

# Affect, Mood, and Emotion

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The study of emotions, moods, and affect (collectively referred to here as *affective phenomena*) presents a considerable challenge for researchers. This is an area characterized by a bewildering multiplicity of constructs, several alternative theories for each construct, and multiple measures based on each theory. The history of research and theorizing on affective phenomena is long, and the associated literature is vast. On certain key topics, such as the interface between cognition and emotion, the first substantive debates date to antiquity. Furthermore, the issues are often complex and, in many cases, have been the subject of intense controversy. Consequently, there is an overwhelming amount of information that a researcher needs to master before being ready to make a meaningful contribution. This means that while on the one hand, the dedicated and patient scholar will discover a fascinating wealth of ideas within this field, on the other hand, the impatient researcher with an ephemeral interest is likely to feel bemused, fall easy victim to uninformed advice, and, perhaps more importantly, reproduce more misinformation into an already confusing literature. Simply put, this is not an area that a researcher can enter after reading just one or even a few papers on the subject. Therefore, given the space constraints of this chapter, those who are now embarking on a study in this field should view this chapter as a very brief introduction and not a sole resource. Researchers are strongly encouraged to consult the cited references and to conduct their own in-depth study of the original material before selecting a construct or a measure.

## Choosing a Measure: A Three-Step Process

The process of choosing a measure ideally includes three steps (Ekkekakis, 2008). The first step involves

deciding which construct to target among the three main constructs that constitute the affective domain, namely *emotion*, *mood*, and *core affect*. The differences in these constructs are summarized in the following section.

The second step involves choosing among different theoretical models that have been proposed for conceptualizing the chosen construct. Measures do not evolve in a theoretical vacuum; when researchers choose a measure, they presumably also accept the theoretical infrastructure upon which the measure was built. Thus, the researchers must have a good knowledge of the underlying theory and must be able to explain the reasons for choosing one theory over another.

The third step consists of considering the psychometric information—namely, whether a measure meets or surpasses conventional criteria for evaluating reliability and validity. Was the Cronbach alpha value greater than .70? Was the goodness-of-fit index greater than .90 or .95? Are the coefficients for convergent and discriminant validity satisfactory? This is certainly important information that requires considerable experience and expertise in psychometrics to evaluate properly. However, this step should be considered only as the *last* step in this multistep process and not as the sole step. Its meaningfulness is questionable if the previous two steps are missing.

## Understanding the Differences Between Affect, Emotion, and Mood

In the early 1990s, Batson, Shaw, and Oleson (1992) noted that, in general psychology, “most often, the terms *affect*, *mood*, and *emotion* are used interchangeably, without any attempt at conceptual differentiation” (p. 295). Today, progress is being

made in drawing some lines of demarcation (Alpert & Rosen, 1990; Batson et al., 1992; Beedie, Terry, & Lane, 2005; Russell, 2003; Russell & Feldman Barrett, 1999). Thanks to considerable convergence among the stated views, a workable classification scheme has started to emerge.

**Core Affect.** This term is defined as a “neurophysiological state consciously accessible as a simple primitive non-reflective feeling most evident in mood and emotion but always available to consciousness” (Russell & Feldman Barrett, 2009, p. 104). Examples of core affect include pleasure and displeasure, tension and relaxation, energy and tiredness. A person experiences core affect constantly, although the nature and intensity of affect vary over time. Core affect can be a component of emotions and moods (defined next), but it can also occur in pure, or isolate, form. For example, according to Russell (2003), “*pride* can be thought of as feeling good about oneself. The ‘feeling good’ is core affect and the ‘about oneself’ is an additional (cognitive) component” (p. 148). As explained next, this qualifies *pride* as an *emotion*.

**Emotion.** Russell and Feldman Barrett (1999) defined a “prototypical emotional episode” (what is commonly called an occurrence of an *emotion*) as a “complex set of interrelated sub-events concerned with a specific object” (p. 806), such as a person, an event, or a thing, whether past, present, future, real, or imagined. The co-occurring components that compose a prototypical emotional episode include (a) core affect, (b) overt behavior congruent with the emotion (e.g., a smile or a facial expression of fear), (c) attention directed toward the eliciting stimulus, (d) cognitive appraisal of the meaning and possible implications of the stimulus, (e) attribution of the genesis of the episode to the stimulus, (f) the experience of the particular emotion, and (g) neural (peripheral and central) and endocrine changes consistent with the particular emotion.

Because emotional episodes are elicited by something, are reactions to something, and are generally *about* something, the cognitive appraisal involved in the transaction between person and object is considered a defining element. Some examples of emotions—which comprise all the elements listed here, including cognitive appraisal—are anger, fear, jealousy, pride, and love.

**Mood.** One distinguishing feature of moods is that they typically last longer than emotions. Other authors have emphasized that a more meaningful differentiating feature of moods might be that they are diffuse and global as opposed to specific. According to Frijda (2009), *mood* is “the appropriate designation for affective states that are about

nothing specific or about everything—about the world in general” (p. 258). For example, when a person is in an anxious mood, the object might be something as general as the whole future or as distant as life in 20 years; when a person is in a depressive mood, the object might be the totality of self; and when a person is in an irritable mood, the object could be anything and anyone. In such cases, moods essentially have a cause. However, unlike emotions, which follow their eliciting stimuli closely or even instantaneously, a mood is usually temporally remote (Morris, 1992) from its cause (e.g., a person can wake up in a bad mood in the morning as a result of a confrontation the previous evening). Consequently, the cause of a mood may not always be easy to identify.

An important consideration when choosing a measure is whether the goal is to assess a specific, narrowly defined state (or a set of distinct states) or broad dimensions that are theorized to underlie a global domain of content (such as *mood* or *core affect*). Despite the fundamental importance of this consideration, it is not one that is addressed explicitly in most published reports. However, this issue has direct relevance to the ability of a researcher to make generalizations. If what was assessed is a narrowly defined state (or even an assortment of distinct states), then the researcher is not justified in drawing inferences about the global domain in which the specific state belongs. This is because the domain presumably includes more content than is reflected in a measure of a narrowly defined state.

