Chapter 11
Strategies to Facilitate More Pleasant Exercise Experiences

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Chapter Overview

There is broad acknowledgement that how we feel during exercise is a predictor of long-term adherence. In this chapter, we describe the evidence that leads us to focus on the promotion of pleasant exercise experiences as an important strategy for long-term exercise adherence. This is followed by a discussion of modifications that can be made to exercise itself (intrinsic) and to the exercise environment (extrinsic) with the aim of influencing how people feel during exercise. Exercise intensity is the predominant intrinsic strategy that we focus on given its central role in determining our affective responses to exercise. We discuss a range of extrinsic strategies including indoor and outdoor exercise, exercising with others, virtual reality, music, imagery, and exergaming, among others. We aim to provide a broad overview of the available strategies that researchers and practitioners can implement to help foster more consistently pleasant and enjoyable exercise experiences.

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Introduction

When asking students to identify the benefits of regular physical activity, they will often recall numerous positive physical benefits of exercise such as improved cardiorespiratory and muscular fitness, and improved bone health. “Feeling good” is often a response when pressed to cite the psychological benefits of exercise, but such responses are often delivered reflexively with mantras such as “exercise makes you feel good” deeply ingrained. When probing for further critical insight, the notion of exercise inherently "feeling good" begins to be questioned. While exercise can elicit positive affective states among some, it is not a given that exercise will “feel good” for all. For some individuals, exercise is *not* a consistently pleasant experience, but it might not have to be this way. Researchers are examining different ways to positively shape how we feel about exercise.

Exercise is just one form of physical activity, but it is an effective way to achieve recommended levels of physical activity and can guard against the deleterious effects of sedentary behavior. Acquiring at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity, and two bouts of muscle strengthening activities per week is achievable through structured exercise. Moreover, achieving these targets through one or two sessions per week (the so-called “Weekend Warrior”; Hamer et al., 2017, p. 2) can confer positive mental health outcomes.

As a society, we spend considerable time, effort, and financial resources to shift inactive people towards physical activity. However, if the experience of physical activity is unpleasant, then we have likely wasted much of that time, effort, and money, as unpleasant experiences are unlikely to promote long-term adherence. Efforts to engage people in physical activity will ultimately have limited impact on the broader positive outcomes of physical activity (e.g., longer lives, better quality of life, reduced financial burden on government) without long-term adherence.

A substantial portion of the literature relating to exercise interventions focuses on helping people to *initiate* exercise, whereas there is less focus on what to do once people *begin* exercising; that is, the strategies we can employ to influence how people feel *during* exercise. Perhaps many exercise professionals follow the “exercise makes you feel good” mantra without critically considering whether this is true and might believe that their job is done once they have “convinced” people to exercise. It is long established that exercise is effective at improving health but continued consideration of how we can help facilitate an enjoyable experience is needed.

One approach to exercise promotion is to understand which type of exercise an individual “likes” and advocate that they engage in that activity, but if an inactive individual does not like *any* mode of exercise (this seems possible, otherwise they would probably be doing it already), then this might be a fruitless task. Perhaps we would then fall back on the exercises that we know and suggest activities such as cycling, running, or swimming. It is very likely that an inactive person has already considered these activities and has decided against them. However, we know that these activities can be very effective at eliciting physiological changes that will lead to improved health, so perhaps we can look again at these activities and consider ways in which we can modify them to make them more enjoyable.

This chapter discusses intrinsic and extrinsic strategies to facilitate pleasant and enjoyable exercise experiences. We define intrinsic strategies as those that modify the components of exercise prescription: Frequency, Intensity, Time, and Type (FITT; see Kohl et al., 2020, p. 22). We focus on modifications to exercise intensity as it is a primary intrinsic factor that drives affective responses to exercise. Extrinsic strategies pertain to environmental manipulations of the exercise experience that fall outside of the FITT principles (e.g., listening to music during exercise). These extrinsic strategies are predominantly employed during exercise, but there are some strategies that could be implemented prior to an exercise session to influence how people feel during that session.

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The Importance of Pleasant Exercise Experiences

Imagine that you return from work in the evening and you have an array of choices for your activity. You could relax, browse the internet, watch television, stream movies, study, get prepared for your next day of work, or exercise. Why is it that studying and exercising are preferable for our long-term interests, but so often avoided in favor of an alternative?

During leisure-time, people often choose the activities that make them feel good and avoid activities that make them feel bad. Repeating experiences that feel good and avoiding experiences that feel bad is the basic premise of Hedonic theory (Ekkekakis & Dafermos, 2012). The pleasure and displeasure people experience has been recognized as an important predictor of behavior for millennia (see Ekkekakis & Dafermos, 2012). Although engaging in exercise may be of great benefit for our long-term health and well-being, the tendency of humans to maximize pleasure may lead them to suboptimal or nonrational decisions and behaviors (Cabanac & Bonniot-Cabanac, 2007). In the case of exercising, this tendency may result in a person choosing a sedentary, but suboptimal, alternative.

As with other behaviors, affective responses—the pleasure or displeasure experienced during exercise—are related to current and predictive of future exercise behavior (Williams et al., 2012). For example, Williams and colleagues (2012) were interested in examining the relationships between affective responses during and after short, 10-minute moderate intensity treadmill walks. During and after the walks, participants responded to the Feeling Scale (Hardy & Rejeski, 1989; see Chapter 12; Zenko & Ladwig, 2021) to indicate how good or bad they were feeling, as a measure of the pleasure or displeasure experienced. In addition, participants were interviewed about their level of physical activity behavior in the last seven days. Participants who felt more positive during exercise reported more physical activity cross-sectionally (i.e., affective responses during exercise were related to self-reported physical activity behavior measured on the same day of exercise) and longitudinally (i.e., affective responses during exercise predicted self-reported physical activity when measured six months later). Interestingly, the pleasure and displeasure experienced while participants were seated and resting after exercise was not related to physical activity behavior, either cross-sectionally or longitudinally.

These general findings were supported by a systematic review (Rhodes & Kates, 2015). Rhodes

and Kates (2015) reviewed 24 studies, of which four assessed the relations between affective responses during exercise and physical activity behavior. In both adolescents and adults, affective responses during exercise were related to physical activity behavior, while the authors suggested that "the evidence does not support a relationship between postexercise affective response and subsequent physical activity performance" (p. 725). Overall, the outcomes of the systematic review supported the idea that maximizing pleasure experienced *during* exercise may be the most influential correlate of future physical activity behavior.

