

Exercise Psychology
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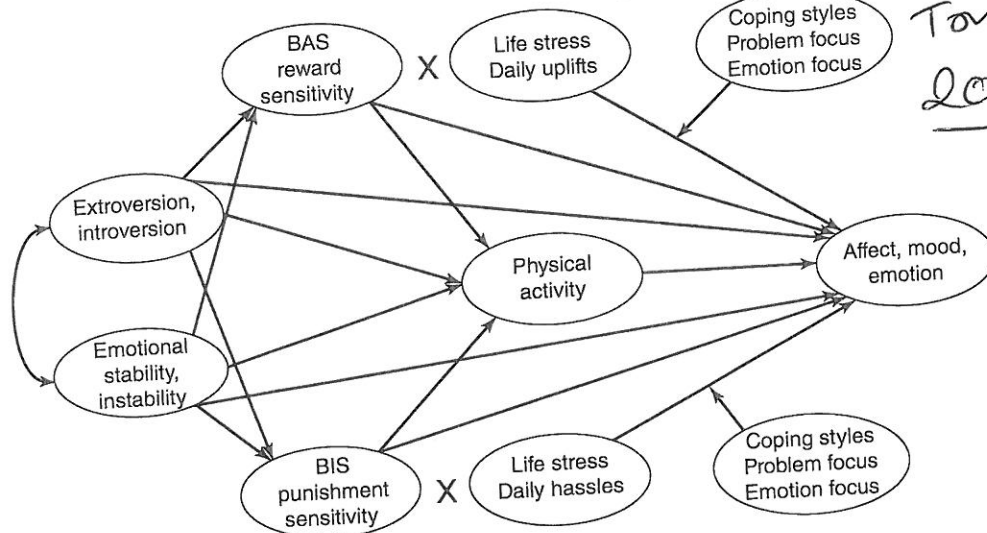


Figure 5.13 Paths by which physical activity could improve affective experience.

disengagement coping (Connor-Smith and Flachsbart 2007; Nes and Segerstrom 2006).

Positive Psychology

The central postulate of so-called positive psychology (Seligman and Csikszentmihalyi 2000) is "if individuals engage in positive thinking and feeling and abandon or minimize their preoccupation with the harsh and tragic—that is, the stressful side of life—they will have found a magic elixir of health and well-being" (Lazarus 2003b, 93). Optimism researcher Martin Seligman, together with Christopher Peterson, developed *Character Strengths and Virtues: A Handbook and Classification*, which they called a positive counterpart to the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* of the American Psychiatric Association (Peterson and Seligman 2004). Drawing from their synopsis of cultures during recorded history from Asia, Greece, Rome, and Western civilization, they compiled a list of virtues that includes six character strengths: wisdom or knowledge, courage, humanity, justice, temperance, and transcendence, each of which has several subfactors, in a slight repackaging of the seven virtues of the Christian tradition: temperance (e.g., modesty, self-control), justice (e.g., fairness, citizenship), courage (e.g., fortitude, bravery), practical wisdom, humanity (e.g., charity), and transcen-

dence (e.g., hope, faith) (Cloninger 2005). The scientific basis of positive psychology has been vigorously debated (Lazarus 2003a, 2003b). Nonetheless, applications of positive psychology to the study and promotion of exercise have emerged during the past few years.

FACTORS INFLUENCING THE EFFECTS OF EXERCISE ON AFFECT

Understanding variables that can moderate the influence of exercise on affect begins with understanding factors that influence affect. Affect varies in valence, or hedonic tone, and in intensity, and these two dimensions are influenced by a variety of endogenous and exogenous factors. For example, emotional memory systems contain reciprocal connections such that emotions can activate memories or thoughts about the emotions, and thoughts can activate stored emotional responses (Lang 2000). The key determinants of affect also differ for mood and emotion. Watson and Clark (1994) organized potentially important factors that can influence mood into four broad types: exogenous factors, endogenous rhythms, traits and temperament, and characteristic variability. Exogenous factors can be transient conditions in the environment such as a series of rainy days or new music in

an aerobics class. Endogenous rhythms include innate biological processes that are associated with a natural cyclicality in mood, such as the menstrual cycle. Traits and temperament refer to the general tendency people have for experiencing positive or negative mood states of specific levels of intensity, and characteristic variability describes the stable individual differences in the magnitude of mood fluctuations.