Let’s consider an example. The Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971) remains one of the most frequently used measures of mood in exercise psychology. This questionnaire taps six distinct mood states: tension, depression, anger, vigor, fatigue, and confusion. There is no claim, either explicit or implicit, in the theoretical basis of the POMS that these six distinct states collectively capture the entire content domain of mood. Another frequently used measure is the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). In contrast to the POMS, the PANAS was developed not to assess distinct mood states but rather to assess “the two primary dimensions of mood” (p. 1069)—namely, positive affect and negative affect. Both dimensions are theorized to be bipolar and orthogonal to each other. They are primary dimensions because together they are believed to account for the majority of the variance (differences and similarities) among distinct mood states. Positive affect is a dimension that “reflects the extent to which a person feels enthusiastic, active, and alert.” Its high pole has been described

as "a state of high energy, full concentration, and pleasurable engagement," whereas its low pole has been described as a state "characterized by sadness and lethargy." In contrast, negative affect has been described as a "general dimension of subjective distress and unpleasurable engagement." Its high pole "subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness," whereas its low pole is characterized by "calmness and serenity" (Watson et al., 1988, p. 1063).

If a researcher intends to draw inferences about the effects of an exercise intervention on the global domain of mood, then the POMS, a measure of just six distinct mood states, is not the most appropriate option. It is easy to think of other mood states not captured by the POMS, some of which might be influenced by an exercise intervention (e.g., cheerfulness). Thus, if a researcher did use the POMS and the exercise intervention resulted in no significant changes, it would be erroneous for the researcher to conclude that exercise had no effect on the broad domain of *mood*. This is because it is possible that exercise might have influenced components of mood other than the six being tapped by this measure.

On the other hand, there are situations in which a researcher may wish to examine the effect of manipulating an exerciser's specific cognitive appraisal. Cognitive theories predict that such a manipulation induces a change in specific states. For example, a decrease in efficacy is expected to lead to anxiety (Bandura, 1988), while an attribution of success to internal causes should evoke a sense of pride (Weiner, 1985). In such cases, a measure of broad dimensions of mood, such as the PANAS, is not the most appropriate option. If the manipulation targets a specific pattern of appraisal theorized to elicit a specific response, then the most appropriate option is a measure that specifically targets the response predicted by theory (e.g., anxiety or pride).

As these examples illustrate, the distinction between the distinct-states approach and the dimensional approach is clearly of fundamental importance. Therefore, this consideration should be addressed explicitly in justifying the selection of a measure. According to the distinct-states approach, each state is a distinct entity. For example, the emotion of anxiety is associated with a unique pattern of antecedent appraisal (facing a perceived threat); a unique experiential quality; characteristic attention-related biases; a possibly distinct signature of visceral and somatic symptoms; tense facial, postural, and vocal expressions; and a repertoire of coping responses. For researchers specifically interested

in anxiety, focusing on this one emotion and its unique characteristics is the only way to understand it deeply and fully.

Although the distinct-states approach highlights the unique features of different states, it has been proposed that such states are not entirely independent of one another but are interrelated systematically. These systematic relationships can be modeled by a small number of underlying dimensions. Hence, this conceptual approach has been labeled *dimensional*.

Although numerous dimensional models were proposed during the 20th century, the most widely accepted contemporary dimensional models are two dimensional. First is the circumplex model proposed by Russell (1980). This model is based on the idea that two orthogonal and bipolar dimensions—*affective valence* and *perceived activation*—define the affective space. The various affective states are combinations of these two basic constituents in different degrees. As a result, affective states are arranged along the perimeter of the circle defined by the two dimensions. States that are close together (e.g., happy and glad) represent similar mixtures of valence and activation. States that are positioned diametrically from each other (e.g., happy and sad) differ maximally in terms of one or the other dimension (e.g., valence). States that are separated by a 90° angle are statistically independent of each other.

Second is the two-dimensional solution that Zevon and Tellegen (1982) and Watson and Tellegen (1985) arrived at via factor analyses of inter- and intraindividual data from self-reports. In agreement with Russell's analyses, these authors identified one dimension reflecting affective valence (ranging from items such as happy and pleased to unhappy and sad) and a second dimension reflecting perceived activation, although they decided to label this dimension as *strong engagement to disengagement* (ranging from items such as aroused and astonished to quiescent and still). However, because most of the items that were subjected to factor analysis did not reflect pure valence and activation but instead reflected mixtures of these two dimensions, following a varimax rotation, the axes passed through the areas with the highest concentration of items. Thus, one axis extended from high-activation pleasant affect (e.g., elated, enthusiastic, excited) to low-activation unpleasant affect (e.g., drowsy, dull, sluggish). This dimension was initially labeled *positive affect* and later renamed *positive activation* (PA). The other axis extended from high-activation unpleasant affect (e.g., distressed, jittery, nervous) to low-activation pleasant affect (e.g., calm, placid, relaxed). This dimension was initially labeled

*negative affect* and later renamed *negative activation* (NA). It should be clear from this description that Russell's (1980) circumplex model and the PA/NA dimensional model are 45° rotational variants of one another rather than fundamentally different conceptualizations.

