committed and prolonged engagement with these activities, continued participation at extreme levels may lead to dependence or addiction (Kerr, Lindner, & Blaydon, 2007).

Critical Summary

Valid significant differences between motivational dominance groups were obtained in the early dominance studies reported above. However, some critics might argue that the results were obtained with newly-developed, general, rather than sport-specific measures, with minimal track record. In addition, early studies were limited because the only measures available dealt with serious-playful and negativism-conformity dominance. In some cases, the measures were used with relatively small samples, with only a few attempts to replicate findings in subsequent studies. In contrast with early dominance studies, the Hong Kong sport and exercise participation studies used large samples of participants (>1500) and examined all RT motivational categories, which added to the importance of the results obtained. Tightly controlled laboratory exercise studies have only been able to partially

support Svebak's (1990, 1999) contention that performance will be optimised when motivational dominance, physiology, and type of sport are aligned. Thus, while Svebak's (1990) model is appealing in its coherence, the evidence is still somewhat ambiguous.

The Relationship of Motivational States to Sport Performance

Dynamic change in an individual's motivational and emotional state is a key principle in RT and the work reviewed so far has shown that reversals occur before and during competition. This creates a challenge when it comes to identifying the relationship between state and performance. The available evidence that describes the motivational state combinations experienced during successful performance is described below. Also, inferences based on studies that have investigated the experience of unsuccessful or losing individuals and teams is drawn upon. Several studies have used non-competitive and laboratory performance tasks and these are referred to where they offer additional insight.

Kerr and Cox (1988, 1990) explored the affective responses of male novice, average, and skilled squash players who were set a series of target performance tasks in a standard squash court. The TSM was completed prior to the first and after the second task. There were no differences in serious state between the groups, but there was a trend for participants to become more serious from pre- to post-task and a majority of participants from all groups were in a serious state during the task. This study did not identify a direct relationship between motivational dominance or state and performance, but it did point to differences in the way skilled squash players perceived the arousaldemands of the task. Kerr extended this research by means of three simulated squash tournaments, so that affective responses could be determined under ecologically valid conditions (Cox & Kerr, 1989, 1990). A similar battery of questionnaires, as used in the previous study, was administered to players before and after each of four tournament games. A post-hoc separation of participants into most- and least-successful players led to the creation of groups of winners and losers. The only significant group difference in serious state scores occurred among losers after the second game (when they had lost the opportunity to

win the tournament); significantly more of them were in a playful than a serious state. In general, more winners than losers were in a serious state before and after the tournament.

Perkins, Wilson, and Kerr (2001) tested maximal performance on a simple explosive hand-grip task with a cohort of male and female elite athletes. Prior to performance, they manipulated serious and playful states and arousal by means of personalised guided imagery techniques and paced breathing. Results showed that significant increases in strength performance occurred in the playful condition when arousal was high and experienced as pleasant excitement (i.e., high positive arousal). The imagery scripts used in this task were geared to the serious and playful states and may not have induced equivalent mastery states in both the serious and playful versions. Careful consideration of the example scripts, included by the authors, suggests that the serious script portrayed a lower level of confidence than the playful script, which included descriptions of high self-confidence. This is potentially a confounding factor.

Males et al. (1998) showed that the reported presence of serious and playful states varied at different stages of canoe slalom competition. While the serious-conformist combination always accounted for the majority of participants' self reports, playful-conformity was the second most prevalent combination. The balance between the two varied according to the phase of the event. Serious-conformity was highest between runs (84.4%) and post-race (77%), but playful-conformity was highest during the race itself (35%). Importantly, more than twice as many above- than below-average performances occurred when participants reported the playful-conformist-self-focused-mastery combination. In contrast, golf places very different demands on competitors compared with canoe slalom. The duration is longer and it requires the consistent delivery of closed skills in a relatively stable environment. Hudson and Walker (2002) found that successful golfers most frequently reported a serious state during competition and went on to suggest, "The self-focused-serious-conformity combination of motivational states is particularly prevalent in competitive sport and may facilitate

positive outcomes." (p. 213).