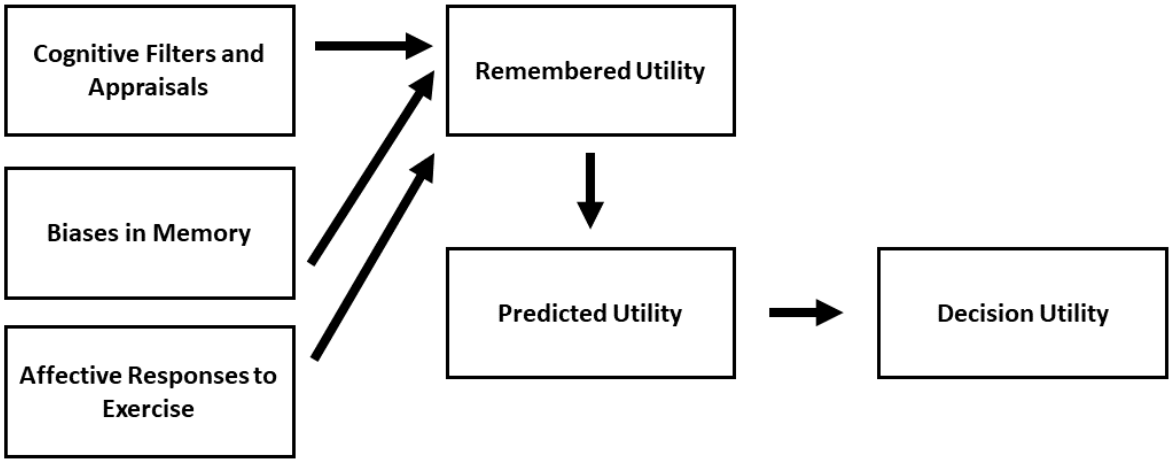
Memories of the Past, Decisions about the Present

When making decisions and choices about behavior—such as the decision to exercise or not—it is important to acknowledge that decision makers may be biased, and the memories of pleasure and displeasure experienced during earlier exercise episodes may be distorted through cognitive filters and other biases in memory. The Nobel Laureate Daniel Kahneman and colleagues (Kahneman et al., 1997) distinguished between several types of utility, including experienced utility and decision utility. Experienced utility can be described as the hedonic experience of an episode, for example, the affective responses during exercise[1]. An exercise experience that is more pleasant has higher experienced utility than a less pleasant (or more unpleasant) exercise session. Decision utility is inferred from the choices people are observed to make. For instance, if a person chooses a sedentary alternative such as television viewing instead of exercise, then television viewing would be said to have more decision utility. Interestingly, a large research literature suggests that decision utility is not a direct result of experienced utility. Instead, it is possible that an experience such as exercising can be remembered differently (e.g., as more or less positive than it actually was), and this remembered utility may inform predicted utility (i.e., predictions about how pleasant or unpleasant future exercise experiences will be), which in turn may inform decision utility (i.e., whether someone chooses to exercise, or not). As Kahneman and colleagues put it, the factors "that determine what people do are not pleasure and pain, but *memories* of pleasure and pain" (Kahneman et al., 1997, p. 385, emphasis added). This is illustrated in Figure 11.1, showing the theorized relations between affective responses to exercise, remembered utility, predicted utility, and decision utility. We suggest that some of the relationships depicted in Figure 11.1 may be conscious or unconscious.

Memories of an activity or event may be biased by many factors, such as the temporal characteristics of an exercise experience (described later), as well as cognitive filters and cognitive appraisals, including individual biases and cognitive appraisals about the importance of exercise (Karnaze et al., 2017), and individual differences such as personality. It is reasonable to suggest, for example, that a person with a strong optimism bias and tendency to predict future experiences will be positive will also be more likely to predict that engaging in an exercise bout will be pleasant and enjoyable. Future research is necessary to test this hypothesis. In short, cognitively mediated variables such as remembered utility (e.g., "How *did* the exercise make you feel?"), predicted utility, affective forecasts, or anticipated affective responses (e.g., "How *will* the exercise make you feel?"), and other affect-laden cognitive constructs such as affective attitudes and affective judgments may be influenced at least in part by previous affective responses to exercise experiences (also see Ekkekakis et al., 2018), but affective responses to exercise are not the only determinant of these cognitive constructs.

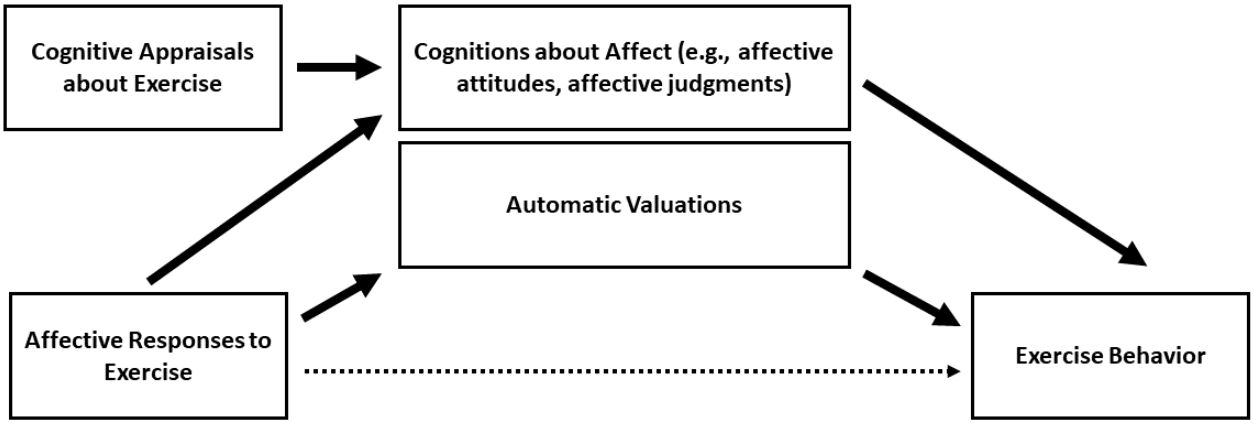
[1] When "utility" of exercise is conceptualized as the pleasure or displeasure associated with exercise, as is the case in this chapter, the terms *remembered pleasure* and *predicted pleasure* can serve as synonyms for remembered utility and predicted utility, respectively. An additional synonym for predicted utility is *forecasted pleasure*, and *affective forecasts* are predictions about future affective experiences.

Figure 11.1
Theorized Influences of Remembered Utility, Predicted Utility, and Decision Utility



Note. Notice that affective responses to exercise, the focus of this chapter, are just one influence of remembered utility. Affective responses during exercise (an indicator of experienced utility) rarely, if ever, fully explain the remembered utility of exercise. Biases in memory and cognitive filters and appraisals also influence remembered utility.

Figure 11.2
Conceptualized Pathways in Which Affective Responses to Exercise Influence Future Exercise Behavior



The dotted line in Figure 11.2 represents the overall relationship between affective responses to exercise and exercise behavior. Several mediators of the relationship between affective responses to exercise and exercise behavior are theorized. Here, we suggest that affective responses to exercise may impact future exercise behavior through affect-laden cognitions or cognitions about affect (e.g., thoughts about whether the exercise makes one feel prideful or shameful, embarrassed or accomplished, and expectations of the increased sense of energy or euphoria one may experience after exercising). These cognitions about affect are also expected to be influenced by messaging strategies and other techniques for changing cognitive appraisals about exercise (e.g., information and media campaigns about how exercise makes people feel good, and how exercise may reduce depression).

