

The Dual-Mode Theory of affective responses to exercise in metatheoretical context: II. Bodiless heads, ethereal cognitive schemata, and other improbable dualistic creatures, exercising

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According to the Dual-Mode Theory, affective responses to exercise are influenced by the continuous interplay of cortically mediated cognitive processes (e.g., self-efficacy, self-presentational concerns, goals, attributions) and ascending interoceptive cues (e.g., ventilation, acidosis, core temperature). The relative importance of these two factors is hypothesized to shift systematically as a function of exercise intensity, with cognitive factors being the dominant determinants at intensities proximal to the lactate or ventilatory thresholds and interoceptive factors gaining salience at intensities that preclude the maintenance of a physiological steady state. The present review retraces the antecedents of the dual-mode notion in psychological theory. Emphasis is placed on variants of dualistic thought that focus on the ‘mind’ (cognition) as the chief determinant of affect and specifically on the theories of Schachter and Singer, Lazarus, Bandura, Neisser, and Leventhal and Everhart. The applications of these ideas within exercise psychology (i.e., the ‘mind over muscle’ assumption) are critically analyzed, laying the conceptual foundation for the necessity of dual-mode integrative models.

Keywords: cognitive appraisal; emotion; cognitivism; constructivism; social-cognitive theory

The Dual-Mode Theory (DMT; Ekkekakis, 2003, 2005) is a new theoretical formulation that is intended to serve as a hypothesis-generating framework for understanding the patterns and underlying mechanisms of affective responses to exercise. It is grounded on principles of evolutionary theory (Ekkekakis, Hall, & Petruzzello, 2005) and is accompanied by a putative neural basis (Ekkekakis & Acevedo, 2006). According to the DMT, affective responses to exercise are the products of the continuous interplay between two general factors: (a) cognitions originating in the frontal cortex, such as considerations related to self-efficacy, self-presentational concerns, goals, or attributions, and (b) interoceptive cues about the physiological condition of the body, such as respiratory, muscular, or thermal symptoms. The relative contribution of these two factors is hypothesized to change systematically as a function of exercise intensity, with cognitive factors being the primary determinants of affective responses at intensities below and proximal to the ventilatory or lactate threshold and interoceptive factors steadily gaining in

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importance and eventually becoming dominant at intensities above the ventilatory or lactate threshold. As a result of these interactions, affective responses are predicted to be mainly positive at intensities below the threshold, mainly negative at intensities substantially above the threshold, and positive in some but negative in other individuals at intensities proximal to the threshold.

The DMT satisfies certain desiderata that were identified prior to its development. Specifically: (a) it recognizes a role for both ‘mind’ and ‘body’ factors in the generation of affective responses, allowing researchers from diverse areas (from social psychology to affective neuroscience) to derive hypotheses from a common framework and to contribute information into a common knowledge base, (b) it incorporates the notion that affective responses to exercise can run the gamut from complex, appraisal-based and culturally framed emotions (such as embarrassment or pride) to cognitively-unmediated *basic* affective responses (such as a ‘pure’ sense of somatic tension or exhilaration), (c) it proposes a specific dose-response pattern that recognizes the fundamental inadequacy of nomothetic stimulus-response approaches, (d) it attributes psychological significance to patterns of interindividual variability in affective responses and systematic intensity-dependent shifts in these patterns, (e) it is built upon a classification system of exercise intensity that is informed by principles of exercise physiology, and (f) it is accompanied by a testable neural model that could provide the mechanistic substrate for the pattern of affective outcomes predicted by the model.

The general purpose of this series of articles is to place the DMT into a broader metatheoretical context and to clarify the relationships of the DMT to other theoretical formulations. This detailed presentation of the broader framework of the DMT should highlight the implications of hypothesis-testing research based on this model for issues of broader theoretical and practical interest in psychology.

Bodiless heads, exercising

The following excerpt from a thought-provoking text by the late Michael Mahoney (1995), which appeared under the title ‘The mind has become embodied’, can serve as a rather interesting starting point for this analysis:

Rationalists ranging from Pythagoras and Plato to Descartes and Minsky have argued the superiority of the mind over the body. This dualism continues in some extreme expressions of cognitivism . . . With the noteworthy exception of the phenomenologists (e.g., Heidegger, Husserl, Merleau-Ponty), there were few challenges to the conceptual hegemony of dualism until the past two or three decades. It has been during this period that the specialization of health psychology has developed and the era of popularized physical fitness – what I like to call the ‘movement movement’ – has begun to mature (p. 198).

Mahoney (1995) apparently saw the ‘movement movement’ and, presumably, the evolution of exercise psychology (i.e., ‘the specialization of health psychology’) as signs of a *de facto* indictment and intellectual opposition to the dualism inherent in ‘extreme expressions of cognitivism’ and the notion of the ‘superiority of the mind over the body’. However, upon examining the dominant metatheoretical perspective within exercise psychology today, one might find Mahoney’s words somewhat ironic and his enthusiasm premature. Arguably, the belief in the ‘superiority of the mind

over the body' and, by implication, some 'extreme expressions of cognitivism' remain alive and well in this field. This phenomenon could be attributed to the fact that the period of evolution of exercise psychology has coincided with the growing influence of the cognitivist (Gardner, 1987; Johnson & Erneling, 1997) and constructivist (Gergen, 1985) perspective in psychology, in conjunction with the tendency to borrow theoretical models from general psychology rather than develop models that have exercise *per se* at their core (Dishman, 1983). The idea of the 'embodied mind,' which Mahoney had assumed would naturally be the dominant theme within a scientific discipline that studies *physical activity*, does not appear to have had a large influence. This review examines references that have been made within the exercise psychology literature to constructivist, cognitivist, and social-cognitivist models as explanations of affective responses to exercise.