One highly controversial aspect of the PA/NA model that has been the cause of much confusion in the literature was the decision to name the dimensions using descriptors that connote unipolarity (i.e., *positive affect*, *negative affect*) when the dimensions were identified in the original analyses as bipolar. Zevon and Tellegen (1982) tried to explain this decision by stating that the dimensions "are best characterized as *descriptively bipolar* but *affectively unipolar*" (p. 112). This enigmatic statement was based on the argument that only high-arousal states can be conceived of as genuinely affective, whereas low-arousal states (e.g., calmness or fatigue) are nonaffective. Thus, the dimensions were defined (and named) solely by their high-arousal poles. This debatable position generated considerable confusion. For example, *calm* is not a marker of what most people call *positive affect* but is a marker of low negative affect. Furthermore, *happy* is not a marker of positive affect, and *sad* is not a marker of negative affect. Instead, these states are markers of the two opposite poles of a different bipolar dimension named *pleasantness-unpleasantness*. This led to additional confusion, since the dimensions of PA and NA were theorized to be orthogonal to each other (i.e., statistically unrelated), whereas pleasantness and unpleasantness were theorized to be bipolar opposites. Many researchers who did not notice the difference used the PA/NA model as a basis for arguing that people can feel both happy and sad at the same time (see the review by Larsen and Diener, 1992). The PA/NA model clearly does not make such a prediction.

A third variant of a two-dimensional structure was proposed by Thayer (1989). His model again postulates two bipolar dimensions. One, named *energetic arousal* (EA), extends from energy to tiredness. The other, named *tense arousal* (TA), extends from tension to calmness. It is easy to detect the compatibility of this model with the PA/NA model. Indeed, Thayer (1989) and Watson and Tellegen (1985) have made it clear that EA overlaps with PA and TA overlaps with NA. Empirical evidence for the compatibility of these models within a two-dimensional framework was provided by Yik, Russell, and Feldman Barrett (1999). After correcting for as many sources of random and systematic error (which tend to distort the relationships between constructs) as possible, these researchers found

that, for unipolar constructs (e.g., Thayer's energy scale or Watson and Tellegen's PA), valence and activation explained between 53% and 90% of the variance, with a mean of 72%. For bipolar dimensions (e.g., Thayer's EA), valence and activation explained between 73% and 97% of the variance, with a mean of 85%.

## Hierarchical Structure of the Affective Domain: An Integrative Framework

After decades of referring to dimensional models as models of *emotions*, it is now becoming widely recognized that the true heuristic value of dimensional models is limited to the study of *core affect*. According to Russell and Feldman Barrett (1999), "we now believe that this dimensional structure (i.e., the circumplex) represents, and is limited to, the core affect involved" (p. 807). Along the same lines, Russell (2003) acknowledged more recently that "by themselves, pleasure and arousal do not fully account for most emotional episodes," and the circumplex "does not provide a sufficiently rich account of prototypical emotional episodes" because it "fails to explain adequately how fear, jealousy, anger, and shame are different." He concluded that "the dimensional perspective must be integrated with the categorical perspective" (p. 150). The critical insight that led to this development was the distinction between *core affect* and *emotions* (what Russell called *prototypical emotional episodes*). This underscores the importance of what was considered here as the crucial first step—namely, recognizing the differences among the various affective phenomena.

Recognizing both the strengths and the limitations of dimensional models early on, Watson and Tellegen (1985) proposed that the affective domain could be described as having a hierarchical structure. Broad dimensions can capture the differences and similarities between states on a macroscopic scale. Beyond this, however, the distinct-states approach is also required for a microscopic analysis of the uniqueness of the different states. Explaining this position, Watson and Clark (1997) wrote the following:

We want to emphasize that these two basic approaches—dimensions and discrete affects—are not incompatible or mutually exclusive; rather, they essentially reflect different levels of a single, integrated hierarchical structure.... That is, each of the higher order dimensions can be decomposed into several correlated yet ultimately distinct affective states, much like a general factor of

personality (e.g., neuroticism) can be subdivided into several narrower components or "facets" (e.g., anxiety, vulnerability). In this hierarchical model, the lower level reflects the unique descriptive/explanatory power of the individual discrete affects (i.e., specificity), whereas the general dimensions reflect their shared, overlapping qualities (i.e., nonspecificity). (p. 269)

What are the practical implications of these integrative, hierarchical models for the exercise psychology researcher? Perhaps the most important point is that both the distinct states and the dimensional approach have their place, so this issue is not an either-or question. Which approach is most suitable for a given study depends on the specific aim of the study. If a study involves an experimental manipulation that is likely to induce a pattern of cognitive appraisal underlying a specific emotion, then the focus of the investigation should be on that particular emotion (and use a distinct-states perspective). For example, if a study places sedentary women or women highly anxious about their physical appearance in front of mirrors while they exercise (i.e., the study involves a manipulation of a very specific self-evaluative appraisal), then the appropriate target is the distinct emotion of anxiety (i.e., the specific emotional state that is theorized to emerge from that particular appraisal) rather than general affect. If, on the other hand, the purpose of a study is to examine the effects of a more general manipulation (e.g., different levels of intensity or duration) or a manipulation for which the effects cannot be predicted on the basis of current theory (e.g., hydration or glucose supplementation), then it makes more sense to broaden the investigative scope by assessing the global domain of core affect. This can be done effectively and efficiently by using a two-dimensional model (Ekkekakis & Petruzzello, 2002).

## Review of Specific Measures

In the last 20 years, more than 20 different measures of affective constructs have been used in studies of acute exercise (i.e., to examine the effects of single bouts of exercise). An even larger number of measures has been utilized in studies of chronic exercise (i.e., to examine the effects of exercise training programs lasting for several weeks or months). Those in the latter category include measures designed for clinical and healthy populations; questionnaires and clinician-administered interview protocols; measures of distinct states and broad dimensions; and measures of affect, mood, emotions, and broader constructs such as perceived quality of life or satisfaction with life. Furthermore, not all studies have

employed self-reports to operationalize affective constructs. A small but growing number of studies have employed psychophysiological measures (e.g., prefrontal hemispheric asymmetry assessed by EEG or acoustic startle responses assessed by EMG) to draw inferences about affective responses. Given the space constraints of this chapter, only a very selective review can be presented here. Before researchers decide to adopt any of the measures cited here, they are strongly encouraged to conduct a thorough and in-depth review of the theoretical basis, the developmental history, and the relevant conceptual and psychometric critiques that have appeared in the literature. There are measures developed in recent years that have been used or discussed in no more than a handful of published articles. However, there are also measures developed decades ago that have been used in thousands of studies and have been the subject of several critical reviews. Thus, researchers who intend to use such measures should be prepared to invest considerable time and effort in familiarizing themselves with the issues and contemplating the pros and cons of different theoretical perspectives and measures before making a decision.

