Chapter 13
Perceived Effort and Exertion

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Chapter Overview

Perceptions of effort and exertion during physical activity provide a subjective estimate of the workload and play an important role in effort-regulation and tolerance. Such perceptions depend on a complex array of factors including afferent feedback from the working organs, muscles, and joints; subjective perceptions of force, resistance, or strain; psychophysiological perceptions of breathlessness and arousal; psychological components such as motivation, determination, and task-aversion, as well as input from the brain's central motor command system (Hutchinson & Tenenbaum, 2019). The subjective experience of effort and exertion is unique to an individual and can be influenced by a variety of psychological factors. Psychological skills and strategies can also be used to manage sensations of effort and exertion, leading to improved performance and a more positive psychological experience of exercise.

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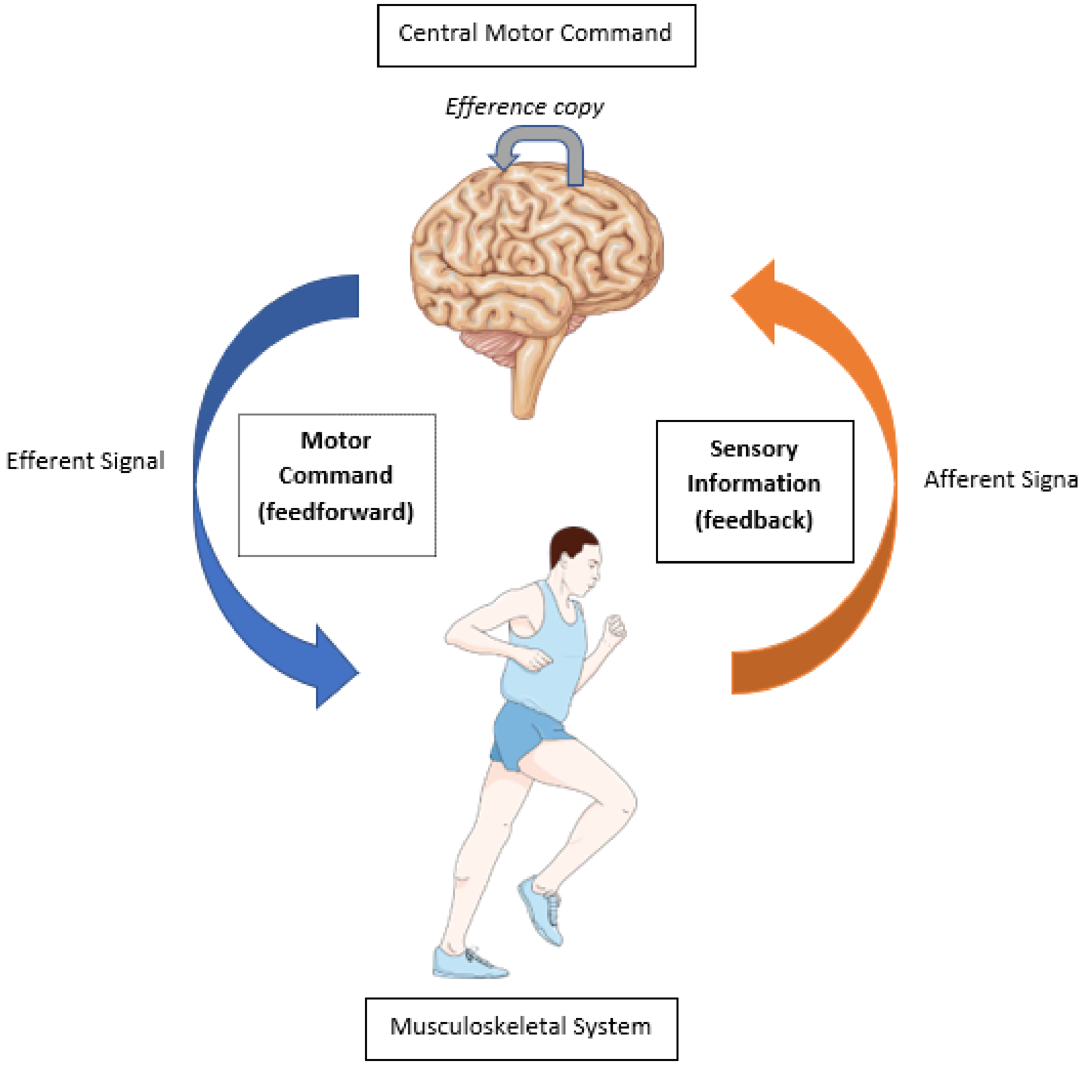
Defining the Concept