Moods can be altered by intense emotion repeated at a high frequency over time, such as a surprise phone call from an old college friend followed by significant improvements in a negative mood as a result of a long conversation about college football games, parties attended, and the antics of fraternity brothers. Moods are also altered by physiological changes, such as drug effects, lack of sleep, and exercise (Ekman 1994). For example, physical activity was found to influence **diurnal** variation in feeling states in a field study of women: positive engagement, revitalization, and tranquility were higher after exercise than was predicted based on diurnal patterns (Gauvin, Rejeski, and Reboussin 2000). The effects of exercise on mood can be influenced by personal, situational, and task variables, such as exercise mode or intensity.

Affect, emotion, and mood are sensitive to a variety of personal factors, such as health (e.g., negative effects from illness or allergies), hormones, and perceptions. Expectations are personal variables that can influence the effects of exercise training on changes in self-esteem

(see chapter 12), but positive changes in mood after acute exercise do not appear to depend on expectations of benefits (Berger et al. 1998; Tieman et al. 2001). There is some evidence that self-efficacy for exercise moderates the effect of exercise on mood, such that higher self-efficacy is associated with positive mood during and after exercise (Bozoian, Rejeski, and McAuley 1994).

Experience with exercise is another personal variable that has been hypothesized as a moderating factor in the effects of exercise on affect, as well as in the importance of mood regulation as a motivator for exercise. A novice exerciser who experiences muscle soreness after the first day of weight training would have a stronger and more negative affective response than an experienced bodybuilder would. The bodybuilder is accustomed to some soreness with exercise, and might even have a positive emotional response if he or she interprets the soreness as a prelude to strength gains from overload based on past training experiences. We should also consider experience with exercise in understanding the effects of exercise on mood. Experienced exercisers rated mood-related reasons for exercising as more important than did inexperienced exercisers in a cross-sectional study of 168 members of fitness centers (Hsiao and Thayer 1998). Advanced members scored higher than beginners on exercising to improve mood and higher than intermediate members and beginners on exercising for socialization.

Situational factors that influence affect include the physical environment (e.g., weather) and the social environment. Laboratory conditions may contribute situational effects that can confound the influence of exercise on mood through the participant's interpretation of the setting. Social environments can interact with a variety of personal and task variables to influence affective responses and mood. For example, a participant in a beginners' aerobics class had felt upbeat and positive with the progress she had been making and the contact with her classmates. She became discouraged and experienced a negative mood after a change in her work schedule caused her to switch to the advanced class, which had a harder routine and more skilled and fit participants.

Characteristics of exercise experience that can influence affective response include intensity,

Example of the Interaction of Factors Influencing Mood

It rained every day for 3 weeks when Jill first moved to the city. Although she enjoyed an occasional rainy day, she was unable to run outside. Jill used exercise to manage menstrual pain during her cycle. Without her workout routine, this typically enthusiastic and cheerful young woman was in a depressed mood for almost a month.

Interpretation of Arousal From Exercise Influences Affective Response

Chad and his grandfather Frank, who was recovering from a mild heart attack, both experienced shortness of breath walking up a steep hill together. Frank's emotional reaction was fear, and he was in a depressed mood for

the rest of the day. To Chad, the breathlessness was a normal physical response, and it generated minimal emotional response or effect on his mood.

duration, and mode. Recall that affect has valence and arousal dimensions. Exercise itself increases arousal with increasing levels of intensity, and the resulting affect (valence, or hedonic, dimension) hinges on the participant's interpretation of that arousal. The duration of the exercise bout may also influence mood, but this has not been systematically investigated (Yeung 1996). Duration effects should be evaluated for different modes, intensities, and populations. Exercise mode is another task variable that can affect mood. Chapters 6 and 7 present some of the evidence for differences in anxiety and depression as a function of the type of exercise (i.e., aerobic versus strength training).