Indeed, affect-laden cognitive constructs have been shown to relate to exercise intentions (Helfer et al., 2015) and behavior (Geers et al., 2017; Kiviniemi et al., 2007). These suggested pathways are shown in Figure 11.2 and illustrated by the boxes labeled "Cognitive Appraisals about Exercise" and "Cognitions about Affect".

Automatic Affective Valuations

We also adopt the theoretical predictions of the affective-reflective theory of physical inactivity and exercise (Brand & Ekkekakis, 2018; Chapter 4, Brand & Ekkekakis, 2021). According to affective-reflective theory, automatic affective valuations (Figure 11.2) are automatic positive or negative associations with physical activity or exercise. The positivity or negativity may be the "result of repeated experiences of emotions mediated by cognitive appraisals (e.g., pride, embarrassment) or a result of repeated exercise experiences of core affective reactions not necessarily mediated by cognitive appraisals (e.g., sense of physical reinvigoration, pain, bodily discomfort)" (Brand & Ekkekakis, 2018, p. 54). In turn, automatic affective valuations serve as a predictor of physical activity or exercise behavior. Therefore, based on the affective-reflective theory, automatic affective valuations serve as a link and mediate the relation between affective responses to exercise and exercise behavior (see Figure 11.2). Taken together, it seems imperative that practitioners should maximize the pleasure experienced during exercise because affective responses to exercise are predictive of future exercise behavior; this relationship is likely mediated by cognitions about affect and automatic affective valuations.

Learning Exercise One

Describe why having an exerciser experience exercise as pleasant or unpleasant is important, and how the *changing the experience of exercise* might influence behavior differently than providing information and education about the various benefits of exercise (e.g., improving cardiovascular health, reducing risk of disease).

Strategies to Facilitate More Pleasant Exercise Experience

How, then, can exercise professionals who understand hedonic theory and the importance of affective responses to exercise do their best to ensure that pleasure is maximized, and displeasure is minimized? Messaging strategies designed to give information about the benefits of exercise are thought to promote exercise behavior through cognitive appraisals (see Figure 11.2). To fully target affective responses to exercise, one must make the experience of exercise more pleasant (Ekkekakis et al., 2018). Here, we describe two broad strategies that are (a) focused on intensity (an Intrinsic factor) and (b) focused on situational and environmental (Extrinsic) factors.

Intensity and Affective Responses to Exercise

The dual-mode theory (DMT; Ekkekakis, 2005; 2009a) suggests that affective responses to exercise are influenced by cognitive factors, such as appraisals about exercise, goals, and perceptions of accomplishment, and interoceptive factors, such as physiological responses to exercise. According to the DMT (Ekkekakis, 2009a), when intensity is "moderate" (i.e., below the lactate threshold or ventilatory threshold), exercise is "consistently beneficial and it is essential for subsistence activities (hunting and gathering) and promotes the healthful effects of exercise without seriously challenging the maintenance of homeostasis or raising the risk of injury or exhaustion" (p. 82). "Heavy" exercise intensity is characterized by intensity that is slightly above the lactate threshold or ventilatory threshold to the level

of critical power, and exercise intensity beyond this point is considered "severe" (Ekkekakis, 2009a; also see Ekkekakis et al., 2005b). It is important to note that moderate, heavy, and severe exercise intensities in this context do not necessarily correspond to the definitions of moderate- or vigorous-intensity exercise according to the American College of Sports Medicine (e.g., 64–76% of maximum heart rate for moderate intensity; Garber et al., 2011). Instead, the domains of moderate-intensity, heavy-intensity, and severe-intensity correspond to levels of challenge to physiological homeostasis.

Since exercise at moderate intensities is "consistently beneficial" from an evolutionary perspective, moderate-intensity exercise is expected to result in pleasant affective responses for most people (Ekkekakis et al., 2005b). Exercise in the heavy domain is neither consistently beneficial nor dangerous, and therefore affective responses in the heavy domain are often highly variable, with cognitive factors being more closely related to affective responses during heavy exercise (Ekkekakis et al., 2005b; Ekkekakis, 2009a). Finally, exercise in the severe domain is associated with several physiological threats to homeostasis, including continuously rising blood lactate, decreased availability of energy resources, and, if prolonged, potential muscle damage (Ekkekakis et al., 2005b). Like moderate exercise, severe exercise is adaptationally significant. Whereas moderate exercise is considered to be adaptive, severe exercise is considered to be maladaptive and dangerous if prolonged. The DMT suggests that exercise at severe intensity is associated with displeasure for most people (Ekkekakis et al., 2005b; Ekkekakis, 2009a). The tenets of the DMT are well-supported in the literature (for a review, see Ekkekakis et al., 2011). Overall, the DMT (Ekkekakis, 2005; 2009a) suggests that practitioners should be cautious about prescribing exercise that is in the range of severe intensity; practitioners also take a risk when prescribing exercise that is in the heavy domain. These intensities are expected to elicit either (a) homogenous, consistent feelings of displeasure (severe intensity) or (b) heterogenous, mixed feelings of displeasure and pleasure (heavy intensity). To illustrate, Zenko and Ekkekakis (2019) had 95 participants exercise at a heavy intensity (i.e., at the intensity corresponding to the ventilatory threshold for each participant) while reporting their affective responses. Compared to affective valence (i.e., pleasure-displeasure) assessed shortly before exercise, 61.1% of participants felt less pleasant during exercise, and 25.2% of participants felt more pleasant. Put differently, prescribing heavy-intensity exercise may make some people feel worse, and, according to the DMT, prescribing severe-intensity exercise is expected to make most people feel worse, and ultimately may increase the risk of dropout.

Ekkekakis and colleagues (2011) suggested that the likelihood of exercise intensity to elicit pleasure or displeasure should be a primary consideration for practitioners, alongside exercise safety and exercise effectiveness. So how can exercise professionals prescribe intensity for pleasure, especially in the absence of equipment to assess the lactate threshold or ventilatory threshold for each client or patient? Promising strategies include allowing the exercisers to choose or self-select their own exercise intensity, using pleasure as a guide for prescribing intensity, and structuring the pattern of exercise intensity in a way that is expected to elicit positive remembered and predicted pleasure.

Self-Selected and Affect-Guided Exercise Intensity

In a review, Ekkekakis (2009b) noted that, when allowed to self-select their own exercise intensity, most (but not all) people select intensities that are both physiologically beneficial and not expected to elicit displeasure (also see Williams, 2008). Allowing people to choose their own exercise intensity may have other benefits that promote exercise adherence. For example, doing so may enhance autonomy (Vazou-Ekkekakis & Ekkekakis, 2009), one of the basic psychological needs proposed by self-determination theory. See Chapter 2 (Rebar et al., 2021) and Chapter 3 (Quested et al., 2021). It may also simplify the practitioner's job of determining individual differences in preferences, recognizing that some people prefer and tolerate higher levels of exercise intensity more than others (see Ekkekakis et al., 2005a). Some students and professionals reading this, for example, may realize that they prefer high-intensity interval training and vigorous exercise experiences. However, students and professionals

should, at the same time, consider that "preferences for me do not mean preferences for thee." Prescribing exercise programming that we like but our patients or clients dread would not be advisable.