Kerr, Wilson, Bowling, and Sheahan (2005) used the TESI to explore pre- and post-game emotions reported by female field hockey players over the course of a World Cup qualifying tournament in which they played seven games with only one loss, in the first game.As the tournament progressed and the team won its games, athletes were significantly more relaxed and excited after each game in the tournament. Unpleasant emotion and stress results, associated with the loss of the first game, significantly diminished as the team progressed to the tournament final. Given that both relaxation (pleasant serious low arousal) and excitement (pleasant playful high arousal) were reported, it is hard to draw clear conclusions on the serious and playful dimensions, other than to speculate that both were salient at different times.

Research has examined players' responses before and after competition and found differences in the emotional states of winning and losing rugby players (e.g., Kerr & van Schaik, 1995; Wilson & Kerr, 1999). Interestingly, these studies identified few defining differences in participants' pre-event emotions. The greatest differences emerged in the post-game responses ofplayers, when context (home vs away games) and outcome appraisals (win vs loss) clearly had important roles in shaping emotional responses. As might be expected, winning is generally associated with more pleasant emotions and lower stress than losing. However, a study of Canadian and Japanese futsal players showed some cross-cultural differences in the experience of winning and losing (Geisler & Kerr, 2007). These studies offer insight into the differing psychological demands on successful and unsuccessful athletes in the post-event phase of competition, but are of limited value in identifying motivational states.

Research into recreational, rather than competitive, sport also provides a useful perspective. Here performance can be assessed by the quality of the participant's experience and well-being rather than by comparisons with others. Flow states of intense, focused peak experience are often considered the sign of a successful performance in recreational and outdoor sports (Csikszentmihalyi &

Csikszentmihalyi, 1988). Houge Mackenzie et al. (2011) explored the relationship between motivational state and flow, and tested Rea's (1993, 2002) hypothesis that both serious and playful flow states formed a dynamic pattern of experience that could be integrated into a state of "serious play". Qualitative data showed that river-surfers reported two distinct forms of flow state, during which they performed optimally. Playful flow accounts were described as sensation-oriented, exciting, playful and/or undertaken without a clear outcome goal, whereas serious flow accounts identified a distinct outcome goal or achievement focus (Houge Mackenzie et al., 2011).

Critical Summary

Considering RT performance research as a whole, there is no obvious correspondence that relates motivational state to optimal performance. At times, performers can be successful when operating with the serious or playful, conformist or negativistic states operative. Several studies have found no relationship between performance outcome and the serious or playful states (e.g., Bindarwish &Tenenbaum, 2006; Thatcher et al., 2011). Therefore, the relationship between the serious and playful states and performance based on current evidence is ambiguous. The mastery state emerges as a potentially critical, if under-explored, performance factor. It is the most consistently reported state during competition (e.g., Hudson & Walker, 2002; Males et al., 1998), yet no published studies to date have attempted to explore its components in detail. In RT terms, by the very nature of competitive sport, participation and success should require the mastery state to be operative, as this provides the motivational orientation towards seeking domination, power, and control over oneself (self-focused-mastery), an opponent or team. Progression of this area of research would appear to be studies with greater control, clearly specified hypotheses, effective measures and a research design that allows the relationship between motivational states and performance to be accurately tested.

The present manuscript has reviewed research that identified and explored psychological experience, as defined by RT, in the context of sport and exercise. Keeping in mind research limitations

pointed out in this review, the following somewhat tentative conclusions can be made about the four main research themes:

1. Competitors' emotional and motivational experience in sport can be described, and mapped using the full range of motivational states in RT.
2. Reversals in motivational state occur for the reasons suggested by RT, and this provides a mechanism for understanding, predicting and influencing changes in an athlete's affective state.
3. Athletes and participants' individual dispositional personality factors can be accounted for through the relationships that exist between motivational dominances and participation and experience of different types of sport.
4. The relationship between motivational states (especially the serious and playful states) and performance remains ambiguous.

In carrying out this narrative review, it became clear to the authors that, as with many bodies of research, progress in RT research has not been logically sequential and research on different topics has progressed at different rates over the years. As a result, there are a number of gaps in the RT sport and exercise research literature that need to be addressed. One such gap exists in the use of RT to understand exercise compliance and this could be the focus of a major future research project. Although RT has made a contribution in terms of understanding the different motivational needs of exercisers (e.g., through the Hong Kong studies), there is much more research that could be done. For example, do people sustain and commit to exercise programs longer when it matches their motivational dominance? Does monitoring changes in motivational state make it easier to adapt exercise regimes so that they are more attractive to non-participants? For example, it should be possible to design exercise programmes to move from a serious (telic) to a playful (paratelic) orientation, or vice versa. In addition, RT should be able to help people who find it hard to sustain self-mastery during exercise and drop out? Can these exercisers be "navigated" to self-sympathy when they need a break, preventing

them feeling guilty and giving up, then return them to self-mastery when required? The big strength of RT is that helps to understand how and why motivation changes over time. This has not been fully developed in RT exercise research so far. Results from RT smoking cessation research work (Cook, Gerkovich, O'Connell, & Potocky, 1995; O'Connell, 2006; O'Connell, Cook, Gerkovich, Potocky, & Swan, 1990), which applies the same principles in terms of giving up smoking is "good for you" yet hard to do, may have implications for exercise. Likewise exercise is considered "good for you" and for many people difficult to achieve. There are RT topics that have received little or no attention and a great deal is still unknown: exercise compliance is one.

In some cases, research findings were limited by focusing exclusively on the serious-playful pair. It is now clear that future studies should encompass all the motivational pairs to better account for a broader range of sport and exercise experience. This notion was utilised to underpin a practical guide for paddlers and coaches in canoeing and kayaking (Males, 2014), with potential applications to other sport and exercise contexts. The guide refers to all the motivational states, but gives emphasis to mastery-based motivation as providing the drive for athletes to challenge themselves and find the limits of their ability.

Also, there is some research evidence supporting the causal factors for reversals, but there is currently no academic research showing that reversals can be controlled, or that particular motivational states can be reliably induced at will in the context of sport and exercise. The existing supporting evidence for the conscious control of motivational states is largely anecdotal from practitioner activity in sport. This is a limitation of RT sport and exercise research to date that must be addressed in the future. For example, well-designed intervention studies using three participant groups under conditions of : (a) an RT-based psychological intervention, (b) a non-RT psychological intervention and, (c) no psychological intervention. A research design which utilised pre- and post-intervention measures plus qualitative interview data could provide insightful results, directly relevant to applied intervention

work.

New research tackling these, and other topics (see Apter, 2013), could shape the future of RT sport and exercise research. However, in order to facilitate the success of any future research, RT researchers need to be open to obtaining the necessary insights into sport and exercise behaviour and experience via a range of methodologies incorporating multiple data sources and possibly new technology. For example, “smart phone apps” have the potential to gather an ongoing stream of psychological and physiological data over time. Also, recent work on brain imaging is developing very fast and reversals, as a result of motivational state manipulations, may be able to be recognised in changing brain images. As with any research study, but especially for future RT studies, researchers need to consider whether they are asking the "right" questions, using the appropriate methods, and have tested the validity of measurement instruments developed in other fields in the context of sport and exercise.

Conclusion

Although narrative reviews can be seen as less objective than systematic reviews, the authors made efforts to reduce the possibility of any publication bias by drawing attention to any methodological limitations and critical appraisal. Despite limitations and some gaps in the literature, past RT research has provided a good deal of important information. This has been useful for practitioners as well as researchers as RT has offered real insight that helps make sense of the psychological experience of athletes. Researchers have used the theory in a variety of different ways (e.g., as a personality model, or for understanding stress, and as a basis for psychophysiological investigation) that have often made its phenomenological basis difficult to fully interpret. Recent phenomenologically-based research (e.g., Grange & Kerr, 2010; Houge Mackenzie & Kerr, 2012) appears to hold promise for understanding the complexity of the individual’s sport and exercise experience and might be an important direction for future research. There is reason for cautious

optimism regarding the future of reversal theory as a coherent psychological theory embracing personality, emotion, and motivation with direct relevance to sport and exercise. However, there is a need for additional robust research if this optimism is to be realised.

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Table 1

Motivational State Combinations and the 16 Primary Emotions

	Somatic emotions	
State combination	Pleasant	Unpleasant
serious-conformity	relaxation	anxiety
serious-negativism	placidity	anger
playful-conformity	excitement	boredom
playful-negativism	provocativeness	sullenness
	Transactional emotions	
State combination	Pleasant	Unpleasant
Self-focused-mastery	pride	humiliation
self-focused-sympathy	gratitude	resentment
other-focused-mastery	modesty	shame
other-focused-sympathy	virtue	guilt