RESEARCH ON EXERCISE AND AFFECT

Research on affect and exercise has typically involved the measurement of affect with self-report instruments, although human emotion has been estimated using psychophysiological and observational techniques. This section presents a review of self-report instruments that have been used to measure the effects of exercise on affective states and provides examples of studies on the effects of acute exercise and exercise training on affect and mood.

Self-Report Instruments

The most popular instruments used in exercise and affect research have been adjective checklists, particularly the Profile of Mood States (POMS; McNair, Lorr, and Droppleman

1981). Other instruments developed to measure affect include the Positive Affect and Negative Affect Scales (PANAS; Watson, Clark, and Tellegen 1988) and the Affect Grid (Russell, Weiss, and Mendelsohn 1989). Still other scales have been designed specifically to measure affective responses to exercise. These include the Feeling Scale (Hardy and Rejeski 1989), the Exercise-Induced Feeling Inventory (Gauvin and Rejeski 1993), and the Subjective Exercise Experiences Scale (McAuley and Courneya 1994). The development of these three scales was based on concerns that existing, validated mood scales either were not sensitive or were not specific enough to detect true changes in mood during or after physical activity (Gauvin and Spence 1998), or that affective response to physical activity is somehow different from that experienced in other settings. Although the first concern is plausible, it would relate as much to the range of the response scale as to the structure of the scale content. The second concern is harder to understand.

Why would there be a special set of moods or emotions unique to the experience of exercise? Were that found to be true, the results would represent a provocative exception to 100 years of research that supports the invariance of the expression of moods and emotions across situations and even cultures. The logical extension of the exercise-specific argument would be that specific scales are needed for each human behavior. Joy or happiness after a tasty meal would be a different joy than that after sex, or after a big pay raise, and so on. Although the strength of the valence and emotional arousal of joy might vary after each of those experiences, the structure of

joy as a distinct affective experience would be the same. This issue is discussed in further detail in chapter 6, Anxiety.

One approach has been to select items from existing general mood or affect scales that seem more sensitive than others to change in response to exercise and to reconfigure those items into a new, specific scale for exercise. Up to now, evidence of the usefulness of this approach (evidence that it yields valid scales measuring affective responses unique to exercise) has not been compelling when judged by the classical standards of construct validation discussed in chapter 2. Nonetheless, exercise-specific scales are discussed in this chapter because it seems likely that this topic will continue to command the attention of exercise psychology researchers for some time (e.g., Ekkekakis and Petruzzello 2000).

The unipolar POMS has 65 items that are rated on a 5-point scale ranging from 0, *not at all*, to 4, *extremely*. It includes six discrete affective states: tension-anxiety, depression-dejection, anger-hostility, vigor, fatigue, and confusion-bewilderment. The respondent is asked to focus on current feelings (i.e., *right now*), but the POMS can also be used to rate daily, weekly, or habitual feelings (i.e., *during the past week, including today*). A shortened 30-item version is also available from Multi-Health Systems, Inc. at www.mhs.com.

The POMS has been used frequently to determine the anti-anxiety and antidepressant effects of acute exercise and in overtraining and staleness studies of endurance athletes. In 1998, LeUnes and Burger published a bibliography of POMS research that included 194 studies using the POMS in exercise or sport since its introduction in 1975. Nonetheless, some investigators have questioned its suitability for use with people without clinical disorders (Gauvin and Spence 1998). The POMS was developed for psychiatric populations for the purpose of detecting the ongoing effects of therapy in outpatients. It is sensitive to these changes, as well as to changes induced by laboratory manipulations. Also, normative data are available according to sex, age, and psychiatric status, including normal youth and young adults. At issue is whether its emphasis on negative affect allows it to be sensi-

tive to changes in positive mood among people who experience few negative moods.