### ***Single-Item Dimensional Measures of Affect***

Single-item measures take only a few seconds to administer, shortening the interruptions of any ongoing tasks and minimizing respondent fatigue. Thus, researchers find single-item measures to be convenient in studies in which the need to track a rapidly changing affective state makes repeated measurements necessary. On the other hand, because scores on single-item measures depend entirely on only one response, and this response could be erroneous (e.g., due to carelessness or confusion), single-item measures generally tend to be less reliable than multi-item measures of the same constructs. Nevertheless, when appropriate care is taken to control the sources of random measurement error, single-item measures can be very informative, as evidenced by the wealth of information that single-item measures of perceived exertion have contributed to the exercise science literature.

### **Self-Assessment Manikin**

The Self-Assessment Manikin (SAM; Bradley & Lang, 1994; Lang, 1980) assesses three dimensions of affect using pictures of a cartoon character as opposed to a numerical scale with verbal anchors. First, the valence scale depicts a character with facial expressions ranging from pleasure (smiling face)

to displeasure (frowning face). Second, the arousal scale depicts a character with facial expressions ranging from sleepiness (eyes closed) to high arousal (shaking and heart pounding). Third, the dominance scale depicts a figure ranging from small size (indicating submissiveness) to large size (indicating dominance). The SAM has been used in only a few exercise studies (e.g., Ekkekakis, Hall, Van Landuyt, & Petruzzello, 2000; Smith, O'Connor, Crabbe, & Dishman, 2002). A bout of exercise has been found to increase arousal, but the changes in valence depend on exercise intensity. Higher intensities are typically associated with declines in pleasure.

### Affect Grid

The Affect Grid (AG; Russell, Weiss, & Mendelsohn, 1989) was developed on the basis of Russell's (1980) circumplex model of affect. Accordingly, it provides two scores, one for pleasure and one for arousal. The format of the AG is a  $9 \times 9$  grid, with the horizontal dimension representing affective valence (ranging from unpleasantness to pleasantness) and the vertical dimension representing perceived activation (ranging from sleepiness to high arousal). Respondents place a single X in 1 of the 81 cells of the grid, and this response is scored along both the valence and the arousal dimensions. The AG has been used in several studies in sport psychology but in surprisingly few studies in exercise psychology (e.g., Ekkekakis et al., 2000). Given the potential problems associated with the somewhat unfamiliar formats of the SAM (i.e., cartoons) and the AG (i.e., a grid), more researchers have opted to assess affective valence and arousal using simple rating scales.

### Feeling Scale and Felt Arousal Scale

- The Feeling Scale (FS; Hardy & Rejeski, 1989) is an 11-point bipolar scale of pleasure and displeasure that ranges from -5 to +5. Anchors are provided at 0 = "Neutral" and at all odd integers, ranging from -5 = "Very bad" to +5 = "Very good." The Felt Arousal Scale (FAS) of the Telic State Measure (Svebak & Murgatroyd, 1985) was originally developed as a measure of the construct of felt arousal in the context of reversal theory. It is a 6-point single-item scale ranging from 1 to 6, with anchors only at 1 = "Low arousal" and 6 = "High arousal." The FS and FAS have been adapted for children with the addition of a series of stylized drawings of faces ranging from very happy to very sad and from very sleepy to very alert (Hulley et al., 2008).

### Multi-Item Measures of Distinct Mood States

Multi-item measures take longer to administer than single-item measures. This makes them less conve-

nient for repeated administrations within a short time frame, as they can increase respondent fatigue and reactivity to testing (e.g., irritation or noncompliance with instructions). They may also distract from ongoing tasks. On the other hand, multi-item measures are generally less susceptible to sources of random measurement error than single-item measures. Because of these characteristics, multi-item measures are typically used to investigate the effects of chronic exercise interventions (with days, weeks, or months between administrations) or in studies of acute exercise in which researchers are interested only in pre-to-post changes rather than closely tracking the trajectory of change over time. When researchers use multi-item measures of distinct mood states, they should explain the reasons why they opted to focus on these particular states and should avoid making unwarranted generalizations to the global domain of mood.

### Multiple Affect Adjective Checklist

The Multiple Affect Adjective Checklist (MAACL; Zuckerman & Lubin, 1965) was one of the first self-report measures designed to assess transient states as opposed to stable traits and to be geared toward the general population as opposed to clinical groups. The first version of the MAACL combined scales for anxiety, depression, and hostility (Zuckerman, Lubin, Vogel, & Valerius, 1964). When factor analysis became more readily available, the 132-item pool was analyzed and a new structure emerged (Zuckerman, Lubin, & Rinck, 1983). Specifically, anxiety-present, depression-present, and hostility-present items formed three separate factors, while the positively worded items formed two factors, one named *positive affect* and the other *sensation seeking*. However, given the strong intercorrelations among factors within each category, Zuckerman and colleagues (1983) proceeded to merge anxiety, depression, and hostility into a dysphoria (DYS) factor and to merge positive affect (PA) and sensation seeking (SS) into a combined PASS factor. The hierarchical structure (five first-order factors and two second-order factors) formed the basis for the revised edition of the MAACL (MAACL-R; Lubin et al., 1986; Zuckerman & Lubin, 1985), which comprised 66 scored and 66 filler items. The MAACL was used in several earlier studies in exercise psychology (e.g., Goldfarb, Hatfield, Sforzo, & Flynn, 1987; Hardy & Rejeski, 1989). However, its popularity has declined in recent years.