Williams and colleagues (2015; 2016) provided compelling experimental evidence in support of self-selected exercise intensity, or what they called self-paced exercise. In a randomized controlled trial, participants were enrolled in a six-month exercise program and randomly assigned to either (a) moderate-intensity exercise, based on heart rate (64–76% of maximum heart rate) or (b) self-paced exercise, in which the participants could choose their own intensity but were asked not to exceed 76% of their maximum heart rate as a safety precaution. All participants were insufficiently active and either overweight or had obesity. In addition, mode was not self-selected. All participants were asked to walk for their exercise. The self-paced exercisers walked about 26 more minutes per week than the exercisers who were prescribed moderate-intensity exercise (Williams et al., 2015). In another study, based on the same intervention, it was found that the self-paced exercisers had more positive affective responses to exercise, and these more positive affective responses mediated the relationship between the type of exercise program (i.e., self-paced vs. moderate intensity) and exercise adherence (Williams et al., 2016). In other words, allowing participants to self-select their own walking intensity evidently resulted in more positive affective responses to exercise, which in turn resulted in greater exercise adherence.

Another, more direct method of prescribing exercise that results in positive affective responses may be to simply guide exercisers to choose an intensity that feels good. This is affect-based, affect-regulated, or affect-guided exercise (Ladwig et al., 2017). Although experimental evidence linking this strategy to increased adherence is lacking, preliminary results requiring replication and extension appear promising (Parfitt et al., 2012; Zenko et al., 2020). With this approach, researchers or practitioners could use the Feeling Scale (Hardy & Rejeski, 1989) or other measure of affective valence as a guide to instruct exercisers to select only intensities that allow them to feel pleasant (i.e., more positive than neutral). This would, ideally, prevent participants from feeling unpleasant during exercise.

Restructuring Exercise Intensity

Researchers have also started to test the effects of restructuring exercise intensity to create more pleasant memories of exercise. Recall that remembered pleasure or remembered utility may be biased and not completely dependent on the overall average pleasure experienced during an episode of exercise. Instead, certain temporal characteristics may have disproportionate influence on how an exercise experience is remembered. Some of these characteristics include the end, or final moment of an experience, the peak, or most intense moment of an experience, and the trend or slope of an experience (i.e., whether an experience becomes more positive or more negative as time progresses; Ariely & Carmon, 2000; Kahneman et al., 1993). To illustrate how the “end” rule might influence the remembered pleasure or remembered utility of an experience, imagine that you’re enjoying dinner with friends and hosting a party at your house. For several hours, you enjoy conversation and company and are having a great experience overall. However, just as the dinner party is ending, one of your guests knocks over a fragile and sentimental family heirloom. The heirloom is destroyed just as guests are leaving your house. On average, you experienced pleasure for several hours. However, the end rule would suggest that the final moment of the dinner party—which was very unpleasant—disproportionately influences your overall memory of the experience. Now, you may recall the dinner party to be unpleasant, despite the fact that you experienced more pleasure than displeasure throughout the party.

Applied to exercise, the importance of the peak-end rule and the trend or slope suggests that experiences should have a more pleasant “peak” moment, end on a positive note, and improve throughout an experience (i.e., if participants start exercise feeling unpleasant, you should ensure that they feel more and more pleasant as exercise progresses). Zenko, Ekkekakis, and Ariely (2016) tested some of these concepts by having participants either (a) start at a high intensity and end at a low

intensity (thus starting from an unpleasant exercise intensity and ending at a more pleasant exercise intensity), or (b) start at a low intensity and end at a high intensity (thus starting from a pleasant exercise intensity and ending at an unpleasant, very challenging exercise intensity). Supporting the research on the trend (and to some extent, the end), the researchers found that exercisers who decreased intensity over time (and increased pleasure) remembered the experience to be more pleasurable, predicted future exercise experiences to be more pleasurable, and enjoyed the exercise more. Remembered pleasure and predicted pleasure were measured about 15 minutes, 24 hours, and seven days following exercise. The slope of pleasure (i.e., how much the exercise experience became more or less positive over time) explained 35–46% of the variance in remembered and predicted pleasure. These findings suggested that the trend of an experience—the slope of pleasure—was a major influence on how the experience of exercise was remembered.

While Zenko et al. (2016) tested this concept in the context of aerobic exercise (i.e., using a cycle ergometer), Hutchinson et al. (2020) replicated the findings in the context of resistance exercise. This time in a within-subjects design (where participants repeated both conditions), participants performed a resistance-training circuit that either increased or decreased in training load. In the decreasing-intensity condition, participants performed one circuit at 75% of their 1-repetition maximum, followed by one circuit at 65% of their 1-repetition maximum, and ending with 55% of their 1-repetition maximum. The pattern was reversed in the increasing-intensity condition. As expected, participants felt progressively more pleasant in then decreasing-intensity condition and reported more pleasure following exercise. The decreasing-intensity condition also resulted in more exercise enjoyment and remembered pleasure (both shortly after and about 24-hours after exercising).

It is likely that context matters here. For example, Stuntz and colleagues (2020) examined patterns of perceived exertion (also see Chapter 13; Hutchinson, 2021), feelings of accomplishment, and affective responses in the context of a practice session for college athletes. Importantly, the authors concluded that change in perceived exertion and change in pleasure did not predict remembered pleasure. Instead, feelings of accomplishment mediated the relation between change in exertion and change in remembered pleasure. When the athletes exerted themselves more and felt more accomplished, they also experienced greater remembered pleasure. Thus, the pattern of intensity is not the only predictor of remembered pleasure and remembered utility. As mentioned previously, individual cognitive appraisals or cognitive filters also play a role in shaping the memory of an experience. The research by Stuntz and colleagues (2020) suggests that cognitive appraisals of accomplishment may be particularly important for athletes in sporting contexts. Further research should continue to examine under which conditions the end, peak, and trend of an experience do and do not predict remembered pleasure, predicted pleasure, and ultimately exercise adherence.

Learning Exercise Two

You have just read about how intensity influences affective responses to exercise. Your task here is to design an exercise session to maximize pleasure and minimize displeasure by regulating exercise intensity. How do you do it? Justify your response.

Extrinsic Strategies

In the context of this chapter, an extrinsic strategy concerns manipulation of the exercise experience outside of frequency, intensity, duration, and type. In practice, strategies are often combined to create interventions, and in many instances more than one strategy is included in a research study which can make isolating the effects of a specific strategy difficult. For example, a person

attending a spin class could experience several extrinsic factors: the music played, the other participants in the class, the instructor, the room set up (e.g., mirrors, lighting), and each would influence a person's responses to the spin class. This is in addition to intrinsic factors such as exercise intensity, and other factors previously mentioned in this chapter. The interaction of these factors leads to difficulties in predicting responses to such situations. Nonetheless, researchers have sought to understand the affective responses to extrinsic strategies that could be employed during exercise.