The bipolar POMS was developed to emphasize positive affect and to be more applicable to people without clinical disorders as well as patients experiencing psychiatric disorders. The bipolar POMS has 72 items that are rated on a 4-point scale from 0, *much unlike this*, to 3, *much like this*. It includes six bipolar scales: composed-anxious, agreeable-hostile, elated-depressed, confident-unsure, energetic-tired, and clearheaded-confused.

The PANAS measures positive and negative affect as two relatively independent dimensions using two 10-item mood scales (Watson, Clark, and Tellegen 1988). The scales have high internal consistency and good stability over a 2-month period. The two-factor structure of the PANAS was confirmed in a sample of 645 participants in a sport camp, 10 to 17 years old, immediately after an exercise session; but there were questionable psychometrics with three items from the negative affect scale (irritable, distress, and upset) (Crocker 1997).

The Affect Grid is a one-item instrument that is based on valence, or hedonic tone, and arousal dimensions of affect, defined as pleasure-displeasure and arousal-sleepiness (Russell, Weiss, and Mendelsohn 1989). A circumplex model is applied by placing feeling-related concepts in a circular order in a space formed by the two bipolar dimensions (see figure 5.1). The Affect Grid has been used effectively to describe current mood, the meaning of emotion-related words, and feelings conveyed by facial expressions. It has also been found to be valid across cultures (Russell, Lewicka, and Niit 1989).

The Feeling Scale is another one-item instrument that measures the valence, or hedonic tone, of affect (Hardy and Rejeski 1989). Participants rate their current overall feelings on an 11-point bipolar scale with verbal anchors of *very good* to *very bad*.

The Exercise-Induced Feelings Inventory has 12 adjectives that are rated on a 5-point Likert-type scale ranging from *do not feel* to *feel very strongly* (Gauvin and Rejeski 1993). It was designed to measure four feeling states (enthusiasm, energy, fatigue, and calmness) assumed to be elicited by positive engagement, revitalization,

physical exhaustion, and tranquility, which are stimulus properties of acute bouts of exercise.

The Subjective Exercise Experiences Scale was designed to measure global psychological responses that are sensitive to the stimulus properties of exercise (McAuley and Courneya 1994). Two of the three scale factors (positive well-being and psychological distress) correspond to positive and negative poles associated with psychological health. The third factor, fatigue, represents subjective feelings of fatigue. The scale includes 12 items that are rated on a Likert-type scale ranging from *not at all* to *very much* so in terms of the respondent's current feelings.

The validity of the last three scales developed specifically for exercise has been critiqued elsewhere (e.g., Ekkekakis and Petruzzello 2001a, 2001b).

Measurement Considerations

Most questionnaires that have been used to assess emotions are arguably measuring mood because of the time it takes to complete them (Smith and Crabbe 2000). For example, a 65-item questionnaire such as the POMS has several scales to measure specific emotions and has the items for each scale scattered throughout the test. The feeling state or emotion of the respondent when he or she answers the first scale item could change before the other items are answered, which hampers the validity of the scale. Single-item measures (e.g., bipolar line scales) might be better for addressing this limitation of assessing emotional state; these types of instruments are probably less likely to change the variable being measured through the measurement act itself than are longer ones. However, a single-item scale such as the Feeling Scale (Hardy and Rejeski 1989) cannot determine what emotion is being rated, or whether different people are experiencing the

same emotion, without anchoring the rating to a specific emotional stimulus (Lang 1995).

Acute Exercise

There is a general consensus in the literature that exercise improves affect. A meta-analysis of 158 studies published from 1979 to 2005 on the effects of acute exercise on positive affect concluded that exercise increases positive mood (Reed and Ones 2006), and there is evidence that acute exercise at intensities below the ventilatory or lactate thresholds can increase self-reported positive affect (Ekkekakis, Parfitt, and Petruzzello 2011). Mood benefits of acute exercise have been found for clinical populations (e.g., type 2 diabetes: Kopp et al. 2012; spinal cord injury: Martin Ginis and Latimer 2007). In addition, daily positive mood but not negative mood has been associated with objectively measured physical activity (Poole et al. 2011). But as already discussed, it is prudent to be cautious about overgeneralizing the benefits in mood and emotional states without considering some of the moderating variables, such as exercise history, task characteristics, and the environment.