The picture that seems to emerge from a collective examination of these accounts is that affective responses to exercise, despite the obvious involvement of the body, are often seen as disembodied, determined fully or mainly within the 'mental sphere'. The 'headless body' is a powerful oratorical device frequently invoked by Morgan: 'especially those who rely exclusively on cognitive psychology seem to believe that the head does not have a body' (Morgan, 1989, p. 100). Indeed, many researchers appear to assume that the cues produced by the exercising body do not inherently carry affective meaning. Instead, the processes that produce affective responses lie entirely within the mind. These mental operations are seen as representational; their material is not the raw sensory datum but a cognitively constructed representation or symbolism of that datum. Averill (1980) encapsulated the traditional constructivist position regarding the role of interoceptive information in the generation of affective responses in the following sentence: 'It is ... worth emphasizing that [bodily] feedback is subject to second-order monitoring ... and it is the monitoring that determines the quality of experience, not the feedback *per se*' (p. 317).

The present analysis consists of a survey of five models: (a) Schachter's two-factor theory of emotion, (b) Lazarus' cognitive-relational theory of emotion, (c) Bandura's self-efficacy theory, (d) Neisser's cognitive theory, and (e) Leventhal and Everhart's parallel processing model of pain. The thrust of this analysis is to highlight problems that might emerge as these models, most (though not all) of which were originally developed to account for *emotional* responses to social and symbolic stimuli, were brought to bear on the study of affective responses to exercise.

Schachter's two-factor theory of emotion

Schachter's classic experiments (Schachter, 1964; Schachter & Singer, 1962; Schachter & Wheeler, 1962) were inspired by Cannon's (1927, 1931) critique of the James-Lange theory and his pioneering writings on the regulation of physiologic manifestations of emotion by cognition. The main methodological feature of these experiments was the use of injections of epinephrine as a means of manipulating the activation component of emotion, a paradigm developed in earlier research (e.g., Cantril & Hunt, 1932; Landis & Hunt, 1932). The basic premise of Schachter's theory can be summarized as follows: 'An emotional state may be considered a function of a state of physiological arousal and of a cognition appropriate to this state of arousal ... It is the cognition which determines whether the state of physiological arousal will be labeled as "anger", "joy", "fear", or whatever'

(Schachter & Singer, 1962, p. 380). Based on this premise, Schachter and Singer formulated the following hypothesis: 'Given a state of physiological arousal for which an individual has no immediate explanation, he will "label" this state and describe his feelings in terms of the cognitions available to him' (p. 381, sexist language in the original).

Despite the fact that there are no known studies that have tested Schachter and Singer's theory in the context of exercise, several authors have assumed that this formulation has direct, self-evident relevance to affective responses to exercise. In this view, exercise produces arousal, which is presumed to be affectively vacuous. It then rests upon a process of cognitive 'labeling' to characterize this arousal as an emotional state of a particular quality. This cognitive process is assumed to be so potent that it can assign very diverse, or even contradictory, emotional 'labels' to the same state of physiological arousal. For example, citing Schachter and Singer (1962) as the basis of their assertion, Gauvin and Rejeski (1993) noted that 'the arousal created by physical activity can lead to a variety of feelings, good or bad, depending upon the cognitive label assigned to events' (p. 405). In a similar vein, Vlachopoulos, Biddle, and Fox (1996) wrote that 'consistent with Schachter and Singer's (1962) two-factor theory of emotions, the "good" or "bad" feelings one experiences during and after physical exercise are generated from the arousal created from the activity and, at the same time, are influenced by the cognitive label assigned to the events' (p. 175).

There are two main problems with citing Schachter and Singer's theory and associated research evidence to substantiate statements about the processes underlying affective responses to exercise. First, the theory, at least its strong form that authors in exercise psychology appear to have embraced (i.e., that physiological arousal can be transformed into diverse emotional states) has not been shown to hold true. Critical reviews of the relevant literature agree that, based on empirical evidence, the theory is untenable (Cotton, 1981; Manstead & Wagner, 1981; Marshall & Zimbardo, 1979; Maslach, 1979; Reisenzein, 1983).

Second, a careful reading of the postulates presented by Schachter and Singer (1962) reveals that the theory is not really applicable to affective responses associated with exercise. This is because, in exercise, the source of the physiological arousal is clearly evident to participants (see Sinclair, Hoffman, Mark, Martin, & Pickering 1994 on this topic). According to Schachter and Singer, it is only when the source of arousal is *unknown* that a cognitive search for explanatory environmental cues is hypothesized to be initiated: 'Given a state of physiological arousal for which an individual has a completely appropriate explanation . . . no evaluative needs will arise and the individual is unlikely to label his feelings in terms of the alternative cognitions available' (Schachter & Singer, 1962, p. 382). Consistent with this hypothesis, Schachter and Singer found that 'in those conditions in which subjects were injected with epinephrine and told precisely what they would feel and why, they proved relatively immune to any effects of the manipulated cognitions' (p. 396). There can be little doubt that, at least during or shortly following a bout of exercise, exercisers have a 'completely appropriate explanation' for their arousal (Sinclair *et al.*, 1994). Given these problems, invoking Schachter's theory as an explanatory framework for affective responses to exercise seems unwarranted. A similar observation was made by Cotton (1981) who criticized those social psychologists

who 'have tended to accept the misattribution paradigm wholeheartedly and uncritically, believing almost any emotion can be manipulated' (p. 367).

Lazarus' cognitive-relational theory of emotion

Lazarus (1966, 1991a, 1999) presented a widely popular theory of emotion that represents a prime exemplar of the cognitivist tradition. According to Lazarus, what determines an emotional response is the cognitive appraisal of the situation. In fact, Lazarus (1991b) has stated that emotion 'is always a response to cognitive activity, which generates meaning' and, therefore, cognition is both a necessary and sufficient condition for the genesis of emotion: 'Sufficient means that thoughts are capable of producing emotions; necessary means that emotions cannot occur without some kind of thought' (p. 353).

Lazarus has often used references to exercise to illustrate these ideas. In his examples, the exercise stimulus itself does not suffice to produce an emotional response; this can only be achieved through a cognitive appraisal of the meaning of exercise:

Arousal can be produced by exercising vigorously ... Doing this will produce an emotion only if we appraise the encounter (e.g., the physical and social conditions and the bodily state it produces) as having a bearing on our well-being, as when, for example, it presents some physical danger or brings blissful relief from discomfort (Lazarus, 1984, p. 124).