### Profile of Mood States

The POMS (McNair et al., 1971) remains one of the most popular self-report measures, not only in

exercise psychology but also in psychology in general. The now-famous initials appeared for the first time in 1964, although they did not originally stand for *Profile of Mood States* but rather for *Psychiatric Outpatient Mood Scale* (McNair & Lorr, 1964). The original goal of the POMS was to "construct and develop a useful method for identifying and assessing mood states in psychiatric outpatient populations" (p. 620). The developers of the POMS initially identified six mood states that they considered of interest in this population (tension, anxiety, anger, depression, vigor, and fatigue). These were somewhat different from those assessed by the present-day version of the POMS, which emerged from subsequent factor analyses. It is important for current and prospective users of the POMS to understand that the item pool was composed of items drawn from various adjective lists, a dictionary, and a thesaurus with the purpose of matching them to the six hypothesized mood states. In other words, the item pool of the POMS was never intended to reflect the global content domain of mood. It was meant only to reflect certain states that were deemed of interest specifically for the study of psychiatric outpatients. A series of factor analyses based on data gathered from neurotic psychiatric outpatients led to a merger of the tension and anxiety items into one group and the emergence of a confusion factor. If any users of the POMS in exercise psychology were wondering about the inclusion of a confusion scale in a measure of mood, it can be explained by the fact that this particular state, although arguably not a mood *per se*, was of interest to the developers of the POMS because confusion is a common side effect of psychotropic drugs. The unabated popularity of the POMS in exercise psychology, despite the facts that it was developed for research within a very different context and that it has been rendered obsolete by conceptual developments in the study of affective phenomena, is a fascinating case study for epistemologists and historians of science. It is perhaps unsurprising that the only argument that is presented by researchers who continue to use this instrument is that it has been used in numerous previous investigations.

### **Multi-Item Dimensional Measures of Affect**

Unlike measures that represent conglomerations of several distinct states, dimensional measures were developed with the explicit goal of capturing a global domain of content. This is accomplished by measuring dimensions that are theorized to underlie and define this global domain. In selecting a dimensional measure, researchers should articulate their reasons for endorsing the theoretical framework

upon which their measure of choice was built (i.e., why they believe that the targeted domain of content should be defined by one set of underlying dimensions as opposed to another).

### **Positive and Negative Affect Schedule**

The PANAS (Watson et al., 1988) was developed as the operationalization of the orthogonal dimensions of positive affect (now called *positive activation*) and negative affect (now called *negative activation*) that emerged from the analyses of Zevon and Tellegen (1982) and Watson and Tellegen (1985). Since its publication, the PANAS has become one of the most widely used measures of affect. It consists of 20 items, 10 for the PA scale (e.g., interested, excited) and 10 for the NA scale (e.g., distressed, upset). Each item is accompanied by a 5-point scale ranging from "Very slightly or not at all" to "Extremely." There are two important limitations of the PANAS that should concern researchers. First, the items of the PANAS appear to represent a mixture of emotions, moods, and affects. For example, the items proud, guilty, and ashamed are commonly considered to be emotions; the items irritable, upset, and hostile could be considered moods; and the items distressed, nervous, and jittery probably fall under the category of core affects (Russell, 2003, 2005). It is debatable whether some of the other items (e.g., interested, strong, inspired, determined, attentive) even belong in any of these categories at all. The fact that the PANAS was described as a measure of *mood* and yet was named a measure of (positive and negative) *affect* implies that Watson did not recognize a difference between the constructs described by these two terms. Second, several authors have criticized the PANAS for an obvious inconsistency between the conceptual model that formed its basis (i.e., Watson & Tellegen, 1985; Zevon & Tellegen, 1982) and its eventual content and structure. Specifically, the PA and NA dimensions that emerged from the analyses of Zevon and Tellegen (1982) and Watson and Tellegen (1985) were clearly bipolar. Yet, as described earlier, Zevon and Tellegen (1982) argued that although the dimensions were "descriptively bipolar," they should be viewed as "affectively unipolar" because states of low activation represent "the absence of affect" (p. 112). Accordingly, the items for the PA and NA scales were selected to represent only the high-activation poles of the PA and NA dimensions. As a result, the scales of the PANAS "include no terms assessing fatigue and serenity" (Watson & Clark, 1997, p. 276). The PANAS has been used extensively in exercise psychology research (e.g., Bixby, Spalding, & Hatfield, 2001; Bodin &

Martinsen, 2004; Miller, Bartholomew, & Springer, 2005). However, given that low-activation pleasant states (e.g., serenity) and low-activation unpleasant states (e.g., fatigue) are of exceptional interest in the context of exercise investigations, the exclusion of such states from the PANAS constitutes a critical limitation.

### **Activation Deactivation Adjective Check List**

In its present form, the Activation Deactivation Adjective Checklist (AD ACL; Thayer, 1989) taps two bipolar dimensions. One is termed *Energetic Arousal* (EA) and extends from high-activation pleasant affect (labeled *Energy*, with 5 items such as energetic, vigorous, and lively) to low-activation unpleasant affect (labeled *Tiredness*, with 5 items such as sleepy, tired, and drowsy). The other is termed *Tense Arousal* (TA) and extends from high-activation unpleasant affect (labeled *Tension*, with 5 items such as jittery, clutched-up, and tense) to low-activation pleasant affect (labeled *Calmness*, with 5 items such as placid, calm, and at rest). Each of the 20 items is accompanied by a 4-point response scale, with *vv* = "Definitely feel," *v* = "Feel slightly," *? = Cannot decide,* and *no* = "Definitely do not feel." The AD ACL can be scored either in terms of the two bipolar dimensions (EA, TA) or in terms of four unipolar scales (Energy, Tiredness, Tension, Calmness). Since the PA and NA scales of the PANAS tap only the high-activation poles of the respective dimensions, Nemanick and Munz (1994) have suggested that the AD ACL is a more complete operationalization of the theoretical space defined by PA and NA. Ekkekakis, Hall, and Petruzzello (2005) examined whether the 20 items of the AD ACL conform to a circumplex before and after a walk. Using stochastic process modeling (the only confirmatory technique that is currently available to test for circumplex structure), they showed that the fit to a circumplex was satisfactory at both time points. However, some problems have also been noted. For example, in exercise studies with healthy and active college samples, there have been problems associated with floor effects. Specifically, the item *fearful* (of the Tension pole of the TA scale) exhibits very low mean and variance (Ekkekakis, Hall, & Petruzzello, 1999; Ekkekakis et al., 2005; Jerome et al., 2002). Furthermore, in some cases, the meaning of the item *intense* has been seen as ambiguous. These problems manifest themselves as reduced indexes of internal consistency of the respective scales.