Generally, regular exercisers compared with nonexercisers have greater mood enhancement after a single bout of exercise (e.g., Hoffman and Hoffman 2008). Reed and Ones (2006) showed consistently positive effects of acute exercise at low intensities, durations up to 35 min, for low to moderate exercise doses. In a study comparing objectively measured physical activity with daily mood, light and moderate physical activities were also associated with positive daily affect, but vigorous activity was not (Poole et al. 2011).

Rudolph and Kim (1996) measured mood responses to aerobic dance, soccer, tennis, and bowling in a sample of 108 physical education students at a Korean university. The Subjective Exercise Experiences Scale was administered before and after the activity. Positive mood was enhanced in students participating in aerobic dance and soccer. There were no changes in negative mood or in the moods of tennis players or bowlers. However, participants self-selected into the various exercise modes, and a randomized trial would provide more clarification of the role of exercise task in affective response.

Measures of affect and exercise usually assess mood, not transient emotional responses.

Acute psychological responses to exercise can be affected by factors in the physical and social environment, such as temperature and humidity, odors, and the presence of others. For example, sedentary women exercised on a stationary cycle at moderate intensity based on RPE for 20 min with and without others in a mirrored or nonmirrored setting (Martin Ginis, Burke, and Gauvin 2007). Feeling states were measured by the Exercise-Induced Feeling Inventory before, during, and after exercise. Revitalization increased significantly less and fatigue increased more for women in the mirrored room with others compared to women in the other three conditions when controlling for body mass index (BMI). The responses to exercising with others in front of mirrors indicates the importance of considering environmental factors in analyzing the effects of exercise on mood.

Increases in positive mood have been found in youth sport participants after a game, but the improved mood seemed to be largely determined by the perception of achievement and the matching of skills against a realistic challenge (Wankel and Sefton 1989). One study of college-age participants showed that mood changes after running exercise were not influenced by competition (O'Connor, Carda, and Graf 1991).

A review of studies that used the POMS concluded that the evidence supports associations between acute physical activity and improved mood among nonclinical populations and between chronic exercise and improved mood among clinical populations (Berger and Motl 2000). The POMS has also been employed to identify social or cognitive explanations for mood alteration after exercise. However, currently there is no conclusive evidence identifying a single explanation or clustering of explanations that consistently mediates or moderates the association between exercise and mood change, although researchers are exploring a variety of possible explanations. For example, regular exercisers reported mood before and after 10 min of self-paced jogging, and were also asked after exercise to recall their preexercise mood (Anderson and Brice 2011). Mood as measured by the total mood disturbance (TMD) of the Incredibly Short Profile of Mood States (ISP) increased significantly and compared to

the no-exercise control group. In addition, the recalled preexercise mood was favorably distorted to indicate mood enhancement. That is, their recalled preexercise mood was worse than actually reported before exercise, which gave a perceived augmented mood benefit of the acute exercise bout. Additional research is needed to determine the reasons for this memory distortion, such as current mood states and expectations of mood benefits from exercise.

We usually think about how exercise can improve positive mood and affect in the short term, but there is also evidence that exercise can reduce negative moods, such as anxiety and even obsessive-compulsive disorder symptoms (Abrantes et al. 2009), and can have effects beyond the exercise session. For example, 30 minutes of moderate-intensity cycling exercise reduced angry mood in college men who scored high in trait-anger and mitigated the increase in anger that was induced by viewing emotional pictures, but it did not alter the intensity of angry emotional responses during picture viewing (Thom et al. 2012). Thus, even though exercise didn't affect the acute experience of an angry emotion, it provided a prophylaxis against angry feelings elicited up to 45 minutes later. Another study used guided imagery to induce an upset or angry mood and reported a reduction in state anger after a session of resistance exercise, but that change was not greater than seen after quiet rest (Bartholomew 1999).