Elaborating on this idea, Lazarus and Smith (1988) argued that the role of cognitive appraisal is indeed so decisive that it can transform the same sensory information elicited during physical effort into diametrically different emotional experiences:

Muscle fatigue and pain ... are often appraised positively and lead to positive emotions for the athlete who believes this is a desirable goal of exercise or practice (as in the expression, 'go for the burn') but are appraised quite negatively and lead to negative emotions when some other goal is involved, as when one is struggling to finish a contest in the best position possible, or when pain or distress signifies physical impairment or illness to the person (p. 287).

And, in a similar vein, Lazarus (1991b) added:

Competitive runners in a close race who are experiencing painful fatigue on the way to the finish line will probably react with distress because the pain signifies that they are running out of steam and that the race may be lost. However, when the same runners are seeking to condition themselves in training, they are apt to feel satisfaction when they experience the same painful fatigue, because it now signifies that their bodies are being strengthened for future races without much being at stake (p. 821).

Within exercise psychology, Rejeski and Hobson (1994) have cited Lazarus' ideas as a basis for arguing that it is the cognitive appraisal of the 'objective' demands of exercise that determines people's behavioral and affective responses. Through cognitive appraisal, the 'objective' demands of exercise can be shaped into diametrically different experiences, from 'benign or positive' to 'threatening, harmful, or challenging' (p. 108).

The application of Lazarus' theory in the context of exercise warrants closer examination. First of all, it should be pointed out that Lazarus' references to the

context of exercise have no empirical basis, as there are no known studies that have actually shown these assertions to be true. The use of exercise in the aforementioned examples represents an attempt to extrapolate to the realm of bodily stimuli conclusions reached through experimental work with exteroceptive stimuli, primarily of a social nature. Therefore, these extrapolations rely on the assumption that an interoceptive stimulus (for example, metabolic acidosis) will lead to an affective response via essentially the same mechanism as a stimulus from the social environment (for example, a condescending comment from a coworker). This is an assumption that many psychologists are willing to accept. For example, in his landmark book entitled *The Psychology of Physical Symptoms*, Pennebaker (1982) wrote: 'One of the most fundamental assumptions of this book is that the perceptual process required for the encoding of internal sensory information represents the same processes that have traditionally been implicated in the perception of external environmental events' (p. 19). However, as modern evidence on the neural basis of interoception suggests, this assumption is probably false. The structure and function of neural systems involved in the processing of interoceptive and exteroceptive stimuli are fundamentally different in many respects (Craig, 2002). Therefore, in the absence of direct empirical evidence, attempting extrapolations from social to somatic stimuli seems like a tenuous enterprise.

To further evaluate Lazarus' claims regarding the cognitive determinants of responses to exercise, it is important to examine what he considers as valid 'emotions'; that is, valid objects of his theory. Lazarus made it clear that the term 'emotion' should be reserved exclusively for those subjective responses that follow an appraisal process. Consistent with this notion, he states that qualify as emotions occur mainly in social contexts and are culturally framed: anger, anxiety, guilt, sadness, envy, disgust, happiness, pride, love, and relief.

States that do not qualify (i.e., do not require an appraisal process) include such things as pleasures and pains emanating directly from the body. These are characterized as mere 'sensorimotor reflexes' and 'physiological drives' (Lazarus, 1991a, Lazarus, 1994, 1999; Smith & Lazarus, 1990). The pleasure of physical rest or the displeasure of pain are examples of 'sensorimotor reflexes'. The pleasure of eating after being hungry or the displeasure of starvation are examples of 'physiological drives', reflecting periodic and predictable 'homeostatic needs'. These responses are believed to be common to all neurologically intact humans, as well as lower animals (Lazarus, 1991a; Smith & Lazarus, 1990). According to Lazarus (1991a), 'we are built so that sensorimotor pleasure, such as sweet taste, physical rest, stroking the body, or certain kinds of full stomachs, is almost always elicited by definable physical stimuli in a neurologically intact and receptive person. So, too, with pain' (p. 55).

Lazarus does acknowledge the evolutionary continuity from sensorimotor reflexes and physiological drives to emotions. All these types of responses facilitate the individual's adaptation to the demands of the physical and social environment by pairing the detection of survival- or well-being-relevant stimuli with the production of survival- or well-being-promoting behavior. However, they achieve adaptation via different routes. As Smith and Lazarus (1990) put it, 'innate reflexes [of pleasure and displeasure] were once the simplest solution to the adaptational problem of getting along in the world, but in more complex creatures these evolved into emotional

patterns' (p. 612). However, clearly, although sensorimotor reflexes and physiological drives, like 'true emotions', serve vital adaptational functions, 'they are not emotions' (Lazarus, 1991, p. 50). Thus, they are of lesser or no psychological interest. Importantly, Lazarus points out that, for all sensorimotor reflexes and physiological drives, 'the degree of [cognitive] modifiability compared to true emotions is always modest' (Lazarus, 1991a, p. 55; also see Ellsworth, 1991; Smith & Lazarus, 1990).

This distinction between true emotions on the one hand and sensorimotor reflexes or physiological drives on the other is of fundamental importance in evaluating the applicability of Lazarus' cognitive-relational theory of emotion to affective responses to exercise. How often does research on the exercise-affect relationship focus on such constructs as guilt, envy, disgust, pride, or love? It is highly debatable whether even the studies on 'anxiety' in fact examine exercise-induced changes in the patterns of cognitive appraisals that Lazarus theorized to be the key distinguishing feature of this emotion, namely 'protection of personal meaning or ego-identity against existential threats' (Lazarus, 1991a, p. 237). Instead, changes in the scores of state anxiety questionnaires appear to more closely reflect changes in items that tap perceived somatic activation, a common symptom of anxiety but definitely not a defining element and not an 'emotion' *per se*, as Lazarus defined this concept (Ekkekakis, Hall, & Petruzzello, 1999; Rejeski, Hardy, & Shaw, 1991).