The terms *effort* and *exertion* are often used interchangeably, although they are different (but related) constructs. The term *perceived exertion* was first introduced by Swedish psychophysicist Gunnar Borg in the 1960s as subjective complement to the objective responses (e.g., heart rate, and force production) observed during exercise. Borg defined exertion as the “degree of heaviness and strain experienced in physical work” (Borg, 1998, p. 8) and developed a scale to measure this concept, known as the Rating of Perceived Exertion (RPE) scale. Borg conceptualized perceived exertion as a configuration of sensations stemming from the peripheral muscles, cardiopulmonary system, and other sensory organs and cues. Included within this conceptualization are psychological constructs such as motivation and affect that are viewed as an integral part of the experience of exertion. The notion of discomfort and/or fatigue was also added to later definitions of perceived exertion. Drawing from Borg’s original definition, Robertson and Noble (1997) defined perceived exertion as “the subjective intensity of effort, strain, discomfort, and/or fatigue that is experienced during physical exercise” (p. 407). Although this definition is widely accepted within the field of exercise science, it is problematic in that it brings together a number of distinct concepts; concepts that are rated differently when adequately defined, such as effort and discomfort (Steele et al., 2016) or exertion and fatigue (Micklewright et al., 2017). As a result, several authors have stressed the need for greater precision in the study of perceptual responses during physical activity (e.g., Hutchinson & Tenenbaum, 2006). Specifically, it is argued that the sense of *effort* is distinct from other sensations experienced during exercise[1] (Abbiss et al., 2015; Pageaux, 2016; Smirmaul, 2012).

Effort perception (or the sense of effort) refers to the cognitive feeling of work associated with voluntary actions (Preston & Wegner, 2009). In an exercise context, *perceived effort* has been operationally defined as “the amount of mental or physical energy being given to a task” (Abbiss et al., 2015, p. 1237). In contrast to perceptions of exertion, which rely upon the integration of sensory information transmitted from the body to the brain during exercise, the sense of effort is believed to be centrally generated (by the brain) with little to no influence from afferent feedback (Marcora, 2009; 2010). See Figure 13.1. To understand this idea, consider that a voluntary action is always carried out with a certain amount of effort, in the sense that each time a motor command is initiated, or even simulated, certain mechanisms in the brain need to determine the strength of this command (Lafargue & Franck, 2008). In essence, how hard one perceives themselves to be trying at a particular task is the subjective experience of effort. Researchers have used anesthesia to block or attenuate sensory feedback during a physical task in order to demonstrate that the sense of effort is independent of afferent feedback (e.g., Marcora, 2009) although this has been a topic of some debate (e.g., Eston, 2009).

[1] Smirmaul (2012) has offered a useful example for distinguishing effort from exertion. Imagine a cyclist who, after a tough uphill climb, begins a downhill section and stops pedaling, coasting downhill solely by momentum. This cyclist will still be feeling strong sensations of discomfort associated with the uphill climb (perceived exertion), but the effort expended to coast downhill is virtually zero, resulting in low perceived effort.

Figure 13.1
Conceptual Diagram of the Origins of Perceived Effort and Exertion



Note. Voluntary movements are produced by sending motor commands from the brain to the muscles via motor descending pathways, with an "efference copy" being concomitantly delivered to sensory brain areas. This neural representation forms the basis of perceived effort. The result of the movement is feedback from sensory receptors in the peripheral nervous system, transmitted via ascending pathways to the brain. The brain then organizes this information and makes sense of this information (thus distinguishing perception from sensation) resulting in perceived exertion. Artwork in Figure 13.1 credited to Servier Medical Art by Servier under a Creative Commons Attribution License (CC-BY). Figure 13.1 is adapted from Muramatsu, K. (2020). Diabetes mellitus-related dysfunction of the motor system. *International Journal of Molecular Sciences, 21*(20), 7485, https://doi.org/10.3390/ijms21207485 under a Creative Commons Attribution License (CC-BY).