Training Studies

Bryne and Bryne (1993) reviewed 30 studies published since 1975 on the effects of exercise training on mood adjustment, such as depression, anxiety, and other states of disturbed mood. Ten of the studies evaluated mood changes in nonclinical populations and showed significant improvements in mood that were not related to changes in fitness. Overall, 90% of the studies reviewed supported the contention that exercise improves mood. Reed and Buck (2009) reviewed 105 studies of regular aerobic exercise and positive affect published from 1980 to 2008 and reported a moderate beneficial effect on self-reported affect with the optimal program at a low intensity for 30 to 35 minutes, 3 to

5 days per week for 10 to 12 weeks. Several randomized clinical trials have shown positive effects on mood and quality of life in clinical populations, such as women being treated for breast cancer (e.g., Yang et al. 2011; Mutrie et al. 2007), people with multiple sclerosis (Dalgas et al. 2010), and people with traumatic brain injury (Driver and Ede 2009). There is also some evidence that mood improvements are related to exercise adherence. For example, the Profile of Mood States-Short Form and other psychological measures were administered to 173 obese women at the beginning and end of a 6-month moderate-intensity exercise intervention (Annesi et al. 2011). Mood significantly improved, and changes in mood and body satisfaction but not self-efficacy contributed uniquely to the variance in exercise session attendance, which was significantly related to changes in BMI.

Additional training studies have been generally supportive of positive effects of exercise on mood for various populations, although training intensity has had mixed effects. Mood was improved in initially sedentary older women after a 12-week strength training program (Tsutsumi et al. 1998). Both high-intensity and moderate-intensity strength training groups significantly improved positive mood and demonstrated some decrease in tension and state anxiety, although support for moderate intensity was greater. The greatest improvements in affect were found in young active aerobic exercisers who were randomized to a moderate-intensity resistance training program; those training at high intensity had the greatest decrements in affect, and those training at low intensity experienced no beneficial changes in affect (Etnier et al. 2005).

Mood was monitored before and after each exercise class over a 7-week exercise program in four self-selected exercise groups (Steinberg et al. 1998). Positive mood increased and negative

mood decreased during each class, but favorable mood from exercise diminished by the following week. There seemed to be a persistent, acute effect that has also been demonstrated with some of the positive physiological effects of exercise.

PSYCHOPHYSIOLOGICAL AND BEHAVIORAL ASSESSMENT

The evidence from animal research on neurological contributions to appetitive and avoidance behaviors suggests that it is possible to detect emotion in humans with psychophysiological techniques (see figure 5.14). Autonomic activation can be measured with **galvanic skin response** (skin conductance or its inverse, resistance), changes in skin temperature, and cardiovascular responsiveness (see chapter 4). Determining the galvanic skin response involves measuring the autonomic-induced changes in the electrical resistance of the tissue path between two electrodes applied to the skin. Emotional arousal has been associated with these changes; skin conductance has been shown to increase with negative emotions and decrease with positive emotions (e.g., Hughes, Uhlmann, and Pennebaker 1994). Changes in skin temperature indicate reflex vasoconstriction and vasodilation from the sympathetic activation of the vasculature associated with the stress response. Changes in heart rate and blood pressure in the absence of motor activation are also associated with the stress response and concomitant affect. Limitations of these methods include the lack of specificity to particular emotions. For example, heart rate and blood pressure increase both during the stress of reading a letter from the Internal Revenue Service announcing an audit of your tax returns and while reading a letter from a television producer inviting you to be a contestant on a game show. The physiological responses per se do not indicate the different emotional responses to these situations. There are also concerns regarding the consistent application of recommended psychophysiological measurement protocols to assess autonomic activation (Smith and Crabbe 2000).

Positive changes in mood after exercise training have been found in many but not all sample populations.