The majority of research on the exercise-affect relationship has targeted such constructs as pleasure, displeasure, tension, energy, vigor, exhilaration, or fatigue. According to Lazarus, however, such states represent types of sensorimotor reflexes or physiological drives, conceptually closer to 'contentless excitement or arousal' (Lazarus, 1991a, p. 83) than to veritable emotions. As such, the cognitive 'modifiability' of these states is limited. In other words, one should not assume that the sense of energy or fatigue that may accompany certain types of exercise is what can be transformed through cognitive appraisal. Perhaps we can slightly increase or lessen our fatigue or perceived energy but there is nothing in Lazarus' theory to suggest that we can transform one into the other. What cognitive appraisal is theorized to influence is the second-order emotional response that might occur when the exerciser reflects upon (i.e., appraises) his or her exercise experience, perhaps during the minutes or hours following an exercise bout. Notice the careful wording in Lazarus' excerpt cited earlier: 'Muscle fatigue and pain ... are ... appraised positively and *lead to* positive emotions [or] are appraised ... negatively and *lead to* negative emotions' (Lazarus & Smith, 1988, p. 287, italics added). The 'muscle pain and fatigue' are the stimuli, the data that are entered into the appraisal system that will ultimately produce emotions. However, the core experiences of 'muscle pain and fatigue' will remain 'muscle pain and fatigue'. They themselves will not change.

It should be evident that what Lazarus views as emotions and, therefore, the true objects of his cognitive relational theory and what exercise psychology researchers tend to view as the common affective outcomes of exercise do not overlap. Consequently, whether cognitive appraisals can be justly assumed to be the all-powerful determinants of these affective responses should be reconsidered.

Bandura's theory of self-efficacy

Self-efficacy is the central construct within Bandura's (1977, 1986, 1997) social-cognitive theory and has been perhaps the most extensively studied cognitive mediator of affective responses to exercise. In this theoretical framework, psychological functioning involves 'a continuous reciprocal interaction between behavioral, cognitive, and environmental influences' (Bandura, 1978, p. 344), a position that seems to imply a balance between these three factors. Importantly, physiological feedback is considered as one of the sources that individuals use to derive information about their efficacy (the others being enactive mastery experiences, vicarious experiences, and verbal persuasion). Because social-cognitive theory takes physiological factors into account and emphasizes the continuous interaction between behavioral, cognitive, and environmental influences, some authors have assumed that the theory stipulates a functional balance between cognition and physiology (e.g., Novy, Nelson, Francis, & Turk, 1995). However, this interpretation does not seem to be entirely accurate.

Bandura has emphasized that, for any stimulus to acquire meaning for the individual, it must first be subjected to cognitive interpretation: 'Information that is relevant for judging personal capabilities – whether conveyed enactively, vicariously, or physiologically – is not inherently enlightening. Rather, it becomes instructive only through cognitive appraisal' (Bandura, 1982, p. 127). Commenting specifically on the role of bodily cues, Bandura wrote: 'As in the other modes of influence, the information conveyed by physiological states and reactions, is not by itself, diagnostic of personal efficacy. Such information affects perceived self-efficacy through cognitive processing' (Bandura, 1997, p. 107). To justify this position, Bandura echoes one of the standard cognitivist-constructivist arguments on the role of physiologic feedback, namely that bodily activation is too 'diffuse' and 'undifferentiated' to adequately account for the great diversity of phenomenological accounts of affective responses. It should be noted, however, that, despite its wide popularity, this thesis does not appear to be consistent with psychophysiological evidence (Davidson, 1994; Levenson, 1992, 1994, 2003). Both autonomic and neuroendocrine concomitants of affective states show remarkable diversity and specificity of patterns. This fact is usually overlooked.

Bandura's views have been enormously influential in exercise psychology, where statements often tend to go beyond what has been established by actual empirical evidence. In particular, the fundamental notion that bodily cues (such as those produced during exercise) are devoid of inherent meaning and can only acquire significance for the individual after being subjected to cognitive appraisal has appeared in various forms, usually unqualified and unrestricted. McAuley and Courneya (1992) asserted that '*perceptions* of personal capabilities, regardless of actual physical capabilities, appear to play a role in what and how individuals feel during exercise' (p. 321, italics in the original). Along similar lines, McAuley (1994) summarized the implications of the self-efficacy framework for the experiences participants derive from exercise as follows:

Teaching participants to modify or reinterpret their impressions of their physiological states during exercise serves as a final source for efficacy information ... Having a racing heart, dry throat, and shortness of breath are all natural physical responses to the exercise stimulus, and participants should be taught to interpret gradual change in the degree of those symptoms as markers of improved conditioning and thereby increased

physical capabilities ... In turn, this sense of efficacy will safeguard against discouragement, feelings of displeasure and incompetence, a dislike for activity, and a proclivity to give up in the face of any real or perceived adversity and challenge of physical activity (p. 88).

One can easily decipher the influence of the constructivist metatheoretical perspective. Bodily cues or physiological symptoms (e.g., 'a racing heart, dry throat, and shortness of breath') are considered malleable raw sensory material. To acquire affective content and significance, these symptoms must be subjected to cognitive 'interpretation' of what they might mean for a person's efficacy. This interpretation of efficacy implications is what will determine the quality of the experience (and, thus, it could result in pleasure, perceived competence, and a positive attitude toward exercise or, conversely, in displeasure, perceived incompetence, and a negative attitude toward exercise).

A critique of these ideas must begin with the observation that, not unlike the models reviewed previously, there is actually very limited direct empirical support for many of the statements found in the literature. With few exceptions (Hu, Motl, McAuley, & Konopack, 2007; Jerome *et al.*, 2002; Marquez, Jerome, McAuley, Snook, & Canaklisova, 2002; McAuley, Talbot, & Martinez, 1999), studies on the role of self-efficacy in affective responses have been correlational, not experimental (Bozoian, Rejeski, & McAuley, 1994; McAuley & Courneya, 1992; Mihalko, McAuley, & Bane, 1996). Moreover, these results have been criticized as 'statistically significant but practically trivial' (Lee, 1998, p. 29), since the strength of association found in both correlational and experimental studies is typically modest. When the explained portion of variance in affect is limited to 10% or 20%, it is very unlikely that any manipulation of efficacy can transform an affective response from unpleasant to pleasant or *vice versa*, despite how such findings are often interpreted. Lee (1998) has also criticized this research by pointing out the failure to account for variance due to other, relevant yet unmeasured, variables. Importantly, there is no evidence that physiological variables do not play a *direct* role (i.e., unmediated by self-efficacy or other cognitions) in shaping affective responses to exercise. Consequently, extrapolating from this evidence that a manipulation of efficacy can transform interoceptive sensory data into diverse experiences is unjustified.