A measure with a structure similar to that of the AD ACL was recently developed. The state version of the Four-Dimension Mood Scale (4DMS; Gregg

& Shepherd, 2009) measures Positive Energy, Tiredness, Negative Arousal, and Relaxation. Unlike the Tiredness scale of the AD ACL, which comprises items that refer mainly to sleepiness and wakefulness (sleepy, drowsy, wide awake, wakeful), the Tiredness scale of the 4DMS comprises items that refer more directly to tiredness and fatigue (exhausted, fatigued, tired, weary, worn out). Because of this difference, Gregg and Shepherd (2009) speculated that "the 4DMS could be more sensitive to the effects of physical exercise" (p. 153).

### **Multi-Item Measures of Specific Emotions**

Both the exercise stimulus and the exercise context are highly variable. Likewise, exercise participants are characterized by tremendous variation in their physiological and psychological constitutions (e.g., temperament or personality traits). The interaction of these factors may result in extremely diverse patterns of cognitive appraisals during acute and chronic exercise. Consequently, a similarly diverse array of appraisal-dependent emotions may occur and thus constitute relevant objects of scientific study within exercise psychology. However, an examination of the literature shows that the one emotion that has received the most attention is *anxiety*. Of the numerous measures of anxiety that are available in the literature, the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970; Spielberger, 1983) is the one used most frequently, and it is the focus of this section.

The STAI was based on Spielberger's highly influential theory of state and trait anxiety (Spielberger, 1972). According to the theory, *state anxiety* is defined as a "transitory psychobiological emotional state or condition that is characterized by subjective, consciously experienced thoughts and feelings relating to tension, apprehension, nervousness, and worry that vary in intensity and fluctuate over time" (Spielberger & Reheiser, 2004, p. 70). *Trait anxiety*, on the other hand, is defined as "relatively stable individual differences in anxiety proneness as a personality trait" or "differences in the strength of the disposition to respond to situations perceived as threatening with elevations in state anxiety" (pp. 70-71). Accordingly, the STAI includes two scales, each consisting of 20 items. One is for state anxiety (with items such as "I am worried" and "I feel frightened") and the other is for trait anxiety (with items such as "I worry too much over something that really doesn't matter" and "I lack self-confidence"). The state anxiety items are accompanied by a 4-point scale of intensity ranging from "Not at all" to "Very much so." The trait anxiety items are accompanied by a 4-point scale of frequency ranging

from "Almost never" to "Almost always." The state anxiety scale has been used in exercise psychology to investigate the anxiolytic effects of single bouts of activity (e.g., Bodin & Martinsen, 2004), whereas the trait anxiety scale has been used as a measure of the effects of exercise training studies lasting for weeks or months (e.g., DiLorenzo et al., 1999). The original version of the STAI (Form X; Spielberger et al., 1970) was published in 1970. A revised version (Form Y; Spielberger, 1983) was published in 1983 with the goal of reducing content overlap with depression and replacing certain items with ambiguous meanings.

Despite its unquestionable popularity across many areas of clinical and applied psychology, the STAI has also been the target of considerable criticism. Outside of exercise psychology, the STAI has been criticized for its factor structure (with both the state and the trait scales having been shown to be multidimensional despite the fact that scoring instructions treat them as unidimensional) and its unacceptably high content overlap with depression (which persisted even after the 1983 revision). Within exercise psychology, the criticism has been focused mainly on the state anxiety scale. As first shown by Rejeski, Hardy, and Shaw (1991) and later elaborated on by Ekkekakis and colleagues (1999), during exercise, scores on items indicative of perceived physiological activation (e.g., calm, relaxed) tend to increase (i.e., participants feel less calm and less relaxed, which are scored as increased state anxiety), whereas scores on items indicative of cognitive components of anxiety (e.g., worried) tend to decrease. This divergent pattern of responses suggests that during exercise the different items of the scale become indexes of different constructs rather than a unitary construct of state anxiety. Weakened item intercorrelations lead to declines in the internal consistency of the scale (e.g.,  $\alpha = .33$  in Rejeski et al., 1991).

Although this is a serious problem, perhaps the most critical problem associated with the STAI in exercise psychology is that the measure has been misused and misinterpreted as a proxy measure of mood and negative affect. The origins of this problem can be traced back to the early days of research on the feel-better effect of exercise, in the early 1970s. At that time, the STAI was one of only a handful of self-report measures that could be used with nonclinical samples and that contained a scale for the assessment of transient states. Thus, it was chosen out of necessity by research pioneers who were eager to operationalize and document exercise-induced feel-better effects. Since both the state and the trait scales demonstrated decreased

scores with acute and chronic exercise interventions, respectively, the STAI quickly became the measure of choice for an increasing number of investigators. In the process, the fact that the STAI was a measure of a very specifically demarcated emotion was forgotten. This led to the STAI being used in numerous exercise studies in which the participants were not anxious and anxiety was not experimentally elevated. In such cases, findings that exercise further reduced already low STAI baseline scores by one or two units were interpreted as evidence of the feel-better phenomenon or exercise-induced anxiolysis. After four decades of research with the STAI in exercise psychology, it seems prudent to return to Spielberger's definition of anxiety and to recall that the STAI is a measure of the very specifically demarcated emotion of anxiety.