Monitoring Perceptions of Effort and Exertion

Measurement Scales

The most common instrument used to measure perceived exertion is Borg's RPE scale (Borg 1982; 1998). This 15-point scale ranges from 6 (*no exertion at all*) to 20 (*maximal exertion*), with intermediate points anchored to verbal expressions of effort such as *very light*, *somewhat hard*, and "*very hard*". The 6–20 scale was designed to parallel the heart rate (HR) range of a normal healthy male (i.e., 60–200 beats/min). Initial efforts to validate the RPE scale yielded a correlation of 0.85 between the RPE and HR (Borg, 1962). However, subsequent studies have produced a wide range of correlation coefficients for a variety of tasks and participants (Chen et al., 2002). An alternative to the 15-point RPE scale is the category-ratio (CR-10) RPE scale (Borg, 1982). This scale has a primary numerical range of 0 to 10, although a maximum intensity greater than 10 can be selected using free magnitude estimation (see Borg, 1998). The CR-10 is a general intensity scale that can be used in a variety of settings to assess other sensory perceptions, including pain, dyspnea, and ergonomic fatigue (Borg, 1998).

Alternative RPE scales to those authored by Borg have been developed and may be more appropriate for specific settings or populations. These include an RPE scale based on "repetitions in reserve" for use during resistance training (Zourdos et al., 2016), the Session RPE Scale used in the calculation of athlete training load (Foster et al., 2001), and a variety of pictorial scales designed for use in pediatric populations (e.g., Utter et al., 2002). Buckley et al. (2000) have also validated a braille version of Borg's standard 6–20 RPE scale for individuals with visual impairment.

Differentiated RPE scales have been used to distinguish between the central (cardiopulmonary) and peripheral (muscle and joint) factors contributing to an individual's RPE. Knowledge of differentiated RPE allows for greater understanding of the relative influence of central and peripheral signals of exertion to the overall RPE value (Hutchinson & Tenenbaum, 2019). The Task Effort and Awareness (TEA) scale (Swart at al., 2012) differentiates perceived exertion from *task effort*, which is defined as "the conscious mental (psychic) effort required to sustain or increase the current exercise intensity" (Swart at al., 2012, p. 42). Studies using the TEA scale have been able to shed light on the distinct contributions of perceived effort and the physical symptoms induced by exercise (i.e., perceived exertion) to the regulation of exercise intensity (e.g., Venhorst et al., 2018).

Scale Administration

Just as terminology has been used somewhat loosely and interchangeably, RPE scales have been used to assess both effort and exertion as well as related concepts such as fatigue and discomfort (Hutchinson & Tenenbaum, 2019). It is of critical importance that researchers distinguish between measures aimed at evaluating an internal sense of effort versus a perception of peripheral discomfort or exertion, and/or an integrated sum of all signals (Christian et al., 2014). Careful consideration should be given to the specific definitions provided to participants and the nature and precision of the questions asked when implementing an RPE scale. Furthermore, established principles of administration must be carefully followed to ensure the validity and reliability of the measure. These include clear and comprehensive instructions regarding the use of the scale (see Razon et al., 2012) and an opportunity for scale users to ask clarifying questions and to practice making perceptual estimates. A familiarization or learning trial is recommended prior to either rating, or prescribing, exercise intensity with RPE (Pageaux, 2016).

Estimation and Production Mode

In exercise settings, RPE is usually used in one of two modes: estimation and production. When used in *estimation mode* the client/patient provides an RPE during a prescribed exercise intensity. For example, when exercising at a given percentage of maximal HR, or during a graded exercise test. When used in *production mode* individuals are asked to produce and maintain an exercise intensity corresponding to a target RPE (e.g., moderate intensity exercise is prescribed at 12–13 on the Borg 6–20 scale; Garber et al., 2011). The production paradigm provides an alternative method by which to prescribe exercise intensity, instead of relying on a certain percentage of maximal heart rate or oxygen uptake. This is particularly useful in settings such as cardiac rehabilitation where patients may be taking HR lowering medications such as beta-blockers. In the assessment of cardiorespiratory fitness, maximal oxygen uptake (VO_2 max) can be predicted from the linear relationship between submaximal RPE and oxygen uptake. This method has been found to be valid and reliable across a number of populations and exercise modalities (Coquart et al., 2014).