At least based on certain statements, Bandura's views, by attributing ultimate causation to cognitive appraisal, represent a prime exemplar of the cognitivist tradition. As such, they have been the target of extensive criticism from more conservative proponents of cognitivism, as well as from behaviorists (Biglan, 1987; Hawkins, 1992; Lee, 1992, 1995; Sampson, 1981). For example, Lee (1995) argued that, by assuming cognition to be 'more important, more central to understanding human beings, than are social and physical circumstances' (p. 262), Bandura is essentially reducing the individual to 'a collection of subjective experiences, with a body more or less tacked on as a way of getting around' (pp. 261–262).

The problems stemming from the doctrine of attributing ultimate causation to cognitive appraisal start to become apparent when one considers its implications for applied interventions. If all subjective experiences ultimately depend on cognition, it follows that humans have an unlimited capacity to construct their experiences. Immediately, this thesis raises issues of professional ethics. Lee (1995) charged that, since Bandura's constructivism 'places more importance on cognitive events than on

objective reality', interventions based on this approach are likely to 'focus ... on changing cognition rather than altering objective circumstances' (p. 262).

Following the publication of a provocative paper by Taylor and Brown (1988), arguing that positively biased perceptions of control foster psychological adjustment and superior functioning, a flurry of papers appeared contemplating what the 'optimal margin of illusion' is, how far out of touch with the social and physical reality can people be before they expose themselves to various predicaments. It should be noted that Bandura (1989, 1997) has expressed a conservative position in this debate, arguing that some objective limits must be recognized and taken into account. In his words, 'people who seriously misjudge their swimming capabilities in tackling heavy surf may not survive for more prudent encores' (Bandura, 1997, p. 71). Discussing the appropriate way of conceptualizing perceptions of efficacy, Bandura (1991) wrote:

Appropriate self-appraisal of capabilities plays an important role in successful functioning. Serious misjudgements of personal efficacy in either direction can produce adverse consequences. People who grossly overestimate their capabilities undertake activities that are well beyond their reach. This begets high disappointments, failures, and many other troublesome consequences (p. 230).

This position in favor of matching efficacy to actual capabilities has obvious relevance to studies on the role of self-efficacy in the context of acute exercise. To the extent that perceptions of efficacy substantially exceed the actual capacity of the person to cope with the situational demand, self-efficacy is a potential impediment to successful adaptation and can expose the individual to a host of dangers. In cardiac rehabilitation, for example, Ewart has shown that high ratings of self-efficacy were significantly associated with a tendency to exercise above the target heart rate range and, thus, increase the risk of cardiac complications (Ewart, 1995; Ewart *et al.*, 1986). In other words, the assumption that bolstering self-efficacy always promotes psychological adaptation, as often implied in the exercise psychology literature, is false.

Bandura (1997) has also noted that 'there are limits to the cognitive reconstruals of the same arousal state' (p. 139). Clearly, this is tantamount to an admission that his unqualified aforementioned position, according to which physiological information is not 'inherently enlightening', is actually untenable. What this statement seems to imply is that, ultimately, 'arousal states' (i.e., cues arising from the body under conditions of high activation) do carry at least *some* inherent information and, therefore, can have meaning for the individual without necessitating being subjected to cognitive appraisal. More broadly, then, cognitive appraisal does not have an *unlimited* capacity to construct subjective experiences.

Very importantly, this crucial point did not escape the attention of authors in exercise psychology. Earlier, McAuley and Courneya (1992) had proposed that the association between self-efficacy and affect should become stronger when exercise intensity reaches a level where bodily cues become unequivocally aversive (tentatively specified as above 70% of maximal heart rate). Later, however, a crucial boundary condition was added, limiting the scope of the earlier statement. McAuley, Blissmer, Katula, and Duncan (2000) noted that 'at high intensities, physiological cues ... override cognitive processing' (p. 12). In agreement with Bandura's point, this revised postulate implies the existence of two modes of generating affective responses, one

that relies on cognitive appraisal (in which self-efficacy is heavily implicated, particularly at intensities of exercise that present an appreciable challenge and, therefore, put one's sense of agency to the test) and one that does not. In the latter case, the implication is that 'physiological cues' are inherently charged with affective meaning and their influence over affective responses is impervious to cognitive factors.

Neisser's cognitive theory

In the introduction of his classic book *Cognitive Psychology*, Ulric Neisser (1967) wrote the following, which later became one of the foundation stones of the social-cognitive and social-constructivist movements:

It has been said that beauty is in the eye of the beholder. As a hypothesis about localization of function, the statement is not quite right – the brain and not the eye is surely the most important organ involved. Nevertheless, it points clearly enough toward the central problem of cognition. Whether beautiful or ugly or just conveniently at hand, the world of experience is produced by the man who experiences it. This is not the attitude of a skeptic, only of a psychologist. There certainly is a real world of trees and people and cars and even books, and it has a great deal to do with our experiences of these objects. However, we have no direct, immediate access to the world, nor to any of its properties . . . Whatever we know about reality has been *mediated*, not only by the organs of sense but by complex systems which interpret and reinterpret sensory information (p. 3, italics and sexist language retained from the original).

Within exercise psychology, the belief in the ubiquitous and omnipotent role of cognitive mediation was echoed by Rejeski and Hobson (1994; note that the reference to Neisser's 1976 book instead of the 1967 book was obviously an oversight – see below):

As the history of cognitive psychology has shown, reality is in the eye of the beholder (Neisser, 1976). Although we certainly do not want to dismiss the objective demands inherent in exercise programs, ultimately it is an individual's construction of reality that determines any sense of threat, challenge, or loss/harm experienced (p. 108).

The standard criticisms of (a) this being an assumption rather than an empirically supported statement and (b) this being an overly general declaration, unqualified and unrestricted in its scope, apply to this position as well. Again, sensory data are considered inherently uninformative and, in order to acquire meaning, they must first be subjected to cognitive interpretation.