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Indoor and Outdoor Exercise

For a moment, consider the physical environments in which you exercise. Are there blossoming trees, flowering plants, the scent of freshly cut grass, and birdsong? Are there mirrored walls, grey-metal machines, human body odors, and a local radio station playing in the background? The physical environment in which we exercise intuitively seems an important factor in determining our experience.

The environment in which people exercise is complex and includes numerous different sources of information (e.g., scenery, weather). However, the dichotomy of indoor or outdoor exercise can be useful when trying to understand affective responses to the physical environments where people exercise. Green Exercise is "activity in the presence of nature" (Barton & Pretty, 2010, p. 3947) and a review article by Gladwell et al. (2013) proposed that Green Exercise could be a powerful tool against physical inactivity. A study by Rogerson et al. (2016) sought to control for mode and intensity of exercise while examining the effects of a green outdoor setting, compared to a built indoor setting. Twelve participants cycled on an ergometer that was situated on a sports field or in a windowless laboratory with basic fixtures and fittings. The results of 15-min cycling at 50% heart rate reserve in these environments did not indicate any differences in enjoyment of exercise. Similarly, Turner & Stevinson, (2017) did not find that outdoor exercise promoted greater pleasure during high intensity exercise. They compared a 6km near-maximal intensity run on an indoor treadmill to a trail run through a large woodland area and found that Feeling Scale scores did not differ during or immediately after the ~15min run.

There has been support for the assertion that outdoor exercise leads to more positive affective responses. Lacharite-Lemieux et al. (2014) demonstrated that a 12-week outdoor exercise program comprising both aerobic and resistance components led to greater engagement with exercise and adherence in a sample of 23 postmenopausal women. Participants in this study also reported greater pleasure during outdoor exercise but this analysis did not include all exercise sessions as part of the program. Further work has explored the effects of outdoor exercise in women (e.g., Krinski et al., 2017;

Plante et al., 2007). Krinski et al. (2017) asked women with obesity to walk at a self-selected pace on a laboratory treadmill and on an outdoor athletic track and found that not only did participants walk further outdoors, they also reported greater pleasure during their walk. An important point to note was that pleasure declined from baseline in both indoor and outdoor conditions (a pattern previously reported in women with obesity by Ekkekakis et al., 2010), but the decline was not as sharp during outdoor walking. In a further study demonstrating the efficacy of outdoor exercise, a study with undergraduate women revealed that self-paced walking on a college campus was more enjoyable than walking on a treadmill in a health club (Plante et al., 2007). Focht (2009) compared an outdoor self-paced walk to a laboratory treadmill walk and found that both environments resulted in positive changes in core affective valence from baseline, but outdoor exercise yielded higher Feeling Scale scores, and that greater enjoyment was derived from the outdoor walk.

Consider again the outdoor environments that you might exercise in. There might be an outdoor run in the suburbs, a parkour circuit in a city center, a cycle ride in open countryside, or a swim in a reservoir. It seems plausible that each of these outdoor environments would elicit a different response as they each have different characteristics. Researchers have sought to examine different outdoor environments during exercise in attempts to further understand the role they might play. An early study in this domain explored different outdoor settings by comparing a park run to an urban run with 12 regular runners (Bodin & Hartig, 2003). The park run, through a large nature reserve, did not translate to significant differences in emotional response. In a different research design to many in this field, Dunton et al. (2015) measured affective responses during physical activity using ecological momentary assessment[2] and this captured participants exercising as they naturally would. The outdoor environments in the Dunton et al. (2015) study included at-home outdoors, at a park or trail, or other outdoor locations, but insufficient data for each of these outdoor categories prevented detailed analysis for each category. Nonetheless, outdoor exercise across these different environments resulted in less negative affect than indoor exercise. The benefits of a more "extreme" outdoor exercise environment have also been examined and a comparison between a coniferous forest and an urban park revealed that the more extreme outdoor environment of the forest led to greater pleasure reported immediately after exercise (Pasanen et al., 2018). There appears some preliminary evidence that not all outdoor exercise is the same, with some environments more effective at eliciting positive affective responses than others. However, the existing evidence is scant and there is a need to explore this topic with a greater range of outdoor environments considered. There are studies exploring different outdoor environments (e.g., Green Exercise, Blue Exercise), but the outcomes in these studies are often not captured with dimensional measures of affect or measures of enjoyment, and these outcomes are of central concern in this chapter.

Comparisons between indoor and outdoor exercise are popular but there have been equivocal findings regarding affective responses during exercise. A systematic review by Lahart et al. (2019) supported the view that acute bouts of outdoor exercise have favorable affective responses compared to indoor exercise but concluded that low quality evidence pervaded the field, and that further rigorous research is required.

Purposefully Selected Visual Stimuli

While the evidence for outdoor exercise compared to indoor exercise is tentatively positive, it is not always possible for people to exercise outdoors. Consequently, researchers have sought to

[2] Ecological momentary assessment allows participants to report thoughts, feelings, and behaviours close in time to the experience. As a method, it allows for more externally valid studies compared to lab-based studies as participants can continue with their usual routines. Prompts are provided to the participants to record what they have been doing and their psychological responses to it.

understand the effects of bringing the outdoors, indoors. Research into the effects of showing digital images and videos of the natural environment to people exercising indoors is an attempt to bring the benefits found in some outdoor exercise studies, to indoor exercise. Watching point-of-view video footage of traveling through a national park while cycling on an ergometer was not found to increase pleasure compared to a control condition (Jones et al., 2014). However, when the video footage was combined with a motivational music playlist, there were significant positive effects on pleasure compared to a control condition. The video footage played by itself (without motivational music) was not rated as any more pleasant than the control condition and it was postulated that the unnatural presentation of nature (e.g., without the other sensations of nature such as the wind in your face or hearing the rustle of leaves) was the reason why.

Beyond videos of natural environments, researchers have sought to understand the efficacy of other visual stimuli during exercise. Watching and listening to music videos while running on a treadmill led to greater pleasure when compared to listening to the music without the video, and a control condition (Hutchinson et al., 2015). Bigliassi and colleagues (2019) administered a range of visual stimuli (e.g., movie scenes and television series) based on participants preferences and found that, when delivered with auditory stimuli, pleasure was increased during a 10-min self-paced recumbent cycling task.

The video footage presented by Jones et al. (2014; see Figure 11.3), Hutchinson et al. (2015), and Bigliassi et al. (2019) was delivered to participants via a projection in front of the participant or on a television screen. It is apparent that visual stimuli by itself has been the subject of few studies, and the scant evidence available to date suggests that visual stimuli by itself has limited capacity to positively influence how we feel during exercise. Watching videos (e.g., music videos, or traversing natural landscapes) is common for many exercisers and has been implemented in gymnasia and on cardio exercise equipment for many years. However, recent advances in technology have permitted researchers to more easily examine the effects of visual stimuli delivered in a more immersive style.