### ***Multi-Item Measures of Specific Moods***

Similar to the narrow focus of exercise psychology research on the emotion of anxiety, research on specific moods has concentrated primarily on depression. This is perhaps unsurprising given the prevalence and societal effects of depression. The phenomenon of selecting measures on the basis of their extensive use in other areas of psychological research is also quite common in this case. For example, certain measures such as the Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988) and the Hamilton Rating Scale for Depression (HRSD; Hamilton, 1960) have ascended to the status of gold standard and thus represent default choices in randomized clinical trials investigating the effects of exercise (Blumenthal et al., 1999, 2007; Dunn, Trivedi, Kampert, Clark, & Chambliss, 2005). However, when judged more critically, even these venerable measures show considerable weaknesses. Critical reviewers, for example, have pointed out that the BDI suffers from controversial factorial validity, susceptibility of scores to momentary changes in environmental conditions, and relatively poor discriminant validity against anxiety (Richter, Werner, Heerlein, Kraus, & Sauer, 1998). Similarly, the HRSD has been criticized for an unclear and unreliable factor structure, poor interrater and retest reliability, and questionable content validity for some items (Bagby, Ryder, Schuller, & Marshall, 2004).

### ***Exercise-Specific Measures of Affect***

A new trend appeared in exercise psychology in the 1990s. Following the development of several sport-specific self-report measures in sport psychology, researchers proposed that exercise is characterized by unique stimulus properties and it

therefore elicits unique affective responses that are not captured by domain-general measures of affect. This proposal resulted in the development of the Exercise-Induced Feeling Inventory (EFI; Gauvin & Rejeski, 1993), the Subjective Exercise Experiences Scale (SEES; McAuley & Courneya, 1994), and the Physical Activity Affect Scale (PAAS; Lox, Jackson, Tuholski, Wasley, & Treasure, 2000), which was formed by merging scales from the EFI and the SEES. A shortened version of the EFI (Annesi, 2006) and a version intended for use with chronic exercise (Rejeski, Reboussin, Dunn, King, & Sallis, 1999) have also been developed. Given space constraints, a thorough review of these measures is not possible here, and interested readers are referred to other published sources (Ekkekakis & Petruzzello, 2000, 2001a, 2001b). The main problems with these measures were (a) the absence of a guiding theoretical framework (a consequence of the argument that the affective changes associated with exercise are unique), and (b) the derivation of the item pools on the basis of the experiences of a very select group (young, healthy, and active college students).

Problem (a) resulted in structures that are inconsistent with contemporary models of affect. Problem (b) likely resulted in domain underrepresentation, meaning that the domain of content reflected in these measures probably leaves out variants of affect that may be experienced by other segments of the population, such as people who are older, physically inactive, or facing a chronic disease or disability.

## Recommendations for Researchers and Practitioners

To reiterate a statement made in the introduction, the study of affect, mood, and emotion is not an area of singular constructs, singular theories, or singular measurement options. To the contrary, it is an area characterized by a very long history, a vast literature, an astounding diversity of theoretical views, and considerable confusion and controversy. As a result, the measurement of affective constructs is an enormously challenging undertaking, requiring an extraordinarily high level of preparation and critical thinking on the part of the researcher. Having to study, critically analyze, and distill a century of research on affective phenomena before being truly ready to choose a measure (and articulately defend this decision) can certainly seem daunting. The alternative, such as choosing a measure that is popular, is much simpler and more tempting by comparison.

When authors attempt to justify the selection of a measure, their arguments tend to focus solely on numeric psychometric indexes. If the Cronbach alpha and, more recently, fit indexes from a CFA are above a certain threshold, then the measure is characterized as psychometrically strong. In actuality, the evaluation should begin at a much earlier stage. Of the different constructs that fall under the umbrella of affective phenomena, which was the target of this particular investigation and why? Of the various theoretical models that have been proposed to describe this particular construct, which one was selected and why? Is this theoretical model satisfactory when examined against the background of theoretical advances in the respective field? Finally, does the chosen measure offer a faithful and comprehensive representation of the intended domain of content? Then, and only then, should the researcher start considering whether the fit indexes or internal consistency coefficients are high enough. Getting numbers from a computer printout is easy but, by itself, meaningless. The challenge lies in carrying out the intensive and critical work of evaluating the underlying theory and the correspondence between the measure and the theoretical postulates it is supposed to represent.

For example, the fact that the factor structure of the PANAS (Watson et al., 1988) was found to be replicable in a sample of youth sport participants (Crocker, 1997), with a goodness-of-fit index of .95, does not constitute adequate evidence of the appropriateness and applicability of the measure in youth samples. As noted earlier, the PANAS does not include items or scales that assess either pleasant (e.g., calmness, serenity) or unpleasant (e.g., tiredness, fatigue) low-activation states (Watson & Clark, 1997). A researcher contemplating the use of the PANAS in the context of exercise should first evaluate this fundamental aspect of the theoretical basis of the PANAS and decide whether it seems appropriate (using the current state of theoretical development in the field as a criterion) and whether it serves the purpose of the specific study being planned. The value of the goodness-of-fit index should be a secondary concern.

Thus, the single most important recommendation that can be made here is to follow the three-step approach for selecting a measure that was outlined in the introduction:

1. Decide whether the construct of interest is an affect, a mood, or an emotion.
2. Select the most appropriate conceptual model of the construct of interest for the purpose of the particular study.

3. Choose the most psychometrically sound instrument that was developed on the basis of the conceptual model.

The rationale for each of these decisions should always be explained in published reports. "This measure was used because it has been used extensively before" should never be considered an acceptable justification for a measurement decision by authors, reviewers, or journal editors.