What makes this a rather unique case is the evolution in Neisser's own thinking about the subject, which had rendered his previous beliefs obsolete by the time they were cited and endorsed in the exercise psychology literature. Heavily influenced by James J. Gibson's (1966) ecological psychology, Neisser became increasingly wary of the detachment of theorizing and experimentation in cognitive psychology from the 'reality' of the environment. In *Cognition and Reality*, Neisser (1976) wrote: 'We may have been lavishing too much effort on hypothetical models of the mind and not enough on analyzing the environment that the mind has been shaped to meet' (p. 8). Discussing visual perception, in particular, he stated:

[Constructivism] fails to explain the veridicality of perception. If percepts are constructed, why are they usually accurate? Surely perceiving is not just a lucky way

of having mental images! The answer must lie in the kind and quality of optical information available to the perceiver. The information must be specific enough in most cases to ensure that the constructed percept is true to the real object. But if this is admitted, the notion of ‘construction’ seems almost superfluous. One is tempted to dispense with it altogether, as J.J. Gibson has done. (p. 18)

Completing the overhaul and refutation of his 1967 constructivist stance, Neisser (1994) wrote that the knowledge gained through direct perception is ‘... immediate, non-inferential, bottom-up, and cognitively impenetrable. It does not have to be “constructed” (as I once supposed) and it cannot be “deconstructed” in the modern sense of that term’ (p. 232). In the same year that Neisser’s views were being cited as the basis for the claim that ‘reality is in the eye of the beholder’, Neisser (1994) himself was writing the following:

My first account [of cognitive theory], in a book entitled *Cognitive Psychology* (Neisser, 1967), relied heavily on information processing as well as the notion of ‘constructive processes’. It was a plausible account at the time, but seems both too narrow and too vague in retrospect ... The notion of ‘construction’ (which was applied in *Cognitive Psychology* to everything from object perception to long-term memory) was so vague as to be not very informative, while the concept of ‘information processing’ turned out to be not very constructive ... Another problem with information-processing theory is that so many of the models are simply wrong (p. 226).

What Neisser proposed instead is that there are multiple modes of extracting knowledge from the world, some of which depend on direct perception (i.e., all the necessary information is already contained in the sensory data) and some of which rely on cognitive mediation. Specifically, Neisser (1988) proposed five such modes, which he called ecological, interpersonal, extended, private, and conceptual. This evolution of Neisser’s ideas is as clear as it is dramatic. In essence, Neisser replaced the notion of a central cognitive apparatus involved in the constant process of representation, interpretation, and decision-making with the notion of multiple modular systems:

There is apparently no single central neural control system in the head, no Cartesian center of decision. Instead, behavior results from the overlapping activity of many partially independent ‘modular’ systems. Those systems are not constrained by any central executive, but by the physical body and the real environment as well as by their mutual interconnections (p. 227).

Leventhal and Everhart’s parallel processing model of pain

The 1980s were a very active decade in research focusing on psychological methods for pain control. One approach followed directly from the basic principles of constructivism, assuming that, since ‘reality is in the eye of the beholder,’ the ‘beholder’ can be taught to modify ‘reality’ at will. For example, expressing this point of view in discussing methods for managing chronic pain, Ciccone and Grzesiak (1984) wrote that ‘we must first remember that humans have no direct knowledge of reality. All of our transactions with the environment are made on the basis of subjective inference and not on the basis of objective fact’ (p. 1340).

Another approach was fundamentally different from the perspectives presented so far in that it assumed that certain varieties of somatic symptoms do carry an

inherently negative affective charge. However, this approach should also be considered an exemplar of the cognitivist-constructivist tradition because it maintained that the individual can ultimately use his or her omnipotent cognitive apparatus to gain control over the quality of the experience. This is done not by manipulating the representation or appraisal of the sensory input but by actively redirecting one's attentional focus. According to Cioffi (1993):

Despite a professed respect for the ability of cognition to shape somatic meaning, cognitive-behavioral therapies often operated at bottom as if the fundamental hedonic character of much physical experience was fixed. In the case of an 'unpleasant' sensation, then, the task was to attenuate its inherently noxious character with attentional dodges or cognitive diversions. Sensations were to be mastered [and] the mind was to do the mastering (p. 417).

The 'parallel processing model of pain distress' proposed by Leventhal and Everhart (1979) provided the conceptual framework for the development and application of such 'attentional dodges or cognitive diversions'. According to this model, 'informational' (i.e., sensory properties of the stimulus, location) and 'distress-emotional' components of pain (i.e., displeasure, distress) are processed in parallel. Most of the processing is preconscious and, as a result, *perception* (all the stimulus material collected by sensory receptors) and *focal awareness* (the sensory data to which one chooses to attend) are distinguishable. The notion of a parallel processing model implies the presence of parallel (distinct) 'attentional filters' or 'channels' that convey sensory information from perception to focal awareness. Since sensory information and emotional distress are presumed to be carried by different (parallel) attentional channels, 'situational conditions' (such as instructions) can lead to a separation or integration of this material as it enters consciousness. According to Leventhal and Everhart (1979), an individual could be instructed to 'focus on the informational component,' as opposed to the emotional component, and thus become 'less susceptible to the influence of the [emotional] reaction component, as the two are no longer blended in the subject's pain experience' (pp. 273–274).

Within exercise psychology, Leventhal and Everhart's model became widely known when Rejeski (1985) cited it in support of his social-psychophysiological model of perceived exertion. The popularity of the model may also be explained by the fact that it appeared at a time when discussions on the concept of attentional association-dissociation were at their peak (see Laasch, 1994–1995, Masters & Ogles, 1998, for reviews), following the publication of Morgan and Pollock's (1977) seminal research on the use of cognitive strategies by elite and non-elite runners. The practical recommendation that has emerged from this literature is that novice exercisers, who tend to be inexperienced and of low physical fitness, should dissociate as a way of minimizing any negative affective responses and thus facilitating adherence. This recommendation was again promoted unaccompanied by any qualifiers or caveats. In a book on preventing participant dropout, Rejeski and Kenney (1988) recommended dissociation for new exercisers as a way of 'countering the discomforts of exercise' (p. 85). In another book on maximizing the mental health benefits of exercise, Leith (1998) also recommended the use of attentional dissociation, warning that 'focusing on the physical activity serves to remind us of feelings of fatigue and makes the effort more of a chore' (p. 88). Similarly, commenting on findings that low-fitness participants report decreases in pleasure

during exercise which are reversed upon the termination of the exercise bout, Parfitt and Eston (1995) recommended that exercisers should try to focus their attention not on how they feel during exercise but rather on how they feel afterwards. In these examples (and others), dissociation is portrayed as a simple 'switch' that one just needs to learn to 'flip' for the quality of the exercise experience to be transformed. There is no mention of whether the 'switch' is entirely under one's voluntary control or whether it is presumed to be effective under all conditions.