Figure 11.3

Laboratory Set-Up for Showing Digital Footage of Nature While on a Cycle Ergometer

Note. Image credited to Dr. Leighton Jones

Virtual Reality and Immersive Environments. The recent emergence of low-cost consumer level headsets (e.g., Samsung Gear VR, Oculus Rift) has led to a resurgence of interest in how virtual reality and immersive environments can be used in an exercise context. While this new wave of research is in its infancy, there appears to be some use for the technology. Researchers have sought to use the headsets for two different types of visual stimuli: to display visual stimuli (e.g., music videos) in a more immersive way but lacking interaction, and as a means to display a "computer-simulated environment that aims to induce a sense of being mentally or physically present in another place" (Neumann et al., 2018, p. 183). This section focuses on recent understanding of virtual reality and pertains only to those studies that use a head-mounted display. Neumann et al., (2018) noted in their systematic review that although the term "virtual reality" was used in many studies, it was typical that researchers would use a computer screen or projector with participants. The recency of head-mounted displays being more available for exercise research means there are presently few studies in this area, though this number is growing.

Extending the lineage of work exploring digital images of nature while exercising indoors, Calogiuri et al. (2018) used a Samsung Gear VR headset to compare a 10-min walk along a river bank against video footage of the same walk observed in the head-mounted display. Participants walked on a non-motorized treadmill while viewing a 360° video but found the "real life" walk along the riverbank more pleasant and enjoyable. Alongside the quantitative measures of the exercise experience, participants also provided qualitative feedback about the experience. The issue of cybersickness was raised and this is likely a significant issue for exercise–VR researchers to overcome if the technology is to be used effectively; feeling nauseas and positive affective responses are not common bedfellows. The mode of exercise implemented in this study is also worth considering because the complete visual obstruction of the treadmill has been raised by Neumann et al. (2018) as hazardous and impractical. The comparison of "virtual nature" to "real nature" can have some use in enabling a greater understanding of the extent to which the benefits of real nature can be recreated. However, the benefit of virtual nature during exercise does not seem to be in replacing outdoor exercise, but rather when outdoor exercise in pleasant environments is not possible or feasible. Perhaps continued exploration and comparisons of different types of visual stimuli delivered through head-mounted displays, as opposed to their "real life" counterparts, will prove a fruitful endeavor.

In a change of mode from treadmill exercise, other studies using head-mounted displays have used cycle ergometers to explore the possible benefits during exercise. A study with inactive and overweight adults using a Samsung Gear VR during stationary recumbent cycling demonstrated efficacy for a highly immersive condition (Jones & Ekkekakis, 2019). A comparison between a control condition (no stimulus), watching music videos on a television screen while listening to the music through speakers (low-immersion), and watching the music videos in the head-mounted display while listening to the music via headphones (high-immersion) showed that being highly immersed increased pleasure during exercise. Bird et al. (2020) also used cycle ergometry and a Samsung Gear VR to examine whether a virtual cycling game (with or without a motivational music accompaniment) promoted a pleasant exercise experience. Their findings indicated that during a short bout of exercise (6-min), the virtual cycling game (Cycle: Le Tour by VirZOOM) with and without motivational music promoted greater pleasure and enjoyment than a control condition.

The application of VR and head-mounted displays during exercise has largely involved "traditional" modes of exercise to date (i.e., treadmill and cycle ergometry). However, the application of these emerging technologies with pre-existing modes of exercise might be doing a disservice to the possibilities that these technologies offer. The application of VR while exercising using newly developed devices such as omni-directional treadmills or the Icarus Pro flight simulator might permit exercisers and practitioners to re-imagine what is possible during exercise. Dębska et al. (2019) offered some preliminary data in support of using VR and newly developed equipment to facilitate physical activity,

but further rigorous research is required to understand the efficacy and suitability of such devices for exercise. This topic area appears ripe for extensive future research and there are opportunities for collaborative work between industry and academics.

Photo by mali maeder from Pexels

Learning Exercise Three

The exploration of virtual reality during exercise is in its infancy and offers numerous opportunities for researchers. For this creative learning exercise, design a research study wherein you test the efficacy of a newly created virtual environment using an exercise mode of your choosing. Ensuring a robust research design can be challenging, but the additional challenge here is deciding what that virtual reality environment will be and how it will link to exercise. Try to think beyond what has been examined so far and create a new virtual world or task that would be ideal for a pleasant exercise experience.

Music

So far in this chapter we have mentioned music alongside visual stimuli, but there is a more extensive literature exploring the effects of music singularly. Music is arguably the most popular accompaniment to exercise and is a topic that garners considerable interest from the public and researchers. The past decade has seen a marked increase in the quantity and quality of music in sport and exercise literature and a recent meta-analysis by Terry et al. (2020) included 139 studies. The meta-

analysis serves as a landmark paper in this topic area and would be a suitable starting point for any research on this topic. The role of music in a sporting context is discussed in Chapter 23 (Karageorghis et al., 2021), and this section introduces the use of music in an exercise context.

Music can be applied prior to exercise but the carry-over effects into exercise are not well understood. There are very few studies exploring whether listening to music beforehand can improve how people feel during exercise. Karageorghis et al. (2018) were interested in whether listening to different combinations of loud/quiet and fast/slow tempo music prior to an isometric contraction task (using a handgrip dynamometer) influenced how people felt immediately after the physical task. The loud and fast music (80 decibels and 126 beats per minute [bpm]) resulted in the highest affective valence scores following the task. Other work has examined the use of music before physical tasks, but without assessing affective responses (e.g., Crust, 2004). Pre-task music warrants closer research attention because influencing affective states prior to exercise might have beneficial effects for responses during exercise, but at present it appears that the most efficacious way for music to influence how people feel during exercise, is to listen during exercise.

Listening to music during exercise can be divided into two different applications: synchronous and asynchronous. Synchronous application is when an exerciser *consciously* moves in time to the beat of the music, whereas asynchronous is when there is *no conscious* synchronization between physical movement and the musical beat. In a synchronous music study, Karageorghis et al., (2009) asked 30 exercisers to walk to exhaustion on a treadmill while striding in time with a musical beat. The music tracks were all 125bpm and participants were asked to stride in time with the music "so that the foot of their dominant leg came into contact with the treadmill belt in time with the first beat of each bar" (Karageorghis et al. 2009, p. 25). A playlist of motivational music tracks, rather than motivationally neutral tracks, applied synchronously, resulted in the highest reported pleasure during the task compared to a no-music control condition. A study examining the effects of synchronous music use during circuit training revealed less negative affect with motivational and motivationally neutral music selections in female exercisers only (Karageorghis et al., 2010). The music tracks for the muscular endurance-type activities were slightly slower than the treadmill walking activity, with 120bpm deemed appropriate to match a suitable movement rate for circuit training exercises (e.g., standing squats). While these studies offer some support for applying music synchronously, the application of synchronous music has additional practical considerations. Establishing a suitable tempo for movement is highly dependent on the task and the individual; the two studies described here included healthy young adults but appropriate tempo for different populations might be different. Applying music asynchronously to exercise does not require the same practical considerations as matching music beats to human movement patterns.