Psychological Moderators of Perceived Effort and Exertion

While the experience of effort and exertion depends on task intensity, and is strongly associated with physiological measures (e.g., ventilation rate, oxygen uptake; Chen et al. 2002), there is also a significant contribution of psychological factors. Indeed, psychological factors are estimated to account for approximately two thirds of the variance in RPE among individuals working at the same relative intensity (Noble & Robertson, 1996). RPE can also be altered by experimentally manipulating psychological factors such as self-efficacy (Hutchinson et al., 2008), attentional focus (Tenenbaum & Connolly, 2008), and expected duration of exercise (Baden et al., 2004).

Dispositional Moderators

Dispositional factors operate at the trait level, not the state level. A number of dispositional factors have been examined in relation to RPE, perhaps the most common being personality variables. Findings are mixed, but largely it does not appear that ratings of effort or exertion are influenced by personality type. Studies examining a variety of personality factors such as extraversion and neuroticism (Garcin et al., 2006), Type-A personality (Dishman et al., 2001), and behavioral activation/inhibition systems (Malik et al., 2020) have all reported no significant relationship with RPE. Preference for and tolerance of exercise intensity are interrelated heritable traits (Ekkekakis et al., 2006) that have been shown to influence how people feel during exercise (Box & Petruzzello, 2020; Jones et al., 2018), however there is no evidence yet that these traits might also influence perceptions of effort and exertion (Bradley et al., 2019; Vandoni et al., 2016).

Individual differences in chronotype, or natural circadian patterns, have been found to influence ratings of perceived exertion (Vitale & Weydahl, 2017). Prior research has identified a significant interaction between chronotype and time of day for RPE, wherein higher RPE was observed during evening training for “morning-types” while “evening-types” showed higher RPE values when training in the morning (Vitale et al., 2017).

Recent scientific breakthroughs related to the genome have enabled scientists to study the heritability of subjective responses to exercise. Using identical and nonidentical twin pairs and their singleton siblings, Schutte et al. reported that genetic factors explained 29% and 35% of the individual differences in RPE during cycle ergometer and treadmill tests, respectively (Schutte et al., 2017). A future challenge to researchers is to identify the specific genes underlying the heritability of the perceptual response to exercise, to test their predictive value for the adoption and maintenance of exercise behavior, and their usefulness in personalizing exercise interventions (Schutte et al., 2017). A promising finding by Bryan and colleagues indicated that variants in the brain-derived neurotrophic factor (BDNF) gene moderate the effect of exercise on RPE. These researchers found that individuals with a specific BDNF genotype reported higher RPE in response to moderate-intensity exercise than participants with a different variation (Bryan et al., 2007).

Social-Contextual Factors

Social-contextual factors operate at the state level, not the trait level. They can be external (e.g., the social context of exercise) or internal (e.g., situational motivation), real or imagined, and conscious or nonconscious.

Environmental Influences

Both physical and social aspects of the exercise environment can affect RPE. Exercise in an outdoor exercise setting is associated with lower RPE, relative to indoor exercise (Focht, 2009; Krinski et al., 2017). This effect is likely due to increased environmental distractions outdoors resulting in a more externally oriented attentional focus (Gladwell et al., 2013). Findings on the presence of others in the exercise environment are mixed and are often difficult to separate from performance enhancing effects. Characteristics of the observer can also cause differential effects, for example among male runners, the introduction of a female observer caused a significant decrease in RPE, whereas the introduction of a male observer caused a significant increase in RPE compared to the control trial (Winchester et al., 2012).

The presence of mirrors in the exercise environment can create or exacerbate self-presentation concerns, which may influence RPE. The effect of mirrors has not been assessed on RPE directly, however sedentary women report greater levels of physical exhaustion after exercising in a mirrored (vs. non-mirrored) environment (Martin Ginis et al., 2003). This effect appears to be exacerbated when in presence of co-exercisers (Martin Ginis et al., 2007).