The first issue that warrants discussion is what seems to be inconsistent logic in the recommendations. Morgan (1978) suggested that dissociation is an appropriate choice for non-elite exercisers: 'the average jogger would do well to employ dissociation to negotiate a temporary pain zone' (p. 49). This, however, came with the caveat that dissociation 'carries with it a variety of risks and dangers' (p. 49), such as injury, exhaustion, or adopting an uneconomical pace and running out of steam. On the other hand, association was recommended as the strategy of choice for endurance athletes because it can help them 'maintain a physiological steady state during a race that helps to preserve fuel and to avoid injury' (p. 49). The obvious question is why, then, expose the 'average jogger' to 'a variety of risks and dangers' instead of teaching them how to 'preserve fuel and avoid injury'. According to Morgan and Pollock (1977), 'it is quite likely that elite runners avoid pain zones and fail to come up against the wall simply because they associate, i.e., monitor sensory input, and adjust their pace accordingly, with the net result that "pain" is avoided. Of course, and this must be kept in mind, the elite runner can afford the luxury of associating, whereas the nonelite cannot' (p. 400). Although this makes sense in the case of competitive runners (elite or non-elite), there is no apparent explanation for the promotion of dissociation among non-athletic exercisers if it indeed carries with it 'a variety of risks and dangers', such as increasing the potential for injury.

According to research, dissociation can lead to what Cioffi and Holloway (1993) called 'delayed costs'. These researchers showed that individuals who were instructed to suppress their discomfort (induced by a cold-pressor pain induction procedure) produced slower pain-rating recovery rates compared to individuals who were instructed to closely monitor their sensations. Furthermore, the dissociators rated a subsequent innocuous vibration stimulus (i.e., a painless stimulus) as more unpleasant compared to the associators. These results were replicated recently by Goubert, Crombez, Eccleston, and Devulder (2004) using a different pain induction procedure (lifting and holding a 5.5 kg bag with the non-dominant arm in upright position for 60 s, which caused low-back pain among patients with chronic low-back pain). A distraction task (i.e., dissociation) had no effect on pain during the lifting task. However, *after* the lifting task, those in the distraction condition reported a significantly larger increase in pain intensity than those in the control condition.

Furthermore, research on the use of dissociation for coping with pain has shown that dissociation may only be effective when the level of stimulation is mild (as is the case with typical laboratory stimuli; see McCaul & Malott, 1984) and when exposure to the noxious stimulus is brief (Leventhal, 1992; also see Ahles, Blanchard, & Leventhal, 1983; Hodes, Howland, Lightfoot, & Cleland, 1990; Suls & Fletcher, 1985). On the contrary, when the intensity of the stimulation is high (as is commonly the case with individuals who begin an exercise program after a long period of sedentary living) and exposure to the stimulus is extended over a period of several minutes (as is the case with typical exercise bouts), dissociation has generally been

found to be ineffective in keeping the distress associated with this stimulation outside conscious awareness. In these cases, some evidence suggests that association may be a more effective coping strategy (Leventhal, Leventhal, Shacham, & Easterling, 1989; Suls & Fletcher, 1985). If dissociation is effective under certain conditions (i.e., mild stimulus intensity, brief exposure) and ineffective under others (i.e., high stimulus intensity, prolonged exposure), the implication is that 'pain' (or the generic discomfort induced by noxious somatic stimulation) might be controlled by at least two different mechanisms, one of which is amenable to manipulation of the attentional focus and one that is not. One might speculate that, since dissociation seems to fail under conditions that pose an increased adaptational risk, the dissociation-impervious mode of pain induction could represent a failsafe mechanism, selected for its ability to override or overpower other influences and elicit a reliable and unmitigated affective response.

In sum, the assumption that exercisers can switch to a dissociative mode at will and that this can shield them from the feelings of exertion and the negative affective impact of strenuous exercise seems to reflect a folk belief rather than established fact (also see Tenenbaum, 2001, 2006 and evidence reviewed therein). In a provocative editorial titled 'I know distraction works even though it doesn't!', Leventhal (1992) expressed a similar frustration, noting that 'no matter how many null results are published, statistical findings will lose out to the commonsense belief that distraction works, even if it doesn't' (p. 208).

Have unsupported assumptions led to a radical constructivist metatheory?

The theme that emerges from the critical review of the application of the five theoretical models to the domain of exercise psychology is that, in the absence of an extensive or rigorous evidence base, the field has been quick to endorse assumptions that represent rather extreme versions of a cognitivist-constructivist metatheory. It could be said that the 'mind over muscle' cliché has been taken a little too literally. What has made the process of adopting and applying these theories to the context of exercise a very perilous enterprise in the first place is that (with the exception of the Leventhal and Everhart model), these theories were initially developed with *social* functioning in mind. Thus, the stimuli they were designed to deal with were exteroceptive (e.g., visual, auditory), symbolic, representational, and culturally framed (e.g., social interactions), not somatic. What has complicated the process even further is that, in many cases, authors within exercise psychology, perhaps driven by a pre-established theoretical ideology, appear to have 'glossed over' important details, such as whether a certain theory can really be considered applicable to affective responses to exercise or whether the theory has boundary conditions (i.e., it should be considered applicable under certain conditions but not others).