The main message of this chapter is that the measurement of affective phenomena is a considerable intellectual challenge given the size and complexity of the associated literature. The purpose of this chapter is not to arrive at a recommendation for or against the use of a specific measure. The issues involved do not lend themselves to such simplistic black-and-white differentiations. For practitioners as well as researchers, the choice of a measure depends on what they want to measure. A professional might be interested in a specific emotion (e.g., self-presentational anxiety in a gymnasium or fear for one's life in a cardiac rehabilitation clinic) or in general affective responses (e.g., when tailoring the intensity or duration of an exercise regimen to a client's preferences or abilities). Choosing the most appropriate measure in each situation must be based on a critical evaluation of the relevant literature, perhaps with the aid of an expert.

The value of monitoring the short-term and long-term affective changes of clients and patients as

they engage in exercise is now more clear than ever. Affective constructs are recognized as important both when treated as effects and when treated as causes. For example, exercise has been shown to reduce feelings of fatigue (Puetz, O'Connor, & Dishman, 2006) and to enhance feelings of energy and vigor, both acutely (Reed & Ones, 2006) and chronically (Reed & Buck, 2009). Reducing fatigue and enhancing energy are among the effects most valued by present-day people, who seek to achieve these changes via numerous other means, both legal and illegal.

Similarly, affective responses to exercise are important when considered as a causal factor that influences behavioral decisions. For example, after decades of speculating that people are more likely to continue their exercise participation if they experience pleasure during exercise (and are more likely to drop out if they experience displeasure), the first reliable empirical evidence is beginning to accumulate (e.g., Kwan & Bryan, 2010; Williams et al., 2008). Importantly, in the latest edition of the *Guidelines for Exercise Testing and Prescription*, the ACSM (2010) recommended the use of "measures of affective valence such as the Feeling Scale" as "adjunct measures of exercise intensity" (p. 157). This is a remarkable development; it establishes the measurement of affect as a regular part of the daily practice of exercise professionals worldwide. In doing so, it builds a bridge across the dualistic chasm that has long divided exercise science.

■ Table 28.1 ■

### Self-Reporting Measures Assessing Affect, Mood, and Emotion

Construct	Measure	Dimension	Source	Website
Core affect	Self-Assessment Manikin (SAM)	Valence (pleasant to unpleasant), arousal (excited to calm), dominance (feeling of being controlled versus being in control)	Lang (1980); Bradley & Lang (1994)	None
Core affect	Affect Grid (AG)	Pleasure and arousal	Russell, Weiss, & Mendelsohn (1989)	<a href="http://www2.bc.edu/~russeljm/publications/JPSP1989.pdf">www2.bc.edu/~russeljm/publications/JPSP1989.pdf</a>
Affective valence (pleasure and displeasure)	Feeling Scale (FS)	Affective valence (pleasure and displeasure)	Hardy & Rejeski (1989)	None
Felt arousal	Felt Arousal Scale (FAS)	Felt arousal	Svebak & Murgatroyd (1985)	None

(continued)

**Table 28.1**

(continued)

Construct	Measure	Dimension	Source	Website
Multiple distinct affective states	Revised Multiple Affect Adjective Checklist (MAACL-R)	Anxiety (A), depression (D), hostility (H), positive affect (PA), and sensation seeking (SS) or dysphoria (DYS; A + D + H) and PASS (PA + SS)	Zuckerman & Lubin (1985)	<a href="http://www.edits.net/component/content/article/53/24-maaclr.html">www.edits.net/component/content/article/53/24-maaclr.html</a>
Multiple distinct mood states	Profile of Mood States (POMS)	Tension and anxiety, anger and hostility, fatigue and inertia, depression and dejection, vigor and activity, confusion and bewilderment	McNair, Lorr, & Droppelman (1971)	<a href="http://www.mhs.com/product.aspx?gr=cli&amp;prod=poms">www.mhs.com/product.aspx?gr=cli&amp;prod=poms</a>
Mood dimensions	Positive and Negative Affect Schedule (PANAS)	Positive affect and negative affect	Watson, Clark, & Tellegen (1988)	<a href="http://works.bepress.com/david_watson/211">http://works.bepress.com/david_watson/211</a>
Mood dimensions	Activation Deactivation Adjective Checklist (AD ACL)	Energy, tiredness, tension, and calmness or energetic arousal and tense arousal	Thayer (1989)	<a href="http://www.csulb.edu/~thayer/thayer/adaclnew.htm">www.csulb.edu/~thayer/thayer/adaclnew.htm</a>
Mood dimensions	Four-Dimension Mood Scale (4DMS), state version	Positive energy, tiredness, negative arousal, and relaxation	Gregg & Shepherd (2009)	None
Anxiety	State-Trait Anxiety Inventory (STAI)	State anxiety and trait anxiety	Spielberger (1983)	<a href="http://www.mindgarden.com/products/staisad.htm">www.mindgarden.com/products/staisad.htm</a>
Depression	Beck Depression Inventory (BDI)	Cognitive-affective symptoms and somatic symptoms of depression (total score)	Beck, Steer, & Brown (1996)	<a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=015-8018-370">www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=015-8018-370</a>
Depression	Hamilton Rating Scale for Depression (HRSD)	Depression	Hamilton (1960)	<a href="http://www.assessmentpsychology.com/HAM-D.pdf">www.assessmentpsychology.com/HAM-D.pdf</a>
Exercise-induced feelings	Exercise-Induced Feeling Inventory (EFI)	Revitalization, tranquility, positive engagement, and physical exhaustion	Gauvin & Rejeski (1993)	None
Subjective exercise experiences	Subjective Exercise Experiences Scale (SEES)	Positive well-being, psychological distress, and fatigue	McAuley & Courneyea (1994)	<a href="http://www.epl.illinois.edu/meas_see.html">www.epl.illinois.edu/meas_see.html</a>
Physical activity affect	Physical Activity Affect Scale (PAAS)	Positive affect, negative affect, tranquility, and fatigue	Lox, Jackson, Tuholksi, Wasley, & Treasure (2000)	None

## Chapter 28

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# **MEASUREMENT IN SPORT AND EXERCISE PSYCHOLOGY**

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