Performance Expectations

An individual's prediction of the expected level of effort or exertion associated with a future bout of exercise is known as *predicted RPE*. A mismatch occurs when predicted RPE is greater than actual experienced RPE which can lead to negative attitudes regarding exercise initiation and maintenance (Haile et al., 2015). Expectations of exercise duration and anticipation of an exercise end-point can also influence RPE. Specifically, participants have reported a significant increase in RPE consequent to misinformation about the expected exercise duration compared to when they were honestly informed of the correct duration of the run (Baden et al., 2014). Participants with experimentally induced positive expectations about exercise reported significantly lower perceived exertion than participants in a "no expectation" control condition (Mothes et al., 2017). This effect was moderated by physical self-concept, wherein those with a higher physical self-concept appeared to benefit more (in terms of decreased RPE) from positive outcome expectations.

The role of placebos and expectancy has been documented in many fields of research, including exercise science. McClung & Collins (2007) were able to evaluate the relative contributions of expectancy belief and actual pharmacological impact of a performance enhancing substance (sodium bicarbonate) using a balanced placebo design. Endurance athletes completing 1000m time trials reported lower RPEs *only* when they believed themselves to be running "under the influence" of the drug, regardless of whether they received the actual intervention or the placebo. This demonstrates that expectancy effects alone can influence perceptions of exertion. In a similar study, Azevedo and colleagues reported that when runners believed they received an ergogenic substance their RPE decreased, but when they were told they had received an anti-ergogenic substance their RPE increased, regardless of the actual intervention, which was a caffeine supplement in both sessions (Azevedo et al., 2019).

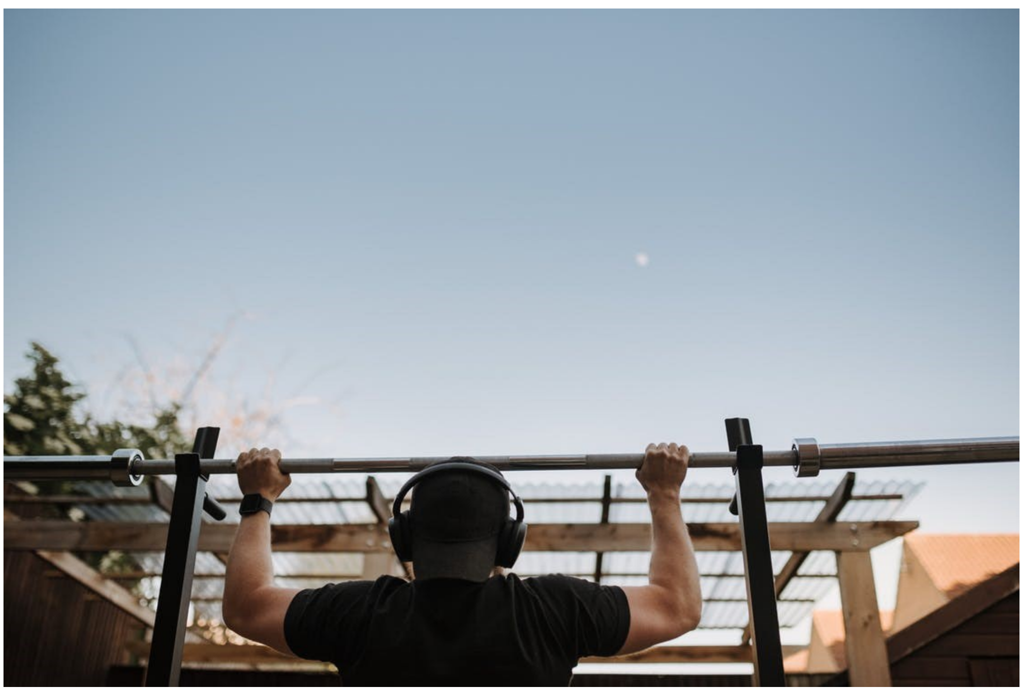
Self-Efficacy

Social-cognitive theory (Bandura, 1986) posits that the relationship between self-efficacy and subjective psychological responses is reciprocal (for more discussion on self-efficacy, see Chapter 27

[Hepler et al., 2021]). Prior research has confirmed this in the case of RPE, where individuals high in self-efficacy reported lower perceived exertion during activity than those with low self-efficacy, and lower perceptions of exertion, in turn, predicted higher post-exercise efficacy (Pender et al., 2002; Robbins et al. 2004). In experimental research designs, self-efficacy for a specific task can be manipulated using false performance feedback. In such experiments, increased self-efficacy led to lower perceptions of effort and exertion (Hutchinson et al., 2008; McAuley et al., 1999). Interestingly the relationship between RPE and daily physical activity has been found to be mediated by self-efficacy for exercise (Pender et al., 2002).