A theoretical model proposed by Karageorghis (2016) described the antecedents, moderators, and consequences of music use in sport and exercise. Musical factors (e.g., tempo, rhythm, lyrics, idiom) form the antecedents and these are thought to be hierarchical in nature whereby tempo is the most influential musical factor over the consequences (e.g., positive affective states) of listening during an exercise task. On this premise, a lineage of work explored the role of tempo in understanding asynchronous music liking and affective responses across a range of exercise intensities. In their 2014 article, Karageorghis and Jones showed that music tracks ranging in tempo from 95 to 160 bpm resulted in greater pleasure compared to not listening to music across exercise intensities ranging from 40%–90% heart rate reserve (HRR). However, it was the "medium" tempo condition (115–120bpm) that elicited the most pleasure across the exercise intensities. This indicated that regardless of whether exercise intensity was low, moderate, or high, medium tempo music was the most suitable for their sample of young, healthy, and active participants. An important point to note is that pleasure was significantly lower at 90%HRR regardless of condition (in line with theoretical predictions), but the pattern of responses to the music conditions across intensities was consistent. In other words, all conditions led to

decreases in pleasure as intensity increased, but medium tempo music remained the most pleasant condition compared to the other conditions. However, the recent meta-analysis by Terry et al. (2020) found that music tempo did not significantly moderate affective responses, and additional work could be undertaken to further understand the role of tempo in determining affective responses.

Beyond explicit examination of music tempo, studies by Elliott and colleagues (Elliott et al., 2004; Elliott et al., 2005) examined the influence that an asynchronous application of motivational music had on affect during moderate-to-high intensity cycle ergometry tasks. The studies found a consistent result; music enhanced in-task affect compared to the no-music conditions. Although previous literature has found a diminished effect of asynchronous music at very high exercise intensities, several studies have explored the effects of listening to music asynchronously during high-intensity interval training (HIIT) and sprint-interval training (SIT). Stork et al. (2015) played music throughout a SIT session and found that self-selected motivational music did not significantly improve pleasure compared to a no-music control condition. Contrastingly, Stork et al. (2019) found that a motivational music playlist did elicit more pleasure over the course of a SIT session compared to a no-music control. As demonstrated by these results, the possible role for music during very high-intensity exercise is not fully understood.

The most recent addition to the music and exercise literature is *respite music*. Respite music is listening to music only during the rest periods of an interval exercise session and preliminary evidence suggests some benefit for this type of application. Listening to fast-tempo music (125–135bpm) during 3-min recovery intervals between 5-min treadmill exercise bouts was shown to increase pleasure compared to a no-music control condition (Jones et al., 2017). Similarly, Karageorghis et al. (2021) found that pleasure increased during the exercise bouts and recovery periods when listening to medium tempo music (120–125pm), despite only listening to music during the recovery periods. However, listening to music only during the recovery periods appears less effective than playing music throughout an entire HIIT session (Jones et al., 2020). A consistent pattern in music and HIIT studies is that affect declines over the course of a HIIT session, but in some instances, music can attenuate that decline.

Listening to music post-exercise (*recuperative music*) has received comparatively less research attention than in-task applications yet offers some promise in regulating affective states immediately after exercise. There is typically an *affective rebound* following demanding exercise whereby people experience a positive affective response immediately upon cessation of exercise (Ekkekakis et al., 2011). Karageorghis and colleagues (2018) found that slow, sedative music (~71bpm) augmented this affective rebound over a 30-min period post exercise.

The extensive evidence base for applying music in an exercise context has provided a foundation for larger scale projects; however, such projects have not yet been conducted and the most significant next step for music and exercise research is to understand the role that music might play in determining continued engagement in exercise.

Exergaming

Combining computer games with physical activity—known as exergaming—has proved to be a popular strategy with many people, and a lucrative strategy for technology companies such a Nintendo and Microsoft. While Nintendo had significant commercial success with their Wii console, researchers have sought to understand whether exergames can be successful in positively changing how we feel during and after physical activities. The literature examining exergaming is vast and a common outcome measure is energy expended, or exercise intensity, with several review articles demonstrating that exergames, or active video games, can result in activity considered moderate-to-vigorous (e.g., Sween et al., 2014). Alongside energy expenditure, enjoyment is a frequently measured outcome, but the measurement of enjoyment in this field includes a wide range of instruments and the measurement of in-task affect is uncommon.

The Wii Fit has frequently been used as a way to examine exergames; Garn et al. (2012) asked

college-age students to engage in several exercises on the Wii Fit (e.g., Ski slalom) and participants reported that the experience was enjoyable. Examining a bespoke cycling game, McGloin and Embacher (2018) showed a relationship between enjoyment and "desire to ride again" (p. 498). However, there is a severe methodological limitation in those two example studies as there is no matched-control condition. For example, Garn et al. asked participants to report their enjoyment following bouts of exercise on a Wii Fit compared to responses based on the question stem "When I am physically active…". This comparison between enjoyment of specific Wii fit exercises and a hypothetical bout of physical activity undermines the usefulness of the findings relating to enjoyment. Further, McGloin and Embacher (2018) did not examine enjoyment compared to cycling without the game. There have been few studies examining affective responses compared to a matched-control condition (e.g., Li et al., 2018). A comparison between Wii Fit exercises (e.g., Wii Bowling) and traditional exercises (e.g., indoor bowling) demonstrated more positive emotions following the exergaming condition using the Positive and Negative Affect Schedule (PANAS; Li et al., 2018). However, conceptual issues with the suitability of the PANAS have been raised previously (see Ekkekakis, 2013).

There appears to be a pattern of positive affective responses associated with exergames (measured with myriad approaches), but there is limited evidence demonstrating affective responses during exercise. As was described earlier in the chapter, it is the affective responses during exercise that appears most predictive of future engagement. To further understand the in-task responses during exergames, researchers could seek to collect core affective responses *during* game play. A recent meta-analysis indicated that active video games do not increase physical activity in young people at short-term follow-up (Oliveira et al., 2020), and it could be suggested that further examination of affective responses during exergaming might help to explain why.