Problems with radical constructivist accounts of the exercising body

There are four aspects of the mind-body dualism inherent in cognitivist-constructivist views that are particularly troubling. First, from this standpoint, psychological functioning and human experience, in general, are disembodied. In other words, there is a persistent tendency to disregard or undervalue the role of the body (along

with anything physical or physiological) in shaping human experience, including affective responses. The term ‘constructivism’ is, not surprisingly, usually accompanied by the adjective ‘social’ (see Gergen, 1985; Greenwood, 1992; Ratner, 1989). Constructivist accounts of emotions deal exclusively with emotions that arise in social contexts and depend on socioculturally framed symbolisms. Arguably, within such contexts, constructivist explanations have considerable merits. However, in exercise psychology, the object of study is *physical* activity. Although it is true that some physical activity is performed in social contexts and some reasons for participating in physical activity have undeniable social and cultural roots, it should be clear that physical activity is not only a social activity. Humans have bodies and those bodies are heavily involved in the process of exercise. To assume that affective responses to physical activity engage the same mechanisms and are, therefore, driven by the same processes as affective responses to social activity would be fallacious. Both in terms of anatomical structure and in terms of basic principles of function, the brain pathways via which exteroceptive and interoceptive stimuli can generate affective responses are, for the most part, independent. For example, decorticate animals and human infants born without cerebral cortices exhibit normal signs of affect (e.g., crying) in response to disruptions of internal homeostasis (e.g., when hungry or cold), although no response to social stimuli would be possible in such conditions (Blessing, 1997).

A second troubling notion associated with radical cognitivist-constructivist accounts is that the body has come to be viewed in an antagonistic role to the ‘mind’. Developing and promoting ‘attentional dodges or cognitive diversions’ (Cioffi, 1993, p. 417) to keep one’s body under control reflects what the philosopher Leder (1990) calls ‘onto-valuational dualism’; mind and body are not just seen as separate, but the mind is assigned a superior role compared to the body. The body is merely identified with ‘mindless passions or passive automaticities’ (Leder, 1990, p. 126) and, as such, it is regarded as ‘a force of negativity, an obstacle to the soul’s attempt to secure knowledge, virtue, or eternal life’ (p. 127). What the embodiment movement has brought to the forefront is the idea that the body has a ‘latent knowledge’ of the world, which is ‘anterior to cognitive experience’ (Gallagher, 1995). Contrary to the idea of bodily cues as essentially contentless and meaningless, which emanates from several of the theoretical models reviewed previously, the notion of embodiment implies that ‘the body and the natural world work together to deliver to consciousness an already formed meaning’ (Gallagher, 1995, p. 233). This is a principle rooted in evolutionary thinking (Dennett, 1996; Plotkin, 1993). In Dennett’s (1996) words, ‘evolution embodies information in every part of every organism’ (p. 79). Walter Cannon (1932) marveled at this amazing property:

The heat produced in maximal muscular effort, continued for twenty minutes, would be so great that, if it were not promptly dissipated, it would cause some of the albuminous substances of the body to become stiff, like a hard-boiled egg. Again, continuous and extreme muscular exertion is accompanied by the production of so much lactic acid (the acid of sour milk) in the working muscles that within a short period it would neutralize all the alkali contained in the blood, if other agencies did not appear and prevent that disaster. In short, well-equipped organisms – for instance, mammalian forms – may be confronted by dangerous conditions in the outer world and by equally dangerous possibilities within the body, and yet they continue to live and carry on their functions with relatively little disturbance (p. 23).

This 'wisdom' of the body, its ability to not only self-regulate, but also to produce life-preserving and life-promoting embodied experiences, is recognized in a variety of contexts, especially when survival is at stake (e.g., Blessing, 1997; Cioffi, 1991, 1993). The displeasure of strenuous exercise (as well as pain or fatigue) is not a foe to be manipulated or eradicated, but rather a warning signal of great adaptational value.

A third troubling implication of radical cognitivism and constructivism is the notion that individuals have essentially unlimited autonomy and freedom to '(re)construct' subjective realities. Mahoney (1991), who characterized himself as a 'critical constructivist', was caustic on this issue:

Those versions of psychological constructivism that focus almost exclusively on the autonomy of the individual and his or her unlimited freedom to (re)construct personal experiences may, in fact, constitute a disservice to the living systems they purport to serve ... Intentionally or otherwise, those proponents of radical constructivism who preach an 'all in your head' sermon to therapists and clients are, in my opinion, flirting with the edges of professional irresponsibility (p. 115).

Others have presented similar ideas. Discussing the issue of personal control in the context of weight management, Brownell (1991) emphasized that 'control over our bodies must be considered within the context of biological realities' (p. 308). The body is subject to inexorable and inflexible biological laws. To serve the purpose of self-preservation, the human body as a functional unit has developed ways to ensure that functioning takes place well within safe biological limits. Affective responses (e.g., displeasure, pain, fatigue) represent one of the main mechanisms by which bodily functioning within safe parameters is preserved (Panksepp, 1998).

The fourth troubling consequence of espousing a radical cognitivist-constructivist perspective deals with the neglect and rejection of findings that result from physiological methods of inquiry. Although the Cartesian notion of substance dualism has been abandoned, the constructivist view is characterized by a variant of dualism, called property dualism (Churchland, 1988). That is, although mental phenomena are generally thought to originate *somewhere* in the brain, physiology (including neurophysiology) is rejected based upon the premise that it is too simplistic or rudimentary to account for the complexity of psychological constructs, including affective ones. The impact of a metatheoretical assumption on a researcher's daily methodological decisions should become apparent. If what *really* matters is 'perceptions of personal capabilities' rather than 'actual physical capabilities' or 'an individual's construction of reality' rather than 'the objective demands inherent in exercise programs', it follows that exercise psychologists have little or nothing of any particular relevance to learn from exercise physiology or neuroscience. The antidote to this dualistic point of view is the principle of multilevel analysis (Berntson & Cacioppo, 2006), the genuine belief in the ability of distinct levels of analysis (such as the 'psychological' and the 'physiological') to mutually inform others.

In conclusion, radical cognitivism and constructivism, the metatheoretical views that reject or undervalue the role of biological reality in shaping human experience, provide a restrictive metatheoretical framework for the study of affective responses to exercise. The inattention to the role of the body that this approach entails must be recognized as especially problematic when the object of study is a primarily *physical* activity. The Dual-Mode Theory acknowledges the crucial role of cognition but

integrates it into a functional unit that also takes into account the ‘wisdom of the body’ that Walter Cannon extolled in 1932.

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