Managing Sensations of Effort and Exertion

Perceived effort and exertion are commonly cited barriers to exercise participation. “Physical exertion” or “feelings of physical discomfort” have been reported as the primary barrier to exercise (exceeding other barriers such as lack of time) in a variety of populations including female university students (Lovell et al., 2010) and culturally diverse adolescents and adults (Bragg et al., 2009). Moreover, sensations of effort and exertion can lead to aversive affective responses to exercise, which can create a negative association with exercise (Ekkekakis et al., 2018) and negatively impact exercise participation (Williams et al., 2008). For more discussion on the relationship between affective responses to exercise and exercise behavior, see Chapters 4 (Brand & Ekkekakis, 2021), 11 (Jones & Zenko, 2021), and 12 (Zenko & Ladwig, 2021). Consequently, interventions aimed at coping with and/or reducing perceptions of effort and exertion are likely to have a positive impact on exercise behavior.



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Attentional Focus Interventions

Exercise interventions aimed at diverting attentional focus away from sensations of effort and exertion have been effective in reducing RPE at fixed workloads (Hutchinson & Tenenbaum, 2019). On the contrary, the removal of distracting external information (via sensory deprivation) can increase perception of effort (Razon et al., 2009). The underlying premise for attentional focus interventions is that attentional capacity is fixed and limited; therefore, distracting stimuli can occupy attentional bandwidth that is critical for bringing perceptions of effort and exertion into focal awareness. It is important to note that this strategy is most effective during low-to-moderate intensity exercise. At very high exercise intensities, attentional processes are dominated by strong afferent feedback that demands attention; thus, perceptions of exertion override the distraction capabilities of external stimuli (Hutchinson et al., 2011).

A variety of attentional focus interventions have been used to draw attention away from internal task-related sensations during exercise. For example, dissociative imagery (images unrelated to the exercise task and/or related sensory inputs), has been found to significantly lower RPE when compared to associative (task-related) imagery and control (no imagery) conditions during a cycling task (Razon et al., 2014). Researchers have also explored the effect of sensory interventions, including taste and smell, on RPE but reported no significant effects (Basevitch et al., 2011; 2013; Raudenbush et al. 2001; Ritchie et al., 2016).

A recent meta-analytic review reported a significant beneficial effect of music listening on RPE (Terry et al., 2020). Appropriately selected music appears to lower RPE by approximately 10% during submaximal aerobic exercise (Karageorghis & Priest, 2012) and explosive power movements (Biagini et al., 2012), and by approximately 6% during strength testing (Silva et al., 2020). When workload is not fixed, music can have an ergogenic, or work-enhancing, effect with no associated increase in RPE (e.g., Waterhouse et al., 2010). The combination of audio and visual stimuli (e.g., music and video) can lower RPE when compared to control and sensory deprivation conditions (Bigliassi et al., 2019; Hutchinson et al., 2015) although this combination does not appear to be significantly superior to music alone (Hutchinson et al., 2015). The content of the audiovisual stimuli is an important consideration; pleasant audiovisual stimuli appears to reduce RPE whereas RPE is actually increased in the presence of unpleasant audiovisual stimuli (Barreto-Silva et al., 2018). See Chapter 23 for more discussion on the effects of music in sport (Karageorghis et al., 2021).

Advances in technology have facilitated recent interventions in the realm of virtual reality and *exergaming*, which refers to the combination of exercise with a computer-simulated interactive game. Initial investigations show promising effects, for example a sample of college students reported significantly higher RPE during a traditional exercise biking session compared with a VR-based exercise biking session (Zeng et al., 2017). Similarly, among active adults, exergaming using XBOX Kinect™ was associated with significantly lower RPE than traditional gym-based exercise despite no difference in mean HR (Barry et al. 2016).