Exercising with Others

As mentioned earlier in this chapter, there are several concurrent factors that influence affective responses when exercising. Studies that have explored the influence of exercising with others have often done so in combination with other strategies. An example of this is an examination of different types of partners when exergaming. Feltz et al. (2014) asked participants to complete exercises in the presence of virtual partners (human, a nearly human-like humanoid, and a hardly human-like software generated partner) or a no-partner control. There were no differences found in enjoyment between the conditions. Further, while participants worked harder in the experimental conditions, they did not report less enjoyment. The role of a virtual partner during a rowing task in virtual reality was examined by Murray et al. (2016) and was not found to influence in-task pleasure or enjoyment. There does not seem to be strong evidence to support the use of digital partners during exergaming or virtual activities if the aim is to enhance affective outcomes. Similarly, there does not appear strong evidence for exercising with "real" partners. For example, Rogerson et al. (2020) showed that running either individually or with a small group (4–5 others) in an outdoor environment did not lead to any changes in total mood disturbance, but they did not assess core affective responses during exercise or enjoyment afterwards. Plante et al. (2007) did measure enjoyment of women exercising alone or with others and found no differences in enjoyment across both indoor and outdoor exercise. Moreover, exercising with a friend during indoor cycling did not garner greater enjoyment than cycling without a friend (Plante et al., 2011). This is not to say that exercising with others does not lead to greater pleasure or enjoyment, just that it appears scant research has directly explored this. While numerous studies have explored other benefits of exercising with others, there are very few that have included responses pertaining to pleasure–displeasure and enjoyment.

The wider role of social support as a determinant of physical activity has received significant attention. It is generally regarded as an important factor towards initiating and maintaining physical activity and exercise programs. However, there are fewer studies showing the direct effects of exercising

with others on affective responses and further examination of this would bolster the evidence base for exercising with others as an effective strategy.

Imagery

The use of imagery in sport and exercise psychology is extensive and it remains a popular and effective tool in the sport and exercise psychologist's toolbox (see Chapter 20; Rymal & Hill, 2021). There is also evidence that it can be effective at positively shaping our exercise experiences. In two studies by Stanley and Cumming (2010a, 2010b), the efficacy of *enjoyment imagery* was demonstrated in participants exercising at moderate intensities on cycle ergometers. Enjoyment imagery comprised of asking participants to recall an exercise experience they found "really enjoyable", and to recreate this as vividly as possible (including the sounds, colors, other people present). The imagery script played during the exercise encouraged participants to "experience again in the present the sensations associated with that time" (p. 585, 2010b). The results indicate this strategy can positively influence in-task pleasure and enjoyment measured post-task. This was further demonstrated by Tempest and Parfitt (2013) who reported greater pleasure in participants listening to an enjoyment and energy-focused imagery script at an exercise intensity proximal to the ventilatory threshold, compared to a control condition. As with other strategies described in this section, imagery appears to have limited benefits at higher exercise intensities as participants in the Tempest and Parfitt (2013) study reported no differences at exercise intensities above the respiratory compensation point.

Compared to some of the other strategies in this section, imagery represents a "low-tech" approach and might be more suitable in a variety of situations. While the imagery script in these studies was delivered via a recording, it could be delivered "live" with likely similar outcomes. The studies described here included young students (~20 years old) as participants, but enjoyment imagery might also have a role to play with other sub-groups of the population and with those were technology-intensive approaches (e.g., VR) might not be entirely suitable.

Mindfulness

Mindfulness can represent a "no-tech" strategy and has been explored as an option for enhancing pleasure during exercise. Most of the strategies described in this chapter seek to promote a dissociative focus, but a mindful approach offers a different path to a pleasant exercise experience. Mindfulness and physical activity are discussed further in Chapter 14 (Cox & Ullrich-French, 2021). The role that mindfulness might play in enhancing affective responses to exercise has only recently begun to be examined. In a study where insufficiently active people were assigned to either a mindfulness condition, a podcast condition, or a "self-monitoring" condition, there were no differences in Feeling Scale scores between the mindfulness and podcast conditions (Gillman & Bryan, 2020). Both conditions were more pleasant than the associative self-monitoring condition, and this is in line with previous literature describing that a predominant focus on bodily sensations (associative focus) elicits more negative affective responses (e.g., Lind et al., 2009). In a similar study exploring the relative merits of mindfulness compared to a condition promoting dissociation (music) and a control condition, there were no statistically significant differences in pleasure reported during the self-paced exercise (Cox, Ullrich-French, Hargreaves, et al., 2020). The intensity of the self-paced exercise might help to explain the lack of difference between the experimental conditions and the control condition; the intensity ranged from ~35%HRR to ~55%HRR. This lower intensity exercise did not likely pose a challenge to regulating affect, and there is diminished "need" for additional strategies at such intensities (Lind et al., 2009) as affective responses are less likely to decline in this range with normal weight exercisers.

The capacity of mindfulness to alter feelings during exercise has also been examined without comparison to other strategies. A mindful treadmill walking condition elicited greater pleasure than a control condition (Cox et al., 2018), and a mindful yoga session resulted in greater remembered pleasure

than a neutral yoga session (Cox, Ullrich-French, Cook-Cottone, et al., 2020). Bigliassi et al. (2020) found a mindful approach to be more pleasurable and enjoyable than a "mindless" condition, and control condition, during a 200m self-paced walk in a park. While mindfulness does not require an electronic device, many of the studies to date have used mindfulness scripts delivered using electronic devices (e.g., iPod). Mindfulness has been described in terms of trait- and state-like qualities, and it might be that individuals with higher trait mindfulness are able to achieve greater pleasure from utilizing this strategy during exercise. Similar to imagery, it is a technique that might require prior training to be effective and further examination of how applicable these approaches are for "naïve" exercisers would shed further light on this strategy.

Other Strategies

The strategies described in this chapter are not exhaustive and there have been other attempts to purposefully influence how people feel during exercise. For example, Pottratz et al. (2020) used subliminal primes (e.g., happy, pleased, joyful) within music videos while participants walked briskly on a treadmill. The music videos with the primes (i.e., words displayed for 16ms every 10s) led to participants reporting more pleasure compared to the music videos without primes. The efficacy of watching music video during exercise has previously been demonstrated (e.g., Hutchinson et al., 2015; Jones & Ekkekakis, 2019) and the additional effects of subliminal primes warrants further research attention.

Other novel strategies include asking exercisers to alter their facial expressions (e.g., smiling or frowning; Brick et al., 2018; Philippen et al., 2012), to wear a transcranial direct current stimulation device (Baldari et al., 2018), and rinse their mouth with water rather than drink it (Shaver et al., 2018). However, the initial evidence on these strategies does not suggest they are particularly effective at improving how we feel during exercise.

Conclusion

This chapter has described how pleasant exercise experiences are of critical importance for adherence. Exercise intensity, a fundamental component of exercise, is a central determinant of affective responses to exercise, and we have described different ways in which exercise intensity can be manipulated to promote more pleasant feelings. We described several strategies (e.g., virtual reality, music, and imagery) that can be considered in addition to the fundamentals of exercise and highlighted some key experimental work supporting their use.

There are several strategies (e.g., imagery) that have not received a great deal of research attention regarding their capacity to positively influence pleasure–displeasure and enjoyment, but there is a foundation for these to be built on. There remains tremendous potential for innovative and creative strategies and it is hoped that those described herein represent only the start of the endeavors to promote more consistently positive exercise experiences.

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