Mindfulness represents an alternative attentional approach to coping with and/or reducing perceptions of effort and exertion (see Chapter 14 for more discussion on mindfulness and exercise [Cox & Ullrich-French, 2021]). Drawing upon an intentional and nonjudgmental awareness of the present moment (Kabat-Zinn, 1990), a mindful intervention targets the development of mindful acceptance of internal sensations, as opposed to diverting attention away from such sensations. Salmon et al. (2010) proposed several advantages to mindfulness-based attention allocation during sustained physical activity, including enhanced awareness, decreased emotional reactivity and improved attentional control. To date, there has been little empirical research on the impact of mindfulness on RPE, although one study indicated a small-to-moderate positive effect, where participants felt like they were not working as hard when they were in the mindfulness condition relative to control (Cox et al., 2018). In a second study, participants reported more accurate RPE (i.e., self-ratings better matched physiological indices of exertion) following a brief mindfulness training intervention (Meggs & Chen, 2021), supporting the notion of improved awareness as an outcome of mindful attention (Salmon et al., 2010).

Mental Skills

The use of mental skills training (MST), also called Psychological Skills Training (PST), is extensive in sport psychology, but less so in exercise psychology. Mental skills in sport have been broken down into basic skills (self-talk, relaxation, goal-setting, and imagery) and advanced skills, which primarily comprise self-regulatory strategies (Hardy et al., 2010). See Chapter 20 for more discussion on psychological skills training (Rymal et al., 2021).

Basic Mental Skills

Self-talk, and in particular motivational self-talk, has been shown to influence perceptions of effort and exertion. Blanchfield et al. (2014a) assessed the effects of motivational self-talk (vs. no-intervention control) on RPE and endurance performance in a constant-load cycling time-to-exhaustion test. The self-talk intervention significantly reduced RPE during the test despite an 18% increase in time-to-exhaustion. Additional studies have reported greater power output with the use of motivational self-talk with no corresponding change in RPE, which infers a perceptual benefit of motivational self-talk (Barwood et al., 2015; Hatzigeorgiadis et al., 2018).

Relaxation training is often incorporated as part of MST interventions in sport, although in exercise settings it is more commonly studied relative to exercise recovery. For example, the use of sedative music during recovery from an exhaustive cycling task was associated with greater decreases in RPE when compared to a no-music control group (Jing & Xudong, 2008). Interesting research exploring the effects of deliberately adopted facial expressions during exercise has consistently shown increased effort perception when frowning in comparison with consciously relaxing and/or smiling (Brick et al., 2018; Philippen et al., 2012).

The role of goal setting in managing sensations of effort and exertion has received limited empirical investigation. However, qualitative research has revealed that goal setting is used by endurance athletes as a way to remain focused on the task in order to cope with painful sensations of exertion (Kress & Statler, 2007). Mental imagery has also been used to cope with exertive sensations. Both dissociative imagery (Razon et al., 2014) and motivational imagery (Giacobbi et al., 2018) have been reported to lower RPE during brief exercise tasks. Mental skills are often combined as part of a comprehensive MST program. In one such example, a program comprising goal setting, arousal regulation, mental imagery, and positive self-talk produced improvements in running performance without a corresponding increase in RPE (Barwood et al., 2008).

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Self-Regulatory Strategies

Broadly, self–regulatory strategies describe particular processes that are engaged in order to achieve a goal. *Cognitive reappraisal* is a self-regulatory strategy which involves reevaluating emotional stimuli to augment or reduce their emotional impact (Gross, 2007). When instructed to utilize cognitive reappraisal, endurance runners reported lower perceived exertion than when provided no instruction (Giles et al., 2018). Evaluating an exhaustive exercise task as a challenge rather than a threat was associated with marginally lower perceived exertion in the presence of significantly increased power output on the task (Wood et al., 2018). If-then planning, sometimes known as *implementation intentions*, refers to a self-regulatory strategy for goal-directed behavior that follows an if-then format (e.g., "If Situation X occurs, then I will perform Behavior A, but if Situation Y occurs, then I will perform Behavior B"). The feasibility of if-then plans to manage perceptions of effort and pain have been explored with mixed results (see Bieleke et al., 2020). Interestingly, ironic effects were reported by Bieleke and Wolff (2018) who observed a steeper increase in RPE among "if-then" participants during a static muscular endurance task and significantly higher RPE in the final 10% of the task relative to control group participants. In this study, the implementation intention instruction prompted participants to ignore sensations of exertion and keep going; it is possible that a more proactive plan might yield different results.

Nonconscious Interventions

A great deal of human functioning is rooted in nonconscious or implicit processes (Bargh, 2006). Dual-process models of behavior have highlighted the importance of impulsive, sometimes nonconscious, influences on exercise behavior (see Rebar et al., 2016 for review). An emerging body of evidence indicates that nonconscious processes are amenable to manipulation in an exercise setting (Hutchinson & Tenenbaum, 2019). In particular, *priming*, which refers to the activation of mental processes through environmental stimuli, can influence a variety of processes and behaviors, including RPE. In a series of experiments, Blanchfield et al., (2014b) assessed the effect of subliminal priming on RPE and effort tolerance during a cycling task. Subliminal primes refer to stimuli that are presented but not perceived consciously. In the first study, participants persisted longer on the time-to-exhaustion task and had significantly lower RPE when they were primed with happy faces compared to sad faces. In the second study, subliminal priming with action words (e.g., "energy" and "go") facilitated a significantly lower RPE during the same cycling test despite no significant difference in objective performance between conditions. A later study by Pottratz et al. (2020) embedded positively-valenced subliminal affective primes into music video. This condition yielded significantly lower RPE and more positive affective responses when compared to music-video (no prime), music, and control conditions.

Optical flow patterns play an important role in locomotion and the perception of movement speed. Parry et al. (2012) manipulated optic flow in cyclists using projected video footage of a cycling course that either represented their actual cycling speed or was varied by ±15% to appear slower or faster (unknown to the participants). Both absolute RPE, and RPE normalized for power output, were significantly lower in the slow optic flow condition, which was also associated with a shallower increase in RPE gradient over the 20km trial.

Practical Implications

From an applied perspective, RPE is widely used as an adjunct to objective physiological measures (e.g., heart rate) during maximal exercise tests and can be used to predict exercise capacity from responses to submaximal exercise tests. RPE is also used as a method of exercise prescription (i.e., target RPE) and a way to monitor exercise intensity in individuals participating in endurance and team sports, cardiac rehabilitation, and fitness training programs. The RPE scale can be applied in nonexercise settings as well, for example to evaluate work demands in occupations involving physical effort. As RPE is strongly correlated with a variety of physiological variables, the RPE scale can be an informative tool to assess overall exertion perception and complement objective measures. However, human perceptions are complex and nuanced and a variety of psychological factors can influence RPE ratings and should be taken into consideration. Care must be taken in the correct administration of the scale; in particular clarity of terminology (e.g., effort v exertion) is important to the validity of the measure.

Conclusion

Perceptions of effort and exertion are common in daily life (e.g., climbing a flight of stairs or lifting a heavy object). Such perceptions are important in the maintenance of homeostasis and play an important role in regulating our physical activity behaviors. These behaviors may range from regulating one's pace during endurance competitions to adopting a sedentary lifestyle (Marcora, 2010). Perceived effort is considered an inverse correlate of physical activity (Bauman et al., 2012) and a source of exercise-induced displeasure and avoidance *(*Ekkekakis et al., 2018*)*. Consequently, interventions that can reduce perceptions of effort and exertion should have a positive impact on exercise behavior. Interventions that draw attention away from exertive sensations, such as music and exergaming, appear to be effective, as does a mindful approach. Mental skills which can be taught and developed show promise and evidence from MST interventions in sport should be translatable to exercise settings. Non-conscious interventions represent a novel (if controversial) approach to managing RPE.

Learning Exercises

1. Exercisers can establish a *preferred RPE*, which corresponds to their preferred training load. How might a preferred intensity (vs. prescribed intensity) exercise protocol impact affective and motivational variables? Would you expect any effect on exercise adherence?

2. Nonconscious interventions, such as priming, can have a positive influence on the exercise experience (e.g., lowered RPE, improved affective valence). Discuss the ethical implications of using these techniques as a means to promoting exercise engagement.

Further